



PIMPRI CHINCHWAD EDUCATION TRUST
A Trusted Brand in Education Since 1990

PCCOER UGCON 2021

A Proceeding of Final Year Project Exhibition
(Mechanical, E&TC, Civil, Computer Engineering)



VOLUME 1, EDITION 4, 2021

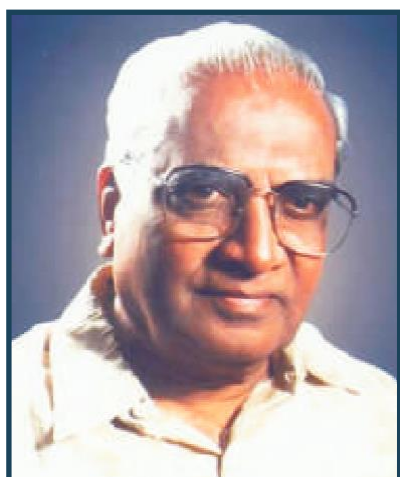
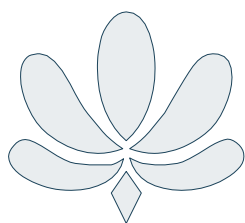
VOLUME 1, EDITION 2, 2019

ABOUT TRUST

Pimpri Chinchwad Education Trust (P.C.E.T) was established by Late Shri S. B. Patil in the year 1990 with a mission to serve the society, industry & all stake holders through value added quality education in the fields of Engineering, Management and Computer Applications & school education.

P.C.E.T. is committed to its mission through preeminence in Creating, Communicating, Preserving and Applying Knowledge, Art and Academic Values. At present in Akurdi campus nearly 5000 students are groomed for professional courses.

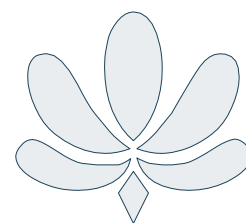
Our Tribute



Late Shri S. B. Patil
(Founder, PCET)



Late Smt. Lilatai S. Patil
(Ex Chairperson, PCET)



Board of Trustees



Shri. Dnyaneshwar P. Landge
Chairman



Smt. Padmatai M. Bhosale
Vice Chairperson



Shri. Vitthal S. Kalbhor
Secretary



Shri. Shantaram D. Garade
Treasurer



Hon. Shri. Harshavardhan S. Patil
Trustee



Shri. Bhaijaan Kazi
Trustee

PCCOER UGCON-2021

**A Proceeding of Final Year Project Exhibition
(Mechanical, E&TC, Civil, Computer Engineering)**

Edition - June 2021

Prof. Dr. Harish Tiwari - Publisher
Prof. Dr. Rahul Mapari - Chief Editor
Prof. Kishor Bhangale - Editor
Prof. Ganesh Fodase - Editor
Prof. Anand Kudoli - Editor
Prof. Manisha Deshpande - Editor
Prof. Jameer Kotwal - Editor

ISBN - 978-81-937647-1-8

All rights reserved

No part of this publication may be reproduced, transmitted, or stored in a retrieval system, in any form or by any means, electronic, mechanical photocopying, recording or otherwise, without the prior permission of the publisher.

Published by:

Pimpri Chinchwad College of Engineering and Research
Plot B, Survey No. 110(P), Laxminagar, Ravet, Pune – 412 101.
Phone: +91-20-69338080,
Website: www.pccoer.com
Email: pccoer.ravet@gmail.com.

Cover Design, Typeset and Layout & Printing
Prowiz Design

Principal Desk



Message

In technical India is developing country and has a strong potential to emerge as a developed country. Research and innovation is the key to advance in this direction at an accelerated pace.

We Pimpri Chinchwad College of Engineering and Research, Ravet (PCCOE&R) feel proud to be a part of this success story. Project based learning and a two-fold approach (student and faculty) contribution for research and innovation is a strong pillar of PCCOE&R philosophy.

The objective of PBL and UGCON proceeding is develop a research culture and to enhance the critical thinking of students. In PBL group of six students design poster in first semester and manufacture the model of it in next semester. The result of this is, in last five years our faculty and student have contributed 250 plus research papers, 300 plus mini & major project through project based learning. PCCOE&R student and faculty have filed 125 patents & 250 copyright in last 3 years. We have established a world record by registering 149 copyright in a single day which has been recognized by world record of India and also by India book of records.

I acknowledge our faculty and students for coming up with exceptionally good and unique research projects and urge the readers to go through the same and extend the ideas further for the betterment of society and themselves..

Dr. Harish U. Tiwari
Principal,
PCCOE&R, Ravet, Pune



Message

It is my great pleasure to welcome you to the PCCOER UGCON 2019 held in Pimpri Chinchwad College of Engineering & Research (PCCOE&R), Ravet, Pune. The PCCOER UGCON is the proceeding where research work of all final year students gets published. Aim of this proceeding is to get the literature to the junior students so that repetition of projects avoided. Also the existing system will be modified by using new technologies. Around 80 + technical projects of Mechanical, Electronics & Telecommunication, Civil and Computer engineering involved in the proceeding.

In particular, I thank the PCET trust for giving a wide scope to organize PCCOER UGCON inaugural, Dr. Harish Tiwari (Principal, PCCOE&R, Ravet, Pune) for their wise advice and brilliant suggestion on organizing the PBL exhibition and UGCON inaugural; the Heads of all department for their thorough and timely guidance. Recognition should go to the Project and PBL coordinators and who have all worked extremely hard for the details of important aspects of the programs. It has been a great privilege for me to serve as the PBL and PCCOER UGCON coordinator and it is my hope that you find the project exhibition stimulating, fulfilling and enjoyable.

I thank you for your support to PBL Exhibition and PCCOER UGCON inaugural

Dr. Rahul G. Mapari
Coordinator,
PBL & PCCOER UGCON



Dr. Sham Mankar
Head, Mechanical



Dr. Sameer Sawarkar
Head, Civil



Dr. Archana Chaugule
Head, Computer



Prof. Tushar
Gaikwad
Head, Applied Science

From HOD's Desk

We take immense pleasure in presenting UGCON-2021 to you, which contains technical articles reflecting research project details carried out by our Final Year BE students in the year 2020-21.

Research is the origin of any progress! It has always been the endeavor of PCCOER faculty and students to carry out research of very high quality. Most of our research projects are live, industry-sponsored projects. PCCOER is well known for its innovations, publications, copyrights and patents in all its five disciplines, viz. Basic Sciences, Civil Engineering, Computer Engineering, Electronics & Communication Engineering and Mechanical Engineering.

Our research provoking ambience, state-of-art laboratories, tie-ups with research institutions and industries and able guidance by the Principal Sir and faculty members motivate the students to exploit their full potential to put forth novel ideas and solutions. The UGCON 2021 showcases some of the most innovative, alternative and sustainable solutions to many engineering problems directly affecting quality and convenience and comfort of human lives. We congratulate our faculty and students for coming up with exceptionally good and unique research projects and urge the readers to go through the same and extend the ideas further for the betterment of society and themselves.

Vision:

To be a Premier institute of technical education & research to serve the need of society and all the stakeholders.

Mission:

To establish state-of-the-art facilities to create an environment resulting in individuals who are technically sound having professionalism, research and innovative aptitude with high moral and ethical values.

Objectives:

To create aesthetically sensitive, socially committed and technologically competent Engineers and Management professionals.

Quality Policy:

We at PCCOE&R are committed to impart Value Added Quality Education to satisfy the needs and expectations of the Students and other Stakeholders. We shall achieve this by establishing and strengthening State-of-the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



Pimpri Chinchwad College of Engineering and Research
Plot B, Survey No. 110(P), Laxminagar, Ravet, Pune – 412 101.
Phone: +91-20-69338080, Email: pccoer.ravet@gmail.com
Website: www.pccoer.com

Index

Civil Engineering		
Sr. No.	Title of Page	Page No.
1	Business model study on preparation of porous concrete block	1
2	Automatic water distribution for smart cities	9
3	Assessment of index properties of soil using bitumen emulsion	14
4	Suitability analysis of block earth retaining structure in landslide mitigation	17
5	To make a cow dung bricks for the construction of eco-friendly house	22
6	Impact of road accidents on economy	26
7	Study of light transmitting mortar blocks using optic fibers	36
8	Use of glass as aggregate in bitumen asphalt pavement	40
9	Physical & mechanical properties of mees bamboo for replacement with steel in concrete structure	44
10	Sensor based accident prevention system	49
11	Use of waste foundry sand in infrastructure	54
12	Experimental study on water balance approach at village level	58
13	Municipal solid waste management system for pune city	64
14	Experimental investigation of waste plastic used in bricks	70
15	A study on granite fine waste in concrete	76
16	Instrument for time optimization in slope Measurement-cambimeter	85
17	To enhance the strength of concrete by partial replacement of coarse aggregate with tile waste	88
18	Strength assessment of concrete structures due to various chemical attacks	92
19	Analysis of beam column junction and retrofitting by natural fibers	96
Computer Engineering		
1	Efficient And Secure Group Data Sharing Model Using Cloud Computing	98
2	Emotionally Intelligent Chatbot	102
3	Analysis Of Portfolio Rebalancing And Technical Indicators	110
4	Sign Language Mediator	118
5	Safe Driving System	122
6	Classification And Prediction Of Diseases With Similar Symptoms	126
7	Mobile Application For Real-Time News Summarization In Indian Languages	129
8	Touchless Attendance System Using Face Recognition	133
9	Smart Expense Manager	137



10	Severity Prediction System For Real Time Pothole Detection	141
11	A survey on various available object detection models and application in automatic licence plate detection	148
12	Music Genre Classification And Segregation	156
13	Customer segmentation using integrated approach	165
14	Virtual police station	169
15	Django Website For Disease Prediction Using Machine Learning	176
Electronics & Telecommunication Engineering		
1	Multi-view Multi-pose Robust Face Recognition based on VGGNet.	178
2	Wireless Weather Monitoring System using GSM	182
3	Design of single band rectangular microstrip patch antenna for 5g application	187
4	Smart mirror using raspberry pi	191
5	LORAWAN Based Smart Farming Modular IOT Architecture	194
6	Autonomous floor cleaning robot	198
7	Secure contactless automatic ration distribution system using internet of things	202
8	Camera-based driver drowsiness detector	206
9	Teleoperated Animatronics Robot	210
10	COVID-19 patient care robot	214
11	Agriculture smart protection from animals using smart scarecrow system	217
12	Biped Walking Robot With Autonomous Balance Unit	224
13	Portable Air Conditioner based on hybrid method of Peltier effect cooling and liquid based cooling	235
14	Real Time Object Detection Using YOLO v3 Tiny with Voice Feedback for Visually Impaired	238
15	Quadcopter For E&TC Department	241
16	Detection and Monitoring of Unauthorized Vehicles in BRT System	245
17	EMR Analysis to predict various	249
18	Fire Extinguisher Robot	252
19	Solar Grass Cutting Robot	256
Mechanical Engineering		
1	Experimental analysis on extrusion of primer composition for ignition	257
2	Fabrication of Multipurpose operation machine (Bench-Drilling, Grinding, Metal-Cutting)	264
3	Behavior Change of Diesel Engine under Starting Low Temperature and idling Condition with Calophyllum oil Biodiesel.	275
4	THERMOSAVE – Using Waste Heat to Generate Electricity	278



5	Design and Analysis of lawn mover	283
6	Design And Fabrication of Mecanum Wheel Scissor-Lift	289
7	Design and Optimization of 25- ton C-frame Hydraulic Press	299
8	Design and Development of Broaching Fixture for Machine Pulley	307
9	Design and fabrication of seat belt assisted and brake lever	313
10	Heat Transfer Enhancement of Diesel Engine Radiator Using Nanofluid	318
11	Design and Analysis of Electric Crane with 500Kg Material Handling Capacity	323
12	Automatic Automobile Brake Failure Detection Indicator	327
13	Design And Analysis of Regenerative Suspension System Using Ansys Maxwell	333
14	Design And Development of Oil Skimmer	338
15	Experimental setup using rotating circular disc for kinetic coefficient of friction using lubricants	338



CIVIL ENGINEERING

BUSINESS MODEL STUDY ON PREPARATION OF POROUS CONCRETE BLOCK

Dr. Sameer Sawarkar¹, Vivekanand L Patil², Pranav G Pawar³, Sandip D Waghmode⁴, and Digvijay S Patil⁵.

¹Assistant Professor, ²Student, ³Student, ⁴Student, ⁵Student

¹Department of Civil Engineering,

¹Pimpri Chinchwad College of Engineering and Research, Pune, India

ABSTRACT Pervious concrete is a special type of concrete, which consists of cement, coarse aggregates, water and if required, admixtures and other cementitious materials. As there are no fine aggregates used in the concrete matrix, the void content is more which allows the water to flow through its body.

Pervious concrete is a special high porosity concrete used for flatwork applications that allows water from precipitation and other sources to pass through, thereby reducing the runoff from a site and recharging ground water levels. Its void content ranges from 18 to 35% with compressive strengths of 400 to 4000 psi (28 to 281 kg/cm²). The infiltration rate of pervious concrete will fall into the range of 2 to 18 gallons per minute per square foot (80 to 720 litres per minute per square meter). Typically, pervious concrete has little or no fine aggregate and has just enough cementitious paste to coat the coarse aggregate particles while preserving the interconnectivity of the voids. Pervious concrete is traditionally used in parking areas, areas with light traffic, pedestrian walkways, and greenhouses and contributes to sustainable construction.

INDEX TERMS Porous Concrete Block, Infiltration Rate, Business Study Of Porous Blocks.

I. INTRODUCTION

As we all know due to over use of natural resources we are depleting some of the naturally occurring essential resources very rapidly. Here in our project we are focusing on one of the main essential component of earth which is one of the main substance that is the cause of life to exist on this planet. Yes you are right that is Water. Nowadays due to environmental harm caused by man there is drastic change in seasons. India is facing major water crises.

In urban as well as in rural regions. Due to change in rainfall pattern and depleting ground water which is a major source of drinking water in our country it is essential to manage stormwater discharge also due to lack of proper drainage heavy rainfall creates water logging problems in urban areas which creates flood conditions on roads which eventually leads towards the problem of traffic jams.

So in this Project we are going to use Porous Concrete Blocks instead of regular interlocking blocks which are being used now a days. We are going to do Business study on the porous concrete and we are going to make product of these material and sell them in society for the betterment of peoples in our society and environment around us.

As we can see in Rainy season the regular pavement gets too wet due to this it becomes very slippery creating trouble while walking over it. So in comparison with that our product will allow water to seep through it so making the top surface of pavement dry due to this it will give us more grip while walking over it.

One more advantage of this product is in urban areas when it rains due to evaporation of water it causes rise in temperature which we called as heating island effect in that area which causes discomfort to the peoples living in society. As we are going to use this product so when it rains it will not cause water to evaporate in the atmosphere thus it will avoid



Fig. No. 1 Pervious Concrete Block

II. AIM

To study porous pavement block as a business model and by this product helps to the environment and to make people aware about its Benefits.

III. OBJECTIVES

The main objective is to study the porous pavement block as a business model.

- To make a well finished porous concrete block in a mould
- To make people aware about the Benefits of Porous Concrete Block over the normal interlocking paver block.
- To do study on initial investment and total finance need to start this business.
- Comparing strength of regular pavement with Porous concrete block.
- To compare cost of unit regular interlocking paver block with porous concrete block.
- To make best and economic product for the people use and to save environment(e.g water)

heating island effect.

IV. LITERATURE REVIEW

Darshan S.Shah Prof : Jayesh Kumar Pitroda, Prof : J J Bhasar: “Pervious concrete: new era for porous road development” (august: 2013) In this paper porous concrete is a new technique for rural road development. By using this technique we can reduce stormwater runoff & also prevent it from being polluted. Porous Concrete Pavement is a unique and effective means to growing environmental demand. It can be used for construction of road pavement in rural areas. It also can be used extensively for other purposes as it has various cost and environmental benefits.

A.M Admure, A.V Gandhi, S.S Adsul, A.A Agarkar,G.S. Bhoir, G.P Kolte: “Permeable pavement new technique for construction of road pavement in india” (april: 2017) In this research paper they have described porous pavement, its needs,types & various applications. Also this paper summarizes various literature and studies conducted on permeable pavement. These systems main goal is to achieve water quality & quantity benefits by allowing movement of storm water through its surface. This pavement can reduce urban runoff & trap pollutants. The Types of pollutants present in the water and which are removed in this system are explained here. Future scope of this system is also discussed in this paper briefly.

Mansi Darji 1, Shraddha Bhatt 2, AaroHi Pattankar 3, Vaidehi Jain 4 Civil engineering department, navrachana university 1,2,3,4 vasna bhayli road, vadodara - 391 410. Gujarat, india: “Porous pavement: design and cost evaluation” In this research paper, we study that the Application of porous pavement concrete will allow storm water to infiltrate into the ground thus reducing the problem of water logging or accumulation in the areas. In this study, they selected an area named Siddharth Bungalows at Sama-Savli road of Vadodara The above residential area the road experiences a great threat of storm water accumulation during every monsoon season. Another important part in this paper is the traffic volume count which will help determine the low traffic volume load on the road to decide the thickness of each layer of road. In this

Vicky N Gupta, Priyesh Yadhav, Darshan Mali, Prabhleen Kaur Bhumrah, Rajeshwari .S. Sozhiachett :“Road side drainage system and disaster management using permeable concrete” (april-2020) In this paper they have given that no use of fine aggregate in the porous concrete therefore cost of permeable concrete is low as compared with conventional concrete. Also in this research paper for increasing strength of porous concrete we can add 20% fine sand by weight of coarse aggregate. The water stored by using this system can be used for gardening purposes. Permeable concrete is now researched and optimised to be used as paver material due to its various benefits. The invention of permeable concrete as pavement showcases its engineering properties & structural properties.

Mrs V Saritha , Mr K Sriram Saran, M.S Kusuma Kumari, Mr. M Rajkumar, Mr. B.R.Rajeshwari and Mrs p Anantha Raju :“Pervious concrete pavement” (may: 2018) In this paper they have concluded that previous concrete is cost effective & eco friendly to support sustainable construction also reducing stormwater runoff plays a significant role. The ideal pervious concrete mix provides better compressive strength. The smaller the size of coarse aggregate gretter the compressive strength it gives. Pervious concrete is the best solution to control flood conditions & effective water management. The mix ratio of 1:4 & 1:6 are very useful for this type of system.

Mr G N Chavan Patil & Mr. S.S Chokaktar :“the study of porous asphalt pavement with emphasis in road construction design” (june: 2018) The main purpose of this paper is to study durability, hydrological benefits and environmental consideration. This paper includes construction, performance & design of porous asphalt. Recent innovation was highlighted and its potential for future research was outlined. This paper concludes high linear correlation of values of porous asphalt. Porous pavement is sound from an economic point of view. The advantages & limitations of different porous pavement systems were discussed therefore porous pavement is

research they are selected a material is single sized aggregates of sizes 6mm, 10mm and 20mm. They are design of Porous Pavement using IRC 37 for deciding a wearing course, sub-base course and base course and also to find the cost evaluation of porous pavement and flexible pavement. from the survey and laboratory work carried out, they can be concluded that the rainfall in the area received heavy rainfall during every monsoon and traffic volume survey shows PCU/hr which is low therefore it can be preferred for constructing porous pavement on it.

1 Arun. H, 2 Franklin Jose. I, 3 Joegin Raj. K. R, 4 Julius Wadlter. A.G, M. Murugan Lingam:

“Experimental investigation on increasing the strength of pervious concrete by varying the mix ingredients” In this research paper pervious concrete or No fineness concrete is a conventional concrete that is used for draining of storm water in foreign countries and increasing the ground water level. In this project they are investigating and increasing the strength characteristics of pervious concrete and they are designed a mixed for considering only cement and coarse aggregate. The mix ratio is considered as a 1:6 and water cement ratio is 0.4 to 0.45 and they are also added admixture in percentage of cement for nano silica and for concrete is polypropylene for increasing strength of pervious concrete. Pervious concrete is also on environment friendly system so it can be

V. METHODOLOGY AND DESIGN DETAILS

A. METHODOLOGY

The Pervious Concrete Block is a mixture of Cement, Coarse Aggregate with little amount of water generally water cement ratio is kept between 0.27 to 0.43. As this mix is harsh to make we can use admixtures to increase workability of porous concrete. It has very little amount of fine aggregate in it or no fine aggregate in it so it is called No Fine Concrete.

Using sufficient paste to coat and bind the aggregate particles together creates a system of highly permeable, interconnected voids that drain quickly. Typically, between 15% and 25% voids are achieved in the hardened concrete. The density of permeable concrete using conventional aggregates varies from 1602 to 1922 kg/m³ . Ghafoori et al produced porous concrete with a compressive strength in excess of 20 MPa when using an aggregate-cement

attractive on both environmental & economic grounds.

used in low road bearing roads. There are many advantages and future scope of project like recharge of local aquifer, natural run-off allows rainwater to drain directly to sub-base, pollutant removal, applications of green building. In future scope point of view the implementation of pervious concrete in the village or rural roads can be very useful for storing storm water for agriculture. The testing results of porous concrete in compression strength is good because of using different type of mixes like pervious Concrete, pervious concrete with nano silica, pervious concrete with nano silicon and polypropylene etc. It can be concluded that the studies have to be done for increasing strength using admixture and different mixes in pervious concrete

Lakshmi Reddy Gari Avinash 1 , Pothireddy Adarsh Reddy 2 , S.S.Vivek 3* School of civil engineering, sastra deemed university, thanjavur-613401, “Study on strength characteristics of pervious concrete using mineral admixtures” The authors found that the porosity was higher for dolomite aggregate than the steel slag aggregate in previous concrete. Hence, the aggregate size in the range of 4 to 8 mm increased the concrete density and obtained highest flexural strength. the study was carried out in the direction the of the partial substitute of cement by silica fume (SF) and metakaolin (MK) with three replacement percentages (from 10% to 30%), total six mixes were developed. The trial mixes were cast and tested for three w/c ratios (0.36, 0.38 & 0.40) and the optimum w/c ratio of 0.38 was adopted. Further, comparison of the compressive strength was made between control pervious concrete (CPC), i.e. without cement replacement and with the six mixes of the partial cement. The compressive strength of cube specimens was obtained at the age of 28 days as Before subjected to the compression test, the permeation of water through the void spaces was ensured. It was observed that the highest compressive strength was attained by SF 20% with 14.09 MPa and SF 30% with 11.71 MPa respectively. t

ratio of 4:1.

The indirect tensile test conducted by Ghafoori et al found that the sample tests varied between 1.22 and 2.83 MPa

Table No. 1 The Exact Proportion Of the Mix

CEMENT	C.A	W/C	SIZE OF C.A	VOID %
1-PART	4-PART	0.4	9.5mm-12mm	15%-20%

B. MATERIAL TO BE USED

Aggregates: The aggregate gradation typically consists of single-sized or a binary mixture of coarse aggregates and it has a significant influence on the properties of pervious concrete. Coarse aggregates range between 9 and 19 mm, while fine aggregates (less than 10% by weight of total aggregates) are added to increase the strength of the concrete, but they gradually reduce the void content.

Cement: Various types of cement can be used (e.g Portland cement, blended cement, and slag cement). Its content seriously affects the compressive strength and void structure of the layer. The optimum cement content depends on the aggregate size and gradation and it ranges between



Fig. No. 2 Drainage System For Porous Block

D. MAINTENANCE

Infiltration rate of porous concrete blocks reduce Over the time so regular maintenance of pavement Needs to be done the type of cleaning equipment also plays an important role in the effectiveness of cleaning Procedures.

Vacuum dry sweeping is usually sufficient to restore

replacement using SF and MK at par with 1.5% of Superplasticizer (SP) dosages.

260 and 415 kg/m³.

The aggregate-to-cement (a/c) ratio ranges between 4:1 and 8:1 as the required compressive strength decreases and the permeability rate increases

Water: The water-to-cement ratio (w/c) usually ranges between 0.28 and 0.40 to provide sufficient coating for aggregates. According to Eathakoti et al, the ideal w/c value for no-fines concrete mixes is 0.45

Admixtures: Chemical admixtures are used to obtain or enhance specific properties of the mixture viscosity modifying, air entraining, retarder, and water reducer agents are the most frequently used Pigments are added to fresh mixtures to enhance sidewalk integration with most surrounding landscape and architectural elements. Fibers could be added to obtain significant improvement in the compressive strength.

C.CONSTRUCTION PROCEDURE

Drainage is Consists of Excavation a trench pit of depth about 0.9m in the selected Site area. After excavation of area we have to fill the trench in Three stages.

Filling of trench consists of Laying Bottom bed having thickness of 0.4m and the size of course Aggregate is of about >12mm.

Then Providing sub-base of having thickness of 0.3m and the size of Course aggregate is of about 8mm.

Third layer consists of Fine aggregate having size of 4.75mm having thickness of about 0.120 m

The last Top layer 0.08 m thick porous concrete blocks layer.

At the bottom of trench we have to provide a pipe line which is connected to the Manhole.

Then in the especially rainy season the rainwater is pass through the porous pavement to sub-base to bottom layers of aggregate.

The rain water passes freely or we can say that smoothly through it.

In these way some amount of water is drained out

50% or more of initial flow rate. Pressure washing can restore 90% or more of initial flow rate and has been documented at a rate of 175 square feet per man-hour.

There are three levels of pervious concrete pavement maintenance:

1) Routine maintenance that includes visual inspection of the pervious pavement to ensure that it is clean of debris and sediments (monthly).

2) periodic maintenance in areas that see freezing temperatures before winter to insure that the pervious concrete voids are clean and free of non-compressible materials to remove any anti-skid materials that may have been used. Proper cleaning procedures would include pressure washing and/or vacuuming the area with either a dry vacuum or a regenerative vacuum sweeper, and

3) Deep cleaning/unclogging: if a pervious concrete pavement system is not periodically cleaned, the void structure system will become clogged with debris over time.

Luke and Beecham (57) presented results from an investigation of permeable pavements that have been in service for over 8 years.

FOR MIX-3

Cement: Coarse Aggregate=1:2.5

Water Cement Ratio= 0.38

Estimated Quantity For 1m³

Table No.4 Amount of Proportion

Cement	Coarse Aggregate	Water
633.6 k.g= 13 Bags	1650 k.g	240 lit

F.TESTING

INFILTRATION TEST

ASTM c1701 : Pervious concrete infiltration test
Objective : To determine the infiltration rate of water in pervious concrete

Specification: ASTM C1701, 1701M-09

Equipment requirement: Infiltration Ring, Stop watch, Plumbers Putty.

Significance & use:

Test performed at the same location across a span of

into the ground and excess amount of water is drained through the manhole as Stormwater discharge.

In this way we are going to manage stormwater then the ground water table will be increased.

They reported that most sediments are retained in 2-5 mm bedding layer.

They also reported that a maximum of 8.3% of the total sediments are retained in the fabric layer at the bottom and that over 90% of the sediments are retained in the pavement and aggregates bedding layers. Their results showed that the overall infiltration performance of the pavement was satisfactory after 8 years of service.

E. TYPE OF MIX AND AMOUNT OF MATERIAL

FOR MIX-1

Making 1m^3 of block

Cement: Coarse Aggregate= 1:4

Water Cement Ratio= 0.38

Estimated Quantity For 1m^3

Volume of Mould= 0.0025m^3

From 1m^3 of mix we can prepare 400 units of block

Table No.2 Amount of Proportion

Cement	Coarse Aggregate	Water
444.52 Kg= 9 bags	1848 kg	168.53 lit

FOR MIX-2

(Coarse aggregate is replaced with 20% of Fine Sand)

Estimated Quantity of 1 unit

Volume of Mould= 0.0025m^3

From 1m^3 of mix we can prepare 400 units of block

Table No.3 Amount of Proportion

Cement	Coarse Aggregate	20% Agg.	Fine	Water

the years may be used to detect a reduction of infiltration rate of the previous concrete thereby the identifying the need of remediation.

To determine the infiltration rate of the entire pervious pavement multiple location must be tested and the result averaged.

ASTM C1701 is the standard infiltration test for the pervious concrete.

We recommend that an infiltration test be performed at least annually in multiple locations. To identify where and when maintenance might be needed.

The test consist of four main components

- 1.Installing the infiltration ring
- 2.Prewetting the concrete
- 3.Testing the concrete
- 4.Calculating the results.



Fig. No. 3 Infiltration Process

VII. ACKNOWLEDGMENT

We feel immense pleasure in presenting the project report on “Business Modal Study on Preparation of Pervious Concrete Blocks”. We wish to express true sense of gratitude towards Prof. Dr. S. S. Sawarkar, our project guide who at very discrete step in study of this project, contributed their valuable guidance and helped to solve every problem that arose.

We take this opportunity to thank our Principal DR. H. U. Tiwari and Prof. Dr. S. S. Sawarkar (HOD Civil Dept.) for opening the door of department toward the realization of our project, for their guidance and encouragement. We offer our sincere thanks to our BE Project Coordinator Prof Satish Pitkae, who gave us extra inspiration to do something new.

1.108 Kg	3.696 K.g	0.924 K.g	0.42 Lit

Infiltration Calculation:

mass) $M = 40.0$ lbs (water

diameter) $D = 12$ in (ring

infiltration) $T = 92$ sec (time in

(constant) $K = 126,870$ in

Result:

$$I = KM/D^2 * T$$

$$= 126,870 * 40 / 12^2 * 92$$

$$= 383.1 \text{ in/hr}$$



Fig. No. 4 Infiltration Rate

VI. CONCLUSION

- 1) The focus of this study was to evaluate mechanical properties and hydrological properties of various pervious concrete mix designs as well as life cycle cost analysis for use in sidewalks.
- 2) Several mix designs were selected based on existing specifications and suppliers mix design, and modifications of them.
- 3) The variables were cement content, aggregate content, water- cement ratio, the presence of sand, fly ash, or slag, admixtures.
- 4) Based on the results of this study the following conclusions can be presented.

VIII. REFERENCE

1. ASTM Designation: C 1701/C 1701M-09 Standard Test Method For Infiltration Rate of In Place Pervious Concrete.
2. National Ready Mixed Concrete Association (NRMCA), Freeze Thaw Resistance of Pervious Concrete, Silver Spring, MD, May 2004.
3. ACI 552R (2010): "Report on Pervious Concrete", American Concrete Institute, Farmington Hills, Michigan
4. Park, S., Tia, M. (2004). "An experimental study on the water-purification properties of porous concrete," Cement and Concrete Research, (Vol. 34), pp.177-184.
5. Abadjieva, T & Sephiri, P. "Investigations on Some Properties of Permeable Concrete".
6. Department of Civil Engineering University of Botswana.
7. AASHTO (American Association of State Highway and Transportation Officials). 1993. "Guide for Design of Pavement Structures", AASHTO, Washington, D.C., USA.
8. Beeldens A., Herrier G., 2006. "Water pervious pavement blocks: the belgian experience", 8th International conference on Block Paving materials.
9. <http://www.concrete.org>
10. <http://www.concretenetwork.com/pervious/>
11. E. Z. Bean, W. F. Hunt, D. A. Bidelsbach and Robert J. Burak 2004. "Study On The Surface Infiltration Rate Of Permeable Pavements." 1st Water and Environment Speciality Conference of the Canadian Society for Civil Engineering.
12. Chai, L., Kayhanian, M., Givens, B., Harvey, J.T., and Jones, D. 2012. "Hydraulic performance of fully permeable highway shoulder for storm water runoff management." Journal of Environmental Engineering, 138(7):<https://youtu.be/7LHPzybDWt>
13. <https://perviousproducts.com/>
14. Darshan S.Shah Prof : Jayesh Kumar Pitroda, Prof : J J Bhasar: "Pervious concrete: new era for porous road development" (august: 2013)



AUTHOR

1. Dr. Sameer Sawarkar

Asst. Prof.

Department of Civil Engineering

Pimpri-Chinchwad College of Engineering and
Research, Ravet

2. Vivekanand L Patil

BEStudent

Department of Civil Engineering

Pimpri-Chinchwad College of Engineering and
Research, Ravet

3. Pranav G Pawar

BEStudent

Department of Civil Engineering

Pimpri-Chinchwad College of Engineering and
Research, Ravet

4. Sandip D Waghmode

BEStudent

Department of Civil Engineering

Pimpri-Chinchwad College of Engineering and
Research, Ravet

5. Digvijay S Patil

BEStudent

Department of Civil Engineering

Pimpri-Chinchwad College of Engineering and
Research, Ravet

AUTOMATIC WATER DISTRIBUTION FOR SMART CITIES

¹Rahul Patil, ²Soham Arun Mancharkar, ³Kartikey SunilMore, ⁴Nikhil Bhagwan More,
⁵Sanket BodhrajBadwaik

¹Assistant Professor, ²Student, ³Student, ⁴Student, ⁵Student

¹Department of Civil Engineering,

¹Pimpri Chinchwad College of Engineering and Research, Pune, India

“This project was supported by Pimpri Chinchwad Municipal Council.”

ABSTRACT Smart city is an upcoming era, there are many houses in which high and middle class people can have facilities according to their comfort. Based on the people population, season, etc, the usage of water is varying. So, water supply management is very much needed and it should be maintained properly. In existing method, corporation may not know how much water is used and the wastage. To avoid the wastage of the water, the proposed system has been developed for water supply management with sensor devices.

INDEX TERMS Sensors, Water management, Valve, Distribution.

I. INTRODUCTION

There are many challenges in the Smart city. One of them is water management. To overcome the water problem, the proposed model has been developed for the water management. Water is most important for our life and man cannot live without water. Already, the water management system exists for finding the leakage of water in the pipelines and also the pH level of water. The monitoring system has been designed with sensors. Readings from the sensor are processed with microcontroller and communicate through computers or wireless networks.

Smart city has been developed for human life for comfort and convenient. In foreign countries used such as Europe, America and Asia, Smart city is a well-established and world class technology has been used. It is based on advanced urban cities with civic amenities. Smart City may vary based on the countries, cultures, life styles, technology, environment and also needs of society. Smart city is an enhanced city with smart

designs in method of housing, infrastructure, mobility, technology, security system, transportation etc. The conceptualization of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to changes and reforms, resources and aspirations of the city residents. A Smart City would have a different meaning in India than in Europe. Even in India, there is no clear way of defining a Smart City.

II. PROBLEM STATEMENT

- To avoid water theft and to overcome the problem of water scarcity.
- Current water distribution solutions are based on centralized management systems.
- These systems offer limited control and are filled with inefficiencies.
- Water losses, high contamination levels, and difficulty in maintenance are some of the common problems faced by the current system.

III. OBJECTIVE

- Uniform distribution of water to every consumer in the cities.
- Creating greater customer awareness of water consumption habits, leading to conservation improvement.
- Consideration of new metering system including improving the cities meter reading.
- Enhancing new services to the customers.

IV.SCOPE OF PROJECT

The main scope of our project is to provide safe and clean, reliable water supply to the cities.

We are considering a new metering system including improving the cities meter reading.

V. LITERATURE REVIEW

A) Water Anti-Theft and quality monitoring system by using PLC and SCADA

Gaikwad Sonali Ashok (2013) has planned this strategy as a model for water circulation framework involving a control framework, communication means, funnelling, actuators, sensors and valves. This framework uses a communication bus for controlling and checking water flow through the channeling by means of control of the actuator and valves. Control framework is additionally coupled to Supervisory Control and Data Acquisition (SCADA) unit. This paper concentrates especially to a control framework for controlling and checking segments inside a water dispersion framework. To transmit or receive the control and status information man machine and electrical interfaces are incorporated to PLC (Programmable Logic Controller)

B) Design of a PI controller for a computerized building water distribution system with PLC system

Hassaan Th. H. Thabet (2011) has considered and built up the framework for water supply framework's energy conservation guideline of a pump with flow control as indicated by unsettling influences. The framework can distribute the water with steady weight and spare energy effectiveness. The framework was tried for every

whole day for 21 days with limit of (20 - 120) liter/minute of water, and around ten meters building elevation. The weight of the supply system is around 1.2 Bar. The test results of the simulated and actualized framework demonstrate enhanced proficiency and expanded precision in the variable heaps of the water devoured in a multi-story working with a constant pressure controlled operation. The PLC connects and controls the operational parameters to the speed asked for by the framework and screen the framework amid typical and anomalous conditions (over-loading and dry running)

C) PLC based automatic corporation water distribution system using solar energy

P. Mukesh Aravind (2013) has implemented the strategy to depict about the PLC based programmed enterprise water circulation framework, which encourages to disseminate the water naturally as per the requirement of the particular region. In conventional framework there is no legitimate strategy took after for the dissemination of water. To defeat the trouble in the regular framework, the PLC based automated framework utilizing embedded controller is used for disseminating the water to the general population similarly as indicated by their usage. The embedded controller is as of now pre-modified to do the tasks and results are appeared in ladder diagram utilizing Pico software. So as to make the framework more effective and contamination free, solar based energy is utilized as an elective hotspot for control supply activity of the PLC unit.

D) Wireless Sensor Networks for monitoring and controlling of water distribution systems

A. J. Whittle (2013) has built up the technique for in-situ, on-line checking of water dissemination frameworks with a precise target to support effective administration and task. Specifically, it is critical to recognize and restrict pipe failures not long after they happen, and pre-emptively, distinguish 'hotspots', or zones of the circulation arrange that will probably be helpless to basic failures. These capacities are indispensable for diminishing the time taken to recognize and repair failures and thus, alleviating impacts on water supply. Water Wise is a tool that oversees and examinations information from a system of

wireless sensor nodes, constantly observing pressure driven, acoustic and water quality parameters. Water Wise helps numerous applications including dynamic forecast of water request and pressure driven state, online recognition of occasions, for example, pipe blasts, and information digging for ID of longer-term patterns. This paper depicts the WaterWiSe@SG venture in Singapore, concentrating on the utilization of Water Wise as a tool for observing, recognizing and foreseeing unusual occasions that might be demonstrative of auxiliary pipe failures, for example, blasts or breaks

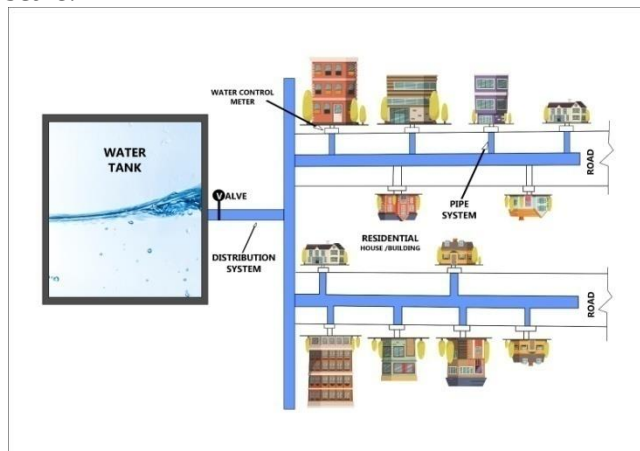
VI. METHODOLOGY

The proposed name 'Automated Water Distribution System' consists of various enhanced components. It is created and assembled in a package which is advancement of current water distribution system which will play a part in future technologies to come. Initially, the water distributaries are fitted with the new introduced system. Data such as amount of water to be discharge, time of discharge, etc is embedded into it before use. When the water distribution is started from any corporation it travels through distributary lines and reaches sub-tanks situated in buildings. The system attached to the distributary water line consists of solenoidal valve.

Once the main solenoid valve gets opened, the water flows through the pipe into the sub-tank. The sensor attached to the solenoid valve will measure the amount of water discharged into water tank. The flow rate is measured with the help of pulse output from the flow sensor. Once the given amount of water discharged is achieved into water tank, the solenoid valve will shut off and stop the flow of water. A RTC (Real Time Clock) is also combined in this system which will automatically open the solenoid valve after 24 hours and allow the flow of water.

Monthly routine checks can be conducted on this system to check any malfunction occurs. This will also help to solve any circumstance which may occur in coming future. This automatic process of shutting on and off of water supply can

continue on daily basis without any man power or human assistance. This will definitely help us to avoid misuse as well as theft of water on large scale.



VII. MATERIAL TO BE USED

- 1) Solenoidal Valve
- 2) Flowmeter
- 3) Real Time Clock (RTC)
- 4) Microcontroller
- 5) Hi-Link Power Supply
- 6) MOSFET (IRF540N)
- 7) OLED Display
- 8) Diode
- 9) Capacitor
- 10) Screw terminal

VIII. ADVANTAGES OF SYSTEM

- 11) Equal water supply for each consumer according to number of members.
- 12) Least wastage of water.
- 13) Least electric power consumed.
- 14) Accurate readings.

IX. LIMITATIONS

- 15) Continuous electric supply needed.
- 16) Expert installation needed.

X. CONCLUSION

The project has given a cost-effective solution for realtime water management and data generation. The data calculated from these systems can be gathered and stored digitally. So as in future, local and higher authorities such as WRD, Jal Sansadhan Mantri can collect this data and plan more efficiently on water resources and generate water resources if in

need.

In this project a major module in Water Controlling in AWDS is successfully implemented using which water misuses are detected in different parts of the system by processing the data collected from module to the server and hence analysing the water wastage in different parts of any area.

The final outcome of the project is a novel smart system that monitors the water discharge in distribution system and prevents wastage of water and also records the data regarding flow rate and total water flow. AWDS is the future of the water distribution system which will operate without zero human assistance.

ACKNOWLEDGMENT

It gives us immense pleasure in presenting this project report on "AUTOMATIC WATER DISTRIBUTION FOR SMART CITIES". We wish to express true sense of gratitude towards Prof. Rahul Patil, our project guide who at very discrete step in study of this project, contributed his valuable guidance and helped to solve every problem that arose.

I take this opportunity to thank our principal Dr. H.U. Tiwari and Dr. Sameer Sawarkar (HOD Civil Dept.) for opening the doors of the department towards the realization of our project, for their guidance and encouragement. We offer our sincere thanks to our BE Coordinator Prof. Satish Pitake, who gave us extra inspirations to do something new.

We also express our thanks to all family members, friends for their support without whom its very hard to complete our project work. I take this opportunity to express our thanks to all who rendered their valuable help, along with all those unseen people across the internet for maintaining those valuable resources for the successful completion of our project. We owe our success to all of them.

REFERENCES

- [1] Xu Meihua, Fei Yu, Zhao Fangjie and Zhu Qian, "A Remote Medical Monitoring System Based on GSM Network," IET Intl. Comm. Conference on Wireless Mobile and Computing, Shanghai, China, pp. 381-384, 7-9 Dec 2009.
- [2] Kim Yunseop, R. G. Evans and W. M. Iversen, "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network," IEEE Transactions on Instrumentation and Measurement, vol.57, no.7, pp.1379-1387, July 2008.
- [3] ETSI TS 127 007 V5.3.0 (200303) Digital cellular telecom. System, Universal Mobile Telecommunications System (UMTS); AT command set for 3G User Equipment, (UE) (3GPP TS 27.007 version 5.3.0 Release 5, available online: <http://www.etsi.org>.
- [4] Gaikwad Sonali Ashok (2013) "Water Anti-Theft and quality monitoring system by using PLC and SCADA".
- [5] Hassaan Th. H. Thabet (2011) "Design of a PI controller for a computerized building water distribution system with PLC system".
- [6] P. Mukesh Aravind (2013) "PLC based automatic corporation water distribution system using solar energy".
- [7] J. Whittle (2013) "Wireless Sensor Networks for monitoring and controlling of water distribution systems".
- [8] Sagar Khole (2015) "Automated drinking water system and theft detection using embedded technology".
- [9] Ahmad T. Jaiad (2017) "Controlling and Monitoring of Automation of Water Supply scheme based on IOT with theft detection".

AUTHOR

	Prof. Rahul Patil Designation: Asst.Professor Qualification: B.E. (Civil) M.E. (Construction Management) Experience: Teaching - 15 years, Industry -2 years Email Id: rahul.patil@pccoer.in You Tube channel: https://www.youtube.com/channel/UCXOebHpflBj9dbJQG7lBgkw/ Blog: https://rahulpatil84.wixsite.com/website
	Mr. Soham Arun Mancharkar BE Civil: PCCOER Mob. No.: 7798440591
	Mr.Kartikey Sunil More BE Civil- PCCOER Mob. No.: 8928046492
	Mr.Nikhil Bhagwan More BE Civil- PCCOER Mob. No.: 9527038483
	Mr. Sanket BodhrajBadwaik BE Civil- PCCOER Mob. No.: 9146851683

Assessment of Index properties of soil using Bitumen Emulsion

Ajit T. Alat¹, Prathamesh R. Gaikwad², Aniket S Ingle³, Mrudul A. Sonar⁴, Asst. Prof. Rahul S. Patil⁵

¹Pimpri-Chinchwad College of Engineering and Research, Ravet, Haveli, Pune-412101

²Department of Civil Engineering

³Savitribai Phule Pune University

ABSTRACT Soil is one of the nature's most abundant construction materials. Almost all type of construction is built with or upon the soil. If the sub grade is not enough good the whole structure will face failure such as cracks. Therefore, the sub grade is normally replaced with stronger soil material so as to improve the strength but this is not economical. In this project the strength of soil is increased by adding bituminous emulsion instead of replacing with stronger soil. The initial strength of the soil is determined by conducting soil tests such as Water content test, Specific gravity test, Standard proctor test, Compression test and Direct shear test. The results obtained are then compared with the soil treated with 10%, 15% and 20% of bitumen emulsion.

INDEX TERMS Laterite Soil, Bitumen Emulsion, Shear Strength

I. INTRODUCTION

Starting from the base, soil is a standout amongst the most abundant construction materials of nature. Just about all kind of construction is based with or upon the soil. Long term performance of pavement structures is altogether affected by the strength and durability of the subgrade soils. In-situ subgrades frequently don't provide the support required to achieve acceptable performance under the traffic loading with increasing environmental demands. Despite the fact that stabilization is a well-known option for improving soil engineering properties yet the properties determined from stabilization shift broadly because of heterogeneity in soil creation, contrasts in micro and macro structure among soils, heterogeneity of geologic stores, and because of chemical contrasts in concoction interactions between the soil and utilized stabilizers. These properties require the thought of site-specific treatment alternatives which must be accepted through testing of soil-stabilizer mixtures.

II. LITERATURE REVIEW

R. Deby Linsha, Y. PreethyDharanya, V. Vinodhini And C. Pavithra

Improvement of shear strength of soil using bitumen emulsion. Test result indicate that with the increase of bitumen emulsion in the soil sample till 10% proportion ratio the soil strength is increased and after certain percentages (20% and 30%) its getting decrease. The results are shown that the strength of the soil is good when 10% bitumen emulsion is added.

N. Vijay Kumar, S S. Asadi, A.V.S. Prasad, G Pradeep Kumar

Study on strength of laterite soil using bitumen emulsion and ESP, CSA

The results which came after carrying out all tests found successful which indicates that the admixtures added (bitumen and ESP and CSA) can be surely used as a laterite soil stabilizer. From the results it is proved that these admixtures were effective in stabilizing the soil at 10% and with further increase in admixtures lowers the strength of soil.

Mr. A. Ghosh, Mr. Rabindranath Ghosh, Mr. Love Gupta, Mr. Ankur Kumar

A review paper on stability of soil block using bitumen emulsion

From this study it is clear that there is a considerable improvement in California Bearing Ratio (CBR) of sub-grade due to use of MS bitumen emulsion if proper mixing is done. It is seen that it best results are obtained if the soil emulsion mix is left for about ve and half hours after mixing. But the cost of emulsion is so high so the amount of emulsion also depends upon budget and importance of structure.

Shubham Langer, Er Paramjeet

A review study on the use of bitumen emulsion in the soil sample

The unconfined compressive strength of soil increased by the addition of admixtures such as bitumen emulsion. Addition of bitumen emulsion with soil reduces their plastic indices significantly the use of bitumen emulsion to stabilize uniform grained soil can create improved ground layer but

also a surface base. Observing its economic cost and quality of stabilization improvement, it is clear that this type of stabilization may be applicable in gravel soil road or in shoulder portion of highways. Specific gravity of the soil is increased when the bitumen emulsion is mixed with gravel.

III. OBJECTIVES

Observing the variation of strength in the performance of soils by using Bitumen Emulsion (Different proportions) Determining the variation in the other properties (water content, specific gravity, dry density, optimum moisture content) by using the bitumen emulsion at different proportions.

IV. METHODOLOGY

Methodology involves collection of soil sample (laterite soil) from the site (Dapoli), study of soil properties by conducting tests (water content, direct shear tests, unconfined compression test, standard proctor compaction, specific gravity), addition of bitumen Emulsion to the soil at different proportions, testing of bitumen emulsion added soil and comparison of test results. The methodology of this study involves

- Study of Bitumen Emulsion
- Material Collection
- Determining the Characteristics of Soil
- Addition of Bitumen Emulsion to Soil Sample
- Tests on Sample treated with Bitumen Emulsion
- Comparison of Results
- Conclusion

V. RESULTS

5.1 MOISTURE CONTENT TEST:

Specification:

This test is done as per IS: 2720 (Part II) – 1973.

Result:

Bitumen Emulsion	Moisture Content
0%	14.99
10%	6.5
15%	4.1
20%	2.15

5.2 SPECIFIC GRAVITY TEST:

Specification:

This test is specified in IS: 2720 (Part 4) – 1985.

Result:

Bitumen Emulsion	Specific Gravity
0%	2
10%	2.51
15%	2.21
20%	1.57

5.3 STANDARD PROCTOR TEST:

Specifications:

The experiment is conducted as per IS 2720-7(1980).

Result:

Bitumen Emulsion	Dry Density
0%	1.09
10%	1.14
15%	1.29
20%	1.01

5.4 UNCONFINED COMPRESSION TEST:

Specifications:

The test is conducted as per IS 2720-10 (1991).

Result:

Bitumen Emulsion	Unconfined Compressive Strength(kg/cm ²)
0%	16.54*10 ⁻²
10%	19.48*10 ⁻²
15%	18.22*10 ⁻²
20%	15.35*10 ⁻²

5.5 DIRECT SHEAR TEST:

Specifications:

The test is conducted as per IS: 2720- 13 (1986), method of tests for soils. One kg of air-dry sample passing through 4.75mm IS sieve is required for this test.

Result:

Bitumen Emulsion	Shear Strength(kg/cm ²)
0%	3.5*10 ⁻²
10%	4.12*10 ⁻²
15%	4.48*10 ⁻²
20%	3.25*10 ⁻²

VI. CONCLUSION

The study made a comprehensive examination of the effectiveness of soils on the performance of bitumen emulsion. The characteristics of soil sample were known from the tests conducted and the similar tests are conducted for the soil sample mixed with three different proportions of bitumen emulsion (10%, 15% and 20%). Test result indicate that with the increase of bitumen emulsion in the soil sample till 15% proportion ratio the soil strength is increased and after certain percentage (20%) it is getting decrease. The results show that the strength of the soil is good when 15 % bitumen emulsion is added.

The results which came after carrying out all tests found successful which indicates that the admixtures added (bitumen emulsion) can be surely used as a soil stabilizer.

By considering its economic cost and quality of stabilization improvement, hence it is clear that this type of bitumen emulsion stabilization may be applicable in Sub-grade soil road or at foundation of structure.

ACKNOWLEDGMENT

It gives me an immense pleasure to submit this project

report on "Assessment of Index properties of soil using Bitumen Emulsion" We tried our level best to represent this topic into compact and to the point framework. Wish to express our sincere thanks with profound gratitude to our project guide Prof. Rahul Patil for his valuable guidance and constant encouragement without which it would have been impossible for us to present and complete this project successfully.

We would like to extend our sincere and true thanks to our Head of Department Dr. Sameer Sawarkar and principal Dr. H.U. Tiwari as well as all the staff members for impairing us the best of their knowledge and guidance. Last but not the least; we also thank Asst. Prof. Omkar Bhalekar, all our beloved friends, Department Staff and respected Teachers for their assistance and help.



Rahul S. Patil
Asst. Prof.
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet



Ajit T. Alat
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet



Prathamesh R. Gaikwad
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet



Aniket S. Ingle
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet



Mrudul A. Sonar
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet

REFERENCES

- 1) R. Deby Linsha, Y. PreethyDharanya, V. Vinodhini and C. Pavithra, IMPROVEMENT OF SHEAR STRENGTH OF SOIL USING BITUMEN EMULSION, IJCIET, Volume 7, Issue 6, November-December 2016
- 2) N. Vijay Kumar, S S. Asadi, A.V.S. Prasad, G. Pradeep Kumar, STUDY ON STRENGTH OF LATERITE SOIL, Technical research organization India
- 3) M.Udaya Sri, P.M.S.S. Kumar, An Experimental Study on Laterite Soil Stabilization Using Bitumen Emulsion, International Journal of Innovative Research in Science, Engineering and Technology Vol. 6, Issue 2, February 2017
- 4) E. Kowaski and Dale Starry, Jr. Wirtgen America, Inc., (2007) Modern Soil Stabilization Techniques. NORMAL SOIL 10% 20% 25%.
- 5) Maheswari g. Bismal and Ravi Kumarbadiger (July 2015) Study on Stabilization of Soil Using Sea and Bitumen Emulsion.
- 6) K. Prashanth Kumar (October 2014) Stabilization of Soil using Bitumen Emulsions.
- 7) Tridib Goswami (May 2014) A laboratory Study on Use of Bitumen Emulsions in Gravel Roadridib Goswami (May 2014) A Laboratory Study on Use of Bitumen Emulsion in Gravel Road.
- 8) SK. Wasim Anwar, Experimental Investigations on Marshall and Modified Marshall Specimens by using Neat Bitumen. International Journal of Civil Engineering and Technology (IJCIET), 7(5), 2016, pp.409-419

Suitability Analysis of H Block Earth Retaining Structure in Landslide Mitigation

Prof. Sudarshan S. Bobade¹, Sushma B. Gaikwad², Shefali B. Gaikwad³, Ruby Oomman Varghese⁴, Rajni R.

kasabe⁵CivilEngineering Department,PimpriChinchwadcollegeofengineering and researchravet,pune

ABSTRACT The significance of landslides is set to increase in the coming years because of population growth, expansion of infrastructure, and increased forestry and agricultural activity in the region. In temperate and tropical Asia, projected climate change related impacts are likely to result in compound effects of land slide incidences. Land slides cause environmental damage to forests and agricultural resources by removing topsoil, blocking rivers, and increasing downstream sedimentation. A retaining wall is a structure designed and constructed to resist the lateral pressure of soil, when there is a desired change in ground elevation that exceeds the angle of repose of the soil. Retaining walls are used for supporting soil laterally so that it can be retained at different levels. Retaining walls are structures designed to restrain soil to a slope that it would not naturally keep to. Landslides are caused by disturbances in the natural stability of a slope and are associated with hilly or mountainous regions. It occurs when masses of rock, earth material, or debris flows move down a slope due to gravity. To retain the earth or other loose material which are unable to stand vertically by itself the structures which are constructed is called as retaining wall. A retaining wall will fail when it is unable to withstand the force on it created by the soil behind it. The failure of a retaining wall is categorized as a geotechnical disaster because it is not only causing major economic losses but also some casualties also. To overcome these failures, we are working with new concept of use of precast H blocks in construction of retaining wall. By using H precast block as a retaining wall to prevent the landslide mostly hilly and mountain area.

INDEX TERMS landslide, population growth, expansion of infrastructure, lateral pressure, retaining wall, stability of a slope, geotechnical disaster, H precast block

I. INTRODUCTION

Landslides occur when ground on slopes becomes unstable. The unstable ground collapses and flows down the side of a hill or mountain, and can consist of earth, rocks, mud, and any debris which may be caught in its wake. If a landslide occurs near inhabited areas, it can cause a great deal of damage. They can strike quickly and bury entire villages. Buildings are damaged or flattened and roads, bridges and infrastructure can be damaged or destroyed by the debris. Given the nature of such disasters, fast relief and rescue operations are required to get to trapped survivors but this can be delayed due to landslides cutting off easy access to the affected area. Satellites provide key observations of the area, assessing the damage and identifying areas where survivors may potentially be. The destabilization of ground can be caused by heavy rain and floods, seismic activity, erosion from oceans and rivers, or changes to vegetation affecting soil composition.

Almost every landslide has multiple causes. Slope movement occurs when forces acting down-slope (mainly due to gravity) exceed the strength of the earth material that composes the slope. Causes include factors that increase the effects of down-slope forces and factors that contribute to lower reduced strength. Landslides can be initiated in slopes already on the verge of movement by rainfall, snow melt, changes in water level, stream erosion, changes

in groundwater, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors. Earthquake shaking and other factors can also induce.

landslides underwater. These landslides are called submarine landslides. Submarine landslides sometimes cause tsunamis that damage coastal areas.

In India, 420,000 sq km, or 12.6% of the total land, is landslide prone. India accounted for 28% of construction-triggered landslide events, followed by China (9%), and Pakistan (6%). On the other hand, of the total landslides triggered by rainfall, 16% were reported from India. Of these, 77% occurred during the monsoon. India also accounted for maximum landslides triggered by mining,

at 12%, followed by Indonesia (11.7%), and China (10%). Konkan region is a large landslide prone area in the Maharashtra. Most roads and railway tracks of Konkan region are connected to the megacities of Maharashtra i.e., Gujarat, Karnataka, and Goa. The road blockage problems occurred due to landslides.

CAUSES OF LANDSLIDES

External Causes

1. Undercutting of the foot of the hills slope due to river erosion, quarrying, excavation for canals and roads, etc.

2. External loads such as buildings, reservoirs, highway traffic, stockpiles of rocks, accumulation of alluvium on slopes, etc.
3. Increase in unit weight of slope material due to increased water content.
4. Vibrations due to earthquakes, blasting, traffic, etc., causing increase in shearing stresses.
5. Anthropogenic changes caused by deforestation.
6. Undermining caused by tunnelling, collapse of underground caverns, seepage erosion, etc.

Internal Causes

1. Increase in pore water pressure.
2. Reduction in cohesive strength caused by progressive laterization.
3. Hair cracks due to alternate swelling and shrinkage from tension.
4. Presence of faults, joints, bedding planes, cleavage etc., and their orientation.
5. Freezing and thawing of rocks and soils.
6. Material properties such as compressive strength, shear strength, etc., of earth material.

MITIGATIVE MEASURES

- Demarcating landslide prone areas and accordingly plan the future development activities.
- Reduce the slope angle.
- Place additional supporting material at the foot of the slope.
- Reduce the load on the slope (rock, soil or artificial structures).
- Stabilize near-surface soil by preferably fast-growing plants with sturdy root system.
- Build thick retaining walls at the toe of the slope (high thin walls have been less successful)
- Decrease the water content or pore pressure of the rock or soil.
 - By covering the surface completely with an impermeable material and diverting the surface runoff above the slope.
 - By providing surface drainage
 - By drilling boreholes (horizontal) to increase subsurface drainage.
- Driving of vertical piles into the foot of a shallow slide to hold the sliding block (on thin slides and on low angle slopes).
- Use of rock bolts to stabilize rocky slopes (on thin slide blocks of very coherent rocks on low angle slopes)

- Clear the blocked drainage channels.
- Clear the debris, especially the huge rock boulders and tree trunks on the slopes.
- Stabilize the depositional area (characterized by loose soil, small rock boulders, etc.) by fast growing trees/plants.
- Rehabilitate the affected people.

WHAT IS A RETAINING WALL?

Retaining wall is a structure that is designed and constructed to withstand lateral pressure of soil or hold back soil materials. The lateral pressure could be also due to earth filling, liquid pressure, sand, and other granular materials behind the retaining wall structure. There are various types of retaining wall structures which are used for numerous goals.

Types of Retaining Walls

1. Gravity Retaining Wall
2. Crib Retaining Wall
3. Gabion Retaining Walls
4. Cantilever Retaining Wall
5. Counterfort/Buttressed Retaining Wall
6. Anchored Retaining Wall
7. Piled Retaining Wall
8. Mechanically Stabilized Earth (MSE) Retaining wall
9. Hybrid Systems

DISADVANTAGES OF RETAINING WALLS

- Some retaining walls begin developing vertical cracks, such as in poured concrete. This is often due to excessive pressure or wide changes in temperature. To prevent the severe vertical cracks, provide plenty of good drainage, which can often be expensive to accomplish.
- Failing Foundation: Brick retaining walls often fail under pressure.
- Retaining walls need extensive drainage resources to prevent moisture, but they also require a strong foundation. Some retaining walls will not be able to retain high amounts of pressure from soil, such as brick walls. This often results in crumbling bricks or a failing foundation.
- Requires relatively long construction period: formwork must be erected & concrete poured and allowed to cure before backfilling loads.
- Costly and requires specialty.
- Wall height is limited based on required structural sections.
- Wall system may undergo relatively movements which may be harmful to nearby structure.

Post-Landslide Measures

SUITABILITY OF H BLOCK ASERS

By using a new type of retaining wall constructed with interconnected H-type concrete blocks we are going to overcome the disadvantages of conventional ERS. Advantages of such a wall include stability, proper drainage, allowance of large displacements or differential settlements.

- It retains backfill materials.
- It eliminates slopes of earth or earth fill materials.
- It helps in control of erosion.
- H block retaining wall is simple and easy to construct.
- It is cost effective.
- It is durable compared to other types of retaining walls.

We are going to propose a block which is effective in shape and size and use them where frequent landslides occur.

The H blocks are going to be designed in such a way that they are interlocked with each other in the form of steps. Such design of blocks is being created to prevent pressure of landslides.

Each of the H block will have a circular hollow pipe penetrating throughout the block at center which consists of steel wire rope passing through every H block in the row.

Steel wire rope will be attached to the threaded pile which is being inserted deep inside the earth thus supporting H blocks.

The thickness of the wire rope should be depending upon pressure on each block and risk of the landslide considering height and slope of mountain.

The gap between two blocks would be used to allow excess groundwater flow which will reduce the pressure on the block. It will also act like a screen which allows the flow of water and restricts the flow of pebbles.

The uppermost H block would attach to the wire rope which can pass under the tar.

road from one end to another end of the road.

The other end of the rope would be tied to the threaded pile to acquire the desired support. Such design of uppermost H block can be used to prevent the vehicle from falling in the valley from any accident.

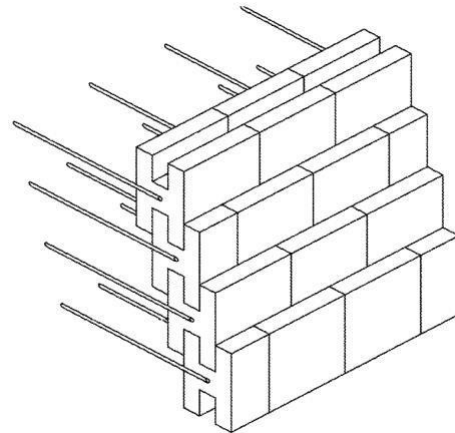


Fig.1 interconnected H block

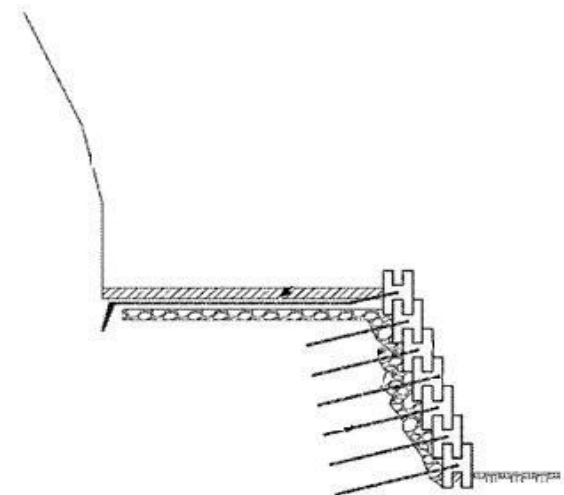


Fig.2 retaining wall using precast block.

CONCLUSION

Conventional earth retaining structures once they fail to provide service for the design period, they are supposed to be replaced with the new one every time as there is no option to repair, maintain, and speedily reconstruct it with earlier defined strength properties economically. This issue can be resolved by having provision of precast H-block earth retaining structure with an easy interlocking system which helps in repairing, maintaining, and speedily reconstructing with defined strength properties economically.

REFERENCES

1. Thigale, S. S., and Bhavana Umrikar. "Disastrous landslide episode of July 2005 in the Konkan plain of Maharashtra, India with special reference to tectonic control and hydrothermal anomaly." *Current Science* (2007): 383-386.
2. Wischmeier, Walter H., and Dwight David Smith. *Predicting grainfall erosion losses: a guide to conservation planning*. No. 537. Department of Agriculture, Science and Education Administration, 1978.
3. Turner, Alan Keith. "Social and environmental impacts of landslides." *Innovative Infrastructure Solutions* 3, no. 1 (2018): 1-25.
4. SONG, Fei, and Jian-Min ZHANG. "Evaluation of seismic earth pressures at the passive side." *The 14th WC EE, Beijing, China* 8 (2008): 12-17.
5. Gandomi, Amir H., Ali R. Kashani, David A. Roke, and Mehdi Mousavi. "Optimization of retaining wall design using recent swarm intelligence techniques." *Engineering Structures* 103 (2015): 72-84.
6. Goh, Anthony T. C. "Behavior of cantilever retaining walls." *Journal of Geotechnical Engineering* 119, no. 11 (1993): 1751-1770.
7. Xu, Changjie, Qizhi Chen, Yili Wang, Wentao Hu, and Tao Fang. "Dynamic deformation control of retaining structures of deep excavation." *Journal of Performance of Constructed Facilities* 30, no. 4 (2016): 04015071.
8. Ahn, Kwanguk, and Hongsig Kang. "Behavior of reinforced retaining walls with different reinforcement spacing during vehicle collisions." *Advances in Materials Science and Engineering* 2015 (2015).
9. Lim, Aswin, and Paulus Pramono Rahardjo. "Lessons learned from retaining wall failures: a geotechnical disaster." (2018).
10. Ukritchon, Boonchai, Sophea Chea, and Suraparb Keawsawasvong. "Optimal design of Reinforced Concrete Cantilever Retaining Walls considering the requirement of slope stability." *KSCE Journal of Civil Engineering* 21, no. 7 (2017): 2673-2682.
11. Ghosh, Rohit. "Effect of soil moisture in the analysis of undrained shear strength of compacted clayey soil." *Journal of Civil Engineering and Construction Technology* 4, no. 1 (2013): 23-31.
12. Small, John C., and Harry G. Poulos. "Structural integrity issues associated with soils and rock in civil engineering industries." *Module Mater. Sci. Mater. Eng* (2018): 01147-2.
13. Collin, James G. "Lessons learned from a segmental retaining wall failure." *Geotextiles and Geomembranes* 19, no. 7 (2001): 445-454.
14. Sharma, Chetan, and Vijay Baradiya. "Evaluation of the effect of lateral soil pressure on cantilever retaining wall with soil type variation." *IOSRJ. Mech. Civ. Eng* (2014).
15. Ukritchon, Boonchai, Sophea Chea, and Suraparb Keawsawasvong. "Optimal design of Reinforced Concrete Cantilever Retaining Walls considering the requirement of slope stability." *KSCE Journal of Civil Engineering* 21, no. 7 (2017): 2673-2682.
16. Goh, Anthony T. C. "Behavior of cantilever retaining walls." *Journal of Geotechnical Engineering* 119, no. 11 (1993): 1751-1770.

AUTHOR

- 1. Prof. Sudarshan S. Bobade**
Asst. Prof.
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
- 2. Sushma B. Gaikwad**
2, BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
- 3. Shefali B. Gaikwad**
3, BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
- 4. Ruby Oommen Varghese**
4, BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
- 5. Rajni R. Kasabe**
5, BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

To Make A Cowdung Bricks For The Construction Of Eco-friendly House

Prof. Anand Kudoli¹, Sunnyraj Aher², Shubham Gaikwad³, Shubham Jayptre⁴, Rushikesh Dalavi⁵

¹Pimpri Chinchwad College of Engineering and Research Ravet

²Department of Civil Engineering PCCOER

³University of SSPU

ABSTRACT

Cowdung is the indigested residue of plant matter which is obtained from animals. It is rich in minerals like Potassium, Magnesium, Sodium, and Manganese and is comprised of organic matters. Cow dung can be used to make eco-friendly bricks. In addition, it provides thermal comfort and has a high embodied energy compared to vernacular materials. The main objective of this work was to produce low cost, resistant and durable (good resistance to water) blocks with thermal behavior enabling quality comfort indoors. The method of producing conventional bricks from the kiln is costly and causes large pollution. The cowdung was added as a reinforcing agent in various ratios. The ratio which gives the best output can be used. By using cow dung there will be less pollution to the environment. It has more advantage than the conventional brick which will help to live a more healthy life.

INDEX TERMS Cowdung, pollution, conventional, eco-friendly

1. INTRODUCTION

It is well known that sustainable development, one of the most important issues in the world at present days, involves building our communities in such a way that we can all live comfortably without consuming all of our resources, we make an impact on the environment through how we survive our lives. In recent years, the use of solid waste derived from agricultural products in the manufacture of bricks has been the focus of research in the construction materials sector. The addition of agricultural materials to brick is at present a frequent practice. Several attempts have been made to reduce the rising cost of bricks production in developing countries with very little success. There is the need to seek alternatives to conventional brick and

to seriously consider the utilization of industrial and agricultural by-products as feedstock for the brick industry to produce brick. When some of these by-products will be added for partial replacement will in the supplement to upgrade the properties of Bricks also generate income and Employment. The problem of disposal of these by-products is minimized and the amount of green gases released into the atmosphere through burning processes is also greatly reduced.

2. OBJECTIVE:

1. To build a house with the help of eco-friendly brick
2. Use of construction material which will be less harmful to the environment

3. APPLICATION OF LIGHT TRANSMITTING BLOCKS:

- The main scope of our project is to enhance and improve Agricultural sector which will benefit to farmer which will help to raise their quality of life.
- It will help to develop the Rural Areas.

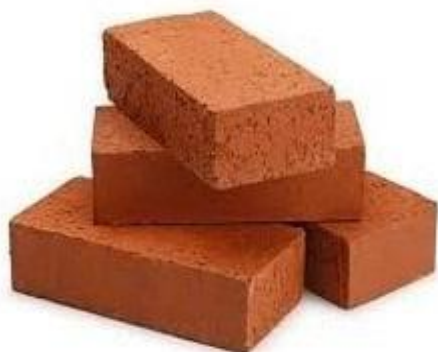
4. LITERATURE REVIEW:

Study of use of cow dung in the construction of making of Bricks by A.G. Krishnan, Gibi Miriyam, Sruthi G. Raj from International Journals.

Experimental study of use of cow dung by Gautam Bhadoriya, O.Y. Ojedokun, S. B. Raheem and S. J. Aderinto.

5. RESEARCH METHODOLOGY OF THE PROJECT:

- With the help of mould we have to prepare a sustainable cow dung brick.
- The ingredients used to make brick are, cow dung, grass, lime and water.
- Mixture of cow dung, lime and water as per the proportion fixed.
- And then it is kept to dry for 21 days as the brick is dried.



6. MATERIAL USED:

1. **COW DUNG:**– Cow dung can be used to manufacture bricks which are eco-friendly and much cheaper. Cow dung ash is obtained by drying Cow dung under sun. **Cow dung**, also known as **cow pats**, **cow pies** or **cow manure**, is the waste product (faeces) of bovine animal species. Cow dung is the undigested residue of plant matter which has passed through the gut of goat. It is rich in minerals like Potassium, Magnesium, Sodium and Manganese and is comprised of organic matters.
2. **LIME** – Lime is a calcium-containing inorganic mineral composed primarily of oxides, and hydroxide, usually calcium oxide and/ or calcium hydroxide .It is also the name for calcium oxide which occurs as a product of coal-seam fires and in altered limestone xenoliths in volcanic ejecta. The word lime originates with its earliest use as building mortar and has the sense of sticking or adhering. The rocks and minerals from which these materials are derived, typically limestone or chalk, are composed primarily of calcium carbonate. They may be cut, crushed, or pulverized and chemically altered. Burning (calcinations) of these minerals in a lime kiln converts them into the highly caustic material burnt lime, unslaked lime or quicklime (calcium oxide) and, through subsequent addition of water, into the less caustic (but still strongly alkaline) slaked lime or hydrated lime (calcium hydroxide, $\text{Ca}(\text{OH})_2$), the process of which is called slaking of lime.
3. **SOIL** — There are many types of soils from which bricks are made. The most suitable one are strong soils, sandy soils and calcareous soils. Strong soils are plastic in nature and contain fewer openings spaces (voids). On drying, the water content of these soils comes out with pressure, thus, cracks are

formed either in the soil or the products cast out of them. Sandy and loamy soils are considered good soils for making bricks.

Soils containing as low as 17 percent clay content may also be used. Calcareous soils containing up to 1 per cent of CaCO_3 do not present difficulties in making good-quality bricks

Compressive test result for Brick:

SRNO	PARAMETER	COMPRESSIVE STRENGTH
1	COW DUNG BRICK	1 Newton per m square

4. GRASS CONTENT IN COW DUNG –

The Tensile strength is increased when the increase in Grass fibres content in cow dung. With an increase in the percentage of the Grass fibre, the compressive strength of the brick increases and water absorption decreases.



PREPARATION OF MIXTURE



CASTED BRICKS

7. CONCLUSION:

- 1) Cow dung brick has a lot of medicinal properties and it also reduces the emission of electronic gadgets which are used on a large scale nowadays.
- 2) Cow dung bricks will be used to build single storey houses.
- 3) One of the major advantages of cow dung bricks is having insulating properties which will definitely be helpful for people in harsh climates.
- 4) The strength of the soil-cow dung mixture decreases as the percentage of cow dung content increases.

7. REFERENCES:

- a) Pavan VSR, Kumar Rayaprolu, PoluRaju P. Incorporation of Cow Dung Ash to Mortar and Concrete. International Journal of Engineering Research and Applications (IJERA). 2012; 2(3): 580-585.
- b) HAL Id: hal-01876848 <https://hal.archives-ouvertes.fr/hal-01876848> Earth blocks stabilized by cow-dung Antonin Fabbri, Jean-Claude Morel
- c) Dittrich, A.D.K. and Helden A.J. 2012. Experimental sward islets: the effect of dung and fertilisation on Hemiptera and Araneae. Insect Conservation and Diversity 5: 46-56.
- d) Earth blocks stabilized by cow-dung Younoussa Millogo, Jean-Emmanuel Aubert HAL Id: hal-01876848 <https://hal.archives-ouvertes.fr/hal-01876848>
- e) Kute S, Deodhar S. "Effect of clay and temperature on properties of cow dung bricks", Journal of Institute of Engineers, Vol. 84. Pp. 82-85, 2003.
- f) Aubert JE, Maillard P, Morel JC, Alrafi M (2015) Towards a simple compressive strength test for earth bricks? Mater Struct DOI 10.1617/s11527-015-0600-0

9. ABOUT AUTHORS:



PROF. ANAND B. KUDOLI
ASSISTANT PROFESSOR
CIVIL ENGG.
DEPT. PCCOER
B.E. (CIVIL)
M.Tech (Hydraulics)



SHUBHAM G. GAIKWAD
PURSUING B.E. (CIVIL)
CIVIL ENGG.
DEPT. PCCOER



RUSHIKESH J. DALAVI
PURSUING B.E. (CIVIL)
CIVIL ENGG.
DEPT. PCCOER



SHUBHAM M. JAYPTRE
PURSUING B.E. (CIVIL)
CIVIL ENGG.
DEPT. PCCOER

Impact of Road Accidents on Economy

Mayura Yeole¹, Adesh Patil², Abhijeet Kunale³, Nilkanth Mathpati⁴, Prasanna Bari⁵, Praphull Kadkanje⁶

¹ Assistant Professor, Civil Department, PCCOER, Ravet, Pune, India

^{2,3,4,5,6} Students, Civil Department, PCCOER, Ravet, Pune, India

ABSTRACT

Road traffic accidents (RTA) are a global problem resulting in deaths, physical injuries, psychological problems and financial losses. These financial damages have immediate consequences and long term consequences on the victims and their families. Different countries have different impact of road traffic accidents and therefore spend dissimilar amounts in their budgets to prevent the road traffic accidents. If the financial losses due to road traffic accidents are calculated and highlighted by the researchers, the respective governments will be willing to spend higher amount in their budgets to prevent such accidents; as governments will be able to directly see the benefits to their countries, of spending higher budget amounts. Various countries are acting differently to reduce this menace of road traffic accidents and World Health Organization (WHO) is celebrating “Decade for road safety” to reduce the accidents and thus the financial losses to the society.

Keywords: Road traffic accidents, GDP, financial losses, Economic Efficiency, Socio- economic impact.



SR.N.O.	YEAR	FATAL ACCIDENTS		SERIOUSLY INJURED ACCIDENTS		MINOR INJURY ACCIDENTS		WITHOUT INJURY ACCIDENTS	TOTAL ACCIDENTS
		No. of Accident	Total Killed	No. of Accident	Total Seriously Injured	No. of Accident	Total Minor Injured		
1	2016	11780	12935	13273	22273	8554	13611	6271	39878
2	2017	11454	12511	12333	20767	7098	11477	5171	36056
3	2018	12098	13261	12648	20335	6585	11030	4386	35717

4	2019	11787	12788	12197	19152	5473	9476	3568	32925
RATIO		-3	-4	-4	-6	-17	-14	-19	-8

ALLMAHARASHTRAYEAR-WISEACCIDENTS

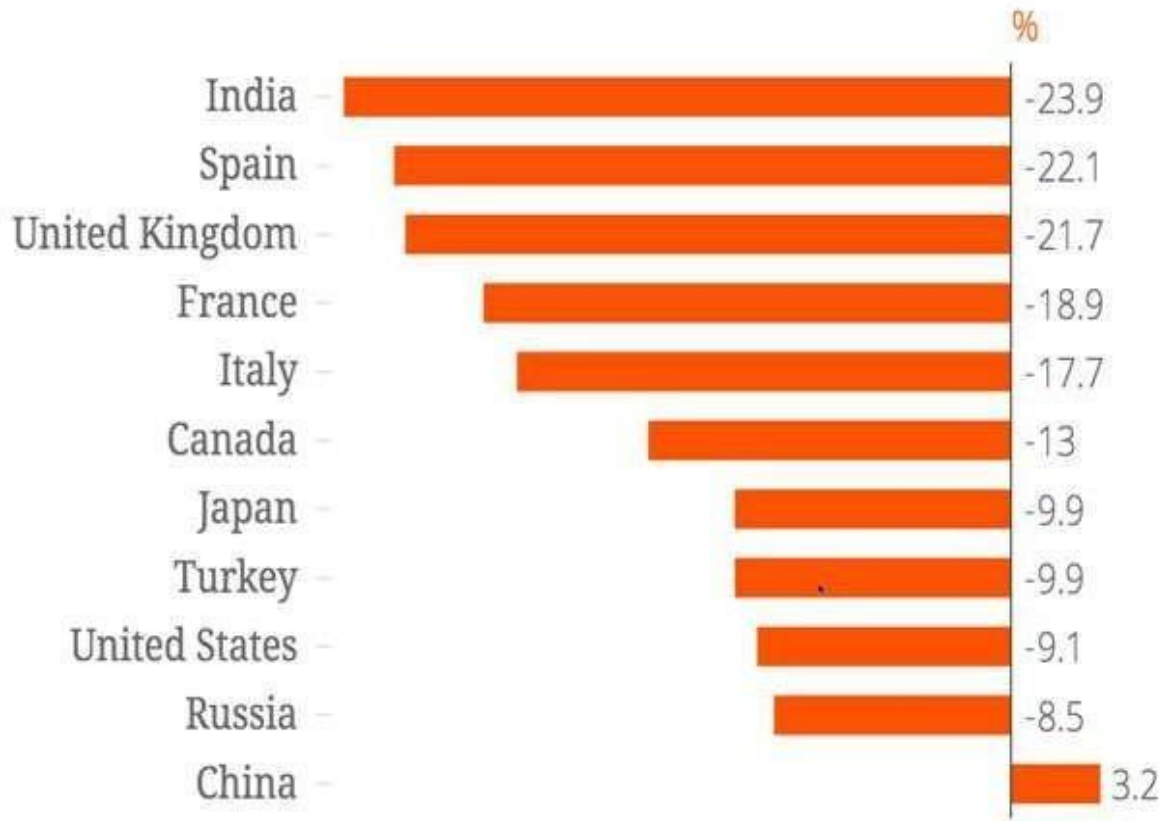
ROADACCIDENTSINMAHARASHTRA								
YEAR	FATAL		GRIEVOUSINJURY		MINORINJURY		WITHOUTINJURY	TOTALACCIDENTS
	Accident	Killed	Accident	Injured	Accident	Injured		
2017	11454	12511	12333	20767	7098	11477	5171	36056
2018	12098	13261	12648	20335	6585	11030	4386	35717
2019	11787	12788	12197	19152	5473	9476	3568	32925
Diff %	-3	-4	-4	-6	-17	-14	-19	-8

YEAR	FATALACCIDENTS		GRIEVOUSINJUREDACCIDENTS		MINORINJURYACCIDENTS		WithoutInjuryAccident	TotalAccident
	No. ofAccident	Total Killed	No. ofAccident	Total GrievousInjured	No. ofAccident	Total MinorInjured		
2016	97	151	61	153	14	26	109	281
2017	89	105	94	147	21	44	156	360
2018	96	110	72	151	16	23	174	358
2019	74	86	67	162	27	31	185	353
RATIO	-22.9	-21.8	-6.9	7.3	68.8	34.8	6.3	-1.4

ACCIDENTS CLASSIFIED ON MUMBAI-PUNE EXPRESSWAY

ACCIDENTS CLASSIFIED ON MUMBAI-PUNE EXPRESSWAY

GDP growth for April-June quarter year-on-year (%)



Scroll.in

Data: Official respective government sources

CONCLUSION

Financial losses due to road traffic accidents are a great burden on the victims, their families, different countries and the world as a whole and especially to the low and middle income countries that bear the major burden due to RTA. These financial losses are preventable by reducing the number of accidents by taking care of the factors responsible for these accidents. Money saved by these measures can be better utilized for developing the new and better roads and many other facilities needed in country.

The world health organization records 12 Lac deaths due to road accidents, globally. India has a major share of more than 1.37 Lac deaths every year. In 2013, the number recorded was more than 1.37 Lac. Maharashtra is the highest contributor towards road accidents in the country. To improve the national status, objective ways will have to be instituted for preventing the accidents by way of better road infrastructure, greater control and stricter legal systems, inculcating higher sense of responsibility and awareness and more efficient response systems.

Towards this, closer coordination and technological support is highly warranted. It should be borne in mind that the cost of any accident is far greater than the calculable cost of damage, insured life and legal as well as administrative costs. It has an incalculable socio-economic impact that transcends deeper than what is visualized.

REFERENCES

- [1] 10 facts on global road safety (Internet). World health Organization. 2016 (cited 2016 Jun 24). Available from: <http://www.who.int/features/factfiles/roadsafety/en/>
- [2] World report on road traffic injury prevention: summary. Geneva: World Health Organization; 2004.
- [3] Top 25 countries In car accidents (Internet). Worldatlas. 2016 (cited 2016 Jun 29). Available from: <http://www.worldatlas.com/articles/the-countries-with-the-most-car-accidents.html>
- [4] Agbonkhese O, Yisa G, Agbonkhese E, Akanbi D, Mondigha E. Road traffic accidents in Nigeria: causes and preventive measures. *Civ Environ Res*. 2013;3(13):90–9.
- [5] Williams D. How do accidents happen? A study of more than 700,000 crashes in the UK has produced detailed evidence on the causes of road traffic accidents. *Telegraph* (Internet). 2011 Aug 25 (cited 2016 Jun 20); Available from: <http://www.telegraph.co.uk/motoring/road-safety/8702111/How-do-accidents-happen.htm>
- [6] NHTSA. The economic and societal impact of motor vehicle crashes. 2010.
- [7] Bolton K. Traffic accident compensation UK: All the types of loss you can claim (Internet). 2016 (cited 2016 May 30). Available from: <http://www.accident-claim-expert.co.uk/compensation-amounts/claim-calculator-uk.html>
- [8] Cost of unintentional injuries by class, 2011. (Internet). 2011 (cited 2016 May 22). (National safety council injury facts, 2013). Available from: <http://www.nsc.org/>
- [9] Matthews L. Work potential of road accident survivors with post-traumatic stress disorder. *Behaviour Research and Therapy*. Brussels: European Transport Safety Council (ETSC); 2007 p. 43. (Social and economic consequences of road traffic injury in Europe).
- [10] Social and economic consequences of road traffic injury in Europe. Brussels: European Transport Safety Council (ETSC); 2007 p. 23.
- [11] Dalal K, Lin Z, Gifford M, Svanström L. Economics of Global Burden of Road Traffic Injuries and Their Relationship with Health System Variables. *Int J Prev Med*.

AUTHOR



1.Prof. Mayura Yeole
Asst. Prof.
Department of Civil Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet



2.Mr .Adesh Patil
BESudent
Department of Civil Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet



3. Mr. Prasanna Bari
BESudent
Department of Civil Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet



4. Mr.Abhijeet kunale
BESudent
Department of Civil Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet



Mr. Praphull Kadkanje
BESudent
Department of Civil Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet



Mr. Nilkanth Mathpati
BESudent
Department of Civil Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet

Study of Light Transmitting Mortar Blocks Using Optic Fibers

Prof. Anand Kudoli¹, Prajwal Chauhan², Amruta Padmawar³, Sayali Khedkar⁴, Harshali Bagul⁵

¹Pimpri Chinchwad College of Engineering and Research Ravet

²Department of Civil Engineering PCCOER

³University of SSPU

ABSTRACT: As we know various structural components exist in buildings in different forms and shapes. These play's vital role in construction industry. So, to produce sustainable Mortar a new development is necessary to deal with. Therefore, light transmitting Mortar blocks is one option that utilize the natural light source effectively and at the same time satisfying the strength and aesthetic needs. This project deals with producing light transmitting blocks using the plastic optic fiber (POF) in cement mortar. The plastic optical fibers are embedded in Mortar to be a translucent Blocks. Fibers (by weight) are sandwiched between each layer of mortar and comparative study carryout on compressive strength of the normal Mortar and Mortar with addition of POF in different percentage. The result indicates that, compressive strength of light transmitting Mortar is nearly equal to the normal Mortar strength. Light transmittance through these Mortar increases aesthetic view of the structures. The result indicates that cement mortar blocks have high transparency than Mortar blocks.

INDEXTERMS: Translucent Mortar, Plastic Fibre Optics, Methodology, Testing.

I. INTRODUCTION:

Nowadays, concrete is the most use building material all around, it takes on nearly any shape and forms the backbone of the variety of world's construction. It is the mixture of cement, fine aggregate and coarse aggregate. It is used to construct massive bridges, manmade water ways, mega dams, super highways, the world's tallest skyscrapers and so on over all around the world. Even though it has many advantages, one of the biggest draws back in concrete is that it creates dark buildings, that do not effectively conduct light. There is not much natural sunlight passing through when two buildings are close together and the natural sunlight is well known. According to Indian green building council accounting for 3 credits which 3% of sunlight is required in a green building. But This can be possible only by embedding plastic optic fiber in a Mortar. The new development in concrete technology is allowing day light through the Mortar blocks by embedding the plastic optic fibers. In order to develop the green building concept, Mortar may also use to transmit the light from one face to another. The light transmitting Mortar is little different than normal Mortar which contains plastic optic fibers. It can be manufactured by prefabricated blocks in

a standard size. Different percentages of plastic optic fiber is added to gives as same as the conventional Mortar strength. It shows the improvement in higher light transmitting capacity when the volume of the fiber increased by its total volume of the Mortar which are very important for reducing electricity by using the day light as source.

2.OBJECTIVES:

- To make blocks partly transparent by using optic fibers and to study its physical properties and characteristics and to impart good appearance to structure and to reduce use of artificial light.
- To study the compressive strength results of translucent blocks and to compare with conventional Mortar blocks (Strength purpose).
- To study the cost analysis of translucent blocks compared to conventional Mortar blocks.

3.APPLICATION OF LIGHT TRANSMITTING BLOCKS:

- Used in sidewalks
- Used at dark subway stations
- In the event of a power failure used in lighting indoor

- At roadways in speed bumps at night
- In tiles as decoratives and also in stair case.

4.LITERATURE REVIEW:

- 1) Light Transmitting mortar by using Optical Fibre by A. B. Sawant, R. V. Jugdar, S. G. Sawant International Journal of Inventive Engineering and Sciences (IJIES).
- 2) Experimental Study of Light Transmitting mortar Using Optical Fibre by mlan Kumar Sahoo, SachinSahu, Aman Kumar Singhal, KuramanaStephen, TamoTalom, Subham Saroj Tripathy, Sidhant Das.

5.WORKINGPRINCIPLEOFOPTICALFIBRE:

When ray of light travels from a denser to a rarer medium such that the angle of incidence is greater than the critical angle, the ray reflects back into the same medium this phenomena is called **Total internal reflection**. In the optical fibre the rays undergo repeated total number of reflections until it emerges out of the fibre from other end, even if the fibre is bent.

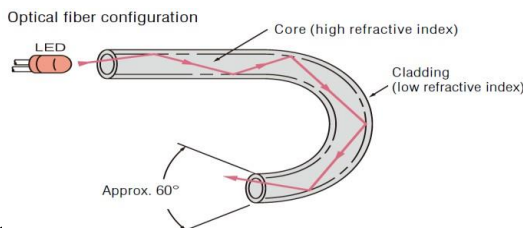


Fig 1. STRUCTURE OF FOF

6.MATERIALS USED:

1. **Plastic Optical fibre (POF)** – Of suitable diameter.
2. **Cement** – Ordinary Portland Cement (OPC) 53 grade, which satisfies the requirements of IS:12269-1987 specifications. It consists of a mixture of calcium silicates (alite, belite), aluminates and ferrites - compounds which combine calcium, silicon, aluminium and iron in forms which will react with water.
3. **Fine Aggregate** – Aggregate whose particle size varies from 0.075 mm to 4.75 mm are called as fine aggregates. Generally, the fine aggregates consist of natural sand or crushed stone with more particles passing through a sieve, Specific Gravity of 2.6 and Fineness Modulus 3.4.
4. **Water**- Water is the key ingredient which when mixed with cement forms a paste that binds all the materials. So, water used should be free from

acid, oils, alkalis and other organic impurities, drinking water can also be used for better results.

7.PROCEDURE:

- **Preparation of the Mould:** We will use normal mould which we use for regular concrete cubes of size 150 x 150 x 150 mm open on one side and placed foam sheet for inserting fibers.
- **Optical Fiber:** Cut the optical fibers more than the thickness of mould.
- **Fixing the Fibers:** The optical fibers are placed in layer wise and along thickness of mould . It is placed in 6-7 bunches.
- **Placing of mix:** The mortar mixture is then poured slowly in layers with caution so that no disturbance is created to the optical fibers beneath. Accumulation of void can be prevented with the help of vibrating tables.
- **Removing the Mould:** After 24 hours, the mould is removed and the mud is pulled off.
- **Curing:** Keeping the blocks in water for 3,7 and 28 days and removing.
- **Cutting:** Then the extra-long fibers are cut.
- **Polishing:** The surface is then polished with the help of sand paper or polishing paper resulting in proper finishing.
- **Testing:** Compressive test of blocks.



Fig 2: POF Placed in Mould

Compressive test result of blocks:

Fiber %	3 Days (N/mm ²)	7 Days (N/mm ²)	28 Days (N/mm ²)
3.5%	3.95	5.98	9.98



Fig 3: Casted cubes

8.CONCLUSION:

- 1) The compressive strength of translucent mortar blocks was to be as same as the conventional mortar block.
- 2) Artificial power consumption is reduced and a good aesthetic view is achieved.
- 3) 3.5% optic fibers of total weight of mortar is perfect at which sufficient light is transmitted.

9.REFERENCES:

1. AAshish B. Ugale, Rushikesh R. Badnakhe and Prathmesh P. Nanhe “Light Transmitting Mortar—Litracon”, Springer; 241-251
2. B. Han “Light-Transmitting Concrete” Springer Nature Singapore 2017, Smart and MultifunctionalMortar Toward Sustainable Infrastructures.
3. K. M. Mosalam, Ph.D., P.E., M.ASCE1; and N. Casquero-Modrego, Ph.D ”Sunlight Permeability of Translucent Concrete Panels as a Building Envelope”ASCE ,J. Archit. Eng., 2018, 24(3): 04018015

4. Thiago dos S. Henriques, Denise C. Dal Molin, Ângela B. Masuero“Study of the influence of sorted polymeric optical fibers (POFs) in samples of a light-transmitting cement-based material (LTCM)”, Elsevier ; Construction and Building Materials 161 (2018) 305–315
5. Yue Li , Jiaqi Li , Hui Guo “Preparation and study of light transmitting properties of sulfoaluminate cement-based materials”, Elsevier ;Materials & Design 83 (2015) 185–192.

USE OF GLASS AS AGGREGATE IN BITUMEN ASPHALT PAVEMENT

Prof.Satish Pitake¹, Vaibhav Patil²,Jyoti Takalkar³, Onkar Tapkir⁴, Vaibhav Thorat⁵

Pimpri Chinchwad College of Engineering & Research, Ravet
Department of Civil Engineering, PCCOER
Savitribai Phule Pune University

ABSTRACT Roads are the integral part of our transport system. A country's road network should be efficient in order to maximize the economic and social benefits. Roads play a significant role in achieving national development and contributing to country's overall performance and social functioning of the community. It is acknowledged that roads enhance mobility and taking people out of isolation and therefore poverty. Roads are built in several layers, consisting of sub-grade, sub-base, base and surface layer. These layers together constitute to the formation of pavement. Pavements made from good quality building materials spread the forces caused by the traffic so the loads exerted on road foundation is protected from overloading and deformation. The pavement can be constructed from a wide variety of the materials and mixtures of materials consisting of gravel, stone, bitumen, concrete or improved soils. The choice of materials and thickness of the pavement layers are determined by the expected traffic density in particular region.

INDEX TERMS:- Introduction , Aim ,Objectives ,Problem Statement , Methodology , Discussion of solution , Test and results ,Conclusion.

I. INTRODUCTION

The massive development of highways everywhere through the world was going ahead at present century. A good roadway infrastructure is the foundation of a solid stable financial .So main aim of the project is to increase the life period and stability of the flexible pavement. Bitumen is used in road construction due to various properties and advantages it has over other pavement construction materials. Bitumen gain certain unique properties that are inbuilt in it during its manufacture. The bitumen as a raw material in flexible road construction and bitumen as a mix (composing other materials i.e. aggregates/ pozzolans) serves certain advantages, that prompt to use bitumen widely in road construction.

Urban India (about 377 million people) generates 62 million tones of municipal solid waste (MSW) each year. Out of the total glass produced in India only 45% is recycled which shows that there is a need for proper procurement and management of waste glass.

Glass is found in municipal solid waste (MSW), primarily in the form of containers such as beer and soft drink bottles; wine and liquor bottles; and bottles and jars for food, cosmetics and other products.

We have used this glass waste for making bitumen flexible pavement by replace 10 to 20 % Of aggregates content. As we know that the life period of the rigid pavement is more than flexible pavement But the cost of the rigid pavement is high and the cost of the flexible pavement is low .And the strength of the flexible pavement is low .So to increase the strength and the reduce the maintenance we are using glass fiber. Glass fiber that is used in the study was the recycled from waste glass as we know all over India some million tons of glass is disposed outside every year in the form of bottles and jars. one answer for a part of the waste transfer issue is to reuse and utilize these material in the managing the developing issue of transfer of this material is an issue that requires coordination and duty by all gatherings development of highways however such an utilization ought not trade off the quality and execution of the roadway framework not bring about a domain issue.

II. AIM OF PROJECT

Testing the effect of adding crushed glass as aggregate in bitumen asphalt pavement.

1.1 OBJECTIVES

To determine acceptable percentages of recycled glass aggregate which could be replaced in a sub-base course of pavement.

1.2 PROBLEM STATEMENT

A study was required to investigate the effect of using crushed waste glass as coarse aggregate and filler in the asphalt binder course as an idea to find out the best percentage of crushed glass that could be used in the preparation bitumen asphalt mix.

2.1 LIST OF IS CODES

TABLE 1
LIST OF IS CODES

Sr. No.	TEST ON	CODE
1.	Bitumen	IS 1202-1978 IS 1203-1978 IS 1448 Part 69 IS 1205-1978 IS 1208-1978
2.	Coarse Aggregate	IS 2386 P-1 2016 IS 2386 P-3 2016 IS 2386 P-4 2016
3.	Fine Aggregate	IS 2386 P-3 2016
4.	Pavement Sample	IS 1203-1978

2.2 METHODOLOGY

1. Preparation of conventional asphalt bitumen pavement samples.
2. Preparation of asphalt bitumen pavement samples with crushed glass.
3. Experimental procedures
4. Experimental analysis.
5. Result and discussion.
6. Conclusion.

2.3 DISCUSSION OF SOLUTION

Glass in the crushed form would help in the fulfilling of the aggregate demand for the pavement designs. This would also result in reduction in the accumulation of solid waste in the form of glass. Glass could be recycled without any alteration in its properties if crushed. Crushed glass being non-metallic and inorganic material would act as a promising replacement.

Advantages of Glass in the pavement are:

- Durability
- Resistance
- Striping resistance
- Binding property with bitumen

3.1 TESTS ON BITUMEN

1. Specific Gravity Test
2. Penetration Test
3. Flash Point Test
4. Softening Point Test
5. Ductility test

3.2 TESTS ON COARSE AGGREGATE

1. Specific Gravity Test
2. Water Absorption Test
3. Flakiness Index
4. Los Angeles Abrasion Test
5. Aggregate Impact Test

3.3 TESTS ON FINE AGGREGATE

1. Sieve Analysis
2. Specific Gravity Test
3. Water Absorption Test
4. Bulk Density Test
5. Moisture Content Test

3.4 TESTS ON CRUSHED GLASS

1. Specific Gravity Test
2. Water Absorption Test



IMAGE 1: FLAKINESS INDEX APPARATUS



IMAGE 2: SOFTENING POINT APPARATUS



IMAGE 3: PENETRATION APPARATUS

4.1 OBSERVATION TABLES

TABLE 2
OBSERVATION TABLE FOR BITUMEN

Sr. No.	Test Particular	Test Results	Minimum Requirement For VG30 Paving Grade (IS 73:2013)	Test Method
1	Specific Gravity	1.034	-	IS 1202-1978
2.	Penetration at 25°C in 1/10 of mm	50	45	IS 1203-1978
3.	Flash Point in °C	241	220	IS 1448 Part 69
4.	Softening Point in °C	51.0	47	IS 1205-1978
5.	Ductility at 25°C in cm	81	40	IS 1208-1978

TABLE 3
OBSERVATION TABLE FOR FINE AGGREGATE

Sr. No.	Test Particular	Test Results	Specified Limits	Test Method
1.	Specific Gravity	2.67	-	IS 2386 P-3 2016
2.	Water Absorption in %	1.07	Max. 2%	IS 2386 P-3 2016
3.	Dry Loose Bulk Density	1.94	Max. 3.0	IS 2386 P-3 2016

TABLE 4
OBSERVATION TABLE FOR COARSE AGGREGATE

Sr. No.	Test Particular	Test Results	Specified Limits	Test Method
1.	Specific Gravity	2.89	-	IS 2386 P-3 2016
2.	Water Absorption in %	0.77	Max. 2%	IS 2386 P-3 2016
3.	Flakiness Index in %	7.67	Max. 30%	IS 2386 P-1 2016
4.	Los Angeles Abrasion Value in %	13.40	Max. 35% (Wearing surface)	IS 2386 P-4 2016
5.	Aggregate Impact Value in %	12.17	Max. 30% (Wearing surface)	IS 2386 P-4 2016

CONCLUSION

From the above observations and results, it can be concluded that use of crushed waste glass as a partly replacement for the crush aggregate in the preparation of flexible bitumen pavement is possible. Also, it is observed that the replacement could be done up to a certain amount of 10% of the total aggregate weight. The stability value and flow index after the replacement were up to the norms laid by the Indian Standard code, fulfilling the minimum requirements for a good bitumen pavement. A significant amount of improvement in the properties of pavement was also observed with the addition of crushed glass into the mixture.

REFERENCES

- M.S.Kuttimarks, R.Shruthi, "Experimental Studies on Replacement of Fine Aggregate with

Glass and Fly Ash”, International Journal of Emerging Engineering Research and Technology Volume 2, Issue 2, May 2014, PP 205-208.

- Khalil Nabil Dalloul, “Study of the Effect of Crushed Waste Glass as Coarse Sand and Filler in the Asphalt Binder Course”, 2013, pp13-34.
- Johnny Bolden, Taher Abu-Lebdeh and Ellie Fini , “American Journal of Environmental Science”, 9 (1): 14-24, 2013 ISSN: 1553-345X ©2013 Science Publication doi:10.3844/ajessp.2013.14.24 Published Online 9 (1) 2013
- T. Phani Madhavi,V. Sampathkumar, P.Gunasekaran , “Partial replacement of cement & fine aggregate by using fly ash & glass aggregate”, International journal of research in engg. & tech. ISSN :2319-1163, November 2013.
- S.P. Gautam, Vikas Srivastava and V.C. Agarwal, “Use of glass wastes as fine aggregate in Concrete”, Research, November 2012, ISSN: 2278-5213
- <https://trid.trb.org/view/1566737/> Use of glass fibers in bituminous mixes for retardatio of cracks in composite pavement.

Physical & Mechanical Properties of Mees Bamboo for replacement with steel in Concrete Structure

Prof. Satish Pitake ^[1], Tushar Panpaliya ^[2], Priyvrata Meena ^[2], Akash Naikare ^[2], Ankush Nomulwar ^[2]

^[1] Faculty at Civil Engineering at PCCOE & R, Savitribai Phule Pune University

^[2] Student of Civil Engineering at PCCOE & R, Savitribai Phule Pune University

ABSTRACT Bamboos in India show a great diversity in both their habitats and species. There is need of research work for investigating feasible properties of bamboo for construction purpose. India Bamboo is a fast-growing wood tree as compared it with other trees. It achieves its optimum strength within four years and full maturity in five years. It is a low-cost sustainable material which is locally available. Due to lack

in understanding in properties of bamboo, its utilization is limited in industry. This paper presents an investigation through various test on bamboo to know its physical and mechanical properties. To know properties of bamboo, species which were locally available were Mees Bamboo (*Dendrocalamus strictus* (Roxb.)), Assam Bamboo (*Bambusa balcooa*), Manga Bamboo. This bamboo was locally available in Pune, India. Among this bamboo we selected Mees Bamboo and performed various test such as tensile test, water absorption test, compression/bending test. The test resulted that, if we treat bamboo and then use it, results for physical properties are good and bamboo has very good mechanical properties

INDEX TERMS Static Bending strength, Compressive strength, Mees bamboo, Tensile strength

I. INTRODUCTION

Bamboo is a fast-growing giant grass as compared it with other trees. It achieves its optimum strength within four years and full maturity in five years. As fast-growing plant bamboo reach 15 to 30 m of height within two to four months of its plantation. It is a low-cost sustainable material which is locally available. Due to lack in understanding in properties of bamboo, its utilization is limited in industry. Generally, steel is used to reinforce the concrete. Though steel has a high tensile strength to complement the low tensile strength of concrete, use of steel should be limited since it is costly and also it takes so much energy in its manufacturing process. Thus, a suitable substitute of this with a low cost, environmentally friendly and also a less energy consuming one, is a global concern; especially for developing country. Addressing all these problems, bamboo is one of the suitable replacements of reinforcing bar in concrete for low cost constructions. Bamboo is natural, cheap, widely available and most importantly strong in both tension and compression. The tensile strength of bamboo is relatively high, which makes bamboo an attractive substitute to steel in tensile loading applications.

There are 1500 identified species of bamboo found around the world. A every bamboo species has similar anatomy, which includes nodes, internodes and diaphragm. To differ the species of bamboo its root is checked, which includes sympodial, monopodial and amphodial. In India, there are a total of 148 species are found in which there are 29 genera (both wild and cultivated). The maximum concentration species is found in the deciduous and semi-evergreen regions of North-east and semi-evergreen regions of north-east and the tropical moist deciduous forests of north and south India. The annual production of bamboo in India is 4.6 Million tones, about which 1.9 Million tones is used by the pulp industry. In Maharashtra, 90% of bamboo is grown in Vidarbha area and in Konkan region only mangrove species of bamboo is grown.

In this paper, tensile property of bamboo is observed and evaluation of the use of bamboo as reinforcing bar in concrete with replacement of steel is done. The aim of this research is to investigate the mechanical and physical properties of different species of local bamboos. This research is a part of an experimental work which focuses on the possibility of utilizing bamboo as reinforcement for beam.

II. Objective of Study

A. The aim of this paper is to determine the practicability of bamboo reinforcement for concrete beams. The mechanical properties and behaviour of steel reinforced concrete have been studied and due to current increasing demand of steel and problem during its manufacturing there is need of research for sustainable material.

B. We selected bamboo as an alternative because it is eco-friendly and having similar properties of steel. Therefore, the aim of this work is to provide a preliminary contribution toward the collection of the mechanical and physical properties with behaviour of bamboo reinforced beams.

III. Material & Method Bamboo

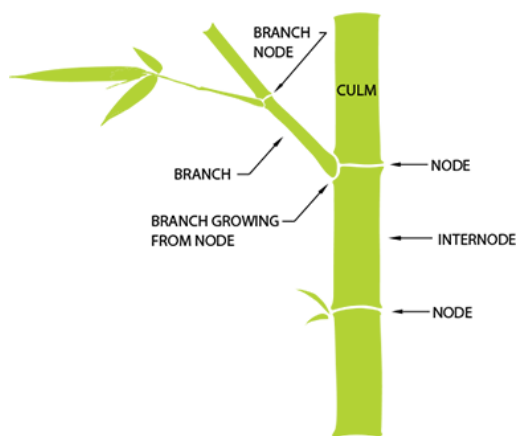


Fig-1: Bamboo anatomy

Bamboo Culm–Culm means bamboo shoot which is shallow for some species and some species have solid culms. Stem has an important job in this plant which is responsible for shape and size of plant and it supports leaves, produces food. Various structures on stem like

- **Node**- where leaf and bud attach to stem and culm segment begins and ends with joint.
- **Internode**-Distance between two nodes is known as internode which tells how much tree grew in one season.

The nodes in bamboo culms were an important factor in the uniform distribution of mechanical properties. The locally available species of bamboo in Pune are Mees bamboo (*Bambusa Vulgaris*), Assam bamboo (*Bambusa Balcooa*) & Manga Bamboo (*Qxytenanthera Ritcheyi*). From the species available, we choose Mees bamboo and conducted some test (as per IS-6874:2008) on the species of bamboo.

Physical Test:

It includes two tests, which are:

1) Density Determination:

The test specimens for determining basic mass per volume taken from freshly felled culms at different positions of the culm (base, middle and top) about 25 mm in length and 25 mm in width with full wall thickness. In this test a sample of calculated dimension was taken from bamboo and its volume and its weight was measured. Density of bamboo species was determined as per procedure mentioned in IS code.

2) Water Absorption Test:

During our research from previous research papers we found that bamboo absorbs water. To stop bamboo from absorbing water we used oil paint as an agent. In this test 8 samples of different size and different bamboo strips were taken. Out of which 4 samples were untreated and 4 samples were treated with oil paint to stop bamboo from absorbing water. The weight of this sample was recorded and then samples were placed in water tank for 24 hours and weight of this sample was recorded again. The test specimen was weighed with an accuracy of 0.01 g. Percentage water content in treated and untreated samples was calculated.



Fig -2: Treated and untreated bamboo for water absorption test

Mechanical Test:

It includes three tests. These tests were conducted on UTM (Universal Testing Machine), which are:

1) Static Bending test:

A beam of suitable length to support the test specimen was kept at right angle to the platform of the Universal testing machine. The test specimen was placed on supports with saddles and a wooden beam was placed over the specimen using saddles in such a way that load is applied through the loading head of the testing machine. The test specimen was then allowed to find its own position; the specimen, saddles, load and supports were aligned visually in one vertical plane. The loading of the test specimen was carried

out uniformly at constant speed. The loading head of testing machine was moved at the rate of 0.5 mm/s. Deflection at the middle of the span was recorded at the points of sudden changes in deflection, at the time of failure and at maximum level. Crack development and the form of failure were noted. A load-deflection diagram was plotted.



Fig-3: Bamboo Strip Bending Test



Fig-4: Hollow Cylindrical Bending Test

2) Tensile Strength Test:

This test was conducted on UTM. The grips were pressing the test specimen perpendicular to the fibers and in radial direction. The load was applied continuously and the movable head of the testing machine shall travel at a constant rate of 0.01 mm/s. The maximum load was recorded.

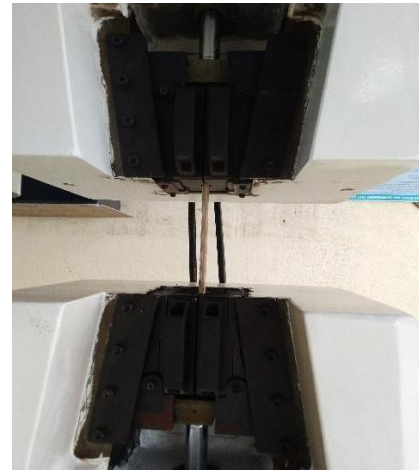


Fig-5: Bamboo Strip Tensile Test



Fig-6: Bamboo Cylindrical Strip Tensile Test

3) Compression Strength Test:

This test was conducted on Digital compression testing machine until crushing and the crushing loads were recorded. The length of bamboo was taken to perform test was 50mm. The inner and outer diameters at top and bottom portion of the samples were measured. The average diameter was considered for calculating crushing strength.

IV. Result & Discussion

Physical Properties Test Result:-

$$\text{Density of Bamboo} = 752.4 \frac{\text{kg}}{\text{m}^3} = 0.7524 \frac{\text{g}}{\text{cc}}$$

Water Absorption Test Result and Observation:-

The water content of each test specimen calculated as the loss in mass, expressed as a percentage of the oven dry mass.

Formula:-

$$w\% = \left(\frac{W_f - W_i}{W_i} \right) * 100$$

W_i=Initial weight of specimen

W_f=Final weight of specimen

w%= percentage water content absorbed in 24hrs.

Observation Table:

Table-1: Water Absorption Test Table

Sr. No.	Specimen & size (in mm)	W _i (g)	W _f (g)	w%
1)	Untreated Sample-1 (100*35*7.5)	20.9	30.67	19.92
2)	Treated Sample-1 (100*35*7.5)	21.98	26.36	46.74
3)	Untreated Sample-2 (50*28*10)	7.42	8.98	21.13
4)	Treated Sample-2 (50*28*10)	7.94	11.32	42.64
5)	Untreated Sample-3 (100*26*9)	16.45	19.98	21.46
6)	Treated Sample-3 (100*26*9)	17.55	24.84	41.64
7)	Untreated Sample-4 (100*27*10)	17.68	21.31	20.56
8)	Treated Sample-4 (100*27*10)	18.72	26.68	42.54

Average water content for untreated samples after 24hrs is 43.36%. Average water content for Treated samples after 24hrs is 20.76%. Water content decrease by 52.12% after treating bamboo with oil paint.

Physical Properties Test Result: -

Bending Test Result

In this test deflection in the bamboo strip and hollow bamboo were measured. The maximum deflection allowed in UTM machine and in bamboo was recorded as 100 mm. But the bamboo strip didn't break. Therefore, the load at which bamboo would break in 2 parts was not determined in single point loading test.

Tensile Test Result and Observation:

Table-2: Tensile Test Table

Specimen	Cross sectional area (mm ²)	Tensile load (kN)	Tensile strength (N/mm ²)
Hollow Cylindrical Bamboo Strip	94.25	11.46	121.59
Bamboo strip	100	12.48	124.8

Compression Test Result

Table-3: Compression Test Table

Length (mm)	Diameter (mm)		Area (mm ²)	Crushing load (kN)	Crushing Strength (N/mm ²)
	inner	outer			
50	20	38.5	849.99	64	75.29
45	21	38	787.75	62	78.7

V. CONCLUSIONS

The study in this paper indicates that bamboo has a promising potential to be used as a construction material. In the study, we performed some physical test and Mechanical tests which includes compression, tensile, bending test were conducted to test two bamboo samples. Ability and capability of Mees bamboo which was locally available was determined. Mees bamboo (*Dendrocalamus strictus*) exhibited a good performance in tensile strength test and compression strength test. The water absorption capacity of bamboo was reduced by moisture resistant material i.e., oil paint. It reduced the water absorption by 52.12%.

Thus, the experimental results revealed that bamboo has a good performance in strength properties.

VI. REFERENCES

- International Journal of Science, Environment and Technology, Vol. 3, No 3, 2014, 836 – 840.
- Steinfeld, C. 2001. “A Bamboo Future,” Environmental Design and Construction.
- ASTM. 2006. Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates, ASTM C136, Annual Book of American Society for Testing Materials Standards, Vol. C 04.02.
- Wu Yao, Zongjin Li Flexural behavior of bamboo–fiber- reinforced mortar laminates, Cement and Concrete Research 33 (2003) 15–19
- Wan Tarmeze Wan Ariffin Numerical Analysis of Bamboo and Laminated Bamboo Strip Lumber.
- B. Sharma, A. Gattoo, M. Bock, H. Mulligan, and M. Ramage, “Engineered bamboo: state of the art,” Proc. ICE - Constr. Mater., no. April, 1–11, (2014).
- M. R. Wakchaure and S. Y. Kute, “Effect of moisture content on physical and mechanical properties of bamboo,” Asian J. Civ. Eng. (Building Housing), 13, no. 6, 753–763, (2012).
- Kabir, M.F., Bhattacharjee, D.K. & Sattar, M.A. Physical and mechanical properties of four bamboo species. Bangladesh Journal of Forest Science, 20, pp 31-36, (1991).
- ISO/TR. 22157-1, "Bamboo - Determination of physical and mechanical properties -Part 1: Requirement," 2004, 1–8, (2004).
- ISO/TR 22157-2, “Bamboo - Determination of physical and mechanical properties -Part 2: Laboratory Manual,” 2004, 28, (2004).
- T. Gutu, “A Study on the Mechanical Strength Properties of Bamboo to Enhance Its Diversification on Its Utilization,” no. 5, 314–319, (2013).

ABOUT AUTHOR



1.Prof. Satish Pitake
Asst. Prof.
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet



2.Tushar Panpaliya
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet



3.Priyvrata Meena
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet



4.Akash Naikare
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet



5.Ankush Nomulwar
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

Sensor Based Accident Prevention System

Prof. Amar Shitole¹, Rahul Chorte², Harshada Kapure³, Pooja Dive⁴, Tanmay Dharkar⁵

Assistant Professor, Department of Civil Engineering

Students, Department of Civil Engineering

Pimpri Chinchwad College Of Engineering and Research, Pune, India

ABSTRACT The basic aim of this system is to reduce accidents on hilly and slippery roads. In curve roads the other road end of vehicle cannot be seen by driver. At night time accidents may happen by intensity of head light from opposite side of vehicles. Also, the light intensity problem occurs both on curved roads and mountain roads. Thousands of people lose their lives. The solution for this problem is alerting the driver about the vehicle coming from opposite side. This is done by keeping an ultrasonic sensor on one side of the road before the curve and keeping a LED light after the curve, so that if a vehicle comes from one end of the curve the sensor senses and the LED light glows at the opposite side.

INDEX TERMS Curve roads, Accidents prevention, sensor, mountain road, hill road, ultrasonic sensor,

1. INTRODUCTION

There are different reasons why roads on mountain and hills are constructed in an exceedingly curved way rather than straight way. First it's because heavy vehicles like trucks and semi trucks find it difficult while moving on steep hill. Another thing is that in cold season, the road can get icy and so in straight path it'd be difficult for vehicles and even people to maneuver up and down on slick way. In such Instance, if road were straight, there would be a case of accident all the time. Vehicles would be sliding everywhere the place. Therefore roads are created in curved way thanks to avoid such Instance.

During the calendar year 2010, there were close to 5 lakh road accidents in India, which resulted in more than 1.3 lakh persons. These numbers translate into one road accident every minute, and one road accident death every 4 minutes. Unfortunately, more than half the victims are in the economically active age group of 25-65

years. In India 137,000 people are killed because of road accidents. That is about 377 people per day. In that 3.7% because of failed to look the road. The solution for this problem is alerting the driver about the obstacle or vehicle. Usually horn is used for this purpose. But in the rainy seasons horn will not be heard. Some people will not use horn itself. So horn is not a good solution to solve this problem. These are the major reasons for accidents. To avoid these problems in curve roads we are introducing sensor based accident prevention system. That is we are keeping ultrasonic sensor on one side of the road before the curve and keeping a LED light after the curve. At that time light will glow at the other side of the curve. In the absence of the vehicle the signal will not be received by the sensor and the light will not glow. As soon as the light glows driver can slow down his vehicle and he could even stop it if it's necessary.

2. SYSTEM DESIGN

The system design includes two parts ; Hardware Design and Software Design . Hardware Design includes sensors like Ultrasonic sensor , a microcontroller and LED .Ultrasonic sensor uses +5V DC supply. Its range is from 2 cm to 100 cm. Micro controller Software design is utilized for detecting the vehicle or obstruction. And to manage the LED by using Arduino 1.0.5 IDE device that is open source software. Programming are often done by using embedded C or C++. Package (OS) that we used is windows 8. The LED light here we used is of green colour and uses maximum +5V DC supply.

2.1 Hardware Design

We have adopted Microcontroller (Arduino UNO), LED light and ultrasonic sensor which are demonstrated in fig. 3 . The sending and gathering function of ultrasonic sensor is same as that of bat .Ultrasonic Sensor have 4 pins. They're +5V VCC , GND , echo pin and output pin. Here echo pin is input pin and trigger pin is output. Ultrasonic sends the signal within the type of pulses from signal pin. When the signal hit the thing it'll get reflected back and it's received by echo pin. From echo the signal is shipped to microcontroller Arduino UNO. Microcontroller Arduino UNO processes this data Operates the LED which is connected to output pin of the microcontroller Arduino UNO. LED is operated according to the command i.e. LED will glow if signal is reflected back . Within the absence of the thing the signal won't reflect back. Hence the LED won't glow. The elementary diagram is demonstrated within fig 6 . Ultrasonic sensor has 4 pins during this trig pin is joined to three and 4digital pin of microcontroller Arduino UNO and echo pin is joined to 2, 5 of digital pin . VCC is linked to +5V and GND is linked to GND of microcontroller Arduino UNO . LED is joined to PIN 6 , 9 , 7 , 10 of microcontroller Arduino UNO . The detector detect If vehicles is present the sensor will sense the vehicle ; the light will glow at opposite end of the curve . If vehicle isn't present at one end of the curve the detector wont' detect the vehicle and light won't glow . This process repeats continuously.

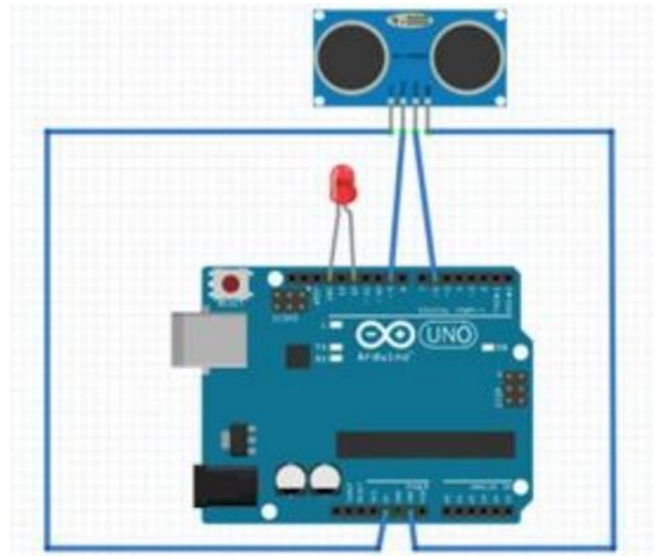


Figure 1: Circuit Design of components Sensor based Accident Prevention.

