Samarth Educational Trust's

Arvind Gavali College of Engineering

Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere.
Approved by AICTE, New Delhi, Recognized by Govt. of Maharashtra, DTE Mumbai.

NAAC and NBA Accredited

PROPOSAL FOR AUTONOMOUS STATUS
A.Y. 2025-26

Name of Document	Particular
Achievements of Faculty Members	List of Faculty Achievements

Annexure No. 22

Dr. Sharad S. Mulik
PRINCIPAL

ARVIND GAVALI COLLEGE OF ENGINEERING EN-6545 SATARA

SAMARTH EDUCATIONAL TRUST
ARVIND GAVALI COLLEGE OF ENGINEERING
Approved by AICTE, New Delhi, Recognized by Govt. of Maha. DTE Mumbai &
Affiliated to MSBTE Mumbai ,Dr. Babasaheb Ambedkar Technological, University Lonere
AICTE ID: 1-4210711 AISHE Code: C-11245 DTE Code: EN-6545 DBATU Code: 6545 MSBTE Code: 1617
NBA Accredited NAAC Accredited
Address : Gat No.247, At.Panmalewadi,
Post.-Varye,Tal.& Dist.-Satara, Pin.- 415 015
Mob.: 9957100100, 9069700100
Email : agcenggsatara@gmail.com
Website: www.agce.edu.in

Ref. No.: AGCE/Office/2024-25/ **Date:27th Feb. 2025**

ACHIEVEMENTS OF FACULTY MEMBERS

The faculty of Arvind Gavali College of Engineering have demonstrated exceptional academic and research excellence. They have published numerous research papers, filed patents, presented at conferences, authored books, and secured external funding. These achievements showcase their expertise and dedication, enhancing the institution's reputation and research ecosystem, making it an ideal candidate for autonomous status.

Sr No	Activity	No of activities academic year wise					
		2023-24	2022-23	2021-22	2020-21	2019-20	2018-19
1	Number of Research Papers Published in Journals	17	27	08	13	11	07
2	Number of Patents Granted	05	05	02	02	01	
3	Number of Papers Published in National Conferences						
4	Number of Papers Published in International Conferences	01	50		02	34	40
5	Number of Books Authored	02		01	01		
6	Number of Book Chapters Authored		01				
7	Number of New Externally Funded Research Projects Received	31	24	25	21	16	14
8	Funds Received	5.74 Lakhs	11.26 Lakhs	4.98 Lakhs	6.98 Lakhs	4.83 Lakhs	3.10 Lakhs
9	Other Achievements	47	22	17	44	110	02
All faculty members achievement certificates Link for reference		View	View	View	View	View	View

Note: All faculty achievements documents are attached in the respective y[illegible] link above[illegible]ble for your reference.

ARVIND GAVALI COLLEGE OF ENGINEERING EN-6545 SATARA

Achievements of Faculty Members in 2019 – 20:

https://www.agce.edu.in/files/autonomy/af/2019-2020.pdf

1. Number of Research Papers Published in Journals:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Paper
1	Mr. R. N. Sapkal	Civil Engineering	Research Paper Published	Watershed management in AGCE, Satara with special reference to Khodjaiwadi Karad
2	Dr. V. R. Thombare	Civil Engineering	Research Paper Published	A Study on hollow core foam concrete wall
3	Dr. A. V. Gujar	Civil Engineering	Research Paper Published	Performance of Exterior Column Beam Connections as built at site
4	Mr. V. B. Gujar	Computer Science and Engineering	Research Paper Published	Intelligent Transportation using Deep Learning
5	Mr. V. B. Gujar	Computer Science and Engineering	Research Paper Published	Intelligent Transportation using Deep Learning
6	Mr. V. B. Gujar	Computer Science and Engineering	Research Paper Published	Deep Learning: Effective Tool for Big Data Analytics
7	Dr. B. M. Nayak	Electrical Engineering	Research Paper Published	Evolutionary Computing Assisted Control Environment for Six-Step Mode High-Speed and Accelerating Induction Motor Drives [SCOPUS]
8	Dr. B. M. Nayak	Electrical Engineering	Research Paper Published	Disturbance Observer Assisted Error Sensitive Predictive Control for Induction Motors in Sensor less Environment: A Vector Field Control Model
9	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Research Paper Published	A Computable Study on Tactics towards Crime Prediction and Analysis using Machine Learning [UGC CARE]

10	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Research Paper Published	FTmRP-NCS: Fault-Tolerant and reliable mRPL routing protocol for W-NCS communication
11	Dr. V. A. Pharande	Mechanical Engineering	Research Paper Published	Investigation of Thermal Properties of Epoxy Composites Filled with Aluminium Nitride (AIN) [UGC CARE]

2. Number of Patents Granted:

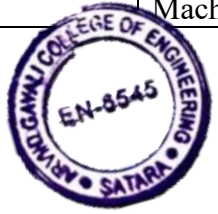
Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Patent
1	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Published Indian Patent	IOT Based Water Dispensing Apparatus

3. Number of Papers Published in National Conferences: NIL

4. Number of Papers Published in International Conferences:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Paper
1	Ms. Diksha Jadhav	Civil Engineering	Presented Research Paper in ICACSE-2020, 4th International Conference on Advances in Civil & Structural Engineering	Impact of Time and Cost Overruns on Building Construction Projects
2	Mr. A. B. Kolekar	Civil Engineering	Presented Research Paper in 3rd GeoMEast International Congress and Exhibition, Egypt "Sustainable Civil Infrastructures"	Impact Analysis of Soil & Water Conservation Structures - Jalyukt Shivar Abhiyan - A Case Study
3	Mr. A. B. Kolekar	Civil Engineering	Presented Research Paper in ICIRTE-2020	AGCE Rain water Harvesting System
4	Mr. A. B. Kolekar	Civil Engineering	Presented Research Paper in ICIRTE-2020	AGCE Amphitheatre
5	Dr. V. R. Thombare	Civil Engineering	Presented Research Paper in ICIRTE-2020	A Study on Hollowcore Foam Concrete Wall
6	Dr. V. K. Bhosale	Computer Science and Engineering	Published Research Paper in ICIRTE-2020	GPS based field force tracking system
7	Dr. V. K. Bhosale	Computer Science and Engineering	Published Research Paper in ICIRTE-2020	A review of GPS system
8	Mrs. R. M. Mandhare	Computer Science and Engineering	Presented Research Paper in ICIRTE-2020	Online platform for managing Advertise Agencies Activities
9	Dr. S. Y. Mulla	Computer Science and Engineering	Presented Research Paper in ICIRTE-2020	WebAR: Mobile Augmented Reality
10	Dr. S. Y. Mulla	Computer Science and Engineering	Attended One Week Faculty Development Programme	One Week Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
11	Mr. P. A. Pathak	Computer Science and Engineering	Presented Research Paper in ICIRTE-2020	Review on applications desired by sugar industries

12	Mr. P. A. Pathak	Computer Science and Engineering	Presented Research Paper in ICIRTE-2020	Customer relationship management application for sugar mill
13	Mr. P. A. Pathak	Computer Science and Engineering	Presented Research Paper in ICIRTE-2020	Review on Development of the Web Application for the User Bike Servicing
14	Dr. B. M. Nayak	Electrical Engineering	Presented Research Paper in ICIRTE-2020	Survey on Electricity Demand due to Electrical Vehicles
15	Mrs. Eva Gupta	Electrical Engineering	Presented Research Paper in ICIRTE-2020	Optimal Placement of PMU for Complete and Incomplete Observability
16	Mr. Basavraj Nelogal	Electrical Engineering	Presented Research Paper in ICIRTE-2020	IoT Based Power Theft Identification System
17	Mr. Devendrappa L.	Electrical Engineering	Presented Research Paper in ICIRTE-2020	Speed Control of BLDC Motor Used in Electrical Vehicle by Using Arduino Microcontroller
18	Ms. P. R. Borate	Electrical Engineering	Presented Research Paper in ICIRTE-2020	Design and implementation of slip ring induction motor control panel
19	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2020	A Review Paper of Smart Flood Control and Intelligent Dam Coordination System
20	Mr. V. C. Khade	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2020	Execution of different commands by using 3G/4G network with GSM
21	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2020	Greenhouse monitoring, controlling and automation by using 8051 microcontroller
22	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2020	Agriculture Based Robot by Using IoT
23	Ms. S. S. Shivdas	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2020	Bridge Analysis and Prevention
24	Ms. P. N. Mahamuni	Electronics and Telecommunication Engineering	Presented Research Paper in ICIRTE-2020	Coal Mine Safety Monitoring and Alternating System by using IOT
25	Dr. V. A. Pharande	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Design & Development of Special Purpose Jig
26	Mr. S. P. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Automation Mechanisms for Centerless Grinding Machine: A Review



27	Mr. S. S. Ghadage	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Complaints Solving Using Design Change Note and Quality Control Tools
28	Mr. A. A. Kadam	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Design and manufacture of Engine lifting crane
29	Mr. A. A. Kadam	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Design And Development of Drilling Jig
30	Mr. P. R. Nikam	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Design And Development of Rice Transplanting Machine
31	Mr. P. R. Nikam	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Plastic Injection Molding Machine
32	Mr. R. R. Kamble	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	HHO Gas Generator Unit for Petrol engine
33	Mr. A. V. Kamble	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Review paper on design and manufacturing of fertilizer mixing machine
34	Mr. S. M. Patil	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Design and development of electric cycle or E-bicycle

5. Number of Books Authored: NIL

6. Number of Book Chapters: NIL

7. Number of New Externally Funded Research Projects Received:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Project
1	Dr. V. R. Thombare	Civil Engineering	Project Sponsored by JW Infra Pvt. Ltd., Satara	A Study on Hollowcore Foam Concrete Wall
2	Dr. A. V. Gujar	Civil Engineering	Project Sponsored by Dhumal Construction Pvt. Ltd., Satara	Beam Column Connection Under Monotonic & Cyclic Loading
3	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Project Sponsored by TEQIP 3 Cell of DBATU, Lonere	Semi-Automatic Approach for Tumor Segmentation in Human Brain MRI Images

4	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Project Sponsored by Gajanan Packwell Pvt. Ltd., Satara	Automatic Packaging Using PIC Microcontroller
5	Ms. P. N. Mahamuni	Electronics and Telecommunication Engineering	Project Sponsored by Aptron Tech, Satara	Coal Mine Safety Monitoring and Alerting System by Using IOT
6	Mr. Somesha Naik S. R.	Electrical Engineering	Project Sponsored by Ajinkya Electrosystems, Satara	Automatic Correction and Control of Power Factor By Using Arduino Uno
7	Mr. Somesha Naik S. R.	Electrical Engineering	Project Sponsored by Ravi Electricals, Satara	Transformer-Based Single Phase Load Balancing
8	Dr. B. M. Nayak	Electrical Engineering	Project Sponsored by Siddheshwar Electricals, Satara	Solar Charging Station for Electric Vehicles
9	Mrs. Ashwini P. Sawant	Computer Science and Engineering	Project Sponsored by Tuljabhavani Constructions	CRM Application for Online Buying and Selling Property
10	Mr. P. A. Pathak	Computer Science and Engineering	Project Sponsored by Kisan Veer Sugar Factory, Wai, Satara	Customized Web Application for Sugar Factory
11	Ms. P. L. Gaikwad	Computer Science and Engineering	Project Sponsored by Aditya English Medium School, Bavdhan, Pune	Digitizing School Framework
12	Dr. V. K. Bhosale	Computer Science and Engineering	Project Sponsored by Inventive Infotech, Satara	GPS-Based Field Force Tracking System
13	Mrs. R. M. Mandhare	Computer Science and Engineering	Project Sponsored by Existance Software Solution, Nashik	Online Platform for Managing Advertising Agency Activities
14	Mr. P. A. Pathak	Computer Science and Engineering	Project Sponsored by 3 Star IT Solutions, Satara	Web Portal for Online Bike Servicing
15	Mr. D. V. Jadhav	Computer Science and Engineering	Project Sponsored by Shree Surveyors and Loss Assessors, Pune	Customized Web Portal for Vehicle Insurance System
16	Mr. S. S. Ghadage	Mechanical Engineering	Project Sponsored by Abhijat Equipments Pvt. Ltd.	Complaints Solving Using Design Change Note and Quality Control Tools

8. Fund Received During This Academic Year:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details/Title of the Project
1	Dr. V. R. Thombare	Civil Engineering	Project Sponsored by JW Infra Pvt. Ltd., Satara	Rs. 25,000/-
2	Dr. A. V. Gujar	Civil Engineering	Project Sponsored by Dhumal Construction Pvt. Ltd., Satara	Rs. 32,000/-
3	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Project Sponsored by TEQIP 3 Cell of DBATU, Lonere	Rs. 2,00,000/-
4	Dr. G S Mirajkar	Electronics and Telecommunication Engineering	Project Sponsored by Gajanan Packwell Pvt. Ltd., Satara	Rs. 15,000/-
5	Ms. P. N. Mahamuni	Electronics and Telecommunication Engineering	Project Sponsored by Aptron Tech, Satara	Rs. 30,000/-
6	Mr. Somesha Naik S. R.	Electrical Engineering	Project Sponsored by Ajinkya Electrosystems, Satara	Rs. 15,000/-
7	Mr. Somesha Naik S. R.	Electrical Engineering	Project Sponsored by Ravi Electricals, Satara	Rs. 17,000/-
8	Dr. B. M. Nayak	Electrical Engineering	Project Sponsored by Siddheshwar Electricals, Satara	Rs. 20,000/-
9	Mrs. Ashwini P. Sawant	Computer Science and Engineering	Project Sponsored by Tuljabhavani Constructions	Rs. 15,000/-
10	Mr. P. A. Pathak	Computer Science and Engineering	Project Sponsored by Kisan Veer Sugar Factory, Wai, Satara	Rs. 15,000/-
11	Ms. P. L. Gaikwad	Computer Science and Engineering	Project Sponsored by Aditya English Medium School, Bavdhan, Pune	Rs. 14,000/-
12	Dr. V. K. Bhosale	Computer Science and Engineering	Project Sponsored by Inventive Infotech, Satara	Rs. 12,000/-
13	Mrs. R. M. Mandhare	Computer Science and Engineering	Project Sponsored by Existance Software Solution, Nashik	Rs. 15,000/-

14	Mr. P. A. Pathak	Computer Science and Engineering	Project Sponsored by 3 Star IT Solutions, Satara	Rs. 15,000/-
15	Mr. D. V. Jadhav	Computer Science and Engineering	Project Sponsored by Shree Surveyors and Loss Assessors, Pune	Rs. 13,000/-
16	Mr. S. S. Ghadage	Mechanical Engineering	Project Sponsored by Abhijat Equipments Pvt. Ltd.	Rs. 30,000/-

9. Other Achievements:

Sr. No.	Name of the Faculty Member	Department	Award/Recognition	Details
1	Mr. R. N. Sapkal	Civil Engineering	Attended One Day Webinar	One Day Webinar on New Higher Education Policy and Digitization of Education
2	Mr. R. N. Sapkal	Civil Engineering	Attended Online Workshop	Online Workshop on "Corrosion and Control"
3	Mr. R. N. Sapkal	Civil Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
4	Mr. R. N. Sapkal	Civil Engineering	Attended One Week Webinar Series	One Week Webinar Series on "Metro Rail Technology - Practices & Issues"
5	Mr. R. N. Sapkal	Civil Engineering	Attended One Week Webinar	One Week Webinar on "Scientific Approach to Vastushastra in Building Planning"
6	Mr. R. N. Sapkal	Civil Engineering	Attended One Week National STP	One Week National STP on "A Smart and Sustainable World in Concrete and Structures"
7	Mr. R. N. Sapkal	Civil Engineering	Attended One Week Online Faculty	One Week Online Faculty Development Program on

			Development Program	"Innovation, Entrepreneurship and its Relevance in Industry 4.0 Practices in the Post Covid-19 Situation"
8	Mr. R. N. Sapkal	Civil Engineering	Attended Three Days Webinar	Three Days Webinar on "Development, Execution, and Maintenance of EPC Project"
9	Mr. V. B. Gujar	Computer Science and Engineering	Attended One Day Webinar	Webinar on "Role of Engineers in Upcoming Industrial Revolution"
10	Mr. V. B. Gujar	Computer Science and Engineering	Attended One Day Webinar	Webinar on “Intellectual Property Rights”
11	Mrs. R. M. Mandhare	Computer Science and Engineering	Attended One Day Coordinator's Workshop	One Day Coordinator's Workshop on C and C++
12	Mrs. R. M. Mandhare	Computer Science and Engineering	Attended One Week Online Faculty Programme	One Week Online Faculty Programme on "BOSS LINUX - UBUNTU OPERATING SYSTEM"
13	Mrs. R. M. Mandhare	Computer Science and Engineering	Attended One Day Workshop	One Day Workshop on Arduino
14	Mrs. R. M. Mandhare	Computer Science and Engineering	Attended One Day Workshop	One Day Workshop on R
15	Mr. P. A. Pathak	Computer Science and Engineering	Attended One Day Workshop	One Day Workshop on Arduino
16	Mr. P. A. Pathak	Computer Science and Engineering	Attended One Week TEQIP Online Faculty Development Program	One Week TEQIP Online Faculty Development Program on “Machine Learning and Deep Learning Applications in Engineering and Science (MLDLAES 2020)
17	Mr. P. A. Pathak	Computer Science and Engineering	Attended One Day Webinar	Webinar on "Future of Training & Placement is REMOTE and Tools for TPOs in 2020 to increase productivity"

18	Mr. P. A. Pathak	Computer Science and Engineering	Attended One Week FDP	one week online Faculty Development Program on "OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"
19	Mr. P. A. Pathak	Computer Science and Engineering	Attended One Day Workshop	One Day Python Workshop
20	Mrs. A. P. Sawant	Computer Science and Engineering	Presented Research Paper in ICIRTE-2020	Smart-Parking System Based on Internet-of-Things
21	Ms. Shital Chavan	Computer Science and Engineering	Attended One Day Python Workshop	Python Workshop
22	Dr. B. M. Nayak	Electrical Engineering	Attended One Day Faculty Awareness Program	Faculty Awareness Program on NBA and Outcome Based Education (OBE)
23	Dr. B. M. Nayak	Electrical Engineering	Attended TEQIP-III Sponsored Faculty Development Program (FDP)	TEQIP-III Sponsored Faculty Development Program (FDP) on "Industrial IoTs, Industry 4.0 & Disruptive Technologies"
24	Dr. B. M. Nayak	Electrical Engineering	Participated in Online Quiz	Online Quiz on "Renewable Energy Resources"
25	Dr. B. M. Nayak	Electrical Engineering	Participated in National Level Online Quiz	National Level Online Quiz on International Yoga Day
26	Dr. B. M. Nayak	Electrical Engineering	Attended One Week Faculty Development Program	One Week Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
27	Mrs. Islavath Parvati	Electrical Engineering	Attended TEQIP-III Sponsored Faculty Development Program	TEQIP-III Sponsored Faculty Development Program on "Industrial IoTs, Industry 4.0 & Disruptive Technologies"

28	Ms. Eva Gupta	Electrical Engineering	Attended Faculty Awareness Programme	Faculty Awareness Programme on Research Methodology
29	Ms. Eva Gupta	Electrical Engineering	Attended Faculty Awareness Programme	Attended Faculty Awareness Programme on "NAAC Revised Accreditation Framework 2020"
30	Ms. Eva Gupta	Electrical Engineering	Attended Online Training Program for Three Days	Attended Online Training Program for Three Days on "Ultra Low Power System Design"
31	Ms. Eva Gupta	Electrical Engineering	Attended One Week Online Faculty Development Program	Attended One Week Online Faculty Development Program entitled "OpenFOAM"
32	Mr. Somesha Naik SR	Electrical Engineering	Attended Webinar	Webinar on "Future of Training & Placement is REMOTE" and "Tools for TPOs in 2020 to increase productivity"
33	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Participated in NAAC Awareness Quiz - 2020	Participated in NAAC Awareness Quiz - 2020
34	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Participated in One Day Coordinators' Workshop on Arduino	One Day Coordinators' Workshop on Arduino
35	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Participated in One Day Workshop	One Day Workshop on C and C++
36	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Participated in Online Quiz	Online Quiz "Awareness about NBA Accreditation and OBE"
37	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"