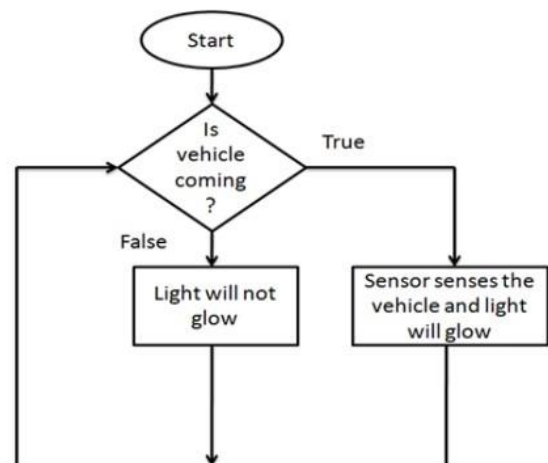


Figure 2: Flowchart for working principle of sensor based accident prevention system

2.2 Software Design

Software design of microcontroller which is programmed by using Arduino1.0.5 IDE tool which is open source software. Programming are often done by using embedded C .Operating system that we used is windows 8. As shown in the flowchart first initialize the trigger (9) and echo (6) pinto input and LED (12) pin to the output. Then send pulse through trigger so receive it through echo. Convert the received value into distance. If the gap is in range, time delay is ready to 300 else no actions are taken

and also the process is sustained. Next check if time delay is zero if it satisfies the condition then turnoff LED if it doesn't satisfy the condition then activate LED and reduce the value of time delay by 1

3. RESULT

STEP 1: Coding for micro controller arduino UNO which consists of set of commands to process the info from sensor and to work the LED as shown in fig 3 & 4

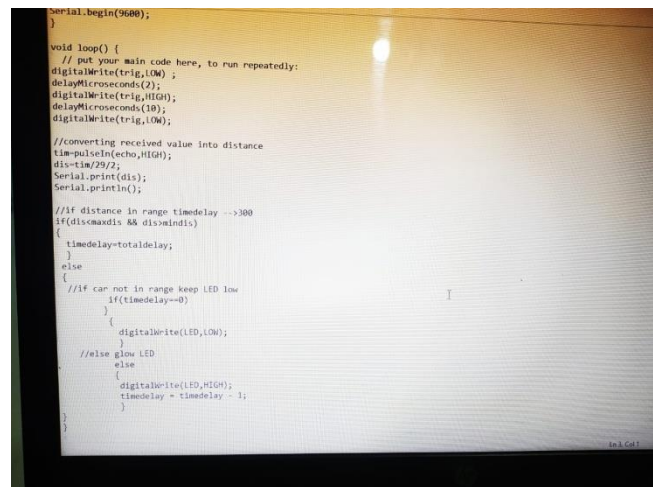
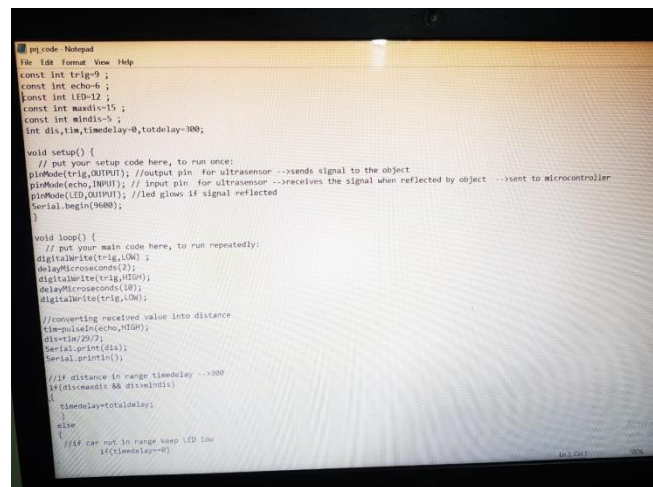


Figure 3 & 4: Program for micro controller arduino UNO of sensor based accident prevention

STEP 2: Circuit connection having sensor and microcontroller arduino UNO where the sensor

senses the obstacle and therefore the microcontroller arduino UNO processes and operates LED as per the command as shown in fig.5

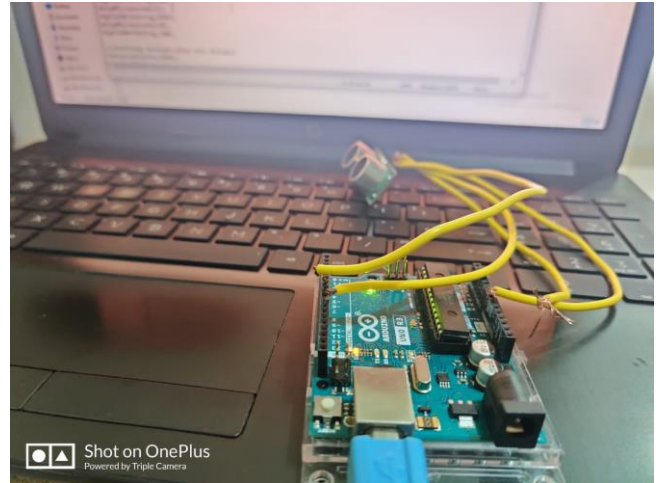


Figure 5: Circuit connections for sensor based accident prevention system

STEP 3: Analyzing, debugging and running the program. The program is uploaded to microcontroller arduino UNO. Sensor sends the signal and senses the item and offers the signal information to microcontroller arduino UNO. Microcontroller arduino UNO is powered by using laptop. It possesses and therefore the output is shown within the serial monitor. Here the output is distance as shown in fig. 6



Figure 6: Analyzing the output of sensor based accident prevention system

STEP 4: Fixing the circuit to the model i.e. fixing microcontroller arduino UNO, ultrasonic sensor and LED light to the model of curve road as shown in fig.7



Figure 7: Circuit fixed to the model of sensor based accident prevention system.

STEP 5: Detection of car by the sensor when vehicle passes through the road. it's the experimental demonstration for this paper. The signal sent by the sensor



Figure 8: Vehicle passing through the road

STEP 6: Output is obtained i.e. glowing of LED at the instant when the signal is received by the sensor after hitting the vehicle. As shown in fig. 9.

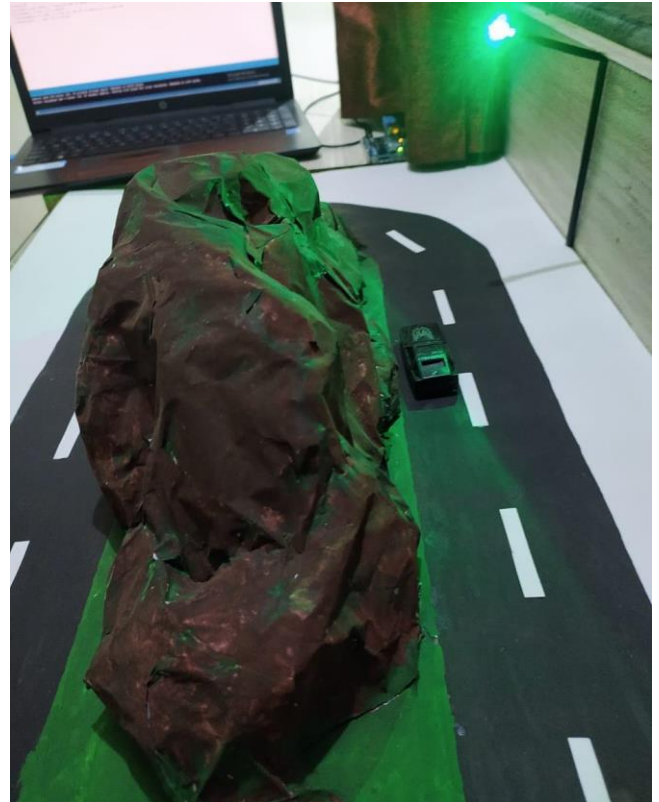


Figure 9: Final output of sensor based accident prevention system by glowing of LED light

4. ADVANTAGES

1. Avoid accidents in curve roads mountains roads and hill roads.
2. Easily implementable to the existing roads.
3. Fully automated (No person is required to operate).
4. Installation cost is very less.
5. Vehicle monitoring systems can be implemented easily.
6. Can work irrespective of weather and climate.
7. Maintenance is easy.
8. Greater flexibility.

5 CONCLUSION

The purpose of this project is to decrease the number of accidents occurring on hilly and curved roads. This is done by keeping an ultrasonic sensor in one side of the road before the curve and keeping a LED light after the curve, so that if vehicle comes from one end of the curve sensor senses and LED light glows at the opposite side. By this we can save thousands of lives including animals.

REFERENCES

[1] Jessen Joseph Leo., R. Monisha., et.al.: Vehicle movement control and accident avoidance in hilly track ,IEEE Int. Conference on electronic and communication system (ICESP).pp.1-5(2014).

[2] Ki-Heyon Kim. Dong-Hoon Yum.,et.al.: Improving driver's visual field using estimation of curvature, IEEE Int.Conf.on control Automation and System (ICCAS).pp.728-731(2010)

[3] Duy Tran., Weihua Sheng., et.al.: A hidden Markov Model based driver intention prediction systems, IEEE Int. Conf. On cyber technology in Automation, Control, and intelligent System (CYBER).pp.115-120(2015)

[4] Jiang Yuying., Wu Yazhen., et.al.: A surveillance method for driver's fatigue and

distraction based on machine vision, IEEE Int. Conf. on Transportation, Mechanical, and Electrical Engineering (TMEE).pp.727-730(2011)

[5] Ashutha K., Ankitha K., Smart Shopping Car using embedded system and wireless module ,Recent Patent on computer science (CSENG), UAE vol. I, pp. 1-6 January 2016

[6] Ashutha K., Shetty Arpita ., et.al.: Novel Wireless data communication for fisherman, International journal of computer science and mobile computing (IJCSMC), Vol.5, Issue .4, pp. 511-517 ,April 2016

AUTHOR

1. Prof. Amar Shitole
Asst. Prof.
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

2. Rahul Chorte
BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

3. Tanmay Dharkar
BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

4. Pooja Dive
BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

5. Harshada Kapure
BE Student
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

USE OF WASTE FOUNDRY SAND IN INFRASTRUCTURE

¹Amar.D.Shitole, ²Sujal Haridas, ³Aishwarya Taru, ⁴Pradnya Pradhan, ⁵Ashwini Shinde

¹Assistant Professor, ²Student, ³Student, ⁴Student, ⁵Student

Department of Civil Engineering,

Pimpri Chinchwad Collage of Engineering and Research, Pune, India

ABSTRACT Utilization of industrial waste materials in concrete compensates the lack of natural resources, solving the disposal problem of waste and to find alternative technique to safeguard the nature. There are a number of industrial wastes used as fully or partial replacement of coarse aggregate or fine aggregate. This review carries out a thorough assessment about industrial waste substances, which can be adequately utilized in concrete as fine aggregate substitution. This paper reviewed foundry sand as industrial waste. Basically, sand from industrial waste flow through the machines during the sand reclamation process. Experiments have been conducted using waste foundry sand. Crushed sand has been replaced by waste foundry sand which improves compressive strength.

INDEX TERMS: Waste Foundry Sand, Compressive Strength, Grade of Concrete.

I. INTRODUCTION

Foundry sand is a by-product of the ferrous and nonferrous metal casting industry, where sand has been used for centuries as a molding material because of its unique engineering properties. Industry estimates are that approximately 100 million tons of sand are used in production annually. Of that, four to seven million tons are discarded annually and are available to be recycled into other products and industries. Solid wastes generated from manufacturing industries are increasing at an alarming rate and it is consistently increasing. One such industrial solid waste is Used Foundry Sand (UFS). Waste sand is a major problem for Indian Small and medium scale Foundry. Since foundries make intensive use of sand as primary direct material, the regeneration of this sand can be considered as the main factor in environmental performance to achieve sustainable development. Nowadays it is essential to focus on sand regeneration, recycling, re-use and disposal for sustainable development in foundry industries. The option, adopted by some, is to discard and dispose of the used sand altogether after and start with new sand in every cycle. This is not a feasible proposition on economic and environmental consideration. The availability of dumping ground for used chemically bonded sand is becoming difficult day by day. Cost of dumping is also increasing exorbitantly. In addition to non-availability of dumping ground and high dumping cost, the environmental problem is of critical concern. The dumped sand, being toxic, would pollute the atmospheric air as well as the groundwater, having a long-lasting effect on the environment and plants. The Government authority is becoming stricter on these issues. On the other hand, availability of new sand is becoming a problem these days. Local authorities are imposing restrictions on mining/extraction of sand

altogether. Therefore, supply of new sand to foundries shall be very little or it may even stop altogether. Therefore, they will be compelled to survive on sand obtained by reclaiming used demolded sand. In addition to above compulsion, there are other good technical reasons for reclamation of chemically bonded sand for re-use. Considering the need to make foundry process “Eco-Friendly”, “Kolhapur foundry and engineering cluster” have installed Thermal Sand Reclamation Plant to reclaim used sand and to make the foundries free of waste generation.

II. AIM

To investigate experimentally compressive strength by use of waste Foundry Sand in Concrete with varying proportion of Foundry Sands for M 20 Grade of concrete.

III. OBJECTIVES

- To investigate its further possible uses.
- To develop a new method for cleaning and reusing foundry sand.
- To enhance its strength & utility.
- To keep away contaminated materials from landfills.

IV. LITERATURE REVIEW

Sahu et al. (2003)[8] studied the properties of crushed stone dust as fine aggregate for concrete. Two common mixes (M20 and M30 grade concrete) were taken for natural sand. Results said that concrete made with the replacement attains the same compressive strength, tensile strength with lower degree of shrinkage limit when compared to normal concrete. Khatib (2005) [9] studied the properties of concrete which contains fine recycled aggregate. The recycled aggregate consists of crushed concrete (CC) or crushed brick (CB) with particles size less than 5 mm in diameter. The fine aggregate in concrete was replaced with 0%, 25%, 50% and 100% CC or CB. Results said that concrete made with the replacement attains up to 50% CB shows the same 19 long-term strength. Even at 100% replacement of

fine aggregate with CB, the reduction in strength was only 10%. After 28 days of curing, the amount of strength development in concrete containing is either CC or CB was higher than that of the conventional concrete. There are several types of waste material / by-products, which can be used in concrete as a partial replacement of fine aggregate. Some of the materials which can be used are recycled fine aggregate, coal bottom ash, stone dust and glass cullet, sewage sludge ash, and waste foundry sand, etc. Rakshvir and Barai (2006) [10] studied the various physical as well as mechanical properties of recycled concrete aggregates. Recycled concrete aggregates (RCA) are different from natural aggregates and concrete made from them had different physical as well as chemical properties. The percentage of RCA varies and it was found out that the properties like compressive strength likely to decrease about 10% compared to the conventional concrete. Water absorption of RCA was found to be greater than natural aggregates. Aggarwal et al. (2008) [11] gave an experimental procedure for the design of self-compacting concrete mixes. The test results for self-compacting concrete is 18 as slump flow; V-funnel and L-Box are presented, J-ring. In addition to it compressive strength at the ages of 7, 28, and 90 days was also found to be increasing. Rao et al. (2007) [12] reviewed an international scenario reducing waste generated, and to reuse the waste in concrete without reducing the strength and other physical properties of concrete. They found the effect of use of recycled aggregate on the fresh and hardened concrete and concluded some of the drawbacks in the use of RA in recycled aggregate concrete (RAC), it also includes lack of awareness between the people, lack of government support, no specific codes for using the RA in new concrete.

V. METHODOLOGY



A series of 27 cubes specimens and 3 conventional concrete cubes are cast and tested for compressive strength. To accomplish the aim and objectives, a methodology developed is as follows: 1. Casting of the cube and check for Compressive Strength with

conventional concrete for mix M20 is carried out. 2. The Casting of the cube with replacement of Fine Aggregate with waste Foundry Sand for mix M20 with varying percentage is done. 3. Cube specimens of 150 mm x 150 mm x 150 mm are casted. 4. Testing of the above said cube at 7, 14 & 28 days for compressive strength is done respectively. 5. Compressive Strength result tests are compared with that of the conventional concrete strength.

VI. MATERIALS TO BE USED

1. Cement: Ordinary Portland cement of 53 grade is used in this experimentation conforming to I.S- 8112- 1989.
2. Fine Aggregate: Fine aggregates are the second ingredient of the aggregate phase in concrete. Sand is the most commonly used fine aggregate in concrete. Fine aggregates that pass from 4.75 mm (No.4) sieve but are retained on 75um (No.200) sieve.
3. Coarse Aggregate: The coarse aggregates used for the concrete are 20 mm passing and retained on a 4.75mm.
4. Water: Portable water is used for the experimentation.
5. Foundry Sand: It is obtained from Reclamation Sand process, types of sand used Core Sand, Reclaimed Sand, Raw Black Sand Menon Kagal, Raw Black Sand Vikram Nagar. The Material is brought from "Kolhapur foundry and engineering cluster". They have installed Thermal Sand Reclamation Plant to reclaim used sand.

VII. CONCRETE MIX PROPORTIONS & PREPARATION OF MIX DESIGN

Concrete for M20 grade is prepared. A mixed proportion of 1.36: 2.03: 4.35 with water-cement ratio less than 0.45 to get a characteristic strength of M20. Three sets of mix design were prepared with the use of different substituents such as follows:

1. Cement + Fine Aggregate + 20mm Coarse Aggregate + Water
2. Cement + (Foundry Sand 10%+ Fine aggregate 90%) + coarse aggregate + Water.
3. Cement + (Foundry Sand 15%+ Fine aggregate 85%) + coarse aggregate + Water.

These concretes were prepared and cast in 150mm concrete mould to take the compressive test. After 24 hours these moulds were De-moulded and set for curing in a water tank. The compressive tests were taken in 7, 14 & 28 days respectively to check the results. Sample 0: Plain Concrete Block Sample 1: Core Sand Sample 2: Reclaimed Sand Sample 3: Raw Black Sand Menon Kagal Sample 4: Raw Black Sand Vikram Nagar.

Table:7.1 .Material Required For 1 Cube

Sr. No.	% WFS	Cement (Kg)	C.A (Kg)	F.A (Kg)	WFS (Kg)
1	0	1.36	4.7	2.03	0
2	10	1.36	4.7	1.83	0.2
3	15	1.36	4.7	1.73	0.305

VIII. TESTING

Compression test is to be conducted on cubes on

proposed experimentation work.

• **Compression Test:** The Compression test is the most common test conducted on concrete. The test is easy to perform and gets most of the desirable characteristics properties of concrete which is related to its compressive strength. The compression test is carried out in the cube of the size 150 x 150 x 150 mm. The cubes are filled with 0%, 10%, and 15% with Foundry Sand. Each layer is compacted by hand compaction. After the top layer has been compacted the surface of the concrete is brought to the finished level with the top of the mold, using a trowel. After 24 hours the cubes are remolded and are shifted to a curing tank wherein, they are allowed to cure for 7, 14 & 28 days. After 7, 14 & 28 days of curing the cubes, are tested on a digital compression testing machine as per I.S. 5161959. The failure load is noted. The compressive

COMPRESSIVE STRENGTH OF CONCRETE BLOCK In (Mpa)				
Sr. No	% of WFS	7 Days	14 Days	28 Days
1	0	18.05	21.42	27.77
2	10	21.83	30.14	33.49

strength is calculated as follows: Compressive strength (MPa) = Failure load divided by cross-sectional area = F/A.

X. CONCLUSION

The paper presented a comprehensive parametric study on a wide range of properties and durability characteristics of concrete, on which there is little information. Use of waste foundry sand in concrete reduces the production of waste through metal industries i.e. WFS is eco-friendly building material. The problems of disposal and maintenance cost of land filling is reduced. Application of this study leads to develop in construction sector and innovative building material. Compressive strength increases on increase in percentage of waste foundry sand as compare to traditional concrete. In this study, maximum compressive strength is obtained at 15% replacement of fine aggregate by waste foundry sand.

XI. REFERENCES

- Saha, S., & Rajasekaran, C. (2016). Mechanical properties of recycled aggregate concrete produced with Portland Pozzolana Cement. *Advances in Concrete Construction, An International Journal*, 4(1), 27–35.
- Saha, S., Rajasekaran, C., & Vinay, K. (2017). Use of concrete wastes as the partial replacement of natural fine aggregates in the production of concrete. In *Global Civil Engineering Conferences (GCEC-2017), Lecture Notes in Civil Engineering (Vol. 9)*. Singapore
- Monosi S, Tittarelli F, Giosue C, Ruello ML (2013) Effect of two different sources and washing treatment on

the properties of UFS by-products for mortar and concrete production. *Constr Build Mater* 44:260–266

- Torres A, Bartlett L, Pilgrim C (2017) Effect of foundry waste on the mechanical properties of Portland Cement Concrete. *Construction Build Mater* 135:674–681
- M.C. Zanetti and S. Fiore, Foundry waste recycling in moulding operations and in the ceramic industry, *Waste. Manag. Res.*, 21(3), 2003, 235–242.
- R Siddiquea, G. Kaur, and A. Rajor, Waste foundry sand and its leachate characteristics. *Resour. Conserv. Recycl.*, 54(12), 2010, 1027–1036.
- ABIFA (2015). Brazilian Casting Association – Brazilian Association of the Foundry Industry, ABIFA yearbook 2015, ABIFA foundry guide. June 2015:22–25.
- Kumar Sunil, "Utilization of Fal-G bricks and blocks", *Construction and Building Materials*
- N. Gurumoorthy K. Arunachalam "Durability Studies on Concrete Containing Treated Used Foundry Sand", January 2019.
- IS: 1918 - 1966 "METHODS OF PHYSICAL TESTS FOR FOUNDRY SANDS".
- Huan-Lin Luo, Deng-Fong Lin, Mei-Ling Chung and Lisa Y. Chen "Waste Foundry Sand Reused as Clay Replacement for Tile Manufacture".
- S. Rubini, C.S. Suganya "Fractional restoration of foundry soil in brick manufacturing.

Experimental Study on Water Balance Approach at Village Level

Prof. Gajanan N. Supe¹, Sanket Chaudhari², Sudarshan Devshatwar³, Sneha Birajdar⁴, Ashwini Chopade⁵, Sushant Balgude⁶

¹Dept. of Civil Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra, India, 412101

²Dept. of Civil Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra, India, 412101

³Dept. of Civil Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra, India, 412101

⁴Dept. of Civil Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra, India, 412101

⁵Dept. of Civil Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra, India, 412101

⁶Dept. of Civil Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra, India, 412101

ABSTRACT India is one of the few countries having erratic and unevenly distributed rainfall and hence many parts of the country face severe drought conditions which adversely affects the agricultural crop cultivation and ultimately results in the poor socio-economic condition of farmers. Water plays very crucial role in socio-economic upliftment of society especially in village area because whole agriculture sector is depends on water for irrigation purpose. Micro watershed planning is essential in reducing water scarcity in particular area, but we require proper data regarding different parameters of hydrological cycle and different terms involve in water balance approach and water balance approach provides this data for micro watershed planning hence water balance has lot of importance in solving the problem of water scarcity in particular region. This study gives us accurate approach for water balance at village level which require less input to compute different terms. We have used this approach to villages in Jalgaon district for water budgeting and proper micro watershed planning.

INDEX TERMS Water balance, Runoff, Evapotranspiration, Infiltration

I. INTRODUCTION

Water balance estimation is required for proper micro watershed management and planning related to the use of water but this water balance estimation is not an easy task because we have to consider a lot of factors in calculation. In water balance, runoff plays a very important role in water balance as the decision regarding the new structure for storage in the water-scarce region is mainly dependent on the runoff parameter. There are many empirical formulae to calculate runoff like strange table, Barlow method, SCS curve number method, and Irrigation department method these methods are simple for calculation and also, they are reliable but in village areas, there is a problem of unavailability of data so to overcome this challenge and to get reliable runoff calculation SCS curve method used for calculation which is most widely accepted method for calculation of runoff.

Soil Conservation Service Curve Number (SCS-CN) method documented in Section 4 of the National Engineering Handbook (NEH-4) of the US Department of Agriculture in 1956. Evapotranspiration calculation is important to determine crop water requirement, as in village areas, 95% of water demand comes from agriculture, therefore, its calculation plays a crucial role in water balance. There are so many techniques available for calculation of reference evapotranspiration and potential evapotranspiration like Penman Monteith equation, Blaney-Criddle equation, Hargreaves equation, Jensen Haise equation which are widely accepted and reliable among these equations we have used Blaney-Criddle equation for ETo calculation because this method is suitable for missing meteorological data. This method is documented in chapter 3 (Crop Water need) of FAO 56.

Groundwater recharge is an important component of water budget which is very difficult to calculate directly due to uncertainties and complexities in the subsurface. Numerical modeling gives us information regarding indirect estimation of groundwater recharge but its application is limited due to data scarcity. Data scarcity is a major concern at village level for the calculation of hydrological parameters as so many uncertainties are there in meteorological data. There are some numerical formulas which can be used for the calculation of groundwater recharge but these are applicable to the specific region for which it is created. Such methods usually estimate GR through a regression equation with precipitation and they offer a reasonable alternative for GR estimation especially in the United States and in India, such as Anderson's formula (1992), Sehgal Method (1973), Waltermayer approach (2001), and Eakin Method (1949) from above approaches Sehgal approach is suitable for India. Soil moisture calculation is also done separately in this study which has significant importance in an area having more agricultural land. After calculating all parameters related to water balance like water demand, availability, and components of water balance equation we can determine the status of a particular village related to water availability and also can give suggestions to reduce water scarcity in that village.

II. OBJECTIVES

1. To determine the monthly total water demand and water availability in selected regions.
2. Planning for water security and balancing.
3. To give suggestions to the village to tackle the problem of water scarcity

III. STUDY AREA

Nimkhedi kh, Dhormal, Satod micro watershed region is situated in Muktainagar Taluka, Jalgaon district, India with latitude 20.980 N and 76.0530 E. According to census data this region has a total population of 4833 in which male population is 2465 and the female population is 2368. Average annual rainfall of the region is 577.07mm with a total geographic area of 2146 hect. This region depends on two lakes and some farm ponds having a total combined capacity of 262000 cum and number of wells available in the region.

IV. METHODOLOGY

For Water Balance of Nimkhedi kh. micro watershed, we have to collect the data required for the water balance approach in selected regions. The required data for the village is obtained from the Government Authority. By consideration factors required to compute the water balance and formulas to calculate.

Government authority has provided us data regarding rainfall, Cropping pattern, average monthly temperature, and soil type. Selected regions received an average of 585 mm of rainfall yearly.

A simple equation for water balance is given by hydrologist is as follows,

$$P = R + ET + F + SM$$

Where,

P is precipitation

R is runoff

ET is evapotranspiration

SM is soil moisture

V. TERMS USED:

1. Runoff (R):

Runoff is a very important factor in water balance because it plays a crucial role in determining the potential of the water storage. In this study we have decided to use the Soil Conservation Service Curve Number (SCS-CN) method for runoff calculation.

The formulas used to calculate are (Equation is valid for $P \geq i$ for $i = 0.2$)

$$R = (P - 0.2S)2P + 0.8S$$

Where $S = 25400 / CN - 254$

S = potential maximum retention or Infiltration

CN = curve number

Total runoff value for this region is 1662920 cum which is nearly 12% of total rainfall, from runoff generated only 565968 cum of runoff available for further storage.



Graph no. 1 Monthly rainfall runoff graph

2. Infiltration (F):

Infiltration is the downward movement of water into the land surface, which helps to enhance the groundwater recharge condition of the zone, more the infiltration rate of the soil more the groundwater recharge. As the soil in the zone is mostly clayey the rate of infiltration is found out to be lesser than the sandy soil. Here we done the calculation for the infiltration by Philip Method (Cumulative method)

$$F(t) = St^{0.5} + kt$$

Where, S = Sorptivity (cm/hr)

K = the hydraulic conductivity (cm/hr)

T = time from the beginning of rainfall (hr)

Total infiltration is found out to be 8.19% of the total rainfall, which is less to increase the ground water recharge for the zone.

3. Crop water requirement:

Crop water requirement calculation can be done in two ways, first by considering delta for a particular crop and second by considering the evapotranspiration

approach. In evapotranspiration approach we have to calculate reference evapotranspiration which depends on various environmental factors for calculation of evapotranspiration we have decided to use Blaney-Criddle formula which is easy and accurate as some other methods available but these methods are not suitable for rural areas having less environmental data available. Blaney- Criddle formula is given below,

$$ET_o = p(0.46T_{mean} + 8.13)$$

Where, T_{mean} = mean daily temperature (c)

P = mean daily percentage of annual daytime hours

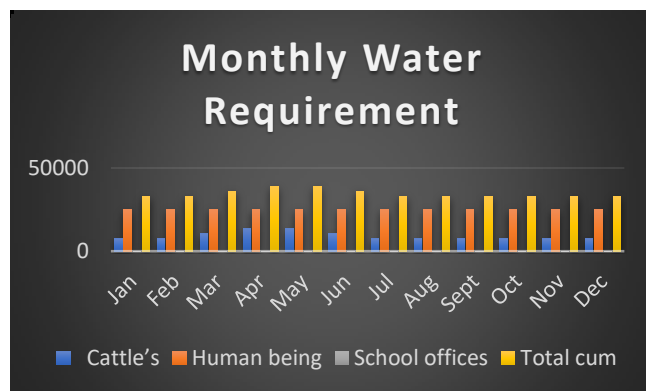
After calculation of reference evapotranspiration, we can determine potential evapotranspiration by simply multiplying it by crop factor which changes according to crop and its age, with the help of potential evapotranspiration we can determine monthly crop water demand. Average yearly crop water demand is 15250580 cum which is around 97.34% of total water requirement therefore calculation of crop water requirement is very important in water balance at village level.

4. Soil Moisture (SM):

Soil Moisture is the volume of water held by soil in its active layer typically for 1-2 m. Soil moisture is important for crop growth as this will help in plant growth and reduces the external water requirement by irrigation. Soil moisture depends on the amount of precipitation (rainfall), water consumption by crops, air temperature, etc. Adequate moisture levels are of high importance to yield, soil moisture available after kharif will be used by rabi crops and therefore calculation of soil moisture is important in computation of accurate water balance. According to calculation 15% of total rainfall gets converted into soil moisture in this region.

5. Water Requirement:

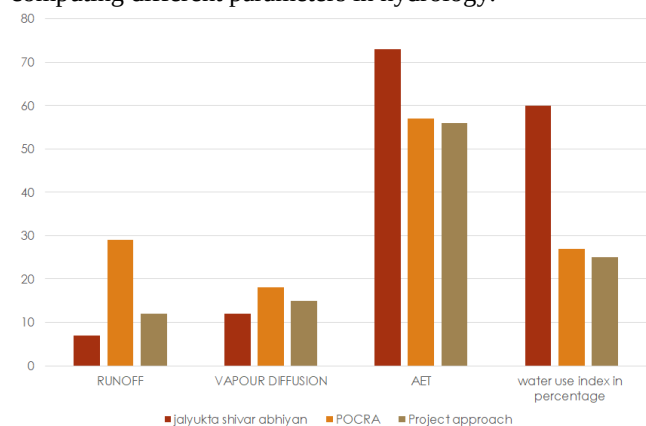
Domestic water requirement in villages is calculated by considering water demand for humans, livestock and schools. As standard values are given as per the Central Public Health and Environmental Engineering Organisation. per day water requirement of humans and different livestock therefore by simple calculation, we can determine domestic water requirement and by adding above crop water requirement we get total water requirement for a particular region. Most of the water requirement in rural areas comes from agriculture hence water demand in April and May is very low because of less activities in agriculture. For calculation of water requirement, we have considered monthly variation in consumption of water which gives us more accurate data to analyse results and for further improvements.



Graph No.2 Monthly water requirement graph

VI.RESULT

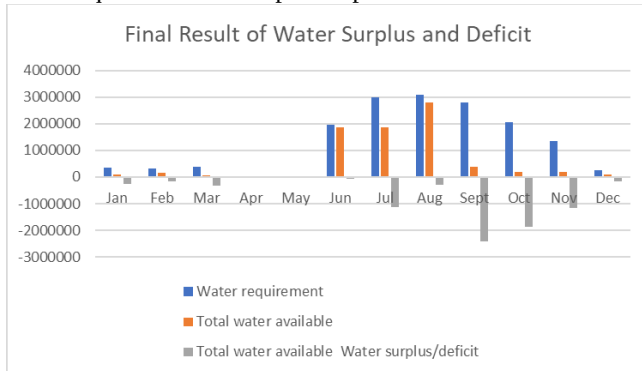
Jalyukta shivar abhiyan and POCRA approach are two important approaches in water balance calculation and they are widely used in Maharashtra for water budgeting. In graph no. 1 We have compared our study and important parameters of the hydrological cycle with the above approaches. Some changes in result arise due to utilization of different formulas and assumptions in the micro watershed region in different approaches. In this study our focus was on more accuracy, simplicity and reliability because less data is available in villages for computing different parameters in hydrology.



Graph No. 3 Water balance parameter comparison with other method

In Nimkhedi kh micro watershed region Rainfall is observed in June, July, August and September, October month and about 12661400 cum volume of water generated by rainfall. This region mostly depends on groundwater for irrigation and domestic water requirement, Total existing groundwater draft for all purposes is 801747 cum, and only 15 % of agricultural land is irrigated. According to the study and calculation we made, we found this region has water deficiency every month except April, as the water requirement for crops in April month is very less. In Nimkhedi kh micro watershed region Rainfall is observed in June, July, August and September, October month and about

12661400 cum volume of water generated by rainfall. This region mostly depends on groundwater for irrigation and domestic water requirement, Total existing groundwater draft for all purposes is 801747 cum, and only 15 % of agricultural land is irrigated. According to the study and calculation we made, we found this region has water deficiency every month except April, as the water requirement for crops in April month.



Graph No. 4 Monthly water balance result

Graph No.2 Final result of water balance

In Nimkhedi kh micro watershed region is a water deficit region having a total yearly water deficit of 7836153 cum which is about 50% deficiency. Therefore, some steps are required to achieve water security in this region. Available runoff for storage is less because of intermittent rainfall and availability of black cotton soil which has more water holding capacity, therefore available runoff is insufficient to fulfil the water requirement, hence some changes in cropping pattern and structural changes are required to achieve water security in the micro watershed region is very less.

VII. CONCLUSION

In this current study we had an approach towards meeting the water requirement of Nimkhedi Kh micro watershed. This is a simple way of approach by using various methods and previously developed hydrological empirical formulae for calculating water balance parameters which will give amount of requirement and availability of water at small scale. The proposed calculation approach is for monthly water balance components which helps to plan uses of water correctly and this approach is most suitable at village level as the dataset required for this approach is less and it is also accurate and reliable.

In this region Rainfall is less which gives Runoff value after calculation is 12% of rainfall which is quite less to fulfill the storage requirement. Infiltration is about 8.19% of rainfall, the maximum water requirement is from agricultural areas. To meet this requirement, we have to take correct decisions and action in the form of structural changes in storage as well as cropping patterns. We found that there is good improvement in irrigation methodology

as drip irrigation is used in 70 to 75% of agricultural areas which will save ample amounts of water. Nimkhedi kh micro watershed region is a water deficit region having a total yearly water deficit of 7836153 cum. We have 296646 m³ of groundwater available for future scope but it is also not sufficient to solve the problem of water scarcity of this region hence some structural changes and proper micro watershed planning required for this region to solve the problem of water scarcity.

As groundwater and available storage is not sufficient to tackle the problem of water scarcity we have to consider some other options. Purna River is near to this micro watershed region so there is scope of studying water availability in this river; We can take decisions about transfer of water in the lake, so that water availability can be increased. With this method we can easily calculate water balance parameters and find the solutions to tackle water scarcity problems. This method can be applied to any other

ACKNOWLEDGMENT

The support provided by Pimpri Chinchwad College of Engineering & Research, Pune and Dr. Sameer Sawarkar Head of Department of Civil Engineering; Our Project Guide Prof. Supe PCCOE&R are gratefully acknowledged. Thanks also extended to the Senior Geologist, GSDA Department and agriculture

department, Jalgaon Last but not least, we would like to thanks all those who directly and indirectly involved in this project.

REFERENCES

- [1] 1. Surendran, U., C. M. Sushanth, George Mammen, and E. J. Joseph. "Modelling the crop water requirement using FAO-CROPWAT and assessment of water resources for sustainable water resource management: A case study in Palakkad district of humid tropical Kerala, India." *Aquatic Procedia* 4 (2015): 1211-1219.
- [2] 2. Ivezić, Vedran, Damir Bekić, and Ranko Žugaj. "A review of procedures for water balance modelling." *Journal of Environmental Hydrology* 25, no. 4: 1-20.
- [3] 3. Ghandhari, A., and SMR Alavi Moghaddam. "Water balance principles: a review of studies on five watersheds in Iran." *Journal of Environmental Science and Technology* 4, no. 5 (2011): 465-479.
- [4] 4. McCabe, Gregory J., and Steven L. Markstrom. A monthly water-balance

-
- model driven by a graphical user interface. Vol. 1088. Reston, VA: US Geological Survey, 2007.
- [5] 5. Khan, Fazle Yar, Arshad Ashraf, Gulraiz Akhter, Muzaffar Ali Baig, and Shams Ali Baig. "Appraisal of groundwater recharge in Neelum watershed (upper indus basin) using geospatial water balance technique." *Science of The Total Environment* (2021): 147318.
- [6] 6. Falalakis, George, and Alexandra Gemitzi. "A simple method for water balance estimation based on the empirical method and remotely sensed evapotranspiration estimates." *Journal of Hydroinformatics* 22, no. 2 (2020): 440-451.
- [7] 7. "CHAPTER 3: CROP WATER NEEDS". www.fao.org.
- [8] 8. Ashrafi, Seyed Mohammad, and Tayebah Moradpoor. "A Conceptual Framework of a Surrogate-based Quality-Quantity Decision Support System (Q2DSS) for Water Resources Systems." *Journal of Hydraulic Structures* 6, no. 1 (2020): 77-89.

Municipal solid waste management system for Pune city

¹Prof. Gajanan N. Supe, ²Kiran kshirsagar, ³Pranali Mahind, ⁴Shravani Thobde, ⁵Ashwini Yalangphale.

¹Assistant Professor, ²Student, ³Student, ⁴Student, ⁵Student,

¹Civil Engineering Department,

¹Pimpri Chinchwad College of Engineering and Research

ABSTRACT

The increasing population create issues of solid waste management (SWM) is a major challenge for Indian cities and villages. We are thinking about to keeping our Pune city clean but have we ever thought about the mounting wastes in the land filling area of the city. Our aim is reduction, recycling and reuse of the waste; to make cities clean. The study is all about the growth of solid waste management (SWM) in different part of the Pune city. Pune city have policy and program to be adopted by the municipal corporation in managing solid wastes. There are cities which are successfully converting the solid waste into compost, vermicomposting, Biogas, RDF (Refused Derived Fuel), etc.,we need to learn their process to be replicated in each cities of India. Solid waste management includes the activities and actions required to manage waste from its inception to it's final disposal. This includes the collection, transport, treatment and disposal of waste. The main and important aim of waste management is to minimize the effect of waste product and hazards to the environment. Effective waste management is quite expensive, usually comprising 20%-50% of municipal budget. With rapid urbanisation, industrialization and an explosion of population in Pune , solid waste management will be a key challenge for governments and local municipal bodies in future. The "SWACHH BHARAT ABHIYAAN" (clean India mission) was created to tackle these very issue's related to waste management, cleanliness and sanitation on a national level.

INDEX TERMS Pune, Solid Waste Management, RDF, Swachh Bharat Abhiyaan

I. INTRODUCTION

In Pune city, solid waste management has become a top priority. Day by day population increases with increasing waste. According to increasing number of population, management face challenge to manage all those things. Management of Solid Waste may be defined as the control of generation, segregation, storage, collection, transfer and transport, processing and disposal of waste based on scientific principles. This includes all technological, financial, institutional and legal and policy aspects involved for solving the whole spectrum of issues related with solid waste. In India, Pune is 13th cleanest city, according to Swachh Survekshan. Term 'waste' relates to materials which is produced by human activities and the process is generally undertaken to reduce their effect on environment and health. Poor waste management can create serious health and social problems in a community. With increasing population, management of Municipal Solid Waste (MSW) in the country has emerged as a severe problem not only because of the environment and aesthetic concerns but also because of the sheer quantities generated every day. Segregation at source, collection, transportation, treatment and scientific disposal of waste was largely insufficient leading to degradation of the environment and poor quality of life. In Pune city due to growth of population solid waste is increasing. Due to improper management of solid waste most common problems associated it includes odour nuisance, diseases, atmospheric and water pollution (Jilani 2002). And also improper disposal on the landfill site's may cause the diseases like asthma, jaundice also reduces the quality of the drinking water (Bean, et al. 1995). In Pune city solid waste comprises, discarded and unwanted materials from commercial, industrial, from houses, hospital, hotels, establishment market changing life style and increase in urban population lead to the generation of solid waste. If solid waste is disposed off in open area on land, then it causes environmental causes, negative impact on health. Large amount of waste poorly disposed and untreated. PMC (Pune municipal corporation) is responsible for collection, storage, segregation, transportation and disposal of MSW. So there is immediate need for designed scientific Integrated SW management system using GIS, Remote sensing to control and minimize negative effects on environments. Covid-19 in India shows that the peak is yet to come and India has a long way to go to control the virus.

Because of coronavirus the biomedical waste is generated from the hospitals and laboratories not all the waste is hazardous but even the smaller amount of hazardous waste is enough to spread the virus and hinder our fight against corona. Biomedical waste required handled carefully and it should be treated carefully and properly in way that it does not affect anyone before it gets treated. Solid waste management is critical and essential job in response to coronavirus after seeing all condition that amount of biomedical waste has been increased to 15 times more than amount of the waste generated from the general patients.

II OBJECTIVES -

The main objective of this research work is to decide the most suitable disposal method of "Municipal Solid Waste Management for Pune city" for future forecast in year 2050

III STUDY AREA

Pune is the second largest quick developing urban city in Maharashtra and ranks eight at national level. It is now quickly changing from an education-administrative center to an important industrial centres and the IT Center. Pune is a plateau or upland city which is situated near the western margin of the Deccan Plateau or upland. Pune is situated at an elevation of 560 m above the mean sea level. PMC lies between latitudes 18° 25'N and 18° 37'N and longitudes between 73° 44'E and 73° 57'E and the geographical area is around 243.84 Sq. Km with a population of 3.12 million. The area in the central part of the PMC is slowly populated than the marginal regions.

IV METHODOLOGY -

The purpose of the study is find out the total solid waste by population at 2050 year. For the work, first we calculate population projection for 2050 year using geometrical increase method. Population projection is calculated using the equation:

$$P_b = P_a(1+r)^t;$$

P_b = is population of the for which projection is to be made

P_a = is population of the base year

r = is the rate of growth divided by 100

t = is the number of years between 'a' and 'b'

Ex: If present population (2020) of a Pune city is 6629 with a growth rate of 2.74%, then project the population for the year 2050.

$$P(2050) = P(2020) * (1 + 2.74/100)^{30} \\ = 6629 * 2.250$$

$$P(2050) = 14915.25 \text{ Thousands}$$

Determination of waste generation rate:-

- Small Town-100g/p/day
- Medium Town-300-400g/p/day
- Large Town-500g/p/day

For Pune city waste generation rate is more than 500g/p/day because Pune is rapid growth city.

Future waste generation = per capita waste generation* projected population

We calculate area required for sanitary landfill:-

- Location - Pune
- Waste generation - 2677 tons per day (current)
- Design life - Active period (30 year)
- Topography - Hilly area
- Water table - Below 3m ground surface
- Average total precipitation - 722mm per year
- Current waste generation per year = 2677 t
- Estimated waste generation after 30 yr =7458t
- Total waste generation in 30 yr = $0.5(2677+7458) \times 365 \times 30$
= 55,489,125
= 56 MT
- Total waste volume (assumed density 0.85 t/cu.m)
= $56 \times 10^6 / 0.85$
= 65.88×10^6 cu. m
- Volume of daily cover
= $0.1 \times 65.88 \times 10^6$
= 6.5×10^6 cu. m
- Volume of linear and cover systems:- $= 0.125 \times 65.88 \times 10^6$
= 8.23×10^6 cu. m
- First estimate of landfill volume
= $(65.88 + 6.5 + 8.23 - 6.5) \times 10^6$
= 74.11×10^6 cu. m

4.2 Area Calculation-

- Area required for infrastructure facility:-

$$= 0.15 \times A$$

$$= 0.15 \times 37.05 \times 10^5$$

$$= 55.57 \times 10^5 \text{ sq. m}$$

- Area available for landfill Area required for landfill separation

$$= 0.85 \times A_r$$

$$= 0.85 \times 37.05 \times 10^5$$

$$= 31.49 \times 10^5 \text{ sq. m}$$

- Area required for landfill separation A_i

$$= (74.11 \times 10^6) / 20$$

$$= 37.05 \times 10^5 \text{ sq. m}$$

- Total area required for landfill separation

$$= 1.15 \times A_i$$

$$= 1.15 \times 37.05 \times 10^5$$

$$= 42.60 \times 10^5 \text{ sq. m}$$

V Functional Element-

Various functional elements associated with the management of solid wastes such as generation, storage, collection, transportation, processing and disposal which are given below-

•Waste generation-

Waste generated at the start of any process, and at every stage as raw materials are converted into goods for consumption. The source of waste generation determines composition, quantity and waste characteristics.

•Waste storage-

Storage of Municipal solid waste (MSW) after collection and prior to transportation to the transform Or disposal site . It is an relevant practical component. Storage time depends on the type of Municipal solid waste.

•**Waste collection**-Collection refers two features: collection from the origin or source of generation to the upcoming collectionpoint and collection from that point to the wide vehicles for transportation or to the transferstations and then finally go to the processing plant / disposal area. Collections based on thenumber of containers, frequency of collection, types of collection services and track.

•Transfer and transport-

This involves transfer of waste from minor collection vehicle to major ones at transfer stations.

- **Processing**-It is very important functional component of Solid Waste Management system, which leads to many types of resource recovery, recycling, energy generation, production of organic manure, etc.

- **Disposal of final projects**-

Engineering principles are followed to intern the waste to the little possible area, reduce them to lowest particle volume by compaction at area or site and cover them after each day's operation to shorten exposure to ant/vermin.

VI Waste Treatment Methods

1) Windrow Composting- This method is useful for disposal for the disposal of biodegradable waste. This method is not expensive composting method. It improves the fertility of soil. eg. Yard waste.

2) Sanitary Landfill- It involve the dumping of waste into a land fill. A low-laying open area out of the city where solid waste/ Garbage is collected and dumped. e.g. Food Waste

3) Incineration Method- It is mainly used to dispose of the medical waste hazardous and toxic wastes. Waste can be easily be rid by using this method. It features combustion of waste to transform them into base component with the generated heat being trapped for Deriving energy. eg. E-waste

4) Recycling- It is the process of convert waste material to useful product. This is done to reduce the use of raw materials and minimize the quantity of waste generation.

5) Integrated System- Integrated waste management system all inclusive waste prohibition, recycling, composting and disposal program. An efficient integrated system considers how to prohibit, reuse, recycle, manage solid waste in ways that most efficiently. and it protect environment and human health.

6) Vermiculture-It is a technique based on utilizing earthworms to convert organic waste into vermicomposting, the product of decomposition by various worms. Harvesting worms that take part in decomposing organic waste and convert it into nutrient rich fertilizer.

7) RDF- RDF (Refuse Derived Fuel). This fuel is produced from fundamental which are explosive or combustibile that the industry calls Municipal Solid Waste (MSW) for short. This waste, which is from industrial or commercial areas or sites is burned to produce electricity power. Refuse Derived Fuel (RDF) is a renewable energy source. That make sure waste isn't thrown into a landfill area and instead, put to sustainable use.

VII. Result and Discussion

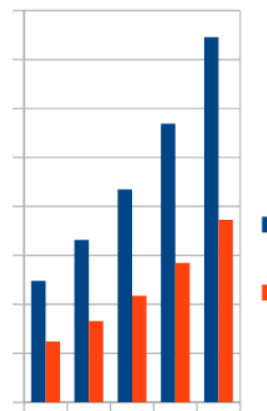


Fig 1. Bar chart OF MSW generation, Population projected form 2010 to 2050.

Total population of Pune city and waste generated from population, Rapidly Increasing from 2010 to 2050. According to climate change, seasonal variations from wet to dry season, which cause significant changes in the moisture content of solid waste, varying from less than 50% in dry season to greater than 65% in wet season. In wet months, collection and disposal of wastes are often more problematic. High temperature and humidity cause solid wastes decomposes for more rapidly than in colder climates. In India usually a community storage system is practised where individuals deposit their waste in bins located at street corners and at specific intervals. The containers generally are constructed of metal, concrete or a combination of the two.

VIII Conclusion

From the study is concluded municipal solid waste disposal at urali devachi depot at Pune, in India. MSW creates many problems to human health as well as to

environment. Open Dumping of solid waste affects on the aesthetic view of surroundings area and produce bad smell in nature. At the time of decomposition of waste released many gases like SO₂, CO₂ which affect on human health. From this process land and air also get polluted. It also causes harmful effects on human health. Leach-ate is a corrosive activity, which is very harmful to human beings. From the land pollution the water table get polluted. It is not safe, most important for drinking, commercial and industrial purposes. In Pune city it is observed that there is enough provisions for recycling the waste, but plants are unable to operating at full capacity, as a result waste is getting piled up. Municipal corporation should understand the commercial cost and benefit aspects of creating capacity to recycle is not enough. The main problem is that in most of the cases, for recycling of waste municipal corporation does not have its own plant, so it has to depend on the private companies. These private companies have an edge in case of investment, efficiency, effectiveness and technology. These private companies are driven by the market dynamism or energy of supply and demand, investment and output and cost and profit. The moment they realize that the operation is not profit-making they surrender the operation. Therefore it is Mandatory that the authority understands the existing commercial aspects and market competition. Municipal corporation should understand the pros and cons of consensus with the private players. PPP (public private partnership) is good, but needs enough defence measures for sustainable and stable operation. There should be proper section and provision for fine and also against breach of contract. The contact with NGO's and private players should be comprehensible. Corporation or local municipalities are spending immense amount on keeping the city clean. There is vast cost attached with the collection and conversion of waste. The complete process is cumbersome and need effective handling at each and every step. It is inappropriate to see litter all around in a promising city such as Pune. Everyone likes cleanliness. Commitment from citizen, government and the corporation is crucial to keep city garbage free. The study determines the capacity to use GIS, GPS and remote sensing technology for the effective assessment of solid waste management system will reduce the human health problems and environment risk. The study is useful in planning for the city in future. It highlights on the importance of the requirement of solid waste system.

Reference –

1. Nomesha Bolia, " Analysis of citizen's perception towards segregation and composting." (Nov 2020)
2. Meenakshi Nandal, "Effective and sustainable solid waste management in India: A Challenge" (March 2020)
3. Akhilesh Kumar, Avlokita Agrawal "Recent trends in solid waste management status, challenges, and potential for the future Indian cities" (December 2020)
4. Author Kapil dev sharma 2019 "Overview of Municipal Solid Waste generation, composition Management in India 2019
5. Jilani, T. , " State of solid waste management in khulna city " - unpublished undergraduate thesis Environmental Science Discipline, khulna university khulna, (pp 25-85 2002)
6. Municipal solid waste manual
7. By- Nitin munde "Assessment of Municipal Solid Waste Management of Pune City using Geospatial Tools"(2016).

AUTHOR

1. **Gajanan N. Supe**
Asst. Prof.
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
2. **Kiran kshirsagar**
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
3. **Pranali Mahind**
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
4. **Shravani Thobde**
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet
5. **Ashwini Yalangphale**
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and Research, Ravet

EXPRIMENTAL INESTIGATION OF WASTE PLASTIC USED IN BRICKS

Prof. Sahil Sanjeev Salvi, Komal Mantute, Rutuja Sabale, Siddhi Lande, Akash Kadlag

Department of Civil Engineering,

Pimpri Chinchwad Collage of Engineering and Research, Pune, India Maharashtra

ABSTRACT A large number of constructive wastes have been assembled from several places such as traveler and public places etc., High density polyethylene bags are collected, cleaned, and used as a variation for cement in the manufacturing of bricks. Plastic waste is easy in large quantity and hence the cost factor comes down. when we having waste plastic then we can use as reuse, recycle and reduce. Be careful of what you do, pay care to the items you buy, and always check yourself to see if you condition it or if it comes in a collection with less waste.

INDEX TERMS: Bricks, Plastic waste, Ceramic Waste, Compressive Strength

III. Introduction

Plastic is heinous. You can hardly do away with it. Every day we use plastic in daily lifestyle that is Waste product, coffee cup, electronic material, plastic bags Etc. so plastic is very harmful to humans, animals, marine and as well as to surroundings. But where is all the plastic going? It would be surprising to note that large integer of tons of impressionable are ending up in the world's oceans. Pollution caused by plastic is not only pernicious to marine life but is also affecting the health of humans. The pernicious chemicals like PCBs, DDT, and PAH, which get absorbed in the plastic rubble that interval in the seawater, have a varied and harmful range of degenerative effects like endocrine magnitude. The toxins are transferred in the food chain as they get attentive in the animals' bodies after they eat the plastic composition. Human beings take up these polluted fish and vertebrate. Plastic pollution is affecting the global economy. It is overcome the fishing and cultivation industries. Plastic is mostly produced by household, tourism and trekking etc. In many countries, the composing of Waste is different, that it is affected by the socioeconomic characters, waste governance programs, and intake patterns, but generally, the equal of plastic in the waste composition is high. One of the sizeable components of plastic waste is polythene which is followed by polypropene.

Definition of plastic-Looking to the international issue of environmental uncleanness by post-consumer plastic waste, research exertion have been centralized on intense this waste on a large scale in an prompt and environmentally friendly manner. Plastic contains in solid as well as in painted state.

Need of recycling the plastic-Recycling plastic is very important because of this material is used in the commercial enterprise of individual products, Utilization is important if we want to leave this celestial body for our future create. when we having waste plastic then we can utilization as reuse, recycle and reduce. Be evocative of what you do, pay attraction to the items you buy, and always check yourself to see if you want it or if it comes in a collection with less waste.

IV. AIM

The aim of this project is to succeed cement with plastic waste in brick and to reduce the cost of brick when compared to that of convention concrete bricks.

III. OBJECTIVES

- 1.To determine the suitability of waste plastic in the modification of bricks.
- 2.To valuate compressive strength and permanency of ordinary concrete brick and plastic brick.
- 3.To solid food cost-effective bricks and eco-friendly. Which a popular person can afford easily.

V. LITERATURE REVIEW

Pooja Bhatia Most of the change nations lack a decorous solidified waste management system undischarged to the psychological feature factor faced during the sample aggregation and treatment phases. Distributed polyethylene (LDPE) testimonial as a major source of such pollution due to the distributed use of its commodity which admit water bag, thin bags, wrapper paper, etc. The waste plastic which is powerfulness in landfilling that will affect the ground water tale as well as circumferent soil. A relatively simple practical application has been

projected in this paper that produces LDPE-bonded sand blocks and bricks. The tightness and compressive strength were found to be enhanced as the molecule size of the sand were decreased. The illustration also showing far topnotch impact resistance as compared to conventional clay bricks.

Aarti Ghude Plastic is a non-biodegradable substantial. The plastic waste in assemblage solid waste is Enhanced quickly day by day. When we necessity to use of plastic that time is very essential to use of plastic after using of plastic they can use as a reuse. Plastic is of many antithetical types such as High-Density Poly-ethylene (HDPE), This project aims to succeed the soldering given by cement in bricks with the liquified plastic waste. The abasement of plastic is a very long process, it may take one thousand of years. Hence, a project helps bring down plastic waste. In this project, we have used impressible waste in different ratios with fine and coarse aggregate. The bricks were prepared and tested. The water absorption production of the plastic bricks is less.

S. Arjun Kumar S. Ganesh Babu In addition, with waste plastic waste lime sludge from the paper industry replaces fine aggregate. In project, we have to use lime sludge, waste plastic in different proportion with sand. The bricks is tested and we discussed about all test. Because of population increment the production of plastic waste is also increased. We will be using the method of landfilling for disposal of plastic which is very important. so, we can use the plastic in paver block.

Avinash G B, Roja A P, Santosh M R The Plastic bricks are fitted out by exchange waste plastics. A large amount of plastic is being brought into the modification neighborhood are throwaway or unburned which leads to the pollution of the surroundings and air. The heated up of waste plastic and then syndrome sand in it which is manually carried out as well as automatically. In this in attendance work, the Plastic bricks is made by adding 35%, 45% And 55%, of plastic waste by weight of sand required to fill the mold of bricks. In that four-trial works, it is found that a stripped of 55% waste additive is required to get the desired shape of the mold and waste additive.

Avinash Gb, Rosa Ap, Santosh M R, Puneetha kumari H M In this project we can use a waste plastic as cement, and we purpose do instead of plastic powerfulness we can use the plastic in paving material block, then it is economic as well as easily available .as analysis to concrete paved surface block the bricks are light in weight. Also, it has a small operation to making a block. The use of plastic waste which is non-biodegradable is quickly flourishing in the encompassing and proper a someone to the surroundings in many aspects.

V. METHODOLOGY AND INVESTIGATION

5.1 Methodology

This study has the following methodological analysis for using recycled plastic used in brick.

1. Lest out physical necessary for the study
2. Check the geographic area of the collected material.
3. Prepare a mix design for the recycled plastic used in the bricks.
4. Making the bricks using proper mix and guidelines.
5. Check the geographic area of the recycled plastic used in the bricks.

5.2 Experimental Investigation

In the project use sand and plastic for the bricks in proper shape. In group meeting concrete bricks use cement, sand, and aggregate with water. Cement is used for the attraction substantial in the application block, But the recycled plastic bricks required only sand and plastic. Where the plastic is used as a protective covering in the brick.

5.3 Materials used for plastic brick.

The wastes of plastic in the menage are large and indefinite quantity with time. The largest ingredient of plastic waste is polythene, followed by plastic, polyethylene terephthalate, and phenylethylene. Sounding to the global issue of biological science pollution by post-consumer plastic waste, the use of post-consumer plastic waste in concrete will not only be its safe powerfulness method but may also improve concrete properties like tensile strength, chemical resistance, drying lessening, and creep on a short and long-term basis.

1. Good Detachment for cold, heat, and sound-saving energy.
2. As compare to concrete block it is economical.
3. Sanitary and clean
4. Ease of physical process/installation
5. Nobody
6. Maintenance-free (such as painting is minimized)

5.4. Mix Design (1:3)

In this process of fabrication plastic bricks mix design is not given becoming calculation. This mix design calculates on the trial-and-error method while during the construct cognitive operation.

5.5. Collect the Plastic Waste

The commercial enterprise of plastic paving blocks requires a Brobdignagian plastic. The importance of the plastic is very small so the abstraction of the plastic is required a Brobdignagian quantity. The 1 kg plastic requires 4 kg sand. Sand is another material used in the plastic paving block. The quantity of the sand calculates on the plastic used for bricks.

5.6. Preparation of The Mixture

Plastic bag uncollected and not need to clean but stored and roughly cleaned. Weight the plastic and sand with a proportion of the 1 parts of and 2 part of the plastic. The rate of the sand and plastic are calculating on the type of the product The abstraction of the mixture is undetermined to enable easy manual labour and conveyance.

5.7: Heating the Mixture

The mixture is more and more heated in a recycled half-barrel with day-and-night and muscular mixing. Taking a

cylinder and heat at constant fundamental quantity and placed the plastic at a proper weight. After phase transition the plastic add quickly sand in good disporportion. Flutter this mixture constantly. During the mixing take care of proper mixing. The composing of the gas and suspension produced during the phase change is fundamentally CO2 and H2O2 all the same it is suggested that the operator wears a proper facial mask.

5.8. Moulding

The plastic paste still identical hot and fluid is crowd put together into the mold and steadfastly leveled witha trowel. Then it is closed with a consecrate tool which is designed as per bricks shape.

5.9. Unmolding

When plastic is cool sufficiency, the activity of the blocks out of the mold is unmediated. It is only involving a gentle actuation off of the mould. bricks on their auriferous support is immersed in an armored combat vehicle with cold water.

VI.RESULT AND DISCUSSION

Result:

In this study we made 3 blocks the bricks was oven-ready and tested the result when the unregenerate. We performed the Water Natural process Test and Compressive strength test.

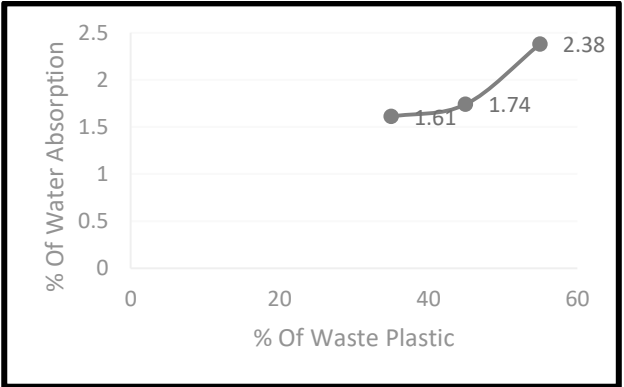
Table:5.1 Table showing water absorption

Sr. No.	Description (%)	Weight Before Test (Kg)	Weight After Test (Kg)
1	B1 (35)	2.59	1.61
2	B2 (45)	1.72	1.74
3	B3 (55)	2.30	2.38

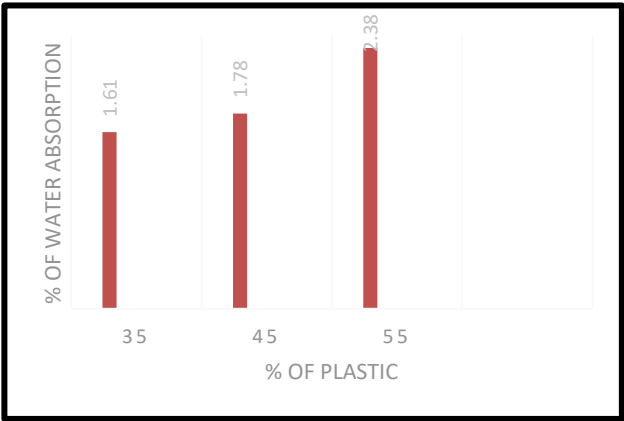
Table 5.2 Table Showing Compressive Strength

Sr. No.	Description (%)	Load (KN)	Compressive strength in MPa
1	B1(35)	72	21.49
2	B2(45)	60	18.08
3	B3(55)	45	12.43

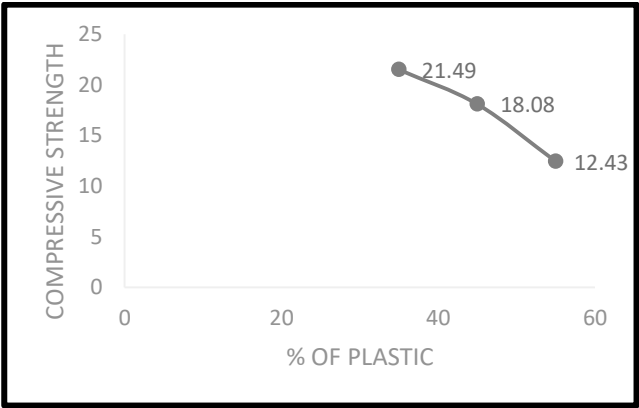
Graph 5.1 Percentage of Water Absorption v/s Percentage of Plastic



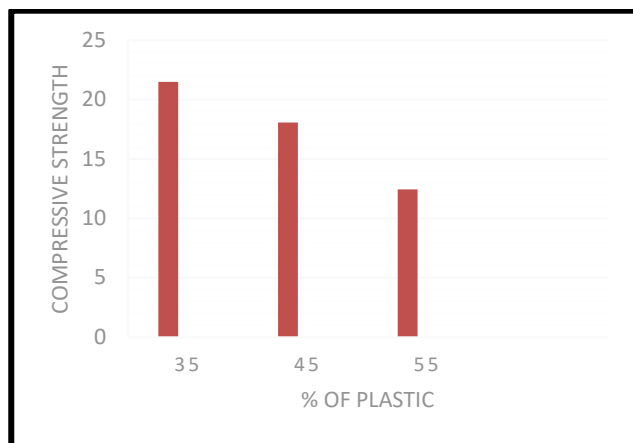
Bar Graph 5.2 Percentage of Water Absorption v/s Percentage of Plastic



Graph 5.3 Compressive Strength v/s Percentage of Plastic



Bar Graph 5.4 Compressive Strength v/s Percentage of Plastic



VII.CONCLUSION

1. These bricks are used in the park and, on foot path of the route. It also used in the making international nautical mile stone, side guard in the road construction.
2. When we passage water natural action test on plastic bricks, we discovered that plastic calm is more than 50% then capacity of water absorption of bricks is i.e., more than 2% compare to other bricks.
3. The Water soaking up value is less 2% material is suited for structure
4. As proportion of plastic content flexure, compressive strength of 35%, 45% and 55% content of plastic angularity gradually severally.

VIII. ACKNOWLEDGMENT

We feel immense pleasure in presenting the project report on “**Experimental Investigation of waste plastic used in bricks**”. We wish to express true sense of gratitude towards **Prof. Sahil S Salvi** Sir, our project guide who at very discrete step in study of this project, contributed their valuable guidance and helped to solve every problem that arose.

We take this opportunity to thank our Principal **DR. H. U. Tiwari** and **Prof. Dr. S. S. Sawarkar** (HOD Civil Dept.) for opening the door of department toward the realization of our project, for their guidance and encouragement. We offer our sincere thanks to our BE Project Coordinator **Prof Satish Pitkae**, who gave us extra inspiration to do something new.

IX. REFERENCES

- [1] B. Shanmugavalli, B. Eswara Moorthy, Reuse of Plastic Waste in Bricks, ISSN:2278-0181: Vol. 6 Issue 02, February-(2017).

[2] Ganesh Tapkire. Satish Parihar. Pramod Patil. Hemra, R. Kumavat, Recycled Plastic used in Concrete Bricks. International Journal of Research in Engineering and Technology, ISSN:2321-7308:Vol.3, Issue 09, (2014)

[3] Joel Santhosh. Ravikant Talluri. Manufacture of Interlocking Concrete Bricks with Fly Ash and Glass Powder. International Journal of Civil Engineering and Technology, ISSN:55-64, Vol:06, Issue:04 (2015).

[4] Mohan D.M, Vignesh, Utilization of plastic bags Bricks. Volume:119, No15 ,1407-1415 ISSN: 1314-3395., (2018)

[5] Nivetha, C. Rubiya, M. Shobana, S. Vijayanathi, Production of Plastic Bricks from the Solid Waste. ARPJ Journal of Engineering and Applied Science. G. ISSN.1819-6608: Vol.11 Issue 02 (2016)

[6] Poonam Sharma. Ramesh Kumar Batra., Cement Concrete Bricks for Rural Roads. International Journal of Current Engineering and Scientific Research, ISSN:114-121. Vol 3, Issue :01(2016).

[7] Praveen Mathew et al, Utilization of plastic bags in concrete bricks, Literature Review, Volume 2, Issue 6 JETIR ISSN-2349-5162. June(2015)

[8] Raghatate Atul M, use of plastic in a concrete to modify its properties, ISSN2249–8974 IJAERS/Vol. I/ Issue III/April-June, 2012/109-111

[9] R.L. Rame, Recycled plastics used as coarse aggregate for constructional concrete, project reference no 37S1114, ISSN:2319-8753, Vol:02, Issue :03, March (2013)

[10] V. Natraj “Utilization of Waste Plastics as a Partial Replacement of Coarse Aggregate in Concrete Bricks, ISSN:0994-5645, Vol:08, Issue:12, June (2015).

AUTHOR



Prof. Sahil S. Salvi
Assistant Professor
Civil Engg. Dept. PCCOER
B.E. (CIVIL) M. Tech (EWRE)



Rutuja Sabale
Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER



Komal Mantute
Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER



Siddhi Lande
Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER

A STUDY ON GRANITE FINE WASTE IN CONCRETE

Prof. Sahil Sanjeev Salvi, Srinath A Chavan, Akash R Dangat, Siddhart S Kore, and Swapnil M Londhe.

Department of Civil Engineering

Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, Maharashtra

ABSTRACT In the world of the construction industrial era, the waste produced from the stone industries cause environmental problems. At the same time, Construction industries face many problems not only at the end of the life cycle of the products but also at the beginning of it. It is also significant to develop low-cost building material by the waste produced by stone industry. Therefore, the recycle of Granite fine waste material in the construction industry can be emphasized to produce low-cost concrete. This Project aims at pioneering use of Granite Fine waste in concrete by substituting the fine aggregate which is the other alternative that can be used in conventional concrete. The proposed work is investigated for a concrete mix of M15 grade with 0%, 15%, 25%, and 35% of Granite Fine waste used as the replacement of fine aggregate. A series of 12 cubes are casted and tested after 28 days for the compressive strength. The result appears that the compressive strength of concrete increases up to 15% after the replacement of fine aggregate with Granite fine waste and further, it falls as the percentage of granite increases.

INDEX TERMS: Granite Fine Waste, Compressive Strength, Grade of Concrete.

I. INTRODUCTION

Granite is an important structural and ornamental stone and it also has high compressive strength and durability, it is used widely for massive structural work. Fine-grained granite that takes and preserves good polish is employed for ornamental and monumental works and also for engraving purposes. The word granite is derived from the Latin word 'granum', which is a grain. Solid waste is produced mainly from industrial processing, mining, and agriculture, and is disposed of ineffectually. The waste produced at the time of mining, processing, and finishing of rocks such as granite, marble, sandstones, consists of a large quantum of the total solid waste. Since there is an increase in population day by day is resulting in ultimatum for building of infrastructure has increased constantly. Concrete is the most widely used manmade construction material in the world whereas the

most ingredient in concrete is cement, fine aggregate, and coarse aggregate. For construction purposes river sand is used as fine aggregate in concrete. Recently in India many states like Rajasthan, Tamil Nadu have imposed restrictions on sand removal from the river beds due to unsafe impacts threatening and has forced the search of feasible alternativematerials. The complete and proper removal of this waste is not possible, and the only way to minimize the damages caused by it is its complete utilization. This waste, although with no proper method of disposal, has a possible for usage as a partial or complete replacement of aggregates in cement mortar, or can be used as a Fine aggregate auxiliary in concrete.

II. AIM

To study the compressive strength by use of Granite Fine waste in Concrete with varying proportion of Granite Fines for M 20 Grade of concrete.

III. OBJECTIVES

The main objective is to study the influence of Granite fine waste in concrete.

- 1) To evaluate the possible use of granite powder in concrete as a replacement for natural sand.
- 2) To inspect the degree of strength improvement in concrete obtained with the addition of granite powder.
- 3) To analyse the result of compressive strength with different quantity of granite fines with that of conventional concrete.

IV. LITERATURE REVIEW

Anandhu Ramesh, Sravanan.S, Kanesh Pandian.M, and Charles Raja P investigated the grade of concrete and the percentage of substitution of granite powder with various percentages. The cubes are prepared by 0%,15%,25%,35% of fine/natural aggregate replacement Granite Powder by-product on the behavior of concrete, compressive strength on cubes is performed. Experimental outcomes exposed that compressive strength and axial stress strain behavior of the substitution rate up to 20% is fairly greater than values obtained with natural aggregates and it is suggested that substitution of natural aggregates by GP by-product up to 20% is favorable for the concrete resistance.

G. Ganesh Naidu, M Sri Durga Vara Prasad, N. Narendra investigated to discover the combined effect of granite cutting waste and reused concrete on the workability and mechanical properties of self-compacting concrete. In this experiment the granite cutting waste is replaced with fine aggregate at 0%, 20%,40%,60%,80%, and 100% proportions. Recycled concrete is replaced with coarse aggregate starting from 20 to 100%. Total 36 mixes of cubes were designed to check the fresh and hardened properties. Slump flow and T500, vfunnel, and Lbox tests are conducted to know the flow skill and passing ability of concrete. The result obtained is that the Granite Cutting Waste and Recycled Concrete values are increasing; Slump flow values are gradually decreasing. The motive after this is, increasing viscosity and nonbonding behavior of recycled concrete and granite cutting waste. As

the GC waste and RC values are increasing, Slump flow values are gradually decreasing. The reason behind this is, growing viscosity and nonbonding behavior of recycled concrete and granite cutting waste.

Dr.G. Prince Arulraj, Mr. Adin and Mr. Suresh Khanna obtained the test result that replacement of fine aggregate with granite powder is found to improve the strength of concrete after the replacement of 15% of Fine Aggregate with Granite powder. The operation of granite powder will evade disposal problems and linked environmental issues. The utilization of granite powder will reduce the usage of river sand and keep natural resources. The Various percentages of granite powder are added by weight to replace sand by weight which are 0%, 5%, 10%, 15%, 20%, and 25%. To improve the workability of concrete 0.5% Superplasticizer was added. 54 cubes and 36 cylinders were cast. Compressive strength and split tensile strength were found. The test results represent that granite fine as replacement sand has a beneficial effect on the mechanical properties such as compressive strength and split tensile strength of concrete.

Manasseb Joel determined the suitability of Crushed granite fine to replace river sand in concrete production for use in rigid pavement. Various tests like Slump, compressive and indirect tensile strength tests were performed on concrete. 40.70N/mm² and 2.30N/mm² are the values obtained as high compressive and indirect tensile strength respectively with the fractional replacement of river sand with 20% Crushed Granite Fine, as against values of 35.00N/mm² and 1.75N/mm², gained with the use of river sand as fine aggregate after 28 days of curing the. Based on the results of tests obtained, river sand can be replaced with 20% Crushed Granite fine and is commended for use in the production of concrete for use in the rigid pavement. Conservation of river sand in addition to better ways of disposing wastes from the quarry sites are some of the advantages of using Crushed Granite Fines.

Kanamalai Williams C, Partheeban P, Felix Kala T. investigated the high-performance concrete made with replacement of fine aggregate with granite powder. The various percentage of granite powder was added by weight. 0%, 25%, 50%, 75%, and 100% as a replacement of fine

aggregate used in concrete and cement was replaced with 7.5%Silica fume, 10% fly ash, 10% slag, and 1% superplasticizer. The effects of curing temperature at 32 0.40 Celsius water binder (w/b) ratio were there for 1, 7, 14, 28, 56, and 90 days which is shown on various test like compressive strength, split tensile strength, modulus of elasticity, drying shrinkage, and water saturation of concrete were studied. Experimental outcomes show that there is an increase in the proportions of granite powder resulted in a decrease in the compressive strength of concrete. After the replacement of 25% granite powder concrete, the highest compressive strength was shown which 47.35 kPa was after 90 days. The overall close discovered that granite powder can be utilized as a partial replacement of fine aggregate in high-performance concrete.

V. METHODOLOGY AND INVESTIGATION

- 1) A series of 9 cubes specimens and 3 conventional concrete cubes are cast and tested for compressive strength.
- 2) To achieve the aim and objectives, a methodology developed is as follows:

A. METHODOLOGY

- 3) Casting of the cube and check for Compressive Strength with conventional concrete for mix M15 is carried out.
- 4) The Casting of the cube with replacement of Fine Aggregate with Granite fines for mix M15 with varying percentage is done.
- 5) Testing of the above said cube at 28 days for compressive strength is done respectively.
- 6) Compressive Strength outcome tests are compared with that of the conventional concrete strength.

B. EXPERIMENT AND INVESTIGATION

- 7) The experimental program is considered to study the bond strength of Granite Fines wastes with variable percentages substituting Fine Aggregate in concrete. The replacement of Fine Aggregate is done at 0%, 15%, 25%, and 35% in M15 concrete mix which is later used in the casting of the cubes. Cube specimens of 150 mm x 150 mm x 150 mm are cast and are kept in water for curing to 28 days for testing the compressive strength of concrete

C. MATERIAL TO BE USED

- 8) 1) Cement: Ordinary Portland cement of 53 grade is used in this experimentation following to I.S- 8112- 1989.
- 9) 2) Fine Aggregate: Fine aggregates are the second ingredient of the aggregate stage in concrete. Sand is the most commonly used fine aggregate in concrete. Fine aggregates that pass from 4.75 mm (No.4) sieve but are reserved on 75um (No.200) sieve.
- 10) 3) Coarse Aggregate: The coarse aggregates used for the concrete are 20 mm passing and retained on a 4.75mm.
- 11) 4) Water: Potable water is used for the experimentation.
- 12) 5) Granite: Granite fits to the igneous rock family. The density of the granite is between 2.65 to 2.75 g/cm3. The material is ordered from Granite Powder Company named Rajendra R Raibagi situated in Gajendragad, Karnataka, India. The type of Granite used is a Mixture of Himalayan Blue and Mudgal Grey.

Table 1 Material Testing

Materials	Specific Gravity	WaterAbsorption	Grading
CoarseAggregate	2.61	0.54	As per table 2 of IS383
Crushed Sand	2.66	2.0	Zone 2 as per Table4of IS383
Granite Fines	2.7	0.5 to 1.5%	---

Table 2 Chemical Compound of Granite Powder

D. MATERIAL TESTING

Fine aggregate and coarse aggregates are tested before the experiments and checked for conformism with relevant Indian standards. Specific gravity test and water absorption test of course aggregate are shown as per IS: 2386 (Part III)1963. Specific gravity test of fine aggregate is done as per IS: 2720 (Part II)1973.

E. CONCRETE MIX PROPORTION

Concrete for M15 grade is prepared. A mixed proportion of 1: 2: 4 with 0.5 water-cement ratio to get a characteristic strength of M15 which are

E. PREPARATION OF MIX DESIGN

Four sets of mix design were prepared with the use of different substituents such as follows:

1. Cement + fine aggregate + 20 mm coarse aggregate + water
2. Cement+ (Granite Fines 15% + Fine aggregate 90%) + coarse aggregate + water
3. Cement + (Granite Fines 25%+ Fine aggregate 80%) + coarse aggregate + Water
4. Cement + (Granite Fines 35% + Fine Aggregate70%) + Coarse aggregate +Water

These concretes were prepared and cast in 150mm concrete mould to take the compressive test. After 24 hours these moulds were De-mouldedand set for curing in a water tank. The compressive tests were taken in 28 days respectively to check the results.

Thorough mixing of the materials is important for the production of uniform concrete. The mixing should ensure that the mass becomes homogenous, uniform in colour, and consistency. There are two approaches adopted for mixing concrete:

(i) Hand mixing (ii) Machine mixing

From two methods, hand mixing is efficient and also economical for small concreting work.

An in-house casting setup is done in the Laboratory of Civil department using Cubes of 150mm x 150mm x 150mm.

G. CURING

The process of providing adequate temperature, moisture and time to allow concrete achieve to the desired properties for it is termed as 'Curing'. The cubes are stored in the moist air of at least 90% relative humidity a place free from vibration, and at a temperature of 27°C for 24 hours. After this period, the cubes are marked and removed from the mold and unless required for the test within 24 hours, immediately submerged in clean fresh water and kept there until taken out just before to the test for 28 days.

H. TESTING

Compression test is to be conducted on cubes on proposed experimentation work.

I.COMPRESSION TEST

The Compression test is the most common test conducted on concrete. The test is easy to perform and gets most of the desirable characteristics properties of concrete which is related to its compressive strength. The compression test is carried out in the cube of the size 150 x 150 x 150 mm. The cubes are filled with 0%, 15%, 25%, and 35% with Granite Fines. Each layer is compacted by hand compaction. After the top layer has been compacted the surface of the concrete is brought to the finished level with the top of the mold, using a trowel. After 24 hours the cubes are remolded and are shifted to a curing tank wherein, they are allowed to cure for 28 days. After 28 days of curing the cubes, are tested on a digital compression testing machine as per I.S. 5161959. The failure load is noted. The compressive strength is calculated as follows:

Compressive strength (MPa) = Failure load divided by cross-sectional area.

VI. RESULT AND DISCUSSION

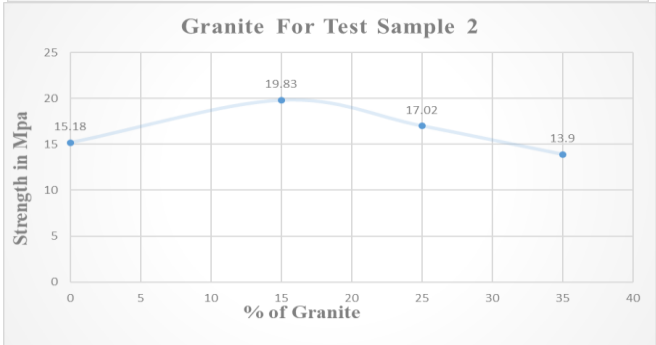
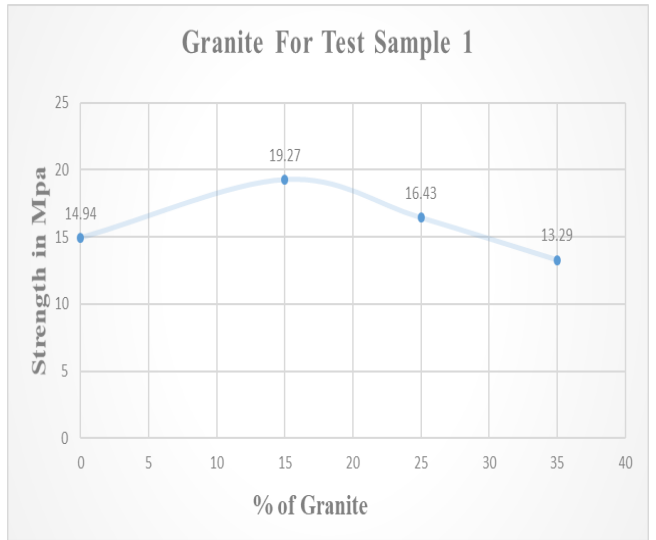
In this study, the different percentages of Granite Fine as 0%, 15%, 25%, and 35% were replaced by Fine Aggregate in concrete. Results obtained in this research have been given in subtitles as 'compressivestrength'.

Compressive Strength:

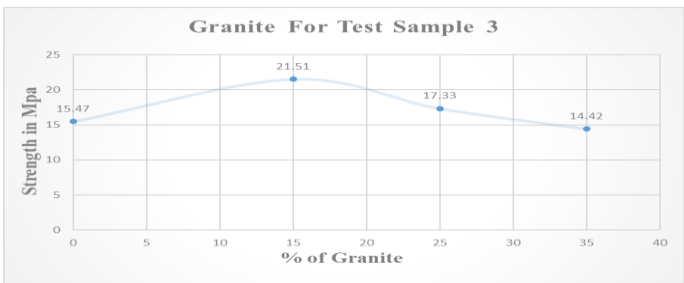
Results of Compressive strength for M15 grade of concrete on cube specimen with 0%, 15%,25%, and 35% with Granite Fine replacement of Fine aggregate in concrete are shown in the table.

Table 4 Compressive Strength in KN

GRAPH 1 COMPRESSIVE STRENGTH V/s PERCENTAGE OF GRANITE REPLACEMENT FOR SAMPLE



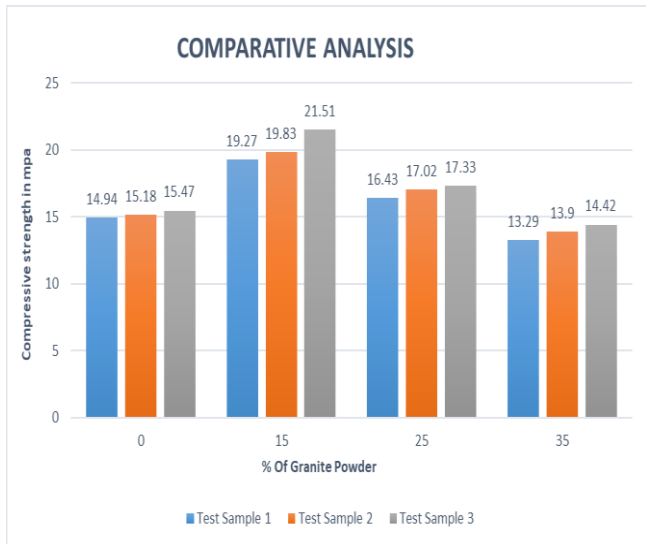
GRAPH 2 COMPRESSIVE STRENGTH V/s PERCENTAGE OF GRANITE REPLACEMENT FOR SAMPLE 2



COMPRESSIVE STRENGTH In (Mpa)				
Sr. No	%Of Granite Powder	Test Sample 1 in N/mm ²	Test Sample 2 in N/mm ²	Test Sample 3 in N/mm ²
1	0	14.94	15.18	15.47
2	15	19.27	19.83	21.51
3	25	16.43	17.02	17.33
4	35	13.29	13.90	14.42

GRAPH 3 COMPRESSIVE STRENGTH V/s PERCENTAGE OF GRANITE REPLACEMENT FOR SAMPLE 3

GRAPH 4 COMPARATIVE ANALYSIS FOR ALL 3 SAMPLES



VIII. CONCLUSION

- 1) The use of Granite Fine waste in partial replacement of Fine Aggregate in concrete showed an increase in Compressive strength.
- 2) Compressive Strength shows an increasing trend till 15% of replacement of Granite and further, it decreases which is nearly equal to the strength of conventional concrete.
- 3) The use of Granite Fine waste in the replacement of fine aggregate shows a

32% increase in Compressive Strength when it is replaced by 15% as compared to conventional concrete.

- 4) The comparative increase in compressive strength as compared with conventional concrete at 25% of Granite fine waste content is 11% for M15 mix of concrete.
- 6) The comparative decrease in compressive strength as compared with conventional concrete at 35%

of Granite fine waste content is 9% for M15 mix of concrete.

- 5) All the Specimens with Granite Fine Waste failed in Crushing Mode.

IX. ACKNOWLEDGMENT

We feel immense pleasure in presenting the project report on "A Study on Granite Fine Waste". We wish to express true sense of gratitude towards Prof. Sahil S Salvi, our project guide who at very discrete step in study of this project, contributed their valuable guidance and helped to solve every problem that arose.

We take this opportunity to thank our Principal Dr. H. U. Tiwari and Prof. Dr. S. S. Sawarkar (HOD Civil Dept.) for opening the door of department toward the realization of our project, for their guidance and encouragement. We offer our sincere thanks to our BE Project Coordinator Prof. Satish Pitake, who gave us extra inspiration to do something new.

IX. REFERENCES

- 1) A. Arivumangai T. Felixkala (2014), "Strength and Durability Properties of Granite Powder Concrete" (Journal of Civil Engineering Research, 4(2A): 1-6)
- 2) Abhishek Jain, Rajesh Gupta, Sandeep Chaudhary (2019), "Performance of self-compacting concrete comprising granite cutting waste as fine aggregate, Construction and Building Materials" Volume 221,2019, Pages 539-552, ISSN 0950-0618
- 3) Allam M. E., Bakhoun E. S., Garas G. L., and Ezz H., "Durability of Green Concrete Containing Granite Waste Powder" (Allam M. E. et al. / International Journal of Engineering and Technology (IJET)).
- 4) Anandhu Ramesh , Sravanan.S, Kanesh Pandian.M, Charles Raja P., "Experimental Study On Granite Powder As Replacement Of Fine Aggregate In Concrete" (IJARIE-ISSN(O)-2395-4396)
- 5) Divakar. Y, "Experimental Investigation of Behaviour of Concrete with The Use of Granite Fines" (M-Tech Thesis report, B.I.T, Bangalore)
- 6) Dr. G. Prince Arulraj, Mr.A. Adin and Mr.T. Suresh Khanna (2013), "Granite Powder Concrete." (IRACST – Engineering Science and Technology: An International Journal (ESTIJ), ISSN: 2250-3498, Vol.3, No.1, February 2013)
- 7) F. Kala (2013), "Effect of granite powder on strength properties of concrete" (Int. J. Eng. Sci. Res. Invent. Vol. 1 (Issue 12) 36–50).
- 8) Felix kala T and Partheeban P, "Granite Powder Concrete" (Indian Journal of Science and Technology, Vol 3, no. 3, mar 2010, PP 311-317)
- 9) Felix kala T, N. Soundarya, and P. Partheeban (2007), "Combining Granite Powder and River Sand as Fine Aggregate" (Int. Conference on Emerging Challenges in Design and Manufacturing Technologies, ECDEM 2007, 28-30 Nov 2007, pp.495-498).
- 10) G. Ganesh Naidu, M Sri Durga Vara Prasad, N. Narendra (2019), "Influence of Granite Cutting Waste and Recycled Concrete on Properties Of Self Compacting Concrete" Engineering (IJRTE) ISSN: 2277- 3878, Volume-8 Issue-4, November 2019).
- 11) K. Charanjevi Reddy (2015), "Experimental study on concrete with waste granite powder as an admixture" (journal of engineering research and application. ISSN:2248-9622, vol.5,Issue 6, (part-2) june 2015, pp.87-93)
- 12) Dr KS Jagdish, "Effect of Granite Fines

on Strength of Hollow Concrete Blocks Waste” (International Journal of Advanced Engineering Technology (E-ISSN 0976-3945).

- 13) Kanamalai Williams C, Partheeban P, Felix Kala T. (2008), “Mechanical Properties Of High Performance Concrete Incorporating Granite Powder As Fine Aggregate” (International Journal on Design and Manufacturing Technologies, Vol.2, No.1, July 2008)
- 14) Lokeshwari M, K.S Jagdis H. (2016), “Eco-Friendly use of Granite fine waste in Building Block” (Procedia Environmental Sciences 35 (2016) 618 – 623).
- 15) Manasseb Joel, “Use of Crushed Fine as Replacement To River Sand In Concrete reduction” (Leonardo Electronic Journal of Practices and Technologies ISSN 1583-1078)

AUTHOR



Assistant Professor
Civil Engg. Dept. PCCOER
B.E. (CIVIL) M. Tech (EWRE)



Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER



Akash R Dangat
Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER



Siddhart S Kore
Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER



Swapnil M Londhe
Pursuing B.E. (CIVIL)
CIVIL ENGG. DEPT. PCCOER

Instrument for time optimization in slope measurement-CAMBIMETER

Prof. Akash Gunjal¹, Pallavi Rathod², Sony Shete³, Pranav Kargote⁴, Aditya Pawale⁵

¹Pimpri Chinchwad College of Engineering and Research Ravet

²Department of Civil Engineering PCCOER

³ University of SPPU

ABSTRACT In this project instrument for time optimization in slope measurement called as cambimeter a novel construction of instrument is done with spirit level, measuring tape, monochromatic light, iron rods with welded measuring scale on them in order to develop a high accuracy instrument in slope measurement. The primary purpose is always to develop a instrument with high accuracy, easy to handle and carry places, low construction cost and to achieve precise vertical, horizontal and angular measurements. Experiment's specially suited to measure camber slope during execution of slope as it gives instant results. The present study aims that slope reading can be determined easily and quickly with high accuracy monochromatic light and measuring scale. Different readings were obtained after measuring the camber of various roads. The readings obtained from various roads using the cambimeter were almost accurate and quickly obtained than other slope measuring instruments.

INDEX TERMS Camber, slope measurement, prompt result, apparent handling, optimum economic.

1. INTRODUCTION

Cambimeter is an instrument for measuring angles of slope, elevation or depression, rise or fall in the staff with respective gravity. It is designed with three basic equipments i.e spirit level, measuring tape, monochromatic light. This instrument is specially suited to measure camber slope during execution of slope as it gives instant result which assists engineer for immediate corrections. Camber is the slope provided to the road surface at the transverse direction to drain off the rain water out of road surface. It is also known as the cross slope of the road. Incorrect slope of camber leads to

overloading, fatigued. Improper camber can make the tire wear on one edge and may cause the vehicle to pull to the side that has the most positive camber. Zero camber will result in the most uniform tire wear over time, but may reduce performance during cornering.

2. OBJECTIVE:

Precise measurement of camber's element: angular measurement, vertical measurement, horizontal measurement. Prompt results with optimum economy.

3. LITERATURE REVIEW:

Daniel Osorio, University of Sussex, United Kingdom-Human Wavelength Discrimination of Monochromatic Light Explained by Optimal Wavelength Decoding of Light of Unknown Intensity. Takahiko Yoshino, Hiromichi Nozaki This research focused on a method of ground negative camber angle control that is proportional to the steering. Daan Roethof, Tarik Sezer, Mustafa Ali Arat, and Barys Shyrokau-In this research we looking for the influence of active camber control on steering fee.



4. MATERIALS USED

- A. Ranging rod : Two 2m rods linked precisely to each other where one of the rod has vernier scale graduation.
- B. Vernier scale : 0.5m scale with least count of 0.1mm
- C. Measuring tape : 5m tape for measuring horizontal distance.
- D. Monochromatic light : Red colored light for measuring vertical difference.
- E. Spirit level : For leveling purpose.

6. CONCLUSION

The instrument facilitates evident regime which not only helps in apparent handling but also helps in convenient transportation without compromising accuracy. The inbuilt tape calculates the distance between the crown and the edge unaffected by the ground undulations.

7. REFERENCES

- 1). <https://explorationoutfitters.com/pages/castercamber-toe-explained>
- 2). https://en.wikipedia.org/wiki/Spirit_level
- 3). <https://www.google.com/search?q=measuring+tape&client=ms-android-xiaomirev1&sxsrf>
- 4). <https://g.co/kg/6mM5MF>

5. METHODOLOGY:

Hold both the rods in position one at crown and one at edge. Level both the rods such that they are exactly parallel to each other and strictly horizontal. After leveling flash the monochromatic light fixed on one rod on other rod and note the level difference.

Considering the level difference X and the horizontal distance Y we get ,

$$\tan \theta = X/Y$$

$$\theta = \tan^{-1} (X/Y)$$

Here θ is the required camber of road.

AUTHOR NAME



Prof. Akash Gunjal
Asst. Prof.
Department of Civil
Engineering
Pimpri-Chinchwad College of
Engineering and Research,
Ravet



SONY SHETE
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet

5).<https://www.google.com/search?q=slope+measurement&client=ms-android>
xiaomi



PALLAVI RATHOD BE
Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet



ADITYA PAWALE
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet



PRANAV KARGOTE
BE Student
Department of Civil
Engineering Pimpri-
Chinchwad College of
Engineering and Research,
Ravet

To Enhance the Strength of Concrete by Partial Replacement of Coarse Aggregate with Tile Waste

Prof. Akshay B. Rahane, Vrushali S. Jagtap, Papiha R. Wade, Mohammad Ismail, Sarwar F. Adilkhan

1Pimpri Chinchwad College of Engineering and Research Ravet

2Department of Civil Engineering PCCOER

3 University of SSPU

ABSTRACT Growth in construction industry is linked to the growth of infrastructure sector and the building industry. Construction industry has been growth @10-12% per annum. Concrete is widely used as a construction material due to inherent advantages. The demand for granite aggregates only expected to grow as the demand for infrastructure is ever increasing. Hence, there is a pertinent need to look for alternate materials to granite aggregates. This study explores use of ceramic tile waste as an option to the replacement of granite aggregates in terms of suitability. In this study the ceramic tile waste is being used to replace the granite aggregate i.e., coarse aggregate (CA). The ceramic coarse aggregate (CCA) is used in concrete by replacing CA by 25%, 35% and 45%. To compare the results of conventional concrete (CC) with CCA concrete a concrete design mix of M20 is produced with various proportion of CCA material. Due to the good bonding nature of ceramic material with cement it increases the strength of concrete. From the study it is found that the percentage of replacement of CA with CCA material is 45%, within which the performance of concrete is better, and all the results attained within the designed limit.

INDEX TERMS Infrastructure sector, Granite, Ceramic material, Conventional concrete, Mix design, Compressive strength, solid waste, ecology, sustainable material, construction industry, Coarse aggregate.

1. INTRODUCTION

The ceramic waste will help to increase the high compressive strength of the concrete when compared to the other materials. Considering the environmental factors, we can recycle the construction and debris waste used in the concrete. Concrete is an essential element in the construction material which is usually associated with coarse aggregate henceforth coarse aggregate acts as an essential element in the construction field. In the present condition the demand of coarse aggregate is going increased, and it leads to the gradual cost increment of aggregates. Thus, the introducing new ceramic tiles from waste ceramic tiles by crushing it to get the required size. The 30% of ceramic products are being waste daily so there is a small cost of this waste or sometimes it has no cost because the ceramic products are not recycled and reused.



Waste Ceramic Tiles

2. OBJECTIVE

1) To analyze the potential application of tile waste in concrete production which would reduce the usage of coarse aggregate in concrete and preserve the clean environment.

2) **Coarse Aggregate:**

Coarse Aggregate ranges between 9.5 mm to 37.5mm in diameter.

3)Waste Ceramic Tiles:

2)To reduce the cost of construction and evaluate the significance of waste material for manufacturing of sustainable concrete for construction.

rushed ceramic tiles of nominal size 10mm.

3. LITERATURE REVIEW

1) “The effect of ceramic waste aggregate on strength properties of concrete”, E.E. Ikponwosa and S.O. Ehikhuenmen, Nigerian Journal of Technology (NIJOTECH) July 2017

2)“An Experimental analysis of partial replacement of coarse aggregate by waste ceramic tiles in concrete”, N. Sivachandiran, A. Magesh, International Journal of pure and applied Mathematics ,2015

3)“Effect of Partial replacement of fine and coarse aggregate with ceramic waste on the properties of concrete”, Vikas Rajora1, Gurtej Singh Sidhu, International Journal of science and research (IJSR), August 2016.

4)“Partial replacement of coarse aggregate by waste ceramic tile in concrete” by M Sekar, International journal for research in applied science and engineering and technology”, March 2017

5) “Utilization of waste ceramic tiles as coarse aggregate in concrete” by Parminder Singh, Dr. Rakesh Kumar Singla, November 2015

4. METHODOLOGY**Materials:****1)Cement:**

Cement is a binder, a substance that sets and hardens and can bind other materials together.Type of cemet to be used is 43 grade. passing through 2.36 mm.

5) Water:

Water is the key ingredient which mix with cement to form a paste that binds all the material.

4)Fine Aggregates:

Fine aggregates conforming to sieve

Methods:**1.Preparation of moulds:**

We will use normal mould which we use for regular concrete mould of size 150*150*150mm with proportion 1:1.5:3 for M20 grade of concrete.



Moulds of size 150*150*150mm

2.Mix Concrete:

Water measured exactly is added to uniform dry mixed proportion until a homogeneous mix is achieved. This mix is then ready for casting.

3.Placing of concrete in Moulds:

All the test specimens are cast in removable standard (cast iron) moulds conforming to IS 10086 -1982. In total 3 specimens are cast for different percentage replacement of ceramic tile waste.

4.Curing:

Curing is done until such a period that the specimens are tested for their strength characteristics at the end of 28 days.

5.Testing of Specimens:

In this investigation, specimens are tested for compressive strength and results are noted at the end of 28 days according to their schedule.



Specimen for test6. Result for Compressive Strength of

Concrete Cubes :

Symbol	7 days	14 days	21 days
S0	14.6	17.4	19.2
S25	17.89	20.0	23.26
S35	17.36	19.82	22.42
S45	15.44	17.67	19.60

All values are in N/mm^2 .

'S' denotes tile waste and '0' denotes %.

'S35' means replacement of Coarse Aggregate by tile waste is 35%.



ession test by UTM

Compr

5.CONCLUSION

- 1) Based on investigation and experimental result, it is observed that the compressive strength of concrete increases with the addition of tile waste up to 25% and it gives 23.26 N/mm^2 strength value.
- 2) Beyond which there is no specific increase in strength, and it started to decrease with further addition of tile waste.
- 3) Ceramic tile waste can be formed into useful coarse aggregate.

6. REFERENCES

- 1) Adeniran Jolaade Adeala and Lawrence Ademola Omisande yop, "Strucutral performance of broken ceramic tiles as partial replacement of coarse aggregate in concrete", International Journal of Research and scientific innovation, January2021.
- 2) N.Sivachandiran,A.Magesh, "An Experimental analysis of partial replacement of coarse aggregate by waste ceramic tiles in concrete",International Journal of pure and applied mathematics,2015 International Journal of Pure and Applied Mathematics Special Issue (2018) .
- 3) S.O Ajamu, J.R . Oluremi and E.S ogunyemi "Impact of replacement of coarse aggregate with ceramic tile waste on the strength characteristic of concrete" Journal of research information in civil engineering (2018).
- 4) E.E. Ikponwosa and S.O Ehikhuenmen "Effect of ceramic waste as coarse aggregate on strength of properties of concrete" Nigerian Journal of technology (NIJOTECH) (2017).
- 5) M Sekar, "Partial replacement of coarse aggregate by waste ceramic tile in concrete", International journal for research in applied science and engineering and technology", March 2017

7.ABOUT AUTHORS

Qtr Qtr Qtr Qtr



PROF.AKSHAY AHANE
ASSITANT PROFESSOR
CIVIL ENGG. DEPT.
PCCOER
B.E. (CIVIL)
MTech (STRUCTURAL



VRUSHALI JAGTAP
PURSUING B.E. (CIVIL)
CIVIL ENGG. DEPT.
PCCOER



PAPIHA WADE
PURSUING B.E. (CIVIL)
CIVIL ENGG. DEPT.
PCCOER



SARWAR F. ADILKHAN
PURSUING B.E. (CIVIL)
CIVIL ENGG. DEPT.
PCCOER



MOHAMMAD ISMAIL
PURSUING B.E.
(CIVIL)
CIVIL ENGG. DEPT.
PCCOER

Strength Assessment of Concrete Structures Due to Various Chemical Attacks

Prof. Akshay Rahane¹, Omkar shelar², Varun Salgaonkar³, Sanket Oswal⁴, Mohanesh Tamboli⁵

¹Assistant Professor, ^{2,3,4,5}Student

^{1,2,3,4,5}Civil Engineering Department

^{1,2,3,4,5}Pimpri Chinchwad College of Engineering and Research

ABSTRACT

The strength and durability of concrete after casting changes at variance factors regarding physical and chemical damages Concrete structures with steel-reinforcement are in a continuous and losing life with corrosiveness that naturally occurs from long-term exposure to an aggressive environment. The concrete structure like dams, canals, bridges which have the influence of water forms various types of chemical reactions which include carbonation attack, sulphate attack, chloride attack, alkali aggregate reaction etc. Chemical reactions, either intrinsic or extrinsic, are one of the main reasons for concrete's deterioration. The present dissertation consists on an analysis of the chemical expansive reactions in concrete element, the alkalis aggregate reaction, and the internal sulphuric reaction. During the carbonation process the fundamental element identified in the concrete microstructure is calcite which comes out at the surface of concrete structure, in the form of cracks. When carbon dioxide causes by environment come contact into the concrete structure and effect with calcium hydroxide to create calcium carbonate this phenomenon is called as carbonation. Carbonation usually describe by pH value which indicate the depth of reaction in the structure. The depth of carbonation directly affects the life of structure in year. Through the years to overcome this problem the solution is being discovered by performing various experiments on Concrete after and before the casting. Which gave us the Chemical test like by increasing the CO₂ binding capacity, improving CaO Value and physical tests such as applying epoxy coating, etc.? After all, performing the various types of test for particular outcome finally check for durability tests for concrete structure is take place for better result. There are many of them but in this case it will be pH indicator, UTM and CTM is being discussed. This project addresses the study of chemical reaction which is taking place on various type of concrete structures and affect the durability and strength of it.

INDEX TERMS *Strength Assessment, Concrete Structure, Chemical Attack, Epoxy, Chlorine, Sulphur*

I. INTRODUCTION

What is chemical attack?? When we are dealing with durability of concrete chemical attack which result in volume change, cracking of concrete and the consequent deterioration of concrete become an important part of discussion. Chemical attack is the reaction of chemical element from exposure and moisture present in the concrete which results into deterioration of RCC structures.

Ordinary Portland Cement (OPC) is highly alkaline in nature with pH values above 12. When the cement paste comes into contact with the acids its components break down, this phenomenon is known as acid attack. If pH decreases to values lower than stability limits of cement hydrates, then the corresponding hydrate loses calcium and decomposes to amorphous hydrogel. The final

reaction products of acid attack are the corresponding calcium salts of the acid as well as hydrogels of siliceous, aluminium, and ferric oxides.



Fig 1: Hydrochloric Acid Attack on Concrete

II. OBJECTIVES

- ✓ To study about attacks of the chemical.
- ✓ To study the effect of various acid attacks on concrete.
- ✓ To study preventive methods of concrete deterioration caused by chemicals and acid attacks.

III. LITERATURE REVIEW

Durability of Concrete Exposed to Sulphuric Acid Attack, Seyed Mahmoodreza Joorabchian.

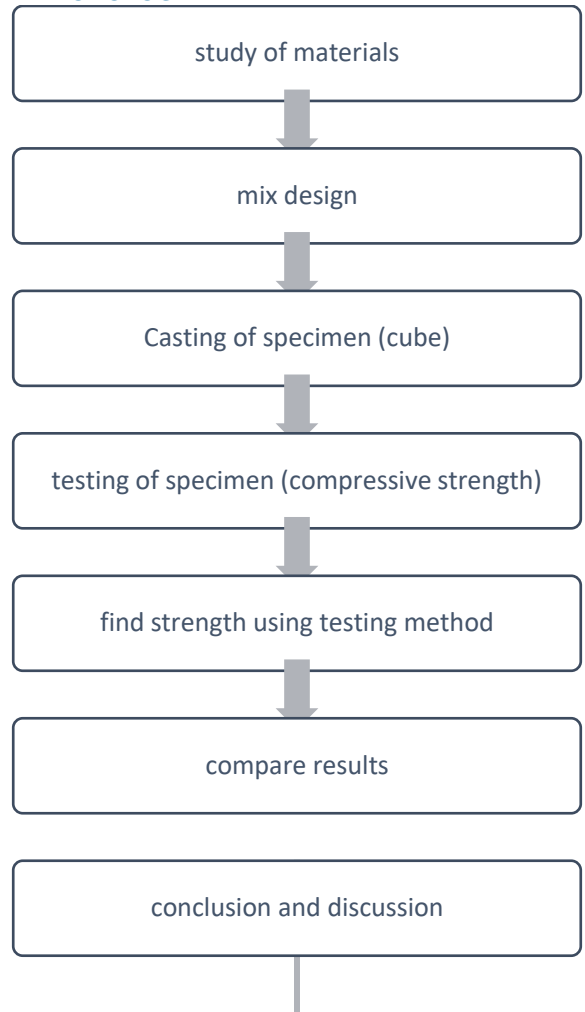
This thesis investigates the effects of aggressive sulfuric acid attack on the concrete mixtures prepared with metakaolin (MK) and limestone filler (LF) at various replacement levels. In addition, rapid chloride permeability (RCPT), water sorptivity, water porosity and rapid freezing and thawing tests were also performed on the concrete samples. Three sulfuric acid solutions with concentrations of 3%, 5% and 7% were used for examining the resistance of concrete specimens for a total exposure period of eight weeks. The performance of the degraded specimens was evaluated by measuring the weight loss, change in strength and visual assessment

Shinmi Biological deterioration of concrete in sewage and wastewater treatment plants has been reported. This deterioration is caused by sulfuric acid attack and is dependent on the concentration of sulfuric acid, this in turn being a function of both the specific location within the plant and also the time over which the concrete is exposed to elevated concentrations of acid. Given that concrete may often be exposed to very strong acid solutions, resin coatings are applied to the concrete to protect them Concrete against acid attack: Preventive measures, Oct19, Dr. Anwar Khitab, Dr. Mohsin Usman Qureshi, ³Mr. Muhammad Nadeem. This paper addresses the measures taken to prevent or minimize the deterioration of concrete, which confronts an acidic environment. Primarily, the mechanism of reaction between alkaline concrete and acid is clearly demonstrated. The mechanism of reaction clearly sets guidelines as to how the chances of this disastrous reaction should be minimized or eliminated at all. The suggested preventive measures are two-fold i.e. the improvement of the basic microstructure of concrete and the provision of barriers against acids. Concrete can be made acid resistant using classical as well as novel techniques like nanotechnology.

Response of Concrete to Sulfuric Acid Attack, Emmanuel K. Attiogbe and Sami H. Rizkalla

The study shows that all three indicators of deterioration are effective measures of concrete response to the acid attack. However, the study suggests that the increase in thickness (expansion) of small specimens (with large surface area-to-volume ratios) may be a more consistent measure than the weight loss of larger specimens when comparing the effects of different sulfuric acid concentrations on concrete.

V. METHODOLOGY



V. MATERIALS USED

A. Cement: -

Ordinary Portland Cement (53 grade)

B. Sand

C. Coarse Aggregate: -

size of aggregate 20mm

D. Water

E. Chemicals: -

Chlorine Solution
Sulphur Powder

F. Epoxy Resin Solution

1. Prof. Akshay Rahane

Asst. Prof.

Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

2. Omkar shelar²

BEStudent

Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

3. Varun Salgaonkar³

BEStudent

Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

4. Sanket Oswal⁴

BEStudent

Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

5. Mohanesh Tamboli⁵

BEStudent

Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

VI. CONCLUSION

- To perform 7/14/28 day Compressive strength on cube and results shown.
- After 7/14/28 day compressive strength when 0.35% of Sulphur is added decreases and by using epoxy coating compressive strength of concrete increases.
- After 7/14/28 day compressive strength when 0.35% of Chlorine is added decreases and by using epoxy coating compressive strength of concrete increases.

VII. REFERENCES

- Performance on an Alkali-Activated Cement-Based Binder (AACB) for Coating of an OPC Infrastructure Exposed to Chemical Attack W. Tahri, J. Aguiar, in Handbook of Low Carbon Concrete 2017
- Types of damage in concrete structures
- K. Kovler, V. Chernov, in Failure, Distress and Repair of Concrete Structures, 2018
- Meyer, Alvin H., and Ledbetter, William B., "Sulfuric Acid Attack on Concrete Sewer Pipe," Proceedings, ASCE, V. 96, SA5, Oct. 1970. pp. 1167-1182.
- Hughes, B. P., and Guest, J. E., "Limestone and Siliceous Aggregate Concretes Subjected to Sulphuric Acid Attack," Magazine of Concrete Research (London), V. 30, No. 102, Mar. 1978, pp. 11-18.
- Fattuhi, N. I., and Hughes, B. P., "Effect of Acid Attack on Concrete with Different Admixtures or Protective Coatings," Cement and Concrete Research, V. 13, No. 5, Sept. 1983, pp. 655-665.
- Raju, P. S. N., and Dayaratnam, P., "Durability of Concrete Exposed to Dilute Sulfuric Acid," Building and Environment, V. 19, No. 2, 1984, pp. 75-79

ANALYSIS OF BEAM COLUMN JUNCTION AND RETROFITTING BY NATURAL FIBERS

Prof. Akash Gunjal¹ , Somesh Sapkale², Aditya Tapkir², Vishal Patil², Siddesh Dabhade²,

¹Pimpri Chinchwad College of Engineering and Research Ravet

²Department of Civil Engineering PCCOER

³ University of SPPU

ABSTRACT

In this paper we got an opportunity to deal with actual retrofitting process of a structural member and understanding the concept of retrofitting., for that we have done the following procedure: Analysis of beam column joint -which neglecting the concrete road in resisting shear stress causes the need of high amount of steel bar reinforcement in beam column joint this will cause the problem to install reinforcement at congested portion so if we have to design an effective beam column joint, we have to proper design regarding development length, shear reinforcement and curtailment of bars has to be done Choosing suitable natural fiber In which natural fibers can be found useful in retrofitting useful in the field of retrofitting and that natural fibers prove economical than the regular carbon fibers or glass fibers which are costlier for that we have to studied the many different methods of retrofitting. Designing of prototype model Is similar to working prototype except that the functional prototype may be developed with different scale and technique as that of the original product then this prototype models tested by using horizontal shake table then we will get the stability of the model under seismic action then the results are obtained shows the relationship between frequency and displacement then this further discuss about the results of the model before and after retrofitting. By exercising overall this we have understood the concept and utility of retrofitting, and increasing the strengthen the column beam junction as well as strengthen the shear and bond slip resistance in order to eliminate brittle failure.

1.0 INTRODUCTION

It has to be noted that when buildings are subjected to earthquake loads, as they are often designed only for a fraction of the earthquake loads (about 10% of load), plastic hinges will be formed at the ends of the members where there are heavy bending moments, and subsequently the frames will fail when there are enough plastic hinges to form a mechanism. Hence, it is clear that unless the joints are designed to sustain these forces and deformations, the performance of structures will not be satisfactory under all the loading conditions, especially under seismic conditions.

The present scenario of seismic activity all over the world is quite threatening to most of the structures. The buildings not designed with respect to seismic codes and old buildings are insufficient to sustain earthquake loads. In that case they need to strengthen externally by using latest techniques and methods of restrengthening. Retrofitting is one of the best option to make the existing building safe against failure probably earthquake and other environmental forces. There are various techniques which are been used in retrofitting such as reinforced concrete jacketing, steel jacketing, fibre reinforced polymer composite jacketing, steel bracing jacketing, addition of shear walls, seismic isolation, shotcrete, over slabbing, sprayed concrete with additional reinforcement, grout and epoxy injection, external prestressing,

ferrocement. The latest techniques which includes elasto-plastic dampers, base isolators, lead extrusion dampers, tuned liquid dampers, friction dampers, etc.

The current study conducts an experimental investigation on beam column junction detailing with special arrangement of reinforcement prototype model and determining appropriate retrofitting method.

1.1 OBJECTIVES

- 1 To Strengthen the shear and bond slip resistance in order to eliminate the brittle failure.
- 2 To ensure that the ductile failure hinging will take place in the beam.
- 3 To increase the strength of beam column junction
- 4 To conduct experimental study on failure of beam column joint
- 5 To compare the behavior of exterior beam column joint with transverse reinforcement details as per IS 456 and IS 13920.
- 6 Understanding the concept and utility of retrofitting.
- 7 To increase the strength of beam column junction
- 8 To conduct experimental study on failure of beam column joint
- 9 To compare the behavior of exterior beam column joint with transverse reinforcement details as per IS 456 and IS 13920.
- 10 Understanding the concept and utility of retrofitting.

1.2 SCOPE OF PROJECT WORK

Studying and understanding the contents of IS 456, IS 1893, IS 13920 and designing the model as per IS

Designing of earthquake resistant structure by using earthquake resistant codes which designers generally neglects.

Very less number of consultants deal with retrofitting, hence in cities like Mumbai, Pune

LIMITATION OF STUDY

- 1) The stress intensity during earthquake is much higher as compared to table vibrator
- 2) Table vibrator produces uniform stresses unlike earthquake.
- 3) Limited time available for executing the project.

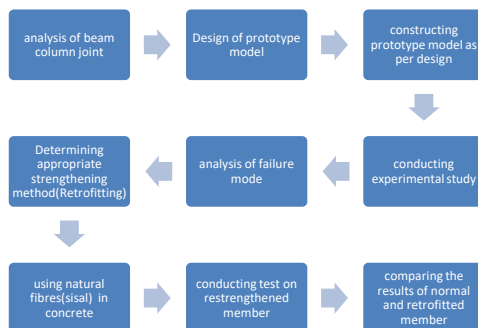
where, large number of building are available to deal with it, it can prove very effective.

1.3 PROBLEM STATEMENT

Analysis, Design of simulation model of RCC Beam-Column joint for vibrations and restrengthening using Sisal in concrete and adopting suitable retrofitting method and comparing the results.

1.4 RESEARCH METHODOLOGY

- 1 Analysis
1. Design of prototype model
2. Constructing prototype model as per design
3. Conducting experimental study
4. Analysis of failure mode
5. Determining appropriate strengthening method (Retrofitting)
6. Using natural fibres (sisal)
7. Conducting tests on restrengthened(retrofitted) member
8. Comparing the results of normal and retrofitted member



Development Length- 120mm
Materials- M25 concrete and 6mmØ main steel for Column and Beam

EXPECTED OUTCOME

- 4) Suggesting suitable retrofitting method.
- 5) We can consider this as our career option.

2.0 ANALYSIS

The basic idea behind the strength enhancement is been discussed. Strengthening the structure improves the flexibility, stiffness, Ductility and unity of the structure. About 50-60% of the total geographical area of India comes under earthquake prone region. Nearly 85% of the buildings are constructed without adopting the guidelines of earthquake resisting building Design Code ie. IS 1893:2002. In that we have study the various literature reviews for analysis of beam column junction .

DESIGN OF PROTOTYPE MODEL

Model 1

Column Size-70mm*70mm
Column Length- 300mm
Beam Size- 70mm*70mm
Beam Length- 440mm
Development Length- 60mm
Materials- M25 concrete and 6mmØ main steel for Column and Beam

Model 2

Column Size-70mm*70mm
Column Length- 300mm
Beam Size- 70mm*70mm
Beam Length- 440mm
Development Length- 120mm
Materials- M25 concrete and 6mmØ main steel for Column and Beam

CONSTRUCTING PROTOTYPE MODEL AS PER DESIGN

The test specimen was reduced to 1/10th scale to suit the loading arrangement and test facilities. For testing model, the dimension of beam was 70 X 70 mm and beam length of 440mm and that column size was 70 X 70 mm. Height of the column was 300mm. The Fig1 shows the shape of form work and reinforcement

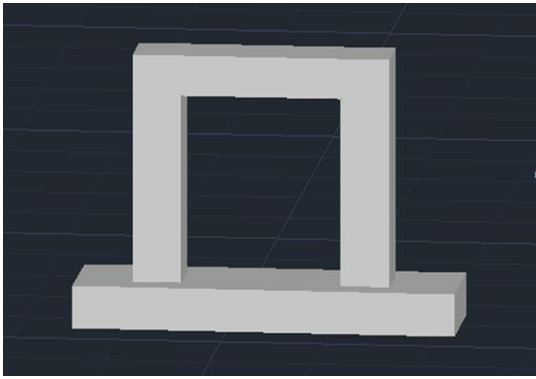
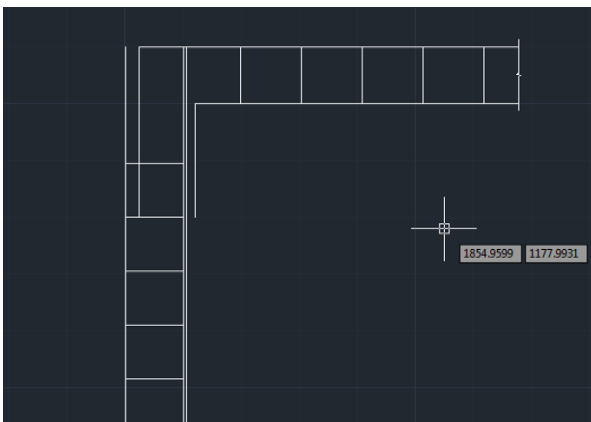


Fig no. 2.0.(A) 3D View of prototype Model of Beam Column joint



details for test specimen.

MOULD PREPARATION

An detachable mould of wooden material was prepared to fit the designed assembly as per the required dimensions. The mould was prepared into two sections; the above section consisted of the column and beam portion and the lower section.



Fig no- 3.0 (A) Preparation of mould for the model of Beam Column joint.

REINFORCEMENT DETAILS

The reinforcement details of the test specimens are shown figure . 4 numbers of 6mm diameters were used for main reinforcement of column and , two numbers of 6mm diameter are used for top reinforcement and two numbers of 6mm diameter are used for bottom reinforcement of beam and Development length of 60mm and 120mm from face of column

Horizontal shake table is a device which is used to bottom column top (beam column division portion), column bottom.

simulate earthquake with known frequency and amplitude. In this shake table different type of cams are provided of particular amplitude. The amplitude can be changed by changing the cam and the frequency can be varied from 0 to 25 Hz. The movement of the movable plate is done with cam follower mechanism where the follower reads the cam



Fig no. – 3.0(B)
Placing of Reinforcement into the mould

CASTING AND CURING

The mould is arranged properly and placed over a smooth surface. The sides of the mould exposed to concrete were oiled well to prevent the side walls of the mould from absorbing water from concrete and to facilitate easy removal of the specimen. The reinforcement cages were placed in the moulds and cover between cage and form provided was 6 mm. Concrete mix designed for M25 (1:1.52: 2.64) and water cement ratio is 0.45. The concrete contents such as cement, sand, aggregate and water were weighed accurately and mixed. The mixing was done till uniform mix was obtained. The concrete was placed into the mould immediately after mixing and well compacted. Control cubes and cylinders were prepared for all the mixes along with concreting. The test specimens were remolded at the end of 24 hours of casting. They were marked identifications. They are cured in water for 28 days. After 28 days of curing the specimen was dried in air.

CONDUCTING EXPERIMENTAL DETAILS

Model was fixed on the horizontal shake table with necessary fitting arrangements (clamps & screw arrangement).The accelerometers were attached at required positions along the beam column joints viz; beam top, beam

profile and moves the plate in horizontal direction.



Fig no – 4.0(A) showing arrangement of model on shake table

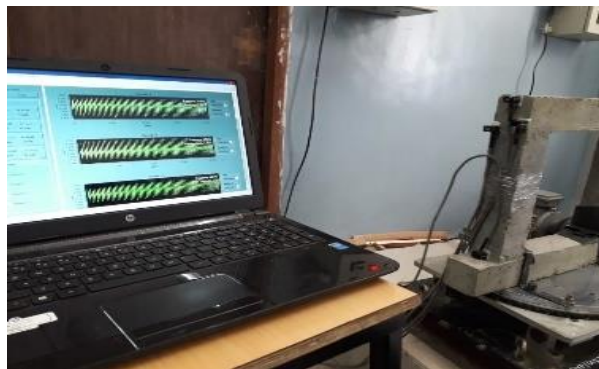


Fig no – 4.0(B) Showing conduction of test on Kampana software

stiffness reduction. The materials presented in this paper will useful in increasing the understanding of earthquake problems and seismic retrofitting.



Fig no –5.0 (A) showing formation of crack

CONDUCTING TESTS ON



Fig no – 4.0(C) accelerometer adapter

Software used to carry out the experimental analysis is Kampana. the model was tested for various frequencies ranging from 0.3Hz to 12.60Hz. Corresponding results were noted down at every 0.3Hz frequency. The final reading was taken when the whole model gets unstable.