38	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Course Coordinator during the One Day Workshop	Course Coordinator during the One Day Workshop on “Arduino”
39	Dr. V. S. Hingmire	Electronics and Telecommunication Engineering	Published Indian Patent	IOT Based Water Dispensing Apparatus
40	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Attended DBATU TEQIP-III Sponsored One Week Online FDP	Attended DBATU TEQIP-III Sponsored One Week Online FDP On "Communication and ICT"
41	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Completed One Week Online Certificate Course	One Week Online Certificate Course on Influenza Pandemics: Yesterday, Today, and Tomorrow
42	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Attended Webinar on "Machine Learning"	Webinar on "Machine Learning"
43	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Attended One Day Satellite Telecommunication Industrial Training Program	One Day Satellite Telecommunication Industrial Training Program at Institute of Satellite Telecom Pvt. Ltd. Pune
44	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Attended Online Workshop on Universal Human Values	Online Workshop on Universal Human Values on the theme "Inculcating Universal Human Values in Technical Education"
45	Mr. V. T. Barkade	Electronics and Telecommunication Engineering	Attended One Day Workshop	One Day Workshop on Arduino
46	Mr. D. B. Jagtap	Electronics and Telecommunication Engineering	Participated in NAAC Awareness Quiz - 2020	NAAC Awareness Quiz - 2020
47	Mr. D. B. Jagtap	Electronics and Telecommunication Engineering	Participated in Online Quiz	Online Quiz on "Awareness about NBA Accreditation and OBE"

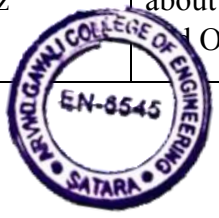
48	Mr. D. B. Jagtap	Electronics and Telecommunicatio n Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
49	Mr. D. B. Jagtap	Electronics and Telecommunicatio n Engineering	Participated in One Day Curriculum Development Program for Electronics and Telecommunication Engineering	One Day Curriculum Development Program for Electronics and Telecommunication Engineering at Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra, India
50	Mr. S. P. Patil	Mechanical Engineering	Participated in One Day Quiz	Karmaveer Research Publication and Review Quiz
51	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Faculty Development Program	Online One Week Faculty Development Program on Funding Opportunities for Engineering Teachers & Technical Paper Writing
52	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Faculty Development Program	One Week Faculty Development Program on "Advanced Materials and Manufacturing"
53	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Faculty Development Programme	One Week Faculty Development Programme on "Research Opportunities and Challenges in Manufacturing Sector"
54	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Online Training Program	One Week Online Training Program on, Implementation of Multi-objective Optimization Algorithm (NSGA-II) Using MATLAB
55	Mr. S. P. Patil	Mechanical Engineering	Attended One Day Webinar	Webinar on "Job Opportunities in Manufacturing Sector"
56	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Online Faculty	One Week Online Faculty Development Program on

			Development Program	"Enhancing Research and Consultancy Skills"
57	Mr. S. P. Patil	Mechanical Engineering	Attended Seven Days Faculty Development Program	Seven Days Faculty Development Program on "Heat Transfer and Computational Fluid Dynamics Towards Industrial Applications"
58	Mr. S. P. Patil	Mechanical Engineering	Attended One Day Webinar	Noise Vibration and Harshness Webinar Series (Session 2) Active Vibration Control in Truck System
59	Mr. S. P. Patil	Mechanical Engineering	Attended One Day Webinar	Noise Vibration and Harshness Webinar Series (Session 1) Noise Attenuation Strategies
60	Mr. S. P. Patil	Mechanical Engineering	Attended One Day Webinar	Noise Vibration and Harshness Webinar Series (Session 3) Acoustic Material Testing and Characterization
61	Mr. S. P. Patil	Mechanical Engineering	Attended Online Faculty Development Programme	Online Faculty Development Programme on "Recent Advances in Modelling and Optimization Techniques"
62	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Online International Faculty Development Programme	One Week Online International Faculty Development Programme on "Advanced Engineering Materials for Strategic & Societal Sectors - Current Perspectives"
63	Mr. S. P. Patil	Mechanical Engineering	Attended Five Days Online Faculty Development Program	Five Days Online Faculty Development Program on OpenFOAM
64	Mr. S. P. Patil	Mechanical Engineering	Attended One Day Online Webinar	One Day Online Webinar on "Career Prospects in

				Mechanical Engineering after COVID-19"
65	Mr. S. P. Patil	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
66	Mr. S. S. Ghadage	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
67	Mr. S. S. Ghadage	Mechanical Engineering	Attended Five Days Online Faculty Development Program	Five Days Online Faculty Development Program on OpenFOAM
68	Mr. S. S. Ghadage	Mechanical Engineering	Attended Seven Days Faculty Development Program	Seven Days Faculty Development Program on "Heat Transfer and Computational Fluid Dynamics Towards Industrial Applications"
69	Mr. S. S. Ghadage	Mechanical Engineering	Attended Faculty Development Programme	Faculty Development Programme on "CFD Simulation of Thermal Management of Batteries and Power Converters"
70	Mr. S. S. Ghadage	Mechanical Engineering	Attended One Week TEQIP Sponsored Online Faculty Development Programme	One Week TEQIP Sponsored Online Faculty Development Programme on "Applications of Finite Element Analysis (FEA) and Computational Dynamics (CFD) Using ANSYS"
71	Mr. A. A. Kadam	Mechanical Engineering	Presented Research Paper in ICIRTE-2020	Design and manufacture of Engine lifting crane
72	Mr. A. A. Kadam	Mechanical Engineering	Attended Three Days Online FDP	Three Days Online FDP on "Acoustics Engineering -

				An Effective Use of Sounds & Vibrations"
73	Mr. A. A. Kadam	Mechanical Engineering	Attended One Week Webinar	One Week Webinar on "AUTOCAD-2D BASIC"
74	Mr. A. A. Kadam	Mechanical Engineering	Participated in Quiz	Quiz on "Resume Writing Techniques"
75	Mr. A. A. Kadam	Mechanical Engineering	Participated in Online Quiz	Online Quiz for awareness programme on COVID-19
76	Mr. A. A. Kadam	Mechanical Engineering	Participated in Quiz	NAAC Awareness Quiz - 2020
77	Mr. A. A. Kadam	Mechanical Engineering	Participated in National Level Online Quiz	National Level Online Quiz on "Mechanics of Material"
78	Mr. A. A. Kadam	Mechanical Engineering	Participated in Online Quiz	Online Quiz on "Basic Knowledge of Automobile Engineering"
79	Mr. A. A. Kadam	Mechanical Engineering	Attended Faculty Awareness Program	Faculty Awareness Program on NBA and Outcome Based Education (OBE)
80	Mr. A. A. Kadam	Mechanical Engineering	Participated in National Level Quiz	National Level Quiz on "Basics of Engineering Mechanics and Engineering Drawing"
81	Mr. A. A. Kadam	Mechanical Engineering	Attended Online Faculty Orientation Programme	Online Faculty Orientation Programme on "Recent Advances in Modelling and Optimization Techniques"
82	Mr. A. A. Kadam	Mechanical Engineering	Participated in Quiz	NAAC Awareness Quiz - 2020
83	Mr. A. A. Kadam	Mechanical Engineering	Participated in National Level Online Quiz	National Level Online Quiz on "Product Design Engineering"
84	Mr. A. A. Kadam	Mechanical Engineering	Attended One Day Webinar	Webinar on "Job Opportunities in Manufacturing Sector"
85	Mr. A. A. Kadam	Mechanical Engineering	Participated in National Level Online Quiz	National Level Online Quiz on "Non-Traditional Machining Processes"

86	Mr. A. A. Kadam	Mechanical Engineering	Attended One Day Online Webinar	One Day Online Webinar on "Career Prospects in Mechanical Engineering after COVID-19"
87	Mr. A. A. Kadam	Mechanical Engineering	Attended Three Days Online FDP	Three Days Online FDP on "Professional Skilling - Advance Simulation Processes & Industry Platforms"
88	Mr. A. A. Kadam	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
89	Mr. A. V. Kamble	Mechanical Engineering	Attended One Day Webinar	Noise Vibration and Harshness Webinar Series (Session 1) Noise Attenuation Strategies
90	Mr. A. V. Kamble	Mechanical Engineering	Attended Online One Week Faculty Development Training Program	Online One Week Faculty Development Training Program on "Outcome Based Education & NBA Accreditation Process"
91	Mr. A. V. Kamble	Mechanical Engineering	Participated in Online Quiz	Online Quiz "Awareness about NBA Accreditation and OBE"
92	Mr. A. V. Kamble	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A step Towards Excellence"
93	Mr. A. V. Kamble	Mechanical Engineering	Participated in Online National Level E-Quiz	Online National Level E-Quiz on “Brain Teaser”
94	Mr. A. S. Shivade	Mechanical Engineering	Attended Online Faculty Development Program	Online Faculty Development Program on Renewable Energy Sources: A Way Ahead
95	Mr. A. S. Shivade	Mechanical Engineering	Participated in Online Quiz	Online Quiz "Awareness about NBA Accreditation and OBE"



96	Mr. A. S. Shivade	Mechanical Engineering	Participated in Online Faculty Program on NBA	Online Faculty Program on NBA
97	Mr. A. S. Shivade	Mechanical Engineering	Attended Two Days Webinar	Two Days Webinar on "Startup Lifecycle and Patent Registration"
98	Mr. A. S. Shivade	Mechanical Engineering	Attended One Week Online Faculty Development Programme	One Week Online Faculty Development Programme on "Modelling and Optimization Techniques for Materials and Manufacturing Processes"
99	Mr. A. S. Shivade	Mechanical Engineering	Attended Online Workshop	Online Workshop on Concept, Methodology & Implementation of Problem Based Learning (PBL)
100	Mr. A. S. Shivade	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "R"
101	Mr. A. S. Shivade	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Outcome Based Education: A Step Towards Excellence"
102	Mr. A. S. Shivade	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "Promoting Quality Culture in Technical Institutions"
103	Mr. A. S. Shivade	Mechanical Engineering	Attended Online Faculty Orientation Programme	Online Faculty Orientation Programme on "Recent Advances in Modelling and Optimization Techniques"
104	Mr. A. S. Shivade	Mechanical Engineering	Attended One Week Online Faculty Development Program	One Week Online Faculty Development Program on "LATEX"
105	Mr. P. R. Tambe	Mechanical Engineering	Participated in Online Quiz	Online E-Quiz Program on "Laplace Transform"

106	Mr. P. R. Tambe	Mechanical Engineering	Participated in COVID-19 Pandemic Awareness Program	COVID-19 Pandemic Awareness Program
107	Mr. P. R. Tambe	Mechanical Engineering	Participated in National Level Online Quiz	National Level Online Quiz on "Mechanical System Design (MSD)"
108	Mr. P. R. Tambe	Mechanical Engineering	Participated in Online Quiz	Online Quiz "Awareness about NBA Accreditation and OBE"
109	Mr. P. R. Tambe	Mechanical Engineering	Participated in Quiz	Quiz on "Basics of Mechanical Engineering"
110	Mr. P. R. Tambe	Mechanical Engineering	Participated in Quiz	NAAC Awareness Quiz – 2020

ARVIND GAVALI COLLEGE OF ENGINEERING EN-8545 SATARA

Principal
Principal
Samarth Educational Trust
Arvind Gavali College of Engineering
Panmalewadi, Satara

1. Number of Research Papers Published in Journals

WATERSHED MANAGEMENT IN ARVIND GAVALI COLLEGE OF ENGINEERING , SATARA WITH SPECIAL REFERENCE TO KHODJAIWADI KARAD

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ABSTRACT:
Scarcity and threats to resource from pollution, climate change, and overexploitation have made it increasingly important to have sound watershed management. The link between land, water, and people has further made it necessary to widen the scope of watershed management beyond the "water resource". Overall ecosystem functions as well as the improvement of socioeconomic status of the local communities are of paramount management. Integral water resource management including stakeholder participation, livehood improvement, flood risk management, and financing of watershed management is presented. Furthermore, the scheme of watershed planning process which is fundamental for the development and implementation of watershed management plans is stressed. Watershed assessment, a key component of watershed planning.
Key words: **Integrated Water resource management, Flood risk management, Watershed management planning,**

1. INTRODUCTION-

A watershed, also called a drainage basin, is defined as an area in which all water flowing into it goes to a common outlet. People and livestock are the integral part of watershed and their activities affect the productive status of watershed and vice versa. From the hydrological point of view, the different phases of hydrological cycle in a watershed are dependent on the various natural features and human activities.

Major impact of the watershed implementation are observed based base on impact evaluation studies are given below.

- Rise in ground water level.
- Drinking water scarcity in village has been overcome.
- Local employment generation has improved, reducing off season migration. Increase in agricultural productivity and production.

1.1 MATERIALS:

1.1.1 Geo-textile Coir: Geo-textile coir is made up of coconut. Soil erosion and degradation of nature resource are creating a great threat to the environment around us. Concerted efforts are now on to rejuvenate and restore degraded land with the help of geo-textile. This coir is commonly used in the India for reducing the infiltration losses in landfill area. This coir are place in the base and side of this area the thickness thickness of this coir is very thin. Durability of this landfill sheet is high.

1.1.2 Cetyl Alcohol and Stearyl Alcohol:
These chemicals are applied by using hand spreading from the bank of reservoir. The surface film method is good to save the water from evaporation. This water can be used for domestic consumption. These chemicals are used for purification of water.

Cetyl Alcohol

StearylAlcoho

1.1.3 Bleaching Powder: Bleaching powder is a chlorinated lime containing about 33%of active or available chlorine. These are used for chlorination of water. They are available in small packets.Their chlorine content not decrease with storage. They can be applied in dry condition or as in liquid condition.

1.1.4 Mechanical Mesh Cover:
If the total or partial surface 0f the reservoir is covered, it will control the evaporation. It is very costly method and can be used, in case of sizable small reservoir only. it is helps to avoid falling material in the reservoir like leaves of trees, plastic etc.

2. LITERATURE REVIEW:

2.1.1 S.P. Suryawanshi and AbhijeetKamble watersheds for improved livelihoods through consortium approach in drought prone rain-fed areas. Journal of Hydrological Research and Development.23:55-77.

India occupies approximately 2.4% of the total geographical area of the world while it supports over 15% of the world population. Unprecedented population pressure and demand of society on scarce land, water and biological resources and the increasing degradation of these resources is affecting the stability and resilience of our ecosystems and the environment as a whole. Therefore, the productive agriculture lands in the country are in constant process of varying degrees of degradation and are fast turning into wastelands. It is precisely to restore this ecological imbalance by developing the degraded non-forest wastelands. To harness the full potential of the available land resources and prevent its further degradation, wasteland development is of great significance.

2.1.2 Jonson Creek Assessment of sustainable watershed management approach case study lenchediama, tsegureyesus and DIJJIL watershed presented to the faculty of graduate school of cornelluniversity ,may2011

Implementation of solutions to problems of water quality and quantity in the basin has been hindered by political and social constraints. Reasons for the failure of previous management proposals are analyzed through application of institutional evaluation criteria. Alternative solutions are described and key considerations toward implementation of an effective basin wide management scheme are found to be political coordination, an equitable funding program, and generation of public support.

2.1.3 Suhas P Wani and Kaushal K Garg 'Sustainable groundwater development through integrated watershed management of food security': oraganised by International crops research institute for the semi arid tropics (ICRISAT).

Watershed is not simply the hydrological unit but also socio-political-ecological entity which plays crucial role in determining food, social and economical security and provides life support services to rural people. The criteria for selecting watershed size also depend on objectives of the development and terrain slope. A large watershed can be managed in plain valley areas or where forest or pasture development is the main objective. In hilly areas or where intensive agriculture development is planned, the size of watershed relatively preferred is small.

2.1.4 Karen L. Mora Trees and watershed management in koromoja, Uganda 'produced by department for international development (DFID) contracted through the climate

The effectiveness of land stewardship must be enhanced to meet a growing population's need for conservation, sustainable development, and use of natural resources. Ecosystems-based, multiple use oriented land stewardship is necessary when con-sideling the present and future uses of land, water, and other natural resources on an operationally efficient scale. Holistically planned and carefully implemented watershed management practices

will always be needed to meet the increasing demands for commodities and amenities, clear water, open space, and uncluttered landscapes.

3. METHODOLOGY:

In this project first up all we have study the watershed management concept. We have understood the watershed management concept in different types of references. We have searching the different reference papers in watershed management and watershed development concept. These searching papers are mention in this project. The conclusion of this paper authors are mentioned in literature review in this project. After this, we have searching the study area of watershed management and after discussion in our group we have select the study area related to watershed management. The name of the site is kolamba watershed (pasarTalav).

We have going to this place and observe this area. We have discussed the surpanch in this area and collect the detailed information of this watershed. Kolamba watershed is sixth order stream covering an area of 88.693km2 lying between latitude 17015_ N and 17030_N and longitude 7400_E and 74015_E, is included with in the Survey of India (SOI) topographic sheet no.47 K/3 on the scale 1:50000. After this, we have going to PWD department and collect other information in this watershed for respective authority.

We have surveying the college area and select the suitable site for the watershed management. We have surveying the topographic area near the area. We have finding the stream lime of this topographic area. The following procedure is carried out in this area:

1.Finding out the suitable site.
2. Finding out the measurement of this site.
3. Finding out the area of this site.
4. Total volume of catchment area.
5. Collect the rainfall data of this site.
6. Finding out the run-off of this site.
7.Stored water
8.Total storage capacity of this catchment area.

4. RESULT AND DISCUSSION:

Sr. No.	Contents	Values
1	Small width of catchment area	9 m
2	Large width of catchment area	16.5 m
3	Length of catchment area	28 m
4	Avg. width of catchment area	12.75
5	Area of catchment area	357 m^2
6	Volume of catchment area	1428 m^3
7	Run-off of catchment area	0.22 m
8	Yield	80.325 m^3

Assessment of given watershed area

4.2 METHODS OF REDUCTION OF EVAPORATION LOSSES

1) Surface Area Reduction-:

The rate of evaporation depends upon extent of the exposed surface area. If the exposed area is the reduced the evaporation can be under control. This is can be done by using the following methods:

1) By reducing the done by meandering length of a river.
2) By selecting the size of the dam in such area. Where the ratio of surface area to the storage capacity of the reservoir is minimum.
3) By storing the water under closed surface.

2) Mechanical Cover-:

If the total or partial surface of the reservoir is covered, it will control the evaporation. It is a very costly method and can be used, in case of sizable small reservoir only.

3) Wind shields -:

The velocity of the wind is directly proportionate to the rate of evaporation. i.e. if the wind velocity is high the rate of evaporation also will be high. So if the velocity of wind near the surface of the reservoir is reduced by creating obstruction therefore, in this project the plant are provided around the banks of the reservoir the wind velocity will be reduced, and the rate of evaporation will be put under control. This method very eco-friendly. This can be used for small lakes or reservoir only.

4) Surface Film-:

By using same chemical, a surface film can be spread over the surface of a reservoir. The film obstructs the movements of the water molecules on the surface to the layer of the air, above the reservoir and controls the rate of evaporation. This film is called as monomolecular film because the thickness of the film on molecular thick.