ANALYSIS OF FAILURE MODE

Formation of cracks was seen on the unstable model. The corresponding model was then retrofitted with proper retrofitting material identified. Also modern methods and philosophies of seismic retrofitting including base isolation and energy dissipation devices are reviewed. The case studies of actual buildings where traditional and innovative retrofitting methods have been applied. The paper proceeds with an illustrative description of the seismic action and then addresses the problems of evaluating the seismic resistance and vulnerability of engineering structures. In this, the applications of methodology presented to reinforced concrete structures concepts has been discussed. In the concept of seismic resistance, seismic vulnerability and seismic over-resistance becomes easily understood and appreciated. The paper then considers the retrofitting of building vulnerability and earthquakes and briefly describes traditional and innovative methods of seismic retrofitting. Among all the methods of seismic retrofitting, particular attention is devoted to the method which is based on

RESTRENGTHENED (RETROFITTED) MEMBER

Test Setup and Loading Procedure

Model was fixed on the horizontal shake table with necessary fitting arrangements (clamps & screw arrangement).The accelerometers were attached at required positions along the beam column joints viz; beam top, beam bottom column top (beam column division portion), column bottom.



Fig no- 5.0(D)
Application of sisal fibres over urtethane

COMPAIRING THE RESULTS OF THE NORMAL AND RETROFITTED MEMBER

The results are expressed in terms of displacement versus frequency. Variations in acceleration, velocity and displacement are also mentioned.

A=g, V=mm/s, D=mm (time in milli second)

The results of beam column joint over the shake table at various frequencies are presented in a tabular format.



Fig no-5.0(B)
Repair column and beam joint by applying mortar



Fig no- 5.0(C)
Applying epoxy adhesive over the junction

FOR DEVELOPMENT LENGTH 60MM

Frequency (Hz)	Time (ms)	Channel Configuration											
		Channel 1			Channel 2			Channel 3			Channel 4		
		A	V	D	A	V	D	A0	V	D	A	V	D
0.837	20480	0.15	281.39	107.05	0.14	261.60	99.52	0.15	272.59	103.70	0.08	153.88	
1.92	20480	0.16	132.24	21.93	0.15	119.78	19.86	0.14	117.86	19.55	0.14	114.99	19.07
2.76	20480	0.27	154.83	17.88	0.26	144.82	16.72	0.23	132.80	15.34	0.22	124.13	14.34
3.59	20480	0.40	173.55	15.38	0.37	158.70	14.06	0.33	142.32	12.61	0.30	132.08	11.70
4.43	20480	0.55	194.33	13.96	0.50	176.48	12.68	0.47	164.44	11.82	0.42	147.00	10.56
5.32	20480	0.73	214.89	12.87	0.68	198.62	11.89	0.64	188.59	11.29	0.51	149.83	8.97
6.15	20480	0.87	221.54	11.46	0.81	205.10	10.61	0.78	197.02	10.19	0.76	193.74	10.02
6.99	20480	1.06	236.07	10.75	1.01	226.07	10.30	0.99	221.07	10.07	0.90	201.60	9.18
7.83	20480	1.59	317.54	12.92	1.50	300.15	12.21	1.47	292.39	11.89	1.23	244.91	9.96
8.66	20480	2.06	367.56	13.51	1.89	340.38	12.51	1.94	349.30	12.84	1.50	270.10	9.92
9.3	20480	2.24	379.11	13.11	2.08	352.33	12.19	1.95	329.95	11.41	1.59	269.40	9.32
9.45	20480	2.36	389.68	13.13	2.19	361.26	12.17	2.11	347.83	11.72	1.87	308.51	10.39
10.53	20480	2.54	402.3	13.24	2.26	371.5	12.16	2.18	365.7	11.89	2.14	336.12	11.2

FOR DEVELOPMENT LENGTH 120 MM

Frequency (Hz)	Time (ms)	Channel Configuration											
		Channel 1			Channel 2			Channel 3			Channel 4		
		A	V	D	A	V	D	A	V	D	A	V	D
0.837	20480	0.18	301.39	104.05	0.17	271.60	94.52	0.17	292.59	93.70	0.12	183.88	53.54
1.92	20480	0.22	209.06	15.96	0.19	194.77	29.24	0.23	201.26	32.38	0.16	158.50	21.34
2.51	20480	0.26	211.21	16.44	0.25	182.42	14.33	0.27	176.08	15.79	0.22	153.84	11.70
3.35	20480	0.40	221.91	14.30	0.39	193.12	13.46	0.39	200.81	14.20	0.34	187.18	11.95
4.18	20480	0.47	196.91	9.08	0.46	205.75	8.61	0.49	192.79	10.15	0.45	177.07	9.71
5.02	20480	0.56	189.81	7.66	0.50	184.93	6.73	0.55	189.44	8.64	0.63	234.12	10.19
5.86	20480	0.92	246.7	8.68	0.78	235.86	10.09	0.80	230.22	7.33	0.75	218.07	9.67
6.15	20480	1.22	271.24	9.86	0.99	149.14	8.82	1.06	265.24	9.58	0.96	231.78	8.47
7.53	20480	1.27	277.23	7.80	1.15	257.58	8.98	1.19	260.34	9.30	1.09	234.47	9.43
8.37	20480	1.77	338.26	10.41	1.68	322.31	8.81	1.73	331.27	8.15	1.56	298.70	9.92
9.3	20480	2.08	358.74	10.06	1.95	351.15	8.45	2.01	367.14	10.80	1.81	316.77	8.61
9.75	20480	3.04	522.77	13.44	2.97	500.31	14.52	2.93	513.11	12.27	3.04	521.40	12.89
11.75	20480	4.16	632.54	12.12	3.85	622.52	14.2	4.02	612.12	15.30	5.82	701.16	14.32

OBSERVATION TABLE

Condition	Development length	Frequency in Hz	Avg.Displacement in mm
Before Retrofitting	LD 60 mm	10.53	12.12
	LD 120 mm	10.53	18.48
After Retrofitting	LD 60 mm	11.83	9.37
	LD 120 mm	11.75	13.98

RESULTS COMPARISON

Considerable strength was attained by the retrofitted model with the use of sisal fiber wrapping and bonding with epoxy with the parent surface. The formation of cracks at the joints were not visible due to the fibers. Due to seismic motion the sisal fibres seemed loosened but were not displaced

CONCLUSION

- There is considerable rise in the strength of the Retrofitted model that was tested for earthquake motions on horizontal shake table.
- Natural fibres can be found useful in the field of retrofitting or restrengthening as natural fibres prove economical than the regular carbon fibres or glass fibres which are costlier.
- Increase in development length does not provide extra resistance to the shear failure of the beam column junction.
- Smaller cross-section of the model creates congestion of steels and chances of developing honeycombing are high.
- Design of shear reinforcement at the joints is very essential in order to make joints stronger to resist the seismic actions.
- While selecting repair techniques due consideration has to be made about hindrance to normal uses of building.
- The use of Sisal fibre should be promoted as about 3,00,000 tonnes of sisal is produced world wide.
- Retrofitting is still not standardized and is still in development phase since, it is a new technology. Retrofitting saves the

- cost of demolition and reconstruction.
- Under this subject we got an opportunity to deal with actual retrofitting process of a structural member and understanding the concept of retrofitting.

REFERENCES

- International Journal of Civil & Structural Engineering.
- Anand Rambhau Mitkal, Prof. N. C. Dubey,[2018], G H Raison College, Pune, "A survey on Retrofitting
- Repairing of Heavily cracked Unbonded post tensioned structural member"(IJIRSET)
- Mohamed I. S. Elmasry, et al ; Egypt,[2018] "An analytical study of Beam Column joints behaviour under earthquakes".(Springer International Publishing)
- Aditya kumar Tiwari, et al;[2015], " A review paper on strenhthening of beam column joint upgraded with CFRP sheets".(IOSR-JMCE)
- Al-Saidy A.H., A.S. Al-Harthy, K.S. Al-Jabri, M. Abdul-Halim,N.M. Al-Shidi (2010), Structural performance of corroded RC beams repaired with CFRP sheets, Composite Structures, 92, pp 1931–1938.
- Bentayeb F., K. Ait Tahar a, A. Chateaneuf (2008), New technique for reinforcement of concrete columns confined by embedded composite grid, Construction and Building Materials, 22, pp 1624–1633.
- Camille A. Issa, Pauls Debs(2007), Experimental study of epoxy repairing of cracks in concrete, Construction and Building Materials, 21, pp 157–163.

Author

1. Prof. Akshay Rahane
Asst. Prof.
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet
2. Omkar shelar
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet
3. Varun Salgaonkar
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet
4. Sanket Oswal
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet
5. Mohanesh Tamboli
BEStudent
Department of Civil Engineering
Pimpri-Chinchwad College of Engineering and
Research, Ravet

COMPTER ENGINEERING

Efficient and Secure Group Data Sharing Model Using Cloud Computing

Prof.Amol Dumbare¹, Mohit Kabadi², Gitesh Ghorpade³, Munot Sarode⁴, Sameer Sagar⁵

¹Department of Computer Engineering, Pimpri Chinchwad College Of Engineering and Research, Pune 412101 India

²Department of Computer Engineering, Pimpri Chinchwad College Of Engineering and Research, Pune 412101 India

³Department of Computer Engineering, Pimpri Chinchwad College Of Engineering and Research, Pune 412101 India

⁴Department of Computer Engineering, Pimpri Chinchwad College Of Engineering and Research, Pune 412101 India

⁵Department of Computer Engineering, Pimpri Chinchwad College Of Engineering and Research, Pune 412101 India

ABSTRACT Cloud computing is alleged to be the service homeward-bound computing technology, that ar reasonable and versatile over the web. In past few years the cloud has become more experienced and provided several services, one in all the first service is knowledge sharing in cluster, wherever the information are often simply shared from one member to a different. However, whereas sharing the information security is one in all the first concern. In past many methodology has been planned. However, these strategies lacked from the feasibility. Hence, during this paper we've propose methodology relies on the choice theme. Here General cluster secret's generated and what is more General Key agreement protocol is redistributed primarily based model wherever the information are controlled by the owner inside constant cluster. Moreover, the planned methodology is evaluated by analyzing the comparative analysis supported the assorted range of parameter. Result Analysis counsel that our methodology merely outperforms the present one.

INDEX TERMS Cloud Computing, security, Group data sharing.

I. INTRODUCTION

In recent times as the concept of cloud computing rises, cloud storage is said to be the one of the hotspots of the storage of information

It basically refers to a model, that provides the data storage. Here, CSP (cloud service provider) is directly responsible for making data available as well as accessible according to the requirement of user.

Storage capacity is either bought or leased from provider to store the data by the individual or organization. This service can easily be accessed through the application, which utilizes the API such as cloud storage gateway

Moreover, in the past few years, it has been observed that the demand of cloud storage has been increased phenomenal in accordance with the use of personal as well as business purpose, since it is highly based on the virtualized infrastructure and much more flexible in terms of multi-tenancy, scalability and availability. 07

Since the cloud, computing provides USA the feature of pay as you go service, the organization needs to pay just for the service they use, and cloud service provides precisely the same. Business exploitation the caesium will truly scale back up to seventy p.c of energy consumption. CSP is completely liable for the upkeep of the info and still because the alternative tasks like shopping for the extra storage capability. Since the backup of the info area unit

settled in many places within the globe, it can even be applicable because the proof backup of natural disaster. Meanwhile, cloud storage is one service, that isn't mentioned the physical device, however it's the aggregation of the many server and storage for its users.

II. LITERATURE SURVEY

1. Efficient and Secure Group Data Sharing Model based on Selection scheme in Cloud environment

Description: Cloud computing is aforementioned to be the service oriented computing technology, that area unit reasonable and flexible over the web. In past few years the cloud has become additional matured and provided several services, one of the primary service is knowledge sharing in cluster, wherever the data can be simply shared from one member to another. However, whereas sharing the knowledge security is one of the primary concern. In past many methodology has been projected. However, these ways lacked from the practicableness. Hence in this paper we've propose methodology relies on the selection theme. Here General cluster key's generated and moreover General Key agreement protocol is decentralized based model wherever the knowledge area unit controlled by the owner within identical cluster. Moreover, the projected methodology is evaluated by analyzing the comparative analysis based mostly on the numerous range of parameter. Result Analysis suggest that our methodology merely outperforms the existing one.

Keywords: cloud Computing, security, cluster knowledge sharing

2.Panda: Public Auditing for Shared Data with Efficient User Revocation in the Cloud

Description: With info storage and sharing services among the cloud, users will just modify and share info as a bunch. to substantiate shared data integrity are verified publically, users among the cluster got to be compelled to cypher signatures on all the blocks in shared info. fully fully totally different blocks in shared info ar sometimes signed by {different|totally fully fully totally different|completely different} users as a result of info modifications performed by different users. For security reasons, once a user is revoked from the cluster, the blocks that were antecedently signed by this revoked user got to be re-signed by associate degree existing user. The straightforward methodology, that enables associate degree existing user to transfer the corresponding a district of shared info and re-sign it throughout user revocation, is inefficient as a result of the massive size of shared info among the cloud. throughout this paper, we've a bent to propose a completely unique public auditing mechanism for the integrity of shared info with economical user revocation in mind. By utilizing the thought of proxy re-signatures, we've a bent to permit the cloud to re-sign blocks on behalf of existing users throughout user revocation, therefore as that existing users haven't have to be compelled to be compelled to transfer and re-sign blocks by

themselves. additionally, a public voucher is usually able to audit the integrity of shared info whereas not retrieving the complete info from the cloud, although some a district of shared info has been re-signed by the cloud. Moreover, our mechanism is in associate degree passing position to support batch auditing by verifying multiple auditing tasks at a similar time.

3.NPP: A New Privacy-Aware Public Auditing Scheme for Cloud DataSharing with Group Users

Description: Today, cloud storage becomes one of thecritical services, as a result of users will simply modify and share information with others in cloud. However, the integrity of sharedcloud information is vulnerable to inevitable hardware faults, soft-ware failures or human errors. To guarantee the integrity ofthe shared information, some schemes are designed to allowpublic verifiers (i.e., third party auditors) to expeditiously auditdata integrity while not retrieving the entire users' information fromcloud. sadly, public auditing on the integrity ofshared information could reveal information owners' sensitive informationto the third party auditor. In this paper, we tend to propose afresh privacy-aware public auditing mechanism for sharedcloud information by constructing a homomorphic verifiable groupsignature. not like the prevailing solutions, our theme requiresat least t cluster managers to recover a trace key hand and glove,which eliminates the abuse of single-authority power andprovides nonframeability. Moreover, our theme ensures thatgroup

users will trace information changes through selected binarytree; and will recover the latest correct information block when the current information block is broken. In addition, the formal security analysis and experimental results indicate that our scheme is incontrovertibly secure and economical.

4.Enabling Efficient and Protected Sharing of Data in Cloud Computing

Description: Cloud storage plays a very important role significantly in applications like medical files transfer and inexperienced computing where in-house data storage systems square measure established. In case of group-shared data, the data face every cloud-specific and conventional executive threats. Secure data sharing among a gaggle that counters executive threats of legitimate notwithstanding malicious users is an important analysis issue in cloud. Protected Sharing of knowledge in cloud got to maintain: data confidentiality and integrity; access control; data sharing (forwarding) whereas not victimization computeintensive re-encryption; executive threat security; and forward and backward access management. The PrSDC methodology encrypts a file with one coding key. a pair of wholly completely different key shares for each of the users square measure generated, with the user only getting one share. The possession of 1 share of a key permits the PrSDC methodology to counter the executive threats and prevents stealing of medical files or simply just in case of inexperienced computing on-line credit payment details. the alternative key share is keep by a sure third party, that's termed the scientific discipline server.

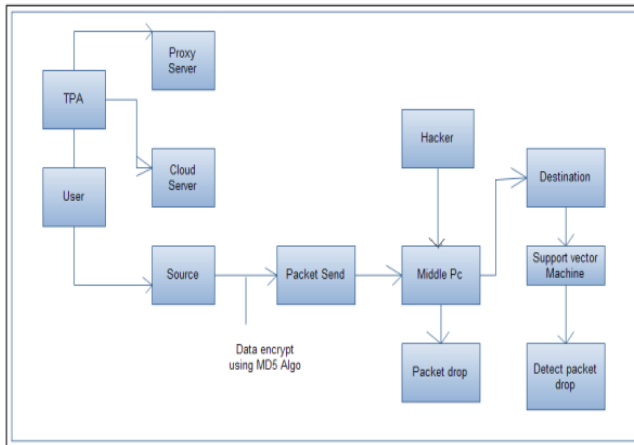
III. EXISTING SYSTEM

In Existing system data is share through the social media, Email, and centralized system but there is no security provided by the system who can recover the data changed by the hacker. In existing system use end to end communication of computers which does not have any security system for data transaction.

IV. PROPOSED SYSTEM

Since the structure and overall arrangement of optical access networks is complicated and meantime, the quantity of operational fiber is big, failures of optical fibre links occur a lot of oftentimes, and thus, the price and operation, administration and maintenance (OAM) stays at a high level. The period on-line fiber-fault detection and site within the optical access network with ancient optical domain reflector (OTDR) is complicated and dear, and has low resolution of the fault location.

- We transfer the data between manager and the employees who are shared data between two system. When data is upload on system then we are stored in cloud server as well as proxy server for security purpose.



•If hacker change data between transaction then we are traces them and recover data using support vector machine (machine learning algorithm).

Architecture Diagram

•So we are securely share and transferred data between multiple users on cloud computing.

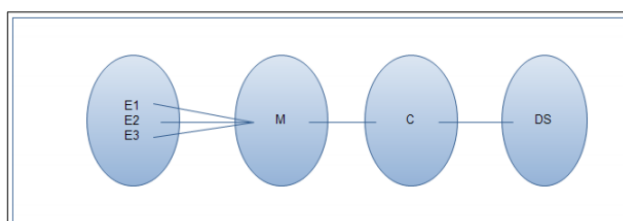
. Advantages of Proposed System

- 1) Secure data transaction
- 2) Data in encrypted through transaction
- 3) Data store in cloud server
- 4) Effective and efficient system for data transaction

V. MATH

Input: Employee and manager are share their data on cloud server

Output: Data is transferred securely between employee and manager.



System Description:

Where,

E1= Employee 1, E2= Employee 2, E3=Employee 3, M=Manager , C=Cloud Server, DS=data sharing platform

Objects Involved: Employee, Cloud Server, Manager, Functional relations, Web Security, Data Security, Machine learning, Cloud Computing.

Functions: Functions implemented to get the Manager get all details of Employee data on cloud server.

Success Conditions: Successfully algorithm implementation and proper input.

Failure Conditions: 1. Huge data can lead to more time consumption to get the information. 2. Hardware 3. Software failure.

The space complexity depends on Presentation and visualization of discovered patterns. More the storage of data more is the space complexity

Above mathematical model is NP-Hard.

VI. CONCLUSION

Group data sharing in the cloud plays an eminent role when the data has to be distributed among the others. Moreover, security is one of the big concern when it comes to preserving the privacy. In this research work, we have developed a methodology based on the selection scheme, which helps in securing the data. We are provide cloud base encryption system for database for security purpose. Data is encrypted during the transaction which never decrypt.

REFERENCES

- [1] Giuseppe Aceto, Valerio Persico, Antonio Pescape, "The role of Information and Communication Technologies in Healthcare: Taxonomies, Perspectives, and Challenges"
- [2] Rui Zhang and Ling Liu," Security Models and Requirements for Healthcare Application Clouds".
- [3] ANSI, ISO/TS 18308 "Health Informatics-Requirements for an Electronic Health Record Architecture", ISO 2003.
- [4] R. Bakker, B. Barber, R. Tervo-Pellikka, A.Treacher, (eds.), "Communicating Health Information in an Insecure World" in: Proceedings of the Helsinki Working Conference. 43:1, 1995. 2.
- [5] B. Barber, D. Garwood, P. Skerman, In: Security in Hospital Information Systems, Security and data protection programme presented at the IMIA.

Emotionally Intelligent Chatbot

Shubham Kokane¹, Shreeyash Khalate², Shreya Newale³, Sakshi Dubewar⁴, Jameer Kotwal⁵

^{1,2,3,4}Pimpri Chichwad College Of Engineering And Research Ravet, Pune, Maharashtra

⁵Asst. Prof, Pimpri Chichwad College Of Engineering And Research Ravet, Pune, Maharashtra

ABSTRACT An emotionally intelligent chatbot system aims to make an effective conversation between humans and machines in as natural and interactive manner as possible. The chatbot agent has pre-embedded knowledge base to identify the sentences, intents, entities and context of the input query to be precise for making a valid, predictable decision itself as a self-generated response to answer the query. The present technical project consists of developing an intelligent system for college enquiry purposes using a web-based chatbot agent, through machine learning, query processing and sentiment and emotion classification system to analyze the sentiment of the visitor towards the college. Emotionally Intelligent College Enquiry Chatbot System is nothing but chatbot to understand the user queries and respond to it during a conversation. Chatbot can actively help human to involve in a digital automated conversation with a machine or a system with effective. In the following proposed system, feature extraction and data cleaning techniques are applied on the dataset and classifiers such as multinomial naive bayes, logistic regression and k nearest neighbors are used to train the model. The classifier with highest accuracy is further used for emotion classification of users

INDEX TERMS Emotion Classification, Sentiment Analysis, Multinomial Naive Bayes, NLTK, TextBlob

I. INTRODUCTION

Textual conversational agents or chatbots development gather tremendous traction from both academic and industries in recent years. Nowadays, chatbots are widely used as an agent to communicate with a human in some services such as booking assistant, customer service and also a personal partner. Emotion Recognition is a buzz research topic in the field of Human Computer Interaction. It has potentially wide applications, such as the interface with robots, banking, call centers, car board systems, computer games etc. Many chatbot systems are created for various purposes but very few of them are designed to know the feedback of the system and the organization indirectly from the user. That is why the Emotionally Intelligent College Enquiry Chatbot System came into picture in our research work.

The proposed idea consists of developing an intelligent chatbot system for college enquiry purposes using a web-based chatbot agent platform DialogFlow, generating a valid response to the user, and retrieving the conversation history from google logfiles for sentiment and emotion classification of the user to determine his/her interests in the college towards taking the admission. Human sentiment can be measured in scores between -1 and 1 which is also called the

polarity of the text. For detailed emotion recognition apart from Positive, Negative or Neutral sentiments, we have used the twitter dataset which contains tweets with corresponding emotions.

The dataset has 40,000 rows and three classifiers as Multinomial Naive Bayes, Logistic Regression and K-Nearest Neighbors are trained. The models are evaluated on their accuracy, f1 score and confusion matrices and the most accurate one is selected. Furthermore, an emotion classification is carried out on the conversation history of users in general and each query will be classified into seven different emotional classes such as neutral, happy, excited, satisfied, not satisfied, boredom and disgust and in the results dataset each query is attached with a polarity, analyzed sentiment and corresponding emotion for more details of the affective states of the user.

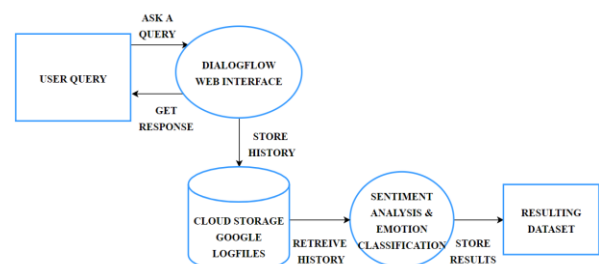


Figure 1. Basis of Chatbot System

II. LITERATURE REVIEW

Ms. Ch. Lavanya Susanna, R. Pratyusha, P. Swathi, P. Rishi Krishna, V. Sai Pradeep,” COLLEGE ENQUIRY CHATBOT”, International Research Journal of Engineering and Technology (IRJET), on 2020

This paper proposes to develop an algorithm which will be wont to identify answers associated with user submitted questions. To develop a database were all the related data are going to be stored and to develop an internet interface.

A. Harimi^{1*}, A. Shahzadi¹, A.R. Ahmadyfard and Kh. Yaghmaie Department of Electrical Engineering and Robotics, Shahrood University of technology, Iran, 09 February 2013

This paper proposes to evaluate the proposed SPs and HEs for the recognition of human emotions from speech. Aim of a speech emotion recognition system is to recognize emotions for real work data, evaluating the proposed system under different conditions such as the presence of noise and chatter is useful.

Sumit Wailthare, Tushar Gaikwad, Ketkee Khadse, Pooja Dubey” Artificial Intelligence Based Chat-Bot”, Dept. Of Computer Science Technology, Nagpur Institute of Technology, Nagpur, Maharashtra, India 03 (IRJET), Mar-2018

This paper has to be providing answers to the query of the user very effectively. The objective of the project is to develop an algorithm that will be used to identify answers related to user submitted questions. The need is to develop a database where all the related data will be stored and to develop a web interface.

III. METHODOLOGY

The machine-based emotion classification of the user has gained a lot of attention in recent times especially by the social media companies for businesses such as ad recommendations, etc. The modules used in this methodology are chatbot design, conversation history retrieval, data pre-processing, feature engineering, sentiment analysis, emotion classification and exploratory data analysis. The proposed methodology is shown in Figure. 2

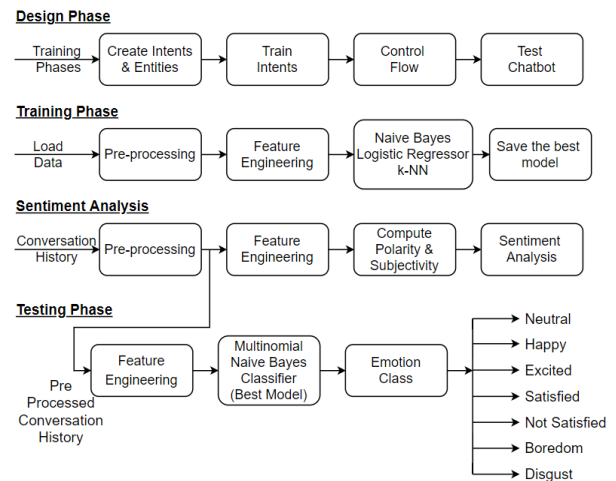


Figure 2. System Architecture

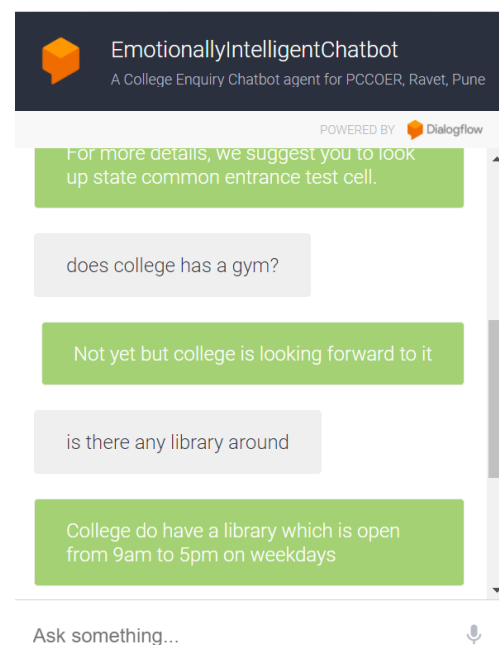


Figure 3. Chatbot Interface

III.A Data Pre-Processing

Data preprocessing is a technique in which we transform the raw data in a useful, clean and efficient format for further training the models. In our module, we transform the raw conversation history downloaded from google log files into clean data. Initially it contained 366 rows and 171 columns and only 2 were extracted 'textPayload' and 'timestamp' for our purposes. All the rows containing null values in the 'textPayload' column are dropped and the data frame is ready for the sentiment analysis part. On the other hand, we loaded a preprocessed twitter emotion dataset for the training phase (for training model for emotion classification) as shown in Figure 2 which contained 40000 rows and 5 columns from which 2 columns

‘emotion’ and ‘content’ are retrieved for further purpose. The tweets are cleaned using regular expressions for removing mentions, hashtags, retweets, hyperlinks and punctuation marks. Here lemmatization is introduced. Lemmatization is a process of converting all the words in the ‘content’ column to their base form for increasing the accuracy of the model. An NLTK toolkit is used for removing stopwords from the twitter emotion data and lemmatization is applied to the ‘content’ column.

III.B Feature Engineering

Feature engineering is a process of transforming the features in the dataset into formats that algorithms can understand that better represent the input values to the predictive models. Here we use the Countvectorizer from scikit-learn for feature extraction. We transform the twitter data into vectors based on the frequency count of each word in the text in the ‘content’ column. CountVectorizer creates a matrix in which each unique word is represented by a column of the matrix, and each tweet sample from the ‘content’ column is a row in the matrix. The conversation history is split into two data frames for query requests and chatbot responses for further analysis.

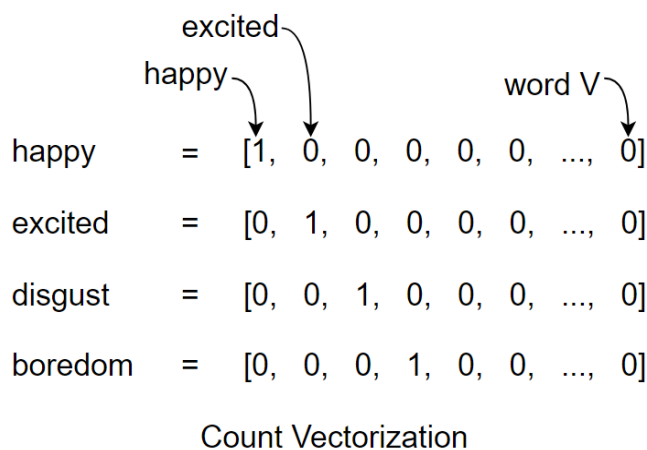


Figure 4. Count Vectorization Example

III.C Sentiment Analysis

Sentiment analysis is a process of analyzing the emotional sentiment in the text. Here, we compute the polarity and subjectivity of the text using TextBlob and visualize them with scatter plots and histograms (as shown in Figure. 5 and Figure. 6). The sentiments are classified in three classes as Positive, Negative and Neutral sentiment. These are computed based on the polarity of the text which defines the orientation of the sentiment. The polarity lies in the range of [-1,1]. Polarity score below 0 is considered as negative sentiment,

polarity above 0 reflects the positive sentiment and polarity equal to 0 shows neutral sentiment.

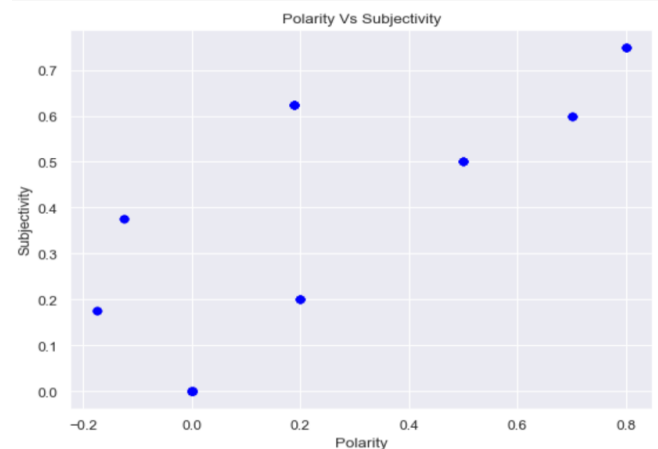


Figure 5. Polarity vs Subjectivity

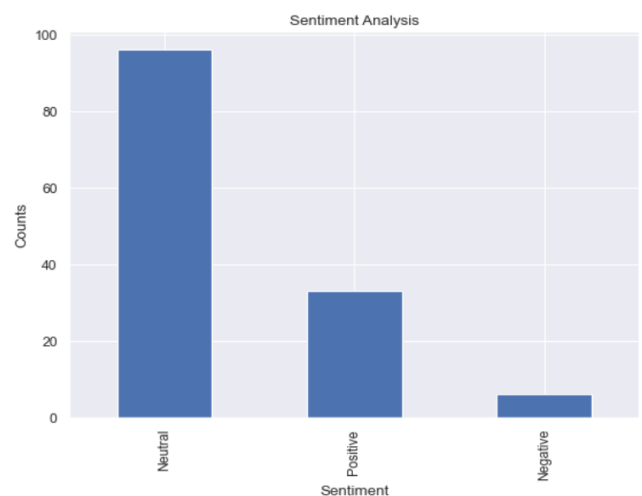


Figure 6. Sentiment Analysis

III.D Multinomial Naïve Bayes Classification

Multinomial Naive Bayes is a probabilistic learning method based on Bayes theorem which predicts the tag of a text (in our case ‘content’ column data) by computing the probability of each tag for a given sample and then gives the tag with highest probability as output. Bayes theorem calculates the probability of a word occurring in the text based on the prior knowledge of conditions related to occurrence of that word in the training dataset. It is based on the following equation.

$$P(A|B) = \frac{P(B|A) \times P(A)}{P(B)}$$

Where we are calculating the probability of class A when predictor B is already provided.

$P(B)$ = Probability of class B

$P(A)$ = Probability of class A

$P(B|A)$ = Occurrence of predictor B given class A probability

The vectors formed from count vectorizer and the target variable are trained with Multinomial Naive Bayes classifier along with Logistic Regressor and k-NN classifier.

We have implemented Naive Bayes with the following steps:

- 1) Take the input from the count vectorizer.
- 2) Take the input from the target column 'emotion'.
- 3) Train the model.
- 4) Comparison of the features from test data to training data is done in following steps for classifying the emotion in the test data:
 1. Naive Bayes creates a frequency table of training data and lists count of all the words against corresponding emotion.
 2. It finds probability of each word for each emotion and creates a likelihood table.
 3. It assumes that the effect of predictor (A) on a given class (B) is independent of the values of other predictors.
 4. It computes the posterior probability for each emotion using the Naive Bayes theorem.
 5. The emotion with the highest probability will be the outcome of that word in the data.
 6. Classified emotion of the string is returned.
- 5) Repeat steps from 1 to 4 until all the training set is computed.

IV. RESULTS AND DISCUSSION

We have used the twitter emotion dataset from Kaggle to evaluate the performance of our emotion classification system model. The dataset (after cleaning) is shown in the Figure. 7 below.

	emotion	content
0	neutral	know listenin bad habit earlier started freaki...
1	not satisfied	layin n bed headache ughh waitin call
2	not satisfied	funeral ceremony gloomy friday
3	excited	want hang friend soon
4	neutral	want trade someone houston ticket one
...	...	...
39995	neutral	
39996	satisfied	happy mother day love
39997	satisfied	happy mother day mommy woman man long momma so...
39998	happy	wassup beautiful follow peep new hit single ww...
39999	satisfied	bullet train tokyo gf visiting japan since thu...

40000 rows × 2 columns

Figure 7. Cleaned Twitter Emotion Dataset

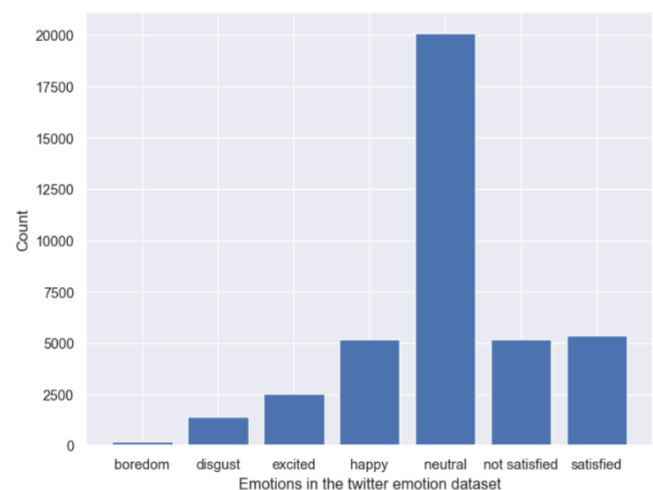


Figure 8. Emotions in the Twitter Dataset

The results obtained from our proposed system are explained below. The overall performance of the system is evaluated by Accuracy and F1 score. Accuracy is calculated by:

$$\text{Accuracy} = \frac{\text{Number of emotions correctly recognized}}{\text{Total number of emotions}} \times 100$$

The accuracy of the proposed system is then calculated by using the total number of correctly classified emotions divided by the total number of emotions. The accuracy for logistic regressor is 71.5%, and of k-NN is 59%, and maximum accuracy came out to be of naive bayes i.e. 73.8%. The confusion matrix is evaluated for the naive bayes model and heatmap is generated for that confusion matrix displayed by percentages as shown below in Figure. 9

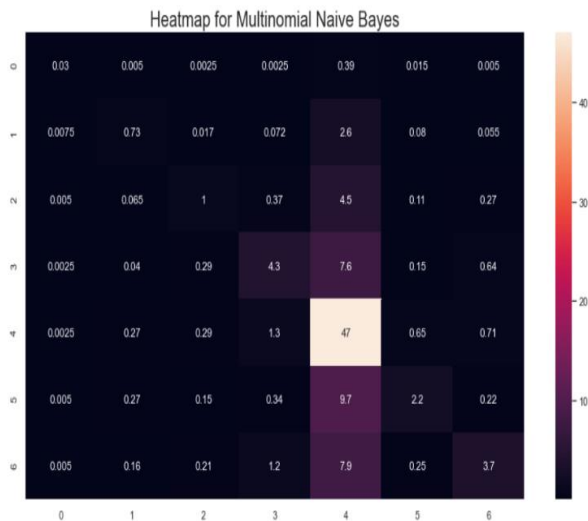


Figure 9. Confusion Matrix of the Proposed System for Multinomial Naive Bayes Classifier

The F1 score of logistic regressor is obtained as 59.7%, that of k-NN is observed as 35.08% and of multinomial naive bayes is 69.8%. F1 score is represented as:

$$F1 = \frac{2}{\frac{1}{recall} + \frac{1}{precision}} = 2 \cdot \frac{precision \cdot recall}{recall + precision}$$

The final outcome of all the emotions recognized/classified by the Multinomial Naive Bayes are shown in Figure. 10 below.

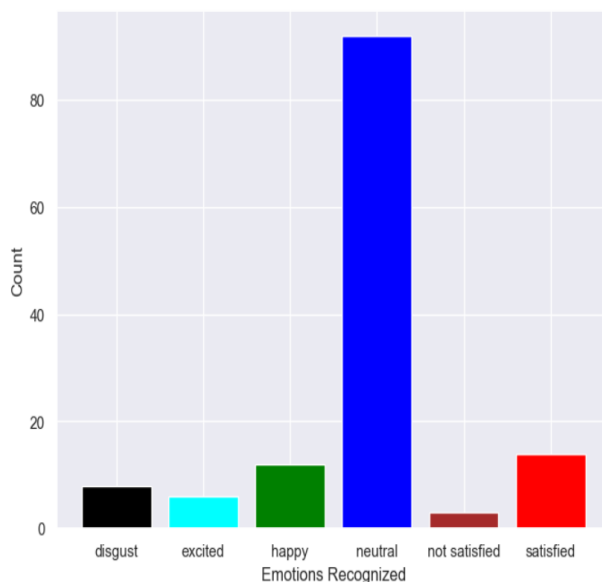


Figure 10. Final Emotions Recognized by Naive Bayes Classifier from the Conversation History of the Chatbot

V. CONCLUSION AND FUTURE SCOPE

It is essential to understand the sentiment and emotion of the user for evaluating his/her interest in the college and estimating user's future decisions about taking the admission in the college. In this project, we proposed a system where the user can ask their queries in textual or voice-based format to our chatbot system and appropriate response is generated by the chatbot. The proposed methodology classifies emotions of users based on their input queries and also computes the overall sentiment. In the proposed work, data pre-processing is carried out using techniques such as count vectorization and lemmatization. The overall accuracy achieved by the system is 73.8%. In future the accuracy of the proposed system can be increased by combination of feature extraction techniques such as TF-IDF and Count vectorization.

ACKNOWLEDGMENT

I would like to take this opportunity to thank my internal guide **Prof. Jameer Kotwal** for giving me all the help and guidance I needed. I am grateful to them for their kind support. Their valuable suggestions were very helpful. I am also grateful to **Prof. Archana Chaugule**, Head Of Computer Engineering Department, Pimpri Chinchwad College Of Engineering And Research for her indispensable support, suggestions. In the end our special thanks to all the **staff members** for providing various resources such as a laboratory with all the needed software platforms, continuous Internet connections for our project.

REFERENCES

- [1] Ms.Ch.Lavanya Susanna, R.Pratyusha, P.Swathi, P.Rishi Krishna, V.Sai Pradeep," COLLEGE ENQUIRY CHATBOT", International Research Journal of Engineering and Technology (IRJET), on 2020.
- [2] Gustavo Assuncao, Paulo Menezes, Fernando Perdigao, "Speaker Awareness for Speech Emotion, Special Focus Paper—Speaker Awareness for Speech Emotion Recognition, 2020
- [3] Intelligent ChatBot System using Artificial Intelligence and Deep Learning, International Research Journal of Engineering and Technology (IRJET) on 2020
- [4] Chat-Bot", International Research Journal of Engineering and Technology (IRJET), on 2018
- [5] Harimi1*, A. Shahzadi1, A.R. Ahmadyfard and Kh.Yaghmaie Department of Electrical Engineering

and Robotics, Shahrood University of technology,
Iran 09 February 2013

shreekhalate555@gmail.com

SHREYA NEWALE from Pimpri Chinchwad College Of
Engineering and Research,
Department of Computer Engg, Pune-412101, India
shreyanewale11@gmail.com

SAKSHI DUBEWAR from Pimpri Chinchwad College Of
Engineering and Research,
Department of Computer Engg, Pune-412101, India
sakshidubewar@gmail.com

JAMEER KOTWAL from Pimpri Chinchwad College Of
Engineering and Research,
Asst. Prof, Department of Computer Engg, Pune-412101, India
Jameer.kotwal@pccoer.in

AUTHORS

SHUBHAM KOKANE from Pimpri Chinchwad College Of
Engineering and Research,
Department of Computer Engg, Pune-412101, India
shubhamkkn7@gmail.com

SHREEYASH KHALATE from Pimpri Chinchwad College Of
Engineering and Research,
Department of Computer Engg, Pune-412101, India

Analysis of Portfolio Rebalancing and Technical Indicators

Samruddhi Bhosle¹, Pranav Vibhandik², Neha Kahane³, Snehal Patil⁴, Amol Dumbare⁵

^{1, 2, 3, 4} Student at Pimpri Chinchwad College of Engineering and Research, Pune

⁵ Prof. at Pimpri Chinchwad College of Engineering and Research, Pune

ABSTRACT Stock Market is a scenario where investments can yield high rewards. However, each investment in any kind of financial market comes with a significant amount of risk for a period of time, a lot of interest has been diverted towards reducing risk associated in the investment and maintaining the risk to reward ratio as high as possible. In this article, we represent strategies and factors for rebalancing portfolio's that can accommodate changes as per the changes in the financial market environment to reduce the risk. Rebalancing is the process of buying and selling portions of your portfolio in order to set the weight of each asset class back to its original state. It is a weighting method of an asset that includes purchasing and selling assets in a portfolio regularly in a specific period of time to preserve an initial or desired amount of asset allocation or risk.

INDEX TERMS CAGR, Indicators, Investment, Maximum Drawdown, Portfolio, Rebalancing, Risk to Reward, Sharpe ratio, Stock Market.

I. INTRODUCTION

Each layer of the portfolio addresses a particular investment goal, independent of the other investment goals. Investors target low-risk investments like cash and money market funds to preserve wealth, they target bonds and dividend-paying stocks to provide income, and they target risky investments like emerging market stocks and IPOs to have a chance to get rich. Opportunities to reduce risk by combining assets with low correlations may be neglected and inefficient investing may result from offsetting positions in the various layers.

Portfolio rebalancing is a powerful risk-control strategy. Over time, as a portfolio's different investments produce different returns, the portfolio drifts from its target asset allocation, acquiring risk and return characteristics that may be inconsistent with an investor's goals and preferences. A rebalancing strategy addresses this risk by formalizing guidelines about how frequently the portfolio should be monitored, how far an asset allocation can deviate from its target and whether periodic rebalancing should restore a portfolio to its target or to some intermediate allocation.

This paper establishes a framework for developing a portfolio-rebalancing strategy. We start by exploring various rebalancing decisions and a portfolio's risk and return characteristics. Investors select a rebalancing strategy that balances their willingness to assume risk against returns net of the cost of rebalancing. We also explore a second important determinant of the appropriate rebalancing strategy the characteristics of the portfolio's assets. For example, high correlation among the returns of a portfolio's various assets reduces the risk that the portfolio will drift from its target allocation, thus limiting the need to rebalance.

II. PORTFOLIO REBALANCING AND IMPORTANCE

Portfolio management (PM), to be brief, the management of basket of stocks and (or) bonds, is the art of selecting the right investment policy for the investor in terms of maximum return at a given risk level. Financial theory suggests a wide range of motives for portfolio rebalancing: one of the widely reported rationales is the fact that investor is passively exposed to greater market risk when realized return on financial assets result in mechanical variations in portfolio allocation. This risk is managed by actively rebalancing his/her portfolio when asset returns change over time. The periodical resetting of weights of asset classes - stocks and bonds - in the portfolio is one of the controversial aspects of portfolio management. Rebalancing of portfolio often involves taking profit from outperforming assets (so as to avoid overweighting) and buying underperforming assets. Portfolio rebalancing helps investors achieve their investment goals and avoid the common investment mistakes. There are two major benefits of portfolio rebalancing the first benefit is risk control which maintains the asset allocation as its original target. The second benefit is the potential return which can be achieved by buy-low/sell-high opportunities.

Portfolio rebalancing is like a tune-up for your car: it allows individuals to keep their risk level in check and minimize risk. Thus, rebalancing is the process of buying and selling portions of your portfolio in order to set the weight of each asset class back to its original state. In addition, if an investor's investment strategy or tolerance for risk has changed, he or she can use rebalancing to readjust the weightings of each security or asset class in the portfolio to fulfill a newly devised asset allocation.

III. MATHEMATICAL RATIO'S AND KPI'S

In this section, some risk management ratios and KPI's (Key Performance Indicators) will be discussed which will be used for calculations of portfolio rebalancing. For rebalancing your portfolio, the goal is to align your portfolio with desired asset allocation. As we invest over time its desired that our asset allocation will change. As our goal shifts our time horizon may change and so as our risk tolerance. Hence by using this ratios and KPI's we can calculate our risk for a specific asset.

A. CAGR (Compound Annual Growth Rate)

Compound annual growth rate (CAGR) is the rate of return that would be required for an investment to grow from its beginning balance to its ending balance, assuming the profits were reinvested at the end of each year of the investment's lifespan.

$$CAGR = (EV / BV)^{1/n} - 1 \quad (1)$$

Where:

EV= Ending Value

BV= Beginning Value

n= Number of years

CAGR can be used in portfolio rebalancing, as it is the most accurate way to calculate and determine returns of anything that can rise or fall in a value of time. We can use CARG of two alternative assets in order to check which stock performed well against the other in the markets.

This formula is continuous compounding which means that all the profits are being reinvested continuously. CAGR provides ease of comparison between different trading strategies. It does not reflect investment risk and therefore should always be used in conjunction with a volatility measure.

B. ANNUALIZED VOLATILITY (AV)

Volatility of a strategy is represented by a standard deviation of the returns. This captures the variability of the returns from the mean return. Measuring the volatility of trading strategy we look at the daily return or monthly returns (or whichever time frame you prefer working with), then we try to see how variable were the returns compared to mean return. If your CAGR is high and volatility is also high that means your returns is compensated by the risk you are taking.(higher the volatility riskier the security). If you are working with daily data, to calculate volatility you will calculate the daily returns and you will find sd (standard deviation) of those returns, it will give you volatility. Annualization is achieved by multiplying the volatility with square root of the annualization factor.

1. To annualize daily volatility multiply by sqrt (252) – as there are 252 trading days in a year.
2. To annualize weekly volatility multiply by sqrt (52) – as there are 52 trading weeks in a year.
3. To annualize monthly volatility multiply by sqrt (12) – as there are 12 trading months in a year.
4. It does not capture the tail risk.

Annualized Volatility is represented as:

$$\text{Annualized Volatility Formula} = \sqrt{252} * \sqrt{\text{Variance}} \quad (2)$$

Where:

$$\text{Variance} = \sum (P_{av} - P_i)^2 / n$$

P_{av} = Mean Price

P_i = Daily Stock Price on i^{th} day

Hence the annualize volatility can also be written as:

$$\text{Annualized volatility} = \sqrt{252} * \sqrt{(\sum (P_{av} - P_i)^2 / n)} \quad (3)$$

C. SHARPE / SORTINO RATIO

Sharpe ratio is the measure of risk-adjusted return of a financial portfolio. A portfolio with a higher Sharpe ratio is considered superior relative to its peers. The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Sharpe ratio is a measure of excess portfolio return over the risk-free rate relative to its standard deviation.

It gives information about both risk and return simultaneously. Sharpe has become industrial standard for measuring the performance or measuring the suitability of particular fund or strategy.

$$\text{Sharpe Ratio} = (R_p - R_f) / \text{Av} \quad (4)$$

Where:

R_p = Return of portfolio

R_f = Risk free rate

Av = Standard deviation of portfolio's excess return

A good sharpe ratio is considered as the below following table:

Table 1 Sharpe Ratio Parameters

Sharpe Ratio	Risk Rate	Verdict
Less than 1.00	Very Low	Poor
1.00 - 1.99	High	Good
2.00 – 2.99	High	Great
3.00 or Above	High	Excellent

D. MAXIMUM DRAWDOWN

A maximum drawdown (MDD) is the maximum observed loss from a peak to a trough of a portfolio, before a new peak is attained. Maximum drawdown is an indicator of

downside risk over a specified time period.

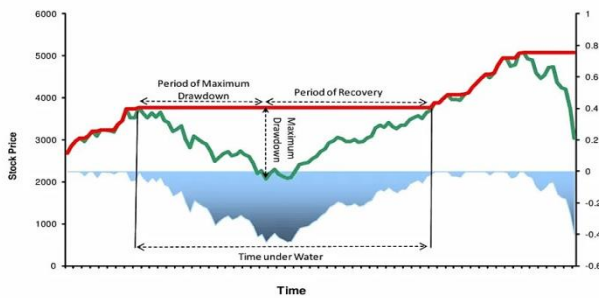


Figure 1 Maximum Drawdown

Largest percentage drop over a specified time period i.e. distance between peak and trough in the line curve of the asset. Investment with longer back testing period will likely have larger max drawdown and therefore caution must be applied in comparing across strategies. The formula for maximum drawdown is:

$$\text{MDD} = (\text{Trough Value} - \text{Peak Value}) / \text{Peak Value} \quad (5)$$

- Maximum drawdown (MDD) measures the maximum fall in the value of the investment, as given by the difference between the value of the lowest trough and that of the highest peak before the trough.
- By measuring the difference between the highest peak and the lowest trough values of an investment, MDD shows the volatility of its value in the past, which provides an almost accurate way of predicting future price movements.
- In addition to associated risk, maximum drawdown also acts as an indicator for market performance.

E. CALMAR RATIO

The Calmar ratio is a formula that measures the performance of an investment fund compared to its risk. It is commonly used as a risk-adjusted measure in the selection of investments. The Calmar ratio is determined by taking the investment annual rate of return and dividing it by its maximum drawdown. The formula for calmar ratio is:

$$\text{Calmar Ratio} = R_p - R_i / \text{Maximum Drawdown} \quad (6)$$

Where:

R_p = Portfolio return

R_i = Risk-free rate

$R_p - R_i$ = Annual rate of return

- The Calmar ratio measures the performance of an investment fund – such as a hedge fund – compared

to its risk.

- It aims to demonstrate the amount of risk required to obtain a return. It will help investors to balance their risk appetite with their investment decisions.
- The ratio cannot be adjusted to various time horizons; hence, portfolios must have the same period of backtesting.

The higher the calmar ratio the better it is. The calmar ratio of 3.0 to 5.0 is often recommended as very good.

IV. REBALANCING METHODS

A. REBALANCING APPROACH BUY AND HOLD

Rebalancing is often thought of as a return enhancer. However, it can also be thought of as a risk reducer, particularly for those investors who employ a buy-and-hold approach. The objective of buy-and-hold is to buy the initial allocation mix and then hold it indefinitely, regardless of performance. Under this strategy, the asset allocation of the portfolio drifts randomly along with the market movements and the market will rebalance the asset allocation. There are a variety of ways to find buy-and-hold stocks. The asset allocation is allowed to vary significantly from the starting allocation as risky assets, such as stocks, increase or decrease. The portfolio becomes more aggressive as stocks rise and you let the profits ride, no matter how high the stock value gets. This strategy also presents benefits like with lower costs like no taxes, trading or brokerage fees and commission.

For example below, we have chosen a monthly rebalancing option (periodic rebalancing) with the intention of allowing only minor deviation from the investment strategy in order to create a version of rebalancing that shows as much distinction from a buy-and-hold approach as possible. However, most of the strategies tend to more closely resemble a buy-and-hold approach in terms of how they work.

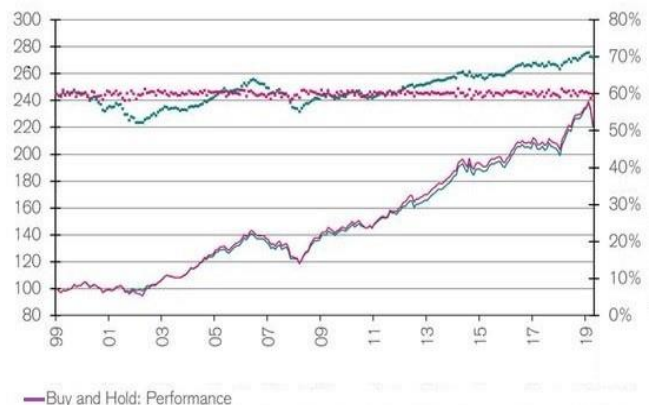


Figure 2 Buy and Hold Performance

The buy and hold approach gives more returns over a period of time. The volatility of buy and hold approach is less as compared to the other rebalancing strategies. The maximum potential loss of other strategies is also higher due to high volatility as compared to the buy and hold strategy. Based on the risk metrics, the buy-and-hold strategy would have required the investor to have lower risk ability compared to the rebalancing approach. It may also be astonishing that both approaches were similar even though the buy-and-hold approach drifted significantly from the neutral allocation multiple times. Hence the buy and hold has an edge over the other strategies due to less volatility and keeping the portfolio more stable with minimum risk and more returns.

B. BUY AND HOLD REBALANCING STRATEGY

The rebalancing in buy and hold strategy will be done on the basis of the output values calculated of a specific stock using the risk management ratios and KPI's (Key Performance Indicators) mentioned above. If a stock is performing good by taking into consideration of the KPI's value then that stock will be picked or replaced with the worse performing stock in the portfolio.

Choose a particular set of stocks from the universe of stocks (Large cap, mid cap, small cap, industry specific, factor specific, etc.) and stick to the group of stocks as the source for your portfolio for entire duration of back testing. This particular set of stocks will be fixed and the portfolio will be rebalanced among them based on their performance. Investor has to build/set a fixed individual position size for long positions only by picking 'M' number of stocks based on monthly returns which will be given by KPI's. As the position sizing is fixed every single position for the 'M' number of stocks will be same. For consideration if the number of stocks 'M' is 5 and the total portfolio value is 5 lakh rs then each individual position will of 1 lakh rs respectively. The portfolio will now drift according to the market conditions for a period of 1 month. After a period of a month based on the performance of the M stocks the portfolio will be rebalanced. The worst performing N number stocks will be replaced with the top performing N number of stocks from the set with keeping the total M number of stocks in the portfolio constant with respect to maintaining the position size of each individual stock same.

If a particular stock X is performing well and giving good returns then that stock can be selected again. For consideration if N stocks are removed from the portfolio and (M-N) are replaced with them then that stock X will be selected again in (M-N) number of stocks. Hence, the investor will have 2 positions of a single particular stock X with other 3 stocks in the portfolio having same position sizing.

The following are the results by comparing DJI (Dow Jones Index) with Buy and Hold portfolio rebalancing strategy:

Three KPI's and risk management ratios CAGR,

Sharpe ratio and Maximum Drawdown are calculated for a period of time for comparing the results.

Table 2 DJI and Buy and Hold KPI values

KPI's	DJI Index	Buy and Hold
CAGR	0.09600805607302076	0.1509145317339049
Sharpe ratio	0.5230631004342344	0.9391471795190502
Maximum drawdown	0.23201266165063417	0.21909479843264232

Sharpe ratio and Maximum Drawdown of the Buy and Hold portfolio rebalancing strategy is giving more returns than the DJI.



Figure 3 Index vs Strategy Return

By plotting the returns on a line chart it clearly shows that the strategy is having a consistent and higher rate of return than the DJI index. As the chart shows the strategy is moving in a similar kind with the DJI index but with a higher rate of return which clearly states that the Buy and Hold rebalancing strategy is having an edge over the market in terms of the rate of return for the portfolio.

V. RESULTS AND DISCUSSION

We had backtested the rebalancing strategy and applied it on different time period to check whether this strategy performs well in each time period and gives consistent return on investment with minimum risk. A set of stocks from NSE (National Stock Exchange) has been taken. All the stocks are of different sector and industries. The Buy and Hold rebalancing strategy will be backtested on the following set of stocks only by including and excluding them in the portfolio for rebalancing purpose.

The following is the set of stocks picked up from NSE:

RELIANCE.NS, TCS.NS, HDFCBANK.NS, INFY.NS,
HINDUNILVR.NS, HDFC.NS, ICICIBANK.NS,
KOTAKBANK.NS, BHARTIARTL.NS,
BAJFINANCE.NS, HCLTECH.NS, SBIN.NS,
ASIANPAINT.NS, WIPRO.NS, MARUTI.NS,
AXISBANK.NS, LT.NS, DMART.NS,
ADANIGREEN.NS, ULTRACEMCO.NS,
BAJAJFINSV.NS, HDFCLIFE.NS, SUNPHARMA.NS,
TITAN.NS, ONGC.NS, ADANIPORES.NS,
BAJAJ_AUTO.NS, TATAMOTORS.NS,

POWERGRID.NS, M_M.NS

By using, the rebalancing strategy on the above mentioned set of stocks the following results were obtained by rebalancing the portfolio in a daily, weekly and monthly period of time and were compared with the NSE index:

A. DAILY REBALANCING

Table 3 Daily Rebalancing Results

KPI's	NSE	Buy and Hold
CAGR	0.10201720025384242	0.29425929108596716
Sharpe ratio	0.4368995297207292	1.1976658902411004
Maximum drawdown	0.38439852452742096	0.31306135498726045



Figure 4 Daily Rebalancing

As we can clearly see the strategy return in daily period of time is way more than the index return in terms of the output of the ratios and as well as by plotting it on a chart. The value of CAGR, Sharpe and Maximum drawdown is greater for the Buy and Hold strategy than that for the index which in term provides more returns as it can also be seen in the chart above. For a period of time the strategy and index returns were increasing gradually and similarly but after a period of time there was a sudden increase in the returns for the strategy which kept increasing over a period of time.

B. WEEKLY REBALANCING



Figure 5 Weekly Rebalancing

In weekly rebalancing the CAGR, Sharpe and Maximum drawdown were greater for the Buy and Hold strategy than that of the index and the chart also supports as we can see the returns at the end of the strategy were greater than the index. The performance of the strategy at the starting was less but after a certain period of time there was a sudden increase in the performance of the strategy which kept on increasing gradually.

C. MONTHLY REBALANCING

Table 5 Monthly Rebalancing Results

KPI's	NSE	Buy and Hold
CAGR	0.1033071233009284	0.15203910106129115
Sharpe ratio	0.44217301280352506	0.2461639066694335
Maximum drawdown	0.29352043977792835	0.7088679457336193



Figure 6 Monthly Rebalancing

In monthly period of rebalancing, the sharpe ratio for strategy was less than that of the index but the CAGR and Maximum drawdown for the strategy were greater than the index and in terms of the final returns, the strategy performed well than the index after a certain period of time.

It is evident from the above results that the Buy and Hold rebalancing strategy produces highest returns as compared to the index. In all daily, weekly and monthly

periods of rebalancing the strategy has given more returns than the index and there by validating form the above results and charts came to the conclusion that the Buy and Hold rebalancing strategy produces highest returns in each period of time.

VI. CONCLUSION

Benjamin Graham wrote in the Intelligent Investors than, "The essence of Investment Management is the management of risks, not the management of returns. Well-managed Portfolios start with this precept." The portfolio can drift away from the optimal target weights as the asset price changes over a period of time. Thus, a profitable portfolio rebalancing strategy is significant in this case, because it affects the returns and risks associated with the portfolio. The portfolio performance can be optimized by using technical analysis or proposed rebalancing strategies.

First, although the return of buy-and-hold strategy is higher than some of the Index returns. Second, the rebalancing strategies results is lower risk than the Index and gives more percentage of returns. Thirdly, the strategy has a greater risk reward than the index. Fourthly, the return of this buy and hold strategy in each period and timeframe is greater than the index return. In trending market, this strategy always performs and yields

more returns than the index.

The strategy performs consistently in all periods for rebalancing the portfolio. Having an edge of different risk management ratios and KPI's for rebalancing purpose the strategy outperform in each and every investors portfolio.

REFERENCES

- [1] M. Lam, "Is Portfolio Rebalancing Good for Invest," *ProQuest*, 2014
- [2] N.Bao, "Technical Analysis of ETF Portfolio Rebalancing Strategy," *ProQuest*
- [3] Tokat, Y., "Portfolio Rebalancing in theory and practice"
- [4] M. Rasu, "Algorithmic Trading and Quantitative Analysis using Python"
- [5] H. Hong, "Portfolio Rebalancing Revisited: What Strategy Optimally Triggers an Adjustment to the Asset Weights?"
- [6] T. M. Antti Ilmanen, "Portfolio Rebalancing Part 1 of 2: Strategic Asset Allocation," *AQR*, 2015
- [7] S. E. R. M. S. K. N. b. A. H. Endang Soeryana Hasbullah, "Optimization of the Mean-Variance Investment Portfolio of Some Stocks under Market Sentiment and the ARMAX-GARCH Model," *International Journal of Advanced Science and Technology*, 2020

Sign Language Mediator

Vishnu Panikar, Kailas Kendre, and Sachin Patekar.

Pimpri Chinchwad College of Engineering and Research
Department of Computer

ABSTRACT Deaf and dumb people's communicate their thoughts using sign language, which is a visual language. Unlike vocal communication, sign language makes use of body language and physical communication to fluidly express a person's thoughts. It can be used by someone who has trouble communicating or by a person who can hear but can not speak and also, by normal people to communicate with hearing disabled people. For deaf individuals, sign language is a very important factor for their growth. Our project aims to bridge the gap between these Deaf people and normal people with the advent of new technologies of web applications, Machine Learning, and Natural Language Processing. The main purpose of this project is to build an interface that accepts Audio/Voice as input and converts them to corresponding Sign Language for Deaf people. It is accomplished by incorporating hand forms, orientation, and movement of the hands, limbs, or body at the same time. The user interface is divided into two steps, first converting Audio to Text using speech to text API (webkitSpeechRecognition api) and secondly, represent the text using Parse Trees and applying the semantics of Natural Language Processing (NLTK specifically) for the lexical analysis of Sign Language Grammar. The work builds upon the rules of ISL(Indian Sign Language) and follows the ISL rules of Grammar.

I. INTRODUCTION

A sign language (SL) is a three-dimensional natural visual-spatial language that uses handshapes, orientation, and movement of the hands, limbs, upper body, and facial expressions to communicate linguistic utterances instead of sound to convey meaning. The language was created as a result of India's deaf, dumb, and hard of hearing population. Because there are distinct groups of deaf and dumb individuals all throughout the world, the languages of these civilizations will differ. There are several languages on the globe, such as English, French, and Urdu, among others. Hearing impaired persons utilise a variety of sign languages and phrases all over the world. In the United States, American Sign Language (ASL) is used; in the United Kingdom, British Sign Language (BSL) is used; and in India, Indian Sign Language (ISL) is used to interact with one another. Many sign languages, such as ASL and BSL, have interactive systems already built. Hearing impairment affects roughly 5.07 million persons in India. More than a third of those surveyed are under the age of 20, with the remaining half falling between the ages of 20 and 60. Because they communicate with others using sign language, these persons are generally unable to talk properly. Many sign languages, such as ASL and BSL, have interactive systems already built. Hearing impairment affects roughly 5.07 million persons in India. More than a third of those surveyed are under the age of 20, with the remaining half falling between the ages of 20 and 60. Because they communicate with others using sign language, these persons are generally unable to talk properly. Because sign languages lack a well-defined structure and

grammar, they are either unaccepted or only marginally accepted outside of the narrow world of these differently-abled persons. According to research on American Sign Language, sign language is a full-fledged language with its own grammar, syntax, and other linguistic properties. There are various efforts, such as Indian Sign Language, to show that the same is true for different sign languages. In 1978, researchers discovered that ISL is a fully functional natural language with its own grammar and syntax. Hearing-impaired people have a difficult time communicating in public locations like railway stations, bus stops, banks, and hospitals since a normal person may not understand the deaf person's sign language. Also, because a normal person may not know sign language, he or she will be unable to communicate with a deaf person. To facilitate communication between deaf and non-deaf cultures, language translation is required

II. LITERATURE REVIEW

The base architecture of our project is based on paper [1] the project aims to develop a communication system for the deaf people. It converts the audio message into sign language. This system takes voice as input, transforms it to text, and then displays the appropriate Indian signing graphics or GIFs that have been pre-programmed.

POS tagger is an important tool, which assigns parts of speech tags for every word of the sentence. Because of the ambiguity in the language, designing effective POS taggers is difficult. The paper [2] discusses the survey of different types of POS taggers designed by the researchers and organizations. Each tagger will have their own set of tags. Tagging in NLP is analogous to

tokenization in computer languages. Choosing the right tag for the context may be a challenge for POS taggers.

The interpretation system discussed in Paper [3] consists of a parser that converts the input English sentence to syntax grammar representation, which is then used to arrange the words of the English sentence using Indian signing grammar rules. The system uses HamNoSys notation and SiGML tags for animation

Paper [4] helps us to implement the concept of lemmatization. Stemming lowers all words with the same stem to a similar form, whereas lemmatization focuses on removal of modified endings and restores the bottom or dictionary sort of a word. A baseline grading system was used to make comparisons between these two methodologies. A search engine was created, and the algorithms were put to the test in order to enable a test collection. Stemming and lemmatization exceed the baseline approach in both mean average precisions and histograms. In terms of language modelling techniques, lemmatization outperformed stemming in terms of precision, though the differences are minor.

III. GAP ANALYSIS

We have researched about the current existing systems and found out that some of the systems just implement plain Audio to text conversion, tokenizing the words, removing stop words and finally displaying the GIFs for these words from the local database. What lacks in these implementations is the need of Restructuring the grammar which is different for Indian Sign Language. Our System ensures that this part is integrated into existing projects making it more flexible and meaning-full.

IV. PROPOSED SYSTEM

The proposed translational system takes audio input and converts it into text. NLP text preprocessing techniques are used to clean and ready the text for sentence reordering according to the conventions of Indian Sign Language (ISL).

Finally searching for Short Videos corresponding to the words in the rearranged sentence and showing it to the end user.

Modules in System Architecture[Fig. 1.]:

1. Audio to text Converter
2. Text Tokenizing and Parts of Speech Tagging
3. Removal of Stopwords
4. Tense Determination
5. Lemmatization
6. Sentence reordering using ISL Grammar Rules
7. Display the Animation

A. Audio to text Converter

The external or in-built microphone on any Personal Digital Assistant (PDA) is used to give input for the module. The module uses webkitSpeechRecognition

API for audio to text. The audio input is converted into English text. The module has been developed in python script. The speech is recognized by the module and punctuation is added accordingly to the input text.

B. Text Tokenization and Parts of Speech Tagging

The process of breaking down a character set and a document unit into bits, or tokens, while omitting characters such as punctuation is called tokenization. The text tokenization algorithm used in this project is Punkt Sentence Tokenizer. This tokenizer uses an unsupervised approach to construct an abbreviation model that splits a text into a list of sentences, words, collocations, and words that start sentences. Before it can be utilised, it must be trained on a large amount of plaintext in the target language.

Input: Friends, Romans, Countrymen, lend me your ears;
Output: [Friends, Romans, Countrymen, lend, me, your, ears]

The method of identifying the parts of speech of each word in a phrase is known as POS tagging. The output is a dictionary with the specified word as the key and the POS as the value. In this application, POS tagging is implemented using an average structured perceptron method. Input: [Friends, Romans, Countrymen, lend, me, your, ears]

Output: {Friends:NN, Romans:NN, Countrymen:NN, lend:VB, me:PRP\$, your:PRP\$, ears:NN}

C. Removal of Stopwords

According to the rules of ISL, we never use am/is/are/was/were/ (linking verbs) or Do not use articles. (a, an, some, the). Such words are called Stop Words. These words are very common in source language but do not give any meaning and are not a part of the dictionary of the target language and thus should be eliminated. In this phase of the module, we eliminate stop words out of reordered tokens.

D. Tense Determination

Tense Determination is a necessary process because the tense of the reordered sentence should be the same as that of the original sentence. Tense can be determined by classifying the type of verb the sentence has. The count of past, present, future, and present participle is calculated and then the maximum among the four is retrieved. This retrieved tense will be the tense of the sentence.

E. Lemmatization

Lemmatization is a technique of finding the root word or lemma of a given word. This root word is present

in the dictionary of a particular language. Stemming is similar to Lemmatization but the lemma or root word found may or may not be present in the dictionary of desired language. Stemming and lemmatization can also differ in that stemming usually collapses derivationally related terms, while lemmatization usually only collapses a lemma's different inflectional forms.

F. Sentence reordering using ISL Grammar Rules

When both languages have differing grammar rules, translating one spoken language to another is a difficult undertaking. Especially when the source language is spoken and the target language is sign language, the complexity is multiplied by a factor of ten. For translating English text to Indian sign language, a comparison of the grammar of both languages is a necessary[Fig. 2].Examples of sentence reordering[Fig. 3]

Verb Pattern	Rule	English Grammar	ISL Grammar
Verb + object	VP NP	Go school	School go
Subject + verb	NP V	Birds fly	Birds fly
Subject + verb + subject complement	NP V NP	His brother became a soldier	His brother a soldier became
Subject + verb + indirect object + direct object	NP V NP NP	I lent her my pen	I her my pen lent
Subject + verb	Subject + verb	Show me your hands	Me your hands show
Subject + verb + direct object + preposition + prepositional object	NP V NP NP	She made coffee for all of us	She coffee for all of us made
Subject + verb + indirect object + direct object	V NP PP	Show me your hands	Your hands to me show
Subject + verb + direct object + prepositional object	NP V NP	We are waiting for suresh	We for suresh are waiting

5. ISL Grammar Rules

G. Display the Animation

The words from the reordered sentence are considered as a single entity and the video for each word is searched in the database and the same is returned. These returned videos are stored into a video buffer in the sequence matching that of the recorded sentence.

V. CONCLUSION

A platform which converts English text into Indian Sign Language is proposed in this paper. The goal of this project is to provide a way to communicate with deaf people. The major components of this project include text processing (POS tagging, lemmatization), Grammar reordering using ISL grammar rules and Animation. A limitation of this project is the limited words present in the ISL dictionary (approximately 6000 words). As the dictionary size may increase the scope of this project may increase at a faster pace..

REFERENCES

- [1] Ankita Harkude, Sarika Namade, Shefali Pati, Anita Morey "Audio to Sign Language Translation for Deaf People" ,2020
- [2] Suvarna G Kanakaraddi "Survey on Parts of Speech Tagger Techniques", 2018
- [3] Lalit Goyal and Dr. Viahah Goyal, "Automatic Translation of English Text to Indian Sign Language Synthetic Animations",2016
- [4] Vimala Balakrishnan and Ethel Lloyd-Yemoh, "Stemming and lemmatization: A comparison of retrieval performances" , 2014

Safe Driving System

Archana Sirsat¹, Dnyaneshwari Munde², Ambushree Bhandari³ Pragati Godase⁴, Prof. Amol Dumbare⁵,

¹Pimpri Chinchwad College of Engineering and Research Pune

²Pimpri Chinchwad College of Engineering and Research Pune

³Pimpri Chinchwad College of Engineering and Research Pune

⁴Pimpri Chinchwad College of Engineering and Research Pune

⁵Pimpri Chinchwad College of Engineering and Research Pune

ABSTRACT India is a country of high population due to the high population one of the biggest problem we face that is traffic and accidents. It has been observed that most of accidents takes place due to the human errors one of the biggest mistake is drowsiness of driver. So we introduce a system ' Safe Driving System using OpenCV and Python ' which will help us to reduce the accidents and save the drivers life. Every year, increases the amounts of deaths and injuries everywhere in the world. So for that reduce the number of accidents due to drivers fatigue will used different algorithms in our module. Hence increase the transportation safety to locate, track, and analyze both the drivers face and eyes. As well as alert message will be generated, Buzzer will be ON.

INDEX TERMS OpenCV, Python

I. INTRODUCTION

India is a country of high population due to the high population one of the biggest problem we face that is traffic and accidents. It has been observed that most of accidents takes place due to the human errors one of the biggest mistake is drowsiness of driver. So we introduce a system ' Driver drowsiness detection ' which will help us to reduce the accidents and save the drivers life

.In this system we are considering the parameters like driver eye blink, head positions, images by using camera. If driver eye is close more than a particular time than this state is consider as a drowse state in such condition we are using a alarm, with the help of alarm we are alerting the driver. This will surely reduce the human mistakes and leads to save so many life.

In this paper, we have implemented a system which will reduce the road accidents. The system will detect the drowsiness of driver using eye blink, head position and retina it also notice the behavior of driver in many conditions, this observation may give the result that is driver is drowse or not. If driver eye is close more than a particular time then it will alert driver using alarm system. The main purpose is to alert driver.

The Goal of this system is to detect the drowsiness of driver using eye blink,head position and retina. Once driver enter in drowse state it should immediately user alarm system to alert driver. In this way we are tring to save driver's life to reduce the chances of road accidents.

Lot of research is done on the safe driving system and it is summerised below:

Sukrit Mehta, Sharad Dadhich, Sahil Gumber, Arpita Jadhav Bhatt [3]

In this paper they developed an android application. This system records the videos and detect drivers face in every frame by employing image processing techniques. Their system is capable of detecting facial landmarks , computes Eye Aspect Ratio(EAR) and eye closure ratio(ECR) to detect drivers drowsiness based on adaptive thresholding. In this machine learning algorithms have been employed to test the efficiency of the proposed approach.

Wierwille[13] this author implemented the most popular algorithm to detect the drowsiness of the driver is PERCLOS. This algorithm is used to count the percentage of time the eyes been closed in a frame. This algorithm can give accuracy upto 90%.

McDonald [14] has gave implementation on random forest model using steering wheel angle to detect if person is sleepy or not. The random forest gives the higher accuracy than the PERCLOS algorithm.

III. WORKING

II.LITERATURE SURVEY

Working of this technique are often divided into two parts.

1. Detecting or Localizing the face
2. Predicting the landmarks of important regions within the detected face.

Camera is mounted on vehicle dashboard which is used to monitor the eyes of the driver and detect the drowsiness of driver in real time. Once face gets detected, then facial landmark task is applied and region of eyes get extracted. Once we get eye region, we can calculate Eye Aspect Ratio[11]. We use Eye aspect ratio[11] equation through that we can easily find out the distance between vertical eye landmark and horizontal eye landmark. If the eye aspect ratio[11] indicates that driver eyes have been closed for fixed amount of time, then we will sound an alarm due to that driver wakes up.

For image classification purpose we used tensorflow[1]. It creates the image classifier using keras.sequential model. And it loads data from preprocessing image_dataset_from_directory.CNN[8] Algorithm and using Keras[9] we implemented the classification model, and installed pygame for playing .mp3 file as an alarm. For detection purpose we need dlib library so we are importing it. We are calculating eye aspect ratio[11] to find the distance between eyes vertically and horizontally. When the eyes are open the value of the eye aspect ratio[11] will remain constant and if the eyes are closed for certain amount of time the counter will be activated and will start increasing rapidly and if counter reaches to five seconds then alarm sound will be played. And the driver will be alerted with the sound in this way we can stop the driver falling asleep. And we could stop the accident to happen.

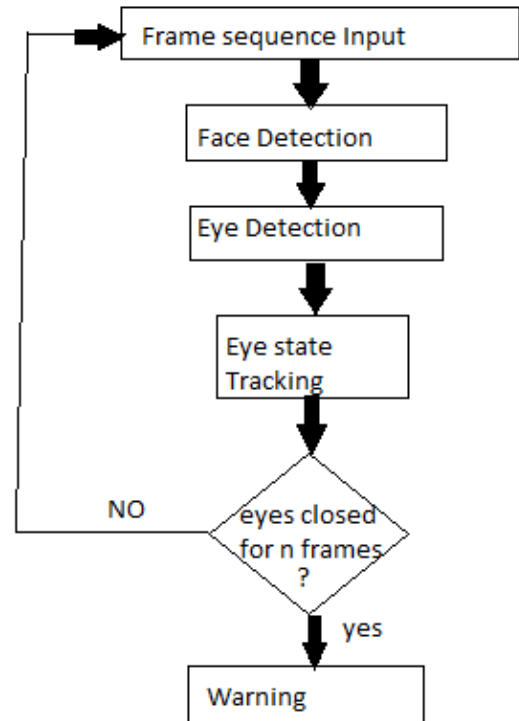
Following code is used to detect the left eye and the right eye region whether they are open or closed.

```
for (x,y,w,h) in right_eye:
    r_eye=frame[y:y+h,x:x+w]
    count=count+1
    r_eye = cv2.cvtColor(r_eye,cv2.COLOR_BGR2GRAY)
    r_eye = cv2.resize(r_eye,(24,24))
    r_eye= r_eye/255
    r_eye= r_eye.reshape(24,24,-1)
    r_eye = np.expand_dims(r_eye,axis=0)
    rpred = model.predict_classes(r_eye)
    if(rpred[0]==1):
        lbl='Open'
    if(rpred[0]==0):
        lbl='Closed'
        break
```

```
for (x,y,w,h) in left_eye:
    l_eye=frame[y:y+h,x:x+w]
    count=count+1
    l_eye = cv2.cvtColor(l_eye,cv2.COLOR_BGR2GRAY)
```

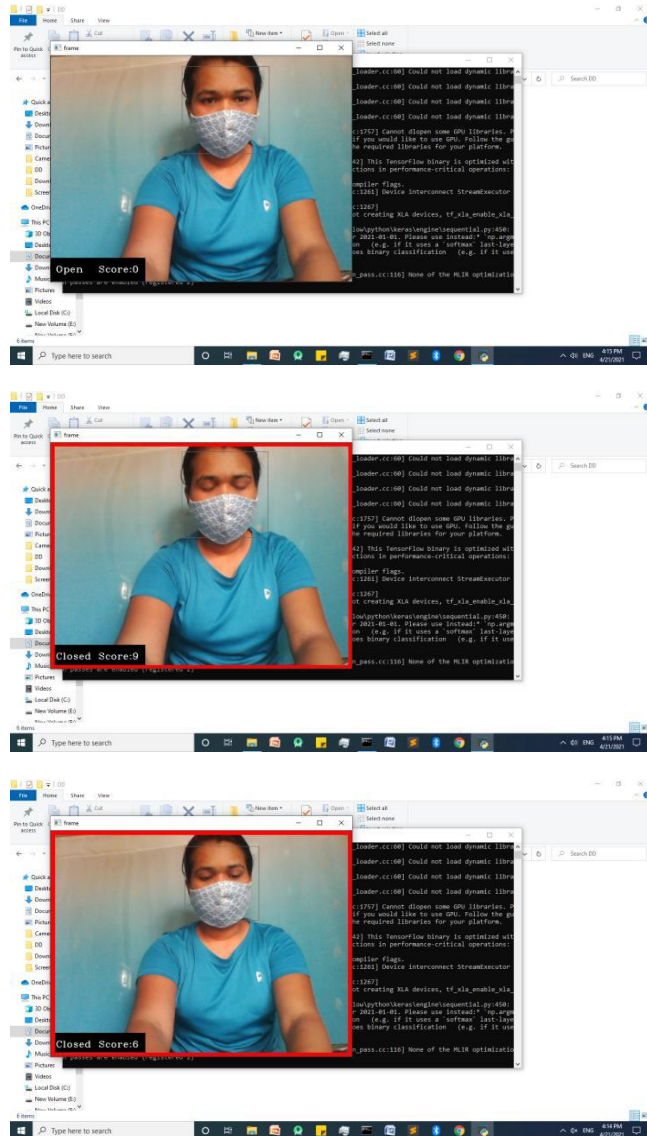
```
l_eye = cv2.resize(l_eye,(24,24))
l_eye= l_eye/255
l_eye=l_eye.reshape(24,24,-1)
l_eye = np.expand_dims(l_eye,axis=0)
lpred = model.predict_classes(l_eye)
if(lpred[0]==1):
    lbl='Open'
if(lpred[0]==0):
    lbl='Closed'
```

IV. FLOWCHART



The flowchart gives the overall idea of the system. First continuous monitoring of the face will be done and after that extracted frames of the face will be given as an input to the algorithm and face detection will proceed further detection and calculations will be done using formula for the eye aspect ratio[11]. It will check eye state whether it is closed or opened accordingly the decision will be given. If the eyes are found open, the value for the counter will be constant and if the eyes are found closed or blinked then the counter will be activated and if the value of the counter exceeds the limit then the time will be calculated for how long it was closed. If it is found closed for more than 5 seconds then the alarm will be triggered.

V. RESULT



VI. ADVANTAGES

1. This system will lead to reduce the road accidents.
2. This system accurately detect the drowsiness.
3. Cost requirement for the project is very less.
4. Implementation can be done without using database storage so it will fetch the values without taking any buffering time.

VII. DISADVANTAGES

1. Difficult to detect drunk people.
2. It will be problematic when multiple faces detected to camera.

VIII. CONCLUSION

In this paper, we have implemented a system which leads to reduce the road accidents. The system will detect the

drowsiness of driver using eye blink, head position and retina. It also notices the behavior of driver in many conditions, this observation may give the result that the driver is drowsy or not. If the driver's eye is closed more than a particular time, then it will alert the driver using an alarm system. The main purpose is to alert the driver.

The goal of this system is to detect the drowsiness of driver using eye blink, head position and retina. Once the driver enters a drowsy state, it should immediately use an alarm system to alert the driver. In this way, we are trying to save the driver's life to reduce the chances of road accidents.

IX. FUTURE SCOPE

Future scope will pay attention to detect alcoholic driver using other aspects and solutions to control such kind of situations. It will also tell us that the driver is more drunk or less drunk. We can capture the images of a drunk driver and using eye blink, pose of person, we can detect the drunk person, for this we can use image processing. By using image processing technique, it will be easy to detect this kind of faces and process.

Neural network system will help us to detect a drunk driver. It will capture the images before and after a drunk driver, which will be used for further comparison. We can consider parameters like alcohol content, eye blink rate, face recognition. We can also implement this system in two wheels also to detect a drunk driver.

REFERENCES

- [1] Drivers are falling asleep behind the wheels. Prevalence of drowsy driving crashes: <https://www.nsc.org/road-safety/safety-topics/fatigued-driving>
- [2] Facial landmarks with dlib, OpenCV and Python: <https://www.pyimagesearch.com/2017/04/03/facial-landmarks-dlib-opencv-python/>
- [3] Sukrit Mehta, Sharad Dadhich, Sahil Gumber, Arpita Jadhav Bhatt real-time drowsiness detection system using eye aspect ratio and eye closure ratio, noida
- [4] Eye blink detection with OpenCV, Python, and dlib: <https://www.pyimagesearch.com/2017/04/24/eye-blink-detection-opencv-python-dlib/>
- [5] Drowsiness Detection with OpenCV: <https://www.pyimagesearch.com/2017/05/08/drowsiness-detection-opencv/>
- [6] Real-Time Eye Blink Detection using Facial Landmarks: <http://vision.fe.uni-lj.si/cvww2016/proceedings/papers/05.pdf>
- [7] InVehicle Alerts: Prevent Drowsy Driving, Near Miss. YouTube <https://www.youtube.com/watch?v=zXJ3RgG97gc>
- [8] CNN Algorithm : <https://insightsimaging.springeropen.com/articles/10.1007/s13244-018-0639-9>
- [9] Keras : <https://keras.io/>
- [10] OpenCV : https://docs.opencv.org/3.4/da/d60/tutorial_face_main.html
- [11] Eye Aspect Ratio : <https://hackaday.io/project/27552-blinktotext/log/68360-eye-blink-detection-algorithms#:~:text=The%20Eye%20Aspect%20Ratio%20is,defined%20by%20the%20below%20equation.&text=A%20program%20can%20determine%20if,is%20another%20facial%20landmark%20plotter.>

Classification and Prediction of Diseases with similar Symptoms.

Dr. Archana Ajit Chaugule (Project Guide), Sonali Gulimi, Shrutika Saravade, Priyanka Dhondage, Sapna Burud.

¹Pimpri Chinchwad College And Research, Ravet.

ABSTRACT The field of medicine is found to have a lot of information but unable to implement that information. This is due to lack of tools to discover the hidden information and development in them. By applying the machine learning algorithms and techniques, valuable knowledge can be extracted from the health care system Malaria and Dengue have group of condition affecting the structure and functions of the body and has many root causes. We are using Deep Learning algorithm to increase the accuracy of Malaria and Dengue Disease Prediction System. It is implemented as desktop application in which user submits the heterogeneous data like text and image of blood cell symptoms. It results in hidden data from stored database and deep learning models are used to compare these user values with our trained model.

INDEX TERMS Cell image (blood cell), Textual data, Convolution Neural Network, Machine learning, Database.

I. INTRODUCTION

Diseases that are caused due to various reasons. They can be transmitted through various viruses or due to some chemical reactions in our body. Among various life-threatening diseases, diseases which have similar symptoms has gathered a great deal of attention in medical research. The diagnosis of disease with similar symptoms is challenging task, which can offer automated prediction about the disease of patient so that further can be made effective. The reason for such diseases is usually based on symptoms, signs, and cell image of the patient. A challenge faced by medical organizations, such as hospitals and medicals is to provide quality service at affordable price and accuracy within less time. The quality service means providing the accurate results within the less amount of time. The available system consists both imageries and textual data. Before further processing, cleaning, and filtering are applied on these records to filter the irrelevant data from the database.

Objective

This project aims to create the quality service that implies diagnosing patients properly and administrating effective treatments. The health care predication system is an end user project which can help in decreasing the total time required for accessing each patient by doctors on

time. The proposed system can determine an exact hidden knowledge that is patterns and relationships associated with diseases from database. Here we provide a system which provide instant result having similar diseases and symptoms through a predictive health care system. This system is also used for classifying diseases having similar symptoms.

- 1- Prediction should be fast.
- 2- Accurate Prediction.
- 3- Manpower Less.
- 4- Low Cost.
- 5- Easily accessible.

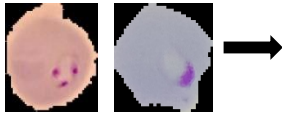
A. IMPLEMENTATION

PREPROCESSING

It is a classification technique based on Bayes' Theorem with an assumption of independence among predictors. In simple terms, a Naive Bayes classifier assumes that unique features are unrelated to any other features. Naive Bayes model is simple to build and very useful for large datasets. Along with simplicity, Naive Bayes is known to outperform even highly sophisticated classification methods.

B. WORKING

Step 1: Convert the Image set into a Matrices.



$$A = \begin{bmatrix} 1 & 3 & 3 \\ 2 & 4 & 10 \\ 3 & 8 & 4 \end{bmatrix}$$

Step 2: Group together by finding probabilities.

Step 3: Now, use Naive Bayesian equation to calculate the probability for each class. The class with the highest probability is the outcome of prediction.

III. CLASSIFICATION

A. CNN ALGORITHM

STEP 1: THE CONVOLUTION OPERATION

The convolution function is used to generate a feature map. In this process, every section of image is reviewed by the convolution function. The feature map is developed depends on how the each section of the image responds to the convolution function. Like the process used by layers in an ANN, we will have layers of neurons that are stimulated by the convolution function.

STEP 2: POOLING

We have our feature map; we need to get this into a manageable data set. The algorithm will move across feature map, a few sections at a time and pool the data there. There are several ways that we can choose for your data to be pooled. For example, deciding to keep only the maximum value from the section the algorithm is looking at. Another option is to take the mean of all the data points in the section. The main thing after pooling is that you have a small size of data to process which is very efficient for running the algorithm.

STEP 3: FLATTENING

This step is relatively self-explanatory. For ANN, to receive the data the input should be flat. In this step you will transform the pooled and minimized dataset into a 1D vector. The algorithm used for flattening will select each row of pixel data and stack them on top of one another.

STEP 4: CONNECTION

The final step is where you connect the flattened-out feature vector and feed it into your ANN as an input

VII. CONCLUSION

The purpose is to prediction of malaria and dengue diseases using deep learning. The personal health monitoring of everyone is considered very important because of the rise in health problems in today's world. we are using convolution operation, Pooling, Flattening, Connection steps for image preprocessing. By applying the machine learning algorithms and techniques, valuable knowledge can be extracted from the health care system, we are using Deep Learning algorithms to increase the accuracy of Malaria and Dengue Disease prediction System.

REFERENCES

- [1] Automatic Diagnosis with Efficient Medical Case Searching Based on Evolving Graphs. (Xiaoli Wang¹, Yuan Wang², Chuchu Gao¹, Kunhui lin¹, and yadi li³), IEEE.
- [2] Using Electronic Health Records and Machine Learning to Make Medical Related Predictions from Non-Medical Data (Stavros Pitoglou, Yiannis Koumpourous and Athanasios Anastasiou), International Conference on Machine Learning and Data Engineering, 2018 An Artificial Neural Network approach for classification of Vector-Borne diseases. (Prajwal Shimpi, Sanskruti Shah, Maitri Shroff, Anand Godbole), (ICEEOT) 2018.
- [3] Analytical study of heart disease diagnosis using classification Techniques. (C.Sowmiya;P.Sumitra), International Conference on Intelligent Techniques in Control, Optimization and Signal Processing, 2017
- [4] Monitoring Mobile Patients Using Predictive Analysis by Data from Wearable Sensors, International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) 2018.
- [5] An ensemble based on distances for a kNN method for heart disease diagnosis. (Alberto Palacios Pawlovsky), IEEE, 2018
- [6] The Ethical Challenges of Applying Machine Learning and Artificial Intelligence in Cancer Care. (Rima Hajjo), IEEE, 2018.



Mobile Application For Real-Time News Summarization In Indian Languages

Shreyas Soni, Saurabh Kushwah, Manthan Parab, Piyush Wadi, Prof. Sonali Lunawat

Pimpri Chinchwad College of Engineering and Research
Department of Computer
Pune-412101, India

ABSTRACT India is a land of various languages, prominent of which are Hindi and Marathi. More than 50% of the population of India speaks and understands these 2 languages. In today's ever happening world, it is difficult to keep track of current events. Newspapers and online articles are a great way of staying up to date with the world, but it is time consuming. Usually newspaper and online articles are very lengthy and time consuming to read. By using natural language processing and text summarization techniques, such as BERT, we can create a short and meaningful summary. The summary covers all the important points from the online article and presents it on mobile application in a very intuitive GUI. For readers in India, it will be more effective to present the summary in their preferred language such as Hindi or Marathi in addition to English. Application is automated for real-time news fetching. Application provides choice to view the article in user understood language.

INDEX TERMS Natural Language Processing, Text Summarization, Automation, Mobile Application, BERT, GUI.

I. INTRODUCTION

In today's ever happening world, it is difficult to keep track of current events. Newspapers and online articles are a great way of staying up to date with the world, but it is time consuming. Usually newspaper and online articles are very lengthy and time consuming to read. By using text summarization techniques, such as BERT, we can create a short and meaningful summary. The summary covers all the important points from the online article and presents it on mobile application in a very intuitive GUI. We are creating a mobile application that does the task of providing NEWS summary in Hindi and Marathi along with English. We are implementing web scrapers for collecting the news articles from online news sources such as Times Of India, IndianExpress, The Hindu, Lokmat, Hitwad and many more. The collected articles will be stored in our database.

The NEWS article will then be summarised for displaying on our Mobile Application. Users are given choices to read news from various different categories such as Health, Technology, Sports and Politics. For readers in India, it will be more effective to present the summary in their preferred language such as Hindi or Marathi in addition to English.

Application is automated so that it fetches the latest news articles from the trending section of every news website in real-time. Application provides choice to view the article in user understood language and switch based on user's preference.

II. LITERATURE REVIEW

From the first study [1] we have studied various summarization techniques and listed out a few, which are well suited for our implementation of the project. We have analysed methods such as Text Ranking, Term frequency

and Text Mining. Learning from it, we gather deep insights about text preprocessing and summarization.

From the study of [2] we gather info about web scraping and its implementation. Use of Python programming language in web scraping and creating scripts for the same.

This helped a lot in gathering news articles and storing it in our database. Stored articles will then be fed to the summariser for further processing.

We took findings from [3] in which they discussed the use of the BERT model in text summarization. We have studied the BERT (Bidirectional Encoder Representations from Transformers) model in detail and its use in text embeddings and extractive summarization. The results of the BERT model were good and promising so we decided to implement it in our project.

From the study of [4] we learn about the use of summarization on online news articles. We learn about sentence tokenization, Parts of speech tagging and other important factors for summarizing news articles. Idea of automation was drawn from studying this paper and

VOLUME 1, 2021

provided a base for extraction and auto summarization of the new article. From the study [5] we found that we can use summarization techniques not only in english but also in other languages. This inspired us to perform news summarization in Hindi and Marathi since more than 50% of the population of India speaks and understands these two languages combined. This paper helped us with how to approach other languages and things necessary for summarizing news articles in these languages.

The study [6] helped us a lot as it deals with extractive summarization of text in Hindi language. Hindi is the fourth most spoken language in the whole world. Hindi is written in devnagri script and is the official language of the Government Of India. By studying the approach to this



language, it provides a base for the study of Marathi language for our summarization. In study of [7] we have finalised our approach for text summarization in Indian Languages. We took the findings of this paper and implemented text summarization on online news articles. Thus integrating Hindi and Marathi, commonly spoken languages in India in our final summarization implementation.

III. PROPOSED ALGORITHM

The system is divided into 5 modules:

1. Web Scraping
2. Text Summarization
3. API design
4. Automation
5. Frontend Mobile Application

1. Web Scraping
The scraper performs the scraping operations of the news articles across multiple websites and stored it in the database hosted on google cloud platform. The scrapers are

scheduled to run every 5 mins for each source using cron and running each scraper inside a docker container. The source data consisting of the url, is stored in a mongodb collection in the database. Scrapy is used to perform this operation.

2. Text Summarization

The collected news articles are then passed through a NLP model that summarizes the text of respective languages and stores it in the database. BERT is used for summarizing news articles. Each language has it's BERT model for summarizing the articles.

3. API design

The API component connects the client with the server acting as a bridge and serving the backend database with the frontend. It provides various endpoints such as GET/NewsArticles, POST/NewsArticles, GET/News/{Date},etc. This provides an efficient way to get data to the frontend. The API is hosted on gcp inside a docker container.

4. Automation

The scrapers are scheduled to run every 5 mins for each source using cron and running each scraper inside a docker container. That will extract the latest NEWS on the website, summarize it and store it in mongoDB.

5. Frontend Mobile Application

Frontend Mobile Application is developed using Flutter and Dart programming. We used dart to create an interactive homepage and widgets to toggle between categories of the news. Since it is a cross-platform application, it can run on Android, iOS and Windows platforms as well. This attracts users from different platforms and has a great experience on all platforms.

Figure 1 : Use Case Diagram

Figure 2 : Architecture Diagram

VOLUME 1, 2021

Figure 3 : Flow Diagram

IV. OUTPUTS

Figure 4: Sample Data entry-I

Figure 5: Sample Data entry-II

VII. CONCLUSION

The goal of this project is to build an application which provides a short and precise summary of news articles in real time which is then served to platforms like mobile and

web. The mobile application also provides summaries in Indian languages of Hindi and Marathi. With this application dashboard, users can view summary on a minimal and intuitive graphical interface. The application is

automated and updated frequently to provide users with the

latest news in Hindi, Marathi as well as in English.

REFERENCES

- [1] Sanjan S Malagi, Rachana Radhakrishnan, Monisha R, Keerthana S, Dr. D V Ashoka, 2020, An Overview of Automatic Text Summarization Techniques, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) NCAIT – 2020 (Volume 8 – Issue 15),
 - [2] Shreesha M, Srikara S B, Manjesh R, 0, A Novel Approach for News Extraction using Web Scrapping, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) ICRTT – 2018 (Volume 06 – Issue 15),.
 - [3] Miller, Derek. (2019). Leveraging BERT for Extractive Text Summarization on Lectures.
 - [4] P. Sethi, S. Sonawane, S. Khanwalker and R. B. Keskar, "Automatic text summarization of news articles," 2017 VOLUME 1, 2021 International Conference on Big Data, IoT and Data Science (BIG), 2017, pp. 23-29, doi: 10.1109/BIG.2017.8336568.
 - [5] D. Kosmajac and V. Kešelj, "Automatic Text Summarization of News Articles in Serbian Language," 2019 18th International Symposium INFOTEH-JAHORINA (INFOTEH), 2019, pp. 1-6, doi: 10.1109/INFOTEH.2019.8717655.
 - [6] S. Vijay, V. Rai, S. Gupta, A. Vijayvargia and D. M. Sharma, "Extractive text summarisation in hindi," 2017 International Conference on Asian Language Processing (IALP), 2017, pp. 318-321, doi: 10.1109/IALP.2017.8300607.
 - [7] Dalwadi, Bijal & Patel, Nikita & Suthar, Sanket. (2017). A Review Paper on Text Summarization for Indian Languages.
- Shreyas Soni** from PimpriChinchwad college of Engineering and Research
Department of Computer
Pune-412101, India
sonishreyas10@gmail.com
Saurabh Kushwah from PimpriChinchwad college of Engineering and Research
Department of Computer
Pune-412101, India
saurabhkushwahsingh@gmail.com
Manthan Parab from PimpriChinchwad college of Engineering and Research
Department of Computer
Pune-412101, India
manthanparab07@gmail.com



Touchless Attendance System Using Face Recognition

Rasika Dhande¹, Mohammad Jaid Mulani², Ashwini Jadhav³, Sushant Said⁴, Prof. Jameer G Kotwal⁵

Department of Computer, PimpriChinchwad college of Engineering and Research

ABSTRACT Attendance systems using face recognition are not a new normal. But after the COVID-19 outbreak, there arises a need to maintain social distancing and avoid physical contact. This paper is about touchless attendance systems using face recognition technology by integrating open-source computer vision (OpenCV). Our unified structure is based on OpenCV, Dlib for face detection, basic image processing operations and Siamese Network Model and Triplet Loss Function for face recognition tasks (face database). We have used Flask Framework for developing web application. This implementation has the entire model in Keras with TensorFlow v2.3 as backend and MySQL as relational database. This system will facilitate the attendance automaton process by capturing the picture twice, one at the start (during registration process) and one during the monitoring session to maintain a log for faculty member's clock-in and clock-out time and thus provide data for generating reports. Our entire system has proven to provide high accuracy in face recognition and along with high performance and reliability.

INDEX TERMS Face recognition, Siamese Network, attendance system, OpenCV, vgg-16

I. INTRODUCTION

Attendance tracking is essential to all the organizations irrespective of size and industry. The attendance management must track and record attendance of the employees accurately. The attendance management system has seen a good change over a short period of time. From manual registers to hi-tech smart attendance tracking systems, technology has transformed the way organizations manage their employee's work timing. The facial recognition-based attendance system is a contact-less and real-time attendance tracking system exceptionally relevant in the current pandemic situation. The workplace will not be the same post COVID-19. Though the pandemic continues to rise, businesses are trying to resume their on-premise operations to ensure business continuity. Under such circumstances, the company must take care of employees' health and safety. Organizations are seeking ways to provide a COVID-free workspace to employees which is safe, and a touch-less check-in/check-out is the first step towards it.

Biometric technology is becoming increasingly popular for tracking time and attendance of the employees. Although

fingerprint biometrics is a popular choice, facial recognition with time tracking is an alternative biometric solution with certain distinct advantages such as a contact-less system, time saving and high security. Facial recognition with time tracking uses biometric identification and verification based on facial features of the person. Facial recognition technology varies. The system may look at specific algorithms for facial recognition to identify specific facial characteristics. The first step in implementing the attendance management system is to get all the employees registered in the face database for future identification and biometrics authentication thereby marking their attendance. Further, when an employee seeks access to an organization, the employee's face is scanned and biometric software identifies and authenticates based on facial recognition and the employee's information which is stored in a database.

II. LITERATURE REVIEW

- In the paper [1], they made two contributions: first, designed a procedure that is able to assemble a large-scale dataset, with small label noise and minimizing the amount of manual annotation involved. One of the key ideas was to use weaker classifiers to rank the data presented to the annotators. This procedure was developed for the faces, but is evidently suitable for other object classes as well as fine grained tasks. The second was to show that a deep CNN, without any embellishments but with appropriate training, can achieve results comparable to the state-of-the-art..
- The experiments in [2] are based on using the state- of-the-art convolutional neural network (CNN) based architecture along with the pre-trained VGG-Face model through which they extract features for machine learning. Used two classifiers namely the cosine similarity (CS) and the linear support vector machines (SVM) to test the recognition rates. The results show that individual parts of the face such as the nose, eyes and cheeks have low recognition rates but the rate of recognition rises when individual parts of the face are combined and presented together.
- The process of learning good features for deep learning applications are often very expensive computationally and difficult in cases where less data is available. An example of this is the one-shot learning, in which we have given only a single example of each new class and must correctly make predictions based on the available data. In [3], they have explored a method for learning Siamese neural networks which apply a unique structure to the class by naturally ranking their similarity between given inputs. Once a network has been adapted, we can then exploit on powerful distinctive features to generalize the predictive power of the network for new data available as well as to entirely new classes from unknown distributions. By using a convolutional architecture, we can achieve powerful results which surpass those of other deep learning models with near state-of-the-art performance on one-shot classification

tasks.

- In [4], they performed a four-stage process were face detection process using skin color detection and Haar Cascade algorithm, alignment process that contains face features normalization process, feature extraction process, and classification process using LBPH algorithm. The system can recognize and identify the face well at a face distance 40 cm from the camera with adequate lighting (24 lux) and the face tilt maximum angle that could still be detected by the camera was about 30 degree.
- In paper [5], face recognition has become a very crucial part of biometric verification and finds uses in many applications, e.g., video monitor systems, human computer interaction, network security. This paper is about integrating the face recognition technology with an open-source computer vision (OpenCV) algorithm and develop an Attendance System. This software will facilitate the attendance automation process and enable faculties to enquire student's data by just maintaining a log for clock-in and clock-out time.

III. PROPOSED ALGORITHM

The system is divided into 4 modules:

1. Registration of new staff member
2. Update the details
3. Mark Attendance
4. Generate Reports

1. Registration of new staff members

Registration of a user is the first stage of our attendance system, 10-20 images of the user are captured along with their details and stored in the database. A folder named with the user's name which contains images captured is used for testing and training the face recognition model.

2. Update the details

Updating or deleting an entry can be performed by this module. The older entry will be updated by the new ones and this will be reflected in the database.

3. Mark Attendance

In this module, the admin starts the session by setting the check-in option and thereby giving access to ON the camera of the device. The registered user will come in front of the camera to mark their attendance. When a face is detected by the system it draws a square around the face and compares this face with the stored faces in the database, if a match is found the user is recognized by the model and his name appears on the screen, if not then "Not Known" is displayed. As the model recognizes the user, his attendance is marked according to the timestamp of that respective

ession. Similarly, the admin ends the session by check-out option to keep the logs of clock-out time of the user.

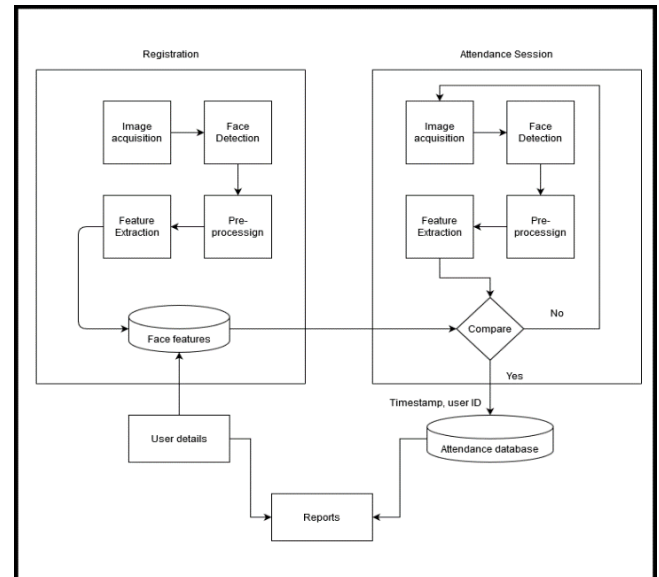


Fig 1 Architecture Diagram

VII. CONCLUSION

From our findings, it was observed that face recognition systems built using Convolutional Neural Network (CNN) model require huge dataset. To solve this problem, state-of-the-art technique, One-Shot learning is used which makes the proposed system high performant even with less dataset available. One of the ways to implement one-shot learning is training a Siamese Network using a triplet loss function. This paper has focused on developing an attendance system based on face recognition backed by one-shot detection technique. An attempt has been made for improving the accuracy of the Siamese Network and triplet loss functions by applying various methods like avoiding repeated triplets and taking hard triplets. This takes us one step ahead in the process of developing more reliable and efficient face recognition systems that can be used for surveillance, security enhancement, visitor management, etc. However, inability to recognize occluded faces is a

limitation of the proposed system and opens up for further research.

REFERENCES

- [1] V. Singh, L. Freeman, B. Lepri, and A. Pentland, "Predicting spending behavior using socio-mobile features," September 2013
- [2] Bijmolt, T., Leeflang, P., Block, F., Eisenbeiss, M., Hardie, B., Lemmens, A., and Saffert, P. "Analytics for Customer Engagement," 2010.
- [3] Moe, W. and Fader, S. "Dynamic Conversion Behavior at E-Commerce Sites," 2004.
- [4] A. Choudhary, "A Hands-On Introduction to Deep Q-Learning using Open AI Gym in Python",
- [5] Wei Pan, NadavAharon, "Fortune Monitor or Fortune Teller: Understanding the Connection between Interaction Patterns and Financial Status," 2011.
- [6] Vipul, P Vinoth Kumar, DivyanshDimri, Mayankpathak "Expenditure Predicting using Machine Learning ", 2019



Smart Expense Manager

Akash Shinde¹, Jiten Adav², Neeraj Yadav³, Kapil Sharma⁴, Prof. Jameer G Kotwal⁵

Department of Computer, PimpriChinchwad college of Engineering and Research

ABSTRACT As we know in today's world managing expenses is a very challenging thing. By analyzing our previous expenses, we can predict our upcoming expenses. Now digitalization is everywhere so we can get bank transaction history easily, just by getting the data from transaction history we can predict the estimation of upcoming expenses. Traditionally the management of personal finances is performed by viewing bank statements. In the modern age of 'Internet banking', banks offer a limited set of tools that mimic the paper statements seen historically. This project sets out to build a web based application that can be used to manage personal finances. As we know in today's world managing expenses is a very challenging thing. By analyzing our previous expenses, we can predict our upcoming expenses. We use machine learning to predict the expenses of next month by taking in consideration all previous data.

INDEX TERMS Machine Learning, Arima, Data Visualization, Web App, Flask, AWS S3, JavaScript.

I. INTRODUCTION

As we know in today's world managing expenses is a very challenging thing. By analyzing our previous expenses, we can predict our upcoming expenses. Now digitalization is everywhere so we can get bank transaction history easily, just by getting the data from transaction history we can predict the estimation of upcoming expenses. We can do this using machine learning, machine learning is used in many things, one of them is prediction. We are using linear and logistic regression and decision tree algorithms, it is a machine learning algorithm used in prediction. The main aim of this project is to build a system that helps in managing personal finances of the user. This project aims to create fully open checkout-free grocery shopping and give the best experience for customers while shopping. Accurately predicting future transactions. A model fitted for each user's individual spending patterns, and is evaluated in order to improve the model. Should be secure and uphold the high security expectations. Information On a sensitive nature - strong security techniques are important. Tracking and predicting your expenses makes you a better money manager. This web application will help to reduce the expense of an individual by predicting his future expenses and Keep track of monthly expenses. This gives the ability to the user to gain better control over individual expenditures and reduce

errors. User's will consider storing your receipts/bills online, which will help user's time if anything gets lost.

II. LITERATURE REVIEW

From the first study [1] this demonstrates a connection between spending and social activity as measured by smartphones. Personality variables were found to be less accurate predictors of a couple's spending decisions than social characteristics. There's plenty of space to extend this study to include a larger number of participants in a variety of settings. The proliferation of spending log apps like Mint, expenditures, and Pennies, as well as collaborations like American Express's with Twitter, are all contributing to this trend, imply that, in the not-too-distant future, an increasing amount of spending data will be available online in order to better understand mobility, sociability, and spending activity. The plan is to look at couples as spending units and social intervention units in communities in greater detail..

We took findings from [2] in which they discussed customer interaction theoretical models, which are distinct from customer transaction models. These models cover the following stages of the customer life cycle: customer

acquisition, customer development, and customer retention. The Data access was improved significantly, allowing for more detailed and advanced analysis in each of these phases, facilitating the management of customer service. There are still a range of operational issues with customer engagement analytics that act as roadblocks to implementing customer engagement analytics.

The architecture of [3] E-commerce administrators already have access to a wealth of data that can be used to analyse online purchasing behaviour thanks to the Internet. The aim of this paper was to look at one of these metrics conversion rates in depth. Their model allows for a more valid and useful analysis of conversion activity than a mere aggregate of visits and transactions can provide. Their model prevents these blunders by explicitly approaching consumer heterogeneity as well as time dynamics. Since consumers visit a retail site for a variety of reasons, it's critical to recognise and account for multiple trends in the relationship between visiting and buying. They've also described their modelling issue by taking the trend of customer visits to the focal website as a given.

From the study [4] we found machine learning is a necessary skill. Artificial intelligence (AI) and deep learning algorithms have revolutionised today's technology. The aim of this paper was to provide a simple introduction to machine learning techniques as well as solve a basic cartpole problem using Python, neural networks, and Tensorflow. As a result, it can be concluded that the problem-solving technique met its goal of scoring above 190 points on average. This paper included Machine Learning basics such as regression, linear, and logistic, as well as sigmoid function basics and hypothesis equations for neural networks and cost functions, in the hopes of providing a clear understanding of how things work in Machine Learning. Also included the information about how to install and set up a basic environment and libraries, as well as compatible versions.

The aim of the study [5] was to create an application that made it easier to manage personal finances by automating the steps that most people go through while preparing a budget. Existing financial applications were investigated, with the aim of identifying the benefits and drawbacks of each, as well as defining the features that users find useful through user feedback. The prediction engine, a critical component of the programme, was examined, with MCMs and Weighted Arithmetic Means among the techniques used to forecast financial expenditure. The ethical implications of storing high-risk personally identifying information are examined and comprehended in terms of application protection and strong security practises. This

work was then used to assess the software's usability, the design and implementation of the prediction engine, and to maintain high safety standards in the application. Common design and implementation problems are discussed, along with the main background and technical knowledge gained to resolve them.

III. PROPOSED ALGORITHM

The two major structural components of our web application are client and server sides. The client component was developed in CSS, HTML, and JS. Since it is in the user's web browser, there is no need for the operating system or modifications related to the device. A client component is a representation of the web application functionality that the end user interacts with. The server component is built using the combination of Python programming language and Flask frameworks. The server component has two parts; app logic and database. The former is the main control center of the web application while the latter is where all static data is stored. The client component assists users to add their expenses with the ability to upload their bills or receipts. This component takes in information like Amount in Rupees (INR), the category and any notes regarding the Expenditure. All the use cases of our system are shown in the [Fig 2]. Once the user has made some entries they can have an overview on the Dashboard which shows various visualizations. Visualization has graphs like Pie chart, bar graphs and line charts. These Visualizations are created on the server component, the records are fetched from MySQL db and plotted with the help of ChartJs. The Server component also takes care of the Prediction. Predication is carried out using ARIMA (Auto Regressive Integrated Moving Average) model. ARIMA model uses input as the user's previous Expenditure patterns to train itself. So each user will have its very own pattern of spending. Depending on the user's trained ARIMA model, the model can predict the Total expense they will incur in the upcoming month. These sequences of activity are shown in the activity diagram. [Fig1]. The Above defined system is represented in an Architecture Diagram [Fig 3].

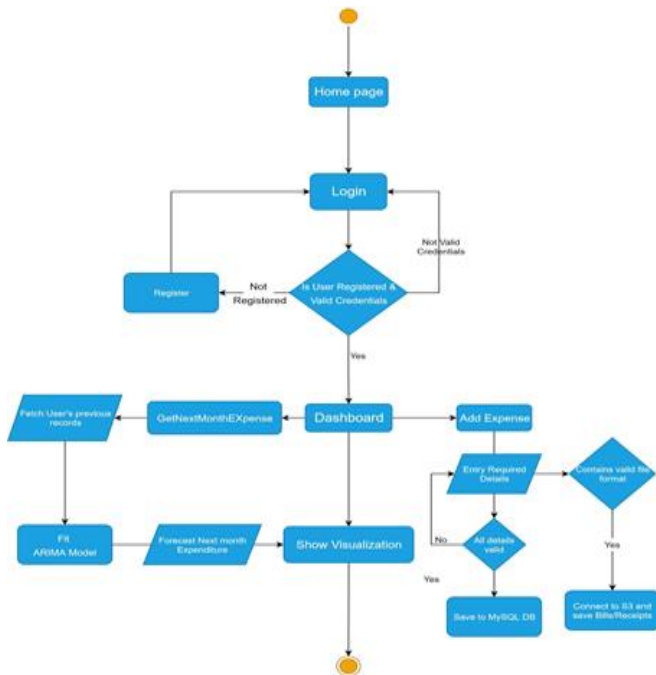


Fig 2 Use-case Diagram

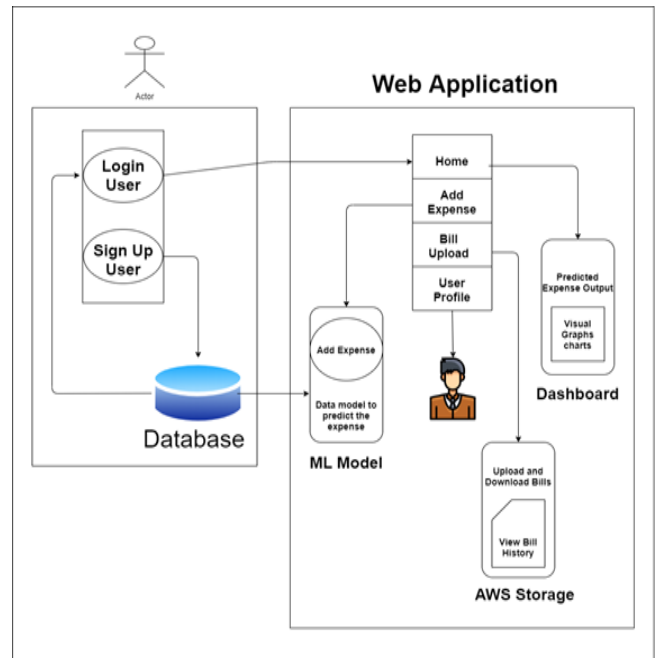


Fig 3 Architecture Diagram.

VII. CONCLUSION

The goal of this project is to build a web-based application that keeps track of user expenses. We can forecast the upcoming monthly expenditure from the previous month's transactions and factors of a user. With this web-based application dashboard, users can manage their expenses more effectively. The application will erase spreadsheets, sticky notes, and ledgers that create confusion and data inconsistency quandaries while recording and splitting expenses.

REFERENCES

- [1] V. Singh, L. Freeman, B. Lepri, and A. Pentland, "Predicting spending behavior using socio-mobile features," September 2013
- [2] Bijmolt, T., Leeflang, P., Block, F., Eisenbeiss, M., Hardie, B., Lemmens, A., and Saffert, P. "Analytics for Customer Engagement.", 2010.
- [3] Moe, W. and Fader, S. "Dynamic Conversion Behavior at E-Commerce Sites.", 2004.
- [4] A. Choudhary, "A Hands-On Introduction to Deep Q-Learning using Open AI Gym in Python",

- [5] Wei Pan, NadavAharoni, "Fortune Monitor or Fortune Teller: Understanding the Connection between Interaction Patterns and Financial Status," 2011.
- [6] Vipul, P Vinoth Kumar, DivyanshDimri, Mayankpathak "Expenditure Predicting using Machine Learning ', 2019

JITEN R ADAV Final Year Student pursuing B.E(Computer Engineering), PimpriChinchwad College of Engineering and Research, Ravet.

AKASH P SHINDE Final Year Student pursuing B.E(Computer Engineering), PimpriChinchwad College of Engineering and Research, Ravet.

KAPIL N SHARMA Final Year Student pursuing B.E(Computer Engineering), PimpriChinchwad College of Engineering and Research, Ravet.

NEERAJ KUMAR YADAV Final Year Student pursuing B.E(Computer Engineering), PimpriChinchwad College of Engineering and Research, Ravet.

JAMEER G KOTWAL Prof. at, PimpriChinchwad College of Engineering and Research(computer department), Ravet.

Severity Prediction System for Real Time Pothole Detection

**Sumit Bhimte¹, Hrishikesh hasabnis², Rohit Shirsath³,
Saurabh Sonar⁴, Mahendra Salunke⁵**

^{1,2,3,4}B.E (Computer Engineering), Pimpri Chinchwad College Of Engineering And Research, Ravet, Pune, Maharashtra, India

⁵Asst. Professor, Department of Computer Engineering, Pimpri Chinchwad College Of Engineering And Research, Ravet, Pune, Maharashtra, India,

¹Email: bhimtesumit118@gmail.com ²Email: hrishikeshhasabnis@gmail.com

³Email: rohitshirsath2182@gmail.com ⁴Email: sonarsaurabh1@gmail.com

⁵Email: mahendra.salunke@pccoer.in

This paragraph of the first footnote will contain support information, including sponsor and financial support acknowledgment. For example, "This work was supported in part by the U.S. Department of Commerce under Grant BS123456."

ABSTRACT: Pothole Detection System using Image Processing or using Accelerometer is not a new normal. But there is no real time application which utilizes both techniques to provide us with efficient solution. We present a system which can be useful for the drivers to determine the intensity of Pothole using both Image Processing Technology and Accelerometer device-based Algorithm. The challenge in building this system was to efficiently detect a Pothole present in roads, to analyze the severity of Pothole and to provide users with information like Road Quality and best possible route. We have used various algorithms for frequency-based pothole detection. We compared the results.

Apart from that, we selected the best approach suitable for achieving the project goals. We have used a Simple Differentiation-based Edge Detection Algorithm for Image Processing. The system has been built on Map Interfaces for Android devices using Android Studio, which consists of usage of Image Processing Algorithm based Python frameworks which is a sub field of Machine Learning. It is backed by powerful DBMS. This project facilitates use of most efficient technology tools to provide a good user experience, real time application, reliability and improved efficiency.

INDEX TERMS: Image Processing, Accelerometer, OpenCV, Dark Net, Pothole Detector, Deep Learning.

I. INTRODUCTION

There are a lot of people who faces severe injuries, traumatic events, accidents, fatal encounters because of poor road facility across different parts of India. This is an attempt to reduce and correct these deadly events. It can also be useful to provide the government with appropriate information. It will also be capable of showing people about different alternatives which can be safer options for travelling. Our attempt is to design a Map based Interface System that takes Real Time Road Images and Pothole Frequency Readings as data using devices like Accelerometer and Camera in order to process the acquired data to check the existence of the pothole and to check the Severity of Potholes and Quality of Road. In this project we have used cutting-edge technology like YOLOv4 which is a framework developed by Snapchat for real time object detection.

Apart from that, we have used 'darknet' library which is extensively developed for computation of YOLOv4. This is a supervised machine learning technique where we have manually trained a dataset of 600 images. Also, we have an IOT aspect in our project in which we have used Accelerometer sensor to take the X, Y, Z 3D coordinates. We have applied queries on RDBMS table accordingly to obtain the pothole location in the form of latitude, longitude. The real time camera input will guide the driver about the potential threats in the form of potholes. If any fluctuations are observed even after pothole detection, it is inferred that the pothole is severe. Accordingly, the location of pothole is provided with appropriate color. Else, the pothole is considered to be less risky, which is notified using some different color. This color chromatology is provided on map-based

interface application designed for mobile phones. The whereabouts of the project are depicted in Figure 1.

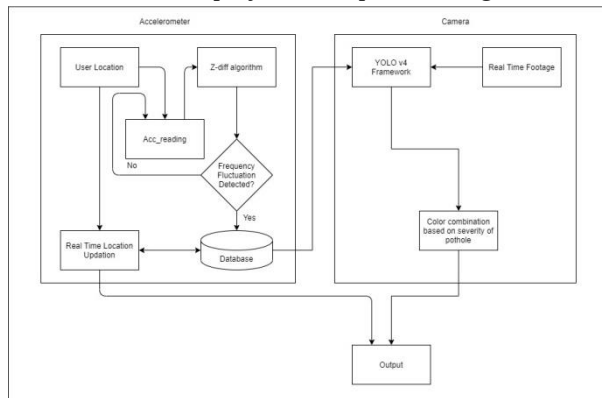


Figure 1. Architecture Diagram for Pothole detection Project

II. LITERATURE SURVEY

A Road Quality Detection Method - HUAIJUN WANG, NA HUO, JUNHUAI LI, KAN WANG, AND ZHIXIAO WANG Shaanxi Key, Shaanxi Key Laboratory for Network Computing and Security Technology, School of Computer Science and Engineering, Xi'an University of Technology, Xi'an 710048, China.

In this research paper the accelerometer sensor has fluctuations when the vehicle passes through the remarkably larger. They developed application to gather and manipulate sensor data, and then predict road quality conditions.

Real Time Pothole Detection using Android Smartphones with Accelerometers - Artis Ednis, Girts Strazdins, Reinholds Zviedris, Georgijs Kanonirs, Leo Selavo, Digital Signal Processing Laboratory Institute of Electronics and Computer Science. This paper describes a mobile inbuilt sensing system for road quality detection. Data processing algorithms to processing the accelerometer data are discussed and their processing presented using actual data.

A Modern Pothole Detection technique using Deep Learning - Abhishek Kumar, Chakrapani, Dhruva Jyoti Kavita, Department of Computer Science and Engineering National Institute of Technology, Allahabad

This paper proposed use of YOLOv4, darknet, Computer Vision i.e., OpenCV library as software aspects for image processing to detect potholes. This model is basically based on region-based Convolutional Neural Network (RCNN) and darknet. According to the model that has been prepared, accurate video output which shows the presence of pothole is returned for the respective input.

III. METHODOLOGY

This is a supervised machine learning technique where we have manually trained a dataset of 600 images. Also, we have an IOT aspect in our project in which we have used Accelerometer sensor to take the X, Y, Z 3D coordinates. We have applied queries on RDBMS table accordingly to obtain the pothole location in the form of latitude, longitude. The real time camera input will guide the driver about the potential threats in the form of potholes. If any fluctuations are observed even after pothole detection, it is inferred that the pothole is severe. Accordingly, the location of pothole is provided with appropriate color. Else, the pothole is considered to be less risky, which is notified using some different color. This color chromatology is provided on map-based interface application designed for mobile phones. The following diagram will depict the whereabouts of the project. The proposed methodology is shown in Figure.2

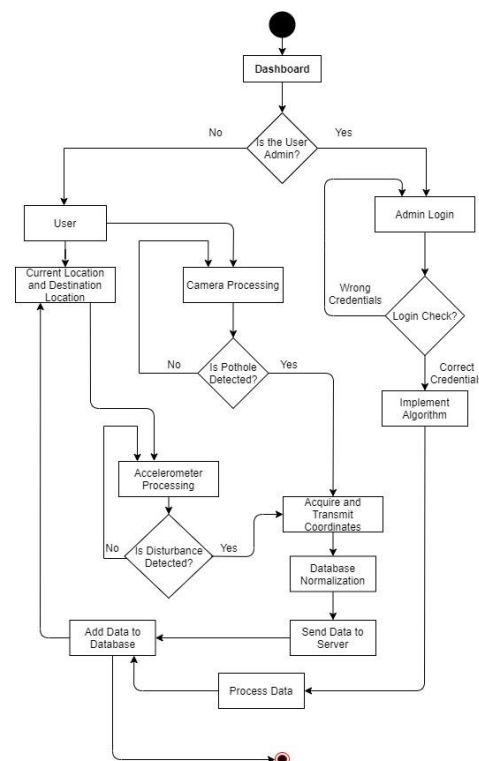


Figure 2. System Architecture

DATA PRE-PROCESSING

Data preprocessing is a technique in which we transform the raw data in a useful, clean and efficient format for further training the models. In our module, we transform X, Y, Z coordinate readings obtained from accelerometer into potential pothole locations. Initially it contained 27166 readings upon which stored procedure was applied, which got converted into 8 readings which were the actual pothole locations. For image processing we took a dataset of 600 pothole images which were manually

trained by all of us.

LOGIC FOR ACCELEROMETER

Data in the form of a dataset from the accelerometer sensors were collected on an urban road with various potholes. MansOS based software was used, to obtain raw acceleration data and transmit it through a USB interface to a laptop computer. Consecutive measurements with difference value above specific threshold level represent events. Road Mic pothole detection methodology was used to collect reference data, where Road Mic tests were performed. Research of potential event-related features was performed, after the acquisition of the first test data set. The emphases were put on features that do not require resource-intensive signal processing techniques and therefore are suitable for implementation of real-time detection using devices with limited hardware and software resources. It is similar to the z-peak algorithm used in Pothole Patrol and Traffic Sense systems, and is thresholding the acceleration amplitude at Z-axis. The features that classify the measurements are the values exceeding specific thresholds that identify the type of the potholes.

The algorithm is trained in such a way that it assumes about the information regarding the Z-axis position of the accelerometer is known. Additional virtual reorientation of the accelerometer is possible, as described in Neric ell. We used the controlled placement of the accelerometer and eliminated the extra processing required for the virtual reorientation. This also tested on the acquired data set. It searches for the two consecutive measurements with a difference in their values above a specific threshold level was performed, instead of ZTHRESH. Fast changes in vertical acceleration data were detected by the algorithm. It is required by the algorithm to determine the Z-axis position similar to the previous approach. After the analysis of the related work, it was decided by the authors to implement some of the algorithms that could be used for post-processing. The standard deviation of vertical acceleration was one of the techniques which looked promising to implement a resource-constrained device. Pothole detection algorithm STDEV. Measurements with standard deviation value above specific threshold level represent events.

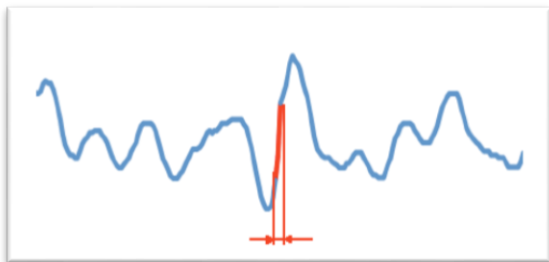


Figure 4. Pothole Detection Algorithm: Z-Diff

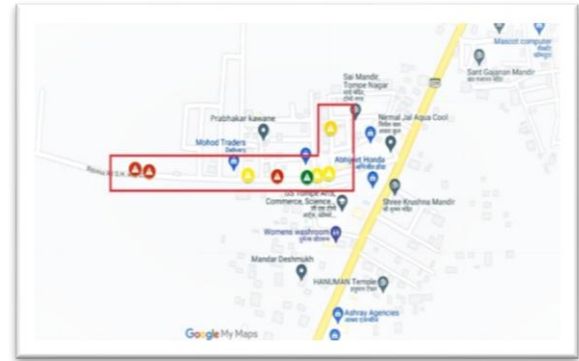


Figure 5. Google Map interface to depict pothole locations

LOGIC FOR IMAGE PROCESSING

We have used high resolution images and videos as input for the purpose of training and building computer vision system. Images are accordingly converted into convenient resolution. We have used YOLOv4, darknet, Computer Vision i.e., OpenCV library as software aspects for this project. We had a dataset consisting of 600 high resolution images, of which 30 images are used for training and remaining images are used for testing. Before providing all the images to create a model, it was necessary to process the images and convert them into suitable format. Initially all the images were in high end resolution which were resized and compressed into suitable processing format but not losing its actual property as well as quality. Also, low light images were enhanced using MIRNET model. We were successful in creating a label called 'Pothole' which was manually provided in each image used for training. Depending on the input images provided it was possible for us to recognize potholes in sample videos.

YOLO framework also known as 'You Only Look Once' deals with object detection. It takes entire image/video in a single instance. It returns boundaries of the detected object in the form of coordinates. It works on the principle of probabilities; higher the obtained probability higher is the accuracy of the detected object. It is a very fast technique which can process 45 frames per second. For training, YOLO takes an image and converts it into 3 x 3 grid and checks for the probability of presence of given object (Pothole) in each grid individually. Each grid is assigned values 0 or 1 according to the probability. For testing, images are passed and run-in forward propagation until we obtain output. It uses RCNN family of techniques. According to the model that has been prepared, accurate video output which shows the presence of pothole is returned for the respective input.

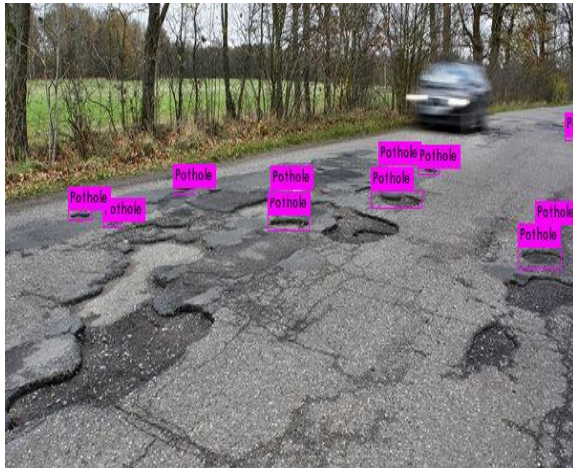


Figure 6. Image Processing Output

IV. GAP ANALYSIS

Current Situation	Desired Situation
Pothole detection using only Accelerometer and only Image Processing has been implemented.	To create a system which can use both Accelerometer as well as Image Processing to obtain high accuracy.
No technology to predict the severity of pothole available.	To create an application in such a way that the severity of pothole can be predicted using color chromatology.
Dataset for these projects only work for day light scenario.	Dataset for our desired project can work in night light as well.
Algorithm like canny edge has been used in pothole detection by image processing.	We will use low light image enhancement algorithms like MIRNET in order to enhance the lighting conditions in image and then use Canny edge algorithm to achieve image processing for low light images.

V. CONCLUSION AND FUTURE SCOPE

We proposed a system where user can get the location of Potholes, the Quality of Road, severity of a pothole, optimal path. The system detects Potholes through Accelerometer and Camera. The frequency related data and the location coordinates are stored in database and respectively processed and updated in real time. The result is shown in the form of Map so that user can choose best possible path and avoid damage or accidents.

Future Scope: In future, we can implement image processing system to avoid pothole in embedded system car. We can implement image processing using thermal imaging, night vision camera to detect potholes in poor lighting conditions. Like Google Maps, we can get information and location about potholes on our smartphones to avoid the accident conditions.

ACKNOWLEDGMENT

We would like to take this opportunity to thank our internal guide **Prof. Mahendra Salunke** for giving us all the help and guidance we needed. We are grateful to them for their kind support. Their valuable suggestions were very much helpful. We are also much grateful to **Prof. Archana Chaugule**, Head of the Computer Engineering Department, Pimpri Chinchwad College of Engineering and Research for her indispensable support as well as suggestions. In the end our special thanks to all the **staff members** for providing various resources such as a laboratory which has all the needed software platforms and continuous Internet connectivity.

REFERENCES

- [1] A Road Quality Detection Method - HUIJUN WANG, NA HUO, JUNHUI LI, KAN WANG, AND ZHIXIAO WANG Shaanxi Key, Shaanxi Key Laboratory for Network Computing and Security Technology, School of Computer Science and Engineering, Xi'an University of Technology, Xi'an 710048, China
- [2] Real Time Pothole Detection using Android Smartphones with Accelerometers - Artis Mednis, Girts Strazdins, Reinholds Zviedris, Georgijs Kanonirs, Leo Selavo, Digital Signal Processing Laboratory
- [3] A Modern Pothole Detection technique using Deep Learning - Abhishek Kumar, Chakrapani, Dhruba Jyoti Kalita, Department of Computer Science and Engineering National Institute of Technology,
- [4] Deep Learning Approach to Detect Potholes in Real-Time using Smartphone -Shebin Silvester, Dheeraj Komandur, Shubham Kokate, Aman Kumar, School of Computer Engineering and Technology Dr. Vishwanath Karad MIT World Peace University India - 2020.
- [5] Multi-lane Pothole Detection from Crowd sourced Under sampled Vehicle Sensor Data - Andrew Fox, Member, IEEE, B.V.K. Vijaya Kumar, Fellow,
- [6] IEEE, Jinzhu Chen, Member, IEEE, and Fan Bai, Fellow, IEEE

A SURVEY ON VARIOUS AVAILABLE OBJECT DETECTION MODELS AND APPLICATION IN AUTOMATIC LICENCE PLATE DETECTION

Aditya Kulkarni¹, Manali Munot², Sai Salunkhe³, Shubham Mhaske⁴, Nilesh Korade⁵

1 Student at Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101

2 Student at Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101

3 Student at Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101

4 Student at Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101

5 Asst. Professor at Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101

ABSTRACT

With the development in technologies right from serial to parallel computing, GPU, AI, and deep learning models a series of tools to process complex images have been developed. The main focus of this research is to compare various algorithms (pre-trained models) and their contributions to process complex images in terms of performance, accuracy, time, and their limitations. The pre-trained models we are using are CNN, R-CNN, R-FCN, and YOLO. These models are python language-based and use libraries like TensorFlow, OpenCV, and free image databases (Microsoft COCO and PAS-CAL VOC 2007/2012). These not only aim at object detection but also on building bounding boxes around appropriate locations. Thus, by this review, we get a better vision of these models and their performance and a good idea of which models are ideal for various situations.

INDEX TERMS Digital Image Processing, OpenCV, License Plate Detection, License Plate Recognition, YOLO, OCR.

I. INTRODUCTION

Many systems use vehicle plate identification and recognition, including travel time calculation, highway car counting, traffic violation detection, and surveillance applications. As the population grows, so does the number of vehicles on the road. As a result, finding a parking spot for a large number of students and faculty at Educational Institutions has become increasingly difficult. The majority of parking lots are handled manually by security guards who may or may not keep track of the vehicles parked there. As a result, the vehicle driver must continue to walk the parking lot in search of a parking spot. In the absence of security guards, car robberies and quarrels between drivers over parking spaces can occur. Automated License Plate Recognition (ALPR) is another name for Automated Number Plate Recognition (ANPR). Automatic Number Plate Recognition, or ANPR, is a technology that 'reads' vehicle number plates using pattern recognition. Simply put, ANPR cameras 'photograph' the number plates of vehicles that violate the rules as they drive by. This 'photograph' is then fed into a computer system, which extracts information about the vehicle's driver and owner, as well as information about the vehicle itself. ANPR is made up of CCs that are regulated by a computer. When a car passes, ANPR 'reads' Vehicle Registration Marks – also known as number plates – from digital images captured by cameras mounted on a mobile unit or in traffic monitoring vehicles. In the identification of license plates, computer vision and character recognition, as well as algorithms for license plate recognition, play a critical role. As a result, they are the foundation of every ANPR scheme. A static camera, a frame grabber, a monitor, and specially built applications for image processing, analysis, and recognition are all part of the framework for automatic car license plate recognition.

2. RELATED WORK

Due to the exponential growth of automobiles, bikes, and other vehicles, automatic number plate recognition is a well-known proposal in today's world. For vehicle identification, this automated number plate recognition device employs image processing technology. This device can be used in densely populated and restricted areas to quickly identify vehicles that have broken traffic rules, as well as retrieve the owner's name, address, and other information.

P. Meghana, S. Sagar Imambi, P. Sivateja, and K. Saira collaborated on the design and implementation of the proposed concept.

3. APPROACH

The solution for these issues can be provided with the help of already feasible and efficient CCTV camera networks. Most of the residential society, tolls, business complexes and parking spaces have CCTV surveillance systems implemented. The idea is SIMPLE: To use existing CCTV systems to cope with the problems. For residential societies: If an unknown vehicle enters the premise, the authorities and security will be notified. Tracking and storing the vehicles passing through a checkpoint. Based on this data critical analysis can be performed. Number plate recognition on real time data: This ensures that the whole video is processed in real time and only the license plate data is stored. Web-based portal for manual monitoring and operating the system.. Methodology of the project is given below:

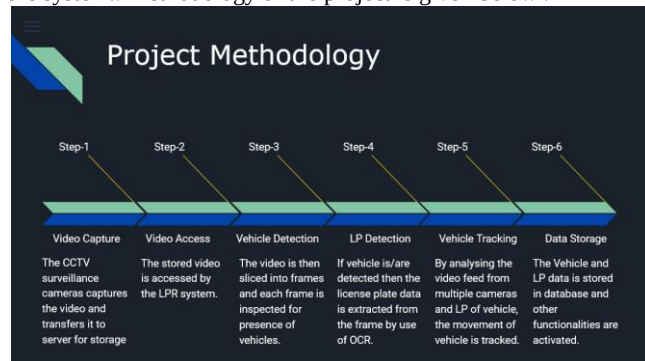


Figure 1: Project Methodology

METHODOLOGY

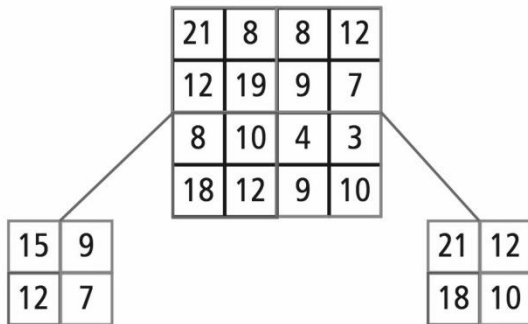
4.1 Convolutional Neural Network (CNN)

Convolution Neural Network (CNN) is a specialized neural network for processing the data that has input in the form of a 2D matrix; like image. The most important property of a convolutional neural network is that the algorithm itself assigns importance in the form of learnable weights and biases to various aspects and objects in the image. This means that CNN is able to recognize the more accurate features and differentiate important features from unimportant ones. CNNs are specifically used for image detection and classification. Seldom use of CNN is noted in pattern detection and matching. Most of the use of CNN is on data in the form of an image. Images are a 2D matrix of pixels. We can use CNN to either recognize the image or classify it. The convolution neural network model can be defined in form of three layers:

- 1. Convolution Layer:** The purpose of the convolution layers is to extract different features of the input. The first convolution layer extracts low-level features like edges, lines, and corners. Higher-level layers extract higher-level features like objects and shapes. The input is a 3D matrix of size $N \times N \times D$ and is convolved with H kernels, each of size $k \times k \times D$ separately. Convolution of input with one kernel generates one output feature, thus a total of H output features are generated. The Kernel starts from the top-left corner of the input, each kernel is moved from left to right, one element at a time. Once the top-right corner is reached, the kernel is moved one element in a downward direction, and again the kernel is moved from left to right, one element at a time. This process is repeated until the kernel reaches the bottom-right corner. For each position of the kernel in a sliding window process, $k \times k \times D$ elements of input and $k \times k \times D$ elements of the kernel are element-by-element multiplied and accumulated. So to create one element of one output feature, $k \times k \times D$ multiply-accumulate operations are required.

- 2. Pooling Layer:** The pooling layer, also called the subsampling layer decreases the resolution of the features. It makes the features immune to noise and distortion. There are two ways to do pooling: max pooling and average pooling. In both cases, the input is divided into non-overlapping two-dimensional

spaces. Consider the following 4x4 matrix:

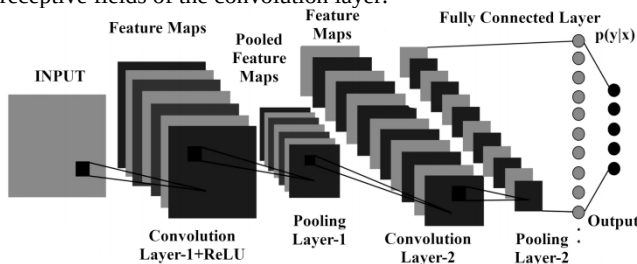


Average Pooling

Max Pooling

Figure 2: Example of max pooling and average pooling

- **Average Pooling:** In this pooling method, the average of the values in a region is calculated and used to represent the region. For instance in the above matrix top-left region has values [21, 8, 12, 19]. So on average pooling, this region is represented by the average of these numbers i.e 15.
- **Max Pooling:** In this pooling method, the maximum of the values in a region is used to represent the region. For instance in the above matrix top-left region has values [21, 8, 12, 19]. So on max pooling, this region is represented by the maximum number among these numbers i.e 21.
- **Fully Connected Layer:** Fully connected layers are often used as the final layers of a CNN. These layers mathematically sum a weighting of the previous layer of features, indicating the precise mix of “ingredients” to determine a specific target output result. In the case of a fully connected layer, all the elements of all the features of the previous layer get used in the calculation of each element of each output feature.
- **ReLU-Rectified Linear Units:** Neural networks in general and CNNs, in particular, rely on a non-linear “trigger” function to signal distinct identification of likely features on each hidden layer. CNN may use a variety of specific functions — such as rectified linear units (ReLU) and continuous trigger (non-linear) functions — to efficiently implement this nonlinear triggering. ReLU implements the function $y = \max(x, 0)$, so the input and output sizes of this layer are the same. It increases the nonlinear properties of the decision function and the overall network without affecting the receptive fields of the convolution layer.



4.2 Region Based Convolutional Neural Networks(R-CNN)

To overcome the problem of selecting a very high number of regions, Ross Girshick et al. proposed a method called region proposals. In region proposals, we use selective search to only take out 2000 regions from the image and work only with these 2000 regions. Selective search uses hierarchical grouping to find out regions that have similar regions based on color, text, size, and shape. Selective search algorithm is :

1. Generate potential regions from the initial Segmentation.
2. Combine similar regions to form larger regions recursively using the Greedy algorithm.
3. Use these regions to produce final candidate regions. [12]

R-CNN: Regions with CNN features

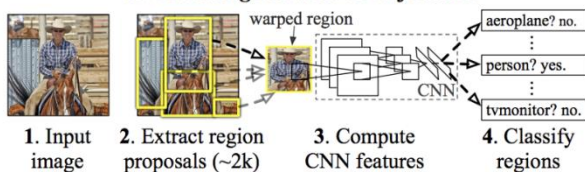


Figure 3: Regions with CNN features-RCNN [12]

Now, these 2000 region proposals are then fed to CNN as input by arranging them into a square pattern. CNN acts as a feature extractor and produces a 4096-dimensional vector output. These output layers consist of features that are further fed to SVM to classify the object present in the candidate region. Furthermore, the algorithm will also predict four values which are offset values to increase the precision of bounding boxes. R-CNN also has a few limitations. It takes up to 47 seconds for each image to be processed which is not possible to be implemented in real life. It also takes much time to train as 2000 regions must be extracted from each image. [12]

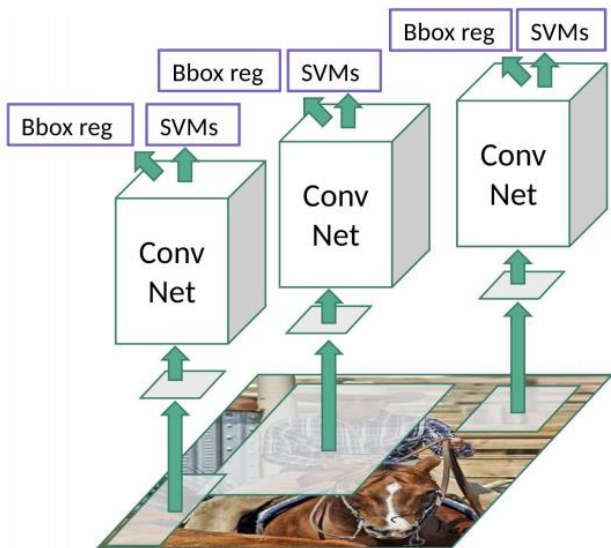


Figure 4: RCNN [3]

4.3 Fast Region Based Convolutional Neural Networks(F-RCNN)

The same author of R-CNN solved some of the issues of R-CNN and developed Fast-RCNN, A faster object detection algorithm.

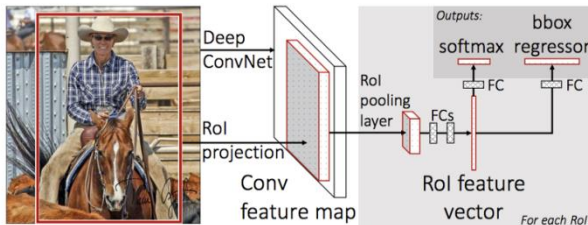


Figure 5: F-RCNN [13]

The approach of Fast-RCNN is comparable to R-CNN but we feed the input image to CNN to generate a convolutional feature map instead of region proposals. From this feature map, we recognize the various regions of proposals and warp them into squares. Further, we reshape them into a fixed size using the ROI pooling layer to feed them to a fully connected layer. From the ROI feature vector, the class of the proposed region and also the offset values for the bounding box can be predicted using a softmax layer. Since you don't have to feed 2000 region proposals to the convolutional neural network every time, "Fast R-CNN" is faster than R-CNN. Instead, a feature map is created from the convolution operation, which is done only once per image. [13]

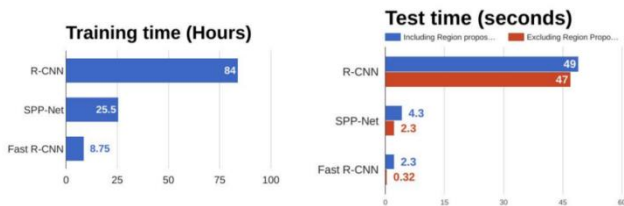


Figure 6: Comparison of Training and Testing time of RCNN and F-RCNN [3]

Fast R-CNN is substantially faster in training and research sessions than R-CNN, as seen in the graphs above. When comparing the output of Fast R-CNN during research, using region proposals significantly slows down the algorithm compared to not using region proposals. As a result, region proposals become bottlenecks in the Fast R-CNN algorithm, slowing it down.

4.4 Faster Region Based Convolutional Neural Networks

To find area proposals, both of the above algorithms (R-CNN and Fast R-CNN) use selective search. Selective search is a slow and time-consuming process that degrades network efficiency. As a result, Shaoqing Ren et al. devised an object detection algorithm that does away with the selective search algorithm and allows the network to learn region proposals.

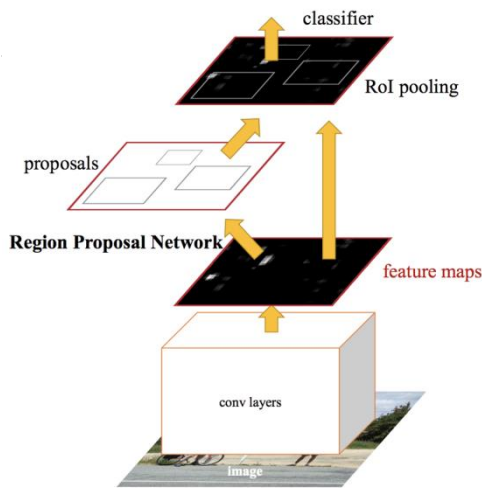


Figure 7 : Faster R-CNN [1]

The image is fed into a convolutional network, which outputs a convolutional feature map, similar to Fast R-CNN. A separate network is used to predict the region proposals instead of using a selective search algorithm on the feature map to find the region proposals. The predicted region proposals are reshaped using the ROI pooling layer and the further image is classified within the proposed region and predicts the offset values for the bounding boxes. [1] Faster R-CNN is clearly faster than its predecessors, as seen in the graph below. As a result, it can also be used for real-time object detection.

R-CNN Test-Time Speed

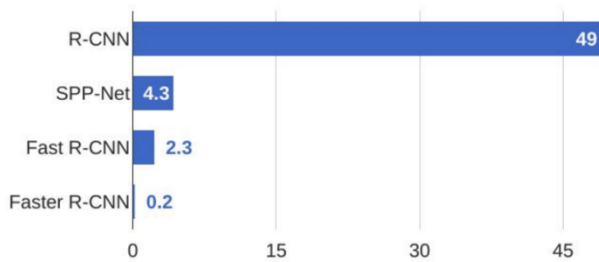


Figure 8: Comparison of test-time speed of object detection algorithms [3]

4.5 You Only Look Once (YOLO)

YOLO is a real-time object detection algorithm that is much faster and accurate than all other models. All other algorithms excluding YOLO use multiple parts of the image which have a good probability of containing the object to detect objects. They do not take a complete view of the image. On the contrary, YOLO uses only a single neural network which will then divide the image into various regions to find bounding boxes and probabilities of the image. This saves a lot of time as thousands of neural networks required by all other models are reduced to just one neural network in YOLO which can make the algorithm up to 100 times faster than all other algorithms. YOLO has the capability of processing images at the rate of 45 frames per second. [2] YOLO divides the image into $S \times S$ grids. For each grid formed we take m bounding boxes. Then the bounding boxes are processed by the network giving us output as class probability and offset values for each bounding box. The bounding boxes which have probability above the baseline are then selected for image detection. The problem with this approach is that this approach will contend resolutely with small objects as they have very less detectable features. [2]

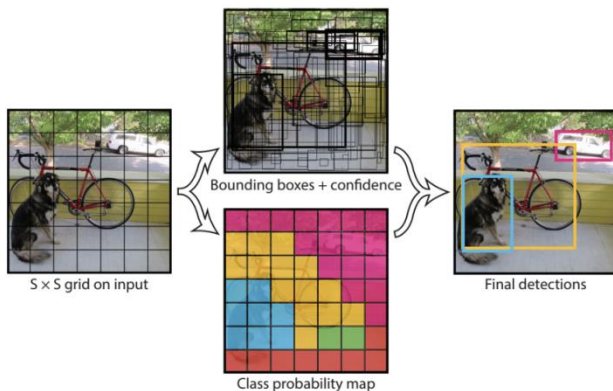


Figure 9: Working of YOLO [2]

Bounding boxes and confidence scores for these boxes are predicted in each grid cell. These confidence scores reflect the model's assumption that the box contains an object as well as the accuracy with which it assumes the box it predicts is. Confidence is defined as: $\Pr(\text{Object}) * \text{IOU}(\text{truth}, \text{pred})$ in formal terms. The confidence scores should be zero if no entity exists in that cell. Otherwise, the confidence score should be equal to the intersection over union (IOU) between the predicted and ground truth boxes. There are five predictions in each bounding box: x , y , w , h , and confidence. The (x, y) coordinates represent the box's centre in relation to the grid cell's borders. The width and height are calculated in terms of the entire image. Finally, the IOU between the expected box and any ground truth box is expressed by the confidence prediction. Each grid cell also predicts:

$$\Pr(\text{Class}_i | \text{Object}) * \Pr(\text{Object}) * \text{IOU}(\text{truth}, \text{pred}) = \Pr(\text{Class}_i) * \text{IOU}(\text{truth}, \text{pred})$$

This gives us confidence scores for each box depending on the class. These scores reflect the likelihood of that class appearing in the box as well as the

accuracy with which the expected boxmatches the item.

5. RESULTS AND DISCUSSION

5.1 Comparison

It is quite difficult to find the comparison between various object detection algorithms. In real life, we can use speed and accuracy to compare them. There are numerous other factors that impact their performance right from feature extractors, image resolution to training sets, platforms used, etc. Performance Results :

1. **Faster R-CNN**: The results of the PASCAL VOC 2012 test set are shown below. The last three rows, which reflect the Faster R-CNN output, are what we're interested in. The number of RoIs made by the region proposal network is shown in the second column. The training dataset is described in the third column. In measuring accuracy, the fourth column is the mean average precision (mAP).

5.1.1 Results on PASCAL VOC 2012 test set:

method	# proposals	data	mAP (%)
SS	2000	12	65.7
SS	2000	07++12	68.4
RPN+VGG, shared [†]	300	12	67.0
RPN+VGG, shared [‡]	300	07++12	70.4
RPN+VGG, shared [§]	300	COCO+07++12	75.9

Figure 10: VOC 2012 for Faster R-CNN.[1]

method	proposals	training data	COCO val		COCO test-dev	
			mAP@.5	mAP@[.5, .95]	mAP@.5	mAP@[.5, .95]
Fast R-CNN [2]	SS, 2000	COCO train	-	-	35.9	19.7
Fast R-CNN [impl. in this paper]	SS, 2000	COCO train	38.6	18.9	39.3	19.3
Faster R-CNN	RPN, 300	COCO train	41.5	21.2	42.1	21.5
Faster R-CNN	RPN, 300	COCO trainval	-	-	42.7	21.9

Figure 11: COCO for Faster R-CNN

model	system	conv	proposal	region-wise	total	rate
VGG	SS + Fast R-CNN	146	1510	174	1830	0.5 fps
VGG	RPN + Fast R-CNN	141	10	47	198	5 fps
ZF	RPN + Fast R-CNN	31	3	25	59	17 fps

Figure 12: Timing on a K40 GPU in millisecond with PASCAL VOC 2007 test set.[1]

5.1.2 Fast-RCNN

	training data	mAP (%)	test time (sec/img)
Faster R-CNN [9]	07++12	73.8	0.42
Faster R-CNN +++ [9]	07++12+COCO	83.8	3.36
R-FCN multi-sc train	07++12	77.6 [†]	0.17
R-FCN multi-sc train	07++12+COCO	82.0 [‡]	0.17

13: VOC 2012 for R-FCN [8]

	training data	test data	AP@0.5	AP	AP small	AP medium	AP large	test time (sec/img)
Faster R-CNN [9]	train	val	48.4	27.2	6.6	28.6	45.0	0.42
R-FCN	train	val	48.9	27.6	8.9	30.5	42.0	0.17
R-FCN multi-sc train	train	val	49.1	27.8	8.8	30.8	42.2	0.17
Faster R-CNN +++ [9]	trainval	test-dev	55.7	34.9	15.6	38.7	50.9	3.36
R-FCN	trainval	test-dev	51.5	29.2	10.3	32.4	43.3	0.17
R-FCN multi-sc train	trainval	test-dev	51.9	29.9	10.8	32.8	45.0	0.17
R-FCN multi-sc train, test	trainval	test-dev	53.2	31.5	14.3	35.5	44.2	1.00

Figure 14: COCO for R-FCN [8]

5.1.3 YOLO

Detection Frameworks	Train	mAP	FPS
Fast R-CNN [5]	2007+2012	70.0	0.5
Faster R-CNN VGG-16 [15]	2007+2012	73.2	7
Faster R-CNN ResNet [6]	2007+2012	76.4	5
YOLO [14]	2007+2012	63.4	45
SSD300 [11]	2007+2012	74.3	46
SSD500 [11]	2007+2012	76.8	19
YOLOv2 288 × 288	2007+2012	69.0	91
YOLOv2 352 × 352	2007+2012	73.7	81
YOLOv2 416 × 416	2007+2012	76.8	67
YOLOv2 480 × 480	2007+2012	77.8	59
YOLOv2 544 × 544	2007+2012	78.6	40

Figure 15: VOC 2007 for YOLOv2 [9]

Method	data	mAP	aero	bike	bird	boat	bottle	bus	car	cat	chair	cow	table	dog	horse	mbike	person	plant	sheep	sofa	train	tv
Fast R-CNN [1]	07++12	68.4	82.3	78.4	70.8	52.3	38.7	77.8	71.6	89.3	44.2	73.0	55.0	87.5	80.5	72.0	35.1	68.3	65.7	80.4	64.2	
Faster R-CNN [15]	07++12	70.4	84.9	79.8	74.3	53.9	49.8	77.5	75.9	88.5	45.6	77.1	55.3	86.9	81.7	80.9	79.6	40.1	72.6	60.9	81.2	61.5
YOLO [14]	07++12	57.9	77.0	67.2	57.7	38.3	22.7	68.3	55.9	81.4	36.2	60.8	48.5	77.2	72.3	71.3	63.5	28.9	52.2	54.8	73.9	50.8
SSD300 [11]	07++12	72.4	85.6	80.1	70.5	57.6	46.2	79.4	76.1	89.2	53.0	77.0	60.8	87.0	83.1	82.3	79.4	45.9	75.9	69.5	81.9	67.5
SSD512 [9]	07++12	74.9	87.4	82.3	75.8	59.0	52.6	81.7	81.5	90.0	55.4	79.0	59.8	88.4	84.3	84.7	83.3	50.2	78.0	66.3	86.3	72.0
ResNet [8]	07++12	73.8	86.5	81.6	77.2	58.0	51.0	78.6	76.6	93.2	48.6	80.4	59.0	92.1	85.3	84.8	80.7	48.1	77.3	66.5	84.7	65.6
YOLOv2 544	07++12	73.4	86.3	82.0	74.8	59.2	51.8	79.8	76.5	90.6	52.1	78.2	58.5	89.3	82.5	83.4	81.3	49.1	77.2	62.4	83.8	68.7

Figure 16: VOC 2012 for YOLOv2 [9]

	backbone	AP	AP ₅₀	AP ₇₅	AP _S	AP _M	AP _L
Two-stage methods							
Faster R-CNN+++ [16]	ResNet-101-C4	34.9	55.7	37.4	15.6	38.7	50.9
Faster R-CNN w FPN [20]	ResNet-101-FPN	36.2	59.1	39.0	18.2	39.0	48.2
Faster R-CNN by G-RMI [17]	Inception-ResNet-v2 [34]	34.7	55.5	36.7	13.5	38.1	52.0
Faster R-CNN w TDM [32]	Inception-ResNet-v2-TDM	36.8	57.7	39.2	16.2	39.8	52.1
One-stage methods							
YOLOv2 [27]	DarkNet-19 [27]	21.6	44.0	19.2	5.0	22.4	35.5
SSD513 [22, 9]	ResNet-101-SSD	31.2	50.4	33.3	10.2	34.5	49.8
DSSD513 [9]	ResNet-101-DSSD	33.2	53.3	35.2	13.0	35.4	51.1
RetinaNet (ours)	ResNet-101-FPN	39.1	59.1	42.3	21.8	42.7	50.2
RetinaNet (ours)	ResNeXt-101-FPN	40.8	61.1	44.1	24.1	44.2	51.2

Figure 17: COCO for YOLOv2 [9]

	backbone	AP	AP ₅₀	AP ₇₅	AP _S	AP _M	AP _L
Two-stage methods							
Faster R-CNN++ [1]	ResNet-101-C4	34.9	55.7	37.4	15.6	38.7	50.9
Faster R-CNN w FPN [6]	ResNet-101-FPN	36.2	59.1	39.0	18.2	39.0	48.2
Faster R-CNN by G-RMI [4]	Inception-ResNet-v2 [19]	34.7	55.5	36.7	13.5	38.1	52.0
Faster R-CNN w TDM [10]	Inception-ResNet-v2-TDM	36.8	57.7	39.2	16.2	39.8	52.1
One-stage methods							
YOLOv2 [13]	DarkNet-19 [13]	21.6	44.0	19.2	5.0	22.4	35.5
SSD513 [4, 7]	ResNet-101-SSD	31.2	50.4	33.3	10.2	34.5	49.8
DSSD513 [2]	ResNet-101-DSSD	33.2	53.3	35.2	13.0	35.4	51.1
RetinaNet [7]	ResNet-101-FPN	39.1	59.1	42.3	21.8	42.7	50.2
RetinaNet [7]	ResNet-101-FPN	40.8	61.1	44.1	24.1	44.2	51.2
YOLOv3 608 × 608	Darknet-53	33.0	57.9	34.4	18.3	35.4	41.9

Figure 18: COCO for YOLOv3 [10]

5.2 Conclusion from Comparisons

Although the R-FCN model is faster on average, it cannot match the precision of the Faster R-CNN if speed is not a factor. R-CNN that is faster needs at least 100 milliseconds per image. Detection accuracy is negatively impacted when only low-resolution feature maps are used. The resolution of the input image has a huge effect on accuracy. When image size is reduced by half in width and height, accuracy is reduced by 15.88 percent on average, but inference time is reduced by 27.4 percent on average. If only one IoU is used to measure mAP, use mAP@IoU=0.75.

5.3 Application in Licence Plate Recognition

YOLO (You Only Look Once) algorithm is used to detect vehicles and the number plate respectively from the videos and images. As compared to other algorithms, YOLO algorithms operate much faster. Because of its algorithm and the way it is trained, YOLO is most likely a highly generalised network. It processes each frame at a rate ranging from 45 frames per second (fps) for a larger network to 150 frames per second (fps) for a smaller network, which is better than real-time. Hence, YOLO improves detection efficiency by training on complete images.

5.4 Conclusions

We proposed a device in this project that would detect when a vehicle entered the premises. Then the number plate will then be detected, the text will be retrieved, and the corresponding owner information will be obtained from the database. To detect vehicles and licence plates, the YOLO V3 is used. As a result, putting this device in place has the potential to alter the current trend and aid protection in a variety of ways.

ACKNOWLEDGMENT

We would like to extend our special thanks to Prof. Dr. Archana Chaugule, Head, Department of Computer Engineering, and Prof. Jameer Kotwal, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research for their encouragement and useful critiques for this research work. We would also like to thank our internal guide, Prof. Nilesh Korade for guiding us through this project.

REFERENCES

- [1] Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks Shaoqing Ren, Kaiming He, Ross Girshick, and Jian Sun
- [2] You Only Look Once: Unified, Real-Time Object Detection Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi University of Washington, Allen Institute for AI, Facebook AI Research
- [3] http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture11.pdf
- [4] A. K. Alexander Mordvintsev, "Face detection using haar cascades," 2013. [Online].
- [5] T. datascience, "What's the difference between haar feature classifiers and convolutional neural networks?" 2018. [Online].
- [6] Z. Yu and C. Zhang, "Image based static facial expression recognition with multiple deep network learning," Proceedings of the 2015 ACM on International conference on Multimodal Interaction - ICMi 15, 2015.
- [7] C. Shan, A comprehensive study, "Image and Vision Computing, vol. 27, no. 6, p. 803–816, 2009
- [8] R-FCN: Object Detection via Region-based Fully Convolutional Networks Jifeng Dai Microsoft Research, Yi Li Tsinghua University, Kaiming He Microsoft Research, Jian Sun Microsoft Research
- [9] YOLO9000: Better, Faster, Stronger Joseph Redmon, Ali Farhadi University of Washington, Allen Institute for AI
- [10] YOLOv3: An Incremental Improvement Joseph Redmon, Ali Farhadi University of Washington
- [11] Sharifara, M. S. M. Rahim, and Y. Anisi, "A general review of human face detection including a study of neural networks and haar feature-based cascade classifier in face detection," 2014 International Symposium on Biometrics and Security Technologies (ISBAST), 2014.
- [12] Rich feature hierarchies for accurate object detection and semantic segmentation Techreport (v5) Ross Girshick Jeff Donahue Trevor Darrell Jitendra Malik UC Berkeley
- [13] Fast R-CNN Ross Girshick Microsoft Research
- [14] M. Nielsen, Neural Networks and Deep Learning. [5] R. K. Samer Hijazi and C. Rowen, "Using convolutional neural networks for image recognition," 2015.
- [15] S. University, "Introduction To Convolutional Neural Networks," 2018 MANALI MUNOT Final Year Student pursuing B.E (Computer Engineering), Pimpri Chinchwad College of Engineering and Research, Ravet.

ADITYA KULKARNI Final Year Student pursuing B.E (Computer Engineering), Pimpri Chinchwad College of Engineering and Research, Ravet.

SHUBHAM MHASKE Final Year Student pursuing B.E (Computer Engineering), Pimpri Chinchwad College of Engineering and Research, Ravet.



SAYEE SALUNKHE Final Year Student pursuing B.E(Computer Engineering), Pimpri Chinchwad College of Engineering and Research, Ravet.

MILESH KORADE Final Year Student pursuing B.E(Computer Engineering), Pimpri Chinchwad College of Engineering and Research, Ravet.

VOLUME 1, 2021 Pimpri Chinchwad College of Engineering & Research

Music Genre Classification and Segregation

Prof. Shweta Koparde¹, Vaishnavi Bhadgaonkar², Gauri Basutkar³, Kalyani Patil⁴, and Dhanashri Gayke⁵

¹Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet – 412101 IND

^{2,3,4,5}Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet – 412101 IND

ABSTRACT Music has become the most favorable area nowadays especially in youth. Most of the people tend to listen music of certain genre such as classical, hip-hop or disco and want a user-friendly way to classify the music as per their preferences. Due to this “Music Genre Classification” came into picture. Music genre classification is a complex task in music information retrieval (MIR) due to selection and extraction of suitable features. The Machine learning models have been shown to be capable of solving these kinds of real life problems. Music genre classification can be implemented using various machine learning algorithms. In the proposed system, we are using a deep learning technique i.e. convolution neural network (CNN) for classifying the music in various genres. CNNs are used to solve image pattern recognition tasks. While analyzing music, acoustic feature extraction is the most crucial task. In proposed system, model is trained over GTZAN dataset.

INDEX TERMS Convolution Neural Network, Classification, Deep Learning, Neural network.

I. INTRODUCTION

Now-a-days, variety of songs are available and in various genres. People find these songs soothing, encouraging and cheerful. Studies show that soothing music triggers relaxation and improve well-being of our mind, helps reduce stress and anxiety. Also, due to globalization, there are significant changes in the Music Industry because various people like musicians, music producers have taken influence of various music art forms present around the world to produce soulful music. So varieties of songs are available to the users to choose from.

There are number of music streaming providers like Spotify, Gaana, Prime Music, Youtube Music, etc. which with the help of new emerging technologies have improved their songs recommendations and segregation system. These providers use Machine Learning to improve and enhance user experiences and have made streaming music really easy for the customers.

Machine Learning in short can be defined as the name suggests is training of a machine i.e. a computer algorithm. We make this machine capable of learning various things and without doing any kind of explicit programming. It's an interesting branch of Artificial Intelligence where systems i.e. machines learn through various data available called as datasets, identify various patterns and take decisions with very minimal human interaction. Various algorithms are present with their advantages and disadvantages suiting a particular real time issue and with the help of them the system learns, classifies and predicts the decision. There are three main categories in which Machine Learning can be classified

a. Supervised Learning:

Here, the system i.e. the algorithm learns from examples and various responses like string labels or numerical values, which can be used later to predict the output when given a new situation for prediction is called as Supervised Learning. It develops predictive model using both the input as well as the output. Classification and Regression falls under supervised learning.

Fig 1 – Supervised Learning

b. Unsupervised Learning:

In Unsupervised learning, the algorithm learns without any responses like labels, etc. just plain examples are there to help the algorithm identify the data patterns and make decisions. It just groups and interprets data based on the input provided to the algorithm. Clustering falls under unsupervised learning. VOLUME 1, 2021

Fig 2 – Unsupervised Learning

c. Reinforcement Learning:

In Reinforcement learning, no labels are used same as unsupervised learning. However, a concept called reward i.e. feedback is used. This feedback can be positive or else negative and is given with an example for the system to come to a decision. It's similar to a human learning from trial and error.

Fig 3 – Reinforcement Learning

Also, a huge variety of songs are available in the Market and there is a need of classification of music according to its genres. Let's consider an example, if we are having an event at our house, we will always give the preference to the songs matching to that event like if there is a party, rock songs or jazz songs are always the choice. So due to this, it is important and very useful in content based music retrieval and music distribution. Also, due to this genre classification we can understand which the favourite genres of users are and depending on those we can give recommendations to the user.

When a user downloads a song, it gets saved into the downloads folder and if he goes on downloading multiple songs, all the songs will be cluttered there and the user has to segregate them manually into various folders genre-wise which is tedious and time consuming process. Hence we are proposing a system to automate this for users to ease the process of music genre classification with improved performance and accuracy using a machine learning approach.

When a user downloads a song into his system, he/she has to manually save the song into folder of its appropriate genres. This process is tedious and time consuming. Due to this we are proposing our system, where the user just has to upload the song on the website and the song will get segregated into its respective folder

II. LITERATURE SURVEY

S. Vishnupriya and K. Meenakshi[10] in their paper "Automatic Music Genre Classification using Convolutional Neural Network" published in year 2018 proposed an automatic music genre classification system using Convolution Neural Network(CNN). They used GTZAN dataset as input to their system. Feature extraction is an important task which is performed in pre-processing

and they used Mel Frequency Cepstral Coefficient (MFCC) as feature vector. Librosa package is used for feature vector extraction in python. The size of feature vector is 599x13x5 for MFCC. From this database, input is then given to generate spectrograms in the training phase. The learning accuracy obtained using MFCC in this paper is 76%.

Yandre M.G. Costaa, Luiz S. Oliveira b, Carlos N. Silla Jr. c[3] in their paper "An evaluation of Convolutional Neural Networks for music classification using spectrograms" published in year 2017 proposed music genre classification system by using Convolution Neural Network and Support Vector Machine algorithm. They used three dataset: Latin Music Dataset [LMD], ISMIR, African Music Database. LMD consisted of three 3,277 full-length music pieces of 10 different genres. ISMIR 2004 consisted of 1,458 music pieces. This dataset was divided into 50% training and 50% testing. In this paper output of both algorithms is combined

to get more accuracy. The result obtained is the fusion of CNN and SVM which gives 83% Accuracy.

Nikki Pelchat and Craig M. Gelowitz[2] in their paper "Neural Network Music Genre Classification" published in year 2019 proposed a music genre classification system using a machine learning approach that is Convolutional Neural Network (CNN) algorithm. They used a dataset consisting of 1880 songs of different genres. Length of each song in dataset was of 3 minutes. They generated 132,000 labelled spectrogram images by dividing song into 2.56 second segment spectrograms. Then, they splitted dataset into 70% training data, 20% validation data, and 10% test data. These spectrogram images are given as input to CNN algorithm which then classifies the song according to their genre. The accuracy obtained in this paper is 67%.

Elizabeth Nurmiyati Tamatjita and Aditya Wikan Mahastama[4] published a paper .i.e "Comparison of Music Genre Classification Using Nearest Centroid Classifier and k-Nearest Neighbours" in 2016. In this paper they compared music genre classification using Nearest Centroid Classifier (NCC) and K-Nearest Neighbours (KNN). Here, Zero Crossing Rate (ZCR), Silent Ratio (SR) and Average Energy (E) features are extracted from audio files in order to classify songs genre. Their dataset included songs of 12 different genres. Selected features .i.e. ZCR, SR, E are giving the classification with maximum accuracy. The accuracy obtained in this paper is 56.3% with k-Nearest Neighbours (k-NN).

VOLUME 1, 2021 III. DATASETS

A. ISMIR 2004

ISMIR 2004[11] dataset is a collection of audio songs used for Genre Identification which was created for a contest organized by the Music Technology Group (Universitat Pompeu Fabra). Songs were from 8 different genres namely classical, electronic, jazz & blues, metal, punk, rock, pop and world and from them 6 classes are formed which are electronic, Jazz/Blues, world, classical, metal/punk and rock/pop. This dataset consist of 320 classical, 115 electronic, 26 Jazz/Blues, 45 Metal/punk, 101 rock/pop and 122 world songs. All the songs are of MP3 format and it is divided into 3 folders which are Training, Development and Evaluation. Each folder has 6 classes and 729 files.

B. LATIN MUSIC DATASET

Latin Music Dataset (LMD)[12] includes 3,227 music songs of different 501 artists. Songs are of 10 different genres namely Bachata, Bolera, Axe, Merengue, salsa, Gaucha, pagode, Forro, Tango and Taneja. Dataset includes songs with significant similarity with respect to rhythmic structure, instrumentation and harmonic content.

C. GTZAN

GTZAN[6] i.e. Genre Collection dataset from MARSYAS (Music Analysis Retrieval and Synthesis for Audio Signals) contains 1000 songs each of 30 seconds long and has 10 genres like hip-hop, rock, classical, blues, country, disco, jazz, reggae, pop, etc. This is the most used dataset available publicly for evaluation in research for music genre recognition (MGR) for Machine Learning.

IV. ARCHITECTURE

A. PROPOSED SYSTEM

In the proposed model, we are developing a Music Genre Classification System which will classify the songs as per their genres and we are using the GTZAN dataset. After reading the dataset, mel spectrograms are created which is a feature extraction of our song. Pixel values of spectrograms are stored in a file and this file is passed as an input to the CNN algorithm along with the song to be classified. With the help of pixel values CNN algorithm classifies the song into their respected genre.

Also, we are proposing the next module in which our system will automatically classify/put the output of algorithm i.e. classified songs into their respective folder as per their genre; this will help to get a list of songs according to genre. This classification of songs into separate folders according to genre will help user to choose any genre according to the mood or an event. Also, managing of the songs properly genre-wise will help user in efficiently handling the music and in choosing the list of songs.

Therefore, this application has following main modules:

1. Spectrogram File Generation
2. Music Genre Classification
3. User interface i.e. Website
4. Store the song in appropriate genre folder

Fig 4 – Architecture Diagram**B. FEATURE EXTRACTION**

Here, Mel Scale plays an important part. It relates perceived frequency, or pitch, of a pure tone to its actual measured frequency. A frequency which is measured in Hertz (f) can be converted to Mel Scale using the below given formula[19]:

Feature extraction in music genre classification can be done by following ways –

1. Spectrograms:

Spectrogram is one of the ways to visually represent the strength or loudness of a signal as it varies with time at various frequencies present in a particular waveform. Spectrograms are generally 2-Dimensional graphs having third variable which is represented by colour. Optical spectrometer is used to generate spectrogram. Horizontal axis represents time and Vertical axis represents frequency or pitch or tone. The third dimension represents audio's energy or amplitude or loudness. VOLUME 1, 2021

To construct the spectrogram of audio, Signal Analyser follows these steps [18]:

- i) Audio is divided into equal-length segments. The segments should be short enough that the frequency content of the audio doesn't change significantly within a segment. The segments may or may not overlap.
- ii) Then each segment is windowed and its spectrum is computed to get the Short-time Fourier Transform.
- iii) Display spectrogram segment by segment, the power of each spectrum in decibels.

2. MFCC

Mel Frequency Cepstral Coefficients (MFCCs) [17] are mainly used for feature extraction. It is used in automatic speech recognition. Prior to MFCCs, Liner Prediction Coefficients (LPCs) and Linear Prediction Cepstral Coefficient (LPCCs). First step in automatic speech recognition system is to extract all the features .i.e. identify components that are good for identifying linguistic content and removing all other stuffs like background noise, emotion, etc. The main point is that it identifies shape of the vocal tract generated by human and this shape determines what sounds are generated. If this shape is determined accurately, we have accurate representation of sound being produced. So the job of MFCCs is to accurately represent all this information.

Following are the steps in creating a MFCC:

- i) Frame the signal into short frames of 20-40 ms. 25ms is considered as a standard.
- ii) For individual frame, calculating periodogram estimate of the power spectrum - Here periodogram estimate of power spectrum is taking Discrete Fourier Transform of the individual frame.
- iii) Apply Mel-spaced filterbank - This is a set of 20-40 (26 being the standard) triangular filters which we apply to step 2's output which is a periodogram power spectral estimate. Here, filterbanks have vector length of 257 and has 26 vectors in total.
- iv) Take logarithm of filterbank - Here we are taking log of each 26 energies from step 3.
- v) Final step is to find discrete cosine transform of log filterbank energies keeping DCT coefficients 2-13 and discarding the rest.

3. Mel-Spectrograms

A Mel-Spectrogram is a type of spectrogram in which frequencies are converted into mel scale. Here, x-axis represents time and y-axis represents mel scale. The waveforms of audio files are passed through mel filter banks which then gives mel spectrogram. Librosa Library in Python can be used to generate Mel-Spectrograms.

V. APPLICATION**Mall:**

Music is played continuously in the malls, and selection of right music to be played is hectic as well as time consuming work. So here, our system helps to choose the song according to any occasion or event.

Restaurant:

In a restaurant, choosing the right music is an important task when it comes to various occasions as per customer's demand; our system will help to choose a particular genre song for the same.

Airport:

Music is played in the airports for the entertainment of people as they wait for hours due to various reasons, so our system will help to choose the song as per the requirements.

VI. CONCLUSION

In this system, we are proposing an efficient Music Genre Classification System which can classify the uploaded audio file into various genres. We are using GTZAN dataset with 1000 songs so as to train our system. Features are extracted using Librosa module provided in Python and after this spectrograms are generated. We are using CNN Algorithm for the classification purpose. The output of CNN classifier i.e. classified song is then segregated into their respective folder.

While concluding we can say that when we compared CNN to various algorithms like K Nearest Neighbor, FFNN, etc. CNN Algorithm gave better accuracy in classifying the genre. Also, we are using Mel Spectrums instead of MFCC (which is less accurate) for converting the audio signals into .png format images which are given as the input to our CNN model.

ACKNOWLEDGMENT

Here, we express our sincere thanks to our project guide Prof. Shweta Koparde and the Head of the Department Prof. Dr. Archana Chaugule for their constant support and for providing guidance. We are also thankful to all other researchers for their publications.

REFERENCES

- [1] S. Vishnupriya, K. Meenakshi, "Automatic Music Genre Classification using Convolution Neural Network", 2018 International Conference on Computer Communication and Informatics (ICCCI), January 2018.



- [2] Nikki Pelchat, Craig M. Gelowitz, "Neural Network Music Genre Classification", Canadian Journal of Electrical and Computer Engineering, Volume: 43, Issue: 3, Summer 2020
- [3] Yandre M.G.Costa, Luiz S.Oliveira, Carlos N.Silla Jr., "An evaluation of Convolutional Neural Networks for music classification using spectrograms", Applied Soft Computing, Volume 52, March 2017, Pages 28-38
VOLUME 1, 2021
- [4] Elizabeth Nurmiyati Tamatjita, Aditya Wikan Mahastama, "Comparison of Music Genre Classification Using Nearest Centroid Classifier and k-Nearest Neighbours", 2016 International Conference on Information Management and Technology (ICIMTech), 18 May 2017
- [5] Machine Learning GeeksforGeek - <https://www.geeksforgeeks.org/machine-learning/>
- [6] GTZAN Dataset Site : <http://marsyas.info/downloads/datasets.html>
- [7] Musical Genre Classification with Convolutional Neural Networks by Leland Roberts : <https://towardsdatascience.com/musical-genre-classification-with-convolutionalneural-networks-ff04f9601a74>
- [8] Understanding the Mel Spectrogram by Leland Roberts - <https://medium.com/analyticsvidhya/understanding-the-mel-spectrogram-fca2afa2ce53>
- [9] Convolutional Neural Network Tutorial by Simplilearn - <https://www.simplilearn.com/tutorials/deep-learningtutorial/convolutional-neural-network>
- [10] Getting started with Django - <https://www.djangoproject.com/start/>
- [11] ISMIR2004 Genre dataset - <https://www.upf.edu/web/mtg/ismir2004-genre>
- [12] The Latin Music Database (LMD) - <https://sites.google.com/site/carlossillajr/resources/the-latin-music-database-lmd>
- [13] Music of Africa dataset - https://research.google.com/audioset/dataset/music_of_africa.html
- [14] Understanding Audio data, Fourier Transform, FFT and Spectrogram features for a Speech Recognition System by Kartik Chaudhary - <https://towardsdatascience.com/understanding-audio-data-fourier-transform-fft-spectrogram-and-speech-recognition-a4072d228520>
- [15] Music Genre Classification Report by Derek A. Huang, Arianna A. Serafini and Eli J. Pugh from Stanford University - <http://cs229.stanford.edu/proj2018/report/21.pdf>
- [16] François Chollet et al. Keras - <https://keras.io>, 2015.
- [17] Mel Frequency Cepstral Coefficient (MFCC) tutorial- <http://practicalcryptography.com/miscellaneous/machine-learning/guide-mel-frequency-cepstral-coefficients-mfccs/>
- [18] Spectrogram computation in Signal Analyzer - <https://www.mathworks.com/help/signal/ug/spectrogram-computation-in-signal-analyzer.html>
- [19] The dummy's guide to MFCC - <https://medium.com/prathena/the-dummys-guide-to-mfcc-aceab2450fd>

CUSTOMER USING INTEGRATED APPROACH

Aadesh bhosale¹, Rahul Chaudhariz, Tejas Chavan³, Umesh Jajoo⁴, Prof. Shweta Kopardes

*1,2,3,4 Student, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, Maharashtra, India.

*5Professor, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, Maharashtra, India.

ABSTRACT Customer segmentation is one of the most important aspects of a business growth and development. In order to grow the business smarter in a competitive market, potential customer identification should be done in a timely manner. This paper suggests an integrated method for determining targeted customers using a predictive model and finding their own integration purchase patterns using integrated approach. The integrated approach consists of RFM analysis and K-means algorithm. The potential customers are identified and placed in various groups based on their purchase patterns. After identifying the customers tags and their corresponding purchase pattern, business executives make the right decisions accordingly.

INDEX TERMS : K Means algorithm, RFM analysis, Customer Segmentation.

I. INTRODUCTION

With the evolution of new technologies and increasing growth of e-commerce it is important for every business to adapt new strategies which help them to win the competitive environment. The most valuable asset of any business is customer. In this emerging market it is very difficult to maintain its customer base. To overcome this difficulty every business has to focus on customer segmentation. Customer segmentation means categorizing the customers into same group. It acts as a base for Customer Relationship Management (CRM) for businesses to firstly identify their target customers and work on them individually. There are various existing predictive models which provide information on customer segmentation and which help them to segregate the customers. For a successful business, apart from retaining and adding new customers, making more profit from each customer is key task. Different variety of models exist which help the business managers to implement the strategic policy according to individual customer taste but each one of it are having their own limitations. To excel the business further this paper is proposing a new integrated approach of customer segmentation combined with association mining of different segmented customer which provides more profit to the business [3]. The paper is organized as following. Section 2 focuses on proposed methodology, section 3 describes the approaches of proposed methodology and section 4 concludes the study of this paper.

II. PROPOSED METHODOLOGY

Identifying right customer and providing right service at right time and treating different types of customers differently is the key to success in business.

The whole process is to be carried out in two phases Phase 1: Customer Segmentation Phase 2: Extracting associative buying pattern of segmented customer Phase 1: Customer Segmentation Step 1: Collecting Customer Data (Transactional data): This step involves the collection of transactional customer data comprises of their static (Eg: Age, Gender etc.) and dynamic data (Eg: Purchase frequency etc.) [1] from shopping vendors. Step 2: Preprocessing of Data: Preprocessing of the data is one of the important step for the accuracy of predictive model. In this step, the collected data will be cleaned and relevant features will be extracted. Feature selection is a data reduction technique which is responsible for extracting relevant features required for input vector of predictive model. This acts as pre-processing steps for creating subset of original features by excluding those features which are redundant.

Step 3: Calculate the centroid of each segment, use it as the new segment centre (one measure of centroid is mean). Step 4:

Go back to Step 2, stop when segment centres do not change any more.

A. Research Method for extracting associative Mining

In order to grow the business more in competitive market, businesses target on cross selling and up selling of the products as well. Cross selling means selling of multiple products offered by a single product to a new customer or old

VOLUME 1, 2021

customer and up selling to sell upgraded version of current product. Thus identification of multiple related products for a single product is a key task. This task can be done using the approach Apriori Technique: Apriori is an iterative level wise

search algorithm which is used for finding frequent itemsets using candidate generation[9]. It finds the frequent item-set based on following property: • If an item-set is frequent, then all of its subsets must also be frequent. • Support of an item-set never exceeds the support of its subsets. This is called as the anti-monotone property of support.

B. Apriori Algorithm works as follows

Let the set of frequent item-sets of size k be F_k and their candidates be C_k . In Apriori Algorithm firstly the whole database is scanned and frequent item sets of size 1 are searched and the count for each item is accumulated and those items are collected which satisfy the minimum support requirement. Then iterates following three steps to extracts all the frequent item-sets. 1. Generate C_{k+1} , candidates of frequent item-sets of size $k+1$, from the frequent item-sets of size k . 2. Scan the database and calculate the support of each candidate of frequent item-sets. 3. Add those item-sets that satisfy the minimum support requirement to F_{k+1} [9].

III. REVIEW OF CLUSTER ANALYSIS

If Data mining is a process that uses statistics, mathematics, artificial intelligence, and machine learning techniques to extract and identify useful information and related knowledge from large databases. Data mining is a part of knowledge discovery data which is a useful, unknown, and

hidden information extraction process from data [4]. Data mining aims to obtain a relationship or pattern that may provide useful indications [10]. The relationship sought by data mining is a relationship between two or more in one dimension [10].

This research using K-means to grouping data transaction with consideration, such as: 1. Could not specified the number of

manual data cluster. 2. Unknown a cluster central point of data. 3. ~~Difficult to grouping the customer types with the amount of data 82.648~~ Besides K-means also having an access, such as : 1. Easy to be implemented and used. 2. Takes the fairly quickly time to execute this learning 3. Easy to adapted. 4. Commonly used. The K-Means algorithm is a distance-based clustering method that partitions data to a number of groups and works on numeric attributes [11]. Here are the steps to calculate K-Mean Algorithm [12]: a. Determine the number of k-clusters to be formed. b. Generate k-centroid (cluster center point) randomly. c. Calculate the distance of each data to each centroid. The formula used is Euclidean distance with the equation (1) as follows: (1) Where is the distance between the cluster with the center of cluster in the i-th word. is the i-th word weight of the cluster whose the distance will be searched for. μ_i is the weight of the i-th word at the center of the cluster.

IV. MODELING AND ANALYSIS

The traditional segmentation technique that vendors use is based on demographic approach which usually includes things like ethnicity, age and genders. The integrated

approach helps business in this era of competition to stand apart and focus on the potential customers and stay one step ahead of other competitors in the market. This analysis for vendors will be of great help to apply different strategies for different groups or clusters and work on them individually which will result in more customer attraction and high profitability of the business

V. A CASE STUDY

The dataset used in this case study is credit sales data on Nine Reload Credit Server. At the company there is a lot of data stacking, thousands of transactions every month. You can imagine how difficult it would be if you had to analyze the data manually one by one. The researchers tried to analyze the data as much as 82,648 customer transactions. The model proposed in determining the profitable customer is described in Figure 1 which shows the steps to determine the profitable customer.

Author Name:
VOLUME 1, 2021

FIGURE 1. Clustering Process

VI. METHODOLOGY

The methodology used in this research consists of data selection, data pre-processing, data transformation, data analysis and evaluation. The methodology followed in this research is based on two analysis techniques that are K-means and RFM analysis. This project aims at acquiring data from a csv file which is to classify the customers based on purchasing patterns. The purchasing pattern is analyzed using clustering models by identifying the Recency, Frequency and Monetary value of customers. This research is implemented through various stages that are explained below, Data Selection To analyze the purchase pattern of customers in retail shops, dataset Sample Sales Data has been downloaded from Kaggle that contains 'order number', 'quantity ordered', 'price each', 'order line number', 'sales', 'order date', 'status', 'month_id', 'year', 'product line', 'product code', 'customer name', 'phone', 'addressline1', 'addressline2', 'city', 'state', 'postal code', 'country', 'territory', 'contact last name', 'contact first name', 'deal size'. Data Cleaning and Preprocessing: The target data is cleaned before proceeding further. Cleaning here includes, handling missing values, detecting and handling outliers etc. The merged database has 25 columns. This database does not contain any missing values. Outliers are detected once RFM values are calculated as all fields will be numeric and the missing values are checked once again. We have some unnecessary columns such as "addressline1", "addressline2", "postal code", "territory", "phone" and we remove them.

1) DATA SELECTION

Figures Data Selection To analyze the purchase pattern of customers in retail shops, dataset Sample Sales Data has been downloaded from Kaggle that contains 'order number', 'quantity ordered', 'price each', 'order line number', 'sales', 'order date', 'status', 'month_id', 'year', 'product line', 'product code', 'customer name', 'phone', 'addressline1', 'addressline2', 'city', 'state', 'postal code', 'country', 'territory', 'contact last name', 'contact first name', 'deal size'.

2) DATA CLEANING AND PREPROCESSING:

The target data is cleaned before proceeding further. Cleaning here includes, handling missing values, detecting and handling outliers etc. The merged database has 25 columns. This database does not contain any missing values. Outliers are detected once RFM values are calculated as all fields will be numeric and the missing values are checked once again. We have some unnecessary columns such as "addressline1", "addressline2", "postal code", "territory", "phone" and we remove them. We also can regroup the column 'product initial' using only three first signs.

3) DATA TRANSFORMATION:

The Cleaned and pre-processed data is then transformed in order to build machine learning models on them. In the transformation stage, customers are grouped, based on the Recency, Frequency and Monetary values that are calculated for each customer. Recency is calculated by identifying the difference between the current date and the last visit date of the customer. Frequency is calculated by identifying the number of orders by a customer. Monetary value is calculated by the total monetary value of all orders by the customer

4) DATA ANALYSIS:

Data analysis is done in following two steps: 1. K-means Clustering: The Elbow method is widely used to identify the optimal number of clusters. For a range of k-value, k-Means is executed and the value of total within cluster Sum of squares is plotted in graph. K-means is executed with the number of clusters as 4. Based on this we classify customers in 4 groups: Group 0: Customers who have been shopping recently, rarely buy and make purchases for relatively small amounts. Group 1: Customers who were shopping for a long time, buy moderately often and they shop for high amounts. Group 2: Customers who have been shopping recently, they buy often and make purchases for large amounts. Group 3: Customers who have not been buying anything for a long time, they rarely buy and make purchases for relatively small amounts. 2. RFM Analysis: The RFM method requires ordinal variables and this can be done in several ways, we used the percentiles of the distribution of the given variable. The labels were of values 1-4. When labeling the values of VOLUME 1, 2021 active). In the case of "Frequency" - the greater the value of the variable, the higher the label (we preferred customers who buy more often).

VII. CONCLUSION

This paper proposes an integrated novel approach for determining target customers using predictive models and also discovering their associative buying patterns using K-means and RFM analysis. Customer segmentation is one of the main aspects of a business decision support system. In terms of growing the business widely in a competitive market and identification of potential customers, the customer segmentation should be done timely. After identification of targeted customers, the business managers and organization take the strategic and marketing profitable decisions accordingly.

ACKNOWLEDGMENT

Shweta Koparde is currently working as a Professor in the Department of Computer Engineering at Pimpri Chinchwad College of Engineering and Research.

REFERENCES

- [1] Maryani, Ina, and Dwiza Riana. 2017. "Clustering and Profiling of Customers Using RFM for Customer Relationship Management Recommendations." 2017 5th International Conference on Cyber and IT Service Management, CITSM 2017, 2-7. <https://doi.org/10.1109/CITSM.2017.8089258>. [2] Tama, Bayu Adhi. 2010. "Penetapan Strategi Penjualan Menggunakan Association Rules Dalam Konteks CRM." Jurnal Generic Vol. 5 (No.1):35-38. [3] Hand, David J. 2007. "Principles of Data Mining." Drug Safety 30 (7):621-22. <https://doi.org/10.2165/00002018-200730070-00010>. [4] Ramamohan, Y, K Vasantharao, C Kalyana Chakravarti, and a S K Ratnam. 2012. "A Study of Data Mining Tools in Knowledge Discovery Process." International Journal of Soft Computing and Engineering 2 (3):191-94. [5] Wongchinsri, Pornwattana, and Werasak Kuratach. 2016. "A Survey -Data Mining Frameworks in Credit Card Processing." 2016 13th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology, ECTI CON 2016. <https://doi.org/10.1109/ECTICon.2016.7561287>. [6] Peiman Alipour Sarvari, Alp Ustundag, and Hidayet Takci. 2014.

“Performance Evaluation of Different Customer Segmentation Approaches Based on RFM and Demographics Analysis.” *Kybernetes* 43 (8):1209–23. <https://doi.org/10.1108/K-01-2015-0009> [7] Rachid, et al. 2015. “Combining RFM Model and Clustering Techniques for Customer Value Analysis of a Company selling online.” 2015 12th International Conference of Computer Systems and Applications (AICCSA) 2015,1-6. [8] Liu Jiali and Du Hyung. 2010. “Study on Airline Customer Value Evaluation Based on RFM Model (2010).” 2010 International Conference On Computer Design And Appliations (ICCDAA 2010) ,278-281 [9] Aviliani, U. Sumarwan, I. Sugema, and A. Saefuddin. 2011. “Segmentasi Nasabah Tabungan Mikro Berdasarkan Recency, Frequency, dan Monetary : Kasus Bank BRI.” *Finance and Banking Journal* 13 (1):95– 109. [10] Kusri Luthfi, Ema Taufiq. 2009. *Algoritma Data Mining*. Edited by Theresia Ari Prabawati. Yogyakarta: C.V Andi OFFSET. <https://books.google.co.id/books?id=Ojclag73O8C&pg=PA3&dq=data+mining+adalah&hl=id&sa=X&ved=0ahUKEwifrefgpYnZAhXBPY8KHWeJCQ4Q6AEIKzAA#v=onepage&q=data+mining+adalah&f=false>. [11] Lubis, Abdul Haris. 2016. “Model Segmentasi Pelanggan Dengan Kernel K-Means Clustering Berbasis Customer Relationship

Management.” *Jurnal & Penelitian Teknik Informatika* 1:36–41. [12] Rahman, Aulia Tegar; Wiranto ;Rini Anggrainingsih. 2017. “Coal Trade Data Clustering Using K-Means (Case Study PT . Global Bangkit Utama)” 6 (1):24–31.

Aadesh Bhosale from Pimpri Chinchwad college of Engineering and Research

Department of Computer

Pune-412101, India

aadeshbhosale1@gmail.com

Rahul Chaudhari from Pimpri Chinchwad college of Engineering and Research

Department of Computer

Pune-412101, India

rahulac711@gmail.com

Tejas Chavan from Pimpri Chinchwad college of Engineering and Research

Department of Computer

Pune-412101, India

tejaschavan221999@gmail.com

Umesh Jajoo from Pimpri Chinchwad college of Engineering and Research

Department of Computer

Pune-412101, India

umeshjajoo76@gmail.com

Prof. Shweta Koparde from Pimpri Chinchwad college of Engineering and Research

Department of Computer

Pune-412101, India

shweta.koparde@pccoer.in

VIRTUAL POLICE STATION

First A. Sneha Karale¹, Second B. Rutuja Maybhate², Third C. Dhruvi Patel³, Fourth D. Vaishnavi Jagtap⁴, Fifth E. . Prof. Mahendra B Salunke⁵

¹Pimpri Chinchwad College of Engineering And Research Ravet,Pune,India-412101

ABSTRACT The fact that the future of the world not only depends upon the latest technologies but also on innovative ideas is not unknown. The innovative concepts emerging from the innovative ideas help to upgrade our information set. There is hardly any field where technology has not reached. Be it in business, in education, in socializing and maintaining human relations, in purchasing, in agriculture or in banking, communication, it has covered almost every aspect of our lives. And when we look at this fact, the Police arena still seems to be devoid of this. Most of the work of Indian Police Department remains manually driven. The officials have been practising the traditional method of pen and paper to carry forward the proceedings. It used to work when the population of India was minimal. But in today's India, the evil strata of the society is increasing and so are the number of cases being registered. It becomes a tedious task to handle these numbers of documents manually. Thus it becomes of utmost importance to digitalise the Indian Police Department. The traditional method of pen and paper needs to be replaced with an online mode of complaint filing. Hence we propose the solution of Virtual police system which will collect complainant's data through a mobile application and will store the details in their centralised database. The chatbot is provided to navigate through the app and resolving queries. Thus the entire process becomes online saving much time and increasing efficiency.

INDEX TERMS Optical Character Recognition, Vincenty Geopy, DialogFlow, Text Extraction.

I. INTRODUCTION

We have proposed this system to solve the difficulties of people face during registering complaints at any police station. Because of this system, the entire manual work is reduced and the complainant can directly file the complaint online, which also saves a lot of energy and money. The system has been developed which has an mobile application which works as a front end and We have been designing the Virtual Police Station in which victims details with respect to identity of complainant, details of the incidence or crime committed will be extracted to capture ingredient of the crimes committed, identity of criminals and likely witnesses the same would be converted in text format as an FIR which then would extract the UID through OCR model and verified through digital signature (using OTP based verification of Aadhar). After filing the complaint the details get transferred to the police database and then the police officer will check from the database and will verify the details and proceed for further investigation. The user can see the progress through android app. The FIR would be routed to the CCTNS system using Citizen Portal Bridge then available. The chatbot would be used to guide through the app and for query resolution.

II. LITERATURE REVIEW

● This article [1] is a kind of a situational snapshot, an overview of what the police profession is thinking, what initiatives are being taken advantage of by the various authorities worldwide.

● The point of this task mentioned in paper [2] is to build up an E-police reporting and administration framework which is effortlessly available to people in general, police division and the managerial department. In this paper we concentrate on the foundation of an e-police framework and in addition its means, difficulties of usage and its need. E-police is planned to give complete electronic data framework support for the work of the police. This framework enrolls the grumblings from individuals through online and is useful to the police division for further process.

● In this paper [3], text extraction from image documents, using combination of the two powerful methods Connected Component and Edge Based Method, in order to enhance performance and accuracy of text extraction is discussed and implementation is done by integrated MATLAB code with

MATLAB/Simulink tool and the proposed system is tested by Digital Image Binarization Competition (DIBCO) 2017 dataset. Finally, the

VOLUME 1, 2021

extracted and recognized is converted to speech for proper use for visually impaired people.

● This paper [4] aims to help the public and the police officers alike. The updates about case details are notified directly to the complainant through the application. The ease of access of the android application by the citizens of India will encourage a more judicial and lawful society.

● The aim of this paper [5] is to upgrade the country's police administration to the world standard. The home ministry would be connected with the several police units of the city in a fiber-optic based metropolitan area network and a database will be set up for warrant notices, examining the fingerprints using the latest electronic device etc. There has to be set up a 'Third Eye' software in the special branches of the police department so that it helps the police supervisors to monitor crime and criminal records.

● This paper [6] explicates a theory-driven design process of a virtual training environment and its application in a German state police department.

● As mentioned in a news article [7] students of Andhra University will be able to report violence or any crime online on the virtual police station. The students of the Andhra University will be able to report violence or any other crime online as a virtual police station (VPS). After a complaint is filed, the police station concerned will take up the issue and initiate a probe.

● News article published in esteemed newspaper [8] to demystify the police station and acquaint the public with the functioning of a police station without visiting it physically, international NGO Commonwealth Human Rights Initiative (CHRI) has developed Virtual Police Station (VPS). It allows the police and public to enter every room of a computerised police station to explore and learn the key procedures such as arrest, registration of complaints of sexual assault, registration of FIRs and more.

● As mentioned in the news article [9] the Virtual Police Station is an online mechanism established at the State Crime Records Bureau in Bhubaneswar. It will facilitate online registration of FIR in unknown motor vehicle theft cases. If a case remains undetected for 21 days, final form shall be auto generated at CCTNS. It will benefit

citizens for claiming insurance in motor vehicle theft cases. A citizen can also file FIR through citizens portal or Sahayata mobile app, read a statement.

IV. GAP ANALYSIS

We have researched about the current existing systems and got to know that The existing system only takes the details such as identity of complainant, complaint details and victim details. The personal information which is taken along with the other details is the mobile number and Aadhar number of the complainant. For verification purposes, some systems send the OTP to the given mobile number. But there is no method to verify whether the entered identity/detail are correct or not. There is a chance that the entered details would be fake. We therefore propose a multi-platform mobile application service which enables victims to file the online complaint.

V. PROPOSED SYSTEM

The system is basically designed in four modules named Complaint Module, Location Module, Information Module and FAQ Module[Fig. 1.]. There will basically be two roles, user and the admin. Various functions of the roles can be seen in the Use-Case Diagram[Fig. 2.]. The Information Module helps users to get the information regarding the working of Police Stations and basic details of the complaint filing process which help users to understand the working and various processes at a single place. The FAQ Module is designed with the service of chatbot feature which helps the users in resolving queries regarding the navigation, working and complaint filing in the form of Question-Answers. Users can search for their nearest Police station by using the Location Module. Users have to give access to their current location and the module will search for the nearest Police Station for them which will help them to contact it in the case of an emergency.

The Complaint Module assists users to file online complaints. The Module takes the general information like complaint details, victim details and personal information of the complainant. It then takes the image of the Adhar card of the complainant and extracts the aadhar number by using the Optical Character Recognition(OCR) Model. Then the OTP is sent to the registered mobile number which is linked to the aadhar card number. This way the verification identity of the complainant is achieved. Once the identity is verified, a PDF of confirmation of complaint registration is sent to the user. The complaint details are then sent to the centralised database system of the Police System which then can be accessed and processed upon. The sequence of the entire process can be seen in the sequence diagram.[Fig. 3.]

VOLUME 1, 2021

Fig. 1. Activity Diagram

Fig. 2. Use Case Diagram

Fig. 3. Sequence Diagram

VII. CONCLUSION

The Indian Police System has always lacked digital transparency, with most works being carried out on a pen and paper basis. This traditional method can cause delays and inefficiency. With the advancement and incorporation of internet and web technology into the Indian Police



System, it will boost up the speed of the proceedings. This project aims to help the public and the Indian police officers alike. The updates about case status are notified directly to the user through the application. The ease of access of the mobile application by the users will encourage a more transparent and secure Indian Police system.

REFERENCES

- [1] Edina Krisko "Virtual Policing from a Hungarian Perspective," National University of Public Service
- [2] Dr. Ayesha Butalia¹, Nilofar M. Shaikh², Avez Quadari³, Roshan Undirwade⁴, Nahid Pathan, "E-POLICE SYSTEM BASED ON ANDROID APPLICATION FOR ENHANCEMENT OF SERVICES OF DEVELOPING COUNTRIES", Department of Computer Engineering, PGMCOE, Wagholi, Pune, Maharashtra, India
- [3] K.N. Natei, J. Viradiya, S. Sasikumar, "Extracting Text from Image Document and Displaying Its Related Information," Dept. Computer Science and Engineering, Parul Institute of Engineering and Technology, Parul University, Vado dara, India.
- [4] Archana Iyer, Prachi Kathale, Sagar Gathoo, Nikhil Surpam, "E-Police System- FIR Registration and Tracking through Android Application", All UG Students, Department of Information Technology, YCCE, Wanadongri, Nagpur, India.
- [5] Muhammad Baqer Mollah, Sikder Sunbeam Islam, Md. Arnab Ullah, "Proposed E-Police System for Enhancement of E-Government Services of Bangladesh".
- [6] Johanna Bertram; Johannes Moskaliuk; Ulrike Cress, "Virtual police: Acquiring knowledge-in-use in virtual training environments".
- [7] <https://www.livemint.com/news/india/odisha-cm-naveen-patnaik-launches-virtual-police-station-11580272512830.html>
- [8] <https://economictimes.indiatimes.com/news/defence/no-w-a-virtual-police-station-to-tell-about-police-functioning/articleshow/49803419.cms>.
- [9] <https://www.newindianexpress.com/states/andhra-pradesh/2019/dec/02/aps-first-virtual-police-station-to-come-up-at-andhra-university-2070119.html>

w-a-virtual-police-station-to-tell-about-police-functioning/articleshow/49803419.cms.

- [9] <https://www.newindianexpress.com/states/andhra-pradesh/2019/dec/02/aps-first-virtual-police-station-to-come-up-at-andhra-university-2070119.html>

AUTHOR PROFILE

FIRST A. MS. SNEHA KARALE

Final Year Student pursuing BE Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101.

SECOND B. MS. RUTUJA MAYBHATE

Final Year Student pursuing BE Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101.

THIRD C. Ms. DHIRUVI PATEL

Final Year Student pursuing BE Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune, India-412101.

FOURTH D. Ms. VAISHNAVI JAGTAP

Final Year Student pursuing BE Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune,

Asst. Prof. Department of
Computer Engineering, Pimpri Chinchwad
College of Engineering and Research, Ravet, Pune,
India-412101

VOLUME 1, 2021

Django Website for Disease Prediction using Machine Learning

Sayali KULKARNI¹, Isha SAWANT², Megha SHINDE³, Vishal SONAR⁴, Vaishali LATKE⁵

¹Student, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, India

²Student, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, India

³Student, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, India

⁴Student, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, India

⁵Professor, Department of Computer Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, India

ABSTRACT Decision making has become easier due to advancement in machine learning and data mining. Machine learning algorithms have helped to solve a lot of real-world problems in many fields. Taking about medical field, data mining, deep learning has made it possible to process huge data and provide more efficient health care to the patients. The types of diseases are increasing day by day and it has been necessary for people to know about the disease. The early-stage prediction of a disease based on the symptoms becomes difficult for the patient alone. The information available online may always not be correct and may lead to tension and unnecessary panic. To avoid this people should look for their health-related queries on the right place. Thus, to make it easier for people to predict the right disease, development of a machine learning based system has become important. The system collects the symptoms from the user and predicts the correct disease. This will help people to recognize the disease at an earlier stage and take the further decision based on it.

INDEX TERMS Disease prediction by symptoms, Django, Machine Learning, PostgreSQL, Python.

I. INTRODUCTION

Advanced technologies have been used in almost all fields now-a-days to make life easier. Technological advancements have made a large impact in medical field as well. The healthcare domain provides improved treatments and are coming up with more efficient ways to identify and further diagnose the diseases. The increase in types of diseases and disorders, the rapid increase in patients has resulted in huge demand of advanced technologies like AI, ML, Big data. The use of such technologies would save a lot of money in healthcare domain and could enhance the patient care.

Machine learning algorithms can help a lot in detection of various diseases, the algorithms would be used to predict the best diagnosis of a crucial disease, the automation of different processes in hospitals, etc. Among these, the detection of a disease at an earlier stage by a patient can be done with the help of various machine learning algorithms. It can be made very easy and cheap to predict a disease with the initial symptoms. This earlier prediction can help common people to decide the further route of treatment and which doctor to consult. So, in this project we have implemented a system which accurately predicts a disease with the help to symptoms entered by the patient. Machine learning algorithms like Decision tree, KNN, Random forest and Naïve Bayes have been used. The comparison of these algorithms in terms of accuracy is also done. The trained model based on these models is used in the prediction system built using Django.

II. PROPOSED WORK

This system mainly focuses on simplifying process of disease prediction which generally takes a lot more time and needs knowledge of talented doctor. We have provided a system where we can predict the disease of a person from the symptoms that he's facing. This will be helpful to those who seek help online and at any time he can consult the doctor. The rush time at hospitals can be avoided by this. There are multiple ML algorithms which could generate result if used alone. But to ensure and get accurate result, we have used 4 different algorithms to predict the disease.

The algorithms that we have used are Decision Tree, Random Forest, Naïve Bayes, k-Nearest Neighbors. We predict the disease using above mentioned classifiers. The use of various algorithms helps in giving maximum accuracy. The accuracies are compared and according the model is trained. This trained machine learning model is used in the system. Thus, the higher accuracy makes the system efficient for patients and then they can consult a doctor accordingly. The dataset used has about 5000 records with 132 symptoms and 41 diseases. Data cleaning and data reduction is performed on dataset to avoid overfitting, the algorithms are applied and at the end the model predicts the most likely disease.

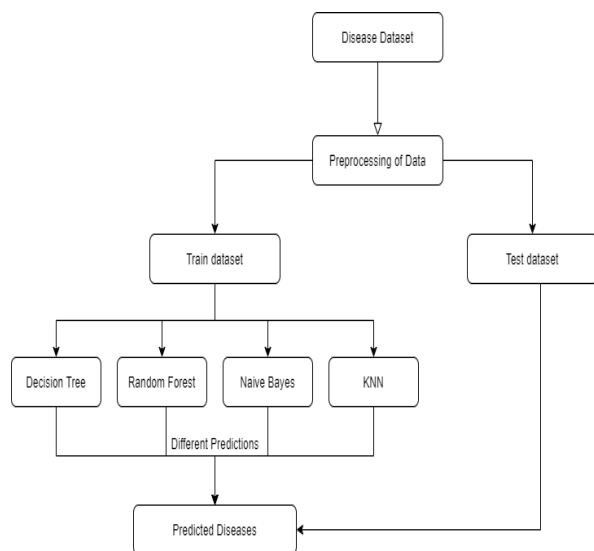


FIGURE 1. PREDICTION MODEL

III. IMPLEMENTATION DETAILS

The overall system is user friendly and mainly consists of two users

- Doctors
- patients

The modules and functionalities present in patient dashboard

- Check disease

- Consultation
- Feedback
- View and update profile

The modules and functionalities present in doctor dashboard

- Consultation
- Feedback
- Update Profile

The user needs to register himself and after signing in he can view the functionalities provided. If the user is a patient, the functionalities provided are to check the disease by proving symptoms, consultation details and feedback option. The patient can view and update his details provided at the time of registration. The system predicts the disease using the machine learning model. Also, an option is provided to know more about that disease. A list of doctors is also provided based on the disease predicted. This will help the patient to get the necessary consultation and help at an earlier stage. This can be done by conversing with the doctor. The patients can view the doctor profile and decide whether he wants to consult the doctor or not. The facility to view the consultation details and history has been provided. Also, ratings can be given and the system can be given a feedback as well. If the user registered is a doctor, he can fill his details which will be seen by the patients. The doctor can see the patient's disease related queries and he can answer them. The system having simplistic yet elegant user interface will work as a connecting bridge of doctor and patient. The UI is designed using HTML, CSS, JavaScript, jQuery. Django has been used for backend. PostgreSQL database and PhpMyAdmin is also used.

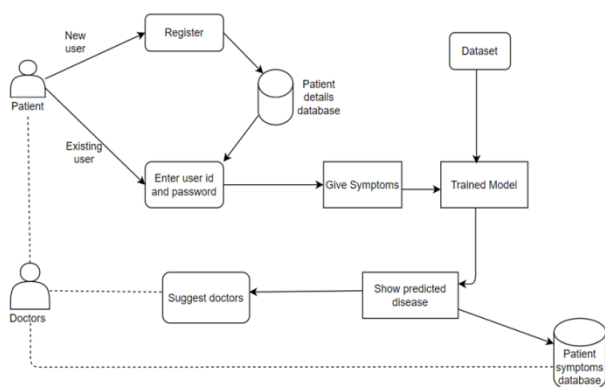


FIGURE 2. ARCHITECTURE DIAGRAM

IV. MODELS USED

A. DECISION TREE ALGORITHM

Decision tree is classified as a very effective and versatile classification technique. It is used in pattern recognition and classification for image. It is used for classification in very complex problems due to its high adaptability. It is also capable of engaging problems of higher dimensionality. It mainly consists of three parts root, nodes and leaf. Roots consists of attribute which has most effect on the outcome, leaf tests for value of certain attribute and leaf gives out the output of tree.

Here, gain

ratio decision tree is used. It uses entropy approach due to which information gain is also maximized. Input is given here in the form of symptoms (attributes) to the nodes and the decision tree helps splitting the large data set into smaller segments. The interior nodes help predicting the output (disease) and the leaf node shows the output. Information gain is calculated using the formula –

$$IG(C,A) = E(C)-E(C,A)$$

where $E(C)$ = entropy of frequency table using one attribute.

 $E(C,A)$ = entropy of frequency table using two attributes

C = current state

A = attribute considered

Decision tree is the first prediction method we have used in our project. It gives us an accuracy of $\sim 95\%$.

Advantages-

- Resultant classification tree is easier to understand and interpret.
- Data preparation is easier.
- Multiple data types such as numeric, nominal, categorical are supported.
- Can generate robust classifiers and can be validated using statistical tests.

B. RANDOM FOREST ALGORITHM

Random Forest algorithm is one of the machine learning algorithm, belonging to the supervised learning technique. It solves both Classification and Regression problems in machine learning. This technique combines multiple classifiers which solves a complex problem resulting in improved performance of the model also called as ensemble learning concept. Random Forest is a technique that contains number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset. Instead of relying on only one decision tree, the random forest algorithm takes the prediction from each tree and based on the majority votes of predictions, it predicts the final output. The greater number of trees in the forest, higher is the accuracy thus, preventing the problem of overfitting. The procedure of random forest algorithm in disease prediction is –

1. The algorithm selects k symptoms randomly from total symptoms m where it builds a decision tree using these k symptoms.
2. In next step it repeats step1 multiple times to get n decision trees.
3. Pass a random variable to n decisions to predict the disease.
4. Frequent predicted disease is calculated and the most frequent one is decided as final.

Advantages-

- a. Lower chance of variance and overfitting of training data compared to DT, since RF takes the average value from the outcomes of its constituent decision trees.
- b. Empirically, this ensemble-based classifier performs better than its individual base classifiers, i.e., DTs.
- c. Scales well for large datasets. It can provide estimates of what variables or attributes are important in the classification.

C. NAÏVE BAYES ALGORITHM

The Naive Bayesian classifier is based on a theorem called Bayes' theorem which assumes the independence between predictors. Naive Bayes model is easy to build, where there is no complicated iterative parameter estimation making it useful for very large datasets. The Naive Bayesian classifier is a simple algorithm, yet it often does well and is widely used because it often outperforms more sophisticated classification methods. It uses the Bayes' theorem with strong independence assumptions between the features to procure results.

Bayes Theorem - Bayes theorem works on conditional probability. Conditional probability is where it depends on the already happened event and assumes that something will happen based on earlier occurrence. The conditional probability gives the probability of an event using its prior knowledge.

$$\text{Conditional probability: } P(A|B) = P(B|A).P(A)/P(B)$$

Where,

$P(A)$ = The probability of a hypothesis being true also known as prior probability.

$P(B)$ = The probability of the evidence.

$P(A|B)$ = The probability of the evidence given that the hypothesis is true.

$P(B|A)$ = The probability of the hypothesis given that the evidence is true.

Advantages –

- a. Simple and very useful for large datasets.
- b. Can be used for both binary and multi-class classification problems.
- c. It requires less amount of training data.
- d. It can make probabilistic predictions and can handle both continuous and discrete data.

D. K-NEAREST NEIGHBORS ALGORITHM

K-Nearest Neighbor is also based on Supervised Learning technique. K-NN algorithm guess the similarity between the new case/data and cases that are already available. After that it put the new case into the category that is most similar to the available categories. All the available data is stored and classified to a new data point based on the similarity. This states that the newly appearing data can be easily classified into a suitable category by using K-NN algorithm. K-NN algorithm is mainly used for the Classification problems. K-NN is a non-parametric algorithm and does not make an assumption on underlying data. K-NN does not learn from the training set immediately, so it also called a lazy learner algorithm. Instead, it stores the dataset and it performs an action on the dataset at the time of classification. KNN algorithm stores the dataset at the training phase and when it gets new data, it classifies that data into a category which is much similar to the new data.

Advantages –

- a. Simple algorithm and can classify instances quickly.
- b. Can handle noisy instances or instances with missing attribute values.
- c. Can be used for classification and regression.

V. RESULTS AND DISCUSSION

The use of k fold cross validation is used to compare the performance of all the algorithms. It shows that Naïve bayes and Random Forest are a bit more accurate than the other two. The results of accuracy after testing the model of 41 diseases is as given below –

Decision Tree – 0.95

Naïve Bayes - 0.95

K-NN – 0.9268

Random Forest -0.95

Out of 41 diseases 38 diseases were correctly classified by K nearest neighbor and 39 were correctly predicted by Naïve bayes, Decision tree and Random forest was seen by confusion matrix.

The percentage accuracy is as high as 96%. Hence, trained model of naïve bayes is used in the system as it is most accurate. The final results and its confidence score are displayed.

VI. CONCLUSIONS

The performance is analyzed using accuracy, confusion matrix, etc. Comparison of the accuracies of each algorithm like Decision tree, Random forest, KNN, Naive Bayes has been made and it is around 96%. Thus, we have reached to a conclusion that our system provides better accuracy of disease prediction. Comparisons show that Naive Bayes given a bit more accuracy. Hence, the model is trained accordingly and use of it in this system will be helpful to those patients who are always worrying about their health and need to know what happens with their body.

The main aim to develop this system is to help such people with their health. Also, this system can be used by small scale doctors or dispensaries to predict the disease and decrease the rush at OPDs of hospitals and reduce the workload on medical staff. The makes available the doctor's list of that particular predicted disease to get instant appointments which helps the patients and the hospitals. This ensures that the system is not affecting doctor's profession and ensures safety of patients along with increase gain of patients in the prediction system.

REFERENCES

- [12] Shahadat Uddin , Arif Khan, Md Ekramul Hossain and Mohammad Ali Moni. "Comparing different supervised machine learning algorithms for disease prediction." *BMC Medical Informatics and Decision Making*.
- [13] Ahelam Tikotikar and Mallikarjun Kodabagi. "A SURVEY ON TECHNIQUE FOR PREDICTION OF DISEASE IN MEDICAL DATA." *School of Computing & IT REVA UNIVERSITY*
- [14] M. Chen, Y. Hao, K. Hwang, L. Wang, and L.Wang, "Disease prediction by machine learning over big data from healthcare communities" *IEEE Access*, vol. 5, no. 1, pp. 8869–8879, 2017.
- [15] Mr Chintan Shah,Dr. Anjali Jivani. "Comparison Of Data Mining Classification Algorithms for Breast Cancer Prediction" *IEEE-31661*

- [16] Balasubramanian, Satyabhama, and Balaji Subramanian. "Symptom based disease prediction in medical system by using K-means algorithm." *International Journal of Advances in Computer Science and Technology* 3.
- [17] Pingale, Kedar, et al. "Disease Prediction using Machine Learning."(2019). Mr. Chala Beyene, Prof. Pooja Kamat, "Survey on Prediction and Analysis the Occurrence of Heart Disease Using Data Mining Techniques" *International Journal of Pure and Applied Mathematics*, 2018.
- [18] Chinmayi Chitnis and Roger Lee. "Improving Health-Care Systems by Disease Prediction." 2018 *International Conference on Computational Science and Computational Intelligence (CSCI)*.
- [19] A.Davis, D., V.Chawla, N., Blumm, N., Christakis, N., & Barbasi, A. L. (2008). "Predicting Individual Disease Risk Based On Medical History." Adam, S., & Parveen, A. (2012). "Prediction System For Heart Disease Using Naive Bayes".
- [20] P. Groves, B. Kayyali, D. Knott, and S. V. Kuiken, "The 'big data' revolution in healthcare: Accelerating value and innovation" 2016.
- [21] Gopi Battineni, Getu Gamo Sagaro, Nalini Chinatalapudi and Francesco Amenta. "Applications of Machine Learning Predictive Models in the Chronic Disease Diagnosis." *J. Pers. Med.* 2020, 10, 21; doi:10.3390/jpm10020021.



Electronics & Telecommunication Engineering

Multi-view Multi-pose Robust Face Recognition based on VGGNet.

Piyush Ingale¹, Divyashri Desale², and ,Rajni Kanse.³

¹Pimpri Chinchwad college of engineering and Research, Ravet,Pune.

²Department of Electronics and Telecommunication, PCCOER Ravet

ABSTRACT

Face recognition has recently received significant attention as one of most successful applications of image analysis and understanding. There are many reasons for growing interest in face recognition has a rising concern for public security, identity verification. There is a need for face analysis and modelling techniques in the data management and digital entertainment. In the face recognition we are facing challenges like pose variation, variation in illumination, occlusion problem in the face. To deal with all these problems we present face recognition based on VGG16 deep learning model. For the experimentation we have use real time database of images. The performance of proposed method is evaluated on the basis of cross validation accuracy and it has shown better performance compared to previous one.

INDEX TERMS: Face Recognition,VGG,FaceDetection,Rectified Linear Unit

I. INTRODUCTION

Face recognition is a technique in which we identify and verify the identity of an individual. In face recognition we compare the features of face of subject with all features of database images. Face recognition basically works in two modes face verification and face identification. The face verification is consist of one to one match that compare subject's face with template face images. Face identification contains one to many matches [1]

We need face recognition because in this rapidly evolving world speed and automation is an important aspect which can be introduced in real life using face recognition.Face recognition used in ,accesscontrol,security,surveillance,multimediamanagement,law enforcement and many others.

There are many challenges in face recognition such as pose variation, change in the lighting conditions,differentbackgrounds,change in face expression and colour complexity. There are also many limitations to face recognition such as the occlusion and low resolution. In this robust conditions the accuracy drops drastically.

In this research paper for making the model robust to

the problems we are using vggnet which is a pretrained model with millions of data. We are using multitask cascaded convolutional networks for face detection followed byvggnet for training of our model using real time database. To deal with many problem like pose variation etc we are using real time database with images which have different pose,illumination,background. We are getting accuracy around 96% even in the robust conditions.

II. Methodology

The proposed methodology encompasses face detection and recognition using MTCNN and VGGNet deep learning architecture as shown in Fig 1.

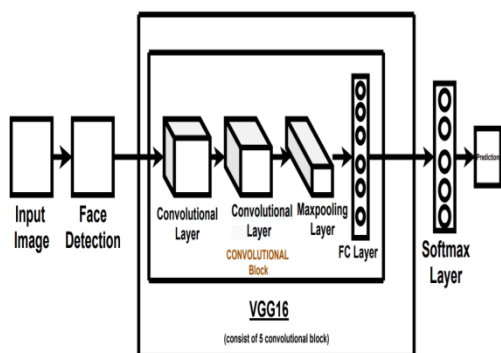


Fig. 1 Flow diagram of proposed system

III. Face detection using MTCNN:

The input images are split into various scaled images to form the image pyramid. This image pyramid is given as input to the MTCNN face detector that includes Proposal Network (P-Net) followed by Refine Network (R-Net) followed by Output Network (O-Net) stage which is almost the same as R-Net. P-Net is CNN based network that selects the possible candidates along with bounding boxes. RNet suppresses the false candidate regions, merges the dense overlapping regions, and calibrates the bounding boxes. O-Net detects facial landmarks such as eye, nose, mouth, etc, and classify the facial region. Training involves face classification and bounding box regression. The cost function for the face classification is given in equation 1 and the regression problem is defined in equation 2 [16][17].

B. Face detection using VGG16:

VGG is a pre-trained model with millions of data. It is based on CNN. CNN is very effective in the object & face recognition area. VGG is a feed-forward neural network with multiple convolution layers. The VGG-16 contains 13 layers of convolutional, 5 layers of max polling, and one fully connected layer. In VGG, convolutional uses a 3×3 filter with a stride of 1 while max-pooling uses a 2x2 filter with a stride of 2. The structure of VGG contains a convolution layer, max pooling layer, fully connected layer, and rectified linear unit activation function

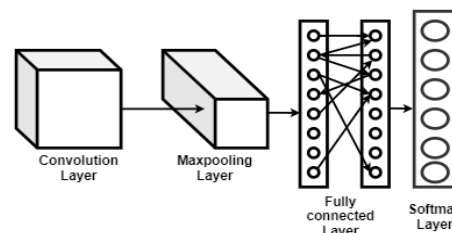


Fig. 2 VGG16 Network architecture

Convolution Layer.

Convolution layer is the layer that convolves the input image (I) with a convolution filter (K) as shown in equation 3. The convolution layer learns features from the input image using a small square of the input image. It gives better feature connectivity, correlation, and representation of the face image. (Equ 3-)

$$\text{conv}(I, K)_{x,y} = \sum_{i=1}^{n_H} \sum_{j=1}^{n_W} \sum_{k=1}^{n_C} K_{i,j,k} I_{x+i-1,y+j-1,k}$$

Where, n_H , n_W and n_C stands for height, width, and several filters.

Pooling Layer.

VGG16 uses max polling for polling operations. Max polling increases the conversion rate by decreasing the dimension of the input image. It helps to improve the generalization performance [20].

Rectified Linear Unit.

It performs the non-linear operation by rounding the nonzero values to zero. The mathematical representation of ReLU is:

$$Y = \max(0, x) \quad (5)$$

Where x is the neuron input of the ReLU layer and Y is the output of the ReLU activation function. After the convolution and pooling layer, we get high-level features in form of data. It needs to classify that data into various classes for that purpose. A fully connected layer followed by a Softmax classifier is used to learn a non-linear combination of these features. Finally, the model is trained with Adam's optimization algorithm using a learning rate of 0.001.

IV. Database:

This database contains images of 5000 images of 100 subjects that consist of 50 images per person captured using the mobile camera in the various pose, angles, view, illumination condition, and background environmental conditions. All these images are in RGB format every image has a different resolution and we convert all these images into 312×312×3.

The images are captured by varying the face position in between -65 to +65 degree orientation. The complete database is split into a train and test database in ratio 70% (3500 images) and 30% (1500 images) respectively. Additionally, two standard face image datasets such as ORL [21] and FERET [22] are considered for the evaluation of the performance of the proposed system. The ORL and FERET consist of 400 (40 subjects) and 14000 (1199 subjects) images respectively.



Fig. 3 Sample dataset images

V. Experimental Result

We are designing our model using VGG so the input image has a size of $312 \times 312 \times 3$. After passing this image as input, the size changes with every block as $156 \times 156 \times 64$, $78 \times 78 \times 128$, $39 \times 39 \times 256$, $19 \times 19 \times 512$, and $9 \times 9 \times 512$. The network is trained using a Mini-batch gradient descent algorithm for 15 epochs with a batch size of 50. The feature representation of VGGNet is given in table 1.

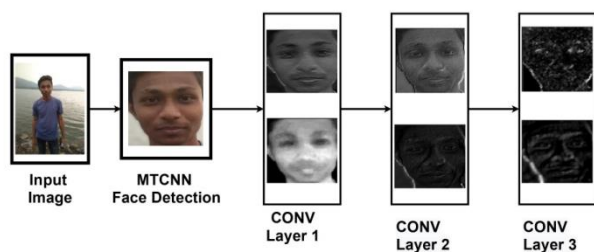


Fig. 4 MTCNN flow diagram

Total trainable parameters are 2073650 and while non-trainable parameters are 14714688. The performance of the proposed system is evaluated on the ORL and FERET dataset and it is noticed that the proposed system gives enhanced performance compared with existing face recognition systems as given in table 2. The proposed system has shown improved performance because of the ability of VGGNet to better represent the face images under various pose, occlusion, illumination, and environmental conditions. The proposed system results in 95.80%, 77.50%, and 98.20% accuracy for ORL, FERET, and proposed real-time face image datasets respectively. For the FERET dataset face recognition rate is lower because some of the images are having larger occlusion.

TABLE 1 NETWORK PARAMETERS AND SPECIFICATION

SR.N O	LAYERS	IMAGE SIZE	NO OF FILTE RS	STRI DE	ACTIVATI ON	PARAMET ERS
1	conv[2]	312x312x 64	64	1	ReLU	36928
	max pooling	156x156x 64	64	2	ReLU	0
2	conv[2]	156x156x 128	128	1	ReLU	147584
	max pooling	78x78x12 8	128	2	ReLU	0
3	conv[3]	78x78x25 6	256	1	ReLU	590080
	max pooling	39x39x25 6	256	2	ReLU	0
4	conv[3]	39x39x51 2	512	1	ReLU	2359808
	max pooling	19x19x51 2	512	2	ReLU	0
5	conv[3]	9x9x512	512	1	ReLU	2359808
	max pooling	9x9x512	512	2	ReLU	0
6	fully connect ed	1x41472	-	-	ReLU	0
7	softmax	-	-	-	softmax	2073650

VII. CONCLUSION

In this paper, we have implemented deep learning-based face recognition that can cope up with illumination problems, pose variation, view variation, and occlusion problems. It used two deep learning structures such as MTCNN for face detection and VGGNet for face recognition. It has shown improved performance over the previous techniques for face recognition and results in 95.80%, 77.50%, and 98.20% accuracy under extreme uncontrolled conditions for ORL, FERET, and real-time face database. VGGNet is slower to train and needs larger space which may limit its application for the extremely higher dataset. In the future, the performance of the network can be improved for the larger database and highly occluded face images.

REFERENCES

- [1]. Jain, A. K., & Li, S. Z. Handbook of face recognition (Vol. 1). New York: springer (2011).
- [2]. Bhangale, K. B., Jadhav, K. M., & Shirke, Y. R. Robust Pose Invariant

Face Recognition using DCP and LBP. *Int. Journal of Mgmt., Tech. and Engg.*, 8(11), 1026-1034 (2018).

[3]. Kortli, Y., Jridi, M., Al Falou, A., & Atri, M. Face recognition systems: A Survey. *Sensors*, 20(2), 342 (2020).

[4]. Payal, P., & Goyani, M. M.A comprehensive study on face recognition: methods and challenges. *The Imaging Science Journal*, 68(2), 114-127 (2020).

[5]. Pan, J., Wang, X. S., & Cheng, Y. H. Single-sample face recognition based on LPP feature transfer. *IEEE Access*, 4, 2873-2884 (2016).

[6]. Vigneau, G. H., Verdugo, J. L., Castro, G. F., Pizarro, F., & Vera, E. Thermal face recognition under temporal variation conditions. *Ieee access*, 5, 9663-9672 (2017).

[7]. Jian, Z. H. A. O., Chao, Z., Shunli, Z., Tingting, L. U., Weiwen, S. U., & Jian, J. I. A. Pre-detection and dual-dictionary sparse representation based face

Wireless Weather Monitoring System using GSM

**Prof.R.R.Kawade¹, Radha Dadge²,
Priyanka Katre³, Sayali Pawar.⁴**

¹ Assistant Professor, Department of Electronics and Telecommunication, Pimpri Chinchwad College of Engineering and Research, Ravet-412101,

^{2, 3, 4} Students, Department of Electronics and Telecommunication, Pimpri Chinchwad College of Engineering and Research, Ravet-412101

ABSTRACT

The meaning of climate assumes a significant part in our regular daily existences, along these lines making a remote framework to follow climate conditions, which can, thus, be utilized as a helpful apparatus to affect day by day human existence. As well as putting away the information gathered and contrasting it and the information gathered in the past to conjecture likely changes in climate conditions, we are building a remote framework in this gadget to quickly screen current ecological conditions, like stickiness, temperature, wind heading, precipitation levels. As indicated by our plan, we will foster explicit rules and safeguards that help increment the unfriendly impacts of changes in climate conditions and help keep the environment protected and clean. To assemble such an undertaking, we will utilize the Raspberry pi as the centre of the gadget and the GSM module (SIM900A) as a remote partner, and other supporting sensors. At long last, for our plan, the mission and last objectives focused on are to accomplish a serious level of dependability, smallness, particularity, and cost-viability.

I. INTRODUCTION

Climate is a significant piece of human existence. Sensors are fundamental segments not just relevant to the enterprises for measure control yet additionally in every day life for the wellbeing of structures and traffic stream estimating, natural boundaries estimation. IoT implies the Internet of Things. It gives internetworking of actual gadgets, structures, vehicles, and different parts like sensors and actuators. By giving organization network to frameworks installed with gadgets, programming, sensors, and actuators; these articles can gather and trade information. By utilizing IoT objects to be detected or controlled distantly through the current organization. It permits interfacing the actual world with PC based frameworks. IoT improves proficiency, precision, financial advantages alongside decreased labor. IoT systems help for the collaboration between "things". Likewise upholds more perplexing constructions like circulated processing and the improvement of disseminated applications. Presently a day's most IoT systems appear to zero in on constant information logging arrangements. The information of the deliberate boundaries are not valuable on the off chance that they are not communicated quick and precise way to the clients. Thusly, communicated and handling the deliberate information is a vital part of the cutting edge climate conjecture. Transmission of the deliberate information should be possible by a few methods: WI-FI connect, GSM/GPRS interface, satellite connection immediate, a wired connection, and so on Climate guaging must be dependable and exact, paying little heed to its application. Additionally, it needs to give basic admittance to every one of the deliberate boundaries. The nature of sensors and exactness of estimations may fluctuate, and the area of the climate guaging station can decide the precision and unwavering quality of the climate information assortment. Raspberry Pi, going about as an information lumberjack measure the changed yield of sensors from simple over to computerized. The logged information would then be able to be moved to a work area or whatever other screen that has GUI for additional examination. So by utilizing effectively

got parts and less convoluted hardware incredible climate station can fabricate Now daily's different climate factors like breeze and a lot other reason an extraordinary effect on people everyday life.

2. LITERATURE REVIEW

The need of this audit to furnish us with a thought regarding the cultivated work and the new condition of exploration in this field, it additionally pictures us to perceive how gigantic this region is and the distance away it can go later on, consequently just chose research, in view of their importance and motivation to our venture, are introduced in this segment:

[1] But F. Ersavas' overview finished up A remote framework can be utilized to give observing of natural, soil, or environment conditions and controlling water system or environment control frameworks at an agrarian or scene site. so it centers around the significance of natural checking for the horticultural field.

[2] Kirankumar G. Sutar, "Minimal expense Wireless Weather Monitoring System." This overview talks about, the utilization of numerous sensors that can consistently peruse a few factors that demonstrate the climate conditions like temperature, moistness, and light force in a mechanical climate.

[3] ZigBee-based climate checking framework by Nisha Gahlot, Varsha Gundkal, Sonali Kothimbire, Archana Thite depends on the reality of decrease of horticultural yield and planning a framework that aides in diminishing the impacts of climate changes on rural yield for the advantages of composers.

[4] Wireless Portable Microcontroller-based Weather Monitoring Station: this paper talked about planning and execute an economical Wireless Moveable Weather Monitoring Station utilizing a PIC16F887 microcontroller. The executed Weather Monitoring Station is outfitted with sensors to quantify climate boundaries like similar stickiness, environmental pressing factor, precipitation, sun oriented radioactivity, wind speed, surface, and encompassing temperature. Additionally to these skills, the considered Weather Monitoring

station likewise contains some remarkable highlights like Modbus correspondence convention, which gives immaculately declaration of continuous climate amounts to the BS over both guided (wires) and unguided interfaces. Moreover, at the BS, the got data is recorded and transferred to a web information worker to allow all inclusive admittance to the climate data.

a. AIM

Our plan depends on a distantly worked framework with sensors, which accumulates climate data and sends estimated qualities to the ground. It is accomplished by checking air climate conditions, like temperature, mugginess, wind speed, and light force. It is profoundly dependable and deployable and is an exceptionally helpful utility in a nation like India. The framework can be effortlessly sent in regions to monitor ceaseless climatic changes.

1.1. PROBLEM STATEMENT

Our plan depends on a distantly worked framework with sensors, which accumulates climate data and sends estimated qualities to the ground. It is accomplished by checking air climate conditions, like temperature, mugginess, wind speed, and light force. It is profoundly dependable and deployable and is an exceptionally helpful utility in a nation like India. The framework can be effortlessly sent in regions to monitor ceaseless climatic changes.

1.2 OBJECTIVES

The goal of this task is to plan a remote climate checking framework in which a microcontroller is interfaced with sensors, LCD, and GSM modules to communicate detected information remotely.

- Read climate information.
- Save information in a data set
- Maintain history according to date time
- Graphical show information

2. BLOCK SCHEMATIC & WORKING

Working

Raspberry Pi is the most recent remote innovation. The proposed System will imagine and store different climate

boundaries as given above with the assistance of sensors interfaced to Raspberry will get all information, SD card on Pi stores the gathered information as like a memory card. At that point at the yield side LCD is to be associated for showing the outcome and on-off transfers for worker access. Likewise, 5V, 1A force supply is given to the Raspberry Pi board through a miniature USB opening. A SD card of 8GB is utilized to store the working framework just as all projects and records required for this task. The console and mouse are associated with the Raspberry Pi board through USB ports. The screen is associated with the Raspberry Pi board through a HDMI port utilizing HDMI to VGA link. Ethernet port is utilized to give a web association with the framework by means of LAN. To know the current climate status at a distant area, the client can sign in on an internet browser by entering the username and secret word given for a specific worker by the client. Web application opens subsequent to entering a secret phrase and with the yield graphical portrayal additionally acquire. Raspberry Pi prepared information will be refreshed consistently on cloud worker and client will become more acquainted with the put away information on hourly and regular routine card with a working framework on it (excluded). The Raspberry Pi is famous, with bunches of model ventures and data accessible on the web. The framework detects temperature, stickiness, and climatic pressing factor, light power, precipitation, wind speed, and wind course and passes on this to the client remotely. Our framework utilizes a temperature sensor to recognize and record the current temperature. It utilizes a light sensor to recognize current lighting conditions. Likewise, a dampness sensor is utilized to identify current mugginess conditions. This information from sensors is passed on to the microcontroller. The microcontroller now measures this information and gives it to a GSM modem interfaced

as a SMS message and sends this message to the customized client. Accordingly, this advances a remote GSM-based climate observing framework where the individual shouldn't be close to the hardware to continually screen meteorological forecasts. The information is naturally shipped off the client through a SMS.

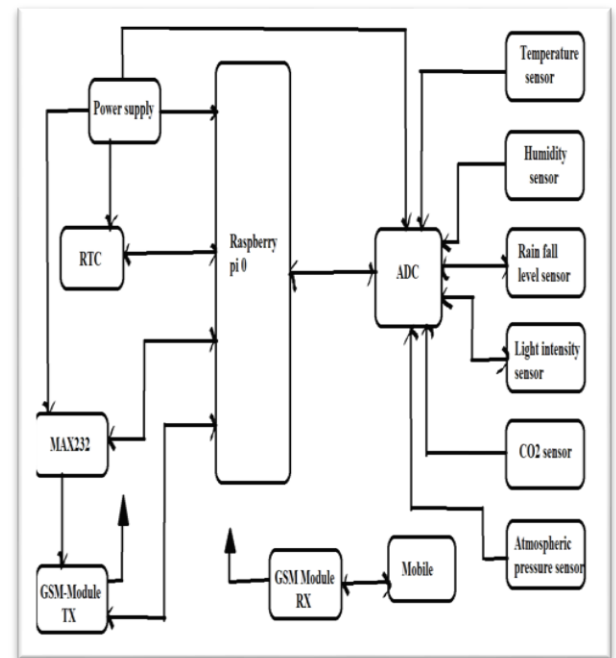
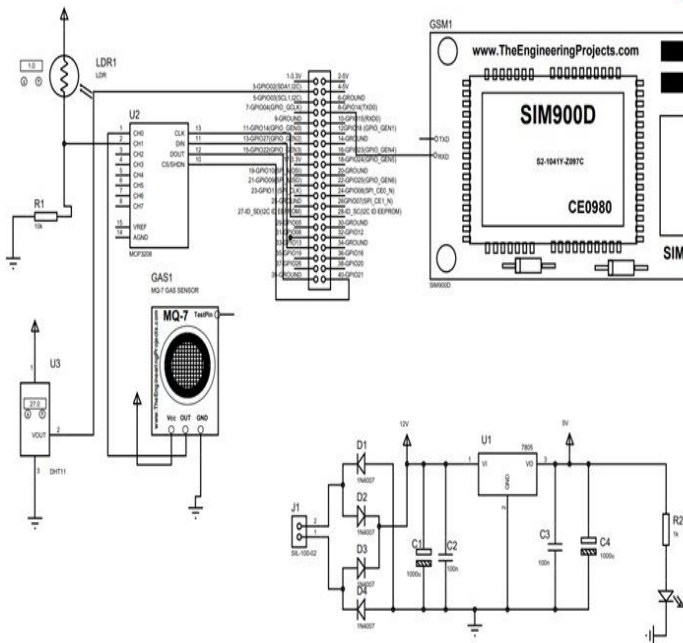


Fig1. Block Diagram

3. CIRCUIT DIAGRAM The circuit diagram of proposed system is shown in fig.2,

4.

to it. The GSM modem presently encodes this information



5. HARDWARE USED:

1. Raspberry pi
2. GSM Module
3. Temperature Sensor
4. Humidity Sensor
5. Rainfall level sensor
6. Light Intensity Sensor
7. Co2 Sensor
8. Wind Direction Sensor
9. Atmospheric pressing factor Sensor

SENSORS USED

- A - DHT11.
- b- BMP20.
- c- Anemometer.
- d- DS3231.
- e- BH1750.
- f- Rain Sensor.
- g- MQ-9

6. RESULT

In this task, the client can follow area boundaries like current temperature, dampness, downpour condition on requests so he can call the framework from any area distantly to demand the situation with that area and by area, we implied ranch, manufacturing plant, or even house. This framework decreases human exertion consequently bring about high productivity and exactness as the sensor estimated information can be sent in a flash dependent on necessities and requests, a similar information estimated is utilized and dissected for future expectation purposes.

7. ADVANTAGES

- High effectiveness.
- Low blunder likelihood.
- Reduces human pressures.
- Display precise data.
- Weather nformation is conveyed at impressive scale.

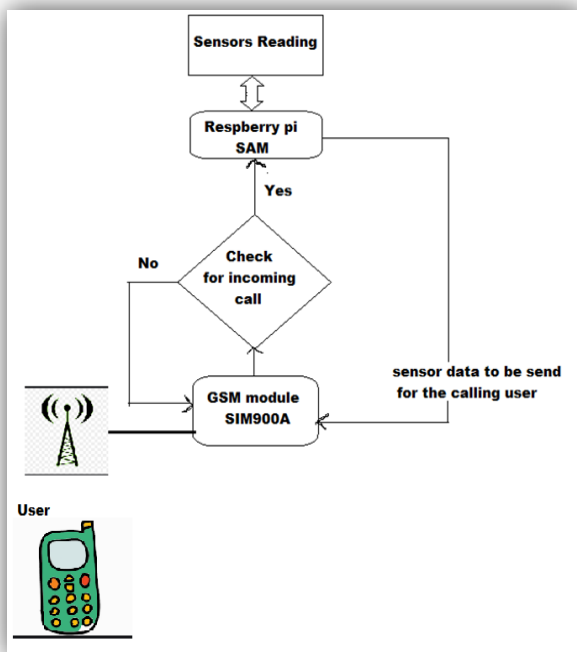
8. APPLICATIONS

This undertaking can be utilized by:

5.