It gives results up to 40 to 70% in the laboratories and about 25 y in the open area of the reservoir. It should not be too costly and must be easily available in large quantities. It must be eco- friendly. The chemicals used to form the films are:-

- Cetyl Alcohol($C_{16}H_{33}OH$) : Hexadecanol
- Stearyl Alcohol ($C_{18}H_{37}OH$) : Octadecal

Sr. No.	Contents	Values
1	Water requirement in our college (sanitary purpose)	8 lit/head/day
2	Area of given Watershed	357 m^2
3	Population of college	1500
4	Quantity of college	12 cu. m
5	Total quantity of water in the catchment	1428 m^3
6	Utilization Period	119 days

Utilization Period of given watershed

5. CONCLUSION:

- Water is a prime natural source, a basic human need and a precious national asset. Watershed development consisting of conservation, Regeneration and judicious use of all the resource natural resource. Watershed development attempts to bring about test possible balance in the environment between natural resources on one side and man and grazing animals on the other.
- The climate of proposed watershed is included in the subtropical temperature category, Characterized by medium rainfall and moderate temperature. The maximum temperature range is 45^0C to 50^0C. And the minimum temperature range is 20^0C to 25^0C. The averagely 850mm rainfall occurs in the rainy season.
- In this work, we have studied the advanced technique of watershed management by using advanced geosynthetic materials like geotextile coir, Black sheet and also chemicals to prevent Evaporation losses.
- In this way it reduces percolation losses as well as evaporation losses.
- Mechanical covers, Floaters, Chemicals like Stearyl Alcohol and Cetyl Alcohol, etc are used for reducing the evaporation losses.
- This proposed method enhances rainwater storage capacity for utilization.
- Irrigation status of region is assessed on the basis of irrigation facility, types of irrigation used for our college purposes.

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[1]S.P. Suryawanshi and AbhijeetKamble watersheds for improved livelihoods through consortium approach in drought prone rain-fed areas. Journal of Hydrological Research and Development.23:55-77.

[2]Jonson Creek Assessment of sustainable watershed management approach case study lenchediama, tsegureyesus and DIJJIL

watershed presented to the faculty of graduate school of cornelluniversity ,may2011

[3]Suhas P Wani and Kaushal K Garg 'Sustainable groundwater development through integrated watershed management of food security': oraganised by International crops research institute for the semi arid tropics (ICRISAT).

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A Study on Hollowcore Foam Concrete Wall

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Abstract **– Now a days the construction time, improving the quality of concrete work, durability and cost of construction of any structure plays important roll to compensate the cost of project. There are number of new technique and innovative method used, hollowcore foam concrete wall is one of them. Foam concrete is either a cement paste or mortar, classified as cellular light weight concrete, in which air voids are entrapped in mortar by suitable foaming agents. In this study, we are carried out mechanical properties of cellular light weight concrete wall, which made from ordinary Portland cement, fly ash, water and foaming agent admixture. This building methodology for low cost housing and economical advantages achieved by its adoption.**

Keywords **– Foamed concrete, Cellular lightweight concrete, Fly ash, Foaming agent, Hollowcore wall, Mechanical properties.**

I. INTRODUCTION

Foamed concrete is produced by the mixing of Portland cement, water and foam. The foam is produced with the help of a foaming generator by using foaming agent. The air content is typically between 30 to 80 percent of the total volume. The bubbles vary in size from around 0.1 to 1.5 mm in diameter.

Hollowcore wall is an environmental-friendly panel which is widely used in wall construction, especially wall partition. It is a new type of non-flammable material made of lightweight materials.

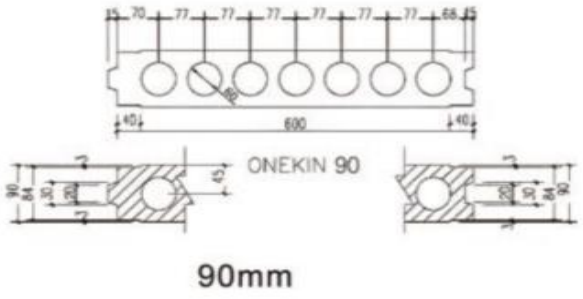

Fig.1. size

When compared with other similar materials, a number of benefits such as completely green material and no asbestos, higher fireproof, sound installation, easier decoration, and lower the total cost of the project.

Fly ash is fine powder that is a byproduct of pulverized in electric generation power plant. Fly ash is pozzoloan, a substance containing aluminous and siliceous material that form cement in the presence of water. When mixed with water and lime, fly ash forms a compound similar to Portland cement. This makes fly ash suitable as a prime material in blended cement, mosaic tiles, and hollow blocks, among other building material. When using concrete mixes, fly ash improves the strength and segregation of the concrete and makes it easier to pump.

1.1Materials:

1.1.1 Cement:

Concrete is the most used material in the world because of its available at cheaper price and large quantity. It is the basic ingredient of concrete, mortar and plaster. Portland cement grade 53 is used in this experimental work.

Fig.2 Cement.

1.1.2 Foaming agent:

Foam is a substance foamed by trapping pockets of gas in liquid or solid. A bath sponge and the head on a glass of beer are example of foam. In most foam, the volume of gas is large, with thin films of liquid or solid separating

the region of gas. Foaming agents is materials that facilitate formation of foam. The role of foaming agents in foamed concrete is to create small and enclosed air bubble by reducing the surface tension of a solution and increasing the stability of air bubble.

1.1.3 Fly Ash:

Fly ash can be a cost-effective substitute for Portland cement in many markets. Fly ash is also recognized as an environmentally friendly material and embodied energy. Fly ash is poorly graded particles, generally spherical in shape and range in size from 0.5 micrometer to 300 micrometers.

Fig.3.Fly Ash.

1.1.4 Fiberglass mesh net:

With high strength, durable service and excellent property against acid and alkali, fiberglass mesh net is the alternative to steel mesh for exterior and interior concrete wall rendering. Fiber reinforcement mesh enjoys easy operation, material saving, long life, it is the ideal energy -saving insulation materials.

1.1.5 Water:

Water is most important material required for concrete. Portable water is used for mixing the material with each other.

1.1.6 Chemical composition and Physical properties of OPC and Fly Ash

Table -I: A typical chemical composition of Portland cement and fly ash.

Chemicals	Portland cement (OPC)	Fly Ash
Chemical composition (% by mass)		
Silicon dioxide	16.39	63.6
Aluminum oxide	3.85	28.19
Ferric oxide	3.48	2.99
Magnesium oxide	0.64	0.54
Calcium oxide	68.48	1.54
Sodium oxide	0.06	0.05
Potassium oxide	0.52	0.003
Sulphur oxide	4.00	0.26
Silicon oxide + Aluminum oxide + Ferric oxide	23.73	94.78
Physical properties		
Loss of ignition (% by mass)	1.7	0.85
Specific gravity	3.2	2.09

1.2 Equipment:

1.2.1. Mounding machine:

The concrete wall panel machine is high degree of automation equipment, hydraulic opening and closing.

Speification:

Annual output	20 panels per moulds(90mm)
Hydraulic power	4 KW
Hydraulic pressure	5 Mpa
Machine size	3.7*3.3*1.2m
Machine weight	4500kg
Product width	600mm
Partition steel plates	Q235, thickness 4mm
Steel plates leveling tolerance	≤1mm
Product length	Can be adjustable within 3m
Moving motor power	4KW

Fig.4 . ulding machine

1.2.2. Foam generator machine:

One of the most ingredient required to produce foamed concrete is the aqueous stable foam. The foaming generator acts as a medium which transforms the liquid chemical into stable foam.

1.2.3. Overhead crane

To move extremely heavy or bulky loads through the overhead space in a facility, instead of through aisles or on the floor, on overhead crane.

II. LITERATURE REVIEW

2.1 Roz-Ud-Dia Nassar and Shazim Ali Memon et.al (2018) [1] has submitted thesis on "Characteristics of foam concrete produced from Detergent used as foaming agent."

In this study, the possibility of production of low-cost foam concrete using locally manufactured detergent powder was experimentally investigated.

They concluded that, the production of low-cost foam concrete using locally manufactured detergent as replacement of commercially available FA is a feasible practice. Strength and durability characteristics of foam concrete mixers produced with detergent as foaming agent are quite comparable to that of control foam concrete mixers produced with FA as the air-entering agent.

The result of the study is encouraging and various properties of the foam concrete produced with detergent as air-entraining agent can be further improved by fine-tuning the mix proportioning.

2.2 Vidya jose and Dr. P. Rajeev kumar et.al (2014) [2] has submitted thesis on "Hollow Core Slabs in Construction Industry."

A hollow core slab is precast prestressed concrete member with continues voids provided to reduce weight and cost. They are primarily used as a floor deck system in residential and commercial buildings as well as in parking structures because they are economical, have good fire resistance and sound insulation properties, and are capable of spanning long distance with relatively small depths.

Hollow core slabs can make use of prestressing strands, which allow slabs with depths between 150 to 260 mm to span over 9 meters. The small gap that is left between each slab is usually filled with a non-shrink grout.

Hollow core slabs are used for a variety of applications in low and high-rise commercial, residential and industrial buildings. It provides an answer to most of the present market
demands and challenges for the building industry: structural efficiency, low material consumption, highly automated an environment friendly production process, high concrete strength, slender floor thickness, and possibilities for reuse and recycling at the end of the life cycle.

2.3 R. Yuvanesh Kumar, K. Vinobalaji and M. Naveen Prasad et.al (2018) has submitted thesis on "Experimental investigation of hollow core slab using different fiber.

Total weight of the building mainly depends on the reinforcement concrete. Large portion of buildings weight caused due to dead load. In order to reduce the self-weight, hollow core slabs are used. Hollow core slab makes the slab much lighter than the massive solid concrete floor slab of equal thickness and strength. Concrete bring brittle is strong in compression but very week in tension, the weakness make it to crack at the tensile end. The tensile property can be induced by adding fibers.

Fibers have the ability to arrest cracks, increase the extensibility and tensile strength. Fibers are able to the matrix together even after extensive cracking. Glass fiber which improves the flexural and split tensile strength of concrete. By adding the fiber to the mix will have ductile failures.

Hollow core slab reduces the dead weight to a great extent. It is observed that compressive strength increases up to 12.95 % with addition of 0.06% glass fiber to the volume of concrete. Flexural strength increases up to 6.96% with addition of 0.06% glass fiber.