Fig2. Circuit Diagram

4. FLOW CHART AND ALGORITHM



1. Sensor Reading
2. Send to Raspberry pi
3. Sensor information to be sent for the calling client to the Gsm module
4. Check for approaching call
5. Gsm Send a message to the client

- Meteorological area.
- Weather stations.
- Farmers.
- Civil engineers.
- Agricultural areas.

9. CONCLUSION

The primary attributes of this examination are day by day information inspecting like clockwork from the sent gadget and availability to the ground station through GSM cell organizations. The attainability of force age is intermittently planned and different temperature, stickiness, and wind speed esteems are tried for an ideal age. Along these lines, we can propose the advancement of sun oriented force age or wind power age stations for the various upsides of the above states of being, at whatever point the conditions are great for the various upsides of the above states of being.

10. REFERENCES

- [1] Mohammad Javad Manashti, Houshang Ghamarnia, Soheila Amirian, Ramin Mohammad Nezhad, "Plan GSM-SMS based framework for old organized nurseries with observing and logging network sensors," International Research Journal of Applied and Basic Sciences, vol. 3, pp. 1497-1507, 2012.
- [2] Jifeng Ding, Jiyin Zhao, Biao Ma, College of Electromechanical and Information Engineering, Dalian Nationalities University Dalian, China, "Far off observing arrangement of temperature and mugginess dependent on GSM," in second International Congress on Image and Signal Processing, 2009.
- [3] www.atmel.com.
- [4] M. A. B. Manaf, "Smaller than expected Wireless Weather Station," University Teknikal Malaysia, Malaysia, 2007.
- [5] Chebbi, W.; Benjemaa, M.; Kamoun, L.; Jabloun, M.; Sahli, A., "Improvement of a WSN coordinated climate station hub for a water system ready program under Tunisian conditions," Systems, Signals, and Devices (SSD), 2011 eighth International Multi-Conference on, vol., no., pp.1,6, 22-25 March 2011.
- [6] Zhen Fang; Zhan Zhao; Du, Lidong; Jiangang Zhang; Cheng Peng; Geng, Daoqu, "another convenient miniature climate station," Nano/Micro Engineered and Molecular Systems (NEMS), 2010 fifth IEEE International Conference on, vol., no., pp.379,382, 20-23 Jan. 2010. doi:10.1109/NEMS.2010.5592239.
- [7] Pramod Arvind Kulkarni, Vaijanath V Yerigeri "An Economical Weather Monitoring System Based on GSM utilizing Solar and Wind Energy", International Journal of Advanced Technology and Innovative Research Volume.07, IssueNo.02, Pages: 0263-0268, February-2015.
- [8] Kirankumar G. Sutar, "Minimal expense Wireless Weather Monitoring System." International Journal of Engineering Technology and Management Research, Vol. 1, No. 1, pp.: 48-52, 2015.
- [9] Popa, M.; Napa, C., "Implanted climate station with far off remote control," Telecommunications Forum (TELFO R), pp.297,300, 22-24, Nov. 2011.
- [10] Ghosh, A.; Srivastava, A.; Patidar, A.; Sandeep, C. more creators, "Sun oriented Powered Weather Station and Rain Detector", India Educators' Conference (TIIEC), 2013 Texas Instruments, pp:131 - 134, 4-6 April 2013, doi:10.1109/TIIEC.2013.30.



DESIGN OF SINGLE BAND RECTANGULAR MICROSTRIP PATCH ANTENNA FOR 5G APPLICATION

Shreya Sakpal¹, Nikita Shirole², Vaishnavi Valanju³ and Triveni Dhamale⁴

¹Electronics and telecommunication, Savitribai Phule Pune University, India

E-mail: shreyasakpal1608@gmail.com

²Electronics and telecommunication, Savitribai Phule Pune University, India

E-mail: nikita.shirole18@gmail.com

³Electronics and telecommunication, Savitribai Phule Pune University, India

E-mail: valanju.vaishnavi11@gmail.com

⁴Electronics and telecommunication, Savitribai Phule Pune University, India

E-mail: triveni.dhamale@pccoer.in

I. INTRODUCTION

In today's digital era the demand for Internet usage is increasing rapidly. Users demand fast data speeds, more reliability, massive network capacity in order to fulfill their needs, and we have come across 5G technology. Mostly the frequency range used for 5G research is in the range of 24 GHz to 60 GHz. So we have designed a single band. It is a rectangular patch antenna having a resonant frequency 30 GHz. This antenna consists of ground, substrate, patch and feedline. The dimensions of the ground are 6.0429mm x 6.9528mm. The antenna is designed with Rogers RT 5880 substrate with dimensions 6.0429mm x 6.9528mm. The dimensions of the patch are 3.0429 mm x 3.9528 mm.

The wide use and considerable decrease in the size of mobile phones led to immediate requirement to develop small sized antennas that could fit in those devices. This gave rise to microstrip patch antennas in the 20th century. It consists of a thin metal foil also called a patch mounted on a substrate, beneath the substrate there is a ground layer. Mostly these antennas are used in microwave and millimeter frequency bands. This future 5G technology can also be used in smart cities, smart transportation and robotics applications.

II. ANTENNA AND ITS PARAMETERS

An antenna is a metallic device which transmits or receives the radio signal. They are basically the transducers which convert voltage to radio signal at transmitter end and pass the signal to receiver through air. At receiver side, the antenna converts that radio signal into voltage form. Antenna parameters play a vital role in

ABSTRACT The purpose of this paper is to design a single band microstrip patch antenna for 5G wireless communication. The resonant frequency of the antenna is 30 GHz. The antenna has a compressed structure of 6.0429x6.9528x0.5mm. This rectangular patch antenna is designed using Rogers RT5880 substrate with dielectric constant 2.2 and of thickness h=0.5mm. The patch antenna was simulated on CST Microwave Studio Simulation Software. This antenna provides gain of 5.938 dB and it is used for wireless communication and mobile equipment.

INDEX TERMS Microstrip patch antenna, CST Studio, 5G communication.

the Design and Development phase. The different antenna parameters are S-Parameter, VSWR, Directivity, Gain, Bandwidth, Radiation pattern, Antenna efficiency etc. S11 parameter defines the return loss of an antenna. Less is the return loss, more is the efficiency of the antenna. VSWR is correlated to reflection coefficient. Practically it should be between 1 to 3. Ideally the value of VSWR is 1. Radiation is an important antenna parameter which determines how good the antenna is in terms of directivity of the antenna. Most of the radiation should be on the broadside perpendicular to the plane of paper. It is minimum at the bottom and maximum at the top because of the fringing field. In the antenna radiation pattern there are major lobe and side lobe. The side lobe represents the loss. The loss happens due to power being transmitted back to the source. Power is returned back to the source or transmitter; those losses are called as return loss.

III. ANTENNA DESIGN

The designed model of Rectangular Microstrip Patch antenna works at a frequency of 30 GHz. This rectangular patch antenna is fed by a 50 ohm microstrip feedline. This antenna has basic three layers namely ground followed by substrate which is followed by patch shown in figure no. 1. The dimensions of ground are 6.0429mm x 6.9528mm as shown in the figure no. 2.1. The dimensions of the substrate which is made up of Rogers RT 5880 are 6.0429mm x 6.9528mm as shown in the figure no. 2.2. The dimensions of the patch are 3.0429 mm x 3.9528 mm as shown in the figure no. 2.3. The precise values of the input parameter of microstrip patch antenna is shown in Table no 1.

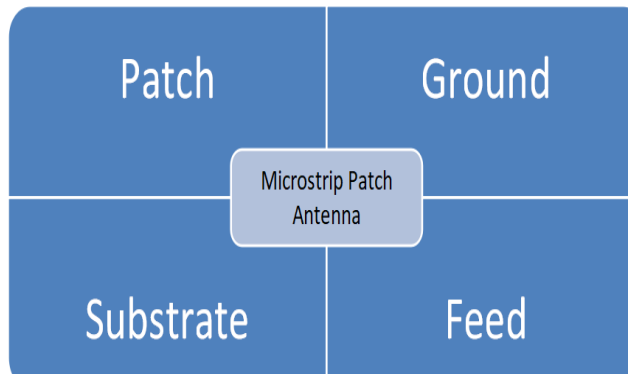


Figure no. 2.1 - Ground of Microstrip Patch Antenna

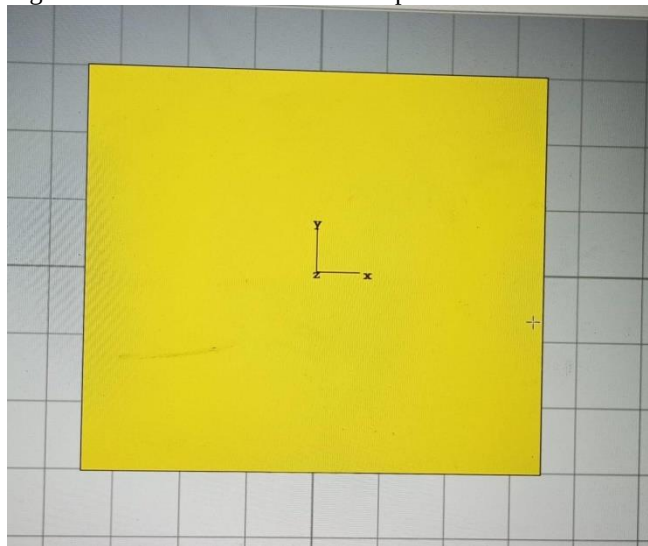


Figure no. 2.2 - Substrate of Microstrip Patch Antenna

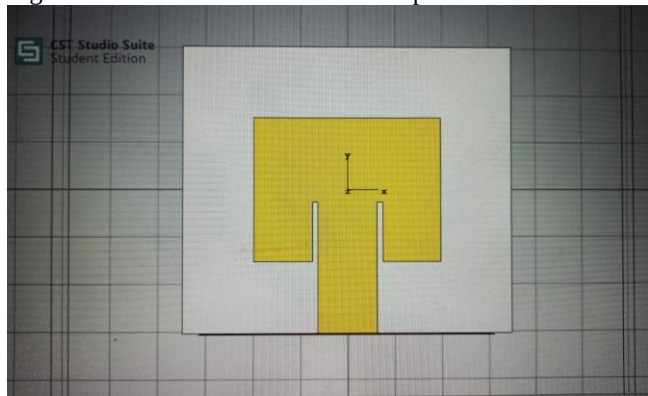


Figure no. 2.3 - Patch of Microstrip Patch Antenna

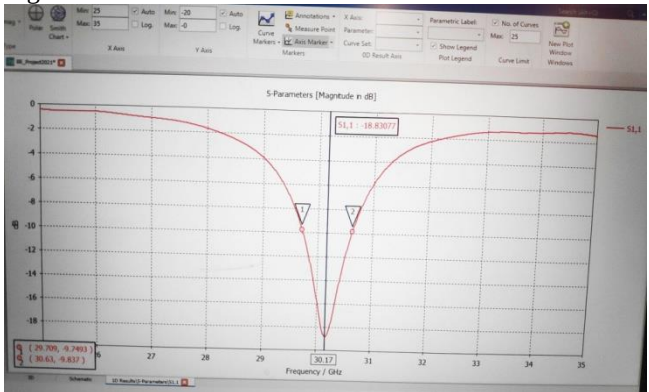
			ground and substrate
3.	Lp	3.0429	Length of patch
4.	Wp	3.9528	Width of patch
5.	h	0.5	Height of substrate
6.	t	0.035	Thickness of ground
7.	wf	1.25	Width of feedline
8.	Lf	1.25	Length of feedline
9.	s	0.12	Width of slot

V. SIMULATION RESULTS

❖ S-Parameter Plot

The S11 parameters are considered as antenna return loss parameters. Considering -10 dB to be the base value, the return loss obtained at 30 GHz is 18 dB. Figure no. 3.1 shows the plot of S-Parameter.

Figure no. 3.1



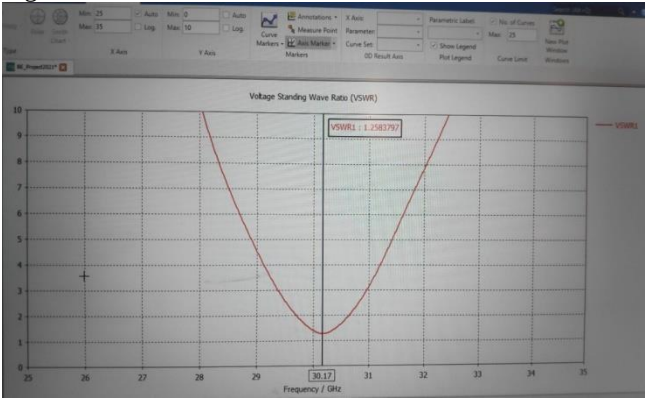
IV. FIGURES AND TABLES

Sr. No	Parameter	Value	Description
1.	L	6.0429	Length of ground and substrate
2.	W	6.9528	Width of

❖ VSWR Plot

The Voltage Standing Wave Ratio i. e VSWR plot is shown in the figure no. 3.2. Ideally the value of VSWR should be 1 and practically the value should be not more than 2.5 dB. This antenna has VSWR of 1.58 dB at 30 GHz.

Figure no. 3.2



Sr. No.	Parameter	Result
1.	S-Parameter	18 dB
2.	VSWR	1.58 dB
3.	Gain	5.938 dB

Gain Plot

The 3D plot shows the gain of the antenna, Figure no. 3.3 and Figure no. 3.4. The antenna has a gain of 5.938 dB.

Figure no. 3.3

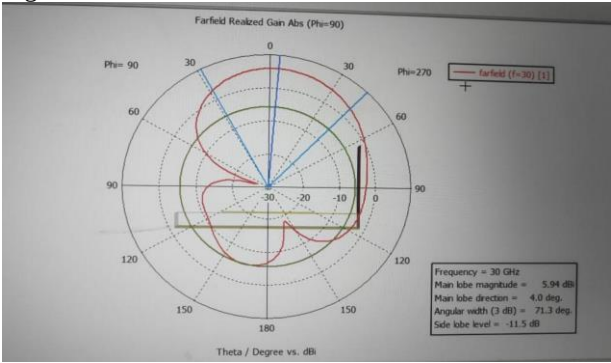
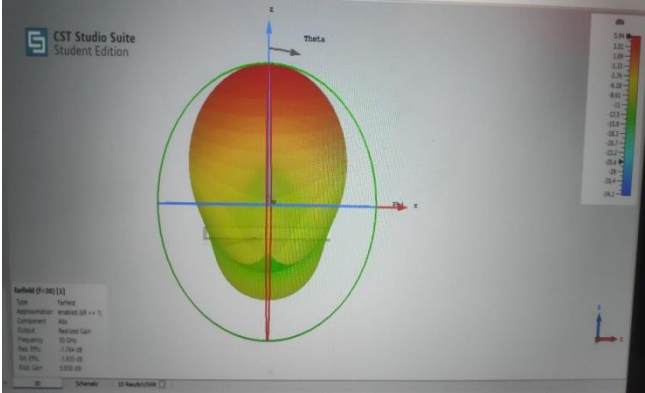


Figure no. 3.4



The Table no. 2 shows the output parameters of the single band rectangular microstrip patch antenna.

Table no. 2 - Output Parameters of Patch Antenna

VI. CONCLUSION

In this a small single band microstrip patch antenna has been proposed for 5G wireless communications. The Microstrip Patch Antenna has a compressed structure of 6.0429mm x 6.9528mm x 0.55mm. The antenna provides the gain of 5.938 dB. This antenna is used for wireless communication systems and mobile equipment.

REFERENCES

- [1] D. M. Pozar, D. H. Schaubert. Microstrip antennas: the analysis and design of microstrip antennas and arrays, IEEE Computer SocPr, 2008.
- [2] JOHNSON, R.c., and JASIK. H (Eds.): 'Antenna engineering handbook' (McGraw-Hill, New York, 1984).
- [3] X.-P. Chen, K. Wu, L. Han, F. He, "Low-cost high gain planar antenna array for 60-GHz band applications", IEEE Trans. Antennas Propag., vol. 58, no. 6, pp. 2126–2129, June 2010.
- [4] B. Biglarbegian, M. Fakharzadeh, D. Busuioc, M.-R. N. -Ahmadi, S. S. -Naeini, "Optimized microstrip antenna arrays for emerging millimeter-wave wireless applications", IEEE Trans. Antennas Propag., vol. 59, no. 5, pp. 1742–1747, May 2011.
- [5] L.Wang, Y.-X.Guo, W.-X. Sheng, "Wideband high-gain 60-GHz LTCC L-probe patch antenna array with a soft surface", IEEE Trans. Antennas Propag., vol. 61, no. 4, pp. 1802–1809, April 2013.
- [6] W. Roh et al., "Millimeter-Wave Beamforming as an enabling technology for 5G cellular communications: theoretical feasibility and prototype results", IEEE Comm. Magazine, pp. 106-113, Feb. 2014.
- [7] R. Q. Lee, K. F. Lee and J. Bobinchak, "Characteristics of a two-layer electromagnetically coupled rectangular patch antenna", Electron.Lett., 23, pp. 1070-1072, 1987.
- [8] V. Palanisamy and R. Garg, "Analysis of arbitrary shaped microstrip patch antennas using segmentation technique and cavity model", IEEE Trans. Antennas Propag., AP-34, pp. 1208-1213, 1986.
- [9] T. Huynh and K. F. Lee, "Single-layer single-patch wideband microstrip antenna", Electron.Lett., 31, pp. 1310-1312, 1995.
- [10] WATERHOUSE.R.B : Theoretical investigation of the effects of substrate parameters in the performance of diode loaded microstrip patches'. Proc. IEEE Antenna Propagat.Symp., 1994, pp. 790-793

Smart Mirror Using Raspberry Pi

Aishwarya Awsarkar¹, Agalya Gowander², Akash Ubale³,
Hrishikesh Suryawanshi⁴, Prof Kishor Wane⁵

¹dept. Electronics and telecommunication, Savitribai Phule Pune University, India.

²dept. Electronics and telecommunication, Savitribai Phule Pune University, India.

³dept. Electronics and telecommunication, Savitribai Phule Pune University, India.

⁴dept. Electronics and telecommunication, Savitribai Phule Pune University, India.

⁵ dept. Electronics and telecommunication, Savitribai Phule Pune University, India.

ABSTRACT Traditionally, the purpose of mirrors was to see our reflection in it. But wouldn't it be great if we use current technology of networking world through the medium of the Internet of Things (IoT) in these traditional mirrors. This concept is widely used in smart display devices to showcase interactive multimedia interface [1]. So to have it in these ambient homes as well as in viable regions will make the mirrors smart. This paper provides the design and development of a smart mirror which offers the user with real time information of best current updates of newscast, climate and apparent time equivalent to the distinct locality and scheduled work and meetings. These contents will be displayed on the two ways mirror mounted with LED monitor display in a wooden frame. These basic features will be made available from Internet using Raspberry Pi module for managing on it. By means of the identity verification method we can distinguish the handler's face and validate the handler. This feature can also be used to determine the scheduling of an assignment allocated to handler

INDEX TERMS Two way mirror, Raspberry pi 4, Camera, SD card, HDMI cable, Monitor, Wooden Frame

I. INTRODUCTION

The internet has been one of the greatest mankind inventions occurred to this world. It has changed and

improved the means of people; also it has been evolving each and every day. In this innovation, concept called The 'Internet of Things' (IoT) helps in making devices smarter with interactive computing and wirelessly connected embedded devices. Considering the fact that a person spends a notable time in front of the mirror our project is aiming to explore various fields where technology can be made resourceful to people. The concept of smart mirror is to boost real time information such as forecast, headlines and corresponding location time with the help of IoT using Raspberry Pi module [5]. These smart mirrors can be mounted on the wall where we are aiming to enhance features in colleges to show the details of reserved task assigned to a certain faculty. With the assistance of OpenCV library we can preserve a certain person's data within himself whenever handler's face discovers in the mirror. It also provides better safekeeping to the handler. Smart mirrors can be very helpful in viable regions with the help of artificial intelligence, machine learning concepts and human lifestyle more standard and evolving.

II. METHODOLOGY

The overall system is divided into three parts Face detection, face recognition and display of appropriate information according to the user's need. Face detection is carried out using HAAR cascade algorithm and face recognition with Viola Johns' algorithm. In the block diagram, Raspberry Pi Controller is used in this project. It is the main controller in the proposed system. Camera is used as the input device to a controller. It captures the image of a person standing in front of the mirror, it detects the face and accordingly the data is displayed on the mirror. The data is fetched from various websites using internet. The mirror used here is not the normal mirror. Two-way mirror is used in the project as it provides direct vision from dark side of normal mirror when light is passed through it. Power supply is given to controller and monitor.

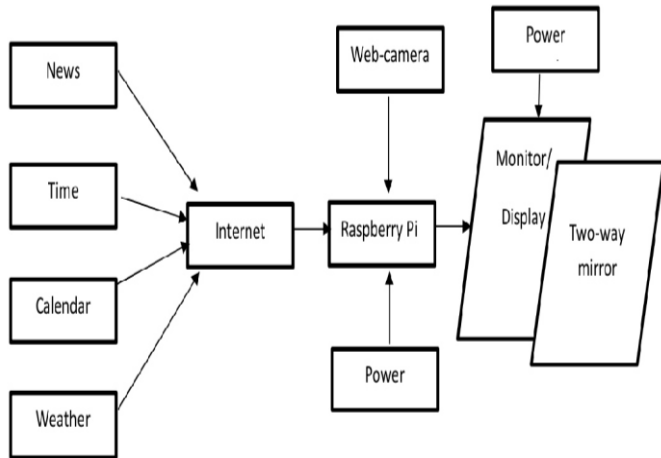


Figure 3.1 Block diagram of proposed system

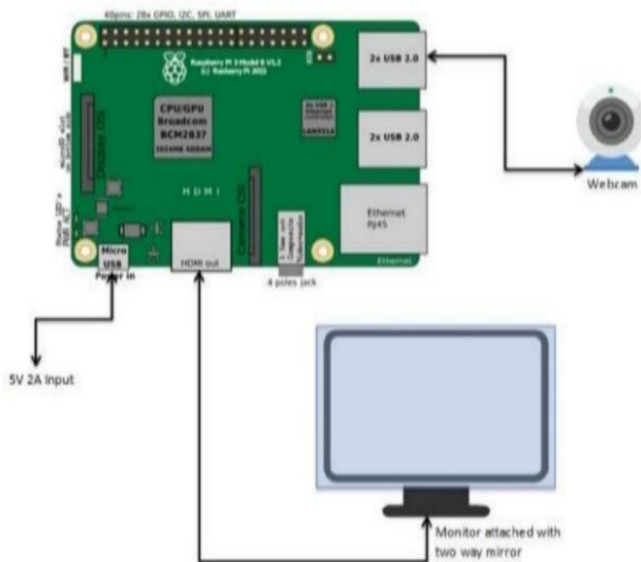


Figure 4.1 Circuit Diagram

the system displays the necessary information in the presences of the user. In the proposed system Raspberry pi 4 is used. A two way mirror is placed on the monitor which acts as a regular mirror when there is no user in front of the mirror the information that is customized will be displayed. The official schedule of events, date, whether report, etc. Are obtained by using Google calendar API and whether API. Tinter, a standard library GUI python module is used for displaying the useful information.

V. DESIGN AND PROPOSED SYSTEM

The task that the mirror undergoes is setting a reminder for college staff in order to work more efficiently. A service-oriented architecture is adapted for the development and deployment of the various services. Power Consumption is completely minimum since the mirror will display information only in presence of a staff due the sensors. Block diagram of system is Raspberry pi based display when connected to the internet then only

- [7] O. Gomez-Carmona and D. Casado-Mansilla, "SmiWork: An interactive smart mirror platform for workplace health promotion," 2017 2nd International Multidisciplinary Conference on Computer and Energy Science (SpliTech), Split, 2017, pp. 1-6.
- [8] S. Athira, F. Francis, R. Raphael, N. S. Sachin, S. Porinchu and S. Francis, "Smartmirror: A novel

CONCLUSION

After studying various methodologies and algorithm used for smart mirror application we have implemented the face detection using HAAR Cascade. Using internet the smart mirror provides an ambient environment for the users. It can be used in industries, school, college, hospital, etc. The main security for the smart mirror is face recognition. The smart mirror in advance can be made touch panel display. The system is very reliable and easy to use, in the interactive system; mainly we have been concentrating on an interactive system for school, college, office, hospital, etc.

VI. REFERENCES

- [1] Piyush Maheshwari, "Smart Mirror: A Reflective Interface to Maximize Productivity" International Journal of Computer Applications (0975 –8887) Volume 166 – No.9, ay 2017.
- [2] Salu George Thandekkattu "Smart Mirror-Network Architecture Based on Iot And Cloud Computing Technology.
- [3] Ayushman Johri; Sana Jafri; Raghav Narain Wahi;

Dhiraj Pandey "Smart Mirror: A time-saving and Affordable Assistant" 2018 4th International Conference on Computing Communication and Automation (ICCCA); 2018.

[4] Kun Jin; Xibo Deng; Zhi Hung; Shaochang Chen, "Design of the Smart Mirror Based on Raspberry PI" 2018 2nd IEEE Advance Information Management, Communication Electronic and Automation Control Conference (IMCEC); 2018.

[5] M. M. Yusri et al., "Smart mirror for smart life," 2017 6th ICT International Student Project Conference (ICT-ISPC), Skudai, 2017, pp. 1-5.

[6] D. Gold, D. Sollinger and Indratmo, "SmartReflect: A modular smart mirror application platform," 2016 IEEE 7th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), Vancouver, BC, 2016, pp. 1-7

framework for interactive display," 2016 International Conference on Circuit, Power and Computing Technologies (ICCPCT), Nagercoil, 2016, pp. 1-6.

[9] Divyashree K J, Dr. P.A. Vijaya, Nitin Awasthi, "Design And Implementation Of Smart Mirror As A Personal Assistant Using Raspberry Pi"

[10] <https://ece-eee.final-year-projects.in/a/2926-smartmirror-a-glance-into-the-future.html>

[11] Lakshami N M, Chandana M S, Ishwarya P, "IoT based smart mirror using RaspberryPi".

LORAWAN Based Smart Farming Modular IOT Architecture

Prof.M.S.Andhare¹, Gunjan Sali²,
Vidya Sutar³, Shivani Walunj.⁴

¹ Assistant Professor, Department of Electronics and Telecommunication, Pimpri
Chinchwad College of Engineering and Research, Ravet-412101,

^{2,3,4} Students, Department of Electronics and Telecommunication, Pimpri Chinchwad
College of Engineering and Research, Ravet-412101

ABSTRACT This system mainly helps to improve Greenhouse management with data-driven smart farming & resource management using Low Power Long Range Wide Area Networks (LoRaWAN). By using this LoRaWAN based IoT system farmers can check & control various day-to-day activities of farming. Like environment monitoring, farm asset monitoring, irrigation control, soil health, etc. Due to that farmers can control various farm activities like maintaining the correct amount of water on the farm, Greenhouse temperature conditions, Soil moisture conditions, Water level conditions to get the best quality product.

.INDEX TERMS LoRa, Network, WAN, cost, Greenhouse

I. INTRODUCTION

To achieve the best quality product & to get easy control on farming we have arranged the Lora nodes with IoT platform & various types of sensors like soil moisture Sensor, temperature sensor, humidity sensor, & on basis of the output of these sensors controlling output devices works that is greenhouse roof opening or closing, Water pump ON or OFF. Lora module controls the activities with help of various node inputs which are arranged in the farm for the working of LoRaWAN very little power is needed also it has a long range of communication. In this system, we used a LoRa module, an atmega328 controller processor, various

types of sensors like temperature humidity sensor, soil moisture sensor, cooling fan, water pump motor. In this project, an IoT platform is used, LoRaWAN provides connectivity over the large agricultural field with low energy requirement. There are main two parts of the system. Transmitter side & Receiver side. On the

transmitter side, there is the controller with a sensor node & on the receiver side, there is a LoRa module with IoT graphic user interface. To controller connected soil moisture sensor SHT10 which will sense moisture level of soil & according to that required amount of water, we can provide to plants using water pump motor. Then the second type of sensor i.e. temperature humidity sensor DHT11 it will sense the temperature level of the greenhouse & according to that we can control turn on or off the cooling fan or if needed we can open or close the greenhouse roof as per requirement Means these three operations will be performed i.e. Water motor on or off, cooling fan on or off & greenhouse roof open or close. These all operations are performed with help of the LoRa module. LoRaWAN stands for Long Range Wide Area Network. It can transmit the data with a distance of 100km also. Lora node is implemented in the farm. This node will collect all the sensor data like soil moisture level, temperature humidity level, water requirement all these data are collected by the Lora transmitter & it sends or transmits data at the receiver side. This transmitted data received by LoRa receiver at PC server & we can see this data on laptop or mobile with the use of IoT graphic user interface. GUI is nothing but the form of interface that allows users to interact with electronic devices through the graphical icon. Due to GUI, we can see the run time condition of the farm & with just one click we can operate motors fans that are connected to the farm. These all happen due to LoRaWAN from long distances also we can control the farm activities from our

home.

5.1. PROBLEM STATEMENT

Main aim of LORAWAN Based Smart Farming Modular IOT Architecture is improving the management of generic farm greenhouse in highly customised way..

5.2. OBJECTIVES

- i. To collect & handle relevant data from farms activities like growing condition of crops, greenhouse products, further processing them for effective farm management.
- ii.
- iii.
- iv. By using this LoRaWAN based IOT system farmer can check & control on various day to day activities of farming. Like environment monitoring, farm asset monitoring, irrigation control, soil health, etc. Farmers can now schedule and apply the right amount of water to crops
- v. .Reducing waste and costs, human efforts

6. BLOCK SCHEMATIC & WORKING

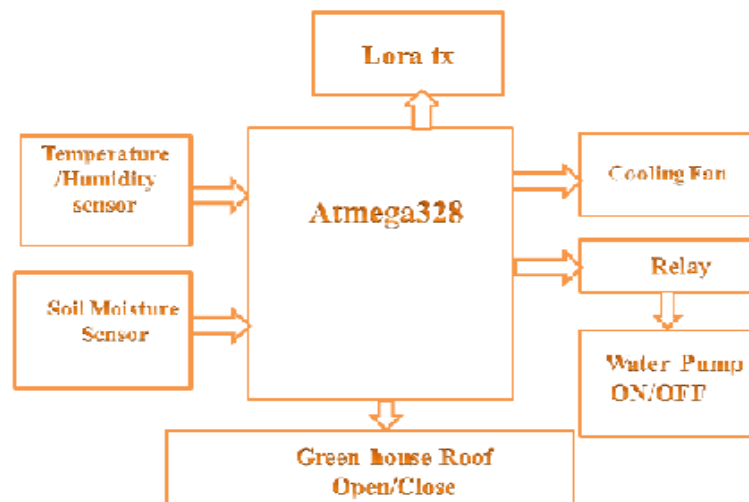
Atmega328: The high-performance 8-bit AVR RISC-based microcontroller. The device operates between 1.8-5.5 volts. LoRaWAN: (433MHz) Lora WAN stands for Long Range Wide Area Network. It is low power & long range communication as it can provide connectivity over large agricultural field with low energy requirements. The design principle of LoRa form aims at deploying a platform able to collect & handle relevant data for farm activities. It collects environmental data i.e. air, soil, temperature & humidity related to growth of farm products.

Temperature & Humidity Sensor(DHT11): DHT11 is a basic digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding atmosphere.

Soil Moisture Sensor(SHT10): This soil moisture sensor module is used to detect the moisture of the soil. It measures the volumetric content of water inside the soil and

gives us the moisture level as output. Operating Voltage: 3.3V to 5V DC

Water Motor: REES52 Micro DC 3-6V Micro Submersible Mini Water Pump For Fountain the farm



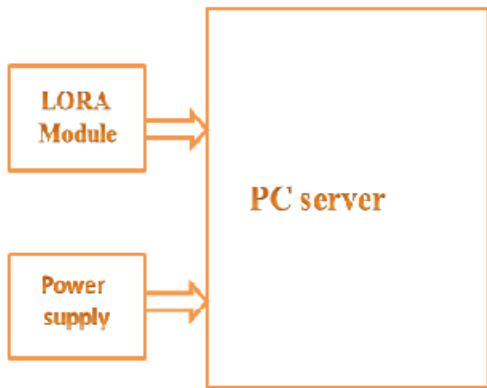


Fig1. Block Diagram

7. CIRCUIT DIAGRAM

The circuit diagram of proposed system is shown in fig.2,

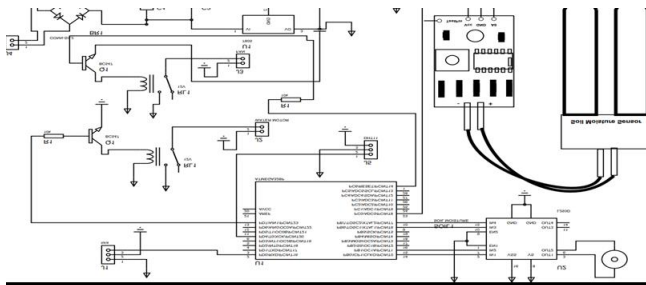
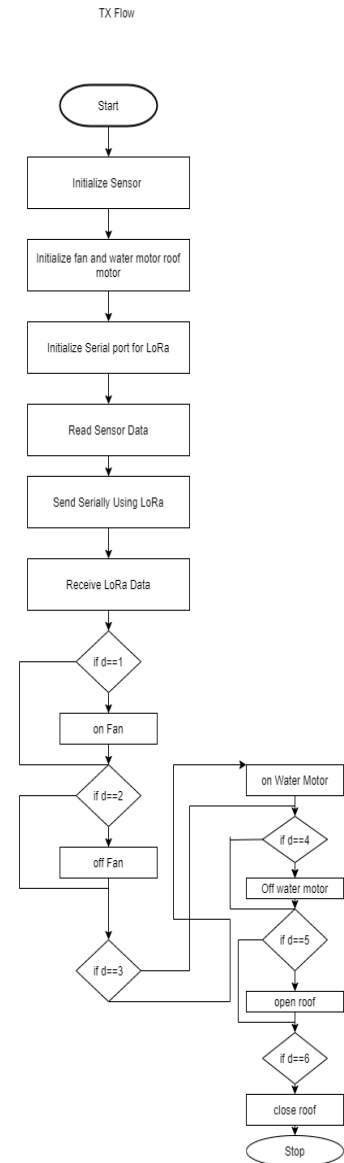
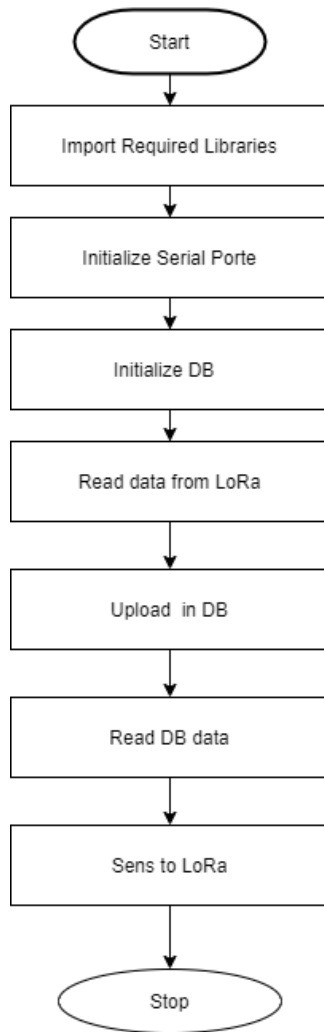


Fig2. Circuit Diagram

4. FLOW CHART



RX Flow

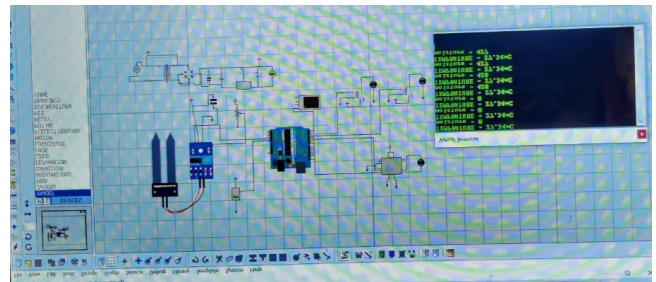


5. SPECIFICATION

Components	Specification
1 Atmega 328	8 bit AVR
2 Lora Module	433 MHZ
3 Water Motor	REES52 Micro DC 3-6 V Submersible mini water pump
4 Soil Moisture Sensor	SHT-10
5 Humidity And Temperature Sensor	DHT11
6 Cooling Fan	MINI 5v DC fan
7 Relay	SRD 5v DC

8 12v adapter	12V
9 L293D	Motor Driver Module
10 DC motor	Motor 500 RPM 12v dc gear for robotics
11 PCB	Aurdino PCB board

6. RESULT



7. ADVANTAGES

1. Manpower Reduction & Labor Effectiveness
2. Raising Reduction of Resources Waste
3. Production Enhancement
4. Lowered Operation Costs
5. Profit increase

8. APPLICATIONS

1. In Greenhouse
2. Agriculture Sector
3. For Monitoring Environmental Condition

9. CONCLUSION

1. The system which utilizes LoRa module to develop a smart agriculture control and monitor has been designed. Wireless sensor networks and network communication technology are used to support intelligent agricultural data collection and equipment control
2. Furthermore we have introduced ability to regulate and observe the system remotely via computer software

10. REFERENCES

- [1]M.Guizani,M.Mohammadi, “Internet of Things: A Survey on Enabling ,Protocols, and Applications”.
- [2]Kim,Yunseop,Robert G.Evans, “Remote sensing and control of an agriculture system using a wireless sensor

AUTONOMOUS FLOOR CLEANING ROBOT

Vijayalaxmi S. Kumbhar¹,
Dnyaneshwari jagtap², Mansi
Kulkarni³, Salim Lakade⁴

¹ Assistant Professor, Department of Electronics and Telecommunication, Pimpri Chinchwad College of Engineering and Research, Ravet-412101,

^{2,3,4} Students, Department of Electronics and Telecommunication, Pimpri Chinchwad College of Engineering and Research, Ravet-412101

ABSTRACT Cleaning the floor is an important task which takes a lot of time; sometimes we assign people for cleaning and pay them money. But due to the advancement of technology households are becoming smarter and more automated, which provides convenience for the people. There are various vacuum cleaners are available in the market but they do not include wet cleaning and operate manually. So, the main purpose of our project is to design an autonomous floor-cleaning robot to make the cleaning task much easier and to include dry and wet cleaning in one design. This robot is designed to clean homes, schools, offices; it is created to make the job easier. Smartphone, ATmega328, Bluetooth model HC05, servomotor, motor driver IC LM293D, DC motor.

INDEX TERMS ATmega328, Bluetooth model HC05, DC motor, motor driver IC LM293D, servomotor, smartphone..

I. INTRODUCTION

The main goal of this research paper is to create a robot that reduces a person's effort in scrubbing and sweeping while also finding a way to resolve the drawbacks of the previous cleaning method. Robots are using for different purposes in home automation. The traditional floor cleaning process is

time-consuming. Due to which people are experiencing various health issues. Therefore vacuum cleaner is designed to reduce these problems. There are different types of vacuum cleaners available in the market. But they are expensive, bulky, and work on either wet or dry cleaning, so to provide a solution

regarding these problems we designed the Autonomous Floor Cleaning Robot. This robot is cost-effective with the combined applications of wet and dry cleaning operations. It has two modes automatic and manual mode. Manual mode is operated by a mobile phone application so that the user can handle the robot. And for Automatic mode robot itself performs all the activities. For obstacle detection, an ultrasonic sensor is used in automatic mode. This robot is affordable to common people and could be used in houses, schools, hospitals, offices, etc. Due to its small size, this robot can reach places where humans are unable to go.

II. PROBLEM STATEMENT

In the traditional floor cleaning process, we use mops and brooms to clear the dirt and dust particles on the floor which requires a lot of human effort. Also, the normal floor cleaning process is time-consuming. In the past few years different types of vacuum cleaners are developed and available in the market but they are used for dry cleaning purposes only. Whereas the cost of these vacuum cleaners is also very high, this is not affordable for common people. The additional features built on the existing systems are quite bulky and expensive. Due to manual handling, this system consumes more power. So, the motive of this research work is to provide easier solutions to all these operational issues, drawbacks in the existing system.

III. OBJECTIVES

1. To design & develop a machine that reduces human efforts & helps in easy and quick cleaning at an affordable cost.
2. To develop a user-friendly system so that anybody with very less basic knowledge can handle the machine.
3. To ensure safety while handling this machine.
4. To develop a fully self-contained low maintenance system.
5. To develop a low power consumption system.

IV. BLOCK SCHEMATIC & WORKING

An autonomous floor cleaning robot is dependent on ATMEGA

IC has been created. This floor cleaning robot is an electronic application that operates in two modes as per user requirement automatic mode and manual mode. Unlike other floor cleaning robots, this isn't only a vacuum cleaner robot as it performs dry and wet cleaning operations in a single system unit. A separable mop is utilizing for wet cleaning purposes. In the automatic mode, the robot plays out all the activities on its own, handling all commands itself. Where firstly the robot

initiates to start the operation and moves in desired commands to perform further cleaning activity. For the critical surface area to stay away from obstacles purposely ultrasonic sensors have been utilized. Assuming any obstacle is distinguished; a robot will suddenly change the path automatically and doesn't quit the ongoing cleaning process. In the cleaning process, it follows a crisscross approach where the water supply is attached, which consequently splashes water for cleaning. Therefore there is no need to join wet fabric every time for cleaning. Motor driver circuits have been utilizing to drive the motors. In the manual mode, the robot is operating through an android application using an advanced mobile phone, which

includes all the necessary commands for the cleaning operation of the system.

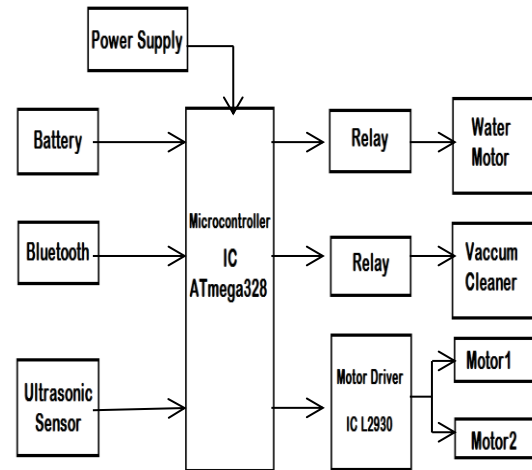


Fig1. Block Diagram

V. CIRCUIT DIAGRAM

The circuit diagram of proposed system is shown in fig.2,

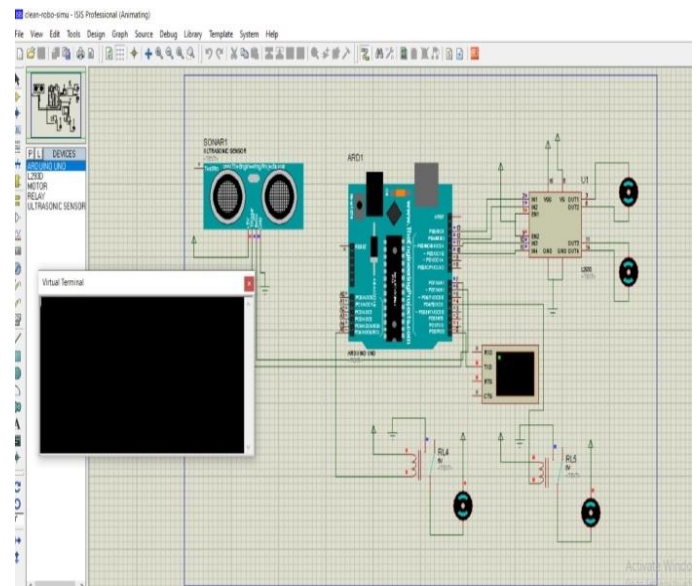
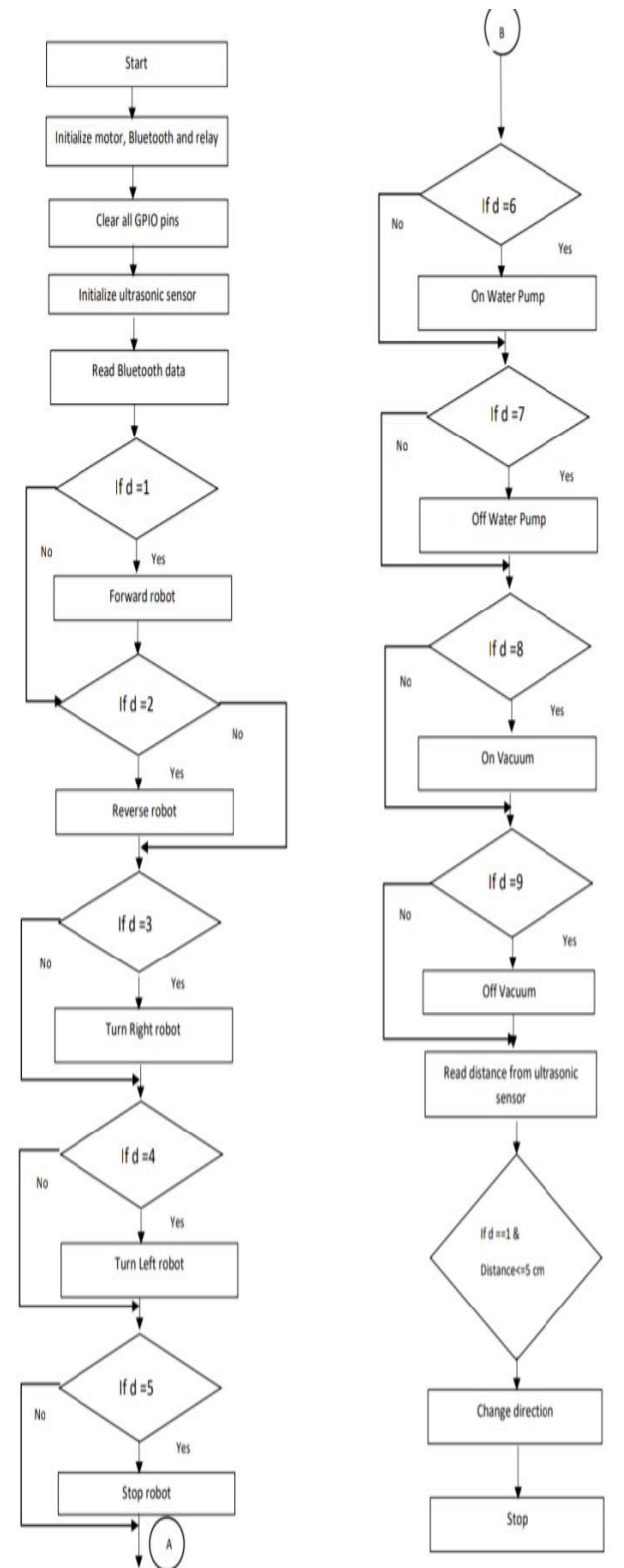


Fig2. Circuit Diagram

VI.FLOW CHART

	Current Rating(mA)	Voltage Rating(v)	Power Rating(w)
1Atmega 328	12.3	5	0.0123
2 Relay	70	5	0.07
3 Relay	70	5	0.07
4 Bluetooth	30	5	0.03
5 CCP	130	5	0.13
6 Ultrasonic Sensor	15	5	0.015
7 water motor	220	9	0.22
8 Cleaner	350	12	0.35
9 DC Motor	600	12	0.6



VII.SPECIFICATION

module.

VIII. RESULT



IX. ADVANTAGES

1. Easy to operate.
2. No skilled person is required.
3. Less Maintenance cost.
4. Less noisy.
5. Clean more space in less time.
6. Less charging time.
7. Simple in construction.
8. Easy to handle.

X. APPLICATIONS

1. This can be used for Low range Mobile Surveillance Devices.
2. This can be used for Military Applications (no human intervention).
3. The robot can be used for Home automation.

XI. CONCLUSION

This research paper explains sweeping and mopping operations for the floor very effectively. It lowers labor costs, saves time, and offers effective cleaning. The robot is controlled by an Android application and a Bluetooth

XII. FUTURE SCOPE

We can replace Bluetooth module with GSM MODEM. Obstacle detection will be added to the same robot.

With some minor modifications, this same robot also can be used to clean the solar panels.

REFERENCES

- [1] Jens-Steffen Guttman, Kristen Culp, Mario E. Munich and Paolo Pirjanian. The Social Impact of a Systematic Floor Cleaner. In IEEE international workshop on advance robotics and its social impacts, Technische University munchen, Germany May 21-23, 2012.
- [2] J FrolizziC.Disalvo. Service robots in the domestic environment: A study of Roomba vacuum in the home”. In int. conference on human robot interaction HRI, PAGE 258-265 March 2006.
- [3] H.Asada and J.-J E. Slotin, robot analysis and control, a wiley-interscience publication, 1986, pp. 29-49.
- [5] Karthick. T. Ravi Kumar. A, Selvakumar. L, Viknesh. T “Simple Autonomous Cleaner Robot” International journal of Science, Engineering & Technology Research (IJSER), Vol.4. Issue 5 May 2015
- [6] Uman Khalid, HaseebHaider, Tahseen Amin Khan Qasuria“ Smart Floor Cleaning Robot (CLEAR)” in IEEE standard 2015.
- [7] NamanAggrawal, PiyushaChaudhari, AkshayMahalkar “Review Paper Based on Cleaning Robot”, vol.3 No.5 May 2016.
- [8] Marneet Kaur, Preetiabrol “Development of floor cleaner robot (Automatic and manual)”, July 2014.
- [3]S.Ivanov,K.Bhargava and W.Donnely, “Precision Farming : Sensor Analytics”. [4] R. Harwahyu, R. G. Cheng, C. H. Wei, and R. F. Sari, —Optimization of Random Access Channel in NB-

IoT, IEEE Internet Things J., vol. 5, no. 1, pp. 391–402, 2018.

[5] K. Mekki, E. Bajic, F. Chaxel, and F. Meyer, —A comparative study of LPWAN technologies for largescale IoT deployment, ICT Express, 2018.

[6] Semtech-Corporation, —What is LoRa© ?, 2016. [Online]. Available:

<https://www.semtech.com/technology/lora/whatislora>.

[Accessed: 20-Mar-2018].References

[7] Dragomir, C., & Surugiu, F. Implementing Lean in a Higher Education University. Constanta Maritime University's Annals, 18 , pp.279–282, 2013.

SECURE CONTACTLESS AUTOMATIC RATION DISTRIBUTION SYSTEM USING INTERNET OF THINGS

First A. Ajinkya Gaikwad, Second B. Sonam Sachdev, and Third C. Simran Khushalani

¹Pimpri Chinchwad College of Engineering and Research, Ravet

² Pimpri Chinchwad College of Engineering and Research, Ravet

³ Pimpri Chinchwad College of Engineering and Research, Ravet

ABSTRACT : An IOT-based automated ration distribution system is presented in this paper. In India, ration distribution is the process in which the state government distributes essential goods to the underprivileged. A well-established framework entails a lot of back-and-forth between business people and those in need. We intend to make the system completely automated to avoid human intervention. The ration card will be scanned by a raspberry pi camera, which will search for customer information such as name, allocated amount, and prices in the stored database. For the consumers to procure ration, they need to have a valid UPI code. We used a raspberry pi, servo motor and, load cell interface to counter the problem of weight measurement accuracy and unlawful activities. The data of scanned ration cardholders can be accessed through an online web portal for legal authorities to verify. Our system takes into account all factors and is ideal for a densely populated country like India

INDEX TERMS: Automatic, Barcode scan, Servo motors, Load cell, Online portal, Cost-effective. I. INTRODUCTION

In India, the state government distributes the necessities such as food grains, oil and, fuel at subsidized rates to economically challenged families through ration shops[2][3]. To avail these commodities, the government provides cards to the people depending on their destitution lines. The cardholders if fail to collect the dispensed ration they are deprived of these essentials. The shopkeepers to transact their

business take undue advantage by selling these commodities illegally at a higher price[1]. Not only this but cardholders are often deceived in terms of inaccurate weight. The needy individuals often fall prey to unlawful activities by the shopkeepers. The existing system is full of nebosity giving rise to suspicious activities.

Conventionally the public distribution system included Biometric Scanning for authentication[3]. It resulted in a major disadvantage for the farmers who continuously worked on fields which could change the finger impressions. This system helps to eliminate this disadvantage by using QR code scanning which consists of unique identification on their ration cards. The second option that could be used is the RFID tags[7] but it is not cost-effective and also requires a complex mechanism. Previously, a government official had to visit the ration shops regularly to check the stock and prices tagged. The officer will now have online access to the database of this scheme, allowing him to verify all transactions without having to physically visit the stores. The idea behind our automatic system is to eliminate this exploitation by adding some extensive features. The main features of the system include :

- ❖ A raspberry pi camera acting as a barcode scanner[8] to identify and secure the details of a particular user.

- ❖ The user has the authority to view the assigned ration quantity and the prices of the same.
- ❖ The machine will dispatch the goods into the container once it receives a valid barcode input.
- ❖ An automatic weighing module is used for accurate measurement of the dispatched commodities.
- ❖ The data regarding cardholders who have procured the ration items will be displayed online for verification by legal authorities. The remaining paper is organized as follows: Section 2 gives a brief literature survey. Section 3 depicts our proposed solution. Inside section 4 comes the results obtained by our implementation. The next section gives us the conclusion and future scope followed by references..

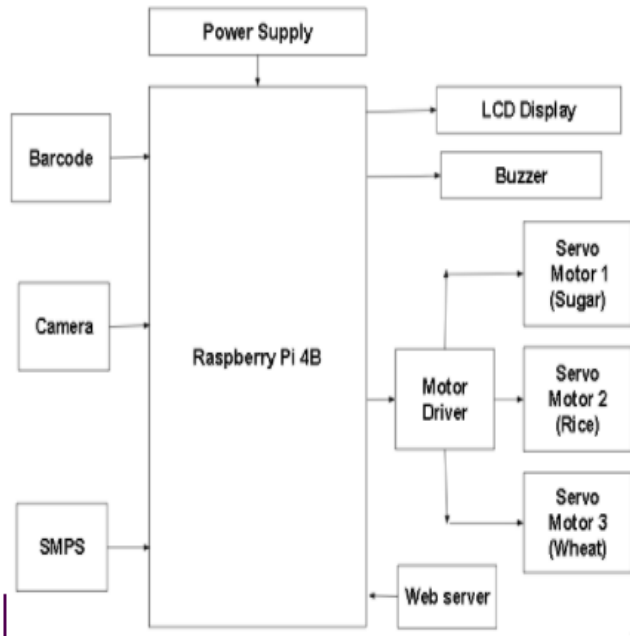
II. OBJECTIVES

1. The objective of this system is to build an automatic and convenient system to protect the interests of the public by countering the malpractices.
2. This system is used to implement Barcode matching algorithm for authentication of the user, which in turn reduces the widespread corruption, misuses of cards and to reduce the

time complexity of the manual data entries

3. The system is used to protect the products of fair price shop in black markets.

BLOCK SCHEMATIC:



III. WORKING

The main components used in the system are :Raspberry pi 4b controller, Raspberry pi camera, LCD display,HX711 load cell, Servo motors, Power supply, Buzzer, Motor driver.

To begin with the camera will scan the barcode that is on the ration card of the user. The details of the user and the allocated ration along with the prices will be displayed on the screen. If the user is not registered it will display an invalid entry. Once the user is verified there will be a 60-sec delay in the system. After 60 sec the motor driver will pass the signal to the 1st servo motor and will rotate 180 degree to dispatch the grains. Once the load cell measures the allocated quantity the motor will stop. There will be another delay of 60-sec before the 2nd

servo motor begins to dispatch. Similar process before the 3rd motor rotation takes place. Once all the grains are dispatched the data is automatically updated in the database. This database is easily accessible by the government official using the online portal. The government official will have a unique username and password to access the portal and keep a track of the stock available in the shop.

IV. MODULES AND FUNCTIONALITY:

Weight measurement using load cell:

A load cell is a force converter. It transforms a force like tension, compression, strain, or torque into a measurable and uniform electrical signal. The electrical signal varies proportionally to the load exerted to the load cell. In our proposed project we used the strain guage type of load cell.

PI Camera 3 for QR Code detection:

The Pi camera system is a small, compact camera that works with the Raspberry Pi. The MIPI camera serial device configuration is used to interact with the Pi. The Pi Camera helped us capture the picture of the QR code when placed in front of the lens and then verification is done in the Raspberry Pi, in simple words this camera module helped us scan the QR code for identification of the customer. It helps us determine the invalid and valid users before distribution.

Servo Motor for dispatching grains:

A servo motor is a kind of motor that has a high degree of precision in rotation. Servo motors usually have a circuitry that gives information on the present location of the motor shaft; this data helps them to rotate with absolute accuracy. In our project the servo model we chose was MG995.

V. COMPONENTS AND SPECIFICATIONS:

Raspberry Pi 4: Model: B

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- Gigabit Ethernet
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE

Load Cell:

24-Bit Analog-to-Digital Converter (ADC) for Weigh Scales.

- Differential input voltage: $\pm 40\text{mV}$ (Full-scale differential input voltage is $\pm 40\text{mV}$)
- Data accuracy: 24 bit (24 bit A / D converter chip.)
- Operating Voltage: 2.7V to 5VDC
- Operating current: $<10\text{ mA}$
- Size: 24x16mm

MG995 Servo Motor:

- Speed: 4.8V: 0.20 sec/60°
- Torque: 4.8V: 138.9 oz-in (10.00 kg-cm)
- Range: 180°
- Pulse Width: 1000 μs - 2000 μs
- Phase Voltage: 4.8V - 7.2V

PI Camera 3:

- It supports 480p, 780p and 1080p

Buzzer:

- Rated Voltage: 6V DC.
- Operating Voltage: 4-8V DC.
- Rated current: $<30\text{mA}$.
- Sound Type: Continuous **Beep**.

VII. ADVANTAGES OF PROPOSED SYSTEM:

- It has helped in stabilizing food prices and making food available to consumers at affordable prices.
- It has helped in avoiding hunger and famine by supplying food from surplus regions of the country to deficient regions.
- This system transforms the entire manual procedure of ration distribution by making the the process automatic.
- It helps reduce the black marketing of food grains and ensures secured distribution of food grains. Size: 20*25*9mm
- Weight: 3 gm
- 5MP Omnivision 5647 Camera Module

VI. ALGORITHM

VIII. CONCLUSION

For a country with a large population and budget limitations, an automatic ration distribution system is a fully efficient system. Our system makes it easy for both citizens and food distribution authorities to do their jobs. It's not only simple to set up, but it also gives you security power. It ensures that the security of distribution is not jeopardized as a result of illiteracy. It encourages paperless service and can be used for a long time.

Additionally, this device can be made cashless. We may link bank accounts to ration cards, and money will be withdrawn from their accounts after they have received their allocated

amount of goods and services.

IX. REFERENCES

[1] Swapnil Kurkute, Dipak Patil, Rashmi Lokhande "E-

Rationing Distribution System" International Conference on Sustainable Computing in Science, Technology, and Management (March 2019).

Prof. S. D. Thorat, Kharade Supriya, Ashok Taware, Pradnya Siddheshwar, Taware Vrushali, Satish Navale, Bhagyashri Babu " E-Ration Distribution System based on QR- Code" IJSRD - International Journal for Scientific Research & Development| Vol. 6, Issue 09, 2018.

[3] Laxman Kumarwad, Rajendra Kumbhar "Biometric Enabled Ration Card Security System for Public Distribution System" International Advanced Research Journal in Science, Engineering and Technology(NCIARCSE 2017).

[4] Vishal Mane , Santoshkumar Chaurasiya , Kunal Warke ,(Prof.)M. N. Agrawal "Anti-Corruption Based Ration Distribution System" International Journal for Research in

Applied Science & Engineering Technology Volume 5 Issue III, March 2017.

[5] Jinali Goradiaa, Sarthak Doshib "Automated Ration Distribution System" International Conference on Advanced Computing Technologies and Applications(ICACTA 2015).

[6] Sandhya Shinde, Himanshu Sarkar, Aditya Samant & Shraddha Dhole "Aadhar-based Smart Ration Distribution" INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS [VOLUME 6 ISSUE 2 1 APRIL– JUNE 2019].

[7] Bharati Chilad, Sanjana MutalikDesai, Ashwini R Jadhav, Kartiki Dhamanekar, Sabaruhee Jagirdar " SMART RATION DISTRIBUTION SYSTEM USING RFID" International Journal of Engineering Research and General Science Volume 4, Issue 3, May-June, 2016.

[8] Sumit Tiwari "An Introduction to QR code Technology" 2016 International Conference on Information Technology(ICIT) 03 July 2017.

[9] Pranjal Pedwal, Ms. Shubhangi Borkar "Real-Time

Automatic Ration Material Distribution System" IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 08 | February 2016.

[10] Kashinath Wakade, Pankaj Chidrawar, Dinesh Aitwade "Smart Ration Distribution and Controlling" International

Journal of Scientific and Research Publications, Volume 5, Issue 4, April 2015.

[11] S.Valarmathy, R.Ramani, Fahim Akhtar, S.Selvaraju, G.Ramachandran "Automatic Ration Material Distributions Based on GSM and RFID Technology" I.J. Intelligent Systems and Applications, 2013, 11, 47-54 Published Online October 2013 in MECS.

[8] T. D. Soedjana and A. Priyanti, —Competitiveness of Indonesian Livestock Production among ASEAN Countries, I Wartazoa, vol. 27, no. 1, pp. 1–14, 2017

CAMERA-BASED DRIVER DROWSINESS DETECTOR

Labhesh Lalka¹, P. MoganaPriya², and Sumedh Patil³

¹Electronics and Telecommunication, PimpriChinchwad College of Engineering and Research, Pune, India

²Electronics and Telecommunication, PimpriChinchwad College of Engineering and Research, Pune, India

³Electronics and Telecommunication, PimpriChinchwad College of Engineering and Research, Pune, India

ABSTRACT The significant causes of road accidents are occurred due to Drowsiness and Fatigue of drivers. We aim to reduce the number of accidents due to driver Drowsiness hence will increase transportation safety. This System will Live Monitor the Driver Facial Expression using Image Processing and Based on the Drowsiness or frequent Yawning it will Notify the driver to take a break and if driver do not take a break, then it will generate an Alert Signals such as Turning on the Music Player, Turning on Vibration Motor of Driver Seat and turning on Hazard lights which will indicate other drivers that this driver is feeling drowsy. The entire system is implemented using Raspberry-Pi.

INDEX TERMS Drowsiness Detection, Image Processing, Facial Detection, Yawning, Hazard Lights.

I. INTRODUCTION

The purpose of this project is to devise a way to alert drowsy drivers in the act of driving. One of the causes of car accidents comes from the drowsiness of the driver. As we know in India the total number of road accidents is increased by 1.8 percent from 1,89,400 in 2018 to 2,01,205 in 2020. The road accident data analysis of 2020 reveals that about 1374 accidents and 400 deaths take place every day on Indian road.

So, our objective is to develop a system for drowsiness detection.

The focus will be placed on designing a system that will accurately monitor the open or closed state of the driver's eyes in real-time. Also, to get the Yawning Count of the driver and accordingly give an alert signal to Driver. The components required for this project are Raspberry Pi 4B, Raspberry Pi 4B Camera, LED's, Vibration Motors. System targets to detect the driver fatigue through analyzing various parameters (data) such as Aspect Ratio of Eyes to detect whether the Eyes are Closed or Opened and also the Aspect Ratio of Lips to detect the Yawning and keep count of Yawning captured through Camera taking inputs from driver's Facial Expression. A Driver is said to be sleepy if his/her eyes are closed for more than 10 seconds and yawning continuously. So, as soon as the Drowsiness is detected the Alert signal will be generated by the micro-controller and can be forwarded to the alert system, which will Turn ON the Music Player, Vibration of Seat Produce by vibration motor, and alerting the other drivers by giving proper indication signs by Hazard Lights. The Camera will be installed at top of the Speedometer Dashboard which will Capture the Frames.

II. LITERATURE SURVEY

In 2006, Matthew Smith, Gerald Witt, Harry Zhang describes the Methodology which uses Brain Wave Sensor which was Brain Computer Interface (BCI). The Limitation was it was not Robust or Compatible and also the cost of the project was High. In 2009, Frank A. Haight described Detection of Drowsiness Using Blinking Technique, the methodology used was Detecting blinks using piezoelectric adhesive disk attached to canthus of eyes but, it was not suitable due to sensor attached to face/eyes it was so intrusive.

In 2011, S. Cotter described the Methodology in which the System Records eye movements via corneal reflection technique but there was some Drawback, this was unsuitable due to need for headset so this was highly intrusive. In June 2012, A. Cheng described 'Driver Drowsiness Recognition Based on Computer Vision Technology'. They presented a nonintrusive drowsiness recognition method using eye-tracking and image processing. A robust eye detection algorithm is introduced to address the problems caused by changes in illumination and driver posture. Six measures are calculated with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes. In 2015, Adrian Rosebrock described Driver Drowsiness Detection Using Image Processing and Facial Landmarks. They used Python Library OpenCV to Detect the Face and used Haar Cascade Classifier file for detection of eyes, and they measured Eye Aspect Ratio and with the help of EAR they detected Drowsiness and Fatigue. If the eye aspect ratio indicates that the eyes have been closed for a sufficiently long enough amount of time, it will

send Alert signal and notify the driver.

III. BLOCK DAIGRAM

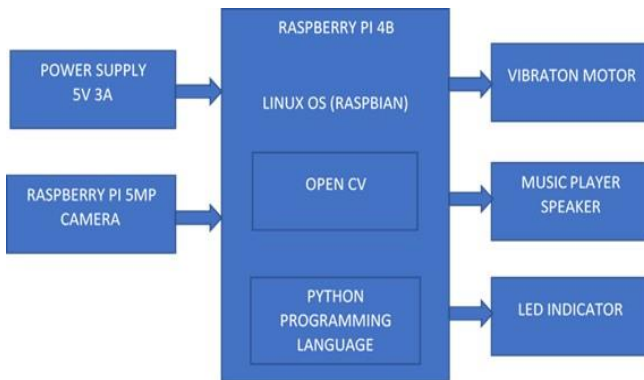


Figure 1.

IV. METHODOLOGY

This project consists of Raspberry Pi 4B, Raspberry Pi 4 Camera, LED's, Vibration Motors. System targets to detect the driver fatigue through analyzing various parameters (data) coming from the Camera taking inputs from drivers Facial Expression.

This system ensures the safe driving of vehicles of any kind. The System will alert the driver if the driver is found to be sleepy or tired. The System can also be further improved by adding other sensors so that more data will be there to work on like for example alcohol sensor to detect alcoholic drivers this kind of system will safeguard the vehicles like school bus etc. where the passengers are wholly dependent on the driver for their safety.

Also, existing systems are not that cost-effective but a system like this could be. Working of the system is, in real-time it continuously monitors the EAR (Eye Aspect Ratio) and head position and the state of the eyelid to decide on alerting the driver about his fatigue and suggesting him/her to take rest. Driver is said to be sleepy if his/her eyes are closed more than 10secs and yawning continuously.

V. FLOWCHART

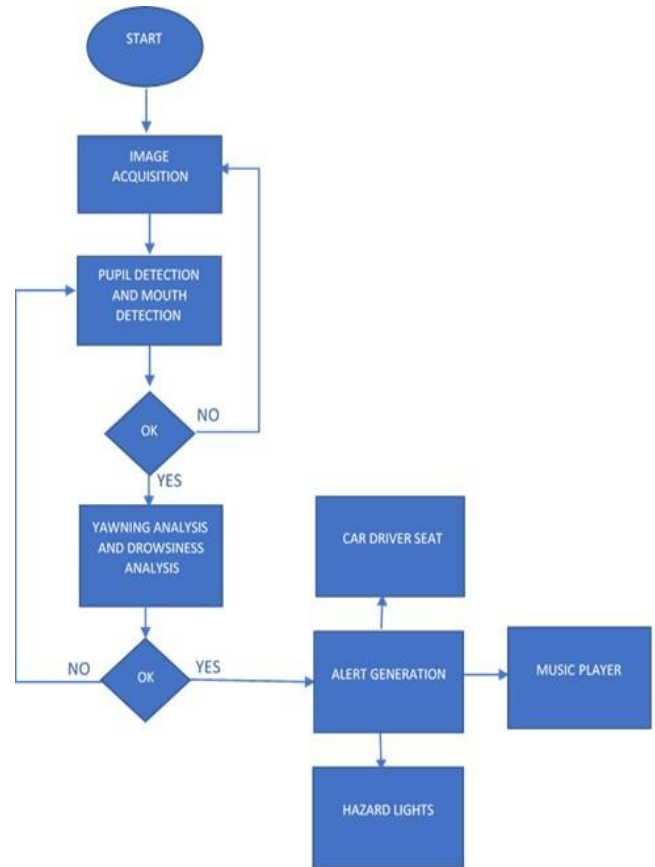


Figure 2.

VI. ALGORITHM

1. StartVehicle
2. Raspberry Initialize and Raspberry CameraInitialize
3. Image Processing Using OpenCV
4. Pupil Detection and MouthDetection
 - i. If no jump to3
5. Check for Drowsiness and YawningDetection
 - i. If no Jump to4
 - ii. If yes AlertGeneration

6. AlertGeneration

- i. Turn on Music Player and PlaySongs
- ii. Blink Indicator of Vehicle (HazardLights)
- iii. Turn on VibrationMotor

7. Repeat Step4

VII. EXPERIMENT AND RESULT

1. RESULT A

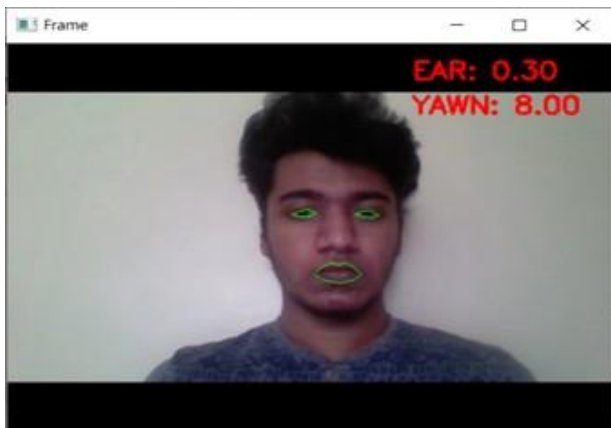


Figure 3.

This is Experimental Result where Eyes and Mouth are detected using Image processing, the Eye Aspect ratio gets calculated and displayed, this is the ideal state where the peer does not feel Drowsiness and it's not Yawning. So the EAR is 0.30. So, there is no any alert signal generated. Yawn factor is the distance between the upper lip and lower lip at the ideal state it is 8.00 and if Yawning occurs the value of the Yawn factor get exceeds 8.00.

2. RESULT B



Figure 4.

This is Experimental Result where Eyes were closed for more than 10 secs so, there was a notification on the screen

“Drowsiness Alert” and an alert signal was generated and was being passed to alert systems such as Music Player and Vibration Motor. The Eye Aspect Ratio is calculated at every frame per second so if the value of EAR is less than 20 in 10 consecutive frames it results in Drowsiness or Fatigue, which means the peer is feeling drowsy.

3. RESULT C

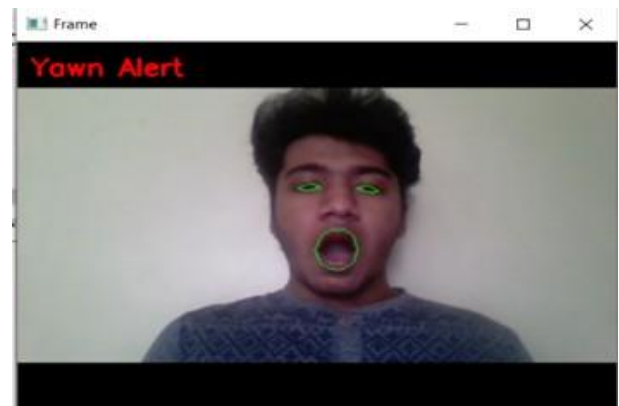


Figure 5.

This is Experimental Result where the peer is Yawning and so there is a notification that “Yawn Alert” and an alert signal was generated to alert the system that is Music Player and warn the peer to “Please Take a Break”. Yawning alert is generated when Yawn Factor calculate the distance between the upper lip and lower lip and if this yawn factor exceeds more than 20 the yawn counter gets incremented by 1 so if the peer is frequently yawning the yawn counter gets incremented and if this yawn counter value exceeds 5 then a notification displayed and an alert signal is generated. The yawn factor is also calculated at every frame.

VIII. ADVANTAGES OF PROPOSED SYSTEM

1. Reduction in road accidents will be one of the main advantages.
2. An efficient system to detect user attentiveness based on fatigue.
3. Easy implementation due to readily available hardware and software.
4. Light Weight Code, Simple Method Uses Eye Aspect Ratio and Mouth Movement while yawning

IX. EXPERIMENT AND RESULT

1. This system can be implemented in different types of vehicles such as Cars, Trucksetc.

2. This project can be integrated with a car so that automatic speed control can be imparted if the driver is found sleeping.
3. This System Can be used to Monitor Employee's Tiredness During Work Hours.

X. EXPERIMENT AND RESULT

This project tries to look at the emerging technologies and deter-

minethebestapproachesintryingtopreventthenumberonebecause of fatal vehiclecrashes.

This System will Live Monitor the Driver Facial Expression and Based on the Drowsiness or frequent Yawning it will Notify the Driver to take a break and If Driver Don't take a break, then it will GenerateanAlertSignalsuchasTurningontheMusicPlayer,Turn ingonVibrationMotorofDriverSeatandTurningonHazardlights which will indicate other drivers that this driver is feeling drowsy

XI. REFERENCE

- [1]A. Rahman, M. Sirshar, A. Khan" Real Time Drowsiness Detection Using Eye Blink Monitoring" 2015 National Software Engineering Conference (NSEC2015).
- [2]Facial Features Monitoring for Real Time Drowsiness Detection by Manu B.N, 2016 12th International Conference on Innovations in Information Technology(IIT)
<https://ieeexplore.ieee.org/document/7880030>
- [3]Real-Time Driver Drowsiness Detection System Using Eye Aspect Ratio and Eye Closure Ratio by Sukrit Mehta, Sharad Dadhich, SahilGumber, ArpitaJadhav Bhatt, ArpitaJadhav Bhatt Proceedings of International Conference on Sustainable Computing in Science, Technology and Management (SUSCOM), Amity University Rajasthan, Jaipur - India, February 26- 28, 2019
- [4]IOT Based Real-Time Drowsy Driving Detection System for the Prevention of Road Accidents by Fabian ParsiaGeorge, Md.Yousuf-Hossian<https://ieeexplore.ieee.org/abstract/document/8550026>
- [5]RezaeeKhosro et al., "Real-time intelligent alarm system of driver fatigue based on video sequences", *Robotics and Mechatronics (ICRoM) 2013 First RSI/ISM International Conference on*, 2013.
- [6]Tawari Ashish, KuoHao Chen and MohanManubhaiTrivedi, Where is the driver looking:

-
- [7] Analysis of head eye and iris for robust gaze zone estimation", *Intelligent Transportation Systems (ITSC) 2014 IEEE 17th International Conference on*, 2014.
- [8] Eskandarian, A. and A. Mortazavi, "Evaluation of a smart algorithm for commercial vehicle driver drowsiness detection" in *Intelligent Vehicles Symposium*, 2007 IEEE. 2007. IEEE
- [9] KunikaChhaganbhaiPatel, ShafiullahAtiullah Khan, VijaykumarNandkumarPatil, "Real-Time Driver Drowsiness Detection SystemBased on VisualInformation", *International Journal of Engineering Science and Computing*, March 2018.
- [10] Quang N., NguyenLe T. Anh ThoToi Vo VanHuiYuNguyenDucThang, "Visual Based Drowsiness Detection Using Facial Features", *6th International Conference on the Development of Biomedical Engineering in Vietnam (BME6)* pp 723-727, BME 2017.

Teleoperated Animatronics Robot

Shruti Shinde¹, Vrushali Shete², Rushikesh Waghmare³, Prof. Dipali Dhake⁴

1, 2, 3 Student, E&TC, Pimpri Chinchwad college of engineering and research, Ravet Pune 4Assistant Professor, E&TC, Pimpri Chinchwad College of engineering and research, Ravet Pune

ABSTRACT: Using Animatronics and Tele-presence technology, we will be controlling the robot's hand (or any mechanical part) movement by sensing human hand movement as if it mimicking it. For that we have implemented model with tele-presence vision which will streaming the images /the videos on the VR headset, on mobile placed in front of an operators eyes. So we designed a model which will be using the tele-presence system used to provide better field view to user side and live streaming of video without any complex control mechanism.

INDEX TERMS: Animatronics, Robot, Tele-operation, Virtual control, Arduino Nano, Arduino Mega.

I. INTRODUCTION

In our day to day life, we have seen lots of rescue operations in the hazardous environment. This problem can be resolved by using artificial intelligence robotic systems. But as artificial intelligence is in development phase; it is not possible that a robot make the decision by own. We have operated robots using tele-presence in different industry, in various defense applications to minimize the efforts of labors and to avoid risks during the work. Also we all are aware of the traditional method of controlling any type of robot. But the drawback of traditional robot is it's not able to catch as it is actions from an operator or a user. To cover this gap we have worked on a robot which will catch an operators right hand movements, it will perform a task according to that. Animatronics is a field which uses anatomy, mechatronics, robotics to replicate human (or any other living subject) motion. [7].Tele-presence is a set of technologies which allow a person to feel as if he/she were present, to give the appearance of being present, or to have an effect, with tele robotics, at a place different than their true location. [3]. So if we work on this and combine these two technologies on a robot then lots of problems can be resolved (some of them are listed above).That's why we need a robot this will work under human control. So our project aims to develop a robotic vehicle under human supervision and for better control on its movements and operations. This robot is having high resolution camera which will be having live-Streaming of video footage around to VR head set at an operator side. We are implementing one robotic hand, which will be similar to the human's right hand to perform various complex operations. We have tried to control the movement of this robotic hand as per operators hand

movement. This system will be mounted on a four wheel robotic vehicle where it is impossible for human to reach at the desired location. All those things can be controlled virtually so that it is easy for us to control a robot without going near to the actual field. So at last we are getting a model with a high definition camera and robotic hand mounted on the four wheel vehicle which will be getting remotely operated.

II. Related Previous Work

As we know these robotic systems have been developing robots from last two decades to minimize human work and to perform various complex operations. For example, in a chemical industry, for bomb diffusion, etc.Few of most noticeable are:

A. RIPSAN MS1

Ripsan MS1 is currently being reviewed by the U.S. Army which was developed in 2000.

This is the tele operated light tank; it's used for limited application of work. [6]

B. DRDO DAKSH

It is currently the Indian Army is using this. It is an electric, remotely operated military robot specially designed for destroying hazardous objects.

This robot can be controlled using remote with a number of buttons, switches and joysticks. As the number of operating elements is so many therefore it is difficult to control this robot and also it is time taking. [6]

III. M Proposed Methodology

Our entire module can be divided into 3-subparts that are robotic body, robotic hand and camera module.

A. ROBOTIC BODY:

It is a four wheel vehicle. On this we are mounting our

whole setup of this model. The movement of this body can be control remotely using Arduino. These values of remote operation can be sending to the controller on the robotic body using wireless transmission. According to the values the movement of body, i.e. forward reverse turn right and turn left can be get managed.

B. ROBOTIC HAND:

This is the system which is used to perform various complex operations. This system can be controlled as per users hand movement. On operators right hand there will be four sensors, namely accelerometer and gyroscope and one Hall Effect sensor which is sending the values to Arduino nano controller and through wireless transmission it is sending to the Arduino mega controller which will be on the rover. Through all the values coming from operator (2 dimensional values) the robotic arm changing its direction accordingly.

C. CAMERA MODULE:

For this we are interfacing ESP-32 camera with arduino. This is high-definition camera which is used for continuously feed the real time on field view. This live vision can be viewed to an operator by wearing VR box with mobile phone placed inside it.

So by combining all these systems, we will have a model which will reach to desired places.

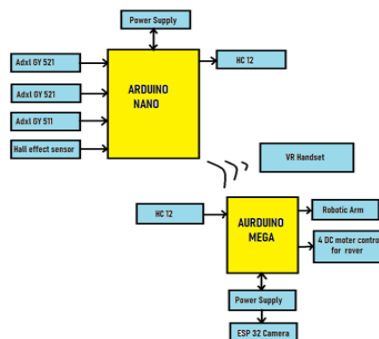


Fig 1 Block Diagram for the proposed methodology

This proposed methodology can be divided into two parts: Transmitter side and receiver side. On transmitter side that is on an operator's side we are using Arduino Nano as a main controller. To this controller we are connecting sensors, namely two Adxl GY 521, Adxl GY 511, HallEffect sensor. Here two Adxl GY 521 sensors will be on an operator's right hand on shoulder and elbow. And Adxl GY 511 sensor will be on a wrist and HallEffect sensor will be on a forefinger. All these sensors will give values to the controller. Using HC12 wireless transmission module we will send those values of sensor to the receiver side, i.e. on actual to a robot. On a robot there will be

another HC12 wireless receiver module which will receive sensor values and send it to the robotic arm system. All the movements of a robot can be control wirelessly. We are giving power supply to an entire system using LiPo battery and using bug we are minimizing voltage to give to controller.

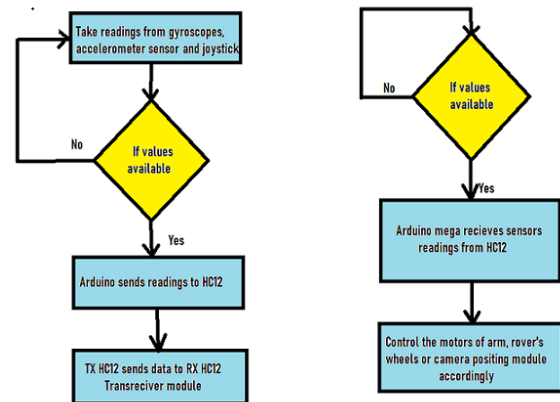


Fig 2 Flowchart at operator and rover's side

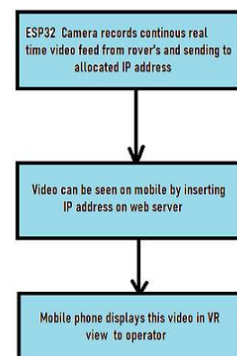


Fig 3: Flowchart of operation of video streaming.

IV. Objectives & Result

- To design animatronics robotic arm, this will mimic an operator's hand movement to perform various complex operations.
- As a part of tele-presence vision system, user will be able to see the exact real time video in a VR box which were capture by camera.

After executing this project model we noticed some various points that we have achieved they are:

- We got continues video from camera module, it is continuously visible on a VR headset.
- The operation of a robotic arm is as per an operators hand movement, it is performing a various tasks.
- We are able to control all the directions of a robot by wireless control.

With this project we could achieve much better control over a very complex robot very easily and got a better

situational awareness of the field. [1]

Parameters	Tradition Way of controlling Robot	New implemented Way
Control on robot	Less	High
Situation awareness	Less	High
Ability to perform complex task	Less	High
Complexity of system Implementation	Simple	Very Complex

TABLE I

COMPARISON BETWEEN CONVENTIONAL TECHNIQUES AND PROPOSED METHODOLOGY

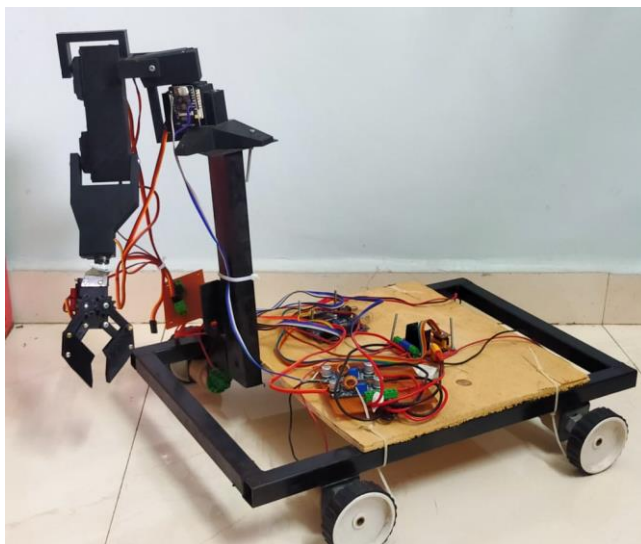


Fig 4: Implemented Model

This represents whole proposed system which contains all the components i.e. Arduino Mega controller HC12 wireless trans-receiver, DC Motors, High resolution camera, Animatronics Robotic Hand.

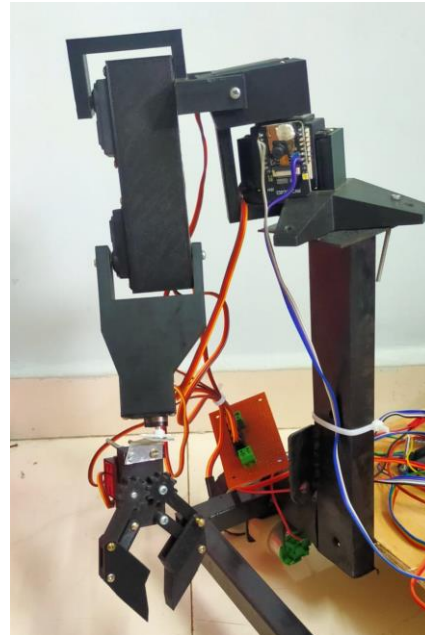


Fig 6: Robotic Hand

This is the implementation of a robotic arm structure which contains servo motor and printed 3D hand structure.



Fig 7: Telepresence view through a camera module.

Here it is observed that we got images from the high resolution camera, which on the model.

V. CONCLUSION

1. Proposed system will fulfill requirements will give better efficiency and accuracy as compared to other systems.
2. We have tried to minimize the delay in response and encountered some problems like latency, agility of robot and no feedback with few limitations.
3. At last we conclude that this system is significantly increased effectiveness and can be performed complex tasks. Further improvement in this project, we can open the doors of robotic systems in large areas of used.

VI. ACKNOWLEDGMENT

We are greatly indebted to my project guide Prof. Dipali N. Dhake for her able guidance throughout the course of this work. It has been an altogether different experience to work with her and we would like to thank her for her help, suggestions and numerous discussions. We are heartily thankful to Prof. Dr. Harish U. Tiwari (Principal, Pimpri Chinchwad College of Engineering & Research, Ravet) for providing research environment; also for his kind inspiration.

REFERENCES

- [1] “Animatronic robot with Telepresence vision” April 2020 Paper ID: IJIRT 150160 Dhananjay Itkal, Kedar D. Deshmukh, Rudrapratisingh Bhatti, and Dipali Dhake.
- [2] “The brain in machine” IEEE magazine June-2019
- [3] Shamin-P-Shaji, Sharon-Mariam-George, Rahul Shaji, Steffy Don, Ms P Careena, IJIERE Virtual Telepresence Robot-International Journal of Innovative and Emerging Research in Engineering e-ISSN: 2394 – 3343 p-ISSN:2394-5494
- [4] Nazmul Hossain, Mohammad Tanzir Kabir, “A Real-time Surveillance Mini-rover Based”,2015 IEEE International Conference on Control System, Computing and Engineering, 27 - 29 November 2015, Penang, Malaysia.
- [5] Keerthi Premkumar and Mr.K Gerard Joe Nigel, “Smart Phone Based Robotic Arm Control Using Raspberry Pi, Android and WiFi”, IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems ICIIECS’15.
- [6] interestingengineering.com/a-brief-history-of-military-robots-including-autonomous-systems.

COVID-19 PATIENT CARE ROBOT

**Pranita More¹, Shubham Patil²,
and Rameshwar Waykule³**

¹ dept. Electronics and telecommunication, PCETs Pimpri Chinchwad College of Engineering and Research, Pune, India

² dept. Electronics and telecommunication, PCETs Pimpri Chinchwad College of Engineering and Research, Pune, India

³ dept. Electronics and telecommunication, PCETs Pimpri Chinchwad College of Engineering and Research, Pune, India

ABSTRACT Covid-19 is a wide-spreading disease throughout the world. The World Health Organization (WHO) reports suggesting that the two main routes of transmission of the COVID-19 virus are respiratory droplets and physical contact. The hospital staff and nurses while contacting patients face difficulty. Hence, this project is designed after considering the safety and medical concern of the Covid-19 patients and hospital staff. This paper presents a robotic delivery of medicines in hospital wards. The robot travels through a line using the line follower concept to deliver pills using two IR sensors to alter nursing efforts. The robot follows the line and uses an ultrasonic sensor for obstacle, detection then reaches the bed and identifies the bed using an RFID tag. The Bluetooth device and the android app control this process. This paper aims at designing an autonomous robot for medicine, food, and water delivery to Covid-19 patients. Thus, this process is cost-effective and reduces human efforts.

INDEX TERMS Covid 19, Sensors, Bluetooth, Medicine delivery, Autonomous Robot, Manual Robot, COVID-19 medicine delivery.

I. INTRODUCTION

Covid-19 is a large family of respiratory viruses, to cause the respiratory syndrome. The transmission of the virus from human to human primarily occurs via respiratory droplets from coughs and sneezes within a range of about 1.8m or by human contact. The hospital staff or nurses while contacting Covid-19 patients have to wear a PPE kit and sanitize themselves frequently and still face the danger of getting Covid-19 positive. In this project, we use robotic technology for delivering the medicines to alternate the nursing services in hospitals and provide safety from getting the virus. This paper aims at designing an autonomous robot for medicine, food, and

water delivery to Covid-19 patients.

The hospital staff and nurses while contacting patients face difficulty. Hence, this project is designed after considering the

safety and medical concern of the Covid-19 patients and hospital staff, doctors, and nurses. This paper presents a robotic delivery of medicines and/or food and water in hospital wards to the desired patients. The robot can be used in two modes viz. auto mode and manual mode. The robot is initialized through manual mode using a mobile app and Bluetooth connectivity. The robot travels through a line using the line follower concept to deliver pills using two IR sensors to alter nursing efforts. The robot follows the line and uses an ultrasonic sensor for obstacle, detection then reaches the bed and identifies the bed using an RFID tag and glows desired LEDs for the desired patients from the medicine box, and then travels to the next patient.

The Bluetooth device and the android app control this process. Thus, this process is cost-effective and reduces human efforts.

II. EXISTING METHODOLOGY

1. Countries like China and Japan are rolling out robots in hospitals, offices, and schools which are implemented on a large scale. In our country implementation of robots is less. Thus, to overcome this problem a low-cost highly efficient robot is designed.
2. The robots existing for medicine delivery are either fully automatic or fully manual. The fully automatic robots use technology like AI and ML and thus can be a complex and difficult task.
3. The fully manual robots are way much easy but lack efficiency, precision, and accuracy.
4. To overcome such a problem a partially autonomous and partially manual with higher efficiency is built in this project.

III. PROPOSED METHODOLOGY

Here we propose an efficient and method of involving robotics as an alternative to nurse in a hospital environment which is the basic requirement for a good hospital. For designing a robot, we need motors, a

controller, driver circuits for running A motor. The proposed pill delivery robot is of the following modules.

1. Line follower robotic chassis with medicine box having four compartments.
2. Ultrasonic sensor for detection of the obstacle.
3. RFID tags and RFID reader to identify the bed of a certain patient.
4. Red-colored LEDs on the box for indication to the patients to have the pills only from the indicated compartment.
5. HC05 Bluetooth module connected to android app for controlling the robot.

The robot can be operated in two ways viz. autonomous and manual mode. The robot would start and stop through a mobile app connected to the Bluetooth module. The start and stop can be done manually with the help of the HC05 Bluetooth module connected to the android app for controlling the robot. In manual mode, the robot is completely controlled through the android app. The other mode is the autonomous mode where the robot follows the line itself. The line tracing robot follows a black line on a white sheet. The line follower robot that can detect the black-colored line drawn on the floor with the help of two IR proximity sensor. Here we have designed an Atmega 328p based line tracing robot. The main principle is to detect the non-reflective colored line like the black line on the floor and move along that line. The robot senses a non-reflective colored line by using infrared sensors and sends a signal to Atmega 328p.

Then L293D motor driver drives the motor according to sensors output. DC motor is used for running the wheels but it is not directly connected to the microcontroller so DC motor driver L293D is used. In this research there are two IR sensors are which are placed in front in the left and right side of the chassis when both left and right sensor faces a reflective colored surface robot move forward. Medicine giving out is a vital procedure in the hospital ward.

Here controller is used as an ATmega328p microcontroller. An obstacle ultrasonic sensor is used to

find the obstacle in the path. The RFID reader is used for reading the RFID tag. There is A separate RFID tag for each bed for identification of the bed. The assembly has A box for medicine delivery. As soon as the robot reaches the patient's bed and detects RFID tag, the LEDs will glow on the box which has the medicines for covid-19 patients. The patient care robot moves further to the next bed and delivers medicines.

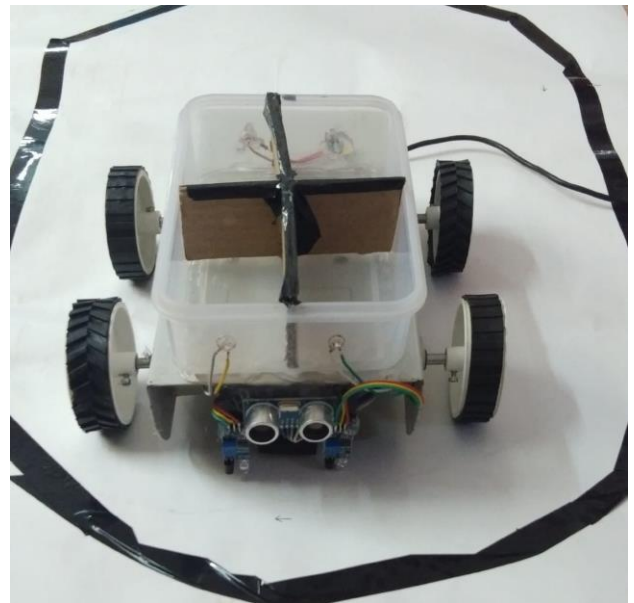


Figure 1. Medicine Delivery Robot with Path.

IV. RESULTS

In this project, we developed PCB by using ATmega328p on Eagle Software. Supply is given to the robot by using a 5v power bank by using a USB cable. Every patient has its unique RFID tag. The robot can reach each patient by using IR Sensor. It is connected to Bluetooth for Autonomous and Manual Mode. As a programmer gives through the mobile application it starts operating in either autonomous or manual mode as the input given.

In autonomous mode, it starts finding the bed by following the line. It stops when the bed detects by using an RFID reader and blinks the LED in the medicine box and sends a message regarding the position of the bed and Message displays in App. As the patient takes the medicine it moves further. In Manual mode, the whole robot can be controlled by using a mobile App. Simulation of this project has been done on proteus software. The result of the simulation is shown in Figure 2 and Figure 3.

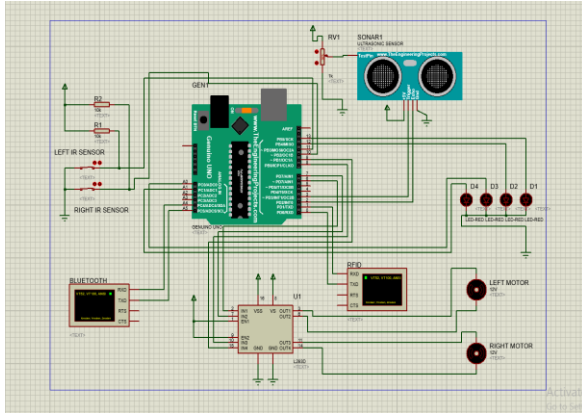


Figure 2. simulation

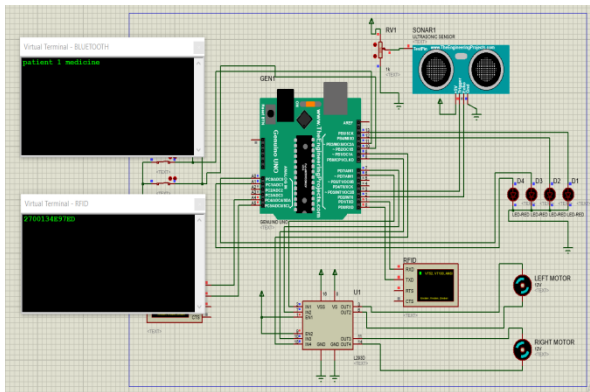


Figure 3. Simulation with output

storing the information in a database. Segregating medicines according to the symptoms and then delivering them to the patients is another scope for this project. Sanitization of the ward can also be implemented with this project.

VI. ACKNOWLEDGMENT

The team would like to thank Prof. Triveni Dhamale for the guidance throughout the project and the management of Pimpri Chinchwad college of Engineering and Research for providing their financial support.

REFERENCES

- [7] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," *Phil. Trans. Roy. Soc. London*, vol. A247, pp. 529–551, April 1955. (references)
- J. Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
- [8] I. S. Jacobs and C. P. Bean, "Fine particles, thin films, and exchange anisotropy," in *Magnetism*, vol. III, G. T. Rado, and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
- K. Elissa, "Title of paper if known," unpublished.

V. CONCLUSION

This robot will help the patient to take the allotted medicine with the help of indicated LEDs present on the Medicine box. It tracks the path by an IR proximity sensor and detects each bed using RFID tags. Since the dc motor is used for the movement of the robot, so it can move in four directions without any constraints. If any obstacle is there it can recognize easily by the obstacle ultrasonic sensor. It moves to the next bed by the line follower concept. Our proposed system is interfaced with sensors that enhance the patient caring level in the hospital with the help of IoT and Robotics technology. We can even implement this caring robot in the hospital for reminding the patients about their medicines without human interference.

The further scope for this project can be measuring temperature and pressure or oxygen of the body and then

R. Nicole, "Title of paper with the only first word capitalized," J. Name Stand. Abbrev., in press.

[9] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[10] T. Vamsi Krishna; Srikanth Kavirayani; Divya Sree Uddandapu, "Robot for Delivery of Medicines to Patients Using Artificial Intelligence in Health Care"

Bangalore Humanitarian Technology Conference (B-HTC), IEEE.

[11] Mr. Hameedhul Arshadh; Mr. I. Dinesh; Mr. V. Caleb, "Design and Fabrication of Medicine Delivery Robots for Hospitals" International Conference on Recent Trends in Computing, Communication, and Networking Technologies (ICRTCCNT'19).

Agriculture smart protection from animals using smart scarecrow system

*Prof. Dr. Rahul Mapari¹, Laukik S. Deshmukh¹, Prashant M. Gode¹, and Ankit D. Gaikwad²

¹A department of E&TC Engg., PCCOER, Ravet, Pune-412101, MH, India 1

^{1*} rahul.mapari@pccoer.in

² Dafe Layout Swagat Coloney in Front of-Durgamata Mandir Pipri Meghe wardha-442001, Green Park Layout, near Gopinath Munde Sabhagruha Pandharkawada TQ. Kelapur Dist. Yavatmal, Gno 1400/2 morewastiswapnanagrihousocchikhali pune-411062

² laukik167@gmail.com, godeprashant5@gmail.com, ankitdg321@gmail.com.

Abstract. A smart scarecrow system to minimize crop raiding and man animal conflict from wild animals and birds was constructed which uses sound, light, movement to fear the animal as well as birds. The system basically comprises servo motors for hand rotation, an irritating audio system, high intensity lights, GSM module and sensors all these peripherals are controlled by the controller placed inside the chest of scarecrow. The scaring system consisted of three parts: object detection, message sending and automatic height adjustment. Object detection is done by the PIR sensor placed on top of scarecrow depending on that preventive action taken by initiating servo for hand movements, sound speaker and high intensity blinking-light. After object detection message corresponding to this is send by GSM to the farm owner. Depending upon seasonal cropping pattern height of the system get automatically adjusted using motor string pulley mechanism after activation of ultrasonic sensor. It is more convenient and cost effective than traditional scaring strategies like trapping, hunting and wood fencing. No manpower is required for scaring. The present system is made up of metal body so it can work in worst weather situation.

Keywords: Hand rotation, high intensity lights, message sending, height adjustment, object detection, PIR, GSM.

1 Introduction

One of the great dilemmas of our era is the increasing conflict between wildlife-farmers and crop raiding. It has been around since beginning of agriculture. Recently Tamil Nadu reported a total of 7,562 incidents of crop-raiding by wild animals in the last three years. There are many different situations and reasons where wildlife-farmer come into conflict. Some of the reasons for that is in search of water, livestock predation, increase in human populations, increase in agriculture and reduction in forest land, the availability of palatable and nutritious foods near farm edges. For that farmers utilize strategies and traditional methods that are often cruel and ineffective. While arbitrary killing, trapping or poisoning of suspect may provide short-term satisfaction but it fails to address long-term needs. So we must seek to understand sociological, economic and cultural aspects to find solution. Researchers suggest managing pastures to reduce competition for forage between wildlife and domestic livestock. In addition, shifting from farming system with perennial crop may reduce losses [2]. But this cannot be the proper solution for the problem. In general, crop

damage by monkey and wild-boar is more serious in northern part especially in lower altitude areas. So farmers usually adopt some crop protection strategies guarded their crop by spending night out in field, wood fencing whereas wealthier farmers used imported barbed wire, trapping, hunting are popular. Use of plastic flags, brightly colored objects, scents and fireworks works sometimes but again that are marginally successful. Some make system consists of sound clips for different animals and red lamp connected to stick which is not durable [9]. There are smartphone controlled systems but here was no provision of movement [5]. For birds unmanned aerial system (UAS) is used to deter birds. To detect birds, background subtraction algorithms have been used [6]. Many systems developed which detects the intruders, monitors any malicious activity and then reports it to the owner of the system but these are unable to fear the wild animals and primates [8]. There is by no means an easy solution to this problem. Wild-animals now a days are smart enough they learn to overcome obstacles such as fences and scarecrow. So there is need of automation system in agriculture field which can avoid man animal conflict

and crop raiding. So one of the technological solution for this problem is smart scarecrow system which uses high intensity light, sound sensor, arm movement to fear the animal as well as birds. The common form of scarecrow is a humanoid structure dressed and placed in open field to discourage the birds and animals from disturbing and feeding on recently cast seeds and growing crops. This system consists of PIR sensor for detection of the object then servo motors present here performs the motion operation of scarecrow arm and firecracker sound buzzer is used to demotivate the animal as well as birds and for the night time high intensity lights placed on head is used to keep animals away from farm field. Also the system consists of ultrasonic sensor for detection of the height of crop depending upon different seasonal cropping pattern based on that scarecrow height gets automatically set using motor and after detection of the object message will convey to the farmer. Scarecrow basically work in two different phases first is object detection and message conveying and second is automatic height adjustment using pulley arrangement. In the first phase after switching on the system PIR sensor activate it is connected to the microcontroller once the object detected by sensor the message is send to controller depending upon this controller activates other three peripherals that are two servo motors

2 Proposed methodology

In this paper, smart scarecrow system uses irritating sound, high intensity lights and arm movement to fear the animal as well as birds. And automatic height adjustment mechanism to increase accuracy in the object detection. This system consists of PIR sensor for detection of the object after detection other three peripherals are activated servo motors present here performs the motion operation of scarecrow arm and firecracker sound buzzer is used to demotivate the animal as well as birds and for the night time high intensity lights placed on head is used to keep animals away from farm field. Simultaneously message of detection is instantly send using GSM module on smartphone of the farm owner. Ultrasonic sensor present here for detection of the height of crop depending upon different seasonal cropping pattern based on that scarecrow height gets automatically set using pulley and motor mechanism. Wild-animals now a days are smart enough they learn to overcome

connected on two sides of system works as the arms of scarecrow normally it rotate with angle 120 degree, second is the activation of firecracker sound sensor and the last is activation of high intensity light at night time here day and night is configured by LDR, while doing this the message will convey to the owner of the farm. In the second phase ultrasonic sensor is connected to the microcontroller when any crop is detected in front of it then message is given to the controller and it activates motor which is placed at bottom of system and system and motor is connected by string using pulley mechanism when motor rotates clockwise and anticlockwise direction it wound and relax the string so that system will able to adjust its height. As per 2018, agriculture employed more than 50% of the Indian work force and contributed 17–18% to country's GDP 70% of country's income is from agriculture and rank 2nd world wide in farm output so the technological advancement is needed in this sector too. The rest of the paper is structured as follows. Section 2 gives the information about proposed scaring methodology for animal detection and prevention of farm along with height adjustment in detail. Section 3 provides the block diagram. Section 4 provides specifications next section gives experimental results and discussion on the results. Finally, last section presents the conclusion of the proposed work.

obstacles such as fences and scarecrow. This system use available technology to reduce manpower. The automatic height adjustment concept is used here to detect the object clearly varying height of the crops should not be the barrier for detection. And this is achieved smoothly by using pulley arrangements. Main body of the system is made up of hollow metallic box in which controller circuit is placed so system can work in worst whether situation. There are different scarecrow system available but these are very specific to particular animal or birds but in present system we try to make a scarecrow by taking consideration of most of the animals and birds.

Objectives

- *Make use of available technology to avoid man animal conflict by making cost effective smart scarecrow.*
- *Built a system which can monitor the farm and prevent the farm from most of the wild animals,*

primates and birds by using sensors and body movement.

- Implement a system which only avoid crop raiding and man animal conflict without doing actual damage & killing of animal and birds.

3 Block schematic and Working

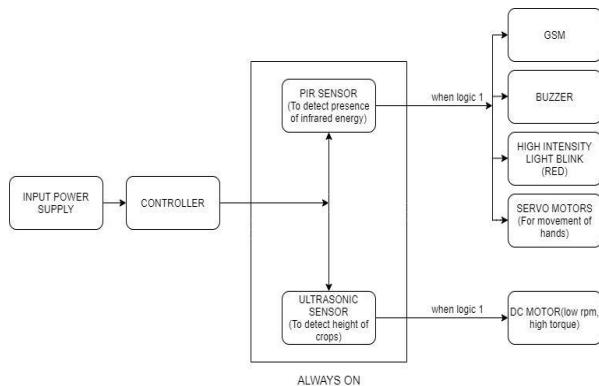


Fig. 1. Block diagram of proposed system

4 System components and specifications

Table 2. Specifications of the components

Sr. no.	Parameters	Specifications
1	DC MOTOR	High Torque Motor-10 RPM Rated Voltage 12V DC. Shaft Diameter 6mm, Motor Length 63mm. Rated RPM 10, Weight 180gm, Load Current 7.5A (Max.), Motor Diameter 28.5mm Torque up to 120Kgcm, No Load Current 800mA (Max.), Shaft Length 30mm
2	SERVO MOTOR	Model: MG995 Weight: 55 gm Operating voltage: 4.8V~7.2V Stall torque @4.8V :

Working

- The whole operation is controlled by controller which is feed by input power supply.
- Controller always keeps PIR and Ultrasonic sensor on for surveillance of field.
- When PIR sensor detect any type of infrared energy then give instructions to the controller to active the successors such as GSM, buzzer, high intensity light and servo motor.
- GSM inform the owner that object is detected further buzzer will make a loud noise to scare the animals, light will be highly intense so that able to visible even in a fog and finally servo motors attached to the two sides of model so that it will rotate at certain angle which will looks like a arms of the scarecrow (movement purpose only).
- When ultrasonic sensor detect any increase in crop height it get activated and it will turn on the DC motor to rotate at certain angle to align height of bot higher than the object (crops).

		13kg-cm Stall torque @6.6V : 15kg-cm
3	ULTRASONIC SENSOR	Operating Voltage: 5 V Sonar Sensing Range: 2-400 cm Max. Sensing Range: 450 cm Frequency: 40 kHz
4	PIR SENSOR	Standard detection type 82° vertical, 100° horizontal detection angle White lens colour 170uA operating current Long Distance(12Mtr) Detection range
5	CONTROLLER	Power input: 4.5V ~ 9V Transfer rate: 110-460800bps Support UART / GPIO data communication interface Working temperature: -40°C ~ +125°C Drive Type: Dual high-

		power H-bridge A great set of tools to develop ESP8266 Flash size: 4Mbyte
6	GSM	Network support: Quad-Band 850/900/1800/1900 MHz TTL serial interface compatible with 3.3V and 5V MCU Power supply: 5 -20 V. Power Interface: 2.54 mm Pin header or MICRO USB
7	BUZZER	Operating voltage 3.3V-5V PCB Dimension: 3.1cm*1.3cm.
8	LED	LED draws approximately 50 mA at 5 V with red 24-bit colour control (8-bit PWM per channel); 16.8 million colours per pixel

5 Flowchart and Algorithm

Here first step shows initialization of the system by switching on the supply. Next step after that is controller it takes decision depending upon sensors detection. The step ahead defines the different peripherals connected to controller this step shows completion of the operation whereas the last step shows the termination of the process. The flowchart of operation is as shown in the figure below

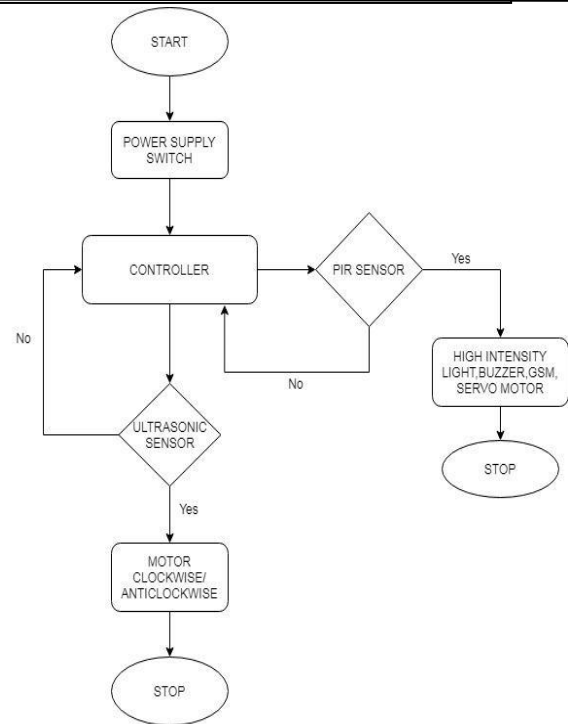


Fig. 2. Work flow chart of smart scarecrow system

Algorithm

- 1] Power supply is provided to whole system.
- 2] Controller will be ON.
- 3] Then PIR sensor will ON through controller and try to detect presence of animal in field.
- 4] As animal is detected then high intense light, buzzer, GSM, servo motor will be ON.
- 5] If not then go to step 3.
- 6] For height adjustment Ultrasonic sensor will ON.
- 7] As height of crop increases it will be detected by ultrasonic sensor then motor will be ON for height adjustment.
- 8] If not then go to step 6.

6 Results and discussion

India is home to a diverse set of habitats – rainforests, deserts, mangroves, grasslands, etc. – sheltering even various wildlife species. It roughly accounts for 7-8 percent of the world's recorded species. The country's protected areas network comprising Wildlife Sanctuaries, National Parks, Conservation Reserves, Community Reserves, and Marine Protected Areas, occupies just 5.02 percent of the total area. Consequently, a large percentage of India's wildlife lives outside protected boundaries. They inhabit or move through farms, gardens, lakes, coasts, and so on in villages, towns, and cities.

Sr. No.	Animal in detection range	PIR sensor output
1	1 meter	Object detected
2	2.58 meter	Object detected
3	3.5 meter	Object detected
4	5 meter	Object detected

1.2 Auto Height Adjustment

As from ultrasonic sensor controller receives the activated signal auto height adjustment function will start performing using motor, pulley and belt. Fig. 7

Table 3. Different height adjustment using motor depending upon sensor output

Sr. No.	Ultrasonic detection	Sensor	Height adjustment
1	Crop height increases by 15cm	by	System will increase its height by 20cm
2	Crop height increases by 20cm	by	System will increase its height by 25cm
3	Crop height increases by 25cm	by	System will increase its height by 30cm
4	Crop height increases by 30cm	by	System will increase its height by 35cm

1.1 Object Detection by PIR sensor

As the object that is animal came in the detection range of PIR sensor then PIR sensor will pass this activated signal to controller to perform further operation which is linked through this signal. Table 2 shows the performance of the system by keeping the animal prototype in the detection range and out of the range.

Table 2: observation through pir sensor

5	7.3 meter	Object detected
6	8.2 meter	Object detected
7	12 meter	Object not detected
8	14 meter	Object not detected

shows the height adjustment scenario of the scarecrow robot. Table 3 shows the performance of the system for the increasing height of the crop. We have implemented the system in the farm consisting of cotton crops.

5	Crop height increases by 35cm	by	System will increase its height by 40cm
6	Crop height increases by 40cm	by	System will increase its height by 45cm
7	Crop height increases by 45cm	by	System will increase its height by 50cm

1.3 Graphical Representation of Season wise Object Detection

In our country different seasons and cropping pattern is responsible for attracting various animals as well as birds towards farm field. So depending upon three seasons the attempts of crop raiding varies. And we can also saw the differences on day and night time. To study this we implement proposed system on three dissimilar farm land with different types of crops and after averaging the sensor outputs we got some results which are shown in the form of responses below. Following graphs shows the object detection on different interval of time in particular season.

This fig.3. Implies variation in animal detection at day and night in winter season. Here animal detection is low after 12 am

because of heavy winter but it starts increasing from sunrise and around 12 pm to 5 pm it is maximum up to 82% shown in graph that means in day time animal detection is maximum in winter. And again it starts falling for night time.

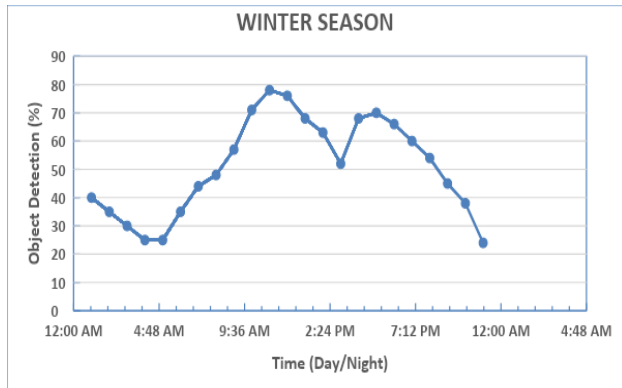


Fig. 3.Rate of object detection by PIR sensor on various time interval in winter season

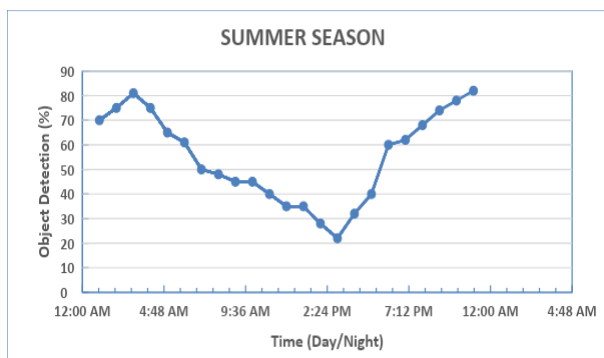


Fig. 4. Rate of object detection by PIR sensor on various time interval in summer season

From this fig.4. It is observed that in summer season major crop raiding is done during night time and early in the morning i.e. from Object detection by sensor is good from 12 am to 9 am and afterwards it will decrease drastically up to 20% shown in response because of high temperature but from sunset again it rises.

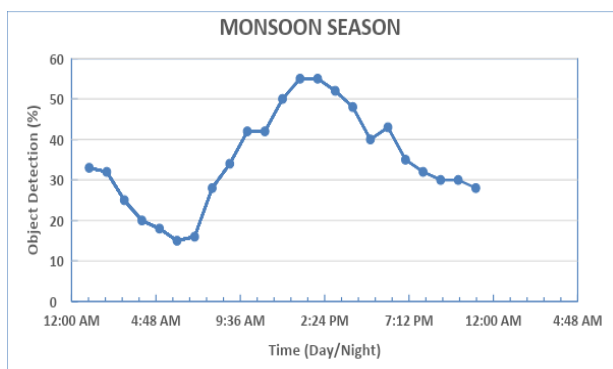


Fig. 5. Rate of object detection by PIR sensor on various time interval in monsoon season

In this fig.5.Shows variation in animal detection at day and night in monsoon season. Object detection is maximum after sunrise and at day time between 1 pm to 7 pm and at the time of clean and dry climatic conditions but if there is cyclonic

wind and heavy rain then sensor accuracy get decrease and proper animal detection is not easily possible.

Hence from above three responses we got different pattern of object detection at day and night in fig.3. It is observed that maximum raiding attempts are detected by our proposed system efficiently in winter similarly from fig.4. In summer most of attempts are detected maximum up to 80% but from fig.5. In monsoon season attempts are effectively detected probably in good weather condition maximum up to

55% so its rate is less as compare to winter and summer season.

1.4 Graphical Representation of System performance in different months

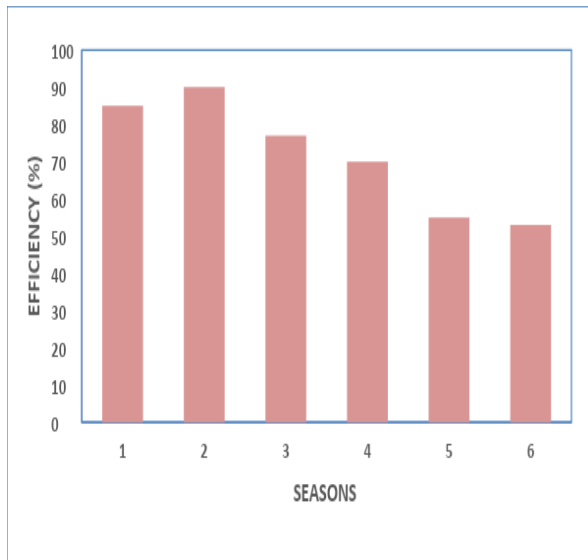


Fig. 6. This graph shows how efficient system can work in three seasons

From above fig.6. Represents the monthly efficiency of the system after studying this it is observed that Smart scarecrow

system perform its operations very efficiently in winter season as compare to summer and monsoon because in summer due to high temperature sensors range reduces this is because difference between background temperature and body temperature is less and signal generated by PIR sensor is smaller similarly in monsoon due to the bad weather conditions like high winds, thunderstorms, snowstorms affect the accuracy of sensor and overall system..



Fig. 7. a) and b) Height adjustment of the scarecrow robot

This fig.7. Shows the photograph of actual proposed system here height adjustment using mechanical pulley arrangement and sliding drawers are shown particularly fig. 7 a) represent low level position of bot for better detection of object when the crop height is less and fig.7 b) represent middle level position of bot for better detection of animals when crop height is moderate

6. Conclusion

The technology brings changes in the agricultural sector in India. Scarecrow system can minimize the loss in the farm ultimately provide safer growing condition, no any night out spending in farm is required for crop protection. Detection from distance and preventive detection is possible using this system. Height adjustment with help of pulley in the proposed system helps exact detection of object. All the sides of the farm can cover by connecting two PIR sensor to the controller. Outer part of the system is made up of metallic box and rod so not easily damageable by wild-animals. It will be more efficient

and cost effective than traditional guarding methods. In general, crop damage by wild-animals is more serious in northern part epically in lower altitude areas. And traditional methods of fencing are ineffective so at such situation Smart scarecrow

system can resolve the problem. This is the man-animal friendly system can resolve conflict.

References

- [1] Claudia Sillero-Zubiri& David Switzer “Crop raiding primates: Searching for alternative, humane ways to resolve conflict with farmers in Africa” 2001.
- [2] Sonam W. Wang,Paul D. Curtis, James P. Lassoie “Farmers Perceptions of crop Damage by Wildlife in Jigme SingyeWangchuck National Park, Bhutan”. Wildlife society bulletin Volume 34, Issue-2, June 2006.

- [3] Jeff Beringer, Kurt C. VerCauteran and Joshua J. Millsbaugh “Evaluation of animal-activated scarecrow and monofilament fence for reducing deer use of soybean fields”. USDA National Wildlife Research Centre, 10-17-2003.
- [4] Ksenija Sabic “Human-Wildlife Conflicts in the Nanda Devi Biosphere Reserve, Uttarakhand, India”. April 2011.
- [5] Kyung Mog Lee “Study on a Smart Phone Application Controlling Harmful Animals Scaring System Applicable to Farm Protection”. WCECS 2016, October 19-21, 2016, San Francisco, USA.
- [6] Shivam Goel, Santosh Bhusal, Matthew Taylor, Manoj Karkee “Detection and Localization of Birds for Bird Deterrence Using UAS”. ASABE Washington July 16-19, 2017.
- [7] C Pornpanomchai, M Homnan “Smart Scarecrow “. IEEE, INSPEC NO- 11850375, 28 Feb 2011.
- [8] SYadahalli, a Parmar “Smart Intrusion Detection System for Crop Protection by Using Arduino”. IEEE, INSPEC NO- 19913406, 01 Sept 2020.
- [9] MR Richardson “Efficiency of an Electronics Scarecrow on 4 Mammalian Crop-Raiders in Limpopo Province South Africa, 2014.

Biped Walking Robot With Autonomous Balance Unit

Kunal Gawhale¹, Suhit Metkar², Rujul Zalte³, Aditya Chandanwar⁴, Abhijith Panikar⁵, Sahana Kulkarni⁶, Labhesh Lalka⁷, and Arti Bole⁸

¹Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

²Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

³Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

⁴Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

⁵Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

⁶Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

⁷Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

⁸Electronics and Telecommunication Department PimpriChinchwad College of Engineering and Research, Pune, India

ABSTRACT This paper describes the system overview and biped walking mechanism of the humanoid robot, Spark. We have created a robot which is able to mimic various human expressions, hand gestures, walking actions, recognize various human faces and objects and perform vocal communication. Spark has a total of 66 DOF. Each arm has 20 DOF and each leg has 6 DOF. The head has 12 DOF and Trunk has 2 DOF. We have used the Broadcom BCM2711 processor for all the major AI operations. It is also acting as a Master control unit for other microcontrollers present in different parts of Spark's body. This system is based on the Raspbian Operating System. Mechanical assembly is based on a hybrid system which includes both serial and parallel operations.

INDEX TERMS Humanoid, Spark, Real time control, Biped walking, Human machine interaction, Autonomous. **I. INTRODUCTION**

Human life is of utmost importance. More and more inventions are made to avoid direct association of human life with tasks that are life risking. Also, the world today is driven by cost and time effective solutions to problems ranging from the simplest tasks such as counting money to one of the most difficult tasks such as deep marine research. We require automation in almost every field possible. A humanoid is possibly the best solution mankind can offer itself at this hour of need. A smart machine is required which can think and work autonomously with a superior workforce than humans. A machine of this kind will bring a novel idea of overall automation and would give a cost and time effective solution to

almost every industry. A humanoid is basically a robot which can perform all the tasks a human can do. The most important of a humanoid's capabilities is that it can think, learn and process just like a human i.e., it has intelligence that matches that of a human. A humanoid can mimic human actions and can

also perform tasks that a human would find impossible. One of the most critical and important characteristics of a humanoid robot is its ability to walk. We have created a machine that is able to walk, see, listen and talk. Spark can think and respond to the stimuli accordingly.

Most of the humanoids present today are either good at facial expressions or biped walking or hand gestures, etc but with Spark, our aim is to develop a fully functional humanoid which can perform all the actions together with proper synchronization. In the past decade, the development of humanoid robots has boosted significantly. There are many humanoid robots such as ASIMO, ATLAS, SOFIA, KHR-3, etc who are currently leading the industry, but these are very costly robots compared to Spark. Spark is a low cost optimum design in the field of humanoid robots. Spark mimics various human expressions using 10 servo motors present in its head. Spark is also able to recognize familiar human faces and is capable of detecting a wide range of objects. The face recognition algorithm is based on OpenCV and Python. Spark's listening and talking algorithm is based on speech recognition and pyttsx3 libraries of Python respectively. Spark walks by collecting data from accelerometer, gyroscope and pressure sensors, actuating the gimbal mechanism and the corresponding

leg actuators. A Raspberry Pi 4 acts as the master controller controlling various ATmega CH2560 microcontrollers and the ATmega CH2560 acts as a slave controller controlling actuators at various joints of the robot's body. These slave controllers also collect data from different sensors present in different parts of the robot. Spark sees through two 8 MegaPixel Sony IMX219PQ image sensors connected to the Raspberry Pi 4. Spark listens and talks using a microphone and a speaker respectively. Various other sensors such as pressure sensor, gas sensor, IR sensor, ultrasonic sensor and temperature sensor are connected at various locations in the robot's body. Spark's walking algorithm is based on a series parallel hybrid walking mechanism.

II. RELATED WORK:(OUR PREVIOUS MODELS/PROTOTYPES)

1 ELECTRONIC ACRYLIC ARMS WITH REAL TIME ACTION MIMIC

Our first prototype in this research was a human-like arm made from acrylic. It was a basic design which was able to mimic a real human arm in real time.

2 EXOSKELETON MODEL FOR ROBOT LEG CONTROL USING REAL HUMAN ACTIONS.

The second prototype was a system which was able to copy leg movements in real time.

3 ANIMATRONIC FACE WITH BASIC HEAD, EYE AND

JAW MOVEMENT AND VOICE COMMAND CONTROL.

Our research on the humanoid face was initiated with an animatronic face prototype which was able to perform some basic face movements which included eye movements, jaw movements and neck movements.

4 SPARK LEGS PROTOTYPES:

Before developing the final leg design we went through two different prototypes. They are as follows:

4.1 VERSION 1 HAVING HEIGHT 45 CM AND HAVING 8 DOF

The first version of legs were designed to walk only in a straight line. It had 8 DOF which included foot movement, knee movement and hip movement.

4.2 VERSION 2 HAVING HEIGHT 90 CM AND HAVING 10 DOF.

The second version of legs had a height that is double that of the first version. This was based on the Inertial Measurement Unit (IMU) for self balancing. It had 10 DOF which allowed all the basic leg movements except hip rotation.

III. BLOCK DIAGRAM

The overall robot is divided into four parts and the functioning of the same is interdependent to each other.

1 SPARK FACE

The spark robot face consists of the main control board through which all the commands are sent and the overall control is decided. The commands from the main control board are sent to different parts of the body. The main control board is a Raspberry Pi microcontroller board. The input devices as well as output devices are connected to it. The input device consists of a microphone through which the commands are received from the user. As the voice command is received the camera which is present in the face gets activated and then it detects the person or the object which is present in front of it. The voice command is detected and according to that the chat bot processes and responds to it and the sound is produced through the speaker. There are servo motors present in the face which are used to create different facial expressions. The motors are connected through a motor driver which drives the motor through Pulse Width Modulated (PWM) signal. The motor driver is connected to an Arduino Mega board. The Mega Board receives commands from Raspberry Pi through SCL SDA line, it is nothing but I2C communication[11]. The voice command is processed and if found the commands to be within the set of predefined tasks then the command is sent to the Mega board and a predefined library function is called which consists of a set of commands, values which are given to the servo motor so that a specific expression is achieved. There is a cooling fan present above the control boards so that the heat doesn't affect the processing of the boards. The power is driven through the Switch Mode Power Supply (SMPS) and the voltage is regulated as per the device requirement. The SCL SDA line is passed to the other parts also and the commands are sent so that the parts are controlled accordingly[11].

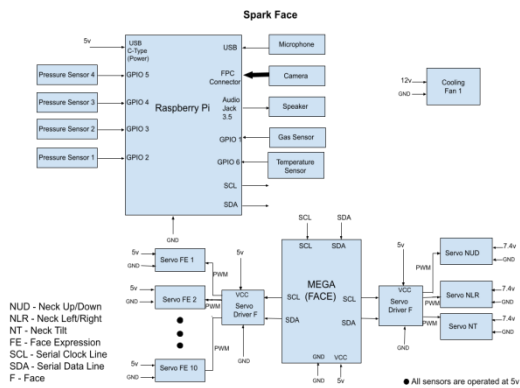


Fig. 1 Circuit schematic

2 SPARK TORSO AND ARM

The torso is the part which consists of the electronics components in it. The arm is controlled by an Arduino Mega board which is connected through the I2C communication[11]. The commands are received by the Raspberry Pi as per the voice commands received. As similar to face in arm also the motors are connected to motor driver and movement in motors is achieved through the PWM signal given to the servo motor. Here also a set of instructions are defined in a predefined library, as the voice command is processed the task or gesture to be performed is identified and as per that the function is selected and the hand action is done. There are pressure sensors which can detect the pressure applied on it. The sensor measures the amount of pressure and the value are then compared. If found more pressure is applied then the motor values are adjusted so that the pressure could be reduced. There is a proximity sensor which detects any kind of obstacle which comes in between. If any obstacle is found then a signal is sent to the Mega board and it takes action on it. Temperature sensor is also there to sense the temperature. Cooling fans are attached to maintain the thermal conditions of the system. The power supply is common and henceforth it is taken through SMPS only and regulated as per the device requirement.

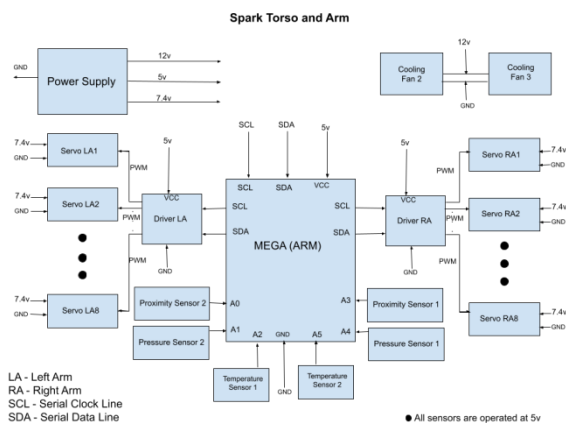


Fig. 2

3.3 SPARK GIMBAL

Gimbal is an independent system which is used to balance the upper body and lower body. It is also used as an interconnection between the two parts of the body. It consists

of an Arduino Nano board which controls the servo motor attached to the platform and a gyroscope and accelerometer sensor which senses the acceleration and direction, these values received from the sensor are sent to the control board. Here the values are processed in such a way that the motor maintains a stable position by adjusting the value. The values which are obtained from the processing are given to the motor to maintain stability. The system is a closed loop system i.e., takes the feedback and processes it as a result the errors are reduced and we get more accurate values, as a result more stability is achieved. Here also the power is drawn from SMPS and regulated.

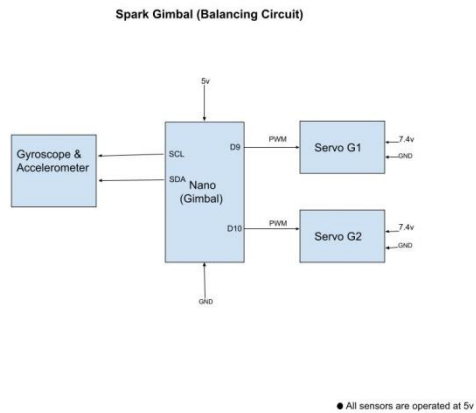


Fig. 3

3.4 SPARK LEGS

Legs also consists of an Arduino Mega board which takes input from Raspberry Pi through I2C communication[11]. As when the voice command to walk is received then the motor moves in a specific pattern to perform walking action. To balance the entire body the center of mass and center of gravity are brought to equilibrium. As there is a predefined set of values which are given to the robot so that it can move it makes the robot unstable leading to loss of balance. To solve this problem we have used a pressure sensor at the bottom of the robot which takes the value of the pressure applied at either side of the foot. Whenever there is an additional load at one side then the values of motors are adjusted so that the weight is shifted to the other side of the body and pressure is equal at both sides[13]. Motors are driven through the motor driver and the signal is received from the Mega board. Power supply is taken from SMPS and the voltages are regulated, cooling fan is also present here.

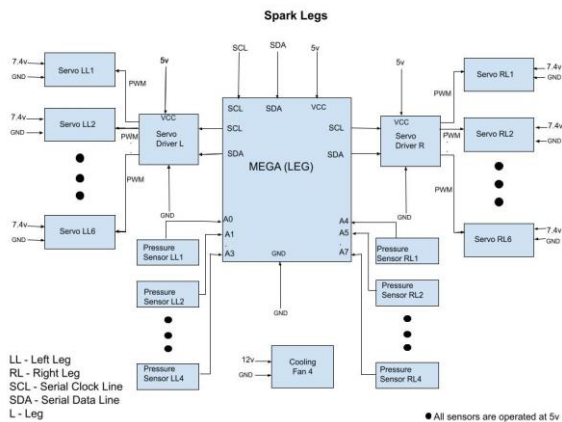


Fig. 4

IV. FLOWCHART

Figure 5 shows the flow of the control system of the robot. At very first all the control boards are initiated, such that the controller prepares to take input values from the sensor. As soon as the controller is ready it provides commands to activate the sensor or it initializes the sensor so that the sensor can receive data from the surroundings. After this the chatbot and image processing codes are run on the control board so that it gets executed and then can perform tasks accordingly. The control board sends the initial value to the servo motor, as a result the motor sets into an initial position making the whole robot stable. Microphone sensors get activated so that it can take input from the surroundings and the robot can respond to it, the robot waits until any voice command is received, as soon as the command is received, the image processing part takes

place and the robot tries to detect the object or person which is giving the command. If a person is detected then the robot greets that person and performs a certain task which is given to it by the user. If instead of a person it detects any object then it responds to it as per the given command. If a person detected is not found in its database then it just responds to the task which is given to it. The tasks are basically performing different gestures or to do certain actions. These tasks can be done by movement of servo motors and the moment is decided by the controller. The control board sends values to the motor so that it moves and tasks are completed. There are multiple sensors to detect any interference, in any case of interference then the sensors detect it and the controller board either decides the value for the servo motor to move based on sensor value or else the robot stops. This whole process keeps on going until and unless the user asks the robot to shut down.

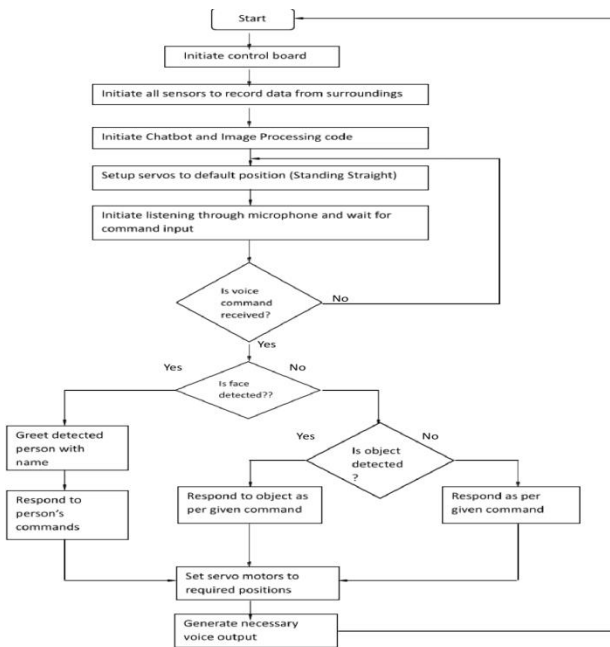


Fig 2. Flow diagram

V. METHODOLOGY

1 HARDWARE ARCHITECTURE

1.1 CONTROLLER NETWORK

The brain of Spark is a Raspberry Pi 4 motherboard acting as a master unit which is further connected with different Arduino boards acting as slave controllers. Each slave controller is connected with a motor driver which further provides commands to different servo motors.

1.2 MASTER CONTROLLER

The master controller of Spark is a Raspberry Pi 4 microcomputer which is based on Broadcom BCM2711 processor. The main reason for using this as a master controller is that it consists of 4GB

RAM which can help in fast execution of the programs. It can also sustain heavy tasks performed on it. Raspberry Pi provides a huge range of peripheral interfacing as a result multiple hardware could be interfaced through it. Being an open source platform there is always support available. To look after the overall operation in the system and to control as per users requirement master control board is needed.

1.3 SLAVE CONTROLLER

An Arduino in each region of Spark's body is acting as a slave controller. Slave controller is nothing but a controller which accepts commands from the master control board (i.e. Raspberry Pi) and acts according to the instructions which are received. There are conditions defined in the slave board if those satisfy then only the board reacts. In Spark the slave control boards are used to control the movement of the motors which are present at the different parts of the body. These are servo motors which move to perform a certain gesture or perform a certain task given by the user.

1.4 SERIAL COMMUNICATION/I2C COMMUNICATION

The communication setup between Arduino and different

sensors is based on I2C communication. For communication between Master controller and slave controller we have used

serial communication (UART) [12][11]. Serial Communication is nothing but the data is transmitted in a sequential manner from the master control board to one or multiple slave control boards which are connected through the Serial Clock Line and Serial Data Line. Through the data line the data is transferred

and to make sure the data is received in a proper sequence and to a proper location a clock signal is also transmitted along with it. This communication is used because multiple devices can be interfaced using only two lines which makes the hardware hezel free. Serial communication is easier to implement.

5.1.5 POWER CONSUMPTION

It works on 24V /15 A Switch Mode Power Supply. For portable purposes, this supply is replaced by two 22.2V, 4500 mAh Lithium-Polymer batteries. Most of the circuitry is based on 5V and 7.4V power ratings. To achieve this we have used a mini MP1584 adjustable voltage regulator at low power consumption regions and 300W 20A DC-DC Buck converter at high power consumption regions.

2 FEATURES

2.1 FACIAL EXPRESSIONS

Face is designed in such a way that it can make basic facial expressions. To achieve various expressions on the face, the face is made of silicon and motors are attached to the face. When the motors move the small movement depicts the facial expression. Servo motors are used to get a specific rotation. Silicon is used because it is the material which feels similar to human skin.

2.2 GESTURE CONTROL

Spark is capable of doing different hand movements, finger movements, leg movements and head movements which all together helps in creating different body gestures. There are multiple servo motors attached at different parts of the body to perform different hand gestures as well as movements. There is a set of predefined values which is given to the servo motor to perform some common gestures such as waving hands, folding hands, folding fingers, walking and so on. These values are stored in a library of functions and as per the command is received the function is called and the movement in the body part is observed.

2.3 OBJECT HOLDING AND INTERACTION WITH THE SURROUNDING.

Spark can recognize different objects and hold them using its

two arms. The image processing is done through the raspberry pi camera which takes the images and the raspberry pi board

processes it. As the object is detected and the command is received through voice to hold the object commands are

transferred to the slave arduino boards and then they hold the object by moving the servo motors of the hand. Pressure sensor is also present in the hand to control the pressure applied on the object. Similarly to interact with the surroundings there are sensors like ultrasonic and temperature sensor to take data from surroundings and react to it accordingly. And a chat bot is installed to interact with the user and give more of a human feel to the robot.

TABLE 1 SPECIFICATION OF SPARK

Height		180 cm
Weight		48 Kg
Actuator		40 Servo motors
Power supply	Battery	LI-PO 22.2V, 4500MAh
	External supply	SMPS 24V, 30A
Sensory devices		Gas sensor, Ultrasonic sensor, IR sensor, Image sensor, Temperature sensor, Pressure sensor, Gyroscope & Accelerometer(IMU)
Control unit		Broadcom BCM2711, Atmel ATmega CH2560, ATmega328P CH340, PCA9685 16 Channel Servo Motor Driver
Total load capacity		5Kg

TABLE 2 DEGREE OF FREEDOM OF SPARK

Head	Eyebrows	1 DOF X 2 = 2 DOF
	Eyes	2 DOF X 2 = 4 DOF
	Cheeks	1 DOF X 2 = 2 DOF
	Chin	1 DOF
	Neck	3 DOF

Hand	Wrist	$1 \text{ DOF} \times 2 = 2 \text{ DOF}$
	Finger	$15 \text{ DOF} \times 2 = 30 \text{ DOF}$
Arm	Elbow	$2 \text{ DOF} \times 2 = 4 \text{ DOF}$
	Shoulder	$2 \text{ DOF} \times 2 = 4 \text{ DOF}$
Trunk		2 DOF
Leg	Hip	$3 \text{ DOF} \times 2 = 6 \text{ DOF}$
	Knee	$1 \text{ DOF} \times 2 = 2 \text{ DOF}$
	Ankle	$2 \text{ DOF} \times 2 = 4 \text{ DOF}$
Total		66 DOF

SOFTWARE ARCHITECTURE:

3.1 CHATBOT SYSTEM3.1.1 DESIGN OF CHATBOT

A chatbot is a computer program that simulates a conversation with one or more human users. Chatbots can be of many types such as simple chatbot, smart chatbot and hybrid chatbot[15]. Simple chatbots are rule based chatbots in which the communication is through pre-set rules[14]. While smart chatbots are supposed to “think like humans”. These chatbots work on the principle of Natural Language Processing(NLP). Hybrid chatbots fall in the middle of simple and smart chatbots, that is, they are the combination of both. These chatbots have some rule based algorithms and are also able to understand intent and context based on NLP[15]. Spark has a voice chatbot that is based on a hybrid chatbot system. The design of the chatbot consists of two main parts. First is the Speech Recognition and second is the Text-to-Speech conversion.

3.1.2 DESIGN FLOW

1. Selection of OS

Spark is based on a Raspberry Pi OS (Raspbian) that is built on top of the Linux Kernel.

2. Creating a chatbot

2.1 Speech Recognition

Speech Recognition or Speech-to-Text is a capability which enables a computer program to process human speech into a text format. Spark uses the ‘speech_recognition’ library of Python that is based on Google Speech’s API[9].

2.2 Text-to-Speech conversion

Text-to-Speech conversion is done to convert speech in text format to human-like voices. Spark uses the ‘pyttsx3’ library of Python to convert text to speech. The advantage of this library is that it works in offline mode[10].

3. Creating a chat

A chat is created for the user to understand the flow of conversation. Spark first greets the user after booting up and asks the user what help he/she needs. Spark speaks different dialogues at various points in time to create and maintain the flow of conversation. Spark showcases a chatbot which is able to converse with multiple users at the same time.

4. Pattern matching
Different algorithms, that is, rule based algorithms and AI based algorithms are used in the chatbot that help Spark respond to a query and maintain the flow of conversation accordingly. Rule based algorithms consist of a database that are used to match the input query and decide on an appropriate response. The AI based algorithms use an even bigger database to accurately recognize and match the input query and to find an appropriate response.

5. Personality

We tried to give a ‘personality’ to Spark based on certain AI algorithms in the chatbot. These algorithms recognize the intent and context of the conversation and choose an appropriate response based on a particular personality. We experimented with different personalities for Spark to further optimize the algorithms.

3.2 IMAGE PROCESSING SYSTEM

One of the most important characteristics of a humanoid robot is its ability to analyze its environment. This mainly includes the vision system of the robot. Such systems are required to recognize certain human faces and detect different objects in the surrounding. Object detection is mainly required for the humanoid to avoid obstacles in its path. Spark uses machine learning algorithms based on Support Vector Machine (SVM), Histogram of Oriented Gradients (HOG) algorithm and Speeded Up Robust Features (SURF) algorithm.

3.2.1 PERSON RECOGNITION AND IDENTIFICATION

The person recognition algorithm identifies humans based on their facial features by comparing it with previously encoded data and identifies the person. This algorithm is based on the ‘face-recognition’ library[4].

The face-recognition library uses Open-cv and deep learning to find facial embeddings using the ‘Deep metric learning’ algorithm[3]. The face-recognition library with the help of dlib’s facial recognition network identifies the person[2]. The neural network is trained to accept an input image, reference data and further output a label based on the person present in the real-time image. It also outputs the list of 128 real-valued numbers used to identify the face and then using the coordinates of the face in the real-time image, we construct a bounding box around the identified face.

The network architecture for face recognition is based on ResNet-34 from the ‘Deep residual learning for image recognition’ with few layers and reduced filters[1].

3.2.2 OBJECT DETECTION

The object detection algorithm is based on the ‘Single-Shot multibox Detection’ (SSD) network which is designed to perform the detection of objects. MobileNet SSD is a light-weight deep neural network architecture designed for mobiles and embedded vision applications which helps in fast and efficient processing of images[5]. It helps to predict the bounding boxes and identify the class of the object using the feature map in a single iteration. It uses small convolutional filters to predict object classes which further increases the efficiency of the algorithm.

For object detection in Spark, we use a pre-trained neural network based on the open source dataset named ‘COCO’[7]. The coco dataset consists of a total of 80 different object classes of segmented and labeled images. Hence, it is possible to identify 80 different objects within a single image[6]. The real time image is obtained and processed using open-cv python library[8].

3.3 INTEGRATED CHATBOT AND VISION SYSTEM

Spark showcases an integrated system of chatbot and image processing. Both the systems run parallelly, interacting with each other on specific occasions depending on certain vocal inputs fed to the system. On receiving certain voice inputs, the chatbot integrates with the vision system module and an appropriate response is returned based on the algorithms.

3.4 SIMULATION AND 3D MODELLING

We have designed different body parts of Spark separately in a designing software. Each part is 3D printed and then used in the project. The dimensions of Spark are of an adult human being with a total height of 180cm. Face parts are designed from raw GI sheets and the silicon mask is developed by moulding process. For assembly of legs, we have used PVC tubes, aluminium bars and pneumatic springs. These parts are connected with proper arrangement of ball bearings and different size nut bolts. We made plastic covers to provide proper covering to the legs assembly.

4 BALANCING MECHANISM

A two axis gimbal mechanism is used to balance the upper body of Spark in synchronization with the lower body movements. We have used two servo motors and an IMU along with an Arduino Nano board to precisely measure the center of mass position and stabilize the position of the upper body so that it will not get imbalanced.

For the inertial measurement unit, we are using an MPU 6050 sensor chip. This sensor has a gyroscope unit to measure x, y and z coordinates of position and it also has an accelerometer to measure inertial changes and accelerations of the body in x, y and z directions. Using these sensor's data, we are able to balance Spark.

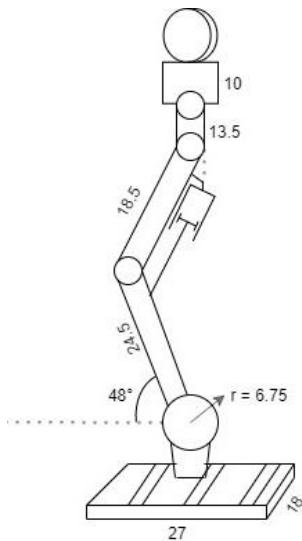
5 WALKING MECHANISM

5.1 SERIES-PARALLEL HYBRID MECHANISM

Spark's walking mechanism is based on a Hybrid Leg mechanism. It is a bipedal mechanism that is a combined structure of series and parallel mechanisms[16]. Spark adopts a pelvis structure with a yaw angle offset to enlarge the feet workspace, inspired by the toe-out angle of the human feet. It is designed to have a large workspace for agile bipedal locomotion. It has a total of 12 DOF, i.e, the hip has 6 DOF and the pair of legs has 6 DOF. Bearings and suspension are used to improve its structural rigidity while supporting its weight.

5.2 MOTION CONTROL

To achieve a particular task using legs such as kicking, walking, dancing, etc. a series of instructions is assigned to every leg motor such that they produce the required movement. Each instruction includes an angle of rotation for each motor in a particular interval of time. The instructions are processed fast enough to maintain the balance of the body

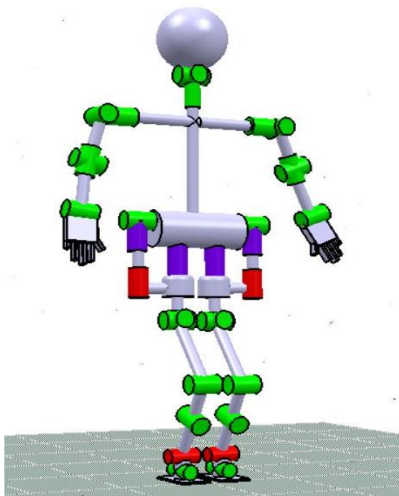


*All dimensions are in cms.

Side view of leg

Fig 6

Joint Structure:



- ☐ - Stiff
- ☐ - Active
- ☐ - Passive

Fig 7

VI. EXPERIMENTAL RESULTS

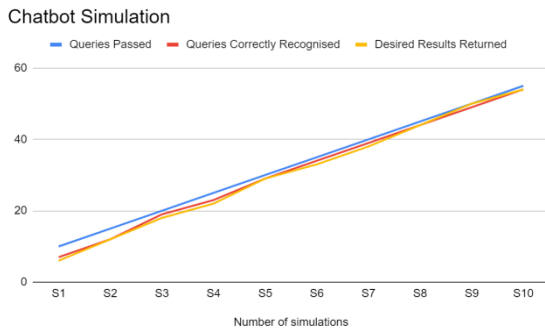


Fig 8

The above graph shows the results of ten simulations of Spark's vocal chatbot. After every simulation, we modified the code to get better accuracy in recognizing correct query. We also modified the algorithms to accurately respond to the query recognized.

6.2 IMAGE PROCESSING RESULTS

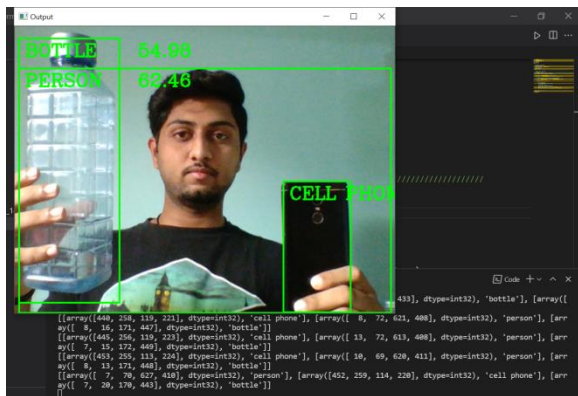


Fig 9

The above image shows the results of an object detection algorithm in Spark, where it is detecting a person, a bottle and a cell phone followed by the accuracy by which the objects are being detected. The object information is being stored in an array for further processing. We have eliminated the problem of multiple detections over a single object by using Non-maximum suppression (NMS). We have conducted multiple trials to obtain the most efficient value for NMS.

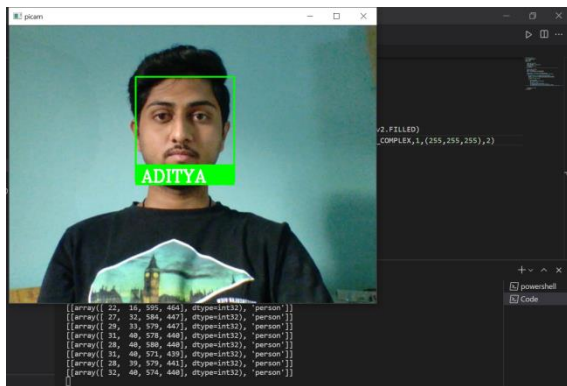


Fig 10

The above image shows the outcomes of the person identification algorithm in Spark, where it is identifying a person based on their facial structure by comparing it with the encoded training data. The algorithm identifies faces on a single image encoding for each unique face.

6.3 BALANCING RESULTS



Fig 11

The above image shows the side view of Spark's movement while walking. It shows the step size of Spark and forward shift of center of mass during the movement.



Fig 12

The above image shows the front view of Spark taking steps in the forward direction.

6.4 GESTURE RESULTS



Fig 13Fig 14

(a)



(b)

The image (a) shows the handshake gesture, (b) shows the salute gesture, (c) shows the grabbing gesture, (d) shows standing position, (e) shows Hands up gesture.



Fig 15

(c)



Fig 16

(d)



Fig 17

(e)

VII. APPLICATIONS

The applications of our humanoid robot include:

1. It can act as a companion to humans such as a domestic helper.
2. It can be used in the field of education to make learning more interesting for children and to encourage them towards the field of robotics and artificial intelligence.
3. It can be used in the field of medical science for supporting doctors or as aid to patients.
4. It can also be used as therapy robots the same way therapy dogs are used.

5. It can be used in the field of defense thereby reducing the chances of human casualties.
6. It can be used to achieve almost complete automation in industry thereby reducing human error and fatigue, reducing time, increasing accuracy and production.

VIII. CONCLUSION

In this paper, we have demonstrated the system overview of a humanoid robot, Spark. Spark is basically developed for using it as a companion in daily life. Spark uses a vocal communication system for a user-friendly experience and to make the user feel as if he/she is talking to an actual human. Equipped with the vision system, Spark can recognize various human faces and a range of different objects around it. Spark's auditory system is useful for understanding vocal commands and interacting with people. Spark showcases an integrated chatbot-vision system for continuous analysis of its surroundings. Various sensors located at different locations in Spark's body also help it in understanding its surroundings. Spark can mimic various human expressions such as smiling, laughing, etc. We were able to achieve biped locomotion with Spark using a series parallel hybrid walking mechanism. A gimbal mechanism helps Spark balance itself.

In the future we plan to enhance Spark's capabilities and create a more intelligent robot by developing more robust sensory and planning systems. Our goal is to make Spark highly autonomous to make it a true human companion and to support humans in daily activities.

IX. ACKNOWLEDGEMENTS

This research is mainly supported by PCCOER (PimpriChinchwad College of Engineering & Research). We thank Mr. Walmik R. Gawhale for the constant guidance, support and initial funding in this research. We thank Dr. H.U. Tiwari (Principal, PCCOER), Dr. Rahul Mapari (H.O.D., E&TC, PCCOER) and Prof. Santosh Randive for their guidance and support throughout this research.

X. REFERENCE

[1] Kaiming He, Xiangyu Zhang, Shaoqing Ren, Jian Sun. Deep Residual Learning for Image Recognition, December 2015

[2] GitHub - davisking/dlib: A toolkit for making real world machine learning and data analysis applications in C++
<https://github.com/davisking/dlib>

[3] Dlib C++ Library: High Quality Face Recognition with Deep Metric Learning
<http://blog.dlib.net/2017/02/high-quality-face-recognition-with-deep.html>

[4] Machine Learning is Fun! Part 4: Modern Face Recognition

with Deep Learning | by Adam Geitgey | Medium

<https://medium.com/@ageitgey/machine-learning-is-fun-part-4-modern-face-recognition-with-deep-learning-c3cffc121d78>

[5] GitHub - chuanqi305/MobileNet-SSD: Caffe implementation of Google MobileNet SSD detection network, with pretrained weights on VOC0712 and mAP=0.727.
<https://github.com/chuanqi305/MobileNet-SSD>

[6] SSD MobilenetOpenVINO Toolkit
https://docs.openvinotoolkit.org/2021.2/omz_models_public/ssd_mobilenet_v1_coco/ssd_mobilenet_v1_coco.html

[7] COCO Dataset - Common Objects in Context

<https://cocodataset.org/#home>

[8] OpenCV - Python Tutorials

https://docs.opencv.org/master/d6/d00/tutorial_py_root.html

[9] Speech Recognition library

<https://pypi.org/project/SpeechRecognition/>

[10] Text-to-Speech conversion library

<https://pypi.org/project/pyttsx3/>

[11] A Review Paper on I2C Communication Protocol by Vivek Kumar Pandey Sparsh Kumar Vimal Kumar Pankaj Goel - April 2018

[12] Mohamed Fezari , Ali Al Dahoud. Good Practice For Uart Communication Using Arduino With Applications, May 2020

[13] ShuujiKajita, Kenji Kaneko ZMP-based biped running control, July 2007.

[14] MenalDahiya. A Tool of Conversation: Chatbot. In The 158 International Journal of Computer Sciences and Engineering(IJCSE), May 2017

[15] Types of Chatbots

<https://www.freshworks.com/live-chat-software/chatbots/three-types-of-chatbots/>

[16] Kevin G. Gim, Joohyung Kim, and Katsu Yamane, Design and Fabrication of a Bipedal Robot using Serial-Parallel Hybrid Leg Mechanism, 1-5 Oct- 2018.

Portable Air Conditioner based on hybrid method of Peltier effect cooling and liquid based cooling

Janhavi Nemade¹, Saurabh Patil², Prerana Singh³, Arti Tekade⁴

^{1,2,3}Department of Electronics and Telecommunication Engineering, PimpriChinchwadCollege of Engineering and Research, Ravet-412101

⁴Assistant Professor, Department of Electronics and Telecommunication Engineering, PCCOER, Pune, India, 412101

ABSTRACT All the researches done on peltier AC's are purely based on the peltier effect. The model of AC developed here is based on a new approach of hybrid cooling system utilizing both *peltier effect* and *liquid based cooling*. It is a compact system with very light weight components used in it and is also very easy to use. It is a portable design with a new efficient cooling method.

INDEX TERMS Peltier effect, Stable Cooling, Hybrid Cooling, Portable A.C.

I. INTRODUCTION

Currently, there is no Peltier based Portable A.C. in market which allows automatic temperature control. Most of the A.C. in the market are very big in size and are not easy to carry while travelling. So, the objective of this project is to make a Portable A.C. which is compact, lightweight, and cost-effective air conditioner. It gives precise and stable cooling. This hybrid system is more efficient than the conventional A.C.[3] It also requires less maintenance. Normal Air Conditioner which are based on compression unit lead to global warming. This Air Conditioner design is based on the Peltier effect and it does not contribute towards global warming[1]. The vibrations created by the moving components (like compressor, big fans) adds up to the maintenance cost and results in reduced life of the conventional A.C. In this A.C design the key component used is Peltier module which results in Peltier Effect[1]. Using this effect, the desired temperature is achieved by the cooling side of the Peltier module which reduces the temperature of the water container[4]. Due to this the temperature of water inside the container drops up to the given input value. The controller inside the Portable A.C. continuously measures the current temperature at the cooling side and compares it with the given input value by the user. An encoder is used to give necessary inputs to the A.C. Cooling fans are replaced on the heating side as well as on the cooling side. The fans on the heating side reduces the temperature of the hot side of the Peltier module. This helps in heat dissipation and allows the A.C. to reach lower temperature values. The fans on cooling side suck the air

from the surroundings and pass it from the cold region and then throws it out of the A.C. using another cooling fan. In this way a very simple and cost- effective method results in achieving extremely low temperatures.

II. LITERATURE REVIEW

The conventional A.C. requires moving components like compressor which adds up in the maintenance of A.C. The vibrations created by the moving components (compressor) results in reduced life of the conventional A.C. In the Peltier A.C moving components like compressor are not needed which would not create any vibrations. Hence the maintenance and life of the Peltier A.C would be more as compared to the conventional A.C. In conventional A.C. working fluid is required which have a chance of leakage. Freon is used in the conventional A.C. which contributes to depletion of the ozone layer, whereas Peltier A.C. doesn't contribute to it. Due to components like compressor the conventional A.C. becomes more bulky than the Peltier A.C. Currently, there is no Peltier based Portable A.C. in market which allows automatic temperature control. Conventional ACs are difficult to carry due to the bulky components used in it. Most of the A.Cs in the market are very big in size and are not easy to carry while travelling. The objectives of the proposed projects are to design compact, lightweight, and cost effective air conditioner, to design AC which do not contribute to global warming, to design AC which gives precise and stable

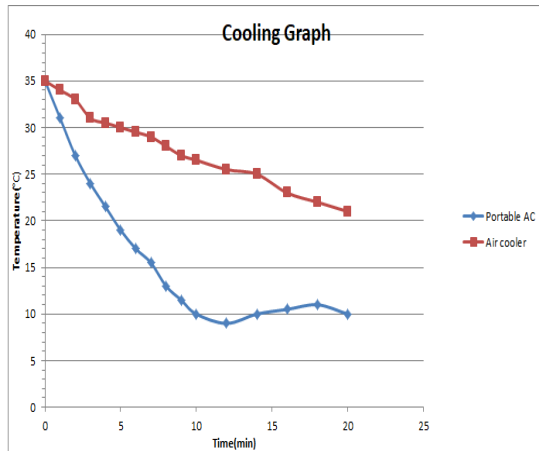


Figure 3: Comparison of conventional cooler and proposed system

VIII. ADVANTAGES OF PROPOSED SYSTEM

1. This AC consumes less space.
2. Cost of the AC is less.
3. Highly precise and stable cooling.
4. Long life.
5. Low maintenance.
6. No risk of leakage of gases.
7. Do not contribute to Global Warming.

IX. APPLICATIONS

1. It can be used for cooling in Polymerase Chain Reaction (PCR) Techniques.
2. It can be used to maintain the temperature in laser systems.
3. It can be used for domestic cooling.
4. It can be used in vehicles for cooling.
5. It can be used for cooling small rooms.

X. CONCLUSION

Peltier module based air conditioners can be an optimum solution when there is a need to cool an object to below the ambient temperature or to maintain an object at a specific temperature. This AC gives precise cooling compared to vapor-compression based AC. This AC consumes less space

and the manufacturing cost is also reduced. It can act as a good solution for portable cooling up to very low temperatures with minimum components. It gives instant cooling as compared to other portable coolers present in the market. This method provides stable cooling for a long time in a single charge of the battery.

XII. ACKNOWLEDGMENT

We are greatly indebted to my project guide Prof. Prof. Arti Tekade for her able guidance throughout the course of this work. It has been an altogether different experience to work with her and we would like to thank her for her help, suggestions and numerous discussions. We are gladly taking this opportunity to thank Head of Electronics & Telecommunication Engineering Prof. Dr. Rahul Mapari and Prof. Kishor Bhangale project Coordinator for their valuable guidance and providing facility during progress of seminar. We are heartily thankful to Prof. Dr. Harish U. Tiwari (Principal, Pimpri Chinchwad College of Engineering & Research, Ravet) for providing research environment; also for his kind inspiration. Special thanks to our friends for the comments and guidance during the completion of our project study and report. We are also thankful to all those who helped directly or indirectly to develop this Project work and complete it successfully.

XIII. REFERENCES

- [1] Bansal P. K. and Martin A., "Comparative study of vapour compression, thermoelectric and absorption refrigerators," *International Journal of Energy Research*, vol. 24, pp 93-107, 2000.
- [2] Hodes, M., "Optimal Pellet Geometries for Thermoelectric Refrigeration," *IEEE Transactions on Components and Packaging Technologies*, vol. 30, issue 1, pp. 50-58, 2007.
- [3] M D Kamrul Russel, "A Hybrid Thermoelectric Cooler Thermal Management System For Electronic Packaging," *Master of Applied Science Thesis, McMaster University, Ontario, Canada, 2011.*
- [4] H.J. Goldsmid, Review of thermoelectric materials, *Introduction to Thermoelectricity (Springer, Berlin, 2016)*, pp. 153-195.
- [5] A. Jose, A. D'souza, S. Dandekar, J. Karamchandani and P. Kulkarni, "Air conditioner using Peltier module," *2015 International Conference on Technologies for Sustainable Development (ICTSD), Mumbai, 2015, pp. 1-4, doi: 10.1109/ICTSD.2015.7095879.*

Real Time Object Detection Using YOLO v3 Tiny with Voice Feedback for Visually Impaired

Sangeeta Mahapatra¹, Neha Chugwani², Pooja Chauthmal³, Prof. Arti Tekade⁴

^{1, 2, 3}Department of Electronics and Telecommunication Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet-412101

ABSTRACT Object Detection is a technique of Computer Vision in which a software system can detect, situate and trace the object from a given image or video. The object's location is identified by drawing a bounding box around the object which is to be identified. In the proposed project we will use this object detection methodology to assist the visually impaired to locate and identify things in their surroundings. This is achieved by using the You Only Look Once (YOLO v3 Tiny) algorithm which is trained on COCO Dataset, TensorFlow, and Open CV. Then the labeled text of the identified object is converted to audio with the help of Google Text To Speech. Multiple frames are captured by the camera on raspberry pi continuously and then they are translated into voice output. The results thus obtained will help the visually impaired to perceive their environment.

INDEX TERMS Google Text To Speech, Object detection, Open CV, Raspberry Pi, YOLO

I. INTRODUCTION

There are a number of individuals who live in this world with the insufficiency of understanding nature due to impaired vision. Because of which they face difficulties in leading their day-to-day life and social awkwardness. For instance, they find difficult to locate things in new surroundings. In our planet with the human population of 7.4 billion, 258 million are visually inefficient. Out of them 39 million are blind completely i.e., they are totally visionless and 246 million suffering from mild or severe impairment.

In recent years there have been considerable breakthroughs in the field of Object detection due to which it has attracted an increasing amount of attention [1]. Identification of objects is associated with computer vision and image processing. This deals with the detection of occurrences of objects of explicit class existing in digital videos and images. This technology thus will give an opportunity to the visually impaired to see this world. There are many computer vision technologies developed that are precise and give accurate results [2]. Primarily, there are three object detectors namely: Shot Detector (SSD), R-CNN, Fast R-CNN, and Faster R-CNN, Single YOLO.

This project uses the sense of hearing to visualize the objects in the surrounding using the "You Only Look Once: Unified, Real- Time Object Detection" algorithm

[3] trained on the COCO [4] dataset to identify the object present before the person thereafter the label of the detected object is translated to audio by the aid of Google Text To Speech (gTTS) which will be the expected output. This output will assist the user to perceive the environment.

II. PROJECT REQUIREMENT

A. Raspberry Pi

Raspberry pi is a lightweight, low cost and low-energy computer. It is the size of a credit card. It has 900-Megahertz quad processor and one gigabyte of RAM. People use Raspberry pi for home automation tasks like internet-enabled garage doors or doorbells. It provides greater networking as it comes with gigabit ethernet and onboard wireless networking along with better Bluetooth connectivity. The official operating system of raspberry pi is Raspbian. It is a version of Linux built especially for the Raspberry pi.

B. COCO Dataset

Common Objects in context are segmentation, large-scale object detection, and captioning dataset. COCO dataset contains a large number of object images captured through different angles to identify the image. Object Detection has

- 1) 121,408 images are present in the COCO dataset.
- 2) 883,331 object annotations are available in COCO Dataset.
- 3) 80 classes are present in COCO Dataset.
- 4) The median image ratio in COCO Dataset is 640x480.

C. OpenCV

It is an open-source Library that contains various real-time programming functions in the field of Computer vision. This makes OpenCV [6] very important for real-time operations. It is easy to use and cross-platform. It has interfaces of Python, MATLAB, C++, and Java.

D. YOLO v3

YOLOv3(You Only Look Once) is the third version of the algorithm used for object detection. This version is faster than the previous version of yolo available. Yolo3 [5] helps us to nearly detect 80 different objects in videos and images. Its accuracy is higher than its previous object detection algorithms. It is a combination object locator (knows the location of the object) as well as an object detector. YOLOv3 runs 22ms at 28.2 maps at 320x320. It makes 3 unique scales of detection. The Deep Learning algorithm is used by yolo3 for object detection.

E. Google-Text-to-Speech(gTTs)

It is a library in Python and a Command Line interface. It writes the spoken data which is in mp3 format into a file or any similar kind of object. This result can be further processed for various audio manipulation or simply outputted as text. gTTs can read an unrestricted length of text.

III. WORKING

Python 3 is being used in this project. Using the Open CV library, the pi camera is initialized. The camera captures the frame with the speed of 30 frames per second. The system makes the use of Yolo v3 Tiny which is trained using the COCO dataset. The object so identified by the system is then converted to audio with the assistance of Google Text To Speech (gTTs) which is also a python library. This audio output gives the identification of the object to the user. With

the aid of this the user is able to identify the objects in the surroundings. This will in turn help the person to avoid injuries and be able to perform his day-to-day activities without much trouble.

IV. EXPERIMENTAL RESULTS

Below are the results that were obtained when the software part of the project was being tested. Fig1 shows the results when we used an image as an input to the software and Fig2 shows the results obtained through live web cam. In both the tests, the objects present in the image and the objects in front of the web cam were detected successfully.

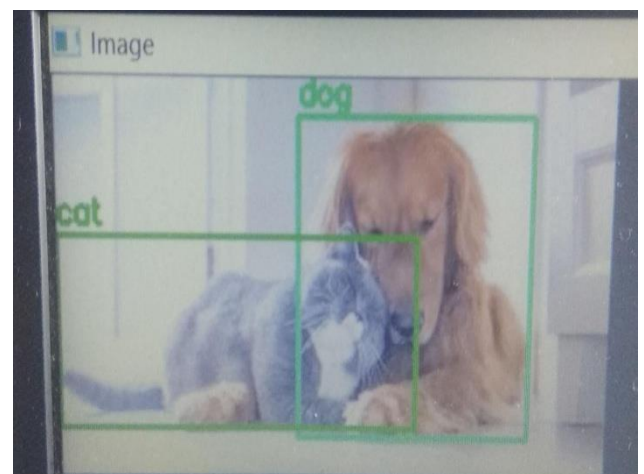


Figure 1. Object Detection using image as an input



Figure 2. Object Detection using Web cam

V. CONCLUSION

The project will accurately detect the surrounding objects using YOLO Algorithm and then convert into voice feedback using gTTs. This project made with the help of Deep Learning and Raspberry Pi will greatly help visually impaired individuals to the great extent by acting as a tool connecting them to the world and surpassing their disability of vision.

VI. ACKNOWLEDGMENT

We are greatly indebted to my project guide **Prof. Arti Tekade** for her able guidance throughout the course of this work. It has been an altogether different experience to work with her and we would like to thank her for his help, suggestions and numerous discussions.

We are gladly taking this opportunity to thank **Prof. Dr. Rahul Mapari** (Head of Electronics & Telecommunication Engineering) and Project coordinator **Prof. Kishor B. Bhangale** for their valuable guidance and providing facility during progress of seminar. We are heartily thankful to **Prof. Dr. Harish U. Tiwari** (Principal, Pimpri Chinchwad College of Engineering & Research, Ravet) for providing research environment; also for his kind inspiration.

Last but not least we are also thankful to all those who help directly or indirectly to develop this Project work and complete it successfully.

VII. REFERENCES

- [22] Kedar Potdar, Chinmay Pai and Sukrut Akolkar, "A Convolutional Neural Network based Live Object Recognition System as Blind Aid", arXiv:1811.10399v1 [cs.CV] 26 Nov 2018 <https://arxiv.org/pdf/1811.10399.pdf>
- [23] Liam Betsworth, Nitendra Rajput, Saurabh Srivastava, and Matt Jones. Audvert: Using spatial audio to gain a sense of place. In Human-Computer Interaction– INTERACT 2013, pages 455–462. Springer, 2013.
- [24] Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi, "You Only Look Once: Unified, Real-Time Object Detection", University of Washington, Allen Institute for AI, Facebook AI Research, 2016.
- [25] Rahul Kumar and Sukadev Meher, "Assistive System for Visually Impaired using Object Recognition, M.Sc. Thesis at Department of Electronics and Communication Engineering, National Institute of Technology Rourkela, Rourkela, Odisha 769 008, India, May 2015.
- [26] J. Redmon and A. Farha, Yolov3: An incremental improvement. arXiv, 2018.
- [27] A. Culjak, D. Abram, T. Pribanic, H. Dzapo and M. Cifrek, A brief introduction to OpenCV, "2012 Proceedings of the 35th International Convention MIPRO, Opatija, 2012, pp. 1725- 1730.
- [28] J. Redmon and A. Farhadi, Yolo9000: Better, faster, stronger. In Computer Vision and Pattern Recognition (CVPR), 2017 IEEE Conference.

Quadcopter For E&TC Department

Nitin Pandita¹, Yash Nagpure², Akash Navale³, Kiran Napte

¹⁻³Final-year students, Dept. of Electronics and Telecommunication Engineering,

Pimpri Chinchwad college of Engineering & Research, Pune, Maharashtra, India.

ABSTRACT

This project aims to build a quadcopter that will safely deliver documents or other things from one faculty member to another. This project aims to reduce the human to human interaction in the wake of covid-19. The drone will pick up the documents or other things from one of the faculty members. It will then carry those things or files and take them to the desired faculty member. The drone will then give those documents or things to the faculty member. After the delivery, the drone will return.

INDEX TERMS Controller, ESC, Motor, Camera, Quadcopter.

I. INTRODUCTION

An unmanned aerial vehicle (UAV) also known as a drone is a remote-controlled aircraft. It can be operated remotely in real-time. The quadcopter is an unmanned aerial vehicle, which has the capability of vertical takeoff, landings, and hovering at the desired location. In recent time drones has been used in different areas for surveillance, delivery, and videography. Currently, in wake of covid19, it has been used for mask detection, spraying sanitizer so as to reduce human interaction. Through this project, we came up with an idea to develop a drone for our department. This drone will deliver different things to different faculty members, so as to prevent the spread of covid19. The user will see on his device where the drone is going through the camera on it. The user will then navigate accordingly through the controller. The first step would be to create a frame where all the components would be mounted. The lithium battery is used to give power to the system because

it has the best weight to power ratio. Propellers are rotated with the help of motors. The camera will be used to guide the drone. The accelerometer and gyroscope are used to control the four motors through Electronic Speed Controller (ESC). Remote Controller (RC) is used to provide input to the Quadcopter.

II. LITERATURE REVIEW

Prof. Vaishali Nirgude, Tejaswi Ninawe et al. [1], this paper proposed an approach to create a frame where all the components would be mounted and the controller will provide input to the quadcopter. This research paper aims to design a lightweight and budget-friendly quadcopter. The quadcopter will be controlled wirelessly through a laptop or remote controller from a certain distance. The camera is also installed in a quadcopter. This camera will be used to acquire video/images and then send them to the laptop.

Dr. P.R. Bhadadpure, Akash Auti et al. [2], In this paper, Drone could allow accelerated delivery time, improved accuracy, and reduce the human cost associated with delivery. This system is designed using a Naza flight controller. This project describes a drone whose operation is completely based on the Naza M-Lite flight controller. The project provides accurate delivery with the help of GPS using the drone. This project reduces the time of delivery and gives a precise performance. With the help of ESC, the behavior of the drone will be controlled and hence it will provide better operation to fulfill the requirements. Using a transmitter, the direction and speed of the drone can be adjusted. Also, with a camera, suspicious activity in the unmanned area can be detected.

Jeevan Murthy, Harshith P S, et al. [3], this paper aims to simplify the delivery process, using the UAV, by delivering the package to a customer at a specific location, hence reducing human efforts and increasing the efficiency of delivery. The system uses OTP (one-time password) for security so that parcel is delivered to its rightful owner. The system uses GPS for navigation and control altitude, latitude, and longitude.

Aditya Bharadwaj, Achira Basu et al. [4], In this paper, they have proposed an approach where for the system to work properly image processing has been implemented to remove obstacles in the delivery path. The system uses GPS to locate

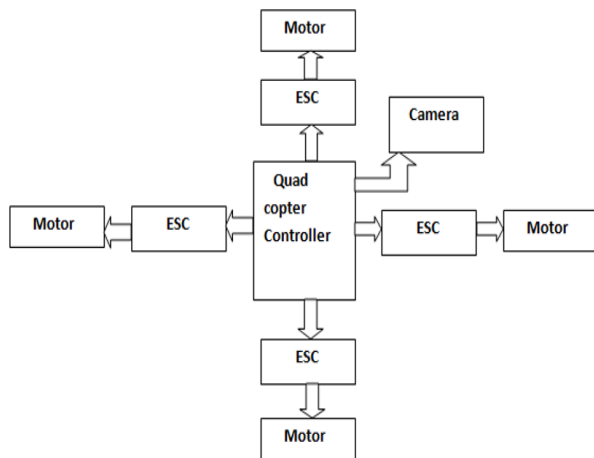
the customer and delivers the package safely. Drone delivers the package within a specific time and thus increases the efficiency of delivery. A live tracking device will detect the location of the customer. The system uses OTP(one-time password) for secure delivery. OTP is provided to the customer during the dispatch of the package to avoid fraud. The drone will pick up the package from the warehouse which is nearest to the customer's location. Customers will be able to track the live location of the package.

A.Samba Siva, B. Prudhviraaj Kumar, et al. [5], this paper presents the development of a Mini UAV (Unmanned Aerial vehicle). Unmanned aerial vehicle offers a variety of applications in different areas such as surveillance, espionage, rescue operations, monitoring forests and wildlife sanctuaries, disaster management, guarding borders. In dangerous conditions, we can send drones instead of humans so as to reduce the risk on human life. Their system uses different sensors to measure temperature and humidity and can easily detect forest fire accident they also use small camera which provides live footage. They use a zig bee and microcontroller for data transfer.

III. PROPOSED METHODOLOGY

The first step would be to create a frame where all the components would be mounted. The lithium battery is used to give power to the system because it has the best weight to power ratio. Propellers are rotated with the help of motors. The camera will be used to guide the drone. The accelerometer and gyroscope are used to control the four motors through Electronic Speed Controller (ESC). Remote Controller (RC) is used to provide input to the Quadcopter.

IV. BLOCK SCHEMATIC & WORKING



The controller is used to control the movements of the quadcopter. The controller is synchronized with the transmitter. The transmitter sends the signal to the controller and the quadcopter will move accordingly. The speed of motors is controlled by ESC (electronic speed controller). The motors consist of stator and rotor parts. The motors are used to spin the propellers. The quadcopter also has a camera to navigate.

V. COMPONENTS REQUIRED

- **Frame:** Frame is the skeleton of a quadcopter. All the components are mounted on the frame.
- **ESC:** Speed of motors is controlled by ESC (electronic speed controller).
- **Motors:** The motors consist of stator and rotor parts. The motors are used to spin the propellers.
- **Propellers:** Propellers are attached to motors. Propellers generate thrust by pushing air downwards on rotating. There are four propellers on the quadcopter. Two propellers spin in a clockwise direction and the other two spin in the anti-clockwise direction. So that the quadcopter has stability.
- **Camera:** The camera is used to navigate the quadcopter. The camera can also be used to capture
 -
 -
 -
 -videos and take photographs. And it is easy to integrate on the quadcopter.

- **Flight Controller:** The controller is used to control the movements of the quadcopter. The controller is synchronized with the transmitter.
- **Receiver-Transmitter:** The transmitter sends the signal to the controller and the quadcopter will move accordingly. The receiver is placed on the drone which receives the signal.
- **Battery:** The lithium battery is used to give power to the system because it has the best weight to power ratio.

VI. ADVANTAGES OF PROPOSED SYSTEM

- Reduces human efforts.
- It reduces human-to-human interaction.
- Easy to operate.
- There is no need for an expert to control it.

VII. APPLICATIONS

- We can use the drone in college for surveillance purposes.
- It can be used to give documents or files to different faculty members of our department.
- It can be used to take photos and videos during different functions at our college.
- It can also be used for streaming live events.

VIII. FUTURE SCOPE

- **Disasters-Management:** The drones can be used to assess the impact of natural disasters such as an earthquake, floods, etc. The drones can also be used to rescue people stranded in disasters and direct them to safety.
- **Delivery-Services:** Many companies and organizations are experimenting with drones to deliver packages. Drone deliveries could begin as soon as regulations are set.
- **Surveillance:** The drones can be used for purpose of spying and intelligence gathering. Drones can also be used for surveillance of the forests, wildlife sanctuaries and to inspect construction sites, and gives real-time footage.
- **Military:** Drones can be used for monitoring the border areas. It can be used for tracking moving targets. It could also be used by the military for reconnaissance.

IX. RESULT

Drone picks up a document from one faculty member and delivers them to another faculty member safely. The camera is attached to the system for navigation. The camera gives a live feed on the mobile app and we can also record videos and captures the image.

X. CONCLUSION

This project aims to reduce human effort and to deliver different things with the help of a quadcopter. The quadcopter will deliver the things to other faculty members efficiently. It will reduce the human-to-human interaction and hence it will prevent the spread of covid-19. It could also be used as a surveillance system to monitor different activities on campus.

ACKNOWLEDGMENT

We are thankful to our respected Guide **Prof. Kiran Napte** for motivating us to complete this project with complete focus and attention. We are also thankful to our Head of Department **Prof. Rahul Mapari**, also he has been persistent source of inspiration to us.

REFERENCES

- [1] Vaishali Nirgude, Tejaswi Ninawe, "Quadcopter for Rescue Mission And Surveillance", IOSR Journal of computer engineering, pp 48-52, 2019.
- [2] Dr. P.R. Badadapure, Akash Auti," Drone Delivery System", International Research Journal of Engineering and Technology (IRJET), vol. 06, June 2019.
- [3] Jeevan Murthy, Harshith P S," Autonomous Drone Delivery System", International Research Journal of Engineering and Technology (IRJET), vol. 07, March 2020.
- [4] Aditya Bharadwaj, Achira Basu," Package Delivery System using GPS Drones", International Research Journal of Engineering and Technology (IRJET), vol. 08, October 2020.
- [5] A. Samba Siva, B. Prudhviraaj Kumar, et al., "Development of Mini Unmanned Aerial Vehicle", IOSR Journal of Mechanical and Civil Engineering, 12(2), 2015, 16-19.

Detection and Monitoring of Unauthorized Vehicles in BRT System

First A. Ashish Hadule^{^1}, Second B. Nimesh Dhumal^{^2}, and Third C. Shivraj Hujre^{^3}

¹Pimpri Chinchwad College of Engineering and Research, Ravet

²Pimpri Chinchwad College of Engineering and Research, Ravet

³Pimpri Chinchwad College of Engineering and Research, Ravet

ABSTRACT : Effective public transit is central to development. For the vast majority of developing city residents, public transit is the only practical means to access employment, education, and public services, especially when such services are beyond the viable distance of walking or cycling. Bus services are too often unreliable, inconvenient and dangerous. However, there is an alternative between poor public transit service and high municipal debt. Bus Rapid Transit (BRT) can provide high-quality, metro-like transit service at a fraction of the cost of other options. For successful implementation of BRT system we need to create a surveillance module to keep a track on unauthorized and commercial vehicles from entering the BRT lane. We have proposed an unauthorized vehicle detection system. It consists of a centralized database holding the information of authorized vehicles. The information is gathered with the help of RFID Vehicle tags, RFID tag Reader and RFID tag. The RFID chip is placed in every vehicle that will be passing through the established point of entrance; with the help of RFID tag reader it is possible to communicate with RFID tags. The process of identifying the vehicle is performed by reading serial number available on the RFID tag.

INDEX TERMS : RFID RC 522 Module , Raspberry Pi 3 Model B+ , IR Sensor, Web Camera , GSM/GPRS Module, Detection, Monitoring. **INTRODUCTION**

Effective public transit is central to development. For the vast majority of developing city residents, public transit is the only practical means to access employment, education, and public

services, especially when such services are beyond the viable distance of walking or cycling.

Unfortunately, the current state of public transit services in developing cities often does little to serve the actual mobility needs of the population. However, there is an alternative between poor public transit service and high municipal debt.

Bus Rapid Transit (BRT) can provide high-quality, metro-like transit service at a fraction of the cost of other options. But the unmonitored usage of BRT system by civilians and other commercial vehicles is being an obstacle in achieving the main objective of the same. Moreover because of this misuse the frequency of road accidents has increased drastically. In order to tackle this there is a need of a monitoring system which will help us to track down the illegal use of the BRT system. The purpose of this document is to provide detailed insight into overall architecture of intelligent transit management system including its components which would hereby be referred as "Intelligent Transport System and Automatic Fare Collection System" or ITMS for PCMC BRTS. The document underlines all IT related requirements of ITMS for PCMC BRT to achieve a highly automated and stable environment for Bus Operations Management.

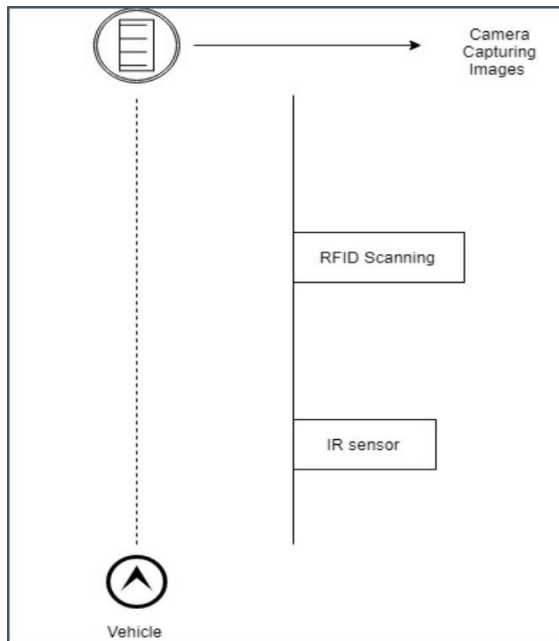
II. Objectives

To provide detailed analysis of unauthorized entry of commercial vehicles into the BRT lanes to the near by Traffic Police Station which will help them to maintain laws and orders related to transportation system.

To identify and analyze common transportation patterns to reduce further occurrences of similar incidences. To explore and enhance classification algorithms to predict non law-abiding behavior based on previous trends. To transform BRT

system into a feasible instrument and to make metropolitan areas more sustainable from the economic, financial, social, political, technical and environmental perspectives.

Block schematic



III. Working

Any vehicle (2/3/4 wheelers and others) enters the BRT route . As soon as it enters the route , width of the vehicle will be checked . If the width is less than the BRT bus, the camera will be notified . If the width is equal to the bus, then the RFID tag

status will be checked. If tag is scanned, it allows the vehicle to proceed freely otherwise it will notify the camera to click the picture of the number plate and send it to respective authority for further legal actions.

Working of the proposed system : The vehicle enters from the bottom as symbolized by the arrow . The camera module is placed behind to capture the image as soon as it is notified . The two sensors check the length of the vehicles and if it is true , then the RFID is notified to scan the tag and notify the camera to perform necessary action.

IV. Modules and Funtionality :

O

object Detection by IR Sensor: An infrared sensor is an electronic

device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IRsensor.

Identification by RFID tag: This functionality is used in case swhen a similar kind of bus structure enter BRTS then the sensors may fail to detect the illegal vehicle. So in this RFID technology is used. In our system all the legal buses have a RFID tag.

Image Capturing: Using RFID we are identifying is the vehicle passing through BRT road is a BRT vehicle or not. If not, the camera will capture the image of that vehicle so that we will take the action who violets the BRT rules.

V. Components and Specifications :

Raspberry Pi 3: Model: B+
Processor: Broadcom BCM2837B0, Cortex- A53 (ARMv8) 64-bit SoC @ 1.4 GHz
RAM: 1 GB LPDDR2
Connectivity:GigabitEthernetoverUSB2.0 Operating Power: 5V/2.5ADC

RFID :

Model: RC522
Working current @3.3V: 13-26 mA Working frequency: 13.56MHz PCB Size(L×W): 60×40mm
Weight: 0.07 kg

IR Sensor :

Operating Voltage: 3.6-5V
Weight: 5gm

Detection Angle: 60°
Dimensions: 8×5×1 cms

GSM Module:

Model: SIM800A
Network Support: Quad band 850/900/1800/1900MHz

Camera :

Resolution: 2592×1944
15-pin MIPI Camera Serial Interface-Plugs Directly into the Raspberry Pi Board

VII. Advantages of proposed system:

We will get the details of unauthorized entry of commercial vehicle into the BRT lanes to the nearby Traffic Police Station which will help them to maintain laws and orders. Because of this system we will get the fast and clear way for BRT buses. BRT system will become more feasible and faster. People will take the BRT buses to travel and indirectly pollution also get decreased. It will make metropolitan areas more sustainable from the economic, financial, social, political, technical and environmental perspectives. The number of accidents happen in BRT lane will decrease Size: 20×25×9mm

Video: Supports 1080p@30fps, 720@60fps and 640×480p 60/90 Recording

Weight: 3gm

VI. Algorithm

Step 1:

First the IR sensor will check the vehicle is present or not. When it detects the vehicle RFID tag reader gets on.

Step 2:

RFID tag reader will detect the tag is present or not on the vehicle.

Step 3:

If tag is present then there will be no action taken.

Step 4:

If the tag is not present on the vehicle then camera will take the picture of vehicle with its number plate.

Step 5:

Then the data of the vehicle will get transmitted to the nearer traffic police. Then they will take appropriate action on the vehicle user.

VIII. CONCLUSION

An Iot system will be developed in order to track and report the unauthorized entries into the BRT. The system will successfully detect all the unauthorised vehicles and capture picture of those vehicles. The main aim of capturing the picture is to capture the number plate of the vehicle. The system will further send those captured pictures to the respective authority for further legal actions. In future , the system can be used by the government in

order to track the unauthorized entries into the BRT, satisfying the main purpose behind the BRT.

IX. REFERENCES

[1]. X. Cui, J. Gao and Y. Y. Wang, "Research of Bus Rapid Transportation based on 'Public transportation first'", International Conference on Future Information Technology and Management Engineering, vol.1, pp.174-177, 2010.

- [2]. A. E. Diez, A. Bohorquez, E. Velandia, L. F. Roa and M. Restrepo, "Modern trolleybuses on Bus Rapid Transit: Key for electrification of public transportation", IEEE AND ESECON, pp.1-7, 2010
- [3]. J. An, J. Teng and L. Y. Meng, "ABRT Network Route Design Model", 11th IEEE International Conference on Intelligent Transportation Systems, pp.734-741, 2008
- [4]. Y. Luo, Y. Yao and H. H. Gao, "The Design of the BRT Signal Priority Control at the Intersection", International Conference on Intelligent Computation Technology and Automation, vol. 1, pp. 507-511, 2008
- [5]. Kurt Konolige, Joseph Augenbraun, Nick Donaldson, Charles Fiebig and Pankaj Shah. A Low-Cost Laser Distance Sensor IEEE International Conference on Robotics and automation, Pasadena, CA, USA, May, 2018.

-
- [6]. Hidalgo-Guerrero D (2008) "Bus Rapid Transit Around the World "International Seminar-cum-Workshopon" BRT Systems in India and Abroad "24 to 26 September 2018, Visakhapatnam, India
- [7]. Hook W (2005) "Institutional and Regulatory Options for Bus Rapid Transit in Developing Countries: Lessons from International Experience Transportation Research Record 2014, 184-191
- [8]. W. L. Huang, S. M. Tang, Z. J. Li, F. H. Zhu and Y. F. Ai, "A Hierarchical Bus Rapid Transit System Based on Wireless Sensor Networks", 11th International IEEE Conference on Intelligent Transportation Systems, pp. 1027-1031,2008[
- 9]. C.H. Zhouand Z.G.Gao. "A Real-Time Information System for BRT Based on GPS/Signpost Compound Navigation Technology ",International Conference on Logistics Engineering and Intelligent Transportation Systems, pp. 1-4,2010
- [10]. P. K. Mzee and Y. Chen, "Implementation of Bus RapidTransit System as an Alternative for Public Transportation in Developing Countries Case of Dart System in Dar Es Salaam", International Conference on Intelligent Computation Technology and Automation, vol. 2, pp.489-493,2010
- [11]. S. Panwai, H. Dia, " Real-Time BRT System ", IEEE Transactions on Intelligent Transportation Systems, vol.6,no.3, pp. 314-325,2005.
- [12]. H.S.Levinson, S.Zimmerman, J.Clinger, J.Gast," Bus rapid transit: synthesis of case studies", Transportation Research Record: Journal of the Transportation Research Board, vol. 1841, pp. 1-11,2003.

EMR Analysis to predict various

A. Dharmesh Chaudhary¹, B. Neha Dodake², C. Sakshi Mukkirwar.³

¹Pimpri Chinchwad College of Engineering and Research, Pune, India

²Pimpri Chinchwad College of Engineering and Research, Pune, India

³Pimpri Chinchwad College of Engineering and Research, Pune, India

ABSTRACT

There is a need to study and make a system that will make it easy for end-users to predict diseases. To detect

I. INTRODUCTION

There is a tremendous growth in image acquisition devices, the data is moving to big data. This makes it very difficult for image analysis. The speedy growth in medical images requires a lot of efforts by the medical specialist that is irrational, liable to err. This may vary expert to expert. A machine learning algorithm, deep learning algorithm, and image processing techniques automate the diagnosis process by using data sets. This is a substitute solution.

I.A DATASETS

In this, datasets are separated into test and train which sets a part of evaluating data mining models. Train/Test is a method is used to measure the accuracy of the model. There are two sets implemented in this model.

1. A training set is used to build up a model. 2. A test set is used to authenticate the model.

The training data helps to fit in the model whereas; testing data to test it. This model is built to predict the results which are present in test data sets. Here datasets are nothing but cell or organ images in which there are two different types of images known to be uninfected Images and infected images.

I.B FEATURE EXTRACTION

Descriptive sentences written by experts for the medical images, such as Red blood cell images (RBCs), X-ray and

the various diseases through examining medical images of a patient using different techniques of deep learning models. To handle image data and structured data is no Proper method. The proposed system considers both the structure & unstructured data. The accuracy will Increase using deep learning and machine learning concept.

INDEX TERMS. Convolutional Neural Network (CNN), Image data Augmentation.

magnetic resonance imaging (MRI) help in medical image diagnosis.

Deep learning provides high performance computing which deal with huge medical data for precise diagnosis. Deep learning and image processing are key parts of the project. These techniques are composed of conventional algorithms-Convolutional Neural Network (CNN); these algorithms indicate the behavior of the data by analyzing the information representation and abstraction spontaneously from a large set of images.

Image processing Techniques used:-

1. A medical image acquisition.
2. Image data Augmentation (pre-processing the layers)
3. Image diagnoses (Extraction of the data of images)

II. LITERATURE SURVEY

In December 2012, Edward Kennedy stated that the use of the electronic medical record (EMR) might increase extensively in future, but a lot of research needs to be conducted to analyze whether using EMR data is flexible, adaptive and if statistical methods could enhance medical disease prediction.

In March 2016, Riccardo Miotto stated the methodology that describes motivation for preventive medicine because of increase in healthcare cost. The main concern is recognizing the effects of the disease so that we can take preventive actions in the earlier stages. Hence they came up

with an application of deep learning to obtain patient representations from EMR and to determine diseases.

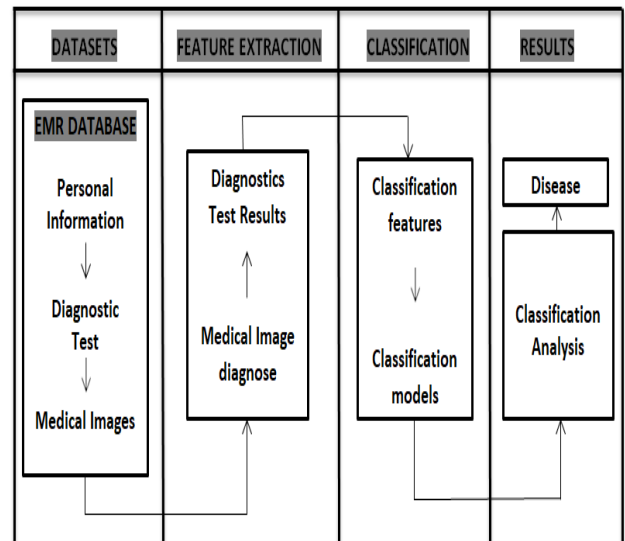
In August 2018, POIS one group proposed a machine learning model for predicting patient mortality in coronary artery disease. This model primarily uses the electronic medical records of the patient that can overcome the shortcoming of the conventional survival models

III. PROPOSED METHODOLOGY

This system is used to predict most diseases. It accepts the structured and image type of data as input to the machine learning model. The end user will use this system. The system will predict the disease based on Blood microscopic images, x-ray, and other biological data. This system uses Machine Learning Technology. For predicting diseases Naïve Bayes algorithm, for clustering CNN algorithm and other deep learning algorithm, the final output will be in the form of labels like Infected for uninfected for which Logistic tree is used.

IV. FLOWCHART

The first step is to collect the dataset which has images of Uninfected and infected blood cells or an infected organ by diagnosing. The next step is to get the data from given uninfected and infected cells or blood images by resizing and training the last layer to extract the data from the given image and preprocessing, again and again, using the CNN model. The step ahead is to plot the graph for both the uninfected and infected cells to get accuracy and loss. The second last step is to classify the plot and evaluate the classifier. The last step is to find the closest match. The flowchart of operation is as shown in the figure below.



V. ALGORITHM

1. Import and Initialize the Libraries.
2. Import the VGG16 library and add a preprocessing layer, get the summary of images.
3. Initiate the images from the training dataset.
4. Train the dataset.
 - a) Resize all the images.
 - b) Flatten the images.
 - c) Create a model and get the summary.
 - d) Create a model using CNN and get the summary by training the last layer again and again.
 - e) Compile the model
 - f) Use the Image data generator to read the images from Datasets.
 - g) Apply the Image data Augmentation, fit the model and run the cell.
 - h) Plot the loss and accuracy.
5. Evaluate the classifier using the test dataset and trained dataset.
6. Select the infected and uninfected images.
7. Represent the feature of images.
8. Find the closest match.
9. Display the string labels of the image.

VI. STIMULATION RESULT

This is the output after the classification of parasitic and uninfected images

```

if(a==1):
    print("Uninfected")
else:
    print("Infected")

```

Infected

VII. CONCLUSION

Considering the above methodology, we can conclude that the newly designed models of image processing and deep learning technologies are highly suitable for accurate detection of diseases. These applications will reduce human efforts as well as human errors. These activities will be performed by automatic machines. Machine learning and deep learning facilitate and assist doctors to diagnose disease accurately. The risk of diseases can be understood faster and can be prevented earlier. We should look for more sophisticated deep learning methods due to the increase in data and the sensitivity of healthcare data. This will help to handle complex healthcare data with greater efficiency. So far deep learning and machine learning based algorithm have provided a positive feedback.

VIII. ADAVANTAGES

1. The disease prediction model has the potential help interested parties such as the government and health insurance companies. It can identify the risk of disease or health conditions of a patient.
2. Tends to give fast results on execution
3. Scalable approach to large datasets.

IX. APPLICATIONS

1. Faster detection using the image than the microscopic test.

2. Low cost.

3. The detection can be made more accurate than another form of detecting disease.

X. REFERENCES

- [1] G.S. Birkhead, M. Klompas, N.R. Shah. Uses of electronic health records for public health surveillance to advance public health Annu. Rev. Public Health, 36 (1) (2015), pp. 345-359,
- [2] S.M. Meystre, G.K. Savova, K.C. Kipper-Schuler, J.F. Hurdle Extracting information from textual documents in the electronic health record Year book Med. Inform., 17 (01) (2008), pp. 128-144
- [3] A. Rajkomar, E. Oren, K. Chen, A.M. Dai, N. Hajaj, M. Hardt, P.J. Liu, X. Liu, Scalable and accurate deep learning with electronic health records Med., 1 (1) (2018), p. 18, [10.1038/s41746-018-0029-1](https://doi.org/10.1038/s41746-018-0029-1)
- [4] Yu Cheng, Fei Wang, Ping Zhang, and JianyingHu.2016. Risk Prediction with Electronic Health Records: A Deep Learning Approach. In Proceedings of the 2016 SIAM International Conference on Data Mining (SDM'16). 432–440.
- [5] Kyunghyun Cho, Bart Van Merriënboer, Dzmitry Bahdanau, and Yoshua Bengio. 2014. On ArXiv preprint arXiv: 1409.1259 (2014).
- [6] Edward Choi, Mohammad Taha Bahadori, Elizabeth Searles, Catherine Coffey, Michael Thompson, James Bost, (KDD'16). 1495–1504
- [7] Masumi Shah, Khushbu Kawale, Divyansh Shah, Rahul Mapari, Santosh Randive. “Beneficial to humankind Malaria Parasite Detection Using Deep Learning”: International Conference on Intelligent Computing and Control Systems (ICICCS), 2020

Fire Extinguisher Robot

Dhananjay
More¹, Saurabh Shikhare²,
Shravani Balki³, Prof. Kishor
Wane⁴

Student, Department of Electronics and telecommunication
Engineering, Pccet's
Pimpri Chinchwad College Of Engineering And Research
College Ravet, Pune1,2,3,4

I. INTRODUCTION

A wide range of firefighting robots are being developed using regular microcontrollers. However, these are only for prototypes and subject to change. There are many reasons for this, several of which include the high cost, lack of efficacy, due to hard to spot fires, etc. The project includes solving the above difficulties and creating a prototype which would be nearly equivalent to function in real time. The project consists of two parts: one is to transfer the robot in the Bluetooth module. The second section includes identification and the transmitting of water signals from sensors to microcontrollers, from microcontrollers to motor drivers, and the transmission of signals from microcontrollers to sprinklers.

A Firefighting robot is an independent land vehicle with the abilities to sense the presence of fire and to extinguish the emerging fire. An automatic fire extinguisher system with built-in sensors and protection to optimize fire-fighting effectiveness. The proper use of the robot would ensure that firefighting and recovery drills are being carried out without risking firefighters lives by using robotics technology as an alternative choice of person. A fire extinguisher robot design and implementation are presented which use three types of fire sensors such as a flame sensor, smoke sensor, and temperature sensor, to improve fire detection reliability. Multiple control systems control the robot so it can extinguish the fire more effectively.

II. Literature Survey

1.Low Cost Bluetooth Controlled Fire Extinguisher Robot Using Light Intensity Sensor

ABSTRACT The study will build a low-cost firefighting robot that uses Bluetooth remote control technology. The HC-05 Bluetooth module is used to start the operation. The robotic vehicle is packed with water dispensers and shower heads, and a wireless network to fuel them. Using the Bluetooth push program instructions, the transmitting end passes direction-based commands to the receiving end to decide where the robot can go. At the receiving end, three engines are connected to a microcontroller which drives two of them. One of them is used to drive the vehicle, and the other is used to sprinkle water onto the burners during service. A water tank is mounted on a robot chassis, and the robot's operation is detected by a Light Intensity (LI) sensor or MQ-3 smoke detector. The microcontroller found inside the ATMEGA328 series operates the cash dispenser. The L293D IC engine driver and the computer that controls the engines are merged into one unit.

The robot is to be built using Bluetooth technology. The HC-05 is used for this. A water vehicle is loaded with water and works via wireless communication. A smartphone is used to send commands to the receiver to power the robot. A engine and a water sprinkler are part of a three motor vehicle. A water tank is mounted on the robot body and its water pumping operation is sensed by a photodiode fire detection sensor. The microcontroller is powered by an ATMEGA328. An L293D drives the engines.

2. Fire Fighting Robot

Fire injuries are very frequent and often become impossible for firemen to save someone's life. It is not necessary to designate a human to watch constantly for accidental fire where the robot will do so. In such situations, however, firefighting robot comes in a frame. Robot can remotely sense a burn. This robots are particularly effective in industries where there is more risk of accidental combustion. The planned vehicle is capable of sensing and extinguishing fire presence automatically by means of a gas sensor and a temperature sensor. It requires gear motors and a motor driver to control the movement of a robot. The relay circuit is used to monitor the pump and when a fire is detected, it interacts with the microcontroller (Arduino UNO R3) through the Bluetooth module. The proposed robot is fitted with a water jet spray capable of sprinkling water. The sprinkler should be pushed in the appropriate direction. At the moment of going towards the source of fire, it may happen that certain obstacles will be met, and so there is an obstacle avoiding the capacity. It will have an Interface for arduino android service. Detects obstacles using ultrasonic sensors up to

80 m. Communication between the cell phone and the robot will take place via Bluetooth, which will have a GUI to monitor the movement of the robot. As mobile is attached to Bluetooth, first set the name of the module, baud rate. Bluetooth connectivity between smartphones and microcontrollers can be introduced. Android-controlled robotics can be conveniently used in daily life, such as in households, businesses, corporations, etc. Creation of Android applications in Android SDK Simple and cost-free.

3. Fire Fighting Robot Remotely Controlled By Android Application

If the fire is viewed at an early point, an immense amount of damage will be prevented. If the fire is noticed right in time, significant deprivation and absence of essential properties will be prevented. Because of their various change capabilities, the robotics industry has earned attention. A weighing unit and a fire extinguisher are part of the robot. Infrared (heat) sensors calculate the necessary distance and heat and make the extinguisher behave according to the atmosphere it perceives. In order to monitor the movement of the robot, we used a virtual Android app. And we use the Bluetooth module to connect with the controller and Android. The controller can be attached via the UART protocol to the Bluetooth module. Commands sent from the Android app provide commands for the robot's primary & secondary behavior.

4. Multiple Sensors Based Fire Extinguisher Robot Based on DTMF, Bluetooth and GSM Technology with Multiple Mode of Operation

In this study, a multi-sensor based fire extinguisher robot is built with knowledge about construction and function included in the research. The fire extinguisher robot can be created using various technologies such as DTMF, Bluetooth, GSM and GPS technology. The use of three separate flame sensors, temperature sensors, and smoke sensors assures utmost fire safety. The robot can be controlled by both a DTMF radio control system

and a phone app and can be programmed to function in three distinct modes. The first mode, which can be triggered by the customer or the robot, lets the robot travel in full autonomy. The second mode is an auto-follow mode where the robot follows a black line drawn on the ground to sense fire, and the third mode is a manual mode where the robot is controlled and operated remotely.

5. A Novel Fire Extinguishing Robotic Vehicle Controlled by Android Application

The project exists to build a mobile robot that can be serviced remotely, controlled by Android. The robotic vehicle is fitted with a firefighting device that includes a water dispenser and an extinguishing system. The ATmega-32 is used for the desired purpose. Remote service is provided by an Android-based Interface that is controlled from a smartphone or tablet. Touch Display Facility The framework is built using X-Machine, and Java elaborates on the framework's features. The android transmitter is used as a remote control and has a wide variety of benefits. It can be used to perform a wide range of jobs.

III. Block Diagram

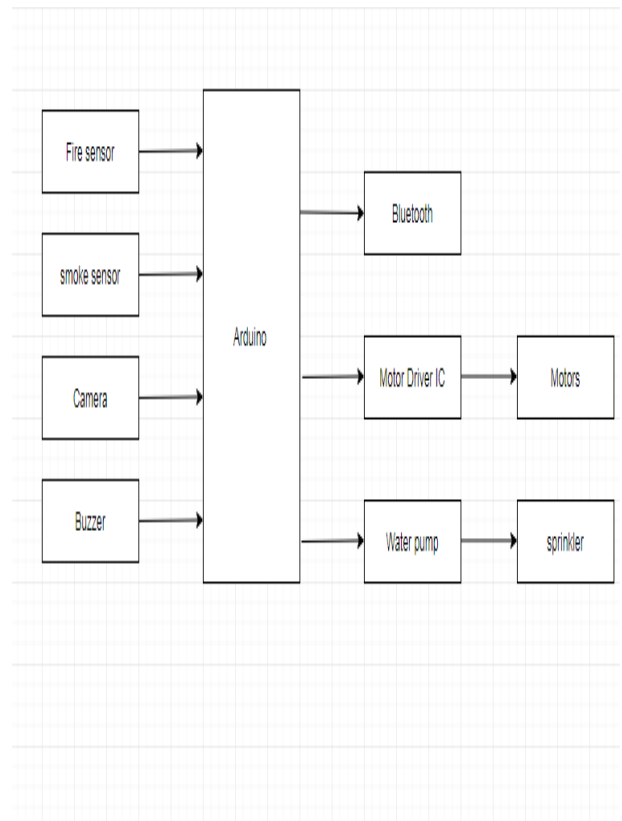


Figure No. 1 Block Diagram of project

IV. BLOCK DIAGRAM EXPLANATION

A wide range of firefighting robots are being designed using regular microcontrollers. These are for prototypes only, though, and are subject to change. There are many reasons for this, several of which are: high costs, lack of performance, complicated design, lack of fire detection (which will be further discussed in the paper), etc. The project includes solving the above problems

and creating a prototype that will be almost equivalent to working in real time.

The project consists of several parts, one part of which is the Bluetooth module controller and the other components are present. Identification and transmission of water signals from sensors to microcontrollers, from microcontrollers to motor controllers and transmission of signals from microcontrollers to sprinklers is part of the second segment. The project focuses mainly on the cost, so that the first step in moving the vehicle is carried out using Bluetooth. Based on the prototype, we would use a real-time Bluetooth range booster that is cost-effective and highly compliant with device signals or some other IR signals or RF signal control. In order to maintain successful communication, which is very necessary for this programme, it must be in line of sight by way of IR signaling, when it is carried out in emergency situations, or it can lead to the loss of human life and financial loss. We can then presume that the use of the Bluetooth module is right, taking all of these into consideration. Using any of the tablets, an android phone is used here, and the availability of Bluetooth enabling software gives you an additional benefit. The strength should be achieved. Here, we used the IOP-specific Bluetooth program for prototype purposes.

Fire detection and how it is achieved and the possible types of detectors that it uses are discussed in the second section. Blaze Detector 2. Smoke Detector 2. Heat Detector 3. Strength meter for lighting. The light intensity detector is used in the project, taking into account all aspects, including low cost, fast sampling time and automated detection. For eg, smoke detectors appear to work well only if the smoke flow is perpendicular to the detector. There are disadvantages involved with any form of detector. While there are many pitfalls involved with the use of these types of detection techniques, temperature detection is the best possible. The Light Intensity Detector is the most applicable solution to the cost factor. The fire alarm just requires the sight line to function. To start the generator, the sensed pulses are sent to the microcontroller, which then processes the signals and switches to the IC driver. This mechanism will appear

before the detector can see a line of fire range.

V. METHODOLOGY

The project is intended to develop an Android-based framework for firefighting robots. The fireman will configure the robot to execute orders via wireless messaging. Smart phones employ Bluetooth which allows firefighters to communicate. There are two fire alarms mounted in the smoke alarm. Light and heat are detected, and smoke is weighed by another. When a fire warning system goes off, the fire can not be extinguished. When the sprinkler is seen, the flow of water begins. The android software enables the microcontroller to transmit instructions to the Android, and the connection between the Android and the microcontroller consists of two engines.

VI. Conclusion

This project can be further extended by incorporating a range of other devices, such as a gas sensor, which can alert the existence of gas leakage as a warning to the mobile phone to avoid a fire accident. This initiative can be seen as a disaster prevention and clearing project by applying it in such a way. Therefore, by noting the use as follows, we should conclude this document: this project should be used as an emergency kit, where there is no need to wait for the fire department to arrive, or a specialist to start using fire extinguishers to clear the fire. While the cost of adopting this program is also significantly smaller, it can be used in all offices, households and public areas. This project, which involves both detection and monitoring, is very cost-effective relative to modern fire alarms, such as smoke detectors, fire detectors, gas leak detectors, etc., and extinguishing systems, and is very easy to work compared to the original appliances.

References:

- [12] G"obel, S., Jubeh, R., Raesch, S. L., and Z"undorf A., "Using the Android Platform to control Robots", Kassel University Germany..
- [13] H. Amano, —Present status and problems of fire fighting robots, || IEEE Proceedings of the 41st SICE Annual Conference, Vol. 2, Aug. 2002, pp. 880-885.
- [14] T. L. Chien, H. Guo, K.L. Su and S.V. Shiau, — Develop a Multiple Interface Based Fire Fighting

- Robot, || IEEE International Conference on Mechatronics, May 2007, pp. 1-6.
- [15] Proceedings of the World Congress on Engineering 2015 Vol I WCE 2015, July 1 - 3, 2015, London, U.K., Development of A GSM - Based Fire Detector System Oke A.O, Falohun A.S and Adetunji A.B
- [16] Fire Equipment Manufacturers' Association - <http://www.femalifesafety.org/types-of-extinguishers.html> Journal Of Electrical and Electronics Engineering
- <http://www.canadianfire.ca/en/home/safety-security/fire-extinguishers.html>
- [17] MFS Fire Extinguishers - <http://www.mfs-fire-extinguishers.co.uk/types.htm>
- [18] Alldatasheet - <http://www.alldatasheet.com>
- [19] HOWSTUFFWORKS - www.howstuffworks.com
- [20] TawfiqurRakib, M. A. Rashid Sarkar, "Design and fabrication of an autonomous firefighting robot with multi sensor fire detection using PID controller", ICIEV Volumn 23 issue-1 JUNE 2016

Solar Grass Cutting Robot

Yash Adhao¹, Hrushikesh Sawale², Aishwarya Zope³, Prof. Dipali Dhake⁴

Student, Department of Electronics and telecommunication Engineering, PCET's Pimpri Chinchwad College Of Engineering And Research College Ravet, Pune 1,2,3,4

ABSTRACT Nowadays grass cutter machines are becoming very popular today. Pollution is manmade, which we can be seen in our daily life. In old model of grass cutter IC engine was used and hence because of its environmental impact pollution level rises IC engine driven cutter is more costly. Maintenance of such conventional machine is more. To avoid these drawbacks

I. INTRODUCTION

The purpose is to avoid energy crisis in India and reduces the human efforts, operating cost and maintenance cost. Also solar based grass cutter keeps the environment clean and healthy. It is used for cutting different types of grasses for various applications. The whole machine operates on the solar energy stored in battery. The Ultrasonic sensor and moisture sensor is used for the obstacle and moisture detection to avoid any damage of the human, object and animal. The sun has been the primary source of energy for human lifestyles since the beginning of time. Solar energy was immediately put to use for things like drying clothing, curing agricultural produce, and preserving meals, among other things. Even today, we derive our strength from fuels such as wood, petroleum, paraffin, hydroelectricity, and even our food, which is derived obliquely from the sun. Solar power is nearly limitless. The total amount of electricity we get from the sun far outweighs our needs. Humans have relied on fuels, electricity, and wind power since the industrial revolutions. Many countries are researching and testing solar and wind energy for human growth, so we created our new concept sun powered grass cutting machine, in which we cut grass at agricultural products or on small plants in lawns and gardens. The fully automated solar grass cutter is a fully automatic grass cutting robotic automobile powered by solar energy that avoids obstacles by using ultrasonic sensors and is capable of automatic grass cutting without the need for human intervention.

we plan to build new type of grass cutter which runs on solar energy and this model is also economical.

The project aims at fabricating a grass cutting machine system which makes the grass cutter motor running through solar energy. The “Solar Powered Grass Cutting Machine” is a robotic vehicle powered by solar energy that also avoids obstacles and checks the moisture of soil. The system uses 12V battery to power the vehicle movement motors as well as the grass cutter motor. A solar panel is used to charge the battery so that there is no need of charging it externally. The grass cutter and vehicle motors are interfaced to microcontroller that controls the working of all the motors. It is also interfaced to an ultrasonic sensor for obstacle detection. The microcontroller moves the vehicle motors in forward direction in case no obstacle is detected and there is moisture less than 50%. On obstacle detection the ultrasonic sensor monitors it and the microcontroller thus stops the grass cutter motor to avoid any damage to the object/human/animal whatever it is and it also provides an alarm. Microcontroller then turns the vehicle as long as it gets clear of the object and then moves the grass cutter in forward direction again.

II. Literature Survey

Nowadays grass cutter machines are becoming very popular today. Pollution is manmade, which we can be seen in our daily life. The aim of our project is to make the grass cutter which operates on solar energy hence save the electricity and reduces manpower. Some of the papers from peer reviewed journal are studied. The conclusions and key points from those papers are described below.

From the paper “*SOLAR BASED GRASS CUTTER*” which was published in “2nd International Conference on Latest Trends in Engineering, Science and management, New Delhi, 2017.” This paper describes the design and automatic lawn mower which operates on solar energy and avoids the drawback of old lawn mowers. The purpose is to avoid energy crisis in India and reduces the human efforts, operating cost and maintenance cost. Also solar based grass cutter keeps the environment clean and healthy. It is used for cutting different types of grasses for various applications. The whole machine operates on the solar energy stored in battery. The IR sensor is used for the obstacle detection to avoid any damage of the human, object and animal. Also we are using relay to control the motor connected to blades as a switch. The prototype is charged from sun by using solar panel.

From the paper “Solar Powered Fully Automated Grass Cutting Machine” which was published in “International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, April-2017” In this paper, the project aims at fabricating a grass cutting machine system which makes the grass cutter motor running through solar energy. The “Solar Powered Grass Cutting Machine” is a robotic vehicle powered by solar energy that also avoids obstacles and is capable of automated grass cutting. The system uses 12V battery to power the vehicle movement motors as well as the grass cutter motor. The grass cutter and vehicle motors are interfaced to microcontroller that controls the working of all the motors. It is also interfaced to an ultrasonic sensor for obstacle detection. The microcontroller moves the vehicle motors in

forward direction in case no obstacle is detected. On obstacle detection the ultrasonic sensor monitors it and the microcontroller thus stops the grass cutter motor to avoid any damage to the object/human/animal whatever it is and it also provides an alarm. Microcontroller then turns the vehicle as long as it gets clear of the object and then moves the grass cutter in forward direction again otherwise it changes the direction.

From the paper “A Fully Automated Lawn Cutter using Solar Panel” the objective of this paper is to design and automatic lawn mower which operates on solar energy and avoids the drawback of old lawn mowers. The main objective is to reduce human efforts by using fully automatic lawn cutter. The project is powered by solar energy hence the consumption of fossil fuel is reduced. The other objective is that the automatic lawn cutter has to differentiate between grass and concrete while monitoring its surroundings continuously. The combination of moisture sensor and pump motor is used in order to monitor the soil moisture. Vacuum will be used to collect the grass residue.

III. Block Diagram

In this project we are fabricating a prototype of the solar powered grass cutter. The methodologies of these attachments are explained in few subheadings.

The Block Diagram of Solar power Grass Cutter is as shown:

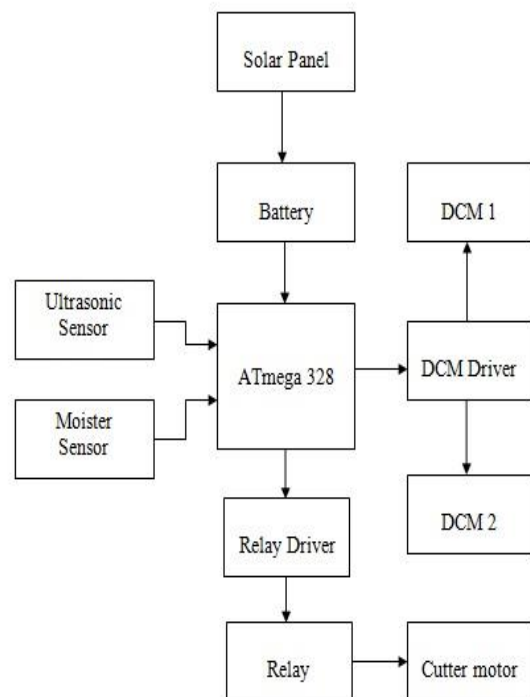


Figure No. 1 Block Diagram of project

IV. WORKING

Coming to the working of solar powered grass cutter, automated solar grass cutter is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles and is capable of fully automated grass cutting, without the need of any human interaction. It has panels mounted in a particular arrangement in such a way that it can receive solar radiation with high intensity easily from the sun. These solar panels convert solar energy into electrical energy. Now this electrical energy is stored in batteries by using a solar charger. The motor is connected to the Microcontroller through connecting wires. Between these a two motor and microcontroller driver is provided. It starts and stops the working of the motor. From this motor, the power transmits to the mechanism and this makes the blade to rotate with high speed and this makes to cut the grass.

The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor. The Blade is kept at the Angle of 180 Deg for flexible operation. We also use a solar panel to charge the battery so that there is no need of charging it externally. The grass cutter and vehicle motors are interfaced to

ATmega328 microcontroller that controls the working of all the motors. The microcontroller moves the vehicle motors in forward direction in case no obstacle is detected. Ultrasonic sensor monitors the obstacle, if obstacle is within a range of 50cm the microcontroller thus stops vehicle and stop grass cutting. It also detects the moisture of soil, if moisture is greater than 50% then microcontroller stops the operation of robot to avoid any damage to the object/human/animal. Microcontroller then turns the vehicle until it gets clear of the object and then moves the grass cutter in forward direction again.

1 SOLAR POWER

In this system our mower is powered by electric energy. The energy required to run our autonomous rover is obtained from the sun which is harnessed using photovoltaic cell. As we know solar power is not continuous in nature and not available throughout the day. The energy obtained from the sun is stored in the battery pack which is mounted on rover. The solar panel used here is to be placed in the direct sunlight for the greater efficiency. A power supply unit dissipates power to various units as per the requirements.

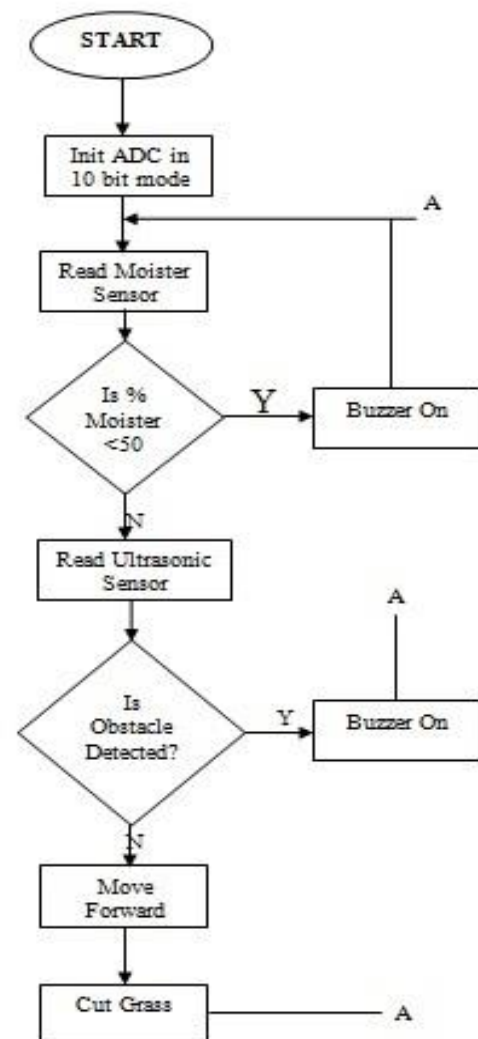
2 Sensing system

In this system input from various sensors is taken. Robotic lawn mowers who have collision sensors detect the edge of perimeters using sensors or a boundary wire. The latter is placed around the edge of the lawn, as well as any obstacles, to instruct the lawn mower to remain within that area. So if they hit something, the robotic lawn mower would turn around and go in a different direction. Input from Humidity is also taken in case of too much moisture content in lawn mowing will be stopped, which will prevent damage to system.

3. Rover:

It's a simple 3 wheel platform. On this the cutter blade which is the working element of the lawn mower, motors, solar panel, sensors, power supply unit will be mounted.

V. Flow Chart



VI. PROPOSED WORK

1. Automated solar grass cutter is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles and is capable of fully automated grass cutting, without the need of any human interaction.
2. The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor.
3. The Blade is kept at the Angle of 180 Deg for flexible operation.
4. We also use a solar panel to charge the battery so that there is no need of charging it externally.
5. The grass cutter and vehicle motors are interfaced to an ATmega 328 microcontroller that controls the working of all the motors.
6. The microcontroller moves the vehicle motors in forward direction in case no obstacle is detected. On

obstacle detection, ultrasonic sensor monitors it and the microcontroller thus stops within 3sec to avoid any damage to the object/human/animal.

7. Assembling is easy.

VII. Result

The following results have made from this project:

The set of motors are used for the movement of the grass cutter. An ultrasonic sensor avoids obstacles and provides safety to the cutter. An moisture sensor observe the moisture of soil to reduce the damage of robot. Solar panel takes the energy from sun and charge the battery which is connected to the grass cutter machine.

VIII. Conclusion

In the world today, all machines are designed with the aim of reducing or eliminating green house gas emissions which is the major causes of climate change. This solar powered grass cutter will meet the challenge of environmental production and low cost of operation since there is no cost for fuelling. A solar powered lawn mower has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used. The machine's capacity is adequate for its purpose. The machine has proved to be a possible replacement for the gasoline powered grass cutter. In the presented paper provides the fabricated information about the "Fabrication of Solar grass Cutting Machine" which was designed such that the solar plate generates solar energy and utilizing this energy for

running the grass cutter motor. Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

References:

- [1]. Ms. YadavRutuja A., Ms. ChavanNayana V., Ms. Patil Monika B., Mr. V. A. Mane," AUTOMATED SOLAR GRASS CUTTER" February 2017 IJSDR Volume 2, Issue 2
- [2]. Vicky Jain, Sagar Patil, Prashant Bagane, Prof. Mrs. S.S. Patil, "Solar Based Wireless Grass Cutter'', International Jour nal of Science, Technology and Engineering, Vol.2, 2016, 23 49-784X.
- [3]. Sultan Mohyuddin, Digesh K D, Vivek T K, Nazeya Khanam F and Vidyashree H V, "Automatic Grass Cutter", International Journal of Science, Technology and Engineering, Vol.2,2017,2349-784X.
- [4]. Praful P. Ulhe, Manish D. Inwate, Fried D. Wankhede and Krushankumar S. Dhakle, "Modification of Solar Grass Cutting Machine", International Journal for Innovative Research in Science and Technology, Vol.2,2018,2349-6010.

Mechanical Engineering

Experimental analysis on extrusion of primer composition for ignition.

Jayashri Chopade¹, Ankur Yadav², Ganesh Nagnurwar³, and Abhishek Singh.⁴

¹Pimpri Chinchwad college of engineering and research , Pune, India

² Pimpri Chinchwad college of engineering and research , Pune , India

³ Pimpri Chinchwad college of engineering and research , Pune , India

⁴. Pimpri Chinchwad college of engineering and research , Pune , India

ABSTRACT

Common igniters such as black Powder, Gun powder, and boron potassium nitrate (BKNO₃) are routinely employed in all calibers of gun systems. Armament Research Development Engineering Center (ARDEC) has pursued efforts to improve the ignition of propellants which has been demonstrated to be the root cause of many tribulations for propulsion systems. This led to the development of several extrudable nitrocellulose-BKNO₃ based igniter materials that are more energetic, and exhibit smaller ignition delay times than most traditional igniters. Demonstration is done via static firing. High speed video during static CV testing has demonstrated significantly more consistent, intense, and rapid flame generation in comparison to BKNO₃ pellets and other granular formulations leading to improved ignition effectiveness of the propellant bed. The method of extrusion was involved using single or twin screw extruder for the purpose of development of strands.

I. INTRODUCTION

The ignition of the propellant bed in large caliber systems has been determined to be critical for proper

performance.¹ Inadequate ignition can lead to hangfires, misfires, loss of accuracy, and catastrophic failure of the gun system. A large majority of these problems arise due to negative differential pressure waves occurring between the two ends of the chamber in the gun and can be traced back to improper ignition.²

Firing begins by the initiation of a small bit of primer material that is either impact or electrically sensitive. The release of the primer energy then ignites the igniter material usually situated inside a perforated metal tube in the center of the propellant bed. Ignition of the propellant bed occurs via two mechanisms. Firstly, the condensed phase material generated from the combustion of the igniter makes direct contact with the propellant bed and transfers its heat via conduction. In a complimentary process, the hot gases generated by the combustion of the igniter material travel across the propellant bed and transfer their heat to the propellant via convection.³ This is a slower process than conduction, but doesn't seem to develop pressure differentials as readily. Attempts to isolate the actions of the condensed and gas phases on ignition were demonstrated to be inconclusive since a dynamic equilibrium exists between molecules in the gas phase and condensed phase, which allows the two phases to constantly interconvert.⁴ The importance of the condensed and gas phases of the igniter combustion products has always been controversial,⁴ but the current belief is that the condensed phase plays a more critical role in ignition of the propellant bed than does the gas phase.

Traditional ignition materials include black powder and benite, with benite being a roughly 1:1 mixture of black powder and nitrocellulose. Boron potassium nitrate (BKNO₃) has been used in rocket fuels for some time and is very similar to aluminum in its combustion characteristics owing to both aluminum and boron containing an outer oxide layer. This boron

Oxide layer (B_2O_3) is thought to have a higher evaporation temperature than elemental boron. Therefore, during the combustion process, elemental boron is burning inside its oxide shell.⁵ Once the oxide shell is evaporated, the rest of the boron can begin combustion with the fuel.⁶ However, if there are hydrogen containing gases present during this second combustion stage, the notorious HOBOS species form and prevent the boron from releasing all of its energy.

In this effort, high performance igniters were formulated and examined in a static test fixture or CV firing and compared to Benite and other traditional compositions

developed by using pelleting method and compression techniques using die and punch, in terms of pressure and

flame generation. Formulations consisted of mixing varied amounts of boron, potassium nitrate, and nitrocellulose.

II. TWIN SCREW EXTRUDER

Twin screw extrusion machines or, twin screw extruders, are the simplest example of multi-screw machines (Figure 1.). The two screws may rotate in the same direction (co-rotation) or they may rotate in opposite directions (counter or, contra-rotation). The flights of the screws may intermesh or they may not intermesh. As intermeshing, or partially intermeshing, types of machines are the most popular the discussion which follows is restricted to this type of machine.

Uses of Twin-Screw Extruders Twin-screw machines have always been popular for certain processes, for example, where there is a need for a compounding step as well as an extrusion step. This is particularly true for unplasticized polyvinyl chloride (UPVC). This material is often stabilized against heat degradation by the use of heavy metal compounds (like organic tins, or lead) and such stabilizers are expensive

Thus, for economic reasons, the amount of these heat stabilizers must be kept as low as possible. One way of doing this is to compound and extrude in one step. This saves a further heating stage (if the material is first compounded, cooled and then re-extruded). Twin screw machines are widely used to make UPVC pipe and profiles. Today they are often used to compound other plastics, or

resins, with additives to make compounds for use in other extrusion or injection molding operations.

The co-rotating twin screw extrusion process is widely employed in chemical industries for the processing of complex fluids including various polymers, suspensions, emulsions and gels. Here we propose a new integrated modeling strategy that is based on the numerical analysis of pressure-generating extrusion elements concomitantly with the pressure-losing extrusion elements of the co-rotating twin screw extrusion process for non-Newtonian fluids under non isothermal conditions.

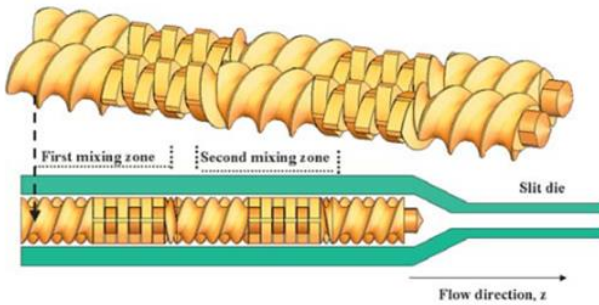


Fig: Typical screw configuration and screw and die configuration

The numerical analysis undertakes three-dimensional (3-D) finite element simulations of any multiple combinations of forwarding and reversing fully lighted screw elements with other types of elements including kneading discs staggered in the forward or reverse configurations and the die.

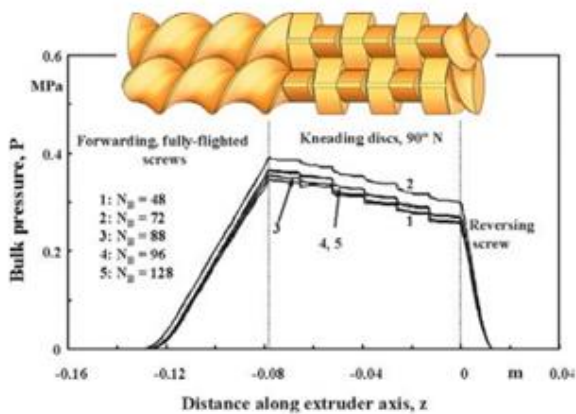


Fig: bulk pressure vs. distance along extruder axis

The abilities of the methodologies in simulating the coupled flow and heat transfer in industrially-relevant mixing sections or pressurization/die shaping are demonstrated with predictions of the degree of fill and typical velocity, deformation rate, stress magnitude, pressure distributions as functions of various operating parameters and basic twin screw extrusion geometries for a viscoplastic type generalized Newtonian fluid.

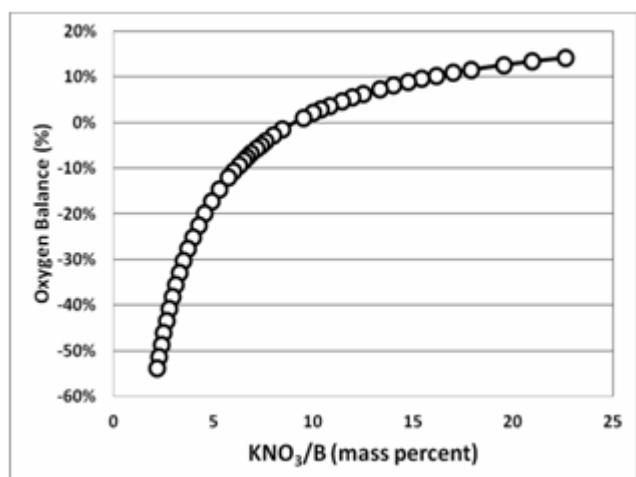


Fig: Calculated oxygen balance and flame temperature as a function of oxidizer: fuel ratio.

III. EXPERIMENTAL FIRING

A static test fire fixture was designed and built to examine igniter performance. In this fixture, two pressure probes are aligned with the perforations in the igniter tube at the forward and aft ends. This provides pressure readings at two distinct points along the igniter tube and allows us to identify the potential for the formation of pressure differentials that would then be magnified in the propellant bed, leading to poor ignition. Once the igniter is initiated, two pressure-time traces are generated, one for each pressure gauge. From this output, the times to maximum pressure (P_{max}) and 10% of P_{max} were measured. All data was obtained from a minimum of five separate shots of each igniter type in the same strand configuration. No igniter tubes were reused for multiple shots. The formulations described below as HPI 11-10-1, HPI 11-10-2, and HPI 11-14-1, had B:KNO₃ ratios of 10:1, 10:1, and 9:1 by weight, respectively.

IV. MODELLING STUDIES

To improve upon the efficiency and performance of BKNO₃ igniters, we first examined the combustion of a standard Type IV BKNO₃ igniter⁷ using Cheetah 5.0 for thermodynamic properties determination. Type IV BKNO₃ had an Oxygen Balance of -33% indicating that it is extremely fuel rich. Because of the severity of this oxygen imbalance, a study was performed on the combustion of BKNO₃ igniters with various boron: potassium nitrate ratios. As demonstrated in Figure on the left side, as the oxidizer (KNO₃): fuel (boron) ratio is increased, there is a non-linear increase in oxygen balance (OB) which should improve the combustion

characteristics. When the flame temperature produced by the igniters was examined as a function of oxidizer: fuel ratio, an interesting result was obtained. Two peak

temperatures are achievable depending on the oxidizer: fuel ratio. Beyond this second peak, the flame temperature drops significantly. Since a hotter flame temperature is predicted to have better ignition effectiveness, formulations with negative oxygen balances and low KNO₃: B ratios were prepared.

By utilizing the thermodynamic studies as a guide, formulations were generated that contained varying amounts of BKNO₃ (at different B:KNO₃ ratios), along with nitrocellulose (NC). The addition of NC allowed for

straightforward processing and extrusion of the igniters into a variety of desired shapes. However, the BKNO₃ and NC mixtures were determined to be

Unstable just by themselves, but this was resolved.⁸ In the following sections only the best three formulations, HPI 11-10-1, HPI 11-10-2,

When the data for the static fire shots was tabulated and analyzed, certain trends became evident. As shown in Figure 2, the magnitude of P_{max} was comparable between Benite and the three BKNO₃ analogues. The standard deviation of the magnitude of P_{max} (ΔP_{max}) was also the same between all samples. As an estimate of how quickly the formulations ignited, we chose to measure the time it took to reach 10% of P_{max} (t_2). The three BKNO₃ analogues had slightly shorter t_2 times than Benite, and their standard deviations (Δt_2) were extremely small in comparison. This clearly demonstrated that the BKNO₃ analogues began the ignition process more

consistently and more rapidly than Benite. When the time interval from trigger pull to P_{max} (t_5) was examined, it became evident that the three BKNO₃ analogue igniters were about ~30% faster than Benite, and once again significantly more consistent.

Another time interval we examined was the interval between P_{max} and 10% of P_{max} , and is designated as t_6 . This is a measure of how quickly the igniter releases its energy into the propellant bed, and relates to ignition effectiveness. The values of t_6 for the three BKNO₃ analogues were half of Benite's.

This indicated that the igniters released their energy twice as fast as conventional igniters.

To compliment the pressure readings along the igniter tube and ascertain the flame generating effectiveness, high

speed video was also employed during the igniter static fire testing.

A surprising result was attained during the baseline establishment using Benite at ambient temperature. As shown in Figure below by the dark boxes, early on in the ignition event of Benite, flames were absent from several ports towards the aft end that should have already ignited. This would cause an uneven ignition of the propellant bed which certainly would lead to the formation of negative pressure differentials in the gun system. This condition was exacerbated under cold conditions, and alleviated under hot conditions

To examine the effects of the forward portion of the igniter tube igniting the propellant bed before the aft portion, we performed a Frazier Nash GUN (FNGUN) modeling study.

FNGUN is a one dimensional ballistics code that allows the determination of pressure time traces and permits the inputting of flame spreading velocity. Using a 120mm model we had generated previously for tank ammunition, we examined the ignition effects when the flame spreading was uniform and instantaneous from the igniter tube as shown Fig.No negative pressure differentials are generated in this case. For the staged ignition study, we selected a point halfway up the igniter tube from which the flame spreading velocity was four times greater than at the aft end to mimic what we saw in the high speed video. A simulation was performed where a propellant bed was thus ignited and is presented in Figure B. Severe negative

pressure differentials were generated, and were well beyond the acceptable limits for a gun system. This finding further confirmed the critical role that ignition plays in large caliber gun system performance.

V. STATIC TEST ANALYSIS

In Figure below, a better view of the flame spreading is observed for the BKNO₃ analogue HPI 11-10-1. After ignition the vents burst sequentially from the aft end towards the tip very rapidly. At 1.3 milliseconds a significant amount of flame is generated. At 4.7 milliseconds, condensed phase particles are seen flying out of the flame front and this continues for 2 milliseconds. This intensity of particle generation was not observed in Benite. The BKNO₃ analogues seem to generate more flame and do it more rapidly and consistently than the Benite and other conventional igniters.

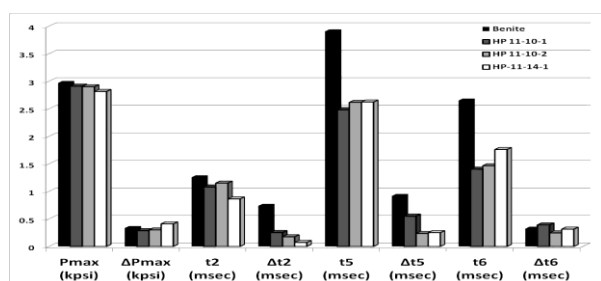


Fig: Figure. Comparison of P_{max} , t_2 , t_5 , and t_6 for Benite and the BKNO₃ based igniters

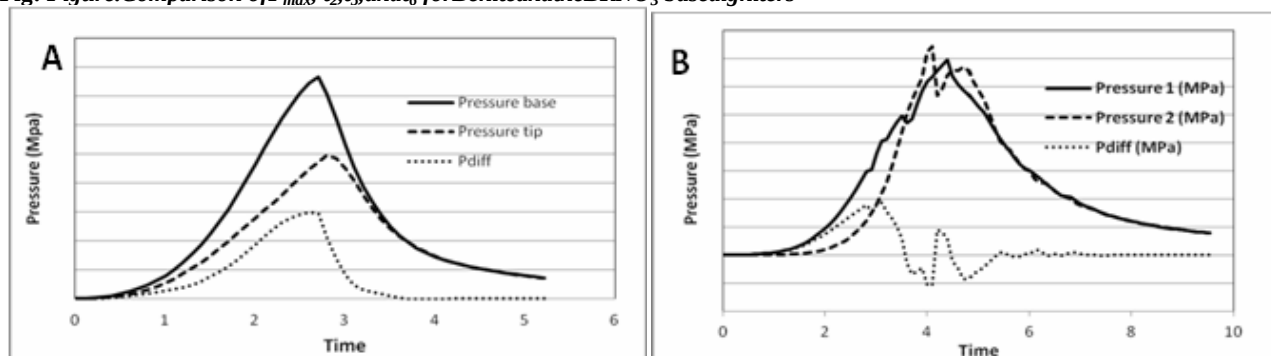


FIGURE .MODELING OF THE INTERIOR BALLISTIC EFFECTS OF UNEVEN IGNITION ON THE PROPELLANT BED. A.) FNGUN SIMULATION OF SIMULTANEOUS PROPELLANT BED IGNITION. B.) FNGUN SIMULATION OF STAGED PROPELLANT BED IGNITION.

VI. CONCLUSION

By employing the lessons learned from the modeling of BKNO₃ analogues in CheetaH 5.0, igniter formulations were produced that exhibited significantly improved

performance relative to Benite. Benite was found to have significant shot to shot variability in terms of pressure and time, except at hot temperatures. High speed video of these ignition events indicated that early in the ignition process, often times the forward end of the igniter tube would have more flame jet output than the aft end. This would lead to undesirable combustion of the propellant bed beginning in the middle of the cartridge, and definitely lead to the generation of pressure waves. Extrudable BKNO₃ analogue igniters were also examined on the igniter static test fixture. They were able to achieve P_{max} faster than Benite with less variance in ignition delays and output pressures than Benite, thus demonstrating that the analogue igniters are more consistent. High speed video of the ignition events also demonstrated more hot particle and

flame generation in the BKNO₃ analogue igniters in comparison to Benite. The BKNO₃-NC based igniters appear to provide a much more consistent and powerful ignition event.

ACKNOWLEDGEMENTS

We are truly in debt of our project guide Prof. JV Chopade for her guidance throughout the course of this work. It has been an altogether different experience to work with him and we would like to thank him for his help, suggestions and numerous discussions. We are gladly taking this opportunity to thank Head of Mechanical Engineering Prof. Dr. S. H. Mankar and Prof. G. M. Fodase project Coordinator for their valuable guidance and providing facility during progress of seminar. We are heartily thankful to Prof. Dr. Harish U. Tiwari (Principal, Pimpri Chinchwad College of Engineering & Research, Ravet) for providing a research environment; also for his kind inspiration. Last but not least we are also thankful to all those who help directly or indirectly to develop this Review paper.