2.4 K. M. Monisha, G. Srinivasan et.al (2017) has submitted thesis on "Experimental behaviour of prestress hollow core slab, Rc hollow core slab and normal Rc solid slab.

The project consists of experimental behavior of hollow core slabs and comparison of this result with different makes and casting. Reinforced hollow slab is casting by making the hole in mold then the prestress hollow core slab is casted with zero slump concrete in factory. The slab has dimension of 1 cubic meter.

The load test is done in this slab by loading frame. Reinforced hollow core slab, prestress hollow core slab is tested and ultimate load, cracking load and efficiency of slab is tabulated. Cost efficiency of prestress hollow core slab is high compare to reinforced concrete hollow core slab. Load caring capacity of slab is 20% less when compare to prestress hollow core slab.

Hollow core slab is precast, prestress concrete element that are generally used for flooring. A hollow core slab consist of continues voids provided to reduce weight and cost. This hollow core slab are primarily used as a floor deck system in residential and commercial buildings as well as in parking structures because this slabs are more economical, have good fire resistance and sound insulation properties and also capable of spanning long distances with relatively small depths.

III. METHODOLOGY

1. Collection of literature about foamed concrete and fly ash
2. Material procurement and collection: Cement, Foam, and fly ash
3. Testing: Specific gravity, Absorption test etc.
4. Concrete mix design
5. Experimental set up
6. Wall Casting, Curing and testing of walls
7. Observation
8. Result and Discussion
9. Conclusion and Future work

Step 1 – Raw Material Preparation- hollowcore wall manufacturing process starts with raw material preparation. List of raw materials and relevant details are mentioned below-

- Pouring Mixture
- Blocks Casting on Mould
- Demoulding
- Steam Curing for 12 Hours
- Hollowcore Wall Ready For Sale

Cement- 53-grade Ordinary Portland Cement (OPC) from r manufacturer is required for manufacturing hollowcore wall.

Fly ash – Fly ash is mixed with water to form fly ash slurry.

Foaming agent - Foam is a substance foamed by trapping pockets of gas in liquid or solid. A bath sponge and the head on a glass of beer are example of foam. In most foam, the volume of gas is large, with thin films of liquid or solid separating the region of gas. Foaming agents is materials that facilitate formation of foam. The role of

foaming agents in foamed concrete is to create small and enclosed air bubble by reducing the surface tension of a solution and increasing the stability of air bubble.

Fiberglass mesh net- With high strength, durable service and excellent property against acid and alkali, fiberglass mesh net is the alternative to steel mesh for exterior and interior concrete wall rendering. Fiber reinforcement mesh enjoys easy operation, material saving, long life, it is the ideal energy -saving insulation materials.

Step 2 – Dosing and Mixing- After raw material preparation, next step of wall manufacturing process is dosing and mixing. Process of dosing and mixing means the quality of final products. A dosing and mixing unit is used to form the correct mix to produce hollowcore wall. Fly ash is pumped into a container. Once the desired weight is poured in, pumping is stopped. Foaming agent is mixed with fly ash by using foam generated machine. Dosing unit releases this mixture as per set quantities into molds.

Step 3 – Casting, Rising and Curing- Once mix of raw materials is ready, it poured is in molds. High degree of automation equipment, hydraulic opening and closing Simple operation and high efficiency, low labor intensity. The machine can also be equipped with vibrator system for thick mortar. Using Q235 steel, thickness 4mm, it will be welded on Horizontal worktable with pressing system to leveling tolerance ≤1mm. The leveling tolerance after all the Q235 steel plates after assembling will be ≤3mm.The bottom steel plate for tongue, the aluminium part with plastic coating for tongue profile to guarantee the precision of tongue. The aluminum part will be fixed on 6mm steel plates. Mound layer for top groove, the aluminium part with plastic coating for tongue profile to guarantee the precision of top groove. The Pipes, using steel pipes inside. PVC pipe fixed outside.

Step 4 – Demoulding and Cutting –After 2 days, it is ready to be demoulded and cut as per requirements. Once a mould is out of pre-curing room, it is lifted by a crane for demoulding operation. While all previous processes like raw material preparation, dosing & mixing and casting are pretty much same across all technologies, demoulding and cutting process vary vastly depending on technology provider. Differences in demoulding and cutting process are also evident from different types of molds required by different technology provider.

Flow chart -

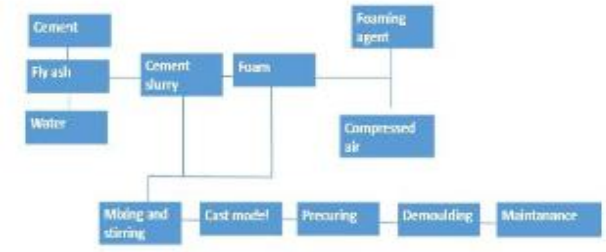

Fig.5 Flow chart of Hollowcore foam concrete.

IV. RESULT AND DISCUSSION

Test result of hollow core foam concrete wall having size (2800x600x100 mm), weight (45kg), Density (1400kg/cubic meter)

No.	Particulars	Result	Unit
1.	Compressive strength	5.56	mpa
2.	Flexural strength	0.492	mpa
3.	Sound insulation	40	dB
4.	Thermal conductivity	0.1739	w/ mk
5.	Cost reduces	30	%

V. CONCLUSION

1. The light weight concrete wall is suitable for sound and heat insulation.
2. Most important advantages of light weight concrete for the wall panel construction to form any shape and size.
3. The cost of the light weight concrete panel wall is very low as compare to normal wall.
4. The raw material for our panel is green material it's without asbestos and no radioactivity.
5. It is easy to install any storied building.
6. It is very economic, construct in less time.

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Performance of Exterior Column Beam Connections as built at site

Abhay Gujar, Sachin Pore

Abstract: ***Comparing performance of ill detailed and ductile detailed connections as per IS: 13920 was the prime aim of this study. It was by and large observed during literature review that, usually investigations are done at laboratory casting and curing conditions. How-ever, site conditions are grossly different from laboratory conditions. It is a general experience that the ductile detailing is rarely followed at site. Thus it was felt necessary to investigate performance of such ill detailed constructions at site testing conditions. Specimen for this experiment were manufactured by site people at site conditions and cured at site conditions. A 6-storied MRF constructed in Satara (IS: 1893, Zone 3) was analyzed. An exterior column-beam connection from first slab was chosen for assessment. Design for seismic requirements was carried out referring to suggestions from latest revisions of IS :1893 and IS: 13920. Four 0.3:1 scaled down specimen from actually site sourced concrete and steel were constructed. Out of the four, two were detailed as per actual site practice. Two specimen were detailed as per IS:13920. Specimen were subjected to reverse cyclic displacement loading protocol. It was observed that latest revisions from IS codes ensure that beam fails prior to the connection. Overall performance characteristics were seen improved in case of ductile detailed connections.***

Keywords: ***Exterior Column beam Connection, Ductile detailing, Ductility factor Experiment, IS:13920, Non-ductile detailing Reverse Cyclic loading, Scaled model, Site conditions, Stiffness degradation.***

I. INTRODUCTION

Deficiencies in the construction of structures are usually not known until they are tragically exposed by unfortunate testing events like earthquakes. Forensic investigation of past seismic events worldwide has revealed the poor performance of ill detailed structures and lack of "Capacity Design" principles. Moment resisting frames (SMRF) built in India are by-n-large vulnerable to lateral actions leading to brittle collapse. Column beam joints are subjected to large inelastic deformations when subjected to Severe reverse cyclic displacements during earthquakes. Ill-detailed joints significantly jeopardize response of frames designed as SMR frames. In order to reduce congestion, the detailing of reinforcement around connection region is more vital.

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It is assumed during the analysis, that connections are perfectly rigid and are capable of transferring stresses from one structural element to other without failure. How-ever severe shear stresses developed during earthquake loads, tend to falsify this assumption regarding connection rigidity [9]. Recent earthquakes have revealed that failure of connection leads to catastrophic failure even if members such as beam and column are intact. It was also observed that exterior joints are most vulnerable for failure. Therefore, ensuring ductility as well as resilience of exterior connections is very important in the seismic design of SMRF [2]. Effect of poor design and constructional ill-detailing of connections is multiplied by excessive deformation demands imposed by connecting members during earthquakes. Resilience of members is derived through their capacity to undergo inelastic deformations without undergoing failure. Ill-designing and detailing of connections leads to impounding failure even if connecting members are properly designed and detailed. Experiments on column beam assemblies reveal that prevalent design and detailing practice on site leads to extensive deterioration of connections.

experimental assessment of interior joints subjected to various parameters like axial load, percentage of confining reinforcement, characteristic strength of concrete, effect of lateral ties, with respect to strength of connections was done by [6]. Similarly, three interior column beam connections with column loads varied between 10%, 5%, and 0% of its axial load capacities were tested by [7]. Results revealed that there was 22 % reduction in ultimate displacement when axial load was decreased from 10 % to 0 %. The prime requirement from the connection is that the plastic hinge shall be formed in the beam prior to connection or the column. Thus flexural strength of column should be more than that of beam to ensure formation of plastic hinge in beam. Moreover, connection should possess sufficient shear strength so that it does not fail prior to column or beam. Confining reinforcement in connection works as effective shear reinforcement, confining joint region and restraining diagonal cracks. Experiments have revealed that use of rectangular confining reinforcement significantly improves resilience of external column beam connections [18]. Hoop reinforcement and anchorage requirements as per code often lead to reinforcement congestion in and around the joint. More-over, the development length requirements ask for larger member sizes or smaller diameter bars, making the situation even worse. There are many reasons why code provisions are not being followed strictly by the construction

industry as such, but practicality of the detailing requirements is one of them. It is interesting to note that, in spite of following all the code provisions, the intense diagonal cracking around joint cannot be prevented. Studying effect of axial load on connection capacity is not in purview of this study, how-ever it is worthwhile to note that increased axial loads increase shear capacity of the joint. Axial load reduces principal stresses induced in connection region and thus improving the shear capacity of the connection [1].

This work is an attempt to compare performance of ill detailed and ductile detailed connections, especially constructed as per site conditions.