REFERENCES

- [1] A.M. Varney, in Gun Propulsion Technology, edited by L. Stiefel, (American Institute of Aeronautics and Astronautics, Inc., Washington DC, 1988), p.1.
- [2] L.-M. Chang, Technical Report BRL-TR-2638, US Army Ballistic Research Laboratory, USA, 1987.
- [3] R.A. Fifer; S.A. Uebman; P.J. Duff; K.O. Fickle; M.A. Schroeder. Proceedings of the 22nd JANNAF Combustion Meeting, CPIA Publication 432. Vol. II, October, 1985.
- [4] J.T. Barnes, and E.B. Fisher, "Identification Of Ignition Criteria For Low Vulnerability Propellants", 1991, AD-B162 252.
- [5] a.) A. Macek, and J.M. Semple, Combust. Sci. Technol. 1, 181 (1969), b.) A. Macek, and J.M. Semple, Proc. Combust. Inst. 13, 859 (1971) c.) A. Macek, Proc. Combust. Inst. 14, 1401 (1972).
- [6] C.L. Yeh and K.K. Kuo, Prog. Energy Combust. Sci. 22, 511 (1996).
- [7] MIL-P-46994B.
- [8] D. M. Kalyon*, M. Mali Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, USA

-
- [9]Alsteens, B., Legat, V., Avalosse, T., “Parametric Study of the Mixing Efficiency in a Kneading Block Section of a Twin-Screw Extruder”,
- [10] Aral, B., Kalyon, D. M., “Rheology and Extrudability of Very Concentrated Suspensions: Effects of Vacuum Imposition”, Plast. And Rubber
- [11]. Cheng, H., Manas-Zloczower, I., “Study of Mixing Efficiency in Kneading Discs of Co-Rotating Twin-Screw Extruders”, Polym. Eng.
- [12]. Herrman, H., Burkhardt, U., The 5Leobener Kuststoffkolloquium Doppelschnelken-Extruder. Lorenz Verlag, Vienna (1978)
- [13], 3150–3160 (2003) Papanastasiou, T. C., “Flow of Materials with Yield”, J. Rheology
- [14]Rauwendall, C., Polymer Extrusion, Hanser Gardner Publications, Cincinnati (2001)
- [15]– Tadmor, Z., Broyer, E., Gutfinger, C., “Flow Analysis Network (FAN) A Method for Solving Flow Problems in Polymer Processing”, Polym. Eng. Sci.

Fabrication of Multipurpose operation machine (Bench-Drilling, Grinding, Metal-Cutting)

J.V. Chopade¹, Amit Sarwade², Ajinkya Chabukswar³, Pritam Desai⁴, Ashwin Nair⁵

^{*}Pimpri Chinchwad College of Engineering & Research, Ravet.

ABSTRACT:

In this Multipurpose Operation Machine machine we are actually giving drive to the main shaft which different tools for the mechanical operations will be attached. These three operations are designed to operate on a single bench with some desired speed and have the capacity of performing different operations simultaneously. The machine is fully automatic driven by a motor based on power transmission through pulley and gears on the same shaft for the operation to work. This machine tool is used to perform machining operations providing a single power source. Referring power from the main shaft to another sub shaft by using different size pulleys we have to reduce the speed required for each operation. On the main shaft we have use the pulley belt drive system for power transmission at two locations and also bevel gear system at one workstation. The model facilitate us to get the operation performed at different working centre simultaneously as it is getting drive from single power source that is motor. Objective of this model are conservation of electricity (power supply), reduction in cost associated with power usage, increase in productivity, reduced floor space which would result more profit.

INDEX TERMS- Multi-operation machine, Drilling, Cutting, Shaping, Motor, Shaft, I.

INTRODUCTION

All manufacturing industries aim is for the production of goods and services at low cost, there must be low machining as well as inventory cost, as industries invest a certain amount for machining installation. As in small-scale industries, various machine operations are performed by using energy sources for individual machine tools. In order to

meet such requirements, machine tools have multiple functions and reconfiguration design architecture many of the parts are finished by a sequence of processes which includes cutting, grinding, deformation, and another finishing process. This model of the multi operational machine may be used in industries and domestic operations, which can perform mechanical operations like Drilling, cutting and shaping of a thin metallic as well as wooden model Or body. The machine uses a single phase motor which is the power source of the machine. The power from the motor is transferred by the belt drive. Like when the motor rotates the power is transferred to the cutting station with the required speed by belt dive system. The required speed is achieved by the selection of the pulley of appropriate diameter and further on and for number of pulleys are used for the power transmission to different work station. The power transmission for the drilling operation is from a horizontal shaft to the vertical shaft. As the power transmission is perpendicular in nature we have used bevel gear for the power transmission. Drilling machine is defined as equipment which is used to drill hole and it play important role in mechanical industries. Cutting is the process of cutting material by a narrow slit cut into a work-piece. Grinding is the abrasive machining operation that uses a grinding wheel which is used for cut or finishing work-piece that requires surface quality as well as high accuracy of shape and dimension. Hence it becomes important to overcome time and cost issues and make out the best possible design for this multipurpose machine.

METHODOLOGY:

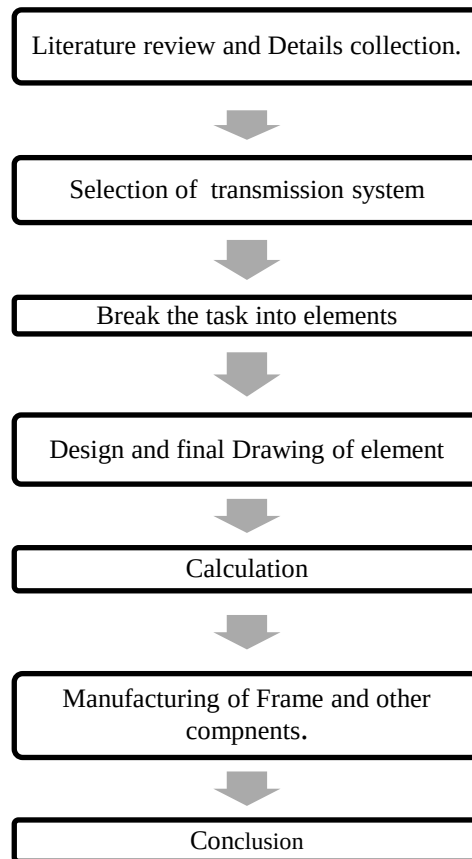


Fig. 2 Process flow

Working:

In this project we use a A.C. is transferred to the shaft with power from the motor is transferred to the main shaft (D1). From the main shaft the power is supplied to the shaft D2 & D3 which is connected to the cutting and grinding set up. The required Ideal speed for cutting and grinding operation is achieved by varying the pulley diameter. For Drilling operation the power from the main shaft is transferred to a shaft (D3). A bevel Gear is attached to the shaft (D3) as a perpendicular power transfer is required for to run the drill head.

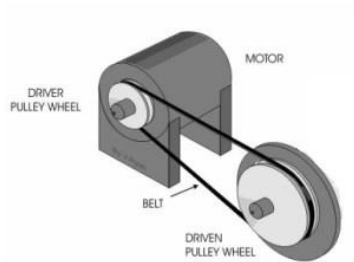
Operations of the Project:

1. Drilling: A drill is a device connected to a cutting device, drill is usually used to drill holes in different materials or by using fasteners, different materials are tied. Add a helper to one end of the drill and press against the target material. The purpose of cutting is cut the material. It is used for wood, metal and construction. Specially designed drills are also used in medicine, space missions and other applications. Drills are available with a wide variety of performance characteristics.
2. Grinding: A grinding wheel is a wheel composed of an abrasive compound and used for various grinding (abrasive cutting) and abrasive machining operations. Such wheels are used in machines. The abrasive grains act as grinding tools, removing material from a work piece to shape and refine it.
3. Cutting: There are many types of metal and each requires different metal cutting techniques. For this reason there are a variety of methods available for cutting metal materials. The method chosen for the project will depend on the type of metal used, the level of precision required and the intended use of the manufactured part and the project.

WORKING PRINCIPLE

Belt and Pulley (Power Transmission): The powers from the motor to the different power stations are transferred by the help of belt drive system. The different ideal speeds for mechanical operations are achieved with

the help of varying the pulley size.



Bevel gears: The use of bevel gear for the power transmission for the drilling machinespindle from the shaft as a perpendicular power transmission is required.



COMPONENTS and Specification:

1. Frame of the model: length=1100mm, width=880mm, height=1000mm.
2. Shaft dia. =30 mm (approx.), shaft length=900mmft
3. Roller bearing no:- SKF UCP206
4. Shaft is also of mild steel.
5. Frame is also made of mild steel
6. AC motor rotates at 1440 rpm and has a power capacity of 1.5 HP
7. Cutting wheel dia= 10inch.
8. Drill bit length=6mm
9. Grinding wheel dia=60mm

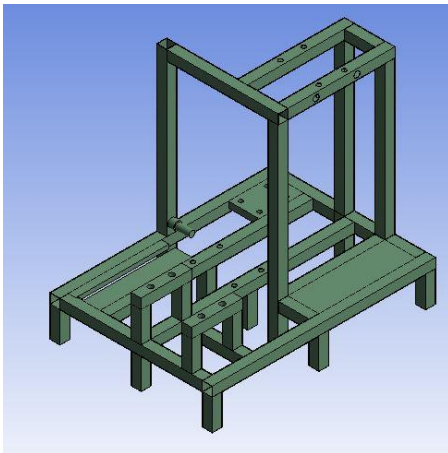


Fig-Frame of machine

Calculations

$$\text{Torque} = x = \frac{60 \times p}{2\pi N} = \frac{60 \times 745.2}{2\pi \times 1440}$$
$$= 4.94 \text{ N-M}$$

1) Main Shaft

$$\frac{N_1}{N_2} = \frac{D_1}{D_2}, N_2 = \frac{N_1 \times D_1}{D_2} = \frac{1440 \times 102}{152}$$
$$= 1204 \text{ Rpm}$$

2) Cutting Calculation

$$\frac{N_2}{N_3} = \frac{D_4}{D_3}, N_3 = \frac{N_2 \times D_3}{D_4} = \frac{966 \times 152}{51}$$
$$= 2879 \text{ rpm}$$

3) Grinding Calculation

$$\frac{N2}{N4} = \frac{D6}{D5}, N4 = \frac{N2 \times D5}{D6} = \frac{966 \times 228}{76}$$

$$= 2898 \text{ rpm}$$

4) Drilling Calculation

$$\frac{N2}{N4} = \frac{D8}{D7}, N5 = \frac{N2 \times D7}{D8} = \frac{966 \times 1}{110}$$

$$= 1450 \text{ rpm}$$

Belt Length Calculation

$$L = 2C + \pi \left(\frac{D1 + D2}{2} \right) + \left(\frac{D1 - D2}{4C} \right)^2$$

1) Main Shaft (D1, D2)

$$L = 2 \times 402.8 + \pi \left(\frac{152 + 102}{2} \right) + \left(\frac{152 - 102}{4 \times 402.8} \right)^2 = 1204 \text{ mm}$$

2) Cutting Calculation (D3, D4)

$$L = 2 \times 175.2 + \pi \left(\frac{152 + 51}{2} \right) + \left(\frac{152 - 51}{4 \times 175.2} \right)^2 = 683 \text{ mm}$$

3) Grinding Calculation (D5, D6)

$$L = 2 \times 484.8 + \pi \left(\frac{228 + 76}{2} \right) + \left(\frac{228 - 76}{4 \times 484.8} \right)^2 = 1459 \text{ mm}$$

4) Drilling Calculation (D7, D8)

$$L = 2 \times 851.4 + \pi \left(\frac{160 + 110}{2} \right) + \left(\frac{160 - 110}{4 \times 851.4} \right)^2 = 2144 \text{ mm}$$

No of Teeth on Gear/Gear = 30/30

Diameter of Gear/Gear = 80/80

Gear Ratio-1, N5 = 1454.5454 RPM.

$$\frac{N6}{N5} = \frac{T2}{T1}, N6 = \frac{N5 \times T1}{T2} = \frac{1454.5454 \times 24}{24} = 1685 \text{ RPM}$$

Cutting Speed (m/min)

$$V_c = \frac{\pi \times D_c \times N_6}{1000} = \frac{\pi \times 13 \times 2000}{1000} = 68.81 \text{ m/min}$$

Analysis of Frame:

Number of Nodes and Elements in the frame:

Statistics	
☐ Nodes	54448
☐ Elements	27718

Total Deformation

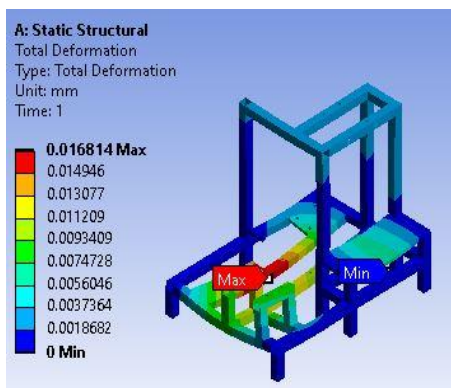


Fig- Total Deformation

Actual setup of Project:



Fig-Actual setup of Project

Conclusion:

We can see that all the production-based industries wanted low production cost and high work rate which is possible through the utilization of multipurpose machine which will less power as well as less time, since this machine provides working at the different centre it really reduced the time consumption up to the appreciable limit. all the operations can be performed in one place and in a small area this machine will be very useful in small-scale industries. This project has a wide range of scope in the small-scale industries. In coming future, this type of lightweight and portable machine will be implemented in every small and large-scale industries. This type of machine can be used by anyone due to its simplicity of working and doing a wide range of operations.

The following conclusions can be drawn:

- The machine is useful particularly for small scale industries.
- Workers movements can be minimized.
- Number of operations can be carried out on the single machine.
- Floor area required is reduced.
- Cost of manufacturing is also reduced.
- Three different operations viz. drilling, grinding and cutting

References:

[1] Sharad Srivastava, Shivam Srivastava and C.B. Khatri, “Multi-Function-operating machine: A Conceptual Model”

[2] **Rakesh Ambad, Akash Pande, Prasad Sangitrao, Rahul Katre, P. Bisen**, “Design & Fabrication of Human Powered Multipurpose”

[3] **Syed Shahnawaz**, “The Design Analysis and Fabrication of Multipurpose Mechanical Machine”

[4] **Jyoti, Surendra Gupta, Vaibhav Dwivedi and Vikash**. “Design & Fabrication of Multi-Purpose Machine”

[5] **Amit Kumar, Abhishek Kumar, Kushwaha Faizan Faridi, Aishwary Singh**, “Implementation and Development of Multi-Purpose Mechanical Machine”

[6] **Krishnappa, Venkates, Shriram M, Gowtham, U.A Varun Prasad, Venkatesh Patki**, “Motorized Multipurpose Machine”

[7] **Aquib Ahmad, Aniket Parasher, Nikhil Tyagi, Pramudit Sahni, Shivom Sharma**, “Multi Operational Mechanical Machine”

[8] **Rajendra Kelwa**, “Design and Fabrication of drilling cum cutting machine”

[9] **Sharad Srivastava** “Developing the Conceptual Model of a Machine”

[10] **Saif Imam**, “Design and Fabrication of

multipurpose grinding machine”

[11] **Rohit Devilal Upadhya, Naresh Bihari Bahmnote**, “Design and Fabrication of multipurpose grinding machine”

[12] **Praveen Karanam, Karthik A.V., Akshay s Bhatt, Swaroop H.P. Ganesh** “Development & Fabrication of Multipurpose Machine”

[13] **Singh Ankitkumar, Awadhesh Patel, Kentankumar H**, “Implementation of Multipurpose Mechanical Machine”

[14] **Mr. Rajendra Sharma**” Multi Operational Mechanical Machine”

[15] **S. S. Kulkarni, K.K. Ahire, A.R. Pingale, V.N. Ahire, J.D. Ghodke, R. Shaikh** “Drilling, Cutting and Grinding System Mechanism”

[16] **Pradip R. Bodade**, “Multifunction Machines”

[17] **A. Raja, R. Rathishb, N. Balakrishnan, M. Elavarasand, J. Dhinakarane** “Fabrication of Three in One Multipurpose Mechanical Machine Using Whitworth Mechanics”

Behavior Change of Diesel Engine under Starting Low Temperature and idling with Calophyllum oil Biodiesel.

S. Pharate¹, R. Sonawane¹, S. Walunj¹, C. Rakshe¹

¹U.G Students, Department of Mechanical Engineering, Pimpri Chinchwad College of Engineering and Research, Ravet, Pune.

I. INTRODUCTION

In 2040, the demand for global energy will be about 30% higher than that of in 2010. Global crude oil demand is expected to reach 101.6 million barrels per day in 2020. Fossil fuels provide for approximately 86 percent of primary energy demand, which is steadily increasing. The majority of industries rely on diesel as a source of energy. Mankind relies heavily on fuels for every aspect of their everyday life, good transport and electricity in particular. Since the last few decades, there is a drastic increase in demand of fuel, price and no. of a road vehicle, climate changes due to air pollutions and now it has become a serious topic for the researchers to guarantee the availability of energy alternatives and reduction in environmental pollution due to vehicular emissions [1]. The fuels which have potential to replace the fossil fuels are natural gas like CNG, LPG, hydrogen gas, electric energy, but all these required modifications in the existing engine or fuel system, but energy sources like primary alcohols or blend of primary alcohols with gasoline, ethers, and biodiesel and its blends [2].

Biodiesels are biodegradable, renewable and more environment friendly than petroleum-based fuels [3]. Ever increasing petroleum products prices and uncertainties concerning their availability have increased the importance of vegetable oil-based biofuel tremendously. The biodiesel has some rewards as compared to petroleum diesel [4-5].

In the present experimental study, performance and emission characteristics of the single-cylinder diesel engine are investigated under the variation of compression ratio, engine load and biodiesel blend proportion. This study focused on finding variation in

ABSTRACT Increasing petroleum prices, depletion of fossil fuels and pollution are leading to find out alternative sources for petroleum fuels. Among the biodiesel, natural gas, electric batteries and hydrogen gas, biodiesel getting worldwide attention due to renewable and environmentally friendly nature and also it does not required modifications in diesel engine. The present work confers the study of impact on diesel engine performance characteristics when engine is fuelled with biodiesel produced from Calophyllum oil and the engine is at low temperature and at idling condition. In the present work engine is run on neat diesel, emulsified diesel and emulsified biodiesel B10, under the engine load conditions of 0 kg load, 5kg load, 10 kg load, and 15 kg load.

INDEX TERMS Performance, Calophyllum Inophyllum, Brake Thermal Efficiency (BTE).

Brake Specific Energy Consumption (BSEC), Brake Thermal Efficiency (BTE), Exhaust Gas Temperature (EGT).

II. MATERIALS AND METHODS

a) Materials-

In the present study non edible oil namely Calophyllum inophyllum is chosen for experimentation on Single Cylinder Direct Injection Diesel Engine. Calophyllum oil is collected from local oil supplier and Methanol and KOH were purchased from Local chemical store in Pune.

b) Production and characterization of biodiesel-

Transesterification of Calophyllum oil was done using Methanol in presence of KOH as catalyst to chemically break the molecule of raw Calophyllum oil into methyl esters of Calophyllum oil with glycerol as byproduct. Emulsification of diesel and Calophyllum oil is done and their composition is shown in table 1.

Table No.1 Composition of Emulsified Diesel and Biodiesel

Emulsified Diesel	Emulsified Calophyllum Oil
Diesel – 270 ml	Calophyllum oil – 270 ml
Tween 80 - 9 ml	Tween 80 – 9 ml
Distilled water – 30	Distilled water – 30 ml

ml	

When you open trans_jour.docx, select “Page Layout” from the View” menu in the menu bar (View | Page Layout), (these instructions assume MS 6.0. Some versions may have alternate ways to access the same functionalities noted here). Then, type over sections of trans_jour.docx or cut and paste from another document and use markup styles. The pull-

The properties of emulsified diesel and emulsified Calophyllum oil were obtained by testing them in laboratory named “Chem-tech laboratories Pune” compared. Those properties are as follows

Table No.2 Properties for Calophyllum oil

Fuel	Flash point (°C)	Kinematic Viscosity (mm ² /sec)	Calorific value (Cal/g)	Density (gm/cc)
Emulsified Diesel	55	1.9-1.4	10867.493	860
Emulsified Calophyllum oil	15	1.15-3	5335	868.7

III. EXPERIMENTAL SETUP –

The setup is basically which consists of single cylinder four stroke engine connected to Eddy current Dynamometer as Shown in Fig.1 and Fig.2

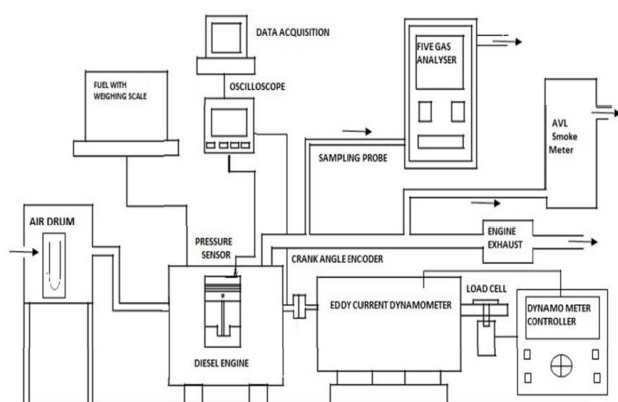


Fig.1 4-stroke single cylinder diesel engine setup (diagrammatic)

Fig.2 Actual setup

IV. EXPERIMENTAL PROCEDURE –

For experimental procedure, we performed the tests on 4-stroke, single cylinder, direct injection, water cooled, 3.5 KW output power with computerized diesel test

down style menu is at the left of the Formatting Toolbar at the top of your Word window (for example, the style at this point in the document is “Text”). Highlight a section that you want to designate with a certain style, and then select the appropriate name on the style menu. The style will adjust your fonts and line spacing. Do not change the font sizes or line spacing to squeeze more text into a limited number of

It is provided with necessary equipment's for Load, water flow, Fuel Measurements and to record the readings of the experiment. Rota meter are provided for cooling water and Calorimeter Water Flow measurement. Engine Performance is analysed by the “IC Engine Soft” Software. Which will be used for further conclusion.

Specifications for the Diesel Engine are given below in the tables:

Table No.3 Engine Specifications

No. of Cylinders	1
No. of Strokes	4
Fuel	High Speed Diesel
Rated Power	3.5 kW @1500 RPM
Cylinder Diameter	87.5 mm
Stroke Length	110 mm
Connecting Rod Length	234.33
Compression Ratio	12 to 18:1
Orifice Diameter	20 mm
Dynamometer arm Length	185 mm
Cooling	Water Cooling
Loading	Electrical loading by varying voltage
Swept Volume	661.45 cc

Table No.4 Other Specifications

Fuel tank	Capacity 20 lit with glass fuel metering column
Temperature Sensor	Thermocouple
Software	ICEnginesoft

setup. The eddy current dynamometer is directly coupled to engine. The characteristics of engine are already cited in specifications and setup is shown in fig. For every fuel we used, the residual fuel cleanse

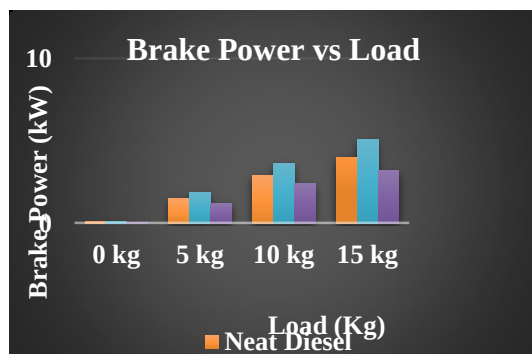
out from fuel line. As we are testing behaviour change of diesel engine under starting low temperature and idling condition, so for new fuel and new load we should operate and take readings for first 30 min of engine start. The test setup ring has necessary attachments to check air-flow, fuel-flow, temperature, loads, etc. Fuel and lubrication oil indicators are there to check fuel level. There is three-way cock which allows fuel to flow in engine. Cooling water jacket is there to ensure adequate supply of cooling water as engine is water cooled. The setup is connected to software ICEnginesoft. Electric power is supplied to needed instruments. Loading and unloading of loads are done by varying voltage to dynamometer. The engine is started by electric switch mechanism. The readings noted are: load acting, speed in rpm, temperature, manometer values in cm, time, fuel consumptions, etc. The procedure is repeated for four different loads i.e., 0 kg, 5 kg, 10 kg, 15 kg and three different fuels i.e., neat diesel, Emulsified diesel and Emulsified Calophyllum oil biodiesel B10.

V. RESULTS AND DISCUSSIONS –

b) Specific Fuel Consumption-

The variation of the brake specific fuel consumption of diesel and blend of Calophyllum oil Biodiesel at different loads is shown in Fig 4. The specific fuel consumption is 5.89, 4.62 and 7.5 kg/kW-h for the Neat Diesel, Emulsified Diesel and Emulsified Biodiesel B10 respectively at 0 load. From the graph we can see that the specific fuel consumption Higher in every case of Emulsified Biodiesel B10 than Emulsified and Neat Diesel. This is because of the combined effects of lower heating value and higher fuel flow rate due to high density of blend. Higher proportions of Calophyllum oil in the blend increase the viscosity which in turn increased the fuel consumption due to poor atomization of the fuel.

c) Brake Power-



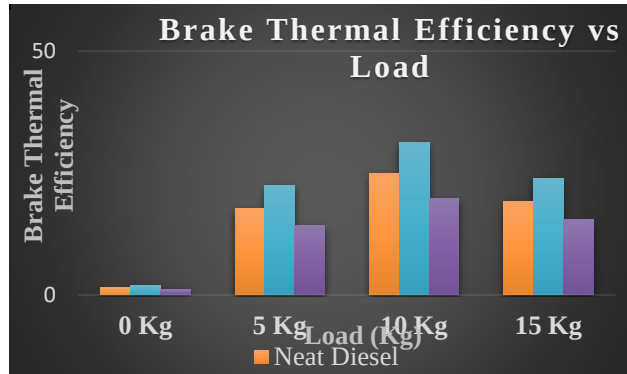
The variation of the brake power of diesel and blend of Calophyllum oil Biodiesel at different loads is shown in Fig 5. Brake Power is almost Zero at 0 load condition. But when increase in load, Brake Power goes on increasing. Emulsified Diesel gives higher value of brake power that Neat Diesel while Emulsified Calophyllum oil biodiesel blend B10 Gives the Lower value of brake power at any load condition that of neat and Emulsified Diesel.



with respect to emulsified Diesel and Emulsified Biodiesel blend B10 is shown in Fig 3 and compared with brake thermal efficiency obtained with neat diesel. Among these Emulsified Diesel gives higher brake thermal efficiency that the Emulsified Biodiesel B10 and neat Diesel at all the loads. The variation is significant particularly at higher loads. The decrease in brake thermal efficiency with increase in Calophyllum oil concentration is due to the poor mixing and evaporation of the blends due to their higher viscosity.

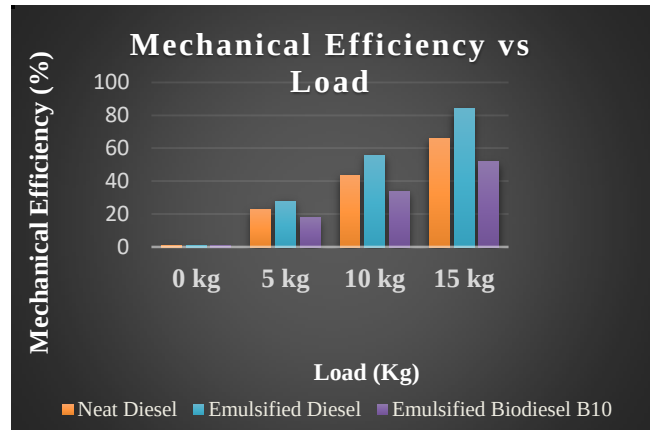
d) Brake Mean Effective Pressure -

The variation of brake mean effective pressure against different loads of the engine for various compositions like emulsified diesel and emulsified biodiesel is compared with neat diesel and shown in Fig.6. The trend shows that brake mean effective



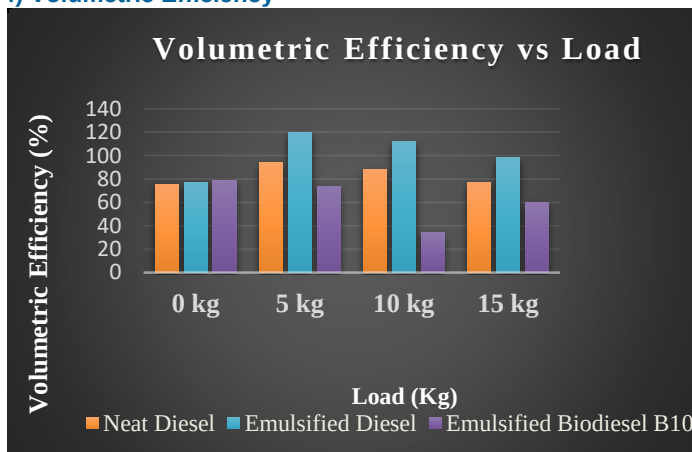
pressure (BMEP) shows gradual increase after emulsification process. From graph we can see that, as load increases the Brake mean effective Pressure increases.

e) Mechanical Efficiency -



The variation of mechanical efficiency against different loads of the engine for various compositions like emulsified diesel and emulsified biodiesel is compared with neat diesel and shown in Fig 7. It is shown in fig that for 15 kg of load we get the highest efficiency up to 83% (emulsified diesel). From here we conclude that, at starting condition efficiency for all composition is much lower.

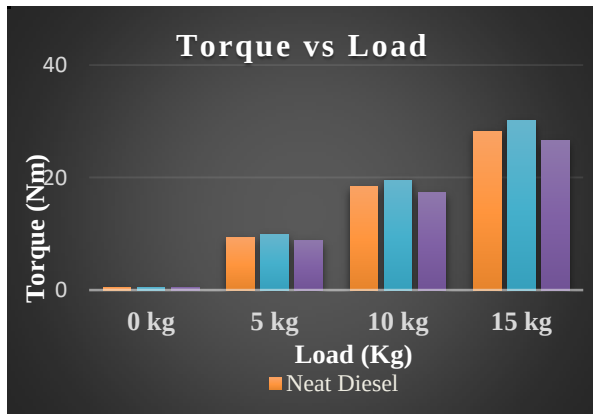
f) Volumetric Efficiency -



The variation of Volumetric Efficiencies for different load conditions are plotted above for Different compositions like Emulsified Biodiesel(B10) and Emulsified Diesel and

compared with the volumetric efficiency of Neat Diesel. The trend shows that Efficiencies are comparatively same at starting conditions but varies as load increases from 5kg to 15kg. Emulsified Biodiesel (B10) shows sudden drop in Efficiency at 10kg due to incomplete Emulsification.

g) Torque –



The variation of torque against different loads of the engine for various compositions like emulsified diesel and emulsified biodiesel is compared with neat diesel and shown in Fig 9. It shows that the torque obtained for emulsified diesel is better compared to emulsified biodiesel and neat diesel for various load conditions. At zero load condition's torque is almost zero.

VI . CONCLUSION –

- 1) Overall, it was observed that, with increase in engine load even at starting time, engine performance improved.
- 2) Specific Fuel Consumption is higher at zero load and reduces as engine load increases.
- 3) Emulsification by 10 vol. % water shows no adverse effect on engine part.
- 4) Emulsification diesel shows better performance as compared to neat diesel and emulsified biodiesel.
- 5) Emulsified biodiesel also prove that it can be used as alternative fuel for diesel engine without any modification.

VII. REFERENCES –

- 1) Shubham P, Shubham W, Chetan R, Rohit S 2021. “Calophyllum oil prospective as alternate fuel for diesel engine”, International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) ISSN – 2581-9429, Volume 6, Issue 1, (June 2021)
- 2) Daisuke, Kawano, Hajime Ishii, Yuichi Goto, Akira Noda, and Yuzo Aoyagi. 2018. “Application of Biodiesel Fuel to Modern Diesel Engine”, SAE Technical Paper Series 2006-01-0233, SAE
- 3) International by University of Auckland (2018).
- 4) . B. Ashok, D.Sakthi Vignesh, “Calophyllum inophyllum methyl ester biodiesel blend as an alternate fuel for diesel engine applications”, Alexandria Engineering Journal (2017) I. López a, C.E. Quintana b, J.J. Ruiz c, F. Cruz-Peragón d, M.P. Doradoc, Effect of the use of Olive–Pomace oil biodiesel/diesel fuel blends in a compression ignition engine: Preliminaryexergyanalysis,EnergyConversionandManagement2014:85:227–233.
- 5) T.Elangovan, G.Anbarasu, L.Jeryraj Kumar, “Development of Calophyllum inophyllum Biodiesel and Analysis of its Properties at Different Blend” International Journal of ChemTech Research, Vol.9, No.04 pp 220-229, (2016).
- 6) Vandana et al, “Synthesis of Calophyllum inophyllum Esters as Biofuel Feed stock” Juniper Online Journal Volume 2 Issue, (2017)
- 7) S. Navya Sree, K. Sandeep Kumar, EC Prasad Nidumolu, “Experimental Investigation on CI Engine Fuelled with the Blends of Olive Oil Methyl Ester and Diesel”, International Journal of Mechanical Engineering and Technology, 8(7), 2017, pp.125–132.

THERMOSAVE – Using Waste Heat to Generate Electricity

Dr. Ramesh Rathod¹, Pratik Lohikpure², Sahil Sawant³, Prathamesh Lokhande⁴, Vijay Pawar⁵

¹Pimpri Chinchwad College of Engineering & Research, Ravet

²Department of Mechanical Engineering, Savitribai Phule Pune University, Pune

³Mechanical Engineering Department, University of Pune, Pune

“This work was supported in part by the Department of Mechanical Engineering, PCCOER.”

ABSTRACT The use of thermoelectric generators (TEGs) to recover useful energy from waste heat has increased rapidly in recent years. Several thermoelectric modules can be connected in series or parallel to provide the required voltage and/or current. The thermoelectric generators convert direct heat flow into electric energy. Thermoelectric modules (TEM) that are normally designed for cooling are suited for power generation as well. They are made up of materials of high thermoelectric efficiency when operated with low level heat sources. These thermoelectric generators (TEGs) make use of Seebeck effect to directly transform thermal energy into electricity. This paper focuses to find an efficient way to make use of the waste heat which is released while using a gas stove. This heat can be used for variety of purposes, for example, charging a mobile phone, lighting LED lights or for the storage in battery. Thermoelectric generators are used for the following purpose. TEGs have many advantages, such as compactness, quietness, and reliability because there are no moving parts. This paper also includes study on TEGs, where they will be exposed to various conditions and then analyze their behavior under these circumstances. These experimental results clearly illustrate the issue and a theoretical model is presented to quantify the impact. This will also help in development of a battery system to store the electrical output obtained from the waste heat to make thoughtful use of the products of non-renewable resources.

INDEX TERMS Thermoelectric generators, Thermoelectric modules

I. INTRODUCTION

In today's world the importance of generating energy from renewable resources or waste products is increasing day by day. Engineers and scientists are mainly focusing on finding out a way to either reduce wastage of energy or make use of waste energy in some way or the other.

About 72% percent of India's population uses gas stove for cooking food regularly. In villages where regular electricity supply is a major crisis hence, induction cannot be used. So, villages are mostly dependent on gas stoves. In this case also only 40% of the heat is utilized and about 60 % of the heat is wasted. This heat if utilized can be of great use. Surprisingly this heat can be utilized for generating electricity which can be very useful in rural areas. So here we are trying to find solution to convert this heat in to electricity and use it for various applications. If this wasted heat is utilized in this era where non-renewable resources are getting costlier day by day, it can be of great use. Hence, finding out a way to make use of this heat so that the resources can be utilized efficiently.

As a solution to this problem, a semiconductor material-based product known as TEG (thermoelectric generator) will be used. Thermoelectric generators (TEGs) produce a current flow in an external circuit by the imposition of a temperature difference ΔT across the TEG. The magnitude of this ΔT determines the magnitude of the voltage difference ΔV and the direction of heat flow determines the voltage polarity. The applications of TEGs has increased rapidly in the fields such as remote sensing, automotive, stove, geothermal, space systems, and industrial power plants. The TEGs range from microwatts to kilowatts; hence in a system where a few watts are needed, several TEGs are connected in arrays of series or parallel connection depending on the voltage and/or current required. These TEGs which are used for high thermal power conversion are made with different materials such as Pb/Te, Si/Ge alloys, etc. In this paper, several experiments have been conducted to measure the output power at different conditions, different connection modes between TEG modules, and different temperature differences between

hot and cold sides and hence by conducting these tests, data has been presented.

II. LITERATURE REVIEW

Studied various ways to recover waste heat. Thermoelectric generators convert heat energy into electric by keeping temperature difference at two different ends of thermoelectric generator. Thermoelectric generators usually work on Seebeck's effect. It actually converts temperature differences into electric energy. This temperature difference is necessary at both ends of a TEG to produce a voltage (i.e., one end of TEG hot and other end cold) More the temperature difference more will be the magnitude of the voltage produced.

The thermoelectric module (TEM) is made up of a certain number of thermo elements which are connected electrically in series and thermally in parallel and are clamped between thermally conducting ceramic plates. It is found out that the difference between the TEG and TEM which is a similar device element but is used for cooling purpose mostly. When charge current flows, one of the plates gets heated and the other plate will be cooled. In one of the papers referred it is observed that the three thermoelectric devices produced 9.22% less power when connected in series. And when connected in parallel the difference stands to about 10%. This work gave the conclusion that connection of thermoelectric devices in series yields a more efficient system at lower cost, compared to parallel connection.

III. OBJECTIVE

1. To study and develop an innovative method of conservation of energy.
2. To generate electricity from waste heat of gas stove.
3. To store the electricity generated and use it for other applications.
4. To improve the efficiency of TEGs.
5. To select a suitable battery.
6. To perform experimentation once the setup is ready to find the best possible circuit.

IV. METHODOLOGY

A. TO STUDY VARIOUS SYSTEMS FOR WASTE HEAT RECOVERY:

After studying various literature reviews to find out ways to recover waste heat and use it for useful purpose we found out that this heat can be circulated back to the system to increase the efficiency. There is also a way in which direct conversion of heat into electricity is possible. For this purpose, TEGs are used. TEG stands for thermoelectric generator. The thermoelectric generator is capable of generating heat into electricity with the help of the Seebeck effect. In

this effect. The Seebeck effect occurs due to the movement of charge carriers within the semiconductors. In doped n-type semiconductors, charge carriers are electrons and in doped p-type semiconductors, charge carriers are holes. Charge carriers diffuse away from the hot side of the semiconductor. This diffusion leads to a build-up of charge carriers at one end. This build-up of charge creates a voltage potential that is directly proportional to the temperature difference across the semiconductor. The advantage of using a TEG is that the output is DC, hence there is no need of conversion.

B. TO FINALIZE THE MATERIAL AND COMPONENTS REQUIRED FOR THE SYSTEM DEVELOPMENT:

The TEGs used are made up of bismuth (Bi_2Te_3) telluride, lead telluride (PbTe) and Silicon germanium (SiGe). The reason for selection of this material of TEGs is they are easily available. The other material TEGs are still in research phase and still not commercialised. These TEGs are packed with heat sinks made up of Aluminium alloy 1050A. These heat sinks help for proper heat dissipation on the cooling side. This electricity can directly be used to light LEDs or charge mobile phones. But in case there is a need to store this electricity it can be stored in a battery. The battery used can be a Lead acid battery as it is robust and easily rechargeable. This battery also doesn't lose charge or electricity over a period of time.

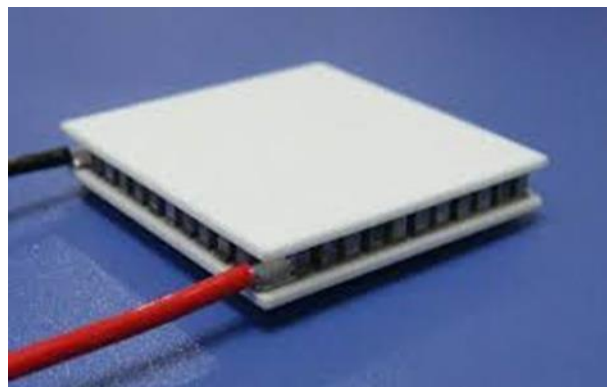


Figure 1: Thermoelectric Generator

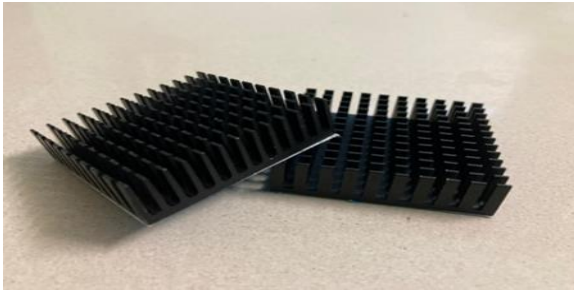
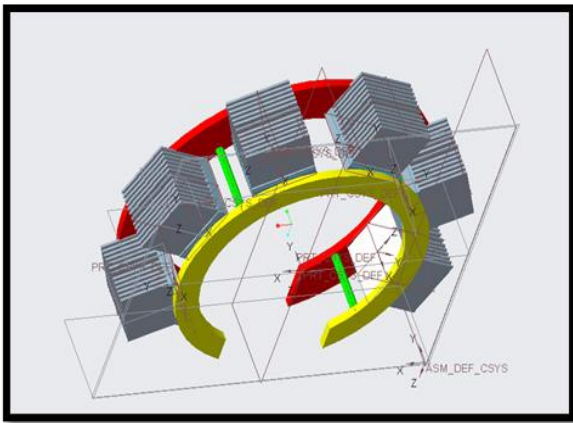


Figure 2: Heat Sink

V. EXPERIMENTAL SETUP AND SPECIFICATIONS



The experimentation set up consists of frame made up of cast iron. In this frame the TEGs are fitted and connected in series, parallel or a modular setup of series and parallel. This setup is placed on the gas stove. The inner side of the TEGs will be maintained hot whereas the outer side will be maintained cooled thus giving us the required temperature difference. The initial design was made on CREO software and the

Temp diff	Output voltage
10	0.43
15	0.76
20	0.98
25	1.22
30	1.32

pictures of the setup are given below.

Figure 3: Frame Design

The setup as shown in the above figures is considered for the experiments to be carried out. Initially all the TEGs are connected in series. The setup is placed on the gas stove. Various readings are taken for different flame speeds and temperature difference. The temperature difference is monitored using thermocouple. A voltage measurement device is connected at the end of the setup which gives the output voltage. This voltage is recorded.

In the second part of the experiment the TEGs are connected in a parallel combination. The same process is repeated and the voltage readings for different temperature difference are recorded. In the third part a modular arrangement is done in which few TEGs are connected in parallel and those are than

Temp diff	Output voltage
10	2.7
15	4.5
20	6.72
25	7.62
30	8.44

connected to remaining TEGs in series and similar process is repeated and the voltage readings are taken. Graphs are plotted and results from these experiments are analysed. The analysed results help us to find out which combination gives the perfect required voltage and current output to perform our needs.

VI. CALCULATIONS AND RESULTS

A. THE TEGs ARE CONNECTED IN SERIES SETUP:

Table 1: Temperature vs. Voltage scenario for series connection

B. THE TEGs ARE CONNECTED IN PARALLEL SETUP:

Table 2: Temperature vs. Voltage scenario for parallel connection

C. the tegs are connected in a modular array arrangement in which four are connected in parallel and those are connected in series:

Table 3: Temperature vs. Voltage scenario for modular array

Temp diff	Output voltage
10	1.8
15	3.04
20	4.08
25	5.08
30	5.6

VII. SCOPE

If properly developed this product can be used in rural areas to charge mobile phones, LED lights which run on batteries. They can be used to store the electricity in a Lead-Acid battery. This equipment can be of great help to those who hike in mountains for days.

VIII. CONCLUSION

After performing the experiment, we came to know that the TEGs when connected in series gave the highest voltage output which was 8.44 volts which can easily be used to charge batteries till that volt. The room temperature observed was 32 degrees Celsius. If a better current output is required, they have to be connected in parallel because the current output was high but the voltage was very less as compared to series. In the modular arrangement the voltage observed was 5.6V for the temperature difference which was achieved. The current was also better than the series combination. The TEGs if directly exposed on flames, due to wrong connections, exposing wrong side to the heat are responsible for TEGs damage and need to be replaced. Hence this product if properly designed and manufactured can be of great use in places where electricity is scarce. It can be used to charge a small size battery and made to work like an inverter to generate electricity. This electricity can be used to light a small sized LED or can be used to charge mobile phones power banks etc.

IX. REFERENCES

[1] Rohit S. Raut, Sachin V. Rathod Use of Heat Pipes and Thermoelectric Generator System for Waste Heat Recovery and Power Generation
[2] Jinlong Chen, Kewen Li, Changwei Liu, Youchang Lv, Lin Jia and Shanshan Jiang Enhanced Efficiency of Thermoelectric Generator by Optimizing Mechanical and

Electrical Structures In the Renewable and Sustainable Energy Reviews 67 (2017) 581–596.
School of Energy Resources, China University of Geosciences (Beijing), Beijing 100083, China; loongchen@cugb.edu.cn (J.C.); changweiliu@outlook.com (C.L.); jialin@cugb.edu.cn (L.J.); shanshanj@cugb.edu.cn (S.J.)
2 Department of Energy Resources Engineering, Stanford University, Stanford, CA 94305, USA
3 State Key Laboratory of Development and Utilization of Coking-coal Resources, China PingmeiShenma Group, Pingdingshan 467000, China; zm13721869229@126.com (M.L.); gmc109@126.com (Y.L.) * Correspondence: likewen@cugb.edu.cn
[3] . Loana Diaconescu, L Grigorescu Thermoelectric generator- an alternative electric power source. In Proceedings of the International Conference on Mechanical Engineering and Renewable Energy 2013 (ICMERE2013) 24- 27 December 2013, Chittagong, Bangladesh ICMERE2013-PI-142.
[4] FaizMohd Siddiqui* and V.K. Maurya Study of TEG When Connected in Series and Parallel Combinations Along With a DC-DC Converter In IOP Conf. Series: Earth and Environmental Science 67 (2017) 012017.
[5] Andrea Montecucco, Jonathan Siviter, Andrew R.Knox The effect of temperature mismatch on thermoelectric generators electrically connected in series and parallel.
[6] Champier D., Bedecarrats JP., Kousksou T., Rivaletto M., Strub F., Pignolet P. 2011.Study of a TE (thermoelectric) generator incorporated in a multifunction wood stove. Energy. 36(1),1518–26.
[7] Crane D., LaGrandeur J., Jovovic V., Ranalli M., Addinger M., Poliquin E., 2012. TEG on-vehicle performance and model validation and what it means for further TEG development. J Electron Mater.
[8] Ferrari M., Ferrari V., Guizzetti M., Marioli D., Taroni A. 2007. Characterization of thermoelectric modules for powering autonomous sensors. Instrumentation and Measurement Technology Conference (IMTC),1–6.
[9] Ferrel L., Samarelli A., Cecchi S., Etzelstorfer T., Muller Gubler E., Chrastina D. 2013. The crossplane thermoelectric properties of p-Ge/Si0.5Ge0.5 superlattices. Appl Phys Lett.

- [10] Hatzikraniotis E., Zorbas KT., Samaras I., Kyratsi T., Paraskevopoulos KM. 2009. Efficiency study of a commercial thermoelectric power generator (TEG) under thermal cycling. *J Electron Mater.* 39(2), 2112–16.
- [11] Wright, P.M. The sustainability of production from geothermal resources. *Bull. Geo-Heat Cent.* 1998, 19, 9–12
- [12] Poran, A.; Tartakovsky, L. Performance and emissions of a direct injection internal combustion engine devised for joint operating with high-pressure thermochemical recuperation system. *Energy* 2017, 124, 214–226. [CrossRef]
- [13] Javani, N.; Dincer, I.; Naterer, G.F. Thermodynamic analysis of waste heat recovery for cooling systems in hybrid and electric vehicles. *Energy* 2012, 46, 109–116.
- [14] Noie-Baghban, S.H.; Majideian, G.R. Waste heat recovery using heat pipe heat exchanger (HPHE) for surgery rooms in hospitals. *Appl. Therm. Eng.* 2000, 20, 1271–1282.
- [15] Haidar J, Ghajel J. Waste heat recovery from the exhaust of low-power diesel engine using thermoelectric generators. In: 20th International Conference on Thermoelectrics (ICT'01); 2001. p. 413–8
- [16] Laird I, Lovatt H, Savvides N, Lu D, Agelidis VG. Comparative study of maximum power point tracking algorithms for thermoelectric generators. In: Australasian Universities Power Engineering Conference (AUPEC'08), 2008.
- [17] Woo BC, Lee DY, Lee HW, Kim IJ. Characteristic of maximum power with temperature difference for thermoelectric generator. In: 20th International Conference on Thermoelectrics (ICT'01); 2001. p. 431–4
- [18] Woo BC, Lee DY, Lee HW, Kim IJ. Characteristic of maximum power with temperature difference for thermoelectric generator. In: 20th International Conference on Thermoelectrics (ICT'01); 2001. p. 431–4

Design and Analysis of lawn mover

Atharva naik¹, Aditya pujari², Neha shinde³, Sahil nagpure⁴

¹Pimpri Chinchwad College of Engineering and Research, Ravet, Pune University, 412101

ABSTRACT Nowadays, pollution is global issue. In a gas-powered lawn mower due to the emission of toxic gases, it's responsible for pollution. Also, the cost of fuel is increasing proving to be less efficient. Traditionally, lawn mowers are often clunky pieces of machinery, require a lot of human effort. These machines lead to noise pollution and high maintenance cost. Sun is major source of energy available worldwide. At present, solar energy (sun rays) is used for drying clothes, curing agricultural produce, preserving food articles, water heating etc. So, we decided to use concept of solar power in lawn mower machine. We are going to fabricate lawn mower to cut grass of different height. The proposed system is suitable for grass(soft) and makes use of castor wheels at rear to ensure multi-axis mobility. Friction generated is low as compared to IC engine-based grass cutter. The lawn mower is cost effective than IC engine based.

INDEX TERMS solar panel, dc motor, controller, front wheel, castor wheel

I. INTRODUCTION

The past technology of grass cutting is manually operated by the use of hand devices like scissor, these results into more human effort and more time required accomplishing the work. Also, in old methods lack of uniformity of the remaining grass. Also due to the use of engine powered machines increases the air and noise pollution also this grass cutter require maintenance.

II. OBJECTIVE

The objective of our project is to design lawn mower which operates on solar energy and avoids the drawback of old lawn mowers. The purpose is to avoid energy crisis in India and reduces the human efforts, operating cost and maintenance cost. Also, solar based grass cutter keeps the environment clean and healthy. It is used for cutting different types of grasses for various applications. The whole machine operates on the solar energy stored in battery. The prototype is charged from sun by using solar panel. Wear and tear should be less. Any of one of the skilled or unskilled worker should be able to use. Decrease in operational cost and maintenance cost.

III. SCOPE

Scope of project is limited to use of blade, DC motor, solar power to cut soft grass. Also, to attain multi-axis movement. The main objectives of our proposed system are as follows:

- To operate on solar energy
- Multi-axis steering
- Compact size and light in weight, hence portable.
- Reducing human time and effort
- Less noise pollution

IV. LITRETURE REVIEW

Firas B. Ismail, Nizar F.O. Al-Muhsen, Fazreen A. Fuzi, A. Zukipl (2019) In this paper, aim of the author is to design a smart solar grass cutter. The cutter is able to operate autonomously or non-autonomously. It makes use of three motors for rear tires and the blade. Height of roof depends on height of battery. One motor is implemented for each rear tire. In autonomous mode, ultrasonic sensor detects obstacle. Whereas in non-autonomous mode Bluetooth module is used to connect the cutter with smartphone and control. If cutter needs to move to the right, the left motor will be having higher speed compared to right motor and vice versa. The cutter is successfully working and can be used for small application. It is not suitable for tall height grasses.

(Basil Okafor) 2013 In this paper, the aim of the author is to design a self-powered mower of electrical source; a wireless electric lawn mower. The system prosed in this paper consist of a DC motor, speed multiplication with v-belt pulleys, cutting blades, 12V alternator for charging and a lifting mechanism to alter height Cutting efficiency achieved while performance test is 89.55.

(N. Nagarajan¹, N.S. Sivakumar² and R. Saravanan³) 2017 The design objective of this paper is to manufacture a portable, durable, easy to operate grass cutter with helix shaped blade for the use of agriculture field, to cut crops. Wheel, gear arrangement, roller, reel, bearing and base frame are the components used in the proposed system. Reel consist of several helix shaped blades mounted on a rotating shaft.

Manpreet Singh¹, Ashutosh Padhan², Suman Saurabh³, Kumar Priyesh⁴, Mausham Rai⁵ A review on solar, electric and gasoline powered grass cutting machine comprises of a panel of photovoltaic cells, an electric motor and a rechargeable battery pack has been studied. This review discusses about the designing, analysis and fabrication of lawn mowers that play a important role in day-to-day life. In this paper author briefly elaborates different technical implementations related to lawn mowers such as variation in blade angles of grass cutting machine and cutting rate of grass, speed and turning radius of machine that led to the more flexible working of lawn mowers. The renewable energy resources such as solar energy from solar panel can be used for charging the battery and used for driving the remotecontrolled machine. A review also includes the environmental issues of gasoline grass cutting systems that affect the environment and reduces the quality of the atmosphere. The research on direct current electric grass cutting machine leads to ascertain the advantages over the gasoline machine. Furthermore, electric and solar powered remote controlled lawn mowers are trying to take over the conventional gasoline and manual lawn mowers. Remote controlled mowers need complicated circuits that are also discussed in the paper. The results revealed that solar cells can produce 175 watts under the normal sun condition in case of solar powered lawn mower. Moreover, it was surveyed that approximately 50,000 U.S. people were injured by lawn mower cutting blades that leads to the quest of novelty in the safe usage of machines and devices in household applications.

Bhupesh Choudhary, Santosh yenchilwar, Amol raut, Iomesh Shende. In this paper the main purpose of this project is to design and develop a machine, which uses human effort as an energy source to take control of their lawn area. It will also help to reduce noise pollution and air pollution. The main advantage of this project is to even unskilled worker can handle this and this project should be held at lower possible prices. Hence thereby it will lead to reduce the daily expenditure of the maintenance and fuel.

Debangshu Kashyap, Urbashia Bordoloi, Amlan Aichoirryya Buragohain In this paper main objectives of author are to design and develop a project for campus cleaning in which they are using green energy to minimize the limitation over the gasoline powered lawn mower. In this project automatic solar powered grass cutter uses high quality crystalline panels with microcontrollers, ultrasonic sensors, grass cutting blades and rechargeable battery with capacity of 12V. and solar panels helps to recharge the batteries. The automatic device consists of solar panels, a 12V battery, DC to DC converter, microcontroller 8051 and IR sensor for obstacles detection. In this project 3 types of motors used for different movements are used in this project. The limitations of this project is to difficult to operate in rainy seasons and time

required is more as compared to traditional solar grass cutter. Conclusion obtained from this project are it is mainly designed for campus cleaning in a sustainable and efficient way. It is time consuming and labor-intensive project. But main purpose is to reduce noise and pollution.

Bidgar Pravin Dilip¹, Nikhil Babu Pagar², Vicky S. Ugale³, Sandip Wani⁴, Prof. Sharmila M.⁵ In this paper, manually handled device is commonly used for cutting the grass over the field which creates pollution and loss of energy. Automatic solar grass cutter will reduce the effort required for cutting grass in the lawns. Also, Solar power will be used to provide the driving force for the cutter and various sensors will be used to detect and avoid the unnecessary objects in the field during operation. It consists of a microcontroller Arduino ATmega328P, IR sensors, LCD Display for better response and understanding to the user. This paper will project the operation and working principle of the Automatic Grass cutter. Also, the design parameters are discussed in this paper.

Ms. Bhagyashri R. Patil, Mr. Sagar S. Patil, Mr. Abhishek U. Ghate In this paper the main objective is to develop a grass cutting machine which is operated on natural source of energy, the reason behind it is constantly increase in cost of fuel. The solar energy is plentifully available in nature. In present the manually handled grass cutter is commonly used. In this paper we try to make automatic grass cutter including obstacle detection unit. Due to the above features the damage to the hardware of the device is avoided. Our main objective is pollution control and the consumption of fuel or non-renewable energy source.

V. CALCULATIONS

Calculations for Rolling Resistance:

Rolling Resistance is the force required to keep the tire rolling.

$$R = W C_{rr}$$

$$R = 14.715$$

$$R = 15N$$

Selection of blade:

$$\text{Volume of blade} = 4.392 \times 10^{-5} \text{ m}^3$$

$$\text{Weight of cutter blade} = 3.924 \text{ N}$$

Min Torque required to rotate blade:

$$T_{br} = W_{br} \cdot r_{blade}$$

$$T_{br} = 0.598 \text{ Nm}$$

Power developed by blade at 'N' rpm (P_{br}):

$$P_{br} = T_{br} \cdot 2\pi N / 60$$

$$P_{br} = 5633.16 / 60$$

$$P_{br} = 93.933 \text{ W}$$

Handle:

Axial stress on handle $S = \text{Input force} / \text{Area of handle}$
 $S = 15 / 7069.5$
 $S = 0.002121 \text{ N/mm}^2$

Sizing of Solar Power System:

- Solar Panel Rated Power = 20 W
- DC Motor Rated Voltage = 24 V, Rated Current = 1.6 A
- DC battery Rated Voltage = 12 V, Ampere hour = 7 Ah
- Solar Panel Efficiency = 18

- DC Motor power = $24 \times 1.6 = 38.4 \text{ W}$
- Output Power of the Solar Panel = $20 \times 0.18 \text{ W} = 3.6 \text{ W}$
- Time required to fully charge the battery
 $= (12 \times 7) / 3.6 \text{ hrs.} = 23 \text{ hrs. (approx.)}$
- Output Power of the DC Battery supplied to the motor
 $= 0.95 \times 12 \times 7 \text{ WH} = 79.8 \text{ WH}$
- Input Power requirement of the DC Motor per day
 $= 38.4 \times 4 \text{ WH} = 153.6 \text{ WH}$
- Number of days the DC Motor can be operated when the Battery is fully charged = $79.8 / 153.6 = 0.6 \approx 14.4 \text{ hours.}$

VI. COMPONENTS

1. SOLAR PANEL

Clean, cheap and abundantly available energy. Here we are using polycrystalline type solar panel. The grass cutter works on the photovoltaic principle. When photons from sun are absorbed in a semiconductor that produces free electrons with higher. These electrons are combining with holes in semiconductor and produces electron hole pairs and hence the external conductor constitutes electrical current.

2. BATTERY

Battery is used to store the solar energy which can be further converted into electrical energy, then mechanical energy. The battery should have a Long life, High reliability and High overall efficiency.

3. DC MOTOR

Dc motor is suitable for such small-scale application and available over varied range.

4. BLADES

The blades should have high mechanical strength and great sharpness. Here we are using linear blades to cut the grass.

5. CASTOR WHEEL

6. FRONT WHEEL

7. SOLAR CONTROLLER

VII. SYSTEM



Fig1: CAD Model 1



Fig2: CAD Model 2

As Static Structural

Equivalent Stress

Type: Equivalent (von-Mises) Stress

Unit: MPa

Time: 1

27-05-2021 20:52

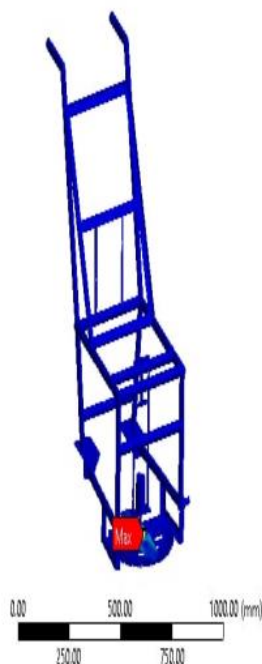
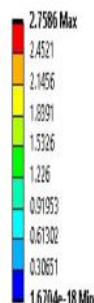


FIG 3 : FEA

VIII. CONCLUSION

The progress in science & technology is a non-stop process. New things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place. The proposed system is found to be more compact, user friendly and less complex, which can readily be used in order to perform several tedious and repetitive tasks.

IX. REFERENCES

- [1] DESIGN OF A FULLY AUTOMATED SOLAR GRASS CUTTER FOR CAMPUS CLEANING, Debangsu Kashyap, Urbashi Bordoloi, Amlan Aoichoirryya Buragohain
- [2] SOLAR BASED GRASS CUTTER Ms. Yogita D. Ambekar1, Mr. Abhishek U. Ghate 2017
- [3] Design and Development of Smart Solar Grass Cutter: Firas B. Ismail, Nizar F.O. Al-Muhsen, Fazreen A. Fuzi, A. Zukipli International Journal of Engineering and Advanced Technology (IJEAT)ISSN: 2249 – 8958, Volume-9, Issue-2, December 2019
- [4] Design and Fabrication of Lawn Mower Asian Journal of Applied Science and Technology (AJAST)Volume 1, Issue 4, Pages 50-54, May 2017
- [5] DESIGN OF A POWER AUTONOMOUS SOLAR POWERED LAWN MOWER International Journal of Mechanical Engineering and Technology (IJMET)Volume 8, Issue 5, May 2017
- [6] Design of an Autonomous Lawn Mower with Optimal Route Planning BingMin Shiu and Chun-Liang Lin

[7] Solar Based Grass Cutter Using Remote Control Technique International Engineering Research Journal (IERJ), Special Issue Page 300-303, 2017 ISSN 2395-1621

[8] www.thespruce.com

[9] www.loomssolar.com

AUTHORS PROFILE



Atharva Avdhut Naik
Final year BE (Mechanical engineering)
1 Copyright.
EX. SEA CADET CORPS



Aditya Divakar Pujari
Final year BE (Mechanical engineering)
1 copyright



Sahil Deepak Nagpure
Final Year BE (Mechanical engineering)
1 Copyright.



Neha Rajaram Shinde
Final Year BE (Mechanical engineering)
1 copyright

Design And Fabrication Of Mecanum Wheel Scissor-Lift

Dipak Bhamare¹, Sanket Jain¹, Raj Patil¹ and Shashank Valapa¹

¹Mechanical Engineering -(BE-B)Pimpri Chinchwad College Of Engineering and Research

ABSTRACT To increase the productivity and to overcome skilled labor shortage, most of the manufacturing industries are going for automation. The main aim for us to select the project work is to acquire practical knowledge in the field of automation using mecanum wheel. We selected " Design and Fabrication of mecanum Wheel Ramp-Lift " as our project work. This report delves into the design and creation of the Multi directional wheels which offers a means to implement Omni-directional translational motion in a vehicle platform. To demonstrate technical contradiction that solve here shows the working of multi-direction ramp lift which is able to move single degree of freedom independently. Lift may be a very simple device used to raise elements or objects or load from ground level to a specific height to perform a particular work with maximum load capacity and minimum efforts of a worker. In this report, it had been tried to think about different research papers containing the research and analysis made on ramp lift evaluated the design and analysis of mecanum wheel Ramp lift.

INDEX TERMS *contradiction, manoeuvres, Mecanum wheel, omni-directional motion, Scissor lift.*

1. INTRODUCTION

One of the common Omni-directional wheel designs Mecanum Wheel. Mecanum wheel was design and invented in Sweden in 1975 by Bengt Ilon, an engineer with Swedish company Mecanum. Mecanum wheel is based on the principle of a central wheel with a number of rollers placed at an angle around the periphery of the wheel.

Compared to conventional vehicles, omnidirectional robotic vehicles possess multiple advantages in terms of their mobility in narrow spaces and crowded environments. They have the ability to easily perform certain tasks in congested environments foreseen with static obstacles, dynamic obstacles or narrow areas. Mecanum omnidirectional vehicles have been widely used in military, storage and transportation, social services, and other fields.

A ramp lift is a sort of platform which will move only vertically. The main aim of the ramp lift was material handling and providing comfort to the operator while performing the operation. The ramp lift was convenient to operate or use and it will be used frequently in industries and other common places. A ramp lift table is used to hold, stack, raise or lower, convey or transfer materials or loads between two or more height.

1.1 Problem Statement:

Inability of available cranes and lifts on shop floor to movement due to the absence of holonomic drive system. This problem with conventional system needs to be overcome to enhance the maneuverability and autonomy.

1.2 Objective:

Technical contradiction that solved here, that make use of multidirectional wheeled ramp lift which has great advantages over conventional platform in term of moving tight areas as it scrub sideways, turn on path and follow complex trajectories. Vehicle are capable of easily performing task in environment with static and dynamic obstacles and narrow space. It run on electrical powertrain to get electrified handling equipment.

1.3 Scope:

Roller of nylon can be used for optimum performance. Shaft alignment. Motor of half hp is to be used. A shock absorbing mechanism to absorb unwanted shocks. If more budget is provided DC Motors can be used thus providing mobility. The design can be made more compact and material made lighter and low frictional contact.

1.4 Methodology:

As our main aim is to achieve multidirectional motion, we need holonomic drive system. One is the omni wheels and other is Mecanum wheels. Mecanum wheels has simple arrangement like a normal vehicle but its complex structure of 45° inclined rollers mounted circumferentially on the wheelhub enables to create force vectors diagonally which creates same effect as the omni wheel's cross configuration.

2. ANALYTICAL WORK

2.1 Analysis of Multi-directional Wheel:

For analysing the wheel, we have to constrain some part of the wheel body. For that purpose, a rectangular surface has been created using Ansys Design Modular. The force is given to the face of the hole considering all the forces are getting concentrated at the center of the Mecanum Wheel. So here the application of the force at the five faces. Meshing of wheel. Element size taken as 10mm. For having the best result, we have to use the finer mesh. For that purpose, we have used body sizing and face meshing method. And resulting mesh is done. After solving the model, the result provided by the Ansys is as shown in

Consider the capacity of the vehicle is 60kg.
So, load on each wheel is $60/4=15\text{kg/wheel}$.
Selection of the mecanum wheel for the capacity of the 15kg/wheel- Easy Mech 100 mm outside diameter wheels with 9 rollers.

Assume for both Mecanum and omni wheel as comparison

$$N = 45 \text{ RPM}$$

$$\omega = \frac{2\pi \cdot 45}{60} = 4.71 \text{ rad/sec}$$

For 100 mm wheel diameter, torque will be

$$T = F \cdot r = \frac{60}{4} \cdot 9.81 \cdot 0.05 = 7.354 \text{ N.m}$$

2.2.1 Kinematic Velocity for Mecanum Wheel:

$$\begin{aligned} V_f &= \omega \cdot r \\ &= 4.71 \cdot 0.05 \\ &= 0.2355 \text{ m/s} \\ V_r &= \omega \cdot r \\ &= 0.2355 \text{ m/s} \\ V_d &= (\omega \cdot r) / \sqrt{2} \\ &= 0.1665 \text{ m/s} \end{aligned}$$

2.2.2 Calculating Forces for Mecanum Wheel:

$$F_f = \frac{2 \cdot T}{r} = \frac{2 \cdot 7.354}{0.05} = 588.32 \text{ N}$$

$$F_r = \frac{2 \cdot 7.354}{0.05} = 588.32 \text{ N}$$

$$F_d = \frac{2 \cdot T \cdot \sqrt{2}}{r} = 416.005 \text{ N}$$

2.2.3 Checking Roller Pin Dimension of Selected Measuring Wheel:

As, the roller which takes all load are mounted on thin roller pins, they can subject to bending.

Diameter of pin (dp) = 6 mm

Length of pin (L) = 45 mm

$$\begin{aligned} \text{Now, Moment (M)} &= W \cdot L = 15 \cdot 9.81 \cdot 45 \\ &= 6621.75 \text{ N-mm} \end{aligned}$$

$$\begin{aligned} \text{Section Modulus (Z)} &= (\pi/32) \cdot (dp)^3 \\ &= (\pi/32) \cdot (6)^3 \\ &= 21.205 \text{ mm}^3 \end{aligned}$$

$$\begin{aligned} \sigma_b \text{ induced} &= M/Z = 6621.75/21.205 \\ &= 312.262 \text{ N-mm}^2 \end{aligned}$$

Therefore, $\sigma_b \text{ induced} < \sigma \text{ permissible}$
Hence design is safe.

2.3 Selection Material Used for Mecanum Wheel Components:

For the 2 vertical plates on which rollers are mounted aluminium alloys are used. Rubber rollers are actually cylindrical tubes that consist of natural or synthetic rubber or rubber bonded to a core. These rollers are fabricated using variety of elastomeric materials such as silicone, EPDM(Ethylene Propylene Diene Monomer), nitrile, polyurethane, neoprene, etc.

Rubber rollers are manufactured with metal cores. Roller cores can be manufactured from material such as Aluminum, Steel, and Stainless Steel. So, in our calculation 45C8 steel is chosen.

SBR (styrene-Butadiene rubber) - Lowest cost and highest volume elastomers available. SBR is tougher and slightly more resistant to heat and flex cracking. Flame resistance is poor. It has temperature range of -65 to 225° F.

Polyurethane - There are two classes- polyester and polyether. It has high tensile strength of 2.8 MPa and is abrasion resistance. Polyester is slightly superior to polyether.

2.3.1 Design Calculation for Motor Shaft:

The material 45C8 represents 45/100% carbon and 8/10% manganese chemical composition in the base metal of iron.

As the material used for shaft is C45(BTS) or 1045 (AISI) and 45C8 (BIS)

Tensile Strength = 600 – 750 mpa.

Take, $Fos = 1.5$

$$\text{So, } \sigma_t = \sigma_b = 650/1.5 = 433.33 \text{ mpa}$$

By maximum shear stress theory,

$$\tau_{\max} = \frac{0.5 \times 650}{1.5} = 216.666 \text{ mpa} = 217 \text{ mpa}$$

2.3.2 Selection of Motor For Required Capacity:

We know that,

$$\text{Torque}(T) = 7.354 \text{ N.m} = 74.964 \text{ Kg.cm}$$

As the required rpm,

Let, $N = 45 \text{ rpm}$

Calculate Power,

$$P = \frac{2 \pi N T}{60} = 34.654 \text{ watt}$$

2.3.3 Motor Shaft diameter Calculation:

Checking failure criteria for motor shaft,

We know that,

$$\begin{aligned} \text{Torque}(T) &= 15 \times 9.81 \times 50 \\ &= 7357.5 \text{ N-mm} \end{aligned}$$

Calculating bending moment on shaft:

$$\begin{aligned} M &= W \times L \\ &= 15 \times 9.81 \times 25 \\ &= 3678.78 \text{ N-mm} \end{aligned}$$

As the motor shaft is experiencing both twisting moment(T) and bending moment(M)

So, take equivalent twisting moment.

$$\begin{aligned} T_e &= \sqrt{(M)^2 + (T)^2} \\ &= \sqrt{(3678.75)^2 + (7357.5)^2} \\ &= 8225.935 \text{ N-mm} \end{aligned}$$

We know that,

$$\begin{aligned} \tau_{\max} &= (16 \times T_e) / \pi(d)^3 \\ 217 &= (16 \times 8225.935) / \pi(d)^3 \\ (d)^3 &= (16 \times 8225.935) / 217 \times \pi \end{aligned}$$

$$d = 5.779 \text{ mm},$$

So, design (diameter) is safe.

2.4 Hub Design:

Material of the hub is same as the material used for shaft (Mild Steel)

$$\begin{aligned} T_{\max} &= (\pi/16) \times \tau(d)^3 \\ &= (\pi/16) \times 217 \times (8)^3 \\ &= 21.8152 \text{ N.mm} \end{aligned}$$

$$T_{\max} = (\pi/16) \times \tau \times \left[\frac{D^4 - d^4}{D} \right]$$

$$21.852 \times 10^3 = (\pi/16) \times 217 \times \left[\frac{D^4 - 8^4}{D} \right]$$

$$D = 9.765 \text{ mm}$$

Take, D as twice diameter of d

Therefore,

$$D = 2 \times 8 = 16 \text{ mm}$$

2.5 Chassis Design:

Load on the chassis is taken as the recommended capacity of the Mecanum wheel.

$$P = 125 \text{ N}$$

$$\Sigma F_x = 0$$

$$R_a + R_b - P - P = 0$$

$$R_a + R_b = 2P = 250 \text{ N} \dots \dots \dots (1)$$

$$\Sigma M_c = 0$$

$$(R_a \times 0.1) + (R_b \times 0.9) - (P \times 1) = 0$$

$$(R_a \times 0.1) + (250 - R_a) \times 0.9 = 125 \text{ N}$$

$$R_a = 125 \text{ N and } R_b = 125 \text{ N}$$

$$\text{S.F at AL} = -125 \text{ N}$$

$$\text{S.F at AR} = 0 \text{ N}$$

$$\text{S.F at BL} = 0 \text{ N}$$

$$\text{S.F at BR} = 125 \text{ N}$$

$$\text{S.F at DL} = 125 \text{ N}$$

$$\text{S.F at DR} = 0 \text{ N}$$

As we choose the Aluminium box section for chassis because of lesser weight and better properties. In manufacturer's catalogue they are available according to the thickness and area of c/s.

Bending Moment:

$$\text{B.M at C} = 0 \text{ N.m}$$

$$\text{B.M at A} = -125 \times 0.1 = -12.5 \text{ N.m}$$

$$\text{B.M at B} = -12.5 \text{ N.m}$$

$$\text{B.M at D} = 0 \text{ N.m}$$

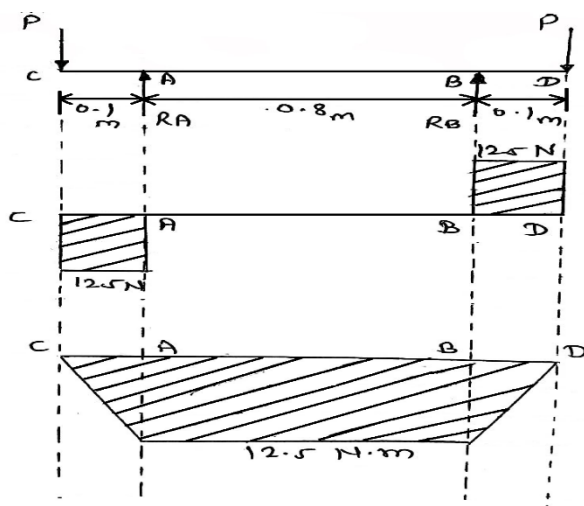


Figure - SFD and BMD of Chassis

Shear Forces:

$$\text{S.F at CL} = 0 \text{ N}$$

$$\text{S.F at CR} = -125 \text{ N}$$

$$I = \frac{BH^3}{12} - \frac{bh^3}{12} = \frac{H^4 - h^4}{12} = \frac{H^4 - (H-4)^4}{12}$$

$$\text{And } y = \frac{H}{2}$$

Now,

$$\frac{12.5 \times 10^3}{\frac{H^4 - (H-4)^4}{12}} = \frac{110}{\frac{H}{2}}$$

$$\frac{H^4 - (H-4)^4}{12} = \frac{12.5 \times 10^3}{110 \times 2}$$

$$H = 9.113 \text{ mm and } h = 5.113 \text{ mm}$$

Therefore,

$$\begin{aligned} \text{area of c/s section} &= H^2 - h^2 \\ &= (9.113)^2 - (5.113)^4 \\ &= 56.904 \end{aligned}$$

2.6 Design of Ramp Lift:

Further design of the ramp-lift is based on the below figure. All the calculations are done by considering the geometry of this model.



Figure no. 3.6.1 Ramp Lift

$$W = 50 \text{ kg, } W_{\text{legs}} = 10 \text{ kg}$$

$$C_y = W + W_{\text{legs}}/2$$

$$D_y = W + W_{\text{legs}}/2$$

$$\sin(\beta) = P_y / P; \cos(\beta)$$

$$\cos(\beta) = P_x / P$$

$$P_y = P \sin(\beta) \text{ \& } P_x = P \cos(\beta)$$

Lower Position

$$\cos(\alpha) = L_x / L, \sin(\alpha) = L_y / L$$

$$L_x = L \cos(\alpha); L_y = L \sin(\alpha)$$

here, $F_y = P_y$ need to be proved

We know that, $F_x = P_x; F_x = P \cos(\alpha)$

Static Condition

$$\sum F_{ox} = 0$$

$$= P_x - F_x$$

$$P_x = F_x$$

Now,

$$\sum M_c = 0;$$

$$0 = W/2 L \cos \alpha + P \sin \beta L/2 \cos \alpha + W_{\text{legs}}/2 * L \cos \alpha + P \cos \beta * L/2 \sin \alpha - P \cos \beta (a + L/2) \sin \alpha - P \sin \beta (a + L/2) \cos \alpha$$

$$0 = L/2 \cos \alpha [W + W_{\text{legs}}/2 - P \sin \beta + P \sin \beta] - a P \sin \beta \cos \alpha + L/2 \sin \alpha [P \cos \beta - P \cos \beta] - a P \cos \beta \sin \alpha$$

$$0 = WL/2 \cos \alpha + W_{\text{legs}}/2 * L \cos \alpha - a P (\sin \beta \cos \alpha + \cos \beta \sin \alpha)$$

$$0 = L \cos \alpha (W/2 + W_{\text{legs}}/4) - a P \sin (\beta + \alpha)$$

$$P = L \cos \alpha (W/2 + W_{\text{legs}}/4) / a \sin (\alpha + \beta)$$

for easier calculations take $AC = 1000 \text{ mm}$

Here, $a = 188.44 \text{ mm}$

$$\alpha = 5; \beta = 13$$

$$P = 1 * \cos (5) (50 * 9.81 / 2 + 10 * 9.81 / 4) / 0.88 * \sin$$

$$(5+13)$$

$$P = 4626 \text{ N.}$$

Where, $\alpha = 66^\circ, \beta = 72^\circ$

Now,

$$\sum F_y = 0 \text{ (downward positive)}$$

$$0 = W + \frac{W_{\text{legs}}}{2} + C_y - D_y \text{----- (1)}$$

$$\sum M_c = 0 \text{ (clockwise positive)}$$

$$0 = (W \times d) + W_{\text{legs}} \times \frac{AB}{2} - D_y \times AB \text{----- (2)}$$

$$D_y = \frac{W \times d + W_{\text{legs}} \times \frac{AB}{2}}{AB}$$

$$D_y = \frac{W \times d}{AB} + \frac{W_{\text{legs}}}{2}$$

$$D_y = (1.228 \times W) + (0.5 \times W_{\text{legs}})$$

Put this in equation (1)

$$0 = W + W_{\text{legs}} + (C_y - 1.23 \times W) - (0.5 \times W_{\text{legs}})$$

$$C_y = (0.23 \times W) - (0.5 \times W_{\text{legs}})$$

Here,

$$\sum F_x = 0,$$

$$0 = P_x - F_x$$

$$\therefore P_x = F_x$$

$$\therefore F_x = P \cos(\beta)$$

$$\sum F_y = 0, \text{ (downward positive)}$$

$$D_y + F_y + W_{\text{legs}} + C_y - P_y = 0$$

$$\therefore F_y = P \sin(\beta) - (1.23 \times W) - (0.5 \times W_{\text{legs}}) - \frac{W_{\text{legs}}}{2} - (0.23 \times W) + \frac{W_{\text{legs}}}{2}$$

$$\therefore F_y = P \sin(\beta) - (1.46 \times W) - (0.5 \times W_{\text{legs}})$$

Now,

$$\sum M_c = 0 \text{ (anticlockwise positive)}$$

$$0 = (D_y \times AB) + F_y \times \frac{AB}{2} + \frac{W_{\text{legs}}}{2} \times \frac{AB}{2} + (F_x \times \frac{L}{2} \sin(\alpha)) - (P_y \times \frac{L}{2} \cos(\alpha)) + a \cos(\alpha) - (P_x \times \frac{L}{2} \sin(\alpha)) + a \sin(\alpha)$$

$$0 = ((1.23 \times W) + (0.5 \times W_{\text{legs}})) \times L \cos(\alpha) + (P \cos(\beta) - (1.46 \times W) - (0.5 \times W_{\text{legs}})) \times \frac{L}{2} \cos(\alpha) + \frac{W_{\text{legs}}}{2} \times \frac{L}{2} \cos(\alpha) + P \cos(\beta) \frac{L}{2} \sin(\alpha) - P \sin(\beta) \times \left(\frac{L}{2} + a \right) \cos(\alpha) - P \cos(\beta) \left(\frac{L}{2} + a \right) \sin(\alpha)$$

$$0 = (1.23 \times W \times L \times \cos(\alpha)) + (0.5 \times W_{\text{legs}} \times L \times \cos(\alpha)) + P \sin(\beta) \frac{L}{2} \cos(\alpha) - (1.46 \times W \times \cos(\alpha)) - (0.5 \times W_{\text{legs}} \times \frac{L}{2} \cos(\alpha)) + \frac{W_{\text{legs}}}{2} \times \frac{L}{2} \times \cos(\alpha) + P \cos(\beta) \times \frac{L}{2} \cos(\alpha) - P \sin(\beta) \times \frac{L}{2} \times \cos(\alpha) - P \sin(\beta) \times a \times \cos(\alpha) - P \cos(\beta) \times \frac{L}{2} \times \sin(\alpha) - P \cos(\beta) \times a \times \sin(\alpha)$$

$$0 = ((0.5 \times W_{\text{legs}}) + (0.5 \times W)) \times L \cos(\alpha) - P \times a \times (\sin(\beta) \cos(\alpha) + \cos(\beta) \sin(\alpha))$$

$$0 = ((0.5 \times W_{\text{legs}}) + (0.5 \times W)) \times L \times \cos(\alpha) - P \times a \times \sin(\beta + \alpha)$$

$$P = \frac{\left(\frac{W_{\text{legs}}}{2} + \frac{W}{2}\right) \times L \cos(\alpha)}{a \times \sin(\alpha + \beta)}$$

$$P = \frac{\left(\frac{9.81 \times 10}{2} + \frac{50 \times 9.81}{2}\right) \times 1 \times \cos(66^\circ)}{0.188 \times \sin(72^\circ + 66^\circ)}$$

$$P = 951.557 \text{ N}$$

From above calculation we find 'p' for both position but as $P_x = F_x$ & $P_y = F_y$, $P = F$. This means there is no resultant force. Cause P & F are like counter force. So, to find stress it is necessary to find normal & shear forces. For that all forces must be project parallel to axis of legs.

2.6.1 Lower Position

$$C_y = D_y = W + W_{\text{legs}} / 2$$

$$= (50 + 10) / 2 + 9.81$$

$$= 294.3 \text{ N}$$

Therefore,

$$C_{y_y} = C_y \times \sin(85^\circ)$$

$$= 294.3 \times \sin(85^\circ)$$

$$= 293.18 \text{ N}$$

$$C_{y_x} = C_y \times \cos(85^\circ)$$

$$= 294.3 \times \cos(85^\circ)$$

$$= 25.64 \text{ N}$$

2.6.2 Higher Position

$$P_x' = P \times \cos(18^\circ) = 4626 \times \cos(18^\circ) = 4399.587 \text{ N}$$

$$P_y' = P \times \sin(18^\circ) = 4626 \times \sin(18^\circ) = 1429.51 \text{ N}$$

$$W_x / 2 = W / 2 \times \cos(85^\circ) = ((50 \times 9.81) / 2) \times \cos(85^\circ) = 21.375 \text{ N}$$

$$W_y / 2 = W / 2 \times \sin(85^\circ) = ((50 \times 9.81) / 2) \times \sin(85^\circ) = 244.316 \text{ N}$$

$$W_{\text{legs}_x} / 2 = W_{\text{legs}} / 2 \times \cos(85^\circ) = ((10 \times 9.81) / 2) \times \cos(85^\circ) = 4.275 \text{ N}$$

$$W_{\text{legs}_y} / 2 = W_{\text{legs}} / 2 \times \sin(85^\circ) = ((10 \times 9.81) / 2) \times \sin(85^\circ) = 48.863 \text{ N}$$

For another leg reaction forces at D & B are same as at A & C.

So, only calculate components of 'P' & 'F'.

Therefore,

$$P_y'' = P \times \sin(8^\circ) = 4626 \times \sin(8^\circ) = 643.81 \text{ N}$$

$$\& P_y'' = F_y''$$

$$P_x'' = P \times \cos(8^\circ) = 4626 \times \cos(8^\circ) = 4580.98 \text{ N}$$

$$\& P_x'' = F_x''$$

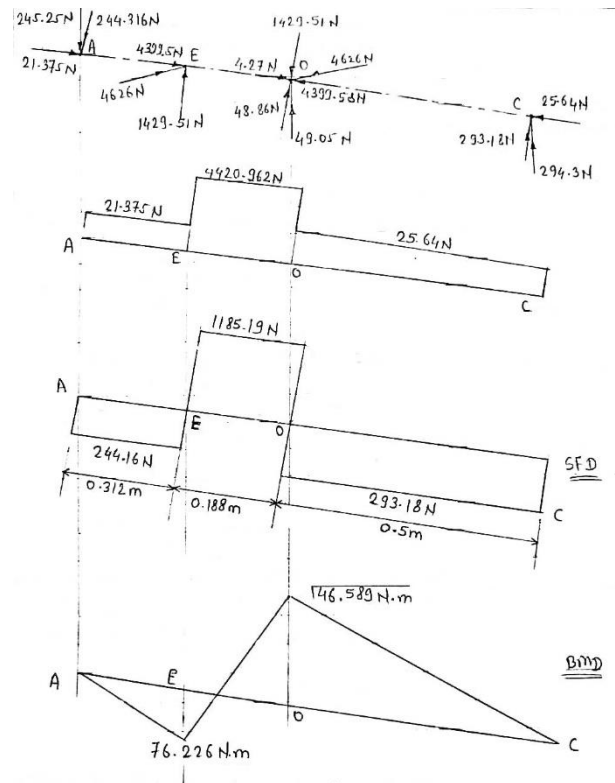


Figure – SFD & BMD of ramp lift

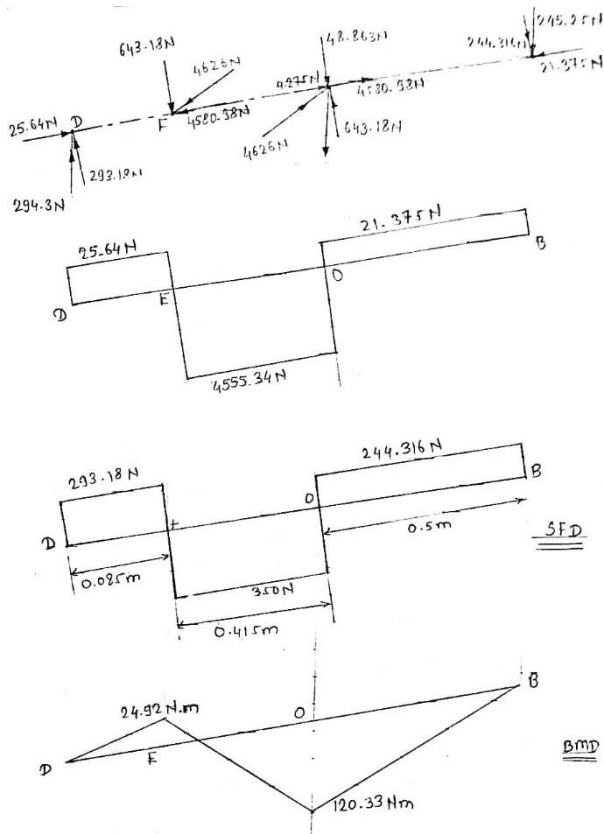


Figure - SFD and BMD of Ramp-lift

$$\begin{aligned}\text{Moment at point E} &= (-244.16 \times 0.312) \\ &= -76.226 \text{ N.m}\end{aligned}$$

$$\begin{aligned}\text{Moment at point O} &= (-24.16 \times 0.5) + (1429.51 \times 0.188) \\ &= 146.589 \text{ N.m}\end{aligned}$$

$$\begin{aligned}\text{Moment at point F} &= 293.18 \times 0.085 \\ &= 24.92 \text{ N.m}\end{aligned}$$

$$\begin{aligned}\text{Moment at point O} &= (293.18 \times 0.5) - (643.18 \times 0.415) \\ &= 120.33 \text{ N.m}\end{aligned}$$

2.6.3 Calculating Stress:

Factor of safety is taken as 3 by safety standard from ANSI MH29-1

Material used 6061, $\sigma_t = 290 \text{ Mpa}$

$$\sigma_{\text{allowable}} = 290/3 = 96.33 \text{ Mpa}$$

$$\tau_{\text{allowable}} = 0.58 * \sigma_{\text{allowable}}$$

At point E,

1) Normal stress,

$$\sigma_n = F/2A$$

$$96.66 = 4420.962/2A$$

$$A = 22.868 \text{ mm}^2$$

2) Shear stress,

$$\tau = F/2A$$

$$56.063 = 1185.19/2A$$

$$A = 10.57 \text{ mm}^2$$

At point F,

1) Normal stress,

$$\sigma_n = F/2A$$

$$96.66 = 4555.34/2A$$

$$A = 23.56 \text{ mm}^2$$

2) Shear stress,

$$\tau = F/2A$$

$$56.063 = 350/2A$$

$$A = 3.12 \text{ mm}^2$$

2.6.4 Vertical position

$$D_y = 1.228W + W_{\text{legs}}/2$$

$$= (1.228*50*9.81) + (10*9.81)/2$$

$$= \mathbf{61.096 \text{ N}}$$

$$P_x = P.\cos(y) = 951.557 * \cos(72)$$

$$P_x = F_x = \mathbf{294.047 \text{ N}}$$

$$P_y = P.\sin(y) = 951.557 * \sin(72)$$

$$F_y = P.\sin(y) - 1.46W - 0.5W_{\text{legs}}$$

$$= 951.557*\sin(72) - (1.46*50*9.81) - (0.5*10*9.81)$$

$$F_y = \mathbf{139.804 \text{ N}}$$

$$C_y = 0.23W - 0.5W_{legs} = (0.23 \times 50 \times 9.81) - (0.5 \times 10 \times 9.81)$$

As the forces induced in vertical or highest position are much lower as compared to lowest position, so, design the scissor lift for the lowest position. If we take maximum area from the lower position's stress calculation results it will not fail in any criteria.

$$A = 23.56 \text{ mm}^2$$

Let's, consider plate thickness as 2 mm

the cross-section $A = B \times H$

$$23.56 = 2 \times H$$

Therefore,

$$H = 11.78 \approx \mathbf{12 \text{ mm}}$$

At point 'O' there is a pin so design the key with bearing pressure take pin material same as before (Al 6061)

$$\sigma = 96.66 \text{ Mpa} = \text{Force/Projected Area}$$

$$\text{Force} = W_{legs}/2 + F_y$$

$$= (10 \times 9.81)/2 + 4626 \times \sin(13)$$

$$= \mathbf{1089.673 \text{ N}}$$

Now,

$$\sigma = 96.66 = 1089.6673 / (2 \times 4 \times d_{min})$$

therefore,

$$\mathbf{d_{min} = 0.7096 \text{ mm}}$$

3. SIMULATION

In this chapter we will check whether all the designed components are satisfactory or not, using simulation and Analysis software ANSYS. Before analysis the CAD model of components are made using CAD software CATIA V5. And converted into .igs format required by the ANSYS software. We virtually check the designed system. CAD model of following components were made and checked in simulation software.

- Mecanum Wheel
- Ramp lift

3.1 Analysis of Mecanum Wheel

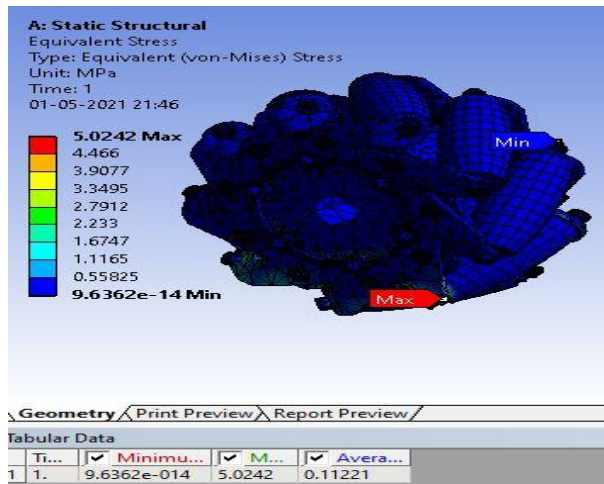


Figure - Equivalent Stress on Mecanum Wheel

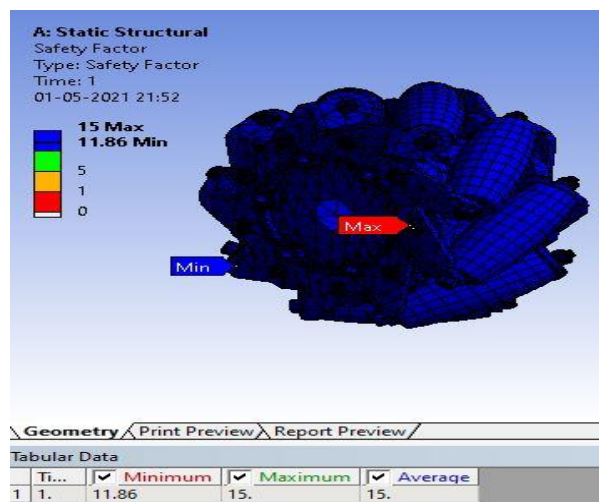


Figure - Wheel Safety Factor

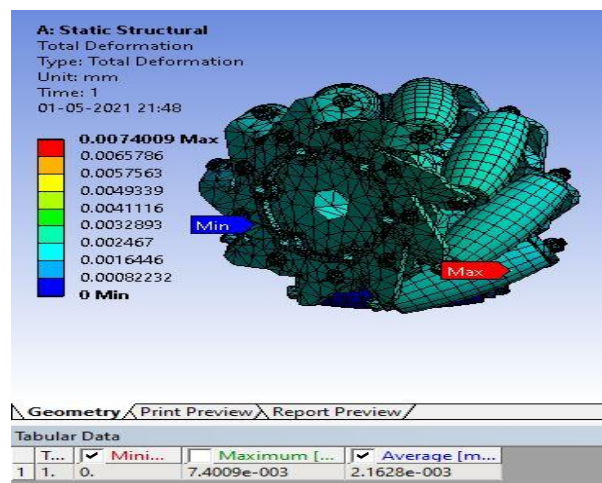


Figure -Total Deformation of Wheel

3.2 Analysis of Ramp Lift:

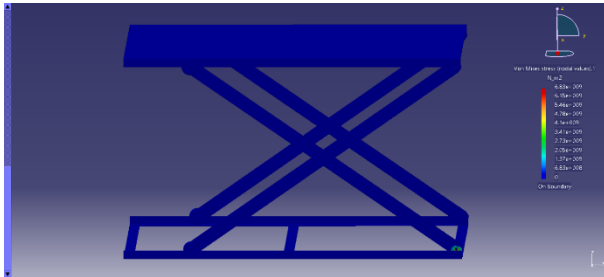


Figure - Scissor Lift Stress Analysis

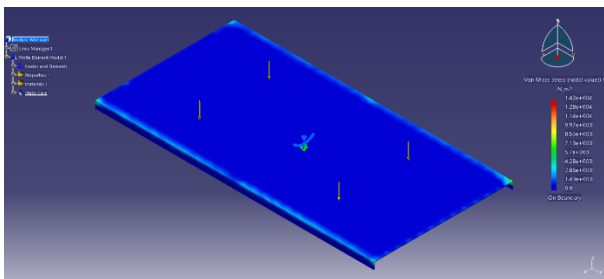


Figure - Scissor Lift Top Analysis

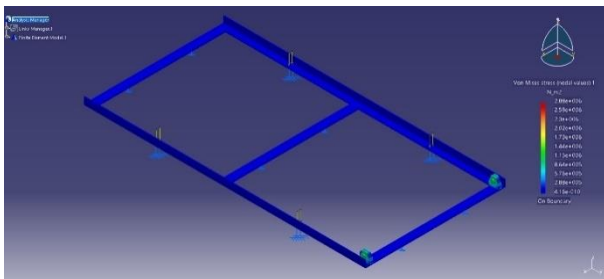


Figure- Scissor Lift Chassis Analysis

4. FINAL PROJECT MODEL



5.CONCLUDING REMARKS AND SCOPE FOR THE FUTURE WORK

The main goal of project was to develop a robust system for the movement of the vehicle that ensures a reliable movement in the required directions. This project reviewed study on multi-directional wheel and design and fabricate scissor lift with multi-directional wheels. it also ensured that the loader of required capacity would capable to lift up & lower the scissor lift. Design of wheel and roller, control system design, and experimental performance evaluation were tested. Also, proper selection of mechanism for Ramp lift leads to carry maximum weight for given power source.

Here DC Lead Ion batteries are used that make use of electric energy which makes project go green and also model is portable that can be used in our small scales industry, in college workshop and also in many shop stores in small scale application.

Overall view over project shows that successfully achieved the objective of project such that fabrication of low cost loader vehicle model. With the help of proper selection of material for roller and scissor lift which has sufficient strength to carry required forces as well as reduce weight. The simulation results can be used to predict the performance of the mecanum wheel base scissor lift and evaluate the design rationality, and design quality can be improved according to the exposed problem.

6. REFERACNES:

Reference Books:

V.B. Bhandari, Design and Data Book

Papers from Journal or Transactions:

- [1] Yunwang Li, Sumei Dai, Yuwei Zheng, et al, 30 June, 2017, Modeling and kinematics of simulation of a Mecanum wheel platform in recur dyn.
- [2] Shruti Deepak Kamdar, May 2015, Design and manufacturing of a Mecanum wheel for the magnetic climbing robot.
- [3] Georgy Olenin, 2016, Design of hydraulic scissors lifting platform.
- [4] Shigenori Sano, Carlos ErlanOlival Lima April 2019, Design and Analysis of a New Type of Mecanum Wheel.
- [5] Suhas B. Bhalake, Amit Gade, Akanksha Sonawale, Nilesh Bhapkar, Rishikesh Dhamane, Aug 2020, Review on Hydraulic Scissor Lift.
- [6] Doli Rani, Nitin Agarwal August 2015, Design and Fabrication of Hydraulic Scissor Lift pp. 81-87
- [7] Kiran Kumar N A, Vijay M Patil, Santosh Kunnur, Design and Fabrication of Improved Mecanum Wheel by Drag Reduction Method

Design and Optimization of 25- ton C-frame Hydraulic Press

Pushpak K. Bhirud¹, Shashikant P. Kokare¹, Hasina R. mangalekar¹, and Hemanshu A. Patil¹.

¹Pimpri Chinchwad College of Engineering and Research, Ravet, Pune University, 412101

This work was supported in part by the N B Technologies, Chinchwad MIDC, 411019.

ABSTRACT A hydraulic press is a machine using a hydraulic cylinder to generate a compressive force. Frame, hydraulic cylinder and press table are the main components of the hydraulic press. In this project press frame, cylinder and press table are designed by the design procedure. They are analyzed to improve their performance and quality for press working operation. Using the optimum resources possible in designing the hydraulic press components can effect reduction in the cost by optimizing the weight of material utilized for building the structure. An attempt has been made in this direction to reduce the volume of material. So in this paper we consider an industrial application project consisting of mass minimization of C frame type hydraulic press. This press has to compensate the forces acting on the working plates and has to fulfill certain critical constraints. Here we use FEA implementation for analysis and optimization of hydraulic press.

INDEX TERMS ANSYS, FEA, Frame Structure, Hydraulic press, Optimization, Stress Analysis.

I. INTRODUCTION

This paper describes design and optimization of multi-purpose C-frame hydraulic press. For mass minimization, we use standard steel sections instead of plates. Due to this, the fabrication of hydraulic press frame also becomes simple. ANSYS has been used for the analysis; the main aim is to reduce the weight of the hydraulic press without compromising on the quality of the output. This particular press is used for a variety of tasks from doing mechanical work to straightening or intentionally bending structural components. It is also used to take force related measurements such as spring rates of coil and leaf springs.

II. OBJECTIVES

- To optimize geometric structure of columns, frame and other components of 25-ton hydraulic press machine.
- To reduce the unwanted stresses causing failure of frame and other components. To reduce the cost and improve the safety.
- Using the optimum resources possible in designing the hydraulic press components can effect reduction in the cost by optimizing the weight of material utilized for building the structure
- Using the optimum resources possible in designing the hydraulic press components can effect reduction in the cost by optimizing the weight of material utilized for building the structure. An attempt has been made in this direction to reduce the volume of material, cost of the press.
- To study the designs of existing 25-ton hydraulic press in geometric modelling software.
- To carry out analysis of existing 25-ton hydraulic press in finite element analysis software
- To analyse the problems, present in existing press.
- To design the critical components of the hydraulic press using geometric modelling software
- To analyse and optimize the critical areas of 25-ton hydraulic press.
- To finalize the design of 25-ton hydraulic press

III. PROBLEM STATEMENT

To design & optimize 25-ton hydraulic press by using suitable geometric modelling software followed by detailed analysis and optimization of its critical components and thereby reducing the manufacturing cost of hydraulic press

IV. LITERATURE REVIEW

Asim M. Kamate, Prof.(dr.) J.S. Bagi. - In this Paper attempt has been made to analyze and optimize the existing press by using Finite Element Software. In the present review paper an effort is made to study the previous investigations that have been made in the different structural analysis and optimization techniques of hydraulic press. Metal forming is one of the manufacturing processes mainly done on hydraulic press.

Deepak Annasaheb More, N.K. Chhapkhane, Ravindra Kolhe - In this work, the theoretical and analytical study has been carried out on the welded structure of a hydraulic press machine of a 200 KN nominal operational load. The theoretically predicted results and those obtained by analytical software have been compared with the design goal of the press structure.

Mr. K. Shravan Kumar, B. Prashant -It is a multi-purpose machine as it can be used for performing different tasks. By changing the die different operation like bending, blanking etc. can be performed on a hydraulic press machine. It is a multi-purpose machine as it can be used for performing different tasks. By changing the die different operation like bending, blanking etc. can be performed on a hydraulic press machine.

Mehmet Aydın, YasinKisioglu - Available literature shows that a few studies have been carried out to analyze hydraulic presses and their structural bodies under different loading conditions. In this study, a suitable hydraulic press having four-column is designed and the stress distribution is calculated using both analytical and finite element methods under different loading conditions.

Umesh S Badakundri, Santosh Kullur, Prof. A.A. Kulkarni - The main aim of this study is to reduce the cost of the Hydraulic presses without compromising on the output quality. By using prime resources in designing hydraulic press can influence cost reduction factor of hydraulic presses. The project needs reduction in thickness of the hydraulic press frame. The thickness of the frame is 5.4mm. they have analyzed that whether it is possible to reduce the thickness of the frame or not.

V. CALCULATIONS

- Press Capacity: 25 Ton.
- Stroke length: 360 mm.
- Work Table Dimensions: 500 mm x 500 mm.
- Pump Specifications:

Forward Stroke:

- Speed = 1cm/s
- LPM = 9.24
- Power = 3.7 KW
- Pressure = 200-210 Kg/cm²

Return Stroke:

- Speed = 8.2 cm/s
- LPM = 37.1
- Power = 2.9 KW
- Pressure = 40 Kg/cm²

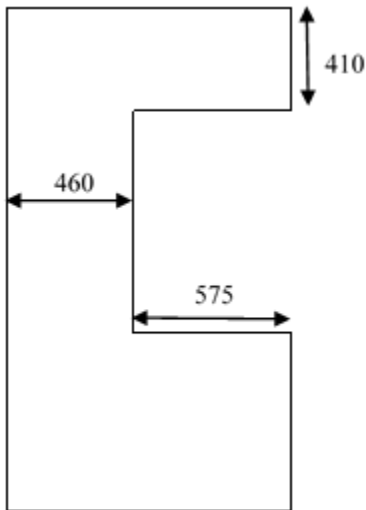
Press Capacity: - 25T

Force = 25 * 103 * 9.81 = 245250 N

Force on each plate = 245250/2 = 122625 N

$\sigma_{\text{allowable}} = \text{SYT} / \text{FOS} = 370/2.5 = 148 \text{ Mpa}$

Thickness of Plate:



Plates are subjected to direct loading and bending, Therefore,

$$\sigma_{\text{allowable}} = \sigma_{\text{direct}} + \sigma_{\text{bending}}$$

$$148 = \frac{F}{A} + \frac{MY}{I} \text{ Mpa}$$

$$\frac{122625}{460 \cdot t} + \frac{122625 \cdot (287.5 + 230) \cdot 230}{\frac{t \cdot 460^3}{12}} \text{ Mpa}$$

$$t = 13.95 \cong 16 \text{ mm.}$$

FOS as per 16 mm thickness:

$$370 = \frac{122625}{460 \cdot 16} + \frac{122625 \cdot (287.5 + 230) \cdot 230}{\frac{16 \cdot 460^3}{12}} \cdot \text{FOS}$$

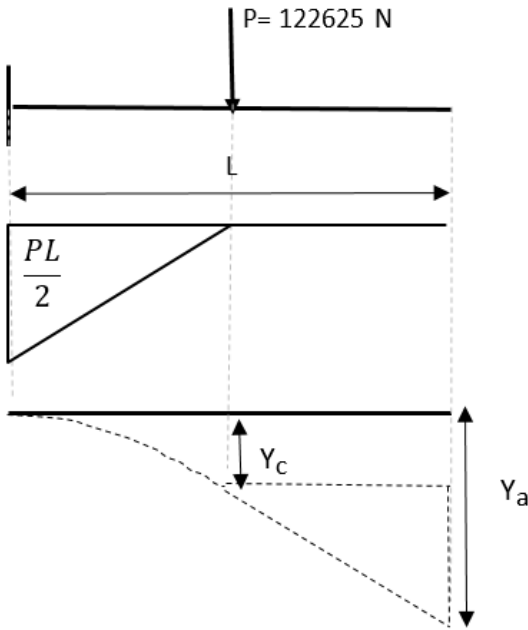
$$\text{FOS} = 3.14$$

Deflection of Beam:

Slope = Area of $\frac{M}{EI}$ Diagram

$$\theta_c = \frac{1}{2} \cdot \frac{PL}{2} \cdot \frac{L}{2} \cdot \frac{1}{EI}$$

$$\theta_c = \frac{PL^2}{8EI}$$



Moment of Inertia is given by;

$$I = \frac{12 * 410^3}{12}$$

$$= 68.921 * 10^6 \text{ mm}^4$$

$$Y_a = \frac{\theta_c * L}{2} + Y_c \quad Y_c = \frac{PL^3}{24EI}$$

$$Y_a = \frac{PL^3}{16EI} + \frac{PL^3}{24EI} = \frac{40PL^3}{384EI}$$

$$Y_a = \frac{40 * 112625 * 575^3}{384 * 210 * 10^3 * 68.921 * 10^6}$$

$$Y_a = 0.125 \text{ mm.}$$

Cylinder Bore Diameter

Considering FOS 2.5 for cylinder design

$$= \frac{310}{2.5} = 124 \text{ MPa}$$

for internal dia. of Cylinder

$$\text{Pressure} = \frac{F}{A} \quad \text{Designing for 18 bar}$$

$$18 = \frac{245250}{\frac{\pi}{4} di^2} = di = 131.17 \text{ mm} \cong 140 \text{ mm.}$$

Thickness of Cylinder Wall

For Thickness, using Clavarino's and birnie's Equation for Thick Cylinders = $\frac{di}{t} \leq 20$

$$t = \frac{D_i}{2} * \left[\sqrt{\frac{\sigma + ((1 - \mu) * P_i)}{\sigma - ((1 + \mu) * P_i)}} - 1 \right] \quad (\mu = 0.29 \text{ for st} - 52)$$

t

$$= \frac{140}{2} * \left[\sqrt{\frac{124 + ((1 - 0.29) * 18)}{124 - ((1 + 0.29) * 18)}} - 1 \right] t$$

$$= 11.54 \text{ mm. } \cong 14 \text{ mm}$$

$$d_o = (2 * t) + d_i = (2 * 14) + 140$$

$$d_o = 168 \text{ mm}$$

Sr. No.	Type	Existing Structure	Optimized Structure
1	Total deformation (mm)	2.136	2.5806

Piston

Assumptions made

- 1) Bar is straight and homogenous material.
- 2) Rod is continuous and no abrupt changes occur.
- 3) Line of force acting coincides with the axis of ram/rod.

Piston design:

For Piston head,

Diameter of piston head = Bore diameter = **140 mm**

$$\text{Load on piston head} = \text{pressure} * \text{Area} = 18 * \frac{\pi}{4} * d_i^2 = 18 * \frac{\pi}{4} * 140^2$$

$$= 277088.5 \text{ N}$$

$$\text{Stress induced in rod} = \frac{F}{A} \text{ where stress} = \frac{\text{Tensile stress}}{FOS} \quad \text{Assuming FOS} = 4$$

$$\sigma_t = \frac{550}{4} = 137.5 \text{ MPa}$$

$$\text{Hence, } 137.5 = \frac{277088.5}{\frac{\pi}{4} * d_p^2} d_p = 50.65 \text{ mm} < 100 \text{ mm} \dots \dots \dots \text{safe}$$

Piston Diameter selected 100 mm from standard cylinder catalogue ISO 6022.

Deformation in Piston Rod

$$\text{Deformation in Piston} = \frac{P * L}{A * E} \quad p = \frac{\pi}{4} * 140^2 * 18 = 277088.472 \text{ N}$$

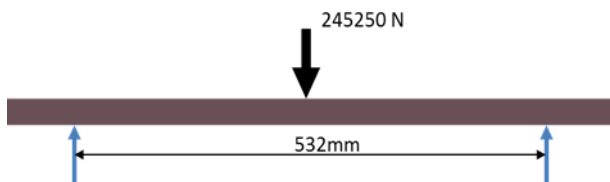
$$= \frac{277088.472 * 642.5}{\pi * 50^2 * 190 * 10^3} = 0.1193 \text{ mm}$$

Deformation = 0.1193 mm

Checking Piston Against Buckling:

$$\text{Buckling load} = \frac{\pi^2 EI}{L_e^2} = \frac{\pi^2 * 190 * 10^3 * \frac{\pi}{64} * 100^4}{(0.707 * 642.5)^2}$$

$$= 46.61 \text{ MN} \gg 0.245 \text{ MN} \dots \dots \dots (\text{Piston will not Buckle})$$



$$\frac{MY}{I} = \sigma_b \quad M = \frac{W * L}{4} = \frac{245250 * 532}{4} = 32.618 * 10^6 \text{ Nmm}$$

$$I = \frac{570 * 40^3}{12} = 3.04 * 10^6 \text{ mm}^4$$

$$\sigma_b = \frac{32.618 * 10^6 * 20}{3.04 * 10^6} = 214.6 \text{ MPa}$$

According to maximum principle stress theory

$$= \sigma_{allowable} = 440 \text{ MPa} \quad \sigma_b < \sigma_{allowable} \dots \dots \dots \text{Hence plate is safe.}$$

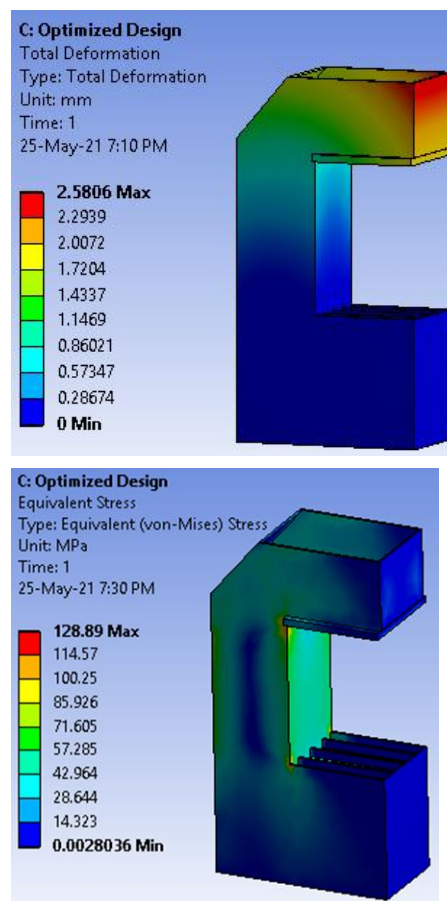
VI. FEA OF STRUCTURE

ANSYS is the mathematical solution software used to present the static condition analysis. The input loading conditions that can be given in a static condition analysis are moment; force and pressure the output of this analysis are displacement, stress and strain. A static structural analyses is used for determine the result of steady loading conditions by ignore the effects of the inertia and the damping.

2	Equivalent Strain (mm/mm)	von-mises	0.000652	0.000966
3	Maximum Shear Strain (mm/mm)		0.000734	0.000831
4	Equivalent von-mises Stress (MPa)		99.909	128.89
5	Maximum Principle Stress (MPa)		131.32	185.18
6	Maximum Shear Stress (MPa)		56.46	74.37

Stresses Generated and Deformation of Mainframe:

Stress of 128.89 MPa is generated in the Frame due to applied load as shown in figure 10. Total deformation of 2.5806 mm is found due to the applied load on the assembly as shown in the figure 11



Weight Comparison:

Total weight before optimization
Main frame Weight= 442 kg
Miscellaneous plate weight = 230 kg
Total = 672 kg

Total weight after optimization
Main frame Weight= 344 kg
Miscellaneous plate weight = 153 kg

Total = 497 kg

Total weight reduction of hydraulic press
 = 672 – 497
 = **175 kg**

Cost Comparison:

Total cost before optimization
 Material cost per kg = Rs.45
 Fabrication cost per kg = Rs.32
 Material cost for 672 kg = Rs.30240
 Fabrication cost for 672 kg = Rs.21504
Total = Rs.51744

Total cost after optimization
 Material cost per kg = Rs.45
 Fabrication cost per kg = Rs.32
 Material cost for 497 kg = Rs.22365
 Fabrication cost for 497 kg = Rs.15904
Total = Rs.38269

Cost reduction of hydraulic press
 Percentage of material cost

$$\text{Reduction} = \frac{(51744 - 38269)}{51744} * 100$$

= **26.04 %**

VII. CONCLUSION

Decrease of material may affect design and gives high deformation and stresses. Which are not acceptable for the machine, as this machine is used for compressive pressing operation in sheet metal industries where the deformation of the press should be permissible. Pressing accuracy plays important role to maintain the close tolerance and to increase productivity.

It can be concluded that simulation software is the powerful tool for prediction of safe design at given load. The analysis of model was thorough at a minimum cost of material and analysis time.

Attempt has been made to analyze and optimize the existing press by using Finite Element Software.

After the Design and Analysis, the New Hydraulic press it has been observed that, the weight of New Hydraulic Press is reduced up to 25% and cost reduced up to 26.06 %.

These have been achieved by changing the design of Existing Hydraulic Press and by using the standard components to manufacture.

The stresses induced in the New Hydraulic press in within the limit. So the New hydraulic press is safe to manufacture and use in industries

VI. REFRANCES

1. AsimM.Kamate* et al.(IJITR) *International Journal of Innovative Technology and Research* Volume No.4, Issue No.1, December - January 2016, 2560 – 2563.
2. Deepak Annasaheb More, N.K.Chhapkhane, Ravindra Kolhe *International Journal for Research in Applied Science & Engineering Technology (IJRASET)* Volume 3 Issue VI, June 2015
3. Mr. K.Shravan Kumar, B.Prashanth*Design & Fabrication of Hydraulic Press July 2017 Ijsdr |* Volume 2, Issue 7.
4. Mehmet Aydın ,YasinKisioglu, Hydraulic press design under different loading conditions using finite element analysis January 2013 .

5. Umesh S Badakundri, Santosh Kullur, Prof. A.A.Kulkarni, Finite Element Analysis of Hydraulic Press Machine ,*International Journal on Recent Technologies in Mechanical and Electrical Engineering (IJRMEE)* ISSN: 2349-7947 Volume: 2 Issue: 5
6. DME V.B Bhandari Ch 4 “*Design against static loading*”

Design and Development of Broaching Fixture for Machine Pulley

Mr. Shekhar Chavan¹ , Mr. Rutwik Chitnis² , Mr. Rahul Deshpande³ , Mr. Atharva Kulkarni⁴ , Prof. Sukhadip Chougule⁵

1, 2, 3, 4, 5 Pimpri Chinchwad College of Engineering & Research , Ravet

ABSTRACT Fixture plays an vital role in the manufacturing industry. Due to its wide application in the production plant the “Broaching fixture for machine pulley” has been designed and manufactured. A systematic method was developed to generate a cutting strategy for the broach. The fixture is the necessary link between the part to be machined and the machine tool. In machining fixtures, minimizing work piece deformation due to clamping and cutting forces is essential to maintain the machining accuracy. The various methodology used for clamping operation used in different application by various authors are reviewed. It is required in various industries according to their application. This can be achieved by selecting the optimal location of fixturing elements such as clamps. Fixtures reduce operation time and increases productivity and high quality of operation is possible. Due to the need of slot of dimension 6*2.8 in the machine pulley part the usage of fixture was inculcated due to which the pulley can be manufactured with accuracy, less human effort, reduced cyclic time and in mass quantity. “Shree Gajanan Industries” has the high demand of this pulley and it is periodically so that the fixture is to be used again. The fixture block should be mobile means it can be reused later when there is again need of same manufacturing plant. Later the force has to be calculate on the fixture and the broaching tools nomenclature are studied and introduced.

I. INTRODUCTION

To locate and position the work pieces for machining, inspection, assembly and other operations fixtures are used. A fixture consists of a set of locators and clamps. Locators are used to determine the position, setting the job and orientation of a work piece, whereas clamps apply clamping forces so that the work piece is pressed and set-up firmly against locators. Clamping has to be appropriately planned at the stage of machining fixture design. The design of a fixture is an highly complex and intuitive process, which require proper knowledge. Fixture design plays an important and vital role at the setup planning phase. Perfect fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined parts. In existing design the fixture set up is done manually, so the aim of this project is to replace with the traditional method to save time for loading and unloading of component. This mechanical fixture provides the manufacturer for flexibility in holding forces and to optimize design for machine operation as well as process function ability.

II. PROBLEM STATEMENT

The manufactured part is the pulley which is to be design and analyzed. In which the specific notch was to be made has the pulley was to be manufactured in the mass quantity and there was increase demand for the work piece repeatedly. So for that purpose the fixture was required which can help in for loading and unloading of the work piece and increase the productivity by reducing the settling time of work piece. Has the broaching machine been readily available so we according the specifications of the machine the fixture were required to be design. Before the design of the fixture when broaching operation was performed the excessive material was removed due to the misalignment of the tool or rapid movement of the broaching tool. Due to which the required dimensional notch was not obtained so to manufacture the 6*2.8 dimensional slot fixture was to be design accordingly. Fixture was to be design accordingly so that the tool can be perpendicular to the work piece. Along with that clamp should be also designed so that the fixture is maintained correctly or positioned on T-slot table of the broaching machine. So for that the force calculations are also required on the clamping device to be achieved to obtain the value.

III. METHODOLOGY

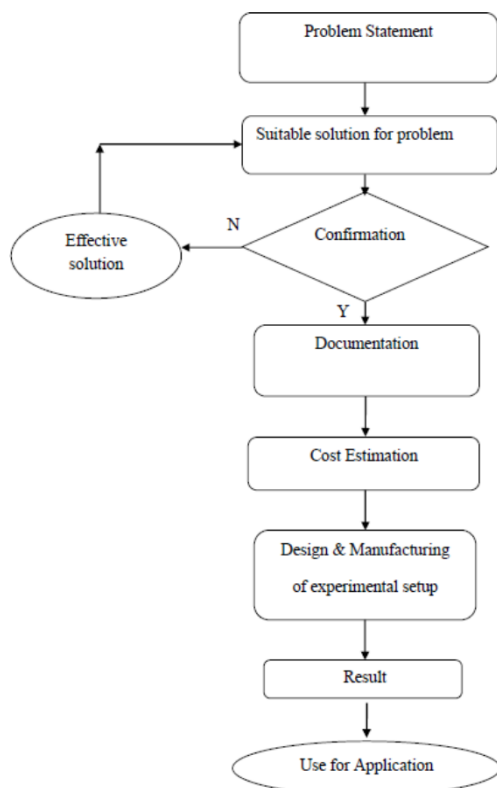
A method for designing a broaching tool comprising the steps of:

- A. Providing geometry of a slot to be broached
- B. Providing a material dependent initial minimum tooth rise for a broach tool that includes multiple broaches inserts.
- C. Calculating a number of broach inserts and teeth per insert based upon steps
- D. Performing the broach inserts
- E. Calculating the stresses on the broach tool and deformation of the slot
- F. Determining whether the slot dimensions are within desired specifications
- G. Revising the broach tool if the slot is outside the desired specifications, and performing the operation until the slot is within desired specifications
- H. design characteristics of the broach tool resulting from performing.

Fig. No.1: Methodology Flowchart

IV. DESIGN OF FIXTURE

To meet all design criteria for work holder is impossible, compromise is inevitable. The most important hint of optimal design objectives is positioning, holding & supporting functions that fixtures must fulfill.



1) **Position:** Fixture must above all else hold the work piece, precisely in place to prevent 12 degrees of freedom, linear movement in the either direction about each axis.

2) **Repeatability:** Identical work piece specimens should be located by work holder in precisely the same space on repeated loading & unloading cycles. It should be impossible to hold the work piece incorrectly.

3) **Adequate Clamping Forces:** The work holder must hold the work piece immobile against the forces of gravity. Centrifugal force, inertia force, wetting force, milling & the design must calculate these machines forces against the fixture holding capacity. The device must be rigid: clamping forces must be maintained.

4) **Care During Loading Cycles:** As the work holders usually receive more punishment during the loading & unloading cycle than during the machining operation. The device must endure impact & aberration for at least the life of the job.

Designing a fixture is a very complex task and it involves taking into consideration very minute details of manufacturing process. Even if a single detail is missed out then it may result in false design of fixture.

Broaching tool is a straight multi tooth cutter in which several cutting edges engage with the work piece simultaneously and each tooth removes a portion of material from the work piece surface. Broaching cutter has a tapered flat or round profile with a series of teeth on its surface. Each successive tooth in a broaching tool is higher than the

preceding one to perform the cutting action and remove material from the work piece surface. Broaching tools in their general form can be geometrically divided into three main sections, namely, roughing, semi-finishing, and finishing. Roughing teeth remove the bulk of material from the work piece, semi finishing teeth produce the basic surface finish (surface quality), and finishing teeth provide the final surface finish and set geometrical and dimensional tolerances. In broaching operation the broach

tool slides in or out of the work piece to convert the raw input material into finished product within just one stroke. The fixture should be designed in such a way that it should not block the path of the broach tool. Along with this the fixture should also help in proper alignment of the product aiding to lower cycle time. The main function of the fixture is to hold the work piece which is achieved by locking the various degrees of freedom of the fixture. To restrict the movement of the work piece 3-2-1 location principle is used. To restrict complete movement of the product total 6 degrees of freedom are to be restricted which comprises of rotary and linear 3 each. Another Considerations in fixture design are specifications of the machine used. The fixture should also compensate for any vibrations from the machine and should be designed for the maximum working force. Before moving towards any calculations we must firstly understand the tool geometry so as to calculate maximum force and then design the force accordingly.

Broach tool Geometry

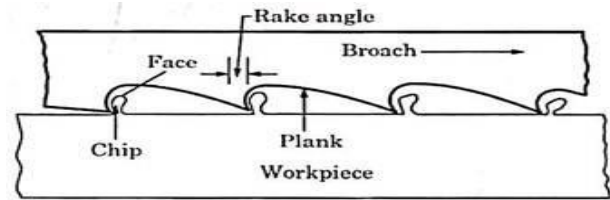


Fig. 17.4

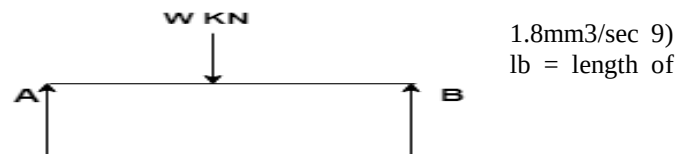
Fig. No.2: Broach tool Terminologies

$$\text{Cutting force per tooth} = \frac{w \times s_s \times \cos(\lambda - \alpha)}{\sin \phi \cos(\phi + \lambda - \alpha)} \text{ Newtons}$$

V. CALCULATIONS

- 1) In the case of broaching operation cutting speed V = speed at which the broach is pushed/pulled.
- 2) Apparent cutting edge engagement b = width of the broach = 6mm.
- 3) Actual cutting edge engagement $b_a = b/\cos \theta_s$
- 4) (θ_s = angle of inclination of the tooth w.r.t. the normal to the cutting velocity) = $6/\cos(15) = 6.211$ mm
- 5) Apparent uncut chip thickness f = difference in heights of two consecutive teeth. $f = 0.05$ mm
- 6) Effective or actual uncut chip thickness $f_a = f \cos \theta_s = 0.05 \times \cos(15) = 0.04827$ mm
- 7) Area of uncut chip = $f b = 0.05 \times 6 = 0.3$ mm²

- 8) Metal removal rate/tooth = $f b V = 0.05 \times 6 \times 6 = 1.8$ mm³/sec
- 9) Machining time = $(l_w + l_b)/V$ (l_w = length of workpiece and broach) = $(15 + 908)/6 = 153.833$ sec



In broaching operation, only one motion, i.e. the primary cutting motion is provided by the machine (cutting speed is around 6 mm/sec). The feed motion is obtained by designing the teeth to be deeper progressively. (The cut per tooth is kept around 0.05 to 0.09 mm). Thus the shape of the broach determines the shape of the machined part.

Fig. No.3: Cutting Parameters

Where,

w = width of cut (In case of circular hole, w = circumference) ϕ = shear angle = 90°

Co-efficient of friction = 0.42 (between MS and EN-19)

λ = friction angle = $\tan^{-1} \mu = \tan^{-1} (0.42) = 22.780$

α = radial rake = 100

f = cut per tooth = 0.05 mm

s_s = ultimate shear stress of work material = 300 N/mm² Cutting force per tooth = 7935.55 N

- 10) Instantaneous broaching load = cutting force per tooth x number of teeth in contact. = $7935.55 \times 2 = 15871.10$ N

Assuming equilibrium condition,

$$\Sigma F_x = 0, \Sigma F_y = 0, \Sigma MA = 0;$$

$$R_A = R_B = 7935.55 \text{ N}$$

Therefore the clamping force is 7935.55 N.

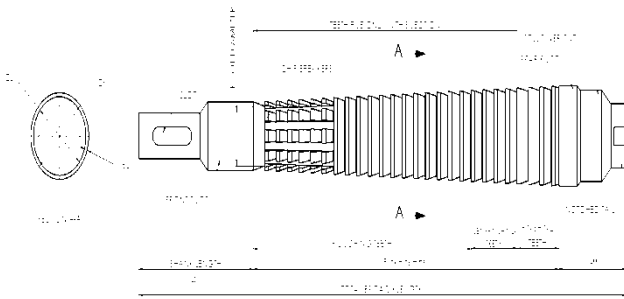
Now to find the compressive stress,

$$\text{Compressive stress } (\sigma_c) \text{ actual} = \text{Clamping force} / \text{Resisting Area}$$

$$= 7935.55 / 245.43 = 32.333 \text{ N/mm}^2$$

$$\sigma_c \text{ (permissible) for MS} = 465.97 \text{ N/mm}^2$$

$$(\sigma_c) \text{ actual} < \sigma_c \text{ (permissible)} \text{ Hence the material is safe}$$



V. STEPS FOR FIXTURE MANUFACTURING

A. Define the Requirements

To start the fixture-design process, clearly state the problem to be resolved or needs to be met after the fixture. State these requirements on the paper as broadly possible, but pin point or specifically enough to define the scope of the design project. The designer should ask some basic questions: Is there any new tooling required for first-time production or to improve existing production?

B. Gather or Obtain Information

Collect all the relevant data and assemble it for proper evaluation. The main sources of information are the part print of the job, process sheets of the process, and machine specifications. Make sure that part documents and records are of the current job or required job. For example, verify and re-check that the shop print is the current revision, and the processing information is up-to-date. Check with the design department shop for pending part revisions in the process. An important part of the evaluation process should be note down which can be implemented later. Complete, accurate notes allow designers to record the important information. With these notes which are mentioned properly, the manufacturer should be able to fill in all items on the "Checklist for Design Considerations."

C. Implement the Design

The final or last phase of the fixture-design process consists of making the chosen design approach into reality. Final details are chosen wisely and decided, final drawings are made, and the tooling is built and tested. The following guidelines should be considered and during the final-design process to make the fixture less costly while improving its efficiency. These rules are a mix of practical considerations, sound design practices, and common sense Manufacturing of fixture is final step in design process. This converts design into reality. In this final drawing is made using all details. Material is chosen and according to that suitable and appropriate manufacturing process is selected.

Broaching fixture manufacturing done in two phases, first operations are performed over lathe machine and then with the use of VMC machine slot is provided.

Fig. No.4: Broaching Fixture

Over turret lathe machine first facing operation is done on the work piece to remove the material from the end of the machine. After that turning is perform first 20 mm diameter is made over a length of 15mm. after that 40mm diameter is made over 20mm length.

1) By using Following Parameter

Spindle speed=1200 rpm Feed=0.5 mm/rev

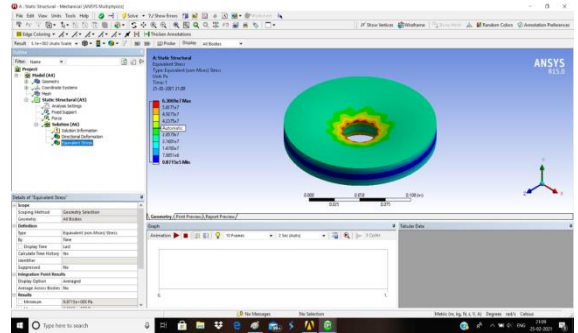
After completion of operation over lathe machine one slot (6.2mm x 20mm) is provided over the work piece in order to give some space to broaching tool to perform the broaching operation. Also, two holes are drilled to clamp the fixture to machine table.

2) Type of Machine Vertical machine center

3) Operation a) Slot milling b) Drilling

4) Machine Parameter For Slot Milling Cutter diameter 6mm Number of flutes 2 Spindle speed 3000rpm Feed 0.5mm/rev Radial depth 35mm

5) Machining Parameters for Drilling Cutter diameter 5mm Number of flutes 4 Spindle speed 1000rpm Feed 0.15 mm/rev Radial depth 15mm One disk of 150mm diameter is made over a length of 20mm on lathe machine and 40mm internal hole is provided, in order to fix the fixture in the disk. Thus, manufacturing of fixture is done.



D. Stress Analysis By ANSYS

Fig. No.5: Stress Analysis By Ansys

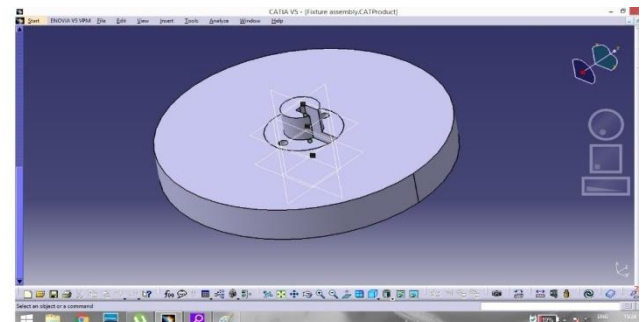


Fig. Stress analysis

VI. CONCLUSION

In a modern manufacturing environment, organizations must be responsive to the requirements of the customers and their specific needs and to fluctuating global market demands. To maintain its competitiveness in market share, the manufacturing firms must manufacture with minimum amount of waste. The main focus of this research is to reduce the setup time for the machining process performed on a high accuracy product, Machine Pulley

VII.ACKNOWLEDGMENT

First and foremost, I would like to express my sincere gratitude to my project guide Mr. Sukhadip Chougule who has in the literal sense, guided and supervised me. I am indebted with a deep sense of gratitude for the constant inspiration and valuable guidance throughout the work.

VIII. REFERENCES

- <https://www.bing.com/search?q=press+clamp+pricesqs=nform=QBREsp=-1pq=press+clamp+pricessc=0-18sk=cvid=8B46E9D2839142308FA4B406FE8C81C7>
- <https://www.bing.com/search?q=bright+hub+engineeringpc=COS2ptag=D052920-N0490A5AF4E3D53Cform=CONBDFconlog=CT3335878SearchUrlPostfix=/searcht>
- <https://www.sanfoundry.com/wp-content/uploads/2017/12/strength-materials-questions-answersmaximum-bending-moment-q9.png> • <https://civildigital.com/simply-supported-beam-with-point-load>
- Kuigang Yu^{1,2,3}, Shiya Wang¹, Yanan Wang^{1,2,3} and Zhihong Yang^{1,2,3} 2018, Vol. 10(2) 1–8 The Author(s) 2018 DOI: 10.1177/1687814018761272 “A flexible fixture design method research for similar automotive body parts of different automobiles.”
- Malyadri Akula¹, K.Chandra Sekhar², Akula Nagendra³, E-ISSN 0976-3945 “DESIGN AND ANALYSIS OF BROACH TOOL FOR SPLINES.”
- International Journal of Engineering Research and General Science Volume 2, Issue 2, FebMar 2014 ISSN 2091-2730 Shailesh S.Pachbhail, Laukik P.Raut² “A Review on Design of Fixtures.”
- Shrikant.V. Peshatwar, L.P Raut “Design and development of Fixture for eccentric shaft: A Review” International Journal of Engineering Research and Applications.

DESIGN AND FABRICATION OF SEAT BELT ASSISTED HANDBRAKE LEVER

DEVGEERGIRI¹, SHIVENDRAPENDA VALE², GANESH DESHMUKH³, PANKAJ PATIL⁴,
Prof. N. S. VELE (Project guide)⁵

[1,2,3,4] U.G. Student, Department of Mechanical Engineering, PCCOER, Ravet, Maharashtra, India [5] Professor, Department of Mechanical Engineering, PCCOER, Ravet, Maharashtra, India.

“This work was supported in part by the Department of Mechanical Engineering, PCCOER.”

ABSTRACT Hand brakes are one of the most important components in vehicles. In general, the hand brake is operated manually. In our project we are developing hand brakes when Seat belt is not acquired for safety purposes.

A Major cause of death in road accidents is carelessness in safety while driving. In 2012, more than half of all people who died on Utah's roadways weren't buckled. Hence wearing seat belts might have reduced serious crash related injuries and saved life. Hence “Driver Assistive Safety System” (DASS) comprises techniques which inculcate the mandatory safety precautions via ignition. This project describes a safety system which ensures that the driver and co-passenger wear a safety seat belt while driving a car. The driver assistive safety system works on ‘HANDBRAKE RELEASE’ concept

INDEX TERMS Safety Seat Belt, Safety system, Hand brake release concept.

I. INTRODUCTION

The aim of our project is to make seat belt wearing compulsory for vehicle movement.

In this project we have designed the mechanism which is used to operate hand brakes using seat belt assist. While removing the hand brake this mechanism or system ensures that the seat belt is plugged in by the driver. As the driver acquires the seat belt the hand brake gets free and can be

removed.

A. NORMAL HANDBRAKE-

When we need to apply the hand brake while parking a vehicle we pull the hand brake lever upward, due to this the hand brake cable is pulled, which causes expansion of the brake shoe in the brake drum of the wheel. And a hand brake is applied.

B. AUTOMATIC HANDBRAKE SYSTEM-

Now we have become more interested to see how the automatic hand brake system actually works. First of all this system consists of a simple hydraulic system with a simple circuit. This hydraulic system plays a very important role for applying and releasing hand brakes while parking a car. Automobile seat-brakes usually consist of a cable directly connected to a brake mechanism on one end and to some type of mechanism that can be actuated by the driver on the other end of mechanism is often a hand operated lever, on the floor on either side of the driver, a pull handle located below and near the steering wheel column, or a pedal located far apart from the other pedals.

II. PROBLEMSTATEMENT

In today's world the accidental rate has increased and the main reason for causing severe injury is not acquiring seatbelts. Due to a unawareness of not using seatbelts many people have faced disastrous events. After all these years of practice it has been neglected which is not ignorable for the driver's safety.

Hence our problem statement is "Seat belt assisted hand brake lever system."

III. OBJECTIVES

To design the Seat belt assisted hand brake lever model using CATIA software.

To do the Fabrication of Seat belt assisted hand brake lever.

To do the testing and analysis of seat belt assisted hand brake levers.

IV. SCOPE

- As this system is cheap and easy to use, it can be used in further vehicles to ensure the safety of the occupant and the driver itself.

V. LITERATURE REVIEW

A. Prof. Hemal Patel (2018)

Some people don't wear seatbelts while driving for different reasons, but this system forces them to wear it because they cannot start the engine without wearing it.

B. Naveen Kumar (2014)

When the seat belt activates the push button type DC valve an outward stroke is obtained in the pneumatic cylinder through an air compressor which is used to release the hand brake.

C. Thorat Ajit (2019)

Automobile brakes usually consist of a cable directly connected to a brake mechanism on one end and to some type of mechanism that can be actuated by the driver on the other end.

D. Akash D. Singh

In a normal seat belt system there is no connection between ignition and seat belt. But, here we would like to discuss some components and its working by which we can connect these sensors to the ignition switches.

VI. COMPONENT

INFRARED SENSORS

A passive infrared system detects energy emitted by objects in the field of view and may use signal-processing algorithms to extract the desired information. It does not emit any energy of its own for the purposes of detection. Passive infrared systems can detect presence, occupancy, and count.



Fig. 1 mechanical Arrangement of work

FIGURE1.INFRAREDSENSOR

WIPERMOTOR

Windshield wiper motors are components in the car, which function on a power supply- with the task of moving wiper blades in a smooth and systematic motion. Just like other motors, the wiper motor functions to rotate continuously in one direction once it is converted to a back and forth motion. The standard voltage requirement for the wiper motor is 12 volts DC. The electrical system in a running automobile usually puts out between 13 and 13.5 volts, so it's safe to say the motor can handle up to 13.5 volts with no problem. Wipers are powered by a small electric motor, usually mounted on the firewall or under the cowl (the area under the windshield's base). The motor activates linkage that moves the wiper arms back and forth. On vehicles with a rear window wiper, a separate motor powers the one in the rear.

FIGURE2.WIPERMOTOR



DRUM BRAKE

The term drum brake usually means a brake in which shoes press on the inner surface of the drum. When shoes press on the outside of the drum, it is usually called a clasp brake. Where the drum is pinched between two shoes, similar to a conventional disc brake, it is sometimes called a pinch drum brake, though such brakes are relatively rare. A related type called a [band brake](#) uses a flexible belt or "band" wrapping around

the outside of a drum.

VII. DESIGN

FIGURE4.ASSEMBLED MODEL

VII. CALCULATION

This is just a prototype, hence forces and lengths are assumed here

MOTOR SELECTION:

Consider weight applied by the human = 2 kg
So the force applied is equal to 2×9.81 Newton.
 $F = 19.62 \text{ N}$

Hence, the torque required = 19.62×600
 $= 11772 \text{ N-mm} = 11.77 \text{ N-m}$

So we have considered the 12V 11Amp wiper motor which has 19 N-m torque

Shaft selection:

$$\text{Maximum bending stress } T_b = (M \cdot r) / I$$

..... Eqn. 1.1

Where,

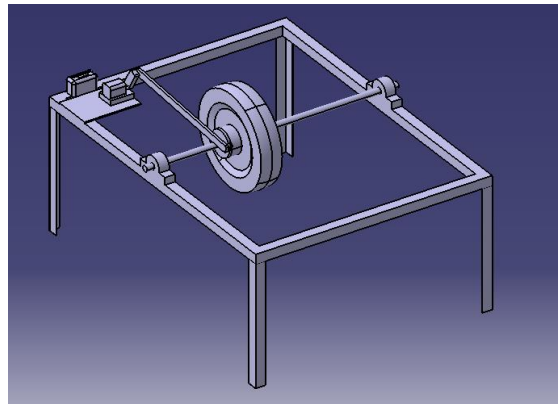
M is the maximum bending moment on the shaft.
 r is the radius of the shaft.

I is the area of inertia of the shaft.

$$L_{10} = (C/P)^p$$

Where,

L_{10} = basic rating life (at 90% reliability), millions of revolutions



C = basic dynamic load rating, kN

P = equivalent dynamic bearing load, kN

VIII. CONCLUSION

1. The automatic parking brakes system can be easily implemented in all 4 wheelers without any appreciable changes in the existing system of manually operated brakes. The operation of the system is very simple and can be successfully implemented in existing braking systems.

2. Developing automatic hand brake systems is the

most effective solution for reducing human effort which is required for applying manual handbrakes.

IX. REFERENCE

- [1] Prof. Hemal Patel , Chauhan Abhijitsinh , Badreshiya Deepak , Patel Harsh ..Professor, Dept. of Automobile Engineering, LDRP-ITR college, Gujarat, India
4 April 2018
“WEARING OF SEAT BELT IS MANDATORY FOR IGNITION OF ENGINE”
- [2] Thorat Ajit, Kokane Sujit, Kokane Tushar, Jadhav Nilesh, Temgire Sanket..U.G. Student, Department of Mechanical Engineering, JCOE Kuran, Maharashtra, India February 2019.
“DESIGN AND FABRICATION OF AUTOMATIC HANDBRAKE USING PNEUMATIC SYSTEM”
- [3] Akash D. Singh , Siddhesh P. Rahate , Amit V. Pawaskar, Ravindra K. Ambekar. Student of Diploma Mechanical Engineering, Rajendra Mane Polytechnic 3 March 2018
“AUTOMATIC HANDBRAKE SYSTEM”
- [4] Naveen kumar., Lokesh raj., Ramerow jacob., Santhosh., Ravi prasad.p.s ., Department of Mechanical Engineering, Jeppiaar Engineering College 10 Oct 2014
“DESIGN OF SEAT BELT ACTIVATED HANDBRAKE SYSTEM IN CARS”

Heat Transfer Enhancement of Diesel Engine Radiator Using Nanofluid

Aniruddha Kulkarni¹, Shreyas Narawade², Prasanna Patrekar³, Swapnil Mane⁴,
Nandkumar Vele(Project guide)⁵

^{1,2,3,4} Students Pimpri Chinchwad College of Engineering & Research , Rave,Pune.

⁵ Faculty, Department of Mechanical engineering, Pimpri Chinchwad College of Engineering & Research , Rave,Pune

ABSTRACT :In vehicles nowadays, liquid cooled engines are the new trend in which the vehicles have a cooling system with the help of coolants. The existing coolant which is used in maximum vehicles is a mixture of distilled water with ethylene glycol. But these coolants provide less heat transfer. So with advancements of new technologies and several researches, results were found that there was enhancement in heat transfer when we used nanofluids. Hence we can use nanofluids as a replacement for the conventional coolant. One more advantage of using nanofluids is that we can also use a small sized radiator which can yield us the same result. Hence this can reduce the weight of the vehicle. We chose Copper oxide(CuO) as our nanofluid and Sodium Do-decyl sulphate(SDS) as surfactant to overcome the settling problem.

INDEX TERMS :Copper Oxide,Diesel engine, Heat transfer, Radiator, Sodium Do-decyl sulphate(SDS)

I. INTRODUCTION

In a Diesel engine generator a lot of heat is produced due to the combustion and only a portion of heat is utilized to produce power, the rest of heat is wasted in the form of exhaust heat. If this excess heat is not removed, the engine temperature becomes too high which results in overheating and engine components failure may occur. So a cooling system is required. The Diesel engine generator utilizes a heat exchanger device, termed as radiator, in order to remove the heat from the cooling jacket of the engine. Conventional fluids, such as water, engine oil, ethylene glycol, etc. have poor heat transfer performance. Recent advances in nanotechnology have allowed development of a

new category of fluids termed nanofluids. Nanofluids are the fluids which have higher thermal conductivity compared to base fluids. So there is a need for the theoretical and experimental investigation to show the effectiveness of the nanofluids as a coolant.

In this report information is introduced on a test examination of the convective fierce heat exchange qualities of nanofluids (CuO water) with 0.5, 0.75, 1.5 vol. %. The heat exchange expanded with an expansion in particle concentration

II. EXPERIMENTAL SETUP AND SPECIFICATIONS



Fig. 1 Diesel Power Plant (Working test rig)

line to record the radiator gulf and outlet temperature. Four thermocouples are introduced on the radiator to quantify the divider temperature of the radiator. At the

The test system utilized in this examination incorporates stream lines, a centrifugal pump, a stream meter, a forced draft fan and a heat exchanger (a car radiator). The pump gives a variable stream rate of 2-42 l/min. The stream rate to the test area is controlled by proper changing of a globe valve on the recycle line. The complete volume of the coursing liquid is consistent in every one of the investigations. The circuit incorporates protected tubes that have been utilized as associating lines. For heating the working liquid a twin chamber diesel engine (VCT10) is utilized. Two thermocouples were actualized on the stream

point when the test began, the location of the thermocouple exhibiting the normal estimation of the readings was chosen as a point of normal divider

temperature. Because of the little thickness and enormous thermal conductivity of the tubes, it is sensible to compare the temperature of the tube with the outside one. The temperature was noted through the temperature marker. Blunder subtleties were estimated from alignment of every thermocouple by looking at the temperature which was estimated by the thermometer.

Specifications of Radiator: For this experimental setup we have selected a standard radiator of Comet Twin Cylinder Diesel Engine (VCT10) from the market having following standard specifications.

No of tubes = 74

Height of tube = 0.382 m

Length of tube = 0.002 m

Width of tube = 0.015 m

Fan Motor type = DC motor

Fan speed = 1200-1500 rpm



Fig. 2 Radiator with cooling fan

The radiator is a type of cross flow, one fluid unmixed and another fluid mixed type. The radiator is used for the purpose of transferring the heat from the fluid which is in the tubes to the outside of the surrounding area. There are several fins around the periphery of the tubes. The radiator is made up of aluminium material. The fins are also made up of aluminium metal. The heat is transferred from the fluid to the tube by convection and from tube thickness to the fins by conduction and then from fins to air again by the convection.

Nanofluids are colloidal suspensions of ultra-fine metallic or non-metallic particles in a given liquid. Regardless of every single other property, it is notable for its high thermal conductivity and better reaction as heat transfer medium. Nanofluids can be of two sorts, for example, metallic nanofluids and non-metallic nanofluids. Metallic nanofluids are set up by scattering nanoparticle produced using metals, for example, aluminum, copper, nickel and so on and non-metallic nanofluids are made by scattering nanoparticles of non-metals for example metal oxides, different allotropes of carbon (Graphene, CNT) and so forth. Synthesis and stability of nanofluids are the

two extremely essential prerequisites to think about nanofluids.



Fig. 3 Copper oxide(CuO) nanofluid

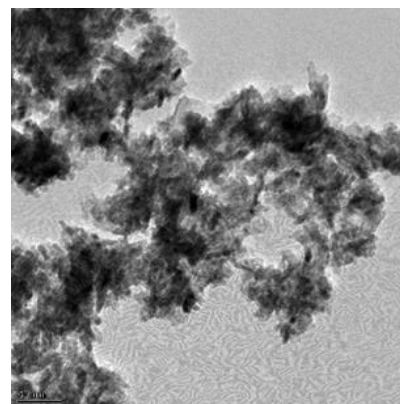


Fig. 4 Microscopic View of CuO Nanoparticles

Sodium dodecyl sulfate (SDS) or sodium lauryl sulfate (SLS), sometimes written sodium lauryl sulfate, may be a synthetic compound with the formula $\text{CH}_3(\text{CH}_2)_{11}\text{SO}_4\text{Na}$. It is an anionic surfactant utilized in many cleaning and hygiene products. This molecule is an organosulfate and a salt. It includes a 12-carbon tail attached to a sulfate group, which is the sodium salt of dodecyl hydrogen sulfate, the ester of dodecyl alcohol and vitriol .

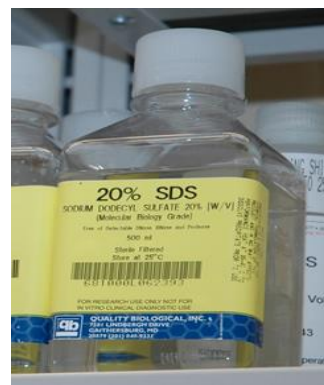


Fig. 5 Sodium Do-Decyl Sulphate(SDS) Surfactant

IIICALCULATIONS AND RESULT

For research purposes, we decided to choose CuO concentration as (0.5%, 0.75%, 1.5%) and SDS concentration at 2% to get the best result. We will be monitoring the temperatures at different flow rates (4LPM, 5LPM, 6LPM, 7 LPM). After performing the experiment, We will compare the result of conventional coolant with the result of [CuO(1.5%) + SDS(2%)] nanofluid.

TABLE I

CuO Nanofluid (1.5%) + Surfactant (2.0%) temperature readings

Flow rate (Lpm)	T_{hi} (°C)	T_{ho} (°C)	T_{ci} (°C)	T_{co} (°C)
7	58	48.3	34	46.7
	64.3	54	34.5	50.4
	70.3	59.6	34.6	53.3
6	72.8	60.2	36	54.5
	75.3	62.1	35.5	55.7
	78.1	65.5	35.7	57.2
5	79.3	67.1	35.4	57.5
	80.9	69.7	35.8	58.2
	83.1	72.5	36.1	59.1
4	82.9	70.2	36.5	58.8
	83.5	72.4	37.3	60.1
	83.9	71.9	37.5	60.9

Sample Calculations for 6 lpm:

Mean inlet and outlet temperatures-

$$1) \quad T_{hi} = \frac{72.8+75.3+78.1}{3} = 75.4^{\circ}\text{C}$$

$$2) \quad T_{ho} = \frac{60.2+62.1+65.5}{3} = 62.6^{\circ}\text{C}$$

$$3) \quad T_{ci} = \frac{36+35.5+35.7}{3} = 35.73^{\circ}\text{C}$$

$$4) \quad T_{co} = \frac{54.5+55.7+57.2}{3} = 55.8^{\circ}\text{C}$$

Logarithmic Mean Temperature Difference-

$$\Delta T_m = \frac{(T_{hi} - T_{co}) - (T_{ho} - T_{ci})}{\ln[(T_{hi} - T_{co})/(T_{ho} - T_{ci})]}$$

$$= \frac{(75.4 - 55.8) - (62.6 - 35.73)}{\ln[(75.4 - 55.8)/(62.6 - 35.73)]} = 23.042$$

TABLE II

CuO Nanofluid (1.5%) + Surfactant (2.0%) mean temperature readings

LP M	T_{hi} (°C)	T_{ho} (°C)	T_{ci} (°C)	T_{co} (°C)	ΔT_m (°C)
7	64.2	53.966 67	34.36 66	50.13 33	50.133
6	75.4	62.6	35.73 33	55.8	55.80
5	81.1	69.766 67	35.76 66	58.26 66	58.26
4	83.433 3	71.5	37.1	59.93 3	59.93

1) Heat Transfer (Q) through nanofluid:

$$\begin{aligned} \rho &= \phi \rho_p + (1 - \phi) * \rho_b \\ &= 1.5 * 6000 + (1 - 1.5) * 1015.75 \\ &= 8492.125 \text{ Kg/m}^3 \end{aligned}$$

$$C_{ph} = \frac{\phi * \rho_p * C_p + (1 - \phi) * \rho_b * C_b}{\rho}$$

$$= \frac{0.5 * 6000 * 520 + (1 - 0.5) * 954.25 * 3465.97}{3477.125}$$

$$= 9242.42 \text{ J/Kg K}$$

$$Q_h = m_h * C_{ph} * \Delta T_h$$

$$= 0.34771 * 9242.42 * (59.23 - 50.3) = 1199.78 \text{ W}$$

2) Heat Transfer through air:

$$Q_c = mc * C_{pc} * \Delta T_c$$

$$= 0.2997 * 1200 * (20.066) = 7218.9 \text{ W}$$

3) Average Heat Transfer:

$$Q_{avg} = 0.5 * (Q_h + Q_c)$$

$$= 0.5 * (4791.623 + 7218.9) = 6005.27 \text{ W}$$

4) Overall Heat Transfer:

$$Q_{avg} = U * A * F * \Delta T_m$$

$$R = \frac{T_{co} - T_{ci}}{T_{hi} - T_{ho}} = \frac{55.8 - 35.73}{75.4 - 62.6} = 1.5677$$

$$S = \frac{T_{ho} - T_{hi}}{T_{ci} - T_{hi}} = \frac{62.6 - 75.4}{35.73 - 75.4} = 0.3226$$

$$F = \frac{\ln[(1 - R * S)/(1 - S)]}{(1 - 1/R) * \ln[1 + R * \ln(1 - S)]}$$

$$= \frac{\ln[(1 - 1.5677 * 0.3226)/(1 - 0.3226)]}{(1 - 1/1.5677) * \ln[1 + 1.5677 * \ln(1 - 0.3226)]}$$

$$F = 0.9227$$

$$U = \frac{Q_{avg}}{A * F * \Delta T_m}$$

$$= \frac{6005.27}{0.979028 * 0.9227 * 23.042}$$

$$U = 288.4 \text{ W/m}^2\text{K}$$

TABLE III

CuO Nanofluid (1.5%) + Surfactant (2.0%) Result (Q and U)

LPM	Q (W)	U (W/m ² K)
7	4474.89	302.07
6	6005.27	288.4
5	5814.90	223.48
4	5596.15	211.17

TABLE IV

CONVENTIONAL COOLANT RESULTS (Q and U)

M	Q(W)	U(W/m ² K)
7	2567.81	245.4
6	2744.37	203.02
5	3642.08	220.95
4	3773.2	200.77

TABLE V

RESULT TABLE OF HEAT TRANSFER (Q) FOR 1.5% CuO

LPM	HEAT TRANSFER of WATER (W)	HEAT TRANSFER OF CuO 1.5% (W) + SDS 2% (W)	ENHANCEMENT IN HEAT TRANSFER of CuO 1.5% (W) + SDS 2%(W)
7	2567.81	4474.89	74.268 %
6	2744.37	6005.27	118.82 %
5	3642.08	5814.9	59.658 %
4	3773.2	5596.15	48.312 %

TABLE VI

RESULT TABLE OF OVERALL HEAT TRANSFER (U) FOR 1.5% CuO

LP M	OVERALL HEAT TRANSFER of WATER (W/m ² K)	OVERALL HEAT TRANSFER OF CuO 1.5% + SDS 2% (W/m ² K)	ENHANCEMENT IN OVERALL HEAT TRANSFER of CuO 1.5% + SDS 2% (W/m ² K)
7	245.4	302.07	23.09 %
6	203.02	288.4	42.084 %
5	220.095	223.48	1.14 %
4	200.77	211.17	5.18 %

TABLE VI
UNITS FOR HEAT TRANSFER

Symbol	Quantity
T_{hi}	Temperature of hot inlet
T_{ho}	Temperature of hot outlet
Heat	
T_{ci}	Temperature of cold inlet
T_{co}	Temperature of cold outlet
Q	Heat Transfer
Q_{avg}	Average Heat Transfer
Q_h	Heat Transfer through Water
Q_c	Heat Transfer through Air
U	Overall Heat Transfer coeff.
C_p	Specific Heat
L_{pm}	Liter Per Minute
F	Correction Factor
A	Area
ΔT_m	LMTD
ρ	Density

IV. CONCLUSION

The results obtained so far are evidence of an increase in the effectiveness of the radiator. The following inferences can be drawn by demonstrating the experiment successfully:

1. The heat transfer rate of CuO nanofluid is greater than that of conventional coolant as the conductivity of the Copper is higher than the simple coolant. The size of the radiator can be reduced if we want the same heat transfer rate as that of the conventional coolant.
2. It is observed that maximum heat transfer enhancement of 118.82% occurred at 1.5% volume concentration at 6 Lpm flow rate compared to conventional coolant.

V. FUTURE SCOPE

1. It may be used in thermal engineering, medical and many other applications. The future scope of this experiment is not yet completed; there are much more areas for research and working.
2. There is a great challenge in finding out more effective coolant having better thermophysical properties for the better heat transfer rates and at the same time it is very important that it should be environment friendly.

VI. REFERENCES

- [1] Sina N. Shoghl *, M. bahrami Ahvaz Petroleum College, Petroleum University of Technology, P.O. Box 63431, Ahvaz, Iran (2013)
- [2] Iman Fazeli1 Mohammad Reza Sarmasti Emami1 Mohammad Hossein Nazeri1 Received: 23 January 2020 / Accepted: 6 July 2020 ©

Akadémiiai Kiadó, Budapest, Hungary 2020 Journal of Thermal Analysis and Calorimetry <https://doi.org/10.1007/s10973-020-10056-8>

[3] K. SHREE MEENAKSHI*1 and E. PRADEEP JAYA SUDHAN2 1 Department of Chemistry, Loyola-ICAM College of Engineering and Technology, Chennai, Tamil Nadu, India 2 Department of Chemistry, Anna University, Chennai, Tamil Nadu, India DOI:10.7598/cst2015.976

[4] Hassan Pahlavanzadeha,* , Mehrdad Khanlarkhanian , Sajjad Rezaeia , Amir H. Mohammadib,c a Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran b Institut de Recherche en Génie Chimique et Pétrolier

00[5] M. Sabeel Khan, and T. Dil Cite as: AIP Advances 7, 045018 (2017); <https://doi.org/10.1063/1.4982669> Submitted: 13 January 2017 . Accepted: 13 April 2017 . Published Online: 25 April 2017.

[6] Hafiz Muhammad Ali * , Hassan Ali, Hassan Liaquat, Hafiz Talha Maqsood (2015) (Energy), 84 (2015) 317-324

[7] Hamid Reza Ghorbani 1* (2017) (J. nanoanalysis), 4(2) 116-119 summer 2017.

[8] Tanzila Hayat * , S. Nadeem (2017) (Results in physics), 7 (2017) 2317-2324.

[9] R.B. Ganvir * , P.V. Walke, V.M. Kriplani (2017) (Renewable and Sustainable Energy Reviews), 75 (2017) 451-460.

[10] Rahul A. Bhogare* B. S. Kothawale (2013) (International Journal of Scientific and Research Publications), 3 (2013) 2250-3153.

[11] Pawan S. Amrutkar, Sangram R. Patil, S. C. Shilwant, (2013) (International Journal of Automobile Engineering), 4 (2013) 1-10.

[12] Sayantan Mukherjee, Somjit Paria, (2013) (IOSR Journal of Mechanical and Civil Engineering), 9 (2013) 63-67.

[13] Krishna Mundada, Kulkarni Durvesh, Harsha Malbari, (2017) (International Conference on Ideas, Impact and Innovation in Mechanical Engineering), 5 (2017) 840-846

[14] N. A. Usri a , W. H. Azmi a* , Rizalman Mamat a , K. Abdul Hamid a , G. Najafi b (2015) (Applied Thermal Engineering), 30 (2010) 2685-2692.

[15] M. Hatami b,* , M. Jafaryar c , J. Zhou a , D. Jing a (2017) (International journal of hydrogen energy), 42 (2017) 10891-10900.

[16] G. Narendar a , A.V.S.S Kumara Swami Gupta b , A. Krishnaiah c Satyanarayana M.G.V. d (2015) (Materials Today: Proceedings), 4 (2017) 3926-3931.

[17] J.A. Ranga Babu, K. Kiran Kumar * , S. Srinivasa Rao (2017) (Renewable and sustainable energy reviews), 77, 2017, 551-561.

[18] M. Yeganeh a,b , N. Shahtahmasebi a,b , A. Kompany a,b , E.K. Goharshadi Bc, A. Youssefi d , L. Šiller e,* (2010) (International Journal of Heat and Mass Transfer), 53 (2010) 3186-3192.

[19] M.J. Pastoriza-Gallegos, C. Casanovab b , J.L. Legidoa a , M.M. Píneiro a* (2016) (fluid phase equilibria), 300, 2011, 188-196.

Design and Analysis of Electric Crane with 500Kg Material Handling Capacity

Sushant Sodanwar¹, Akhil Pillai², Vishal Vani³, Varun Patil⁴, Prof. Sukhadip Chougule⁵.

¹⁻⁴B.E, Students, Department of Mechanical Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, MAHARASHTRA, INDIA.

⁵Assistant Professor, Department of Mechanical Engineering, Pimpri Chinchwad College of Engineering and Research, Pune, MAHARASHTRA, INDIA

ABSTRACT In industry material handling is very important. For that purpose efficient machine is needed. In modern days the electric crane plays important role to fulfil that requirement. It is economical, effective, less time consuming, more safety, and flexible for uses. In industry the safety is most important factor for any material handling machine which deals with the heavy load depending on the capacity. In electric crane the safety keeps on first priority. In this paper we design the electric crane which is more economical, less time consumable, with more safety and the easy to operate. It has two control units, one is at crane frame and one is at the remote location. This crane is able to operate by the single operator far from the crane and also can operate directly from the crane frame itself. Its lifting capacity is up to 500kg. according to load we carried out the load calculations for the crane frame or body & we created a 3D CAD model. Every component should able to deal with that load. To ensure that we carried out the analysis of the whole assembly in ANSYS 19.2. In analysis we found that the whole assembly is able to handle the load which we suppose to apply on it. We implement the pulley reduction to reduce the load on motor and gearbox as well. We tried to keep crane more compact in size so that it consume less space in industry

INDEX TERMS : electric crane, lifting machine, hoist, wire rope.

I. INTRODUCTION

In this paper we design the electric crane which is more economical, less time consumable, with more safety and the easy to operate. It has two control units, one is at crane frame and one is at the remote location. This crane is able to operate by the single operator far from the crane and also can operate directly from the crane frame itself. Its lifting capacity is up to 500kg. For safety it has a ratchet to lock the reverse motion in case of any kind of machine failure. It has a pulley reduction to reduce the load on the motor and the gearbox. That pulley reduction also helps to improve the safety of the machine.

This crane is operated by the 1HP 3Phase induction motor. So it is more power efficient as it consumes less electricity that the other crane from the market. To reduce the speed of the motor and to increase the torque value we used a worm reduction gearbox. It has the reduction of 25. As we use the rope pulley reduction in crane It results it half load on the motor and the gearbox. The motor is connected to the gearbox and the gearbox is connected to the hoist directly. As motor start, the hoist shaft is starting to wound the rope so that the object starts lifting upward.

II. CRANE

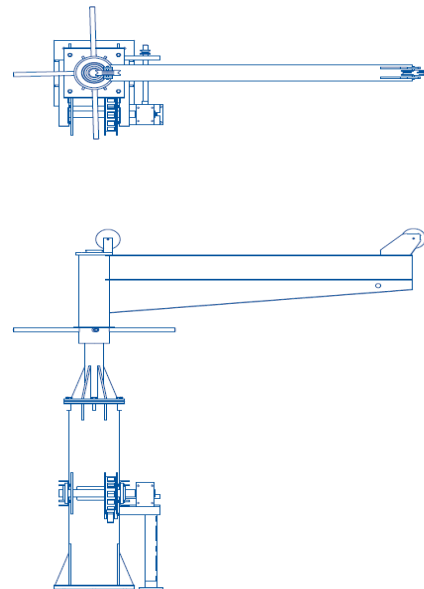


Fig. 1 Schematic diagram

III. PARTS

1. C-channel
2. Cylinder 1
3. Cylinder 2
4. I channel
5. Rib 1
6. Rib 2
7. Rib 3
8. Rib 4
9. Flange bearing
10. Ratchet
11. Hoist shaft
12. Bolt
13. Pulley
14. Gearbox
15. Support plate
16. Taper roller bearing
17. L channel
18. Hoist shaft
19. Gearbox input shaft

IV. WORKING

In this machine we used a electric motor as a rotary actuator instead of any IC engine. The working of this machine is quite simple. The main shaft of motor is linked with the input shaft of the gearbox via belt pulley mechanism. Then the output of the gearbox is directly connected with the hoist. The ratchet is introduce to avoid any unwanted incidents. The wire rope is starts from hoist and it goes through the cylinder and then on the pulley. At the end of the rope we added a hook to hang objects. As we starts the motor it will start the hoist, it means hoist start to wrap the rope around it and so the hanging object will get lifted upward. For the rotation we provide the handles to rotates the upper assembly.

V. LITERATURE REVIEW

Mulugeta Tadesse, Tesfahun Meshesha[1] has described for many years cranes have been designed for lifting heavy objects with different capacities in different work sites. Portable cranes are one type of cranes designed for lifting objects which are beyond the capacity of human beings. Of this lifting operation by using portable and moveable cranes which has not been used before, they have identified that there is the need for using portable cranes to lift up objects that are beyond the capacity and difficult of human power. Thus this paper provides the design of each part of the portable crane. And the design analysis for each part is checked so that it is safe accordingly the size of each part of the crane.

Y. Torres et. [2], initially studied the probable causes of failure of crane hook. It includes the manufacturing and lifting of crane hook, experimental analysis mechanical behaviour of material of crane hook. It was concluded that the brittle fracture was originate from crack in the material.

E. Narvydas et. al [3], investigated circumferential stress concentration factors with shallow notches of the lifting hooks of trapezoidal cross-section employing finite element analysis (FEA).The stress concentration factors were widely used in strength and durability evaluation of structures and machine elements. The FEA results were used and fitted with selected generic equation. This yields formulas for the fast engineering evaluation of stress concentration factors without the usage of finite element models.

Rashmi Uddanwadiker [4], studied stress analysis of crane hook using finite element method and validated results using Photo elasticity. Photo elasticity test is based on the property of birefringence. To study stress pattern in the hook in a loaded condition analysis was carried out in two steps firstly by FEM stress analysis of approximate model and results were validated against photo elastic experiment. Secondly, assuming hook as a curved beam and its verification using FEM of exact hook.

Spasoje Trifkovic et. al [5], this paper analysis the stress state in the hook using approximate and exact methods. They calculated stresses in various parts of the hook material firstly by assuming hook as a straight beam and then assuming it as curved beam Analytical methods were used with the help of computers, using FEM.

Bernard Ross et. al [6], this paper describes the comprehensive engineering analysis of the crane accident, Under taken to disprove the Mitsubishi theories of failure as confirmed by jury verdict. Crucial role of the SAE J1093, 2% design side load criterion and Lampson's justification or an 85%crawler crane stability criterion were presented.

VI. MATERIAL SELECTION

Material	Tensile strength	Yield strength	Elongation
IS 2062	410 Mpa	230 Mpa	23%
EN8	850 Mpa	465 Mpa	16%

The IS 2062 material grade is easily available in the market and it fulfills the requirements for the machine. The main frame the of the same material but for the shaft material we chose a EN8 as it satisfies the needs of shaft material.

VII. DESIGN CALCULATIONS

1. Total Lifting Capacity (W) = 0.5 ton
 $= 0.5 \times 10000$
 $= 5000 \text{ N}$

2. Stationary part 1 (Cylinder 1) [10]

Deflection calculations,

$$I_{xx} = (BD^3)/12 - (bd^3)/12$$

$$I_{xx} = (160 \times 250^3)/12 - (130 \times 210^3)/12$$

$$I_{xx} = 108005833.33 \text{ mm}^4.$$

$$EI = 22681225.3 \text{ Nm}^2.$$

Deflection is 0.5 mm.

3. Stationary part 2 (Cylinder 2) [10]

Deflection calculations,

$$I_{xx} = \pi/64 * (d_o^4 - d_i^4) = \pi/64 * (90^4 - 60^4)$$

$$I_{xx} = 2584450.83 \text{ mm}^4.$$

$$EI = 542734.5 \text{ Nm}^2.$$

Deflection is 6 mm.

4. I channel

Deflection calculations are,

$$I_{xx1} = (BD^3)/12 + A_1 h_1^2$$

$$I_{xx1} = (100 \times 5^3)/12 + 500 \times 72.5^2$$

$$I_{xx1} = 2629166.6 \text{ mm}^4$$

$$I_{xx2} = (BD^3)/12 = 2286666.66 \text{ mm}^4$$

$$I_{xx3} = (BD^3)/12 + A_3 h_3^2 = 2629166.6 \text{ mm}^4$$

$$I_{xx} = 7545000.01 \text{ mm}^4$$

$$EI = 1584450.002 \text{ Nm}^2.$$

Deflection = 7 mm.

5. V-belt drive [8] [Page no. 12.13]

$$\text{Power} = 1 \text{ hp} = 0.7465 \text{ kW}$$

$$N_1 = N_2 = 1420 \text{ rpm}$$

$$\text{Design power (PD)} = P \times F_a = 0.7465 \text{ KW}$$

Take Z-type of v-belt cross section from design power and highest RPM

Dimensions of Z-type belt

$$W_p = 8.5 \text{ mm}$$

$$W = 10 \text{ mm}$$

$$T = 6 \text{ mm}$$

$$A = 40 \text{ degree}$$

$$D_1 = D_2 = 50 \text{ mm}$$

$$C = \text{center distance} = 350 \text{ mm (assumed)}$$

Calculation for pitch length (L_p)

$$L_p = 2C + \pi(D_1 + D_2) + (D_2 - D_1)^2 / 4C$$

Comparing with standard pitch length

$$L_p = 780 \text{ mm}$$

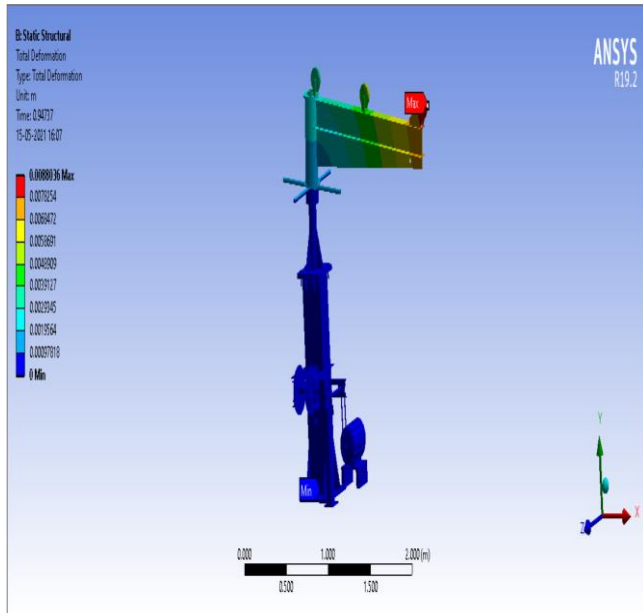
$$\text{No of belts} = PD / p_r \times F_c \times F_d$$

$$= 0.9$$

Therefore,

We will required 1 no of v belt.

VIII. ANALYSIS



We carried out the analysis of the whole machine assembly to verify the safety and the numeric calculations. In the analysis of the assembly we found that the deformation is within the limit and design is safe, the numeric calculations are correct.

VII. CONCLUSION

Deformation (maximum) of I channel is 7mm and the deformation (maximum) of Upper subassembly (including I channel, Rotating cylinder, rib for I channel, Stationary part 2 with ribs, etc.) is 7.4mm. the deformation is very low and negligible. The maximum deflection in the whole assembly is 8.8mm which is also very low as compare to the size of the machine.

From the result we get the deformation is very low and safe so we conclude that the design can be consider for the manufacturing.

REFERENCES

- 1) R.M. Maccrimmon ,Crane-supporting steel structures.
- 2) Mr. A. Gopichand, Ms. R. V. S. Lakshmi, Mr. B.Maheshkrishna “Optimization of design parameter for crane hook using taguchi method” in international journals of innovative research in science ,engineering and technology, vol. 2, Dec 2013, ISSN: 2319-8753.
- 3) Chetan N. Benkar, Dr. N. A. Wankhade “Finite Element stress Analysis of Crane Hook With Different Cross Sections” in International Journal For Technological Research InEngineering, volume 1, Issue 9,May-2014, ISSN 2347- 4718.
- 4) M. Shaban, M. I. Mohamed, A. E. Abuelezz and T. Khalifa,“Determination Of Stress Distribution in Crane

Hook by Caustic” in International Journal of Innovative Research in science, Engineering and Technology, Vol. 2 Issue 5, May 2013, ISSN: 2319-8753.

5) Apeksha. K. Patel, Prof. V. K. Jani, “Design and Dynamic Analysis of 70T Double Girder Electrical Overhead Crane” in Journal of Information, Knowledge and Research in Mechanical Engineering Vol.2, Oct-2013, ISSN- 975-668X.

6) Pradyumna Kesharimaharana, “Computer Aided Analysis and Design of Hoisting Mechanism of an EOT Crane”, .Thesis, National Institute of Technology Rourkela, May-2012.

8) V. B. Bhandari , Machine Design Data Book, MacGraw Hill Education Pvt Ltd , ISBN- 978-93-5134-284-7, page no- 13.17

9) V. B. Bhandari, Design of Machine Elements , MacGraw Hill Education Pvt Ltd.

10) S. S. Ratan , Strength of Material, MacGraw Hill Education Pvt Ltd.

AUTHORS

1. Sushant Sodanwar : B.E. Mechanical student at PCCOER, Ravet institute, Pune.
2. Akhil Pillai : B.E. Mechanical student at PCCOER, Ravet institute, Pune.
3. Vishal Wani : B.E. Mechanical student at PCCOER, Ravet institute, Pune.
4. Varun Patil : B.E. Mechanical student at PCCOER, Ravet institute, Pune.

Automatic Automobile Brake Failure Detection Indicator

Shivam R. Bhavsar¹, Prof. J. Bute²

¹Student of Mechanical Engineering, Pimpri Chinchwad College of Engineering and Research

²Professor of Mechanical Engineering, Pimpri Chinchwad College of Engineering and Research

ABSTRACT Today, Machines are widely controlled by automated system. to satisfy the need of growing population economic, effective and reliable control of machines also as their system is vital. the need for the innovative ideas within the car sector is extremely demanded. Nowadays accidents are increasing, so safety has acquired a priority. Accidents are occurring because of tons of reasons, the one of the foremost reasons is breakdown, it caused to because of poor maintenance, improper use and merchandise defect, so on safeguard the valuable human for the accident the accident monitoring of brake is a particularly important issue within the automobile. The sudden recognition of any object ahead panics the drive and at things, even skilled drivers fail to use brakes correctly and this results in accidents. the whole system is developed taking into consideration the human tendencies, minimum efforts and efficient use of the whole braking system. The system consists of only a few components and requires the smallest amount of space. Special safety features need to be built into vehicles themselves for the safety of Occupants and vehicle. This break failure detector helps to point the breakdown to the rider. The breakdown indicator circuit may be a circuit that monitors constantly the condition of brakes and provides an audio-visual indication. A buzzer is employed to offer the indication to the driving force within the sort of sound. When the brake is applied so as to hamper or to prevent the vehicle the green LED blinks and therefore the piezo buzzer beeps for about one second if the brakes is accurate and dealing properly. If brakes fail the red LED glows and therefore the buzzer don't beep when the brakes are applied. the most advantage of the system is that it's very compact in size, and therefore the installation cost is extremely less. If this technique gets installed in vehicles, then the accident cases thanks to breakdown will certainly get reduced and human life loss are going to be also reduced. this technique is very cost-effective and efficient in purposes in industry.

INDEX TERMS Braking, Safety System, Drum Brakes, Limiter Switch.

I. INTRODUCTION

This The braking systems within the automobiles across the world had comes an extended way. Since the event of wooden

block brakes within the 1800s, the vehicles of today inherit different and highly advanced braking frameworks. The evolution of the braking systems from the straightforward caliper to complex electronic brakes have resulted in enhanced safety and reduced the danger of auto collisions worldwide. Today, keeping in mind the vehicle characteristics and road conditions different set of braking systems are incorporated. Be it any quite braking – plain or sophisticated – the target behind the event of those braking systems is to form the controlling of an in-motion vehicle workable for humans in every era. A brake may be a robot that hinder, restrain, or prevents motion, slowing or stopping a moving object or preventing its motion. Most of the brakes generally uses friction between two surfaces pressed together to vary the shape of the K.E. of the moving object into heat, despite the very fact that other methods of energy conversion could also be employed for an equivalent for instance, regenerative braking converts an outsized amount of the energy to electricity alongside the warmth energy, which can be stored or are often sent back to the source for later use. Other methods convert the K.E. into P.E. in such stored forms as pressurized oil or pressurized air. Magnetic fields are utilized in Eddy current brakes to convert K.E. into current within the brake disc, fin, or rail, which is converted into heat. Still there are other braking methods to rework K.E. into different forms, as an example by transferring the energy to a rotating flywheel. Brakes are generally applied to rotating axles or wheels, but also take other forms just like the surface of a moving fluid (flaps deployed into water or air). some vehicles use a mixture of braking mechanisms, like drag racing cars with both wheel brakes and a parachute, or airplanes with both wheel brakes and drag flaps raised into the air during landing. the aim of this work is to style a braking system with an indicator. breakdown occurs only due to worn-out of shoe and cuts within the liner. this technique provides an audio and visual alert when the brake fails.

TYPES OF BRAKES:

Depending on the vehicle, there are several kinds of brake systems. As an example, many modern passenger cars use an antilock braking system, whereas semi-trucks and trailers may require an air braking system.

1. Mechanical Braking System

One of the foremost widely used braking systems, under the mechanical braking technique the energy is absorbed and is converted to heat. Here, the first aim is to get enough force to carry up the shaft and eventually make the vehicle stop. And disperse or take in the warmth produced during the braking process. All the mechanical brakes have two surfaces rub against one another and generate frictional forces. Owing to the frequent friction, the mechanical brakes tend to wear and their durability relies on the usage of fabric at the shoe or pad. The mechanical braking system is employed within the emergency and therefore the hand brake of the many vehicles. To bring a vehicle to halt,

its braking aspect involves many components like cylindrical rods, fulcrums, springs, etc.

There are two sorts of brakes found under mechanical braking – Disc and Drum.

Disc Brakes: Disc brake, alongside the drum brakes are the 2 hottest sorts of brake within the automotive market. the foremost distinguishing features of the disc brake system from the drum brakes is that it uses a rotor (or the brake disc). The wheel is going to be attached to the rotor. If the rotor is stopped then the wheels won't roll also. to prevent the wheels from running, the disc brake system will transfer the stopping power through the hydraulic wires to the brake pad which can squeeze against the rotor. The friction created between the pad and therefore the rotor will slow the wheel movement down.



Fig 1.1 Disc Brake

Drum Brakes: On the disc brake system, the wheels are attached to the disc or the rotor, while for the drum brakes system, the wheels are going to be attached to a drum. The drum rotation will cause the wheel running. to prevent the wheel the drum must be stopped, which is sort of almost like how things work on the disc brake. However, what makes the disk brake and drum brakes different is that every system will have a special thanks to stop the disc/drum. On the drum brakes system, there's no restraint or calipers. Instead, there'll be brake shoes which will stop the drum brakes from the side. When the pedal is pressed, the hydraulic pressure will push the brake shoes against the drum brakes from inside outwards. The friction between the drum brakes and therefore the brake shoes will make the car stop.



Fig 1.2 Drum Brake

2. Hydraulic Braking System

Invented within the early 1900s, the hydraulic braking mechanism functions on brake fluid, cylinders, and friction. By internal pressure application, the glycol ethers or diethylene

glycol forces the vehicle's resistance brake pads to halt the wheels from advancing.

Quick facts about the hydraulic braking system

- Compared to another types and forms of braking, the force produced in the hydraulic braking is larger.
- Being a crucial braking system, hydraulic braking has very fewer chances of breakdown because it features a direct reference to the actuator and therefore the brake drum/disc.



Fig 2.1 Hydraulic braking system

3. Electromagnetic Braking System Most of today's contemporary cars and hybrid vehicles are often seen donning the electromagnetic braking system. because the name suggests, electromagnetic braking uses the idea of electromagnetism to get frictionless braking, which makes them more durable within the end of the day. the primary choice of hybrid vehicles, compared to the common quick magnetic brakes, it works without friction and lube. The compact size braking system, also utilized in trains, works when a magnetic inflow is passed during a spot perpendicular to the rotating direction of the wheel. This creates swift current flow during a direction opposite to the wheel rotation, which generates opposing energy to the rotation of the wheel and therefore the wheel is decelerated.

Quick facts about the Electromagnetic braking system

- Besides being rapid and cost-effective, it also involves no upkeep cost sort of a periodic replacement of brake shoes, etc.
- With electromagnetic braking, safe delivery of heavy loads at high speeds is formed possible.
- Unlike other sorts of braking systems, where massive heat is produced via shoe, very less amount of warmth is triggered which translates into the smallest amount chances of breakdown.



Fig 3.1 Electromagnetic braking

4. Servo Braking System

Servo braking is more of a braking system booster. during this sort of braking system also referred to as vacuum or vacuum-assisted braking, the pressure applied to the pedal by the motorist is amplified. The vacuum generated in petrol-fueled

powertrains is employed by the air intake system within the powertrain's intake pipe, while the diesel powertrains use an air pump.

Quick facts about the Servo Braking System

- The braking system boosters are functional with the hydraulic brakes, and therefore vacuum boosters practically improve the braking force.
- When the pedal is pressed it releases the vacuum on the side of the booster. The atmospheric pressure disparity thrusts the diaphragm for braking at the wheel.



Fig 4.1 Servo braking system

II. LITERATURE REVIEW

With the passage of our time, today's generation is growing up with the dreams of high-speed vehicles. In the last 20 years, the number of vehicles has been increased and therefore the technology has tremendous changes which drives increment in speed. The speed plays a vital part to maintain time for longer distances. But, this speed also major problem for causes of road accidents. The problem is that because the birth ratio is increasing, the accidents are becoming in number which is one among the major problems faced during this era and it might be rapidly increasing within the coming period. So, everyone tries to avoid accidents while travelling but sometimes it's unavoidable. Accidents are happening at each nook of the streets round the world. Lakhs of life end in death as a facet of those accidents. Because the population is increasing, the number of vehicles is increasing within the same proportion. Which suggests there needs an active hood of the brakes giving out. The condition of brakes is often monitored by the breakdown indicator circuit. The breakdown condition is sensed by the sensors attached to the circuit through monitoring the brake switch. So, when the brake is applied it shows the condition of brake whenever. [1]

Studies from road safety surveys have asserted that even the skilled drivers fail to apply brakes completely during emergency situations. The main reason is that the stopping

distance of the vehicle depends on the deceleration when the driver applies brakes. Due to insufficient braking force applied, the stopping distance is more and hence this leads the vehicle to crash or collide with an obstacle. The work for modelling the system began with the method to detect

the issue by considering the reaction time; hence detect the driver intention and capability to apply full brake during emergencies, detection of failure of primary brakes. The shortest and achievable time to interact the secondary braking system after failure detection through the sensing elements were taken under consideration considering the above reasons observed within the surveys. The trails are made to eliminate any shortcoming in achieving of successful and efficient braking.[2]

According to results, the deterioration of the brakes can be led back to thermal cyclic strain (related with the heating-cooling cycles developed during the brake action) superimposed to the mechanical strain caused by braking torque. The work analyses the aforesaid disc brakes investigating both the most causes and therefore the evolution of its deterioration so as to seek out possible solutions. The short lifespan of such discs has got to be ascribed to the rapid

decay of the mechanical properties of the manufacturing material. Material decay is liable for starting cracks. Several actions might be chosen to face this problem. The choice of a specific chemical composition, which can be demonstrated to be unfit for the

aim, produced an extreme tempering of the steel as an immediate result of its protracted exposure to high temperatures (a situation which can be considered usual referring to disc brakes). [3]

There are several limits that has got to be confine mind while driving a vehicle. The breakdown indicator circuit contains many electrical also as equipment like LED, sensors, piezo buzzers, ICs, transistors, etc. The breakdown indicator is employed to avoid major damage. It's a main advantage of breakdown indicator, and it operate in automatic mode that make it easy to use. At present many other instrument or system are often won't to warn before any accident condition but it's only use to watch the braking system or any disturbances in circuit of the braking system, when the brake is applied to prevent or hamper the vehicle. But this project i.e., Automatic breakdown Indicator uses sensors for constant monitoring of the braking switch and provides the entire condition of braking system of the vehicle. Many problems occur while using automatic braking system like some says hydraulic pipes aren't connected tightly and temperature of braking system increases, it can give adverse effect on brake pad and therefore the rotor. [4]

III. OPERATIONAL PROCESS

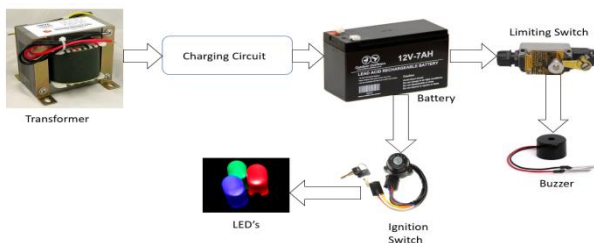


Fig 5.1 Block diagram

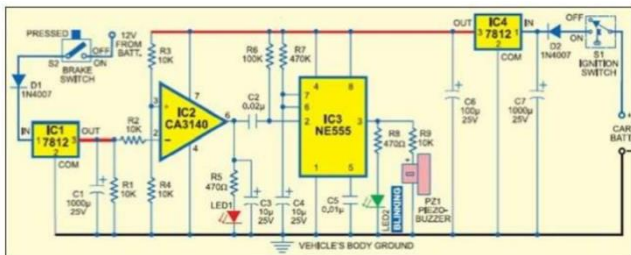


Fig 5.2 Circuit diagram

It is a device used for avoiding accidents. This circuit is continuously monitoring the conditions of brake and gives audio visual indication. If the brakes are unbroken then green LED blinks and for around one second piezo buzzer beeps and when the brake fails the buzzer don't beeps and also only red will LED glows. This circuit only works in vehicles with negative grounding. In nowadays as we all know the hydraulic brakes system is implemented within the vehicle so a brake switch is mounted on hydraulic brake cylinder which will glow the rear brake lamps. This brake switch works on when pressure is maintained and if the pressure drops thanks to leakage, the brake

switch isn't operated and don't perform any function. The pressure drop can't be easily detected unless there would be an outsized pressure drop by the pedal of the vehicle. This is a high fluid leakage which may be sensed by the pedal only. This circuit performs its operation every time when the break is applied so that it can aware every time about the condition of the vehicle braking system. The circuit contains seven capacitors, seven resistors, two diodes, two LEDs, a piezo buzzer and 4 ICs. One of IC (IC2) is an operational amplifier which is employed as voltage comparator and sets the monostable configurations of timer for alarm, this IC2 sense the extent of voltage across break switch. It takes non inverting input which gets half the availability voltage through voltage divider resistors of 10 kilo-ohms (R3 and R4). The brake switch is connected to the IC2 through diode D1, IC2 and

resistor R2. When the brake is applied it receives a high voltage. Normally the red LED glows, because the output of IC2 remains high until the brake is applied. For input stability of IC2 the resistor R1 is employed, for ripple free regulated supply to the input of IC2, IC1 and C1 is employed. IC3 is employed as a monostable which provides pulse output of 1 second, also R7 and C4 timing element also are connected to form the output high for one second to activate the buzzer and therefore the green LED. Usually, the buzzer and therefore the green LED remains off because the trigger pin of IC is high thanks to RC. When the pressure is applied on the pedal, the pin 2 of IC2 receives high voltage from the breakdown switch in order that the output of IC2 goes low and as a result the red LED is transitioned. Where the pressure is in braking system is dropped thanks to leakage, the pressure sensor works and activates the green LED and buzzer beeps for one second. Brake Failure Indicator circuit gets its power from the vehicle's battery and it are often assembled on any general PCB (Project Circuit Board). To avoid the unwanted triggering while the charging of the battery, a well-regulated power supply is required. IC4, C6 and C7 provides the regulated 12V supply to the circuit and stop from unwanted triggering of the circuit. The supply is often taken from the switch as positive terminal and therefore the vehicle's body as a ground terminal.

IV. FUTURE SCOPE

1. Use Triggering or actuation mechanism for secondary braking can be changed to various means viz. using cam and follower arrangement, Magnetic arrangement, etc.
2. Sensor monitoring can be used instead of using two levers; a single lever may serve the purpose.
3. It can be used with high sensitivity pressure sensor.
4. By using micro-controller, we can extent its application in many aspects like controlling of vehicle's starting (vehicle starts only when all the parts of vehicle are in proper working condition).
5. If in case the brake fails, brake failure indicator can also be used in order to shut down the vehicle's engine.

V. CONCLUSION

This project setup reduces the probability of accidents and

prevents loss of life. It improves the efficiency of vehicle and in turn decreases the chances of failure of mechanical systems. Brake failure detector indicates gives additional capability to the driver and to ensure prevention of damage to life and property. Brake failure indicating system is an early warning system. This system can prove to be advancement in mechanical and automotive industry. system endlessly monitors the condition of the brake wire and alerts the rider before it gets cut. The indication to the rider is given within the type of audio-visual sign. This system can prove to be advancement in mechanical and automotive industry.

VI. AKNOWLEDGEMENT

We would like to thank all the authors of all the different research papers referred during making of this paper. It was very Knowledge Gaining and help for further research to be done in future.

VII. REFERENCES

- [21] Avirat Kshar, Veermata Jijabai Technological Institute (VJTI), Mumbai, "Automatic Brake Failure Detection with Auxiliary Braking System", May 2018 | IJIRT | Volume 4 Issue 12 | ISSN: 2349-6002.
- [22] G.Venkata siva, Dr. B. Chandra Mohan Reddy, JNTUA College of Engineering, Aandhra Pradesh, "Automobile Brake Failure Indicator", July 2018 | IJTIMES | Volume 4 Issue 7 | ISSN: 2455-2585
- [23] Abhishek Chaudhary*, Kapil Jariya, Mohit Kumar Sharma, Mr. Vikas Kumar, B.K. Birla Institute of Engineering and Technology, Pilani, "AUTOMATIC BRAKE FAILURE INDICATOR", (I2OR), Publication Impact Factor: 3.785, ISSN: 2277-9655.
- [24] Dhanamjayulu C, Chalamalasetti Guna Sai, Bharath Srinivas G, Hussain Basha D, Arunkumar G, Venugopal P, "Brake Failure Detection and Emergency Braking System", IJITEE, ISSN: 2278-3075, Volume-9 Issue-2, December 2019.
- [25] S. Eswaran1 , A. Raghul , D. Rahul , S. Sudhakar , M. Vignesh, Nandha Engineering College, March 2021 | IJRASET | Volume 9 Issue 3 | ISSN: 2321-9653
- [26] <http://www.Electronics4u.com>

- [27] <http://saranyasblog.blogspot.in/2009/02/introduction-brake-failure-indicator.html>
- [28] <https://en.wikipedia.org/wiki/Brake>
- [29] <http://www.edwardslawok.com/types-of-auto-brakes.html>
- [30] <http://westislandgarage.com/en/auto-repairs/55-systeme-de-freinage>
- [31] <http://www.smartmotorist.com/driving-guideline/failure-of-vehicles-braking-system.html>

Design And Analysis Of Regenerative Suspension System Using Ansys Maxwell

Neeraj Sharma¹, Samiksha Unhale², Vaishnavi Patil³, Samay Meshram⁴, PROF. G.M.Fodase

¹Pimpri Chinchwad College of Engineering & Research, Ravet, Pune

²Department of Mechanical Engineering, PCCOER

ABSTRACT

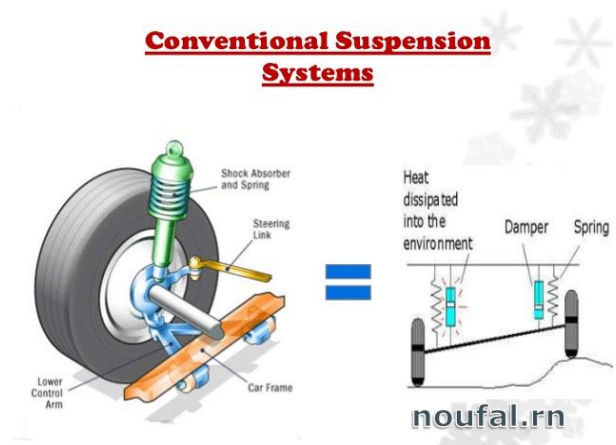
Today's world is full of modern technologies and automotive industry is one of the industry that is evolving to modern technology. Hybrid and electric car is under improvement for a better efficiency. This paper emphasizes the development and analysis of retrofit electromagnetic energy regenerative suspension system test rig. Conventional fluid dampers are providing a reliable and low cost solution in vehicle vibration attenuation over the years. However, these convert vibration energies into heat, which is dissipated to the surrounding. A device capable of converting significant part of this energy into useful electric power, will improve overall fuel efficiency of the vehicle. In response to growing concern for increasing fossil fuel consumption in automobiles, energy harvesting shock absorbers have been extensively explored since past two decades. Electromagnetic dampers with linear or rotary configurations have been used to assist energy dissipation and generation in vehicle shock absorber. The prospective innovative suspension solution requires not only conformance to handling and comfort specifications, but also to convert substantial part of vibration energy into useful electric power. Electromagnetic dampers are emerging as a new technology with developments in the field of high energy magnets and power electronics.

INDEX TERMS Electromagnetic shock absorber, linear generator, Simulation of Ansys Maxwell, Quarter car model

I. INTRODUCTION

Suspension system enhance the driving experience by isolating the vibrations and providing ride comfort to the passenger. Vehicle suspensions are designed to control vehicle vibrations by dissipating vibration energy into heat. If such dissipated energy is recovered, estimated energy gain would be an average 100 -400 watts for mid size passenger car. Regenerative suspension system can convert the kinetic energy directly into electrical energy that can be stored in batteries or for later use.

There are several methods used for shock absorbers in automobiles such as material hysteresis, dry friction, compressed gas, fluid friction, electro rheological or magneto rheological, and combination of fluid friction with compressed air with fluid friction the most widely used approach for vehicle dampers world-wide. Examples of dampers using fluid friction are the mono-tube absorber and the twin tube absorber which are commonly found in most commercial vehicles. Fluid damper is not the most ideal method but it is good enough for most vehicles considering the cost.

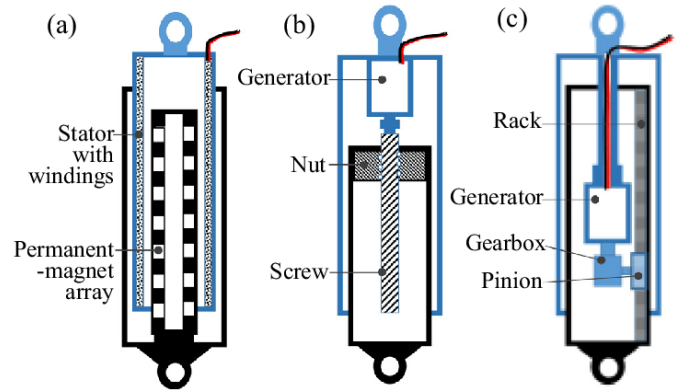
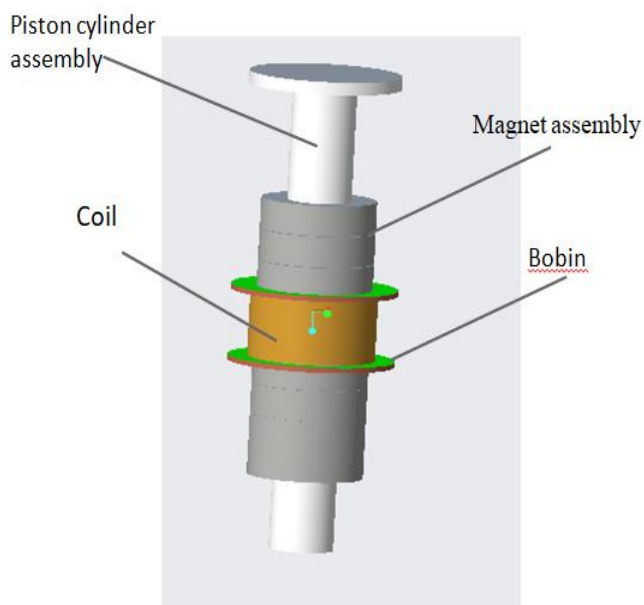


II. General Construction:

- I. A conventional shock absorber consists of piston and rod assembly. The piston has three small holes drilled in it which serves for damping purpose. The fluid in shock absorber resist the vibrations coming from rod surface. The two linear generators are attached to the given shock absorber. In this linear generator, permanent magnet is attached with the help of spring to the casing. Electric coil is wound around this permanent magnet with some air gap. Channel is provided to connect the main shock absorber to linear generator.

II. Working

When vehicle comes across bump or speed breaker, the piston reciprocates in the absorber. The piston moves downwards and oil below piston moves upwards through drilled holes and provides damping. The fluid also moves to linear generator. When fluid exerts the force on magnet, magnet causes relative movement with respect to stationary coil. According to Faraday's law of electromagnetic induction, when magnet moves in stationary coil e.m.f. is induced in coil. This e.m.f. can be supplied to charge the battery. In this way, system works

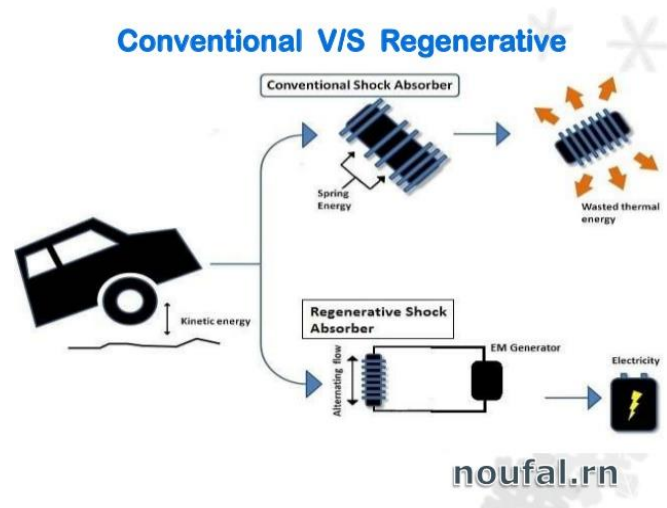


Alternative ways of regenerative suspension system

- Piezoelectric:- Piezo electric material is used to generate the voltage
- Hydraulic:- Pressurized oil is passed through small turbine from pipes.
- Electromagnetic:- Electromagnetic system is based on Faraday's Law of electromagnetic induction

Why Electromagnetic..??!!

- Electromagnetic system is the best one because :-
- No heat generation due to friction
- Possible to implement in vehicle suspension with minimum design changes
- Linear design of electromagnetic energy harvester system
- Can harvest energy in both expansion and compression



III. Literature review

1-Bhavya Bhatia, Anurag Joshi, 2019, "Regenerative

Electromagnetic Shock Absorbers for Independent Suspension System”.

Suspension systems are an integral part of an automobile. Incorporation of the proposed design into the engine based automotive vehicles can greatly reduce the load on the battery, which arises due to the usage of electric accessories. In upcoming electric vehicles, this system can increase the life cycle of the primary battery by providing regenerated electric power to replenish the battery while absorbing the terrain borne shocks. Practical aspects of the defined design, is to be considered in the future scope of this paper.

2-Mustafa Demetgul , Ismail Guney, January 2017,“Design of the Hybrid Regenerative Shock Absorber and Energy Harvesting from Linear Movement”.

Mustafa Demetgul and Ismail Guney proposed a new type of hybrid energy-regenerative suspension system and examined at three different velocities as low as possible by using tensile test machine. This new hybrid system includes the combined hydraulic and electromagnetic structures. A total of 0.25W for 0.004 m/s, 0.4W for 0.0045 m/s and 0.66W for 0.005 m/s was harvested using 80 Ω and 2 Ω external resistors for hydraulic part and for EM part respectively, at 15 mm amplitude in response to the specified excitation. Author stated need of Different experimental conditions, including higher speed excitations, Structural analysis and parameter optimization of this hybrid system.

3-Nitin V. Satpute ,Dr. Shankar Singh, Dr. S. M. Sawant 2015,Design and analysis of linear generator for use in automobile shock absorber.

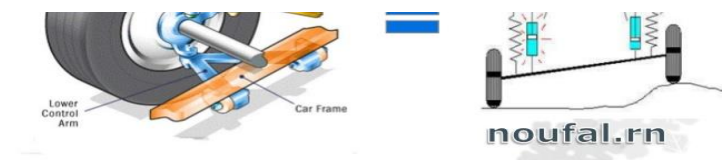
While designing the present linear generator damping factor, efficiency of the generator and weight of the structure has been taken considered. Results of simulation are matching closely to the experimental findings. The fabricated reduced scale Linear Generator is able to harvest peak energy of 0.8 - 1.2 W for suspension velocities of 0.1 – 0.2 m/sec. Full scale linear generator will be able to harvest electrical energy of 60-100W for suspension velocities of 0.1 to 0.2 m/sec, which are normally encountered on the road. Full scale electromagnetic Shock Absorber will offer damping force of 250- 500N for the above velocities.

4-Peng Zheng ,Ruichen Wang , Jingwei Gao,1 and Xiang Zhang³ Published 11 June 2019,“Parameter Optimisation of Power Regeneration on theHydraulic Electric Regenerative Shock Absorber System”

In this paper, a hydraulic electric regenerative shock absorber (HERSA) is designed, modelled, and fabricated to regenerate the kinematic energy of the suspension system. To

maximise the level of regenerated power and power efficiency, a parameter optimisation approach has been proposed, and the result has been validated. The size of cylinder: 50 mm (piston) and 28 mm (rod), the diameter of check valve: 6.35 mm, the accumulator capacity: 0.63 L, the displacement of motor: 5.77 cc, and the electrical load of generator: 20 Ω , respect

5-Nitin V Satpute, Sarika N Satpute ,Lalitkumar M Jugulkar (2016)”Hybrid electromagnetic shock absorber for energy harvesting in a vehicle suspension”



handling of the vehicle. Author presented design of the real size version for implementation in a McPherson strut suspension. Simulation results indicate that average power up to 50.56W can be recovered from a single shock absorber for the normal driving conditions. The real size version will be able to harvest peak power of 18-227 W for the suspension velocities of 0.15-0.4 m/s and lower mass is driven with sinusoidal displacement of 11mm through frequency range of 0.5 to 8 Hz.

IV. CONCLUSION

Incorporation of the proposed design into the engine based automotive vehicles can greatly reduce the load on the battery, which arises due to the usage of electric accessories. In upcoming electric vehicles, this system can increase the life cycle of the primary battery.

The voltage and power produced during transient analysis, is approximately in range of desired voltage values. So system will work when installed on a real vehicle by harvesting kinetic energy from the vehicle suspension system.

ACKNOWLEDGMENT

I am thankful to our respected Guide **Prof. G. M. Fodase** for motivating me to complete this project with complete focus and attention. We are also thankful to our Head of Department **Dr. S. H. Mankar**, also he has been persistent source of inspiration to us.

REFERENCES

- 1) R.M. Maccrimmon ,Crane-supporting steel structures.
- 2) Mr. A. Gopichand, Ms. R. V. S. Lakshmi, Mr. B.Maheshkrishna "Optimization of design parameter for crane hook using taguchi method" in international journals of innovative research in science ,engineering and technology, vol. 2, Dec 2013, ISSN: 2319-8753.
- 3) Chetan N. Benkar, Dr. N. A. Wankhade "Finite Element stress Analysis of Crane Hook With Different Cross Sections" in International Journal For Technological Research InEngineering, volume 1, Issue 9,May-2014, ISSN 2347- 4718.
- 4) M. Shaban, M. I. Mohamed, A. E. Abuelezz and T. Khalifa,"Determination Of Stress Distribution in Crane Hook by Caustic" in International Journal of Innovative Research in science, Engineering and Technology, Vol. 2 Issue 5, May 2013, ISSN: 2319-8753.
- 5) Apeksha. K. Patel, Prof. V. K. Jani, "Design and Dynamic Analysis of 70T Double Girder Electrical Overhead Crane" in Journal of Information, Knowledge and Research in Mechanical Engineering Vol.2, Oct-2013, ISSN- 975-668X.

Design And Development Of Oil Skimmer

A. Prof. Gulab Siraskar¹, B. Santosh Bade², C. Omkar Dubal³, D. Shubham Erande⁴, E. Mohit Ghadge⁵

¹Professor, Mechanical Engineering PCCOE&R, Pune, INDIA

²Student, BE Mechanical Engineering PCCOE&R, Pune, INDIA

³Student, BE Mechanical Engineering PCCOE&R, Pune, INDIA

⁴Student, BE Mechanical Engineering PCCOE&R, Pune, INDIA

⁵Student, BE Mechanical Engineering PCCOE&R, Pune, INDIA

ABSTRACT Oil skimmers are devices which separate oil from water-oil mixture. Oleophilic technique is based on the adhesion of oil to a moving surface. The efficiency with regard to oil skimmer is the quantity of oil recovered in comparison water traditionally used oil skimmers has lower efficiency. Another method used for removing the oil is by using special chemical absorbing pads which when placed over the surface, absorbs the oil. The proposed project aims at increasing the efficiency of the mechanical method of separating oil which uses oil skimmer. This will be done using a disc type oil skimmer and changing the material of the disc.

INDEX TERMS Oil skimmer, oleophilic, efficiency, disc.

I. INTRODUCTION

Oil is the precious crude and it is being used in many day to day applications of human life. Most of the oils are toxic and are dangerous when there is direct contact with them. Many countries has made stringent safety norms for wastewater disposal contained with oils mainly typically from petrochemical and process industries so that such industries are equipped with such kind of oil skimmers to separate the oils from disposal water. The continuous removal of oil from process fluid reduces the machine fluid refilling cost, Improves the disposal water quality and increases the life of the fluid. An oil skimmer is a device that separates oil floating on a liquid surface. They are used for a variety of applications such as oil spill response, as a part of oily water treatment systems, removing oil from machine tool coolant and removing oil from aqueous parts washers

An Oil skimmer is a mechanical device specifically designed for removal of oil from water-oil mixture Oil skimming is a low-tech but reliable and efficient technique. The skimming principle, upon which the technique relies, is dependent on three physical properties of oils, namely specific gravity, surface tension and affinity. Most oils have a lower specific gravity than water, which allows it to separate from water and float to the surface unless agitated. These oils are possible to collect using an oil skimmer. Most oils have little or no affinity for water, which prevents mixing of oil and water. As the skimming medium enters the water, the oil wets the surface preventing water from doing the same. Any water on the surface is pushed away as more oil attaches to the surface because of the surface tension of the oil. However, it is important that the skimming medium is not

submerged too deep into the water, as it may cause the oil to be washed off the skimming medium and thereby lowering the efficiency.

The oil skimmer uses a rotating medium which is submerged inside the water. This rotating medium may be drum, belt or disc. The oil floating on water sticks to the rotating element due to adhesion. This adhered oil is then separated from the element using a separating strip. This separating strip collects the oil in a tank. The disc type oil skimmers have higher efficiency than the other types of oil skimmers. The rotating medium is made to run at lower speeds. Higher speeds will increase the mass flow rate but it will increase the quantity of water recovered thereby reducing efficiency.

A. Skimming Technologies: There are two mechanisms for removing oil from the water surface 1.Oleophilic techniques 2.Non-oleophilic techniques

Oleophilic technique is based on the adhesion of oil to a moving surface. Non- oleophilic techniques include weir skimmers relying on gravity, suction systems, and mechanical skimmers, which physically lift the oil with scoops, or grabs. Oleophilic Skimmers Oleophilic skimmers recover oil based on the properties of specific materials, which have greater affinity for oil than for water. There exist numerous types of oleophilic skimmers and they are therefore divided into subgroups such as disc skimmers, drum skimmers, rope mop skimmers, belt skimmers, and brush skimmers. Oleophilic skimmers usually achieve the highest ratio of recovered oil in relation to entrained water, also referred to as the recovery efficiency, compared to other skimmer types. Oleophilic skimmers reach their highest efficiency

when handling medium viscosity oils. Oil pollution occurs in sea water when leaks from water fronts for the supply of diesel fuel to fishing vessels pass along into the harbour water, when vessels pump out oily bilge water in port, when used engine oil is dumped overboard and when an accident results in leakage of fuel oil; waste disposal and accidents. A fishery harbour which is neighboring with the main dock also faces the risk of major oil splatter if the main port is a transfer point for crude oil or refined products from oil tankers. Human activities are directly linked to these sources. More than 5 million tons of crude oil are transported annually around the world by the sea, putting the ecosystem in danger.

Eventually, it puts the environmental and marine lives in danger. The marine oil spill is classified into thick oil with a thickness of more than 10mm and the thin oil with a thickness of less than 10mm in the field of oil spill disposal. Further the thin oil having thickness less than 1mm are defined as oil film and can be classified into multiple level according to their appearance on the surface of sea water. Disposal of this thin oil film is major problem as it is difficult to separate thin oil from water as compared to thick oil. The thin oil film on the sea would block the exchange of air and water and have adverse impact on the environment.

Modernized world desire rapidness every single field. Hence pace and quick working is most important. Nowadays for achieving rapidness, various machines and the equipments are being manufactured. In such a modern era of globalization, scaled down industries are helping in a various manner to the growth of our country.

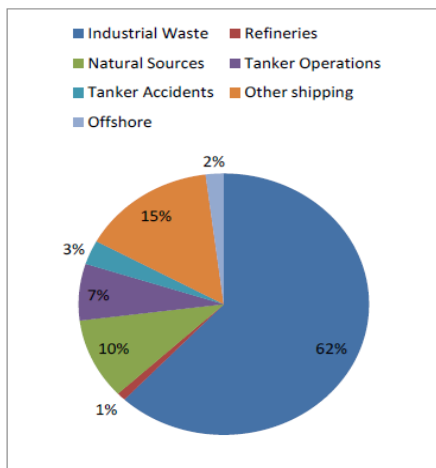


Chart-2 Sources of Oil Spill into the Sea

However, among all this methods mechanical recovery is considered as the most efficient and environment friendly method. Hence it is the first preferred method for oil spill recovery system. So there is necessary to access the mechanical recovery capacity by skimmer as an integral part of overall oil spill response and preparedness capability.

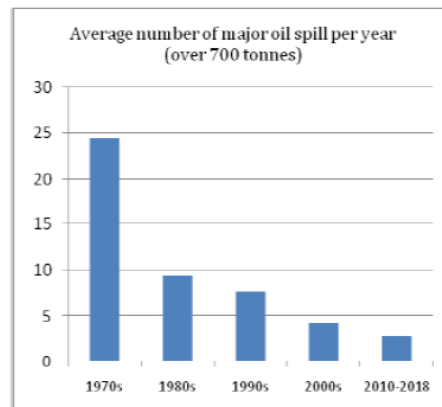


Chart-2: Reduction in Major Oil Spill

The inventor is regularly facing new challenges of importing new concepts and composition into reality. New gadgets and approach are being developed constantly to construct various products at economical rates and great quality. Considering the above inputs we have tried to design a device, which is the adornment of machine tool to have the cure to the cutting fluid after having used as a coolant. Because the coolant after having repeated use, gets mixed up with the lubricating oil and its property gets changed. Hence it becomes necessary to separate the oil from the mixture of the oil and the coolant. Investigation of a novel parameter that considerably enhances the performance of disk and Belt oil skimmers is introduced. During the operating of crude oil, the transportation of crude oil requires the adoption of safety measures in port terminals. At sea accidents are further serious cause of oil pouring and cause of pollution.

In this paper, we intend to show that by changing the material of the disc of disc type oil skimmer, the efficiency of the operation in terms of quality of oil recovered can be increased. Mostly, disc made of mild steel

is used in oil skimmers. We have used a disc made of Acrylic. Acrylic is a low cost oleophilic material which is also light in weight. Our aim is to find the efficiency of disc made of Acrylic and compare it with the efficiency obtained by disc made of mild steel. In oil spills, mostly crude oil is spilt are conducting. We the experiment on the device which we have manufactured. SAE 20W-50 oil is used as a replacement of crude oil.

II. DISK TYPE OIL SKIMMER

- Disc
- Motor
- Separating Strip
- Shaft
- Container
- Frame

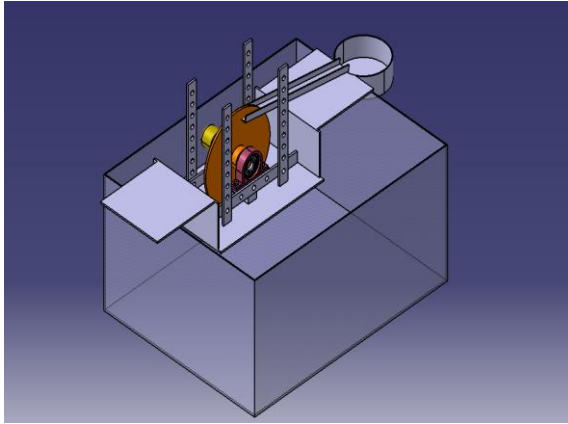


Fig 2.1 CAD model of Disc type Oil skimmer

The design of the disc type oil skimmer is application dependent. The main goal of the project is to skim the oil to calculate its efficiency. The efficiency varies according to the depth of disc inserted and not the size of the disc. Thus, disc of any size can be taken. We have used the disc of 200mm diameter.

Another important design parameter is the selection of motor. As the quality of mixture gets affected by higher speeds, a low speed motor is required. Also, as the weight and size of disc is not very large, a 12V DC motor can be used.

2.2 Material:

1. Acrylic:

Acrylic is artificial fiber made from a special group of vinyl compounds, primarily acrylonitrile. Acrylic fibers are thermoplastic (i.e., soften when heated, re-harden upon cooling), have low moisture regain, are low in density, and can be made into bulky fabrics. They wash and dry easily and are dimensionally stable. They are resistant to bleaches, dilute acids, and alkalis, and to weathering and microbiological attack.

2. Mild Steel:

Mild steel is the most widely used steel. Mild steel isn't promptly tempered or solidified however it has enough quality. It contains 0.16 to 0.18 % Carbon (greatest 0.25% is allowable), 0.70 to 0.90 % Manganese, 0.40% Silicon, Sulphur most extreme 0.04%, Phosphorous up to 0.04%.

2.3 FEA:

FEA is carried out to check for the stresses in the disc and the separator strip. The rotation of the disc causes frictional stress between the disc and the separator. The CAD model of disc and separating strip is brought into Ansys. Both of them are meshed such that disc

rotates and the separating strip is stationary.

(Note: FEA is done primarily to check the areas of stress concentration.)

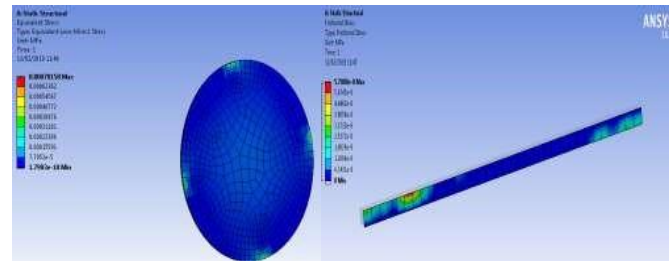


Fig FEA of Acrylic disc and

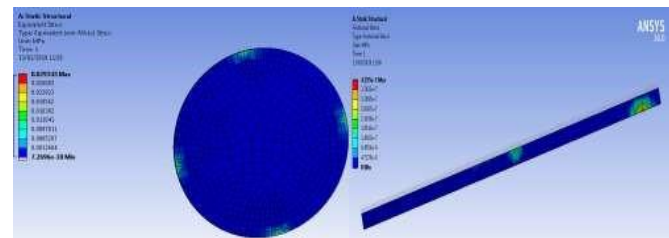


Fig FEA of Mild Steel disc and

2.4 Manufacturing:

The model was manufactured according to standard design parameters discussed in 2.1. The manufacturing of disc, tanks, supporting frame was done. The standard parts bought were DC motor, bus, bolts and rectifier. The various manufacturing processes carried out were as follows:

- Cutting
- Welding
- Drilling
- Sheet metal bending
- Finishing

III. METHODOLOGY

3.1 Data Gathering:

Our main aim is to find efficiency. Efficiency is calculated based on working of device for a time of 60 seconds. The oil content in the collected water-oil mixture is used to calculate the efficiency. The oil used is engine lubricant oil SAE 20W-50. The disc used is made of Acrylic. After testing Acrylic, Mild Steel will be tested.

3.2 Procedure:

The acrylic disc is attached to the motor. The motor rotates at the speed of 60 rpm. The motor works on direct current. It should be attached to DC source or AC source with the help of rectifying arrangement. The tank from which oil has to be skimmed is filled with water-oil ratio of 200:22. The disc is inserted inside the mixture at a

depth of 20mm. The motor is started. The motor is

Material	Depth	Efficiency (%)
Acrylic	20	88.10
	30	81.75
Mild Steel	20	78.20
	30	73.70

switched off after 60 seconds. The skimmed oil is collected in a measuring jar. Allow the collected mixture to settle for 5 minutes. The total height column and water column is measured. The total volume of oil can be calculated by multiplying the measured column height with the area of the jar. The disc is then inserted at a depth of 30mm along with the oil in same ratio and procedure is repeated.

The same procedure is carried out on Mild Steel disc. Make sure to use gloves while handling the equipment. The oil needs to be handled and transported correctly for

Material	Depth	Total height(mm)	Height of water column(mm)
Acrylic	20	51	6
	30	58	10
Mild steel	20	56	12
	30	62	16

increasing the accuracy of the experiment.

IV.OBSERVATIONS AND CALCULATIONS

4.1 Observation Table:

4.2 Calculations:

Efficiency is calculated on basis of content of oil in water- oil mixture.

$\eta = \frac{\text{Volume of oil recovered}}{\text{Total volume of mixture recovered}}$

The volume is calculated by multiplying area of measuring jar with height. (Note: 220ml of oil fills the measuring jar by 50mm)

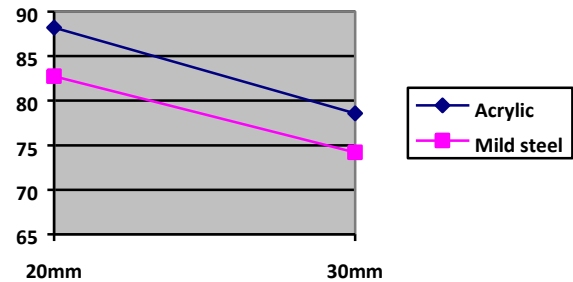


Fig 4.1 Graph of Efficiency Vs Depth

V.CONCLUSION

A disc type oil skimmer can be used to separate oil from water-oil mixture efficiently. The disc when made up of Acrylic gives higher efficiency when compared to the traditionally used disc made of Mild Steel. Efficiency obtained by using the Acrylic disc was 88% which is 10% more than the disc made of mild steel. The FEA analysis also shows that the Acrylic material has enough strength to withstand the forces that act on it. Also, when the disc is immersed deeper, the volume of the mixture recovered increases, but the quantity of water recovered also increases thereby decreasing the efficiency. Thus, disc should be immersed at an optimum depth to get higher efficiency

VI.REFERENCES

- [1] Rashi Yadav, Divyesh Jolapara, Dineshkumar Jawalekar, Rugved Joshi, Soham Holay
"Design, Analysis and Manufacturing of Disc Type Oil Skimmer"
[JUNE 2019]
- [2] Suraj Nair, Kajol Kamble, Sayali Shewale, Sanjay Lohar.
"Design & Fabrication of Disc Type Oil Skimmer" [2017]
- [3] Vishal G. Naphade, Atul M. Parande, Sunil N. Suryawanshi, Muqsid M. Inamdar, Vinayak Kale.
"Design Of Disc Type Oil Separator" [DEC 2018]
- [4] Saathiyamoorthi V, Arumugum K, Arun Pragathish M, Barath B N, Bhaskar M.
"A Review of Mobile Oil Skimmer" [2018]
- [5] Rafi Jamal Algawi, Maha Adnan Dawood.
"Study of operating conditions for oil skimmer apparatus from water"
- [6] International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 05 | May -2017
"Study of operating conditions for oil skimmer apparatus from water"
- [7] 2nd International Tropical Renewable Energy Conference (i-TREC) 2017
"Analysis of effectiveness of oil spill recovery using disc-type oil skimmer at laboratory scale"
- [8]. Guzman, L. and Campodonico, I.[1981]
Studies after the Metula oil spill in the Straits of Magellan, Chile
"In Proceedings of the Petromar '80 Conference", Monaco, 363-376.
Graham and Trotman Ltd., London, UK

Experimental setup using rotating circular disc for kinetic coefficient of friction using lubricants

Mr. Rushikesh Dhanokar 1, Mr Ankit Bhalerao 2, Mr Zahoor Ahmad Nath3, and Mr Aadil Majeed Dar4. Prof. Gulab Siraskar

Department of Mechanical Engineering.

Pimpri Chinchwad College of Engineering & Research, Ravet-412101

[2020-2021]
PCET'S

ABSTRACT- Friction plays an important role in maintaining the contact between two surfaces while transmitting power. If the friction value goes down highly then the power transmission will not be done in effective manner. Similarly, if the frictional forces go very high then also high amount of energy will be dissipated in the form of heat, resulting into concentration of thermal stresses. In the field of designing of power transmitting mechanical system friction plays the most important part. So, while designing them we need to concentrate on the study of tribology. Tribology is the branch of mechanical engineering which deals with the frictional analysis. In this project we are calculating the frictional coefficient of the various materials. To design the system, we use CATIA V5 software. The system is integrated with electronics for direct value calculation. The final testing and analysis will be done after the manufacturing. Using different types of lubricants, having different properties helps in behavior of different lubricants for different conditions and speed. The aim of the experiment is to study different lubricants and their change in properties. Also, it is useful in study of tribology in which other than coefficient of friction we can also investigate behavior of materials and wear in between two surfaces consisting lubricant. Previously, the tester use to determine dry coefficient of friction and mainly static coefficient of friction but this setup ensures the wet friction. Keywords -

Keyword- kinetic coefficient of friction, tribology, lubricants

1. INTRODUCTION

Friction is the force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other. When surfaces in contact move relative to each other, the friction between the two surfaces converts kinetic energy into thermal energy (that is, it converts work to heat). This property can have dramatic consequences, as illustrated by the use of friction created by rubbing pieces of wood together to start a fire. Kinetic energy is converted to thermal energy whenever motion with friction occurs, for example when a viscous fluid is stirred. Another important consequence of many types of friction can be wear, which may lead to performance degradation or damage to components.

Most experimental studies on friction and wear are concerned with finding qualitative and quantitative relationships between friction and wear data and various governing parameters and conditions, for example: the properties of bulk and surface layer materials, the roughness of the surfaces in contact, the stress levels, the sliding speed,

the temperature, the environment, the properties of the lubricants and the lubrication conditions. The correlations found in those experimental works are usually assumed to be intrinsic characteristics of the interfaces tested for the ranges of parameters and conditions considered.[5]Difficulties on the reproducibility of friction data with different experimental apparatus under similar conditions, and dependence of the results of wear tests on the dynamic properties of the equipment, but only in the last few years an increasing attention has been paid to the experimental study of these effects. The focus of research during the 20th century has been to understand the physical mechanisms behind friction.

1.1 Coefficient of friction

The Coefficient of friction is defined because the ratio of force of friction to the traditional force, $= F / N$. Consider the following two Figures. One is for static friction and the other for kinetic friction. In this experiment, only the coefficient of kinetic friction is going to be measured.

At constant velocity force $F = F_k$. On the approach of motion to the Right, $F =$

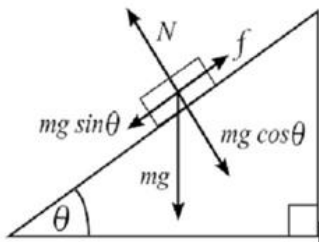


Fig. 1: Friction forces on an inclined plane

$F_s = F_k / N$. Here, $F = F_k$, F_k = Force of kinetic friction, k = coefficient of kinetic friction, N = Normal force. $s = F_s / N$. Here, $F = F_s$, F_s = Force of static friction, s = coefficient of static friction, N = Normal force.

1.2 Arduino UNO

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

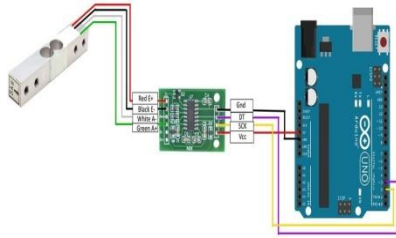


Figure 2: Arduino UNO

1.3 Lubrication Oil

Lubrication is used for the control of friction and wear by the generating a friction-reducing film between moving surfaces in contact with each other. The lubricant used is fluid, solid, or plastic substance depending upon the application for which it is used. It fails to realize all that lubrication actually achieves under different temperatures and conditions.

Many different substances can be used to lubricate a surface. Oil and grease are the most common. Grease is composed of oil and a thickening component to obtain its consistency and properties, while the oil is the main component which actually

lubricates. Oils can be synthetic, vegetable or mineral-based as well as a combination of these. The application determines which oil, commonly referred to as the base oil, and should be used. In extreme conditions, synthetic oils can be beneficial. Where the environment is of concern, vegetable base oils may be utilized. Lubricants containing oil have additives that enhance properties within the base oil. The amount of additives depends on the type of oil and the application for which it will be used. For instance, engine oil might have a dispersant added. This process changes the oil's viscosity and allows it to flow better in cold conditions while still maintaining its high-temperature properties. The only problem with additives is that they can be depleted, and in order to restore additives back to adequate levels, generally the oil volume must be changed. The Role of a Lubricant The primary functions of a lubricant are to: • Reduce friction • Prevent wear • Protect the equipment from corrosion • Control temperature (dissipate heat) • Control contamination (carry contaminants to a filter or sump) • Transmit power (hydraulics) • Provide a fluid seal.

1.4 Force transducer

Force transducers are required to transform a physical force into an electrical signal. Their uses in the Robotics field have traditionally been confined to specialized, custom-built applications and therefore are limited in number. The advent and development of adaptive control techniques, however, have increased the popularity of force and torque sensors which will allow the next generation of robots to interactively control the gripping action as well as the object movement during the programmed task. The adaptive control of a complex mechanical structure, such as a robot, requires

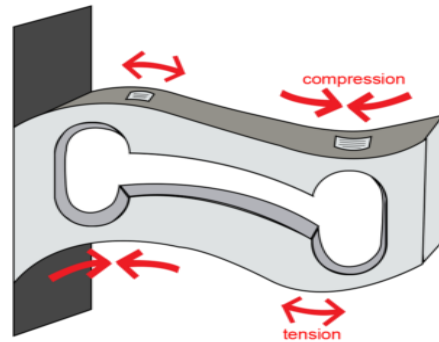


Figure 1.3: Force transducer

1.5 Background Research

Most experimental studies on friction and wear are concerned with finding qualitative and quantitative relationships between friction and wear data and various governing parameters and conditions, for example: the properties of bulk and surface layer materials, the roughness of the surfaces in contact, the stress levels, the sliding speed, the temperature, the environment, the properties of the lubricants and therefore the lubrication conditions. The correlations found in those experimental works are usually assumed to be intrinsic characteristics of the interfaces tested for the ranges of parameters and conditions

considered [5]. Difficulties on the reproducibility of friction data with different experimental apparatus under similar conditions, and dependence of the results of wear tests on the dynamic properties of the equipment, but only in the last few years an increasing attention has been paid to the experimental study of these effects. The focus of research during the 20th century has been to know the physical mechanisms behind friction.

1.6 Problem Statement

Availability of coefficient of friction tester machine for measuring kinetic coefficient of friction and its behavior when lubricant used. To analyze change in properties of lubricant during variable speed conditions.

1.7 Objective

The main purpose of this research is to design and manufacture the experimental setup to determine coefficient of friction.

- To determine variation in coefficient of friction measured by experimental setup.
- Analysis on results of with and without using fluid in between two surfaces of material.
- Behavior of different lubrication on motion and friction between two surfaces.
- To carry out experiment on setup using different lubricants
- Variation in coefficient of friction by changing the speed of motor.
- Analyze application of different lubricants in industry according to change in properties of lubricant.

1.8 Scope

- The measurement of kinetic coefficient of friction for dry as well as lubricated system is to be done.
- The measuring device for such is been proposed in this project.
- This device provides us with parameters needed for the proper selection of lubricants to be used in different system.
- Helps in selection of proper lubricant for suitable application.
- Different lubricants can be used for experiment.
- Use of simple mechanism which makes it cost effective.
- Using electronic circuits and sensors gives efficient results of experiment, accuracy is also increased. It gives output for small deflections so highly sensitive.

1.9 Methodology

Experimental setup comprises of simple mechanism which consist of a rotating disc which is coupled with a motor which variable speed motor. This can be useful to change the speed of the motor, due to which experiment can be carried out at different speed.

As speed of the disc will affect the friction created between two surfaces. Due to increase in speed the spherical ball will try to slide on the disc. The friction developed will increase, wear between two surfaces will also increase.

Main components of the setup are:

- 1) Variable speed motor
- 2) Circular disc with high finishing surface
- 3) Spherical ball
- 4) Force transducer
- 5) Digital display



Figure 1.4: Experimental setup

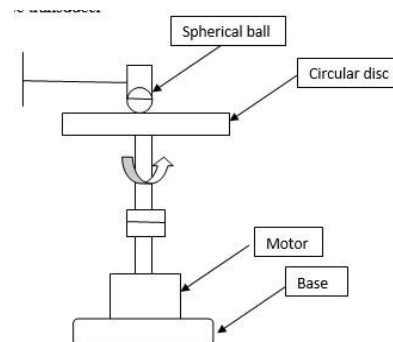


Figure 1.5: Experimental setup

2. LITERATURE SURVEY

Mohd Ali, Mas FawziTukiman, MohdMustaffa, Norrizal.(2016). Small engine lubricant oil friction tester. 11. 11192-11197.They have proposed that extreme friction often occurs in engine components, causes energy loss and reduces the lifespan of the engine. If we change the engine oil according to schedule of maintenance,then it may reduce the chances of engine breakdown. In this study, an apparatus to test the effectiveness of the engine lubricating oil was developed.

Federici, MatteoStraffelini, Giovanni Gialanella, Stefano. (2017). Pin-on-Disc Testing of the very Low-Metallic Friction Material which is Sliding Against HVOF Coated Cast Iron: Modelling of the Contact Temperature Evolution. Tribology Letters. 65. 10.1007/s11249-017- 0904-yIt states that -Pin-on-disc (PoD) testing is widely used to investigate the sliding behavior of materials and relevant wear mechanisms under different tribological conditions.

Hua, XijunPuoza, Julius Caesar Zhang, PeiyunXie, Xuan Yin, Bifeng. (2017). This is an experimental Analysis of Grease in friction Properties on Sliding Surfaces. There is a lot of work on the tribological properties, characteristics and lubrication mechanisms of oil lubricant used on surfaces, however the application of grease lubrication on textured surfaces is something new idea. This research paper represents an experimental study of the frictional behaviors and properties of grease lubricated sliding contact operating under mixed lubrication conditions.

Ozturk, ErkanYıldızlı, K. Memmedov, Royal Ulgen, Ahmet. (2018). “Design of an experimental setup to determine the coefficient of static friction of the inner rings in contact with the outer rings of radial spherical plain bearings.” Tribology International.128. 10.1016/j.triboint.2018.07. 007.In this study, a new experimental setup was designed and manufactured to determine the coefficient of static friction (COFs) for polyoxymethylene (POM)/steel spherical contact surfaces in radial spherical plain bearings. The experimental setup can measure the frictional moment. The POM/steel COFs equations from the frictional moment measurements were obtained. A sequence of tests changing the normal force under dry sliding condition for three different axis angles was performed.

S. Reina, R.J.H. Paynter, D.A. Hills, D. Dini. They have proposed unique technique for measuring the interfacial coefficient of friction between two solids which avoids sliding is described, and sample results are given. The method applies the fact that a simply controlled sequence of partial slip states between contacting bodies may be used to produce relative motion. It is applied that this method induces much small surface damage in the parts, and therefore yields a value for the coefficient of friction which is much more representative of their unmodified condition.

LeRoyAlaways, Nicolas Krumenacker states that non-destruction determination of static coefficient-of-friction for round balls can be challenging. The traditional tilttable test on an individual ball will just cause the ball to roll off the table and little is accomplished. A three-ball test can be performed however

maybe the balls will tumble with each other if the friction is too high. An additional problem generates with this type of testing in that the precise moment of impending slip is determined by observing the ball or ball sample material and this moment is hard to detect.

J Jeswiet, M Arentoft, and P Henningsenhave. They suggested that friction at the workpiece–die boundary, in both bulk forming and sheet forming is basically the single most important physical parameter which influences the processing of metals and it still remains the least understood.Therefore there is a need for some research in the metal–die interface mechanisms. To gain a good understanding of the mechanisms at the interface and to be able to verify the friction and its behaviour in the models that exist and also friction sensors are needed. Designing sensors are also used to measure frictional stress in metal working and has been pursued by many researchers. This paper also tells us about methods that have been used to measure friction in rolling in the past and discusses some of the recent sensor designs that can now be used to measure friction both in production situations and for research purposes.

3. Design of basic component

3.1 Basic design

Computer-aided design (CAD) is that the use of computers to assist within the creation, modification, analysis, or optimization of a design. CAD software is employed to extend the productivity of the designer, improve the standard of design, improve communications through documentation, and to make a database for manufacturing. CAD output is usually within the sort of electronic files for print, machining, or other manufacturing operations. CAD is used as follows:

CAD is used as follows:

1. To produce detailed engineering designs through 3-D and 2-D drawings of the physical components of manufactured products.
- 2.To create conceptual design, product layout, strength and dynamic analysis of assembly and therefore the manufacturing processes themselves.
- 3.To prepare environmental impact reports, during which computer-aided designs are utilized in photographs to supply a rendering of the looks when the new structures are built.

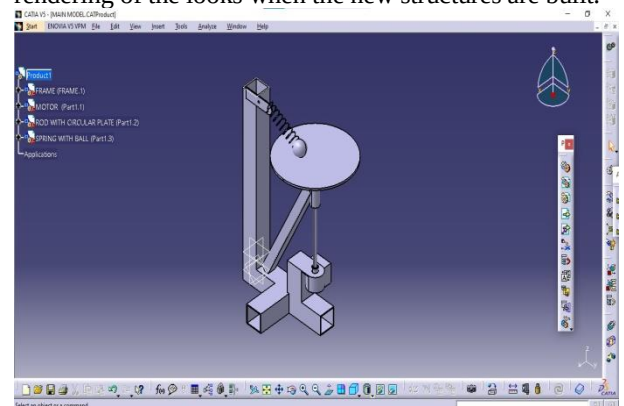


Figure 3.5: CAD model of assembly

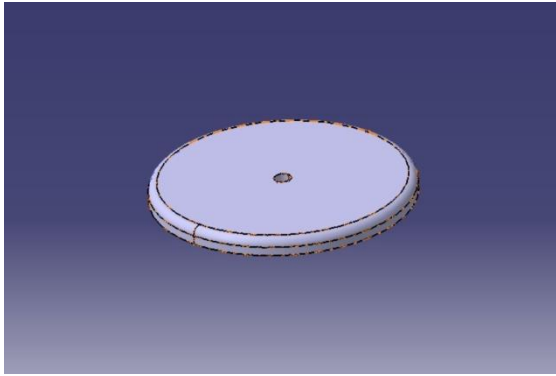


Figure 3.6: Circular disc

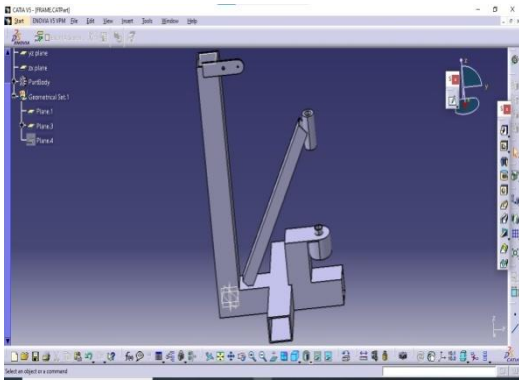


Figure 3.7: Frame

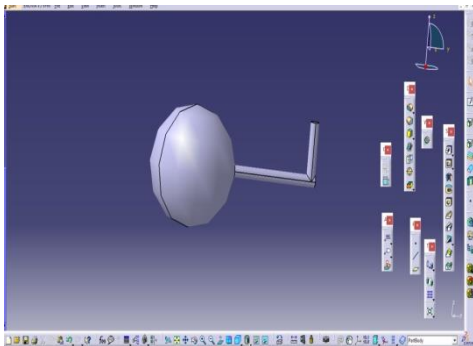


Figure 3.8: Spherical ball

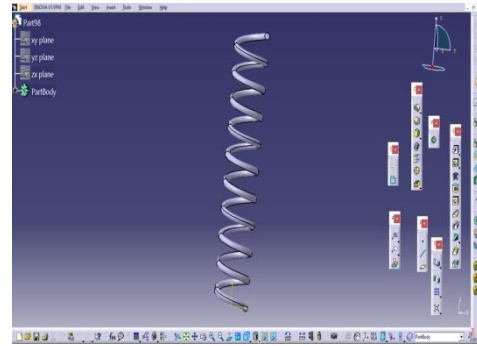


Figure 3.9: Spring

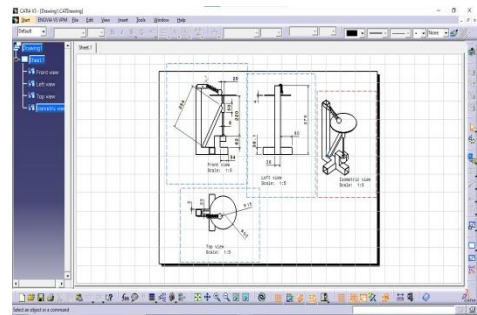


Figure 3.10: Drafting

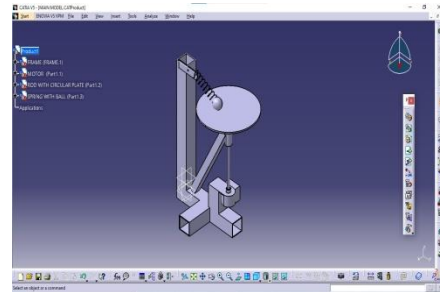


Fig. Experimental setup assembly

Part No.	Part Name
1	Circular disc
2	Spherical ball
3	Spring
4	Frame

Table no 1. List of parts

3.2 Calculation

Nomenclature

M = Mass of disc (kg)
 m = Mass of spherical ball (kg)
 R = Radius of disc (kg)
 r = Radius of spherical ball (kg)
 P = Power (Watts)
 V = Voltage (volts)
 I = Current (Amp)
 T = Torque (Nm)
 N = Speed (rpm)
 ω = angular velocity (rad/sec)
 Fc = Centrifugal Force (N)
 G = Modulus of rigidity
 C = Spring index
 K = Stiffness of spring (N/mm)
 Ks = Shear stress factor

Motor design

Let for a motor with 24 Watts power, 12V and 2 Amp $P = V \cdot I = 24$ Watts.

The motor shaft is coupled with the upper disc, so the total maximum torque required for disc to rotate is given as,

Total Maximum Torque T:

$T = \text{Mean radius of disc} \times \text{weight of the disc}$

Let mass of the disc 'M' be 100 gram

$T = (0.05 \times 0.1 \times 9.81)$

$T = 0.049 \text{ N-m}$ ——— (Required torque)

Now for 24 watts motor rotating with 100 rpm the torque supplied is given as,

Power of motor P:

$P = 2 \pi n T / 60$ ——— (consider $n = 100 \text{ rpm}$)

$T = 2.29 \text{ Nm}$ ——— (supplying torque)

As the supplying torque is greater than the required torque, our design is safe and for this system we can purchase a motor with 24 Watts power.

Force analysis at the ball-

1. Mass of the roller = 10 gram = 0.01 Kg.

2. Rpm supplied by the motor = 100 rpm.

3. Radius of the upper disc = 100 mm = 0.1 m

The angular velocity W

$W = (2 \pi n) / (60)$

$= (2 \times 3.14 \times 100) / (60)$

$W = 10.47 \text{ rad/sec}$

Centrifugal force acting on the ball Fc

$F_c = m \cdot r \cdot W^2$

$= (0.01 \times 0.1 \times (10.47)^2)$

$F_c = 0.109 \text{ N}$

Spring Design-

For plain carbon steel 30C8,

Load = 0.109 N = 350 N

Deflection = 25 mm $G = 84 \times 10^3 \text{ N/mm}^2$

Spring index, $c = 8$

4. CONCLUSION

Hence, we conclude that we have successfully design the coefficient of friction measurement system with the help of CATIA V5 R20 software. The manufacturing of experimental setup is started using appropriate dimensions of various parts. After completion of manufacturing.

REFERENCES

- [1] Mohd Ali, Mas Fawzi Tukiman, Mohd Mustaffa, Norrizal. (2016). "Small engine lubricant oil friction tester." 11. 11192-11197.
- [2] Ederici, Matteo Straffellini, Giovanni Gialanella, Stefano. (2017). "Pin-on-Disc Testing of Low-Metallic Friction Material Sliding Against HVOF Coated Cast Iron: Modelling of the Contact Temperature Evolution." Tribology Letters. 65. 10.1007/s11249-017-0904-y.
- [3] ua, Xijun Puoza, Julius Caesar Zhang, Peiyun Xie, Xuan Yin, Bifeng. (2017). "Experimental Analysis of Grease Friction Properties on Sliding Textured Surfaces". Lubricants. 5. 42. 10.3390/lubricants5040042.
- [4] ztu'rk, Erkan Yıldızlı, K. Memmedov, Royal Ulgen, Ahmet. (2018). "Design of an experimental setup to determine the coefficient of static friction of the inner rings in contact with the outer rings of radial spherical plain bearings." Tribology International. 128. 10.1016/j.triboint.2018.07.007.
- [5] eina, S. Paynter, Robert Hills, D. Dini, Daniele. (2010). "Determining the coefficient of friction between solids without sliding." Wear. 269. 339-343. 10.1016/j.wear.2010.04.017.

- [6] 2012). “Determining Friction Coefficients for Round Balls by Using Center-ofPressure.” *Procedia Engineering*. 34. 491–495. 10.1016/j.proeng.2012.04.084.

eswiet, Jack Arentoft, M. Henningsen, P. (2006). “Methods and Devices Used to Measure Friction in Rolling.” *Proceedings of The Institution of Mechanical Engineers Part B-journal of Engineering Manufacture - PROC INST*