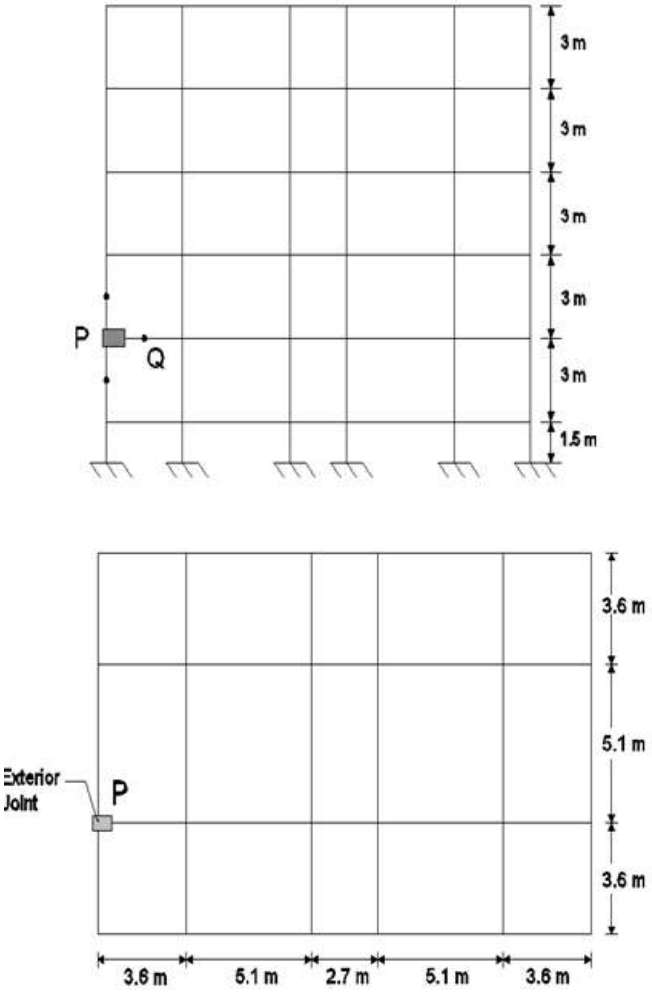


Fig. 1: Details of the frame analyzed

II. EVALUATION OF COLUMN BEAM CONNECTION

Length of columns is 3 m. Dimensions adopted were 600x300 mm. Beams are 3.6 m long with 300x600 mm size as per design. Live load was assumed to be 3 kN/m2 along with finishing load of 1 kN/m2. Wall thickness was assumed to be 230 mm. Grade of concrete assumed was M20 and grade of Steel used was Fe 415. Plane frame analysis was done for the frame shown in Fig.1. IS 456, IS 13920 and IS 1893 were referred to for design and ductile detailing of transverse reinforcement.

III. DESIGN OF BEAM COLUMN ASSEMBLY

A. Reinforcement details

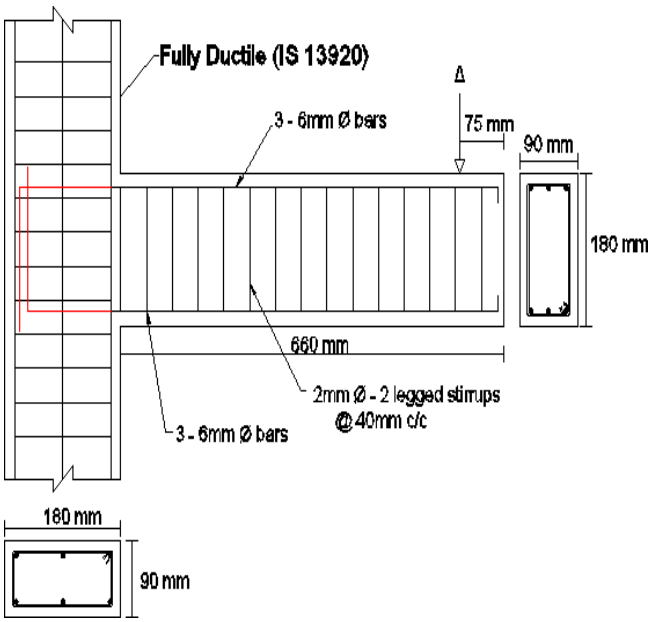
A 6-storied SMRF in Satara (zone 3) resting on class II soil was analyzed. Design parameters like axial load, bending moment and shear forces around selected connection were calculated. The joint marked “P as shown in Fig. 1 was selected for design. Design SF and BM for critical load combinations for beam PQ were 153.99 kN, 137.74 kN-m respectively. Shear reinforcement for beam PQ was calculated and detailed based on relevant codes and is shown in Table 1.It was practically not possible to construct and test, full sized assembly as per design. Hence it was decided to proportionately scale down the designed connection. Designed connection was scaled down to 0.3:1 of its size, as illustrated in Table 2. The details of scaled down specimen, reinforcement in connection and connecting members are depicted in Fig. 2 and Table 2. Specimens in Group 1 were cast with reinforcement ill- detailed as per site condition (HD 1,2). Second Group was detailed as per IS:13920 (FD 1,2). All specimens were subjected to cyclic displacement at the tip of beam as shown in Fig2, until failure.

Table 1: Reinforcement: Full size assembly

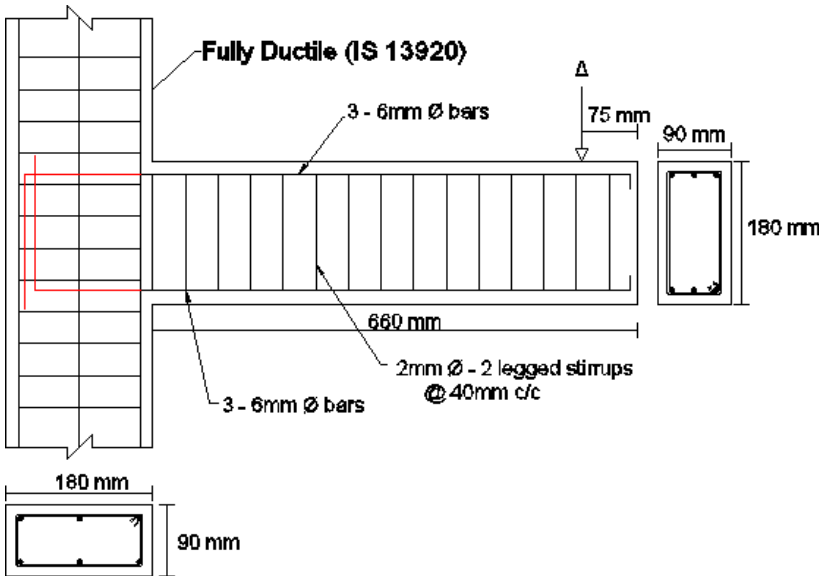
Column		Beam		Joint	Remarks
Longitudinal Reinforcement	Transverse Reinforcement	Longitudinal Reinforcement	Transverse Reinforcement	Transverse Reinforcement	
6 φ 20mm	φ 8mm @ 120.0 mm c/c	3 φ 20 mm (top and bottom)	φ 8mm @ 120.0 mm c/c	φ 8mm @ 120.0 mm c/c	as per IS: 13920
6 φ 20mm	φ 8mm @ 120.0 mm c/c	3 φ 20 mm (top and bottom)	φ 8mm @ 120.0 mm c/c	φ 8mm @ 120.0 mm c/c	as per built at site

Table 2: Reinforcement: Scaled Down Specimen

Specimen	Column		Beam		Joint	Remarks
	Longitudinal Reinforcement	Transverse Reinforcement	Longitudinal Reinforcement	Transverse Reinforcement	Transverse Reinforcement	
FD_1	6 φ 6mm#	φ 2mm @ 40mm c/c	3 φ 6mm (top and bottom)	φ 2mm @ 40mm c/c	φ 2mm @ 40mm c/c	Confining reinforcement as per IS: 13920
FD_2	6 φ 6mm	φ 2mm @ 40mm c/c	3 φ 6mm (top and bottom)	φ 2mm @ 40mm c/c	φ 2mm @ 40mm c/c	Confining reinforcement as per IS: 13920
HD_1	6 φ 6mm	φ 2mm @ 40mm c/c	3 φ 6mm (top and bottom)	φ 2mm @ 40mm c/c	φ 2mm @ 40mm c/c	Confining reinforcement as per built at site
HD_2	6 φ 6mm	φ 2mm @ 40mm c/c	3 φ 6mm (top and bottom)	φ 2mm @ 40mm c/c	φ 2mm @ 40mm c/c	Confining reinforcement as per built at site



(a).Reinf. details as per site condition



(b) Reinf. details as per IS 13920

Fig. 2: Scaled down Specimen.

IV MAUFACTURE OF SPECIMEN

A.Formwork and Casting

Wooden molds were prepared as shown in Fig. 3(b). Reinforcement was detailed as shown in Fig 3(a). Loading and end regions of reinforcement cage were strengthened in order to avoid edge disturbances. Casting was done using OPC (53 grade) cement. Crush sand (medium type) as available at site along with coarse aggregate as available at site was used for preparation of concrete. Site supervisor was instructed to prepare mix for M20 concrete as per their standard site practice. It was observed that water-cement ratio was used as 0.5 as per site conditions.150mm and 90 mm cubes were cast to ascertain characteristic strength of obtained mix. The 28-day average compressive strengths from 150 mm and 90 mm cube test was found out to be 24.62 N/mm2 and 28.11 N/mm2 respectively. Average yield stress of reinforcement tested was 432 N/mm2. All the specimens were cast either in horizontal or vertical position on the same day. Specimens were de-shuttered after 24 hours and cured at site along with other RCC elements at site conditions.

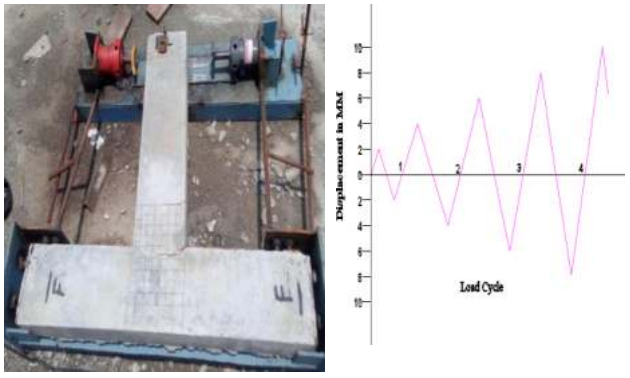
(a) Reinforcement details **(b) Form work for casting**

Fig. 3: Reinforcement and Setup for casting

B. Test procedure

Specimen was kept horizontal on specially fabricated load frame. The hand operated mechanical jack, load cell and digital venire caliper were used for testing. Each connection specimen was tested under reversed cyclic displacement loading. Both ends of the columns were fixed. The beam was loaded at tip as shown in Fig. 2 and as per displacement loading protocol as shown in Fig. 4(b).The connection region was marked with 25 mm x 25 mm grid to understand extent of cracking in the region.

Seismic capacity of RC element is measured in terms of Ductility i.e. capacity to undergo inelastic deformation without undergoing failure, strength to with stand loadings in elastic region and the resilience. Resilience is the capacity to dissipate energy without failure. With the increase in number of cycles and increase in amplitude of cycles, it was expected that all these performance markers will tend to decrease. [1],[18]. It was decided to load the connection to its ultimate capacity. Thus the displacement cycle was chosen to increase in multiples of 2 mm. The specimen was first displaced up to (+)2 mm and then in the reverse direction up to (-)2 mm. The amplitude of subsequent cycles was increased in multiples of 2 mm. To record the loads precisely, load cell with the least count of 1kg was used. The setup was instrumented with a digital Vernier with the least count of 0.1 mm to measure the deflection at the loading point. The readings were recorded in tabular form and various graphs were plotted with the use of spreadsheets.

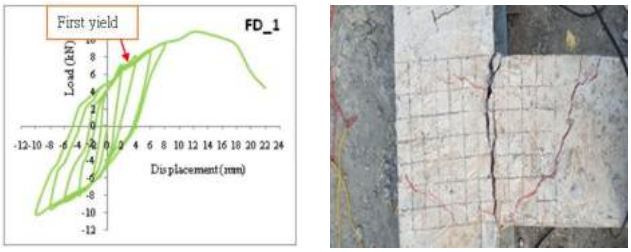


(a)Test Setup **(b) Loading protocol**

Fig. 4.

V. OBSERVATIONS AND REMARKS

A. FD 1: Specimen with bars detailed as per IS:1392

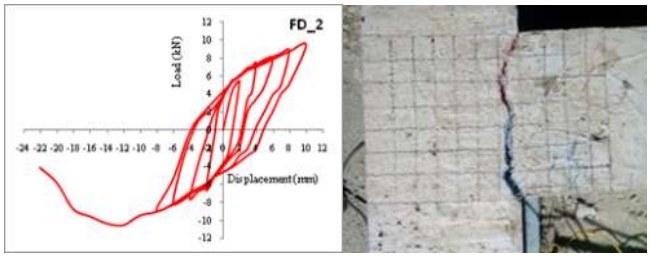


(a).Hysteresis loop of FD 1 (b) Failure pattern of FD 1

Fig. 5: Observations for FD 1

Fig. 5 (a) shows Hysteresis loop of FD 1 and Fig.5 (b) shows failure pattern of FD 1. First shear crack developed during first cycle of loading. Yield load for positive and negative direction was found to be 7.01 kN and 7.89 kN respectively. Ultimate load for positive direction was 10kN and for negative direction was 10.88kN. After yield load plastic deformation started. Specimen failed by vertical crack at connection. Also cracks in beam region were seen. How-ever it was noted that no crack formation occurred in joint region. A vertical cleavage can be clearly seen in Fig.5(b).

B. FD 2: Specimen with bars detailed as per IS:13920



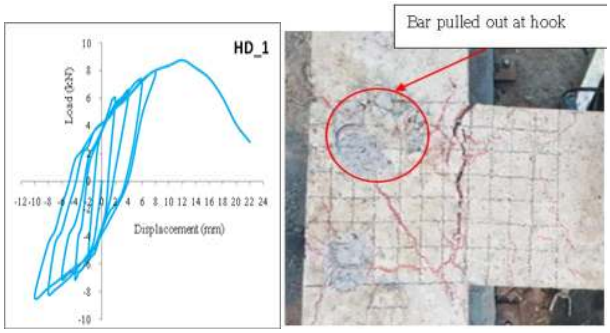
(a)Hysteresis loop of FD 2 (b) Failure pattern of FD 2

Fig. 6: Observations for FD 2

Fig 6. (a) shows Hysteresis loop of FD 2 and Fig.6 (b) shows failure pattern of FD 2. Yield load of positive and negative direction was 6.67 kN and 7.45 kN respectively. Ultimate load in positive direction was 9.46 kN and in negative direction was 10.59 kN After yield load, Specimen failed by vertical cracks at connection. There were no cracks in the connection region. Also, no spalling or cracking was observed around beam hooked bar region. So there was no slip between rebar and concrete.

C. HD 1 : Specimen with bars detailed as per site condition.

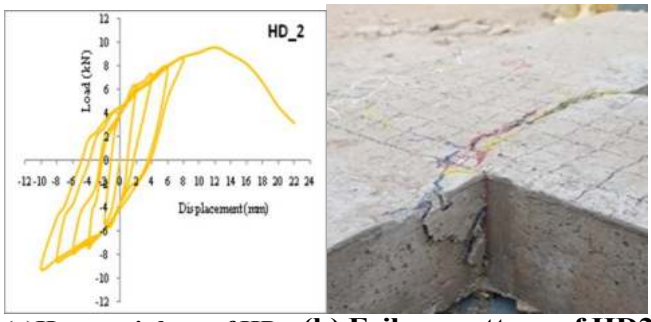
Fig. 7.(a) shows Hysteresis loop of HD 1 and Fig. 7(b) shows failure pattern for HD1. Yield load in positive and negative direction was 6.03 kN and 7.06 kN. respectively. Ultimate load in positive direction was 8.33 kN and in negative direction was 8.77 kN. progressive diagonal cracks were seen to develop in connection region. Concrete around hooked region of bar was seen cracking and spalling due to slip of bar. This was due to inadequate development length of hooked bar. Final failure was due to vertical separation at beam column interface



(a) Hysteresis loop of HD 1 (b) Failure Pattern of HD1

Fig. 7: Observations for HD1 .

D. HD 2: Specimen with bars detailed as per site condition.



(a)Hysteresis loop of HD (b) Failure pattern of HD2

Fig. 8: Observations for HD 2

Fig.8(a) shows Hysteresis loop of HD 2 and Fig. 8(b)shows failure pattern of HD 2. Yield load in positive and negative direction was 6.33 kN and 7.4 kN respectively. Ultimate load in positive direction was 9.12 kN and negative direction was 9.56 kN. Diagonal connection cracks and vertical cleavage at beam column interface were typical for this ill detailed specimen also.

VI. RESULT ANALYSIS

A. Hysteresis Loops

The displacement hysteresis loops for the various specimens are shown in Fig 5 thro 8. It can be observed from Table 3 that ultimate LCC (Load carrying capacity) for ductile detailed joints was more than those for ill detailed connections.

Table 3. Ultimate and Yield LCC

Specimen	Displacement (mm)			
	Yield Load		Ultimate Load	
	Positive Direction	Negative Direction	Positive Direction	Negative Direction
FD_1	7.01	7.89	10	10.88
FD_2	6.67	7.45	9.46	10.59
HD_1	6.03	7.06	8.33	8.77
HD_2	6.33	7.4	9.12	9.56

Energy dissipated by the specimen during a particular cycle is calculated from area under load displacement curve for that cycle.

The area under any loop can be calculated with the help of spread sheets.

Based on trapezoidal rule the area under curve is divided in multiple trapezoids of small widths. Total area under the curve can be calculated by a macro developed in spreadsheet as summation of all strip areas under the loop. Table 4 shows the step-wise and cumulative energy dissipation for all specimens. The highest energy dissipated was 92.77 kN-mm for Specimen FD1. Average Cumulative energy dissipation of FD specimen was 10.95% more than HD.

B. Energy Dissipation

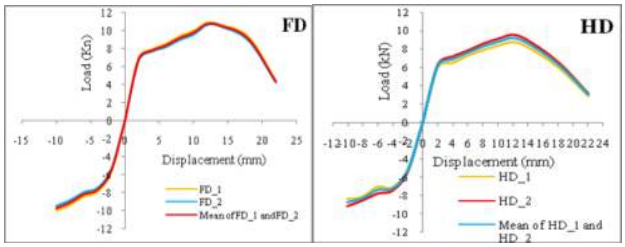
Energy dissipated by the specimen during a particular cycle is calculated from area under load displacement curve for that cycle. The area under any loop can be calculated with the help of spread sheets. Based on trapezoidal rule the area under curve is divided in multiple trapezoids of small widths. Total area under the curve can be calculated by a macro developed in spreadsheet as summation of all strip areas under the loop. Table 4 shows the step-wise and cumulative energy dissipation for all specimens. The highest energy dissipated was 92.77 kN-mm for Specimen FD1. Average Cumulative energy dissipation of FD specimen was 10.95% more than HD.

Table 4. Energy Dissipation

Specimen	Energy Dissipation/cycle					Cumulative Energy Dissipation	Mean	% rise
	Cycle_1	Cycle_2	Cycle_3	Cycle_4	Cycle_5			
FD_1	10.58	16.02	19.30	28.39	20.84	95.13	92.77	10.95
FD_2	10.27	15.25	18.73	26.38	19.79	90.42		
HD_1	9.76	13.63	16.30	24.00	16.73	80.42	83.62	
HD_2	10.17	14.76	17.68	25.84	18.36	86.82		

C. Envelope

Envelope is locus joining peaks of all cycles. Yield load and ultimate load can be observed from envelope. Fig 9(a) and (b) show envelope of specimen FD and HD. Peak and yield loads are mentioned in Table No. 3.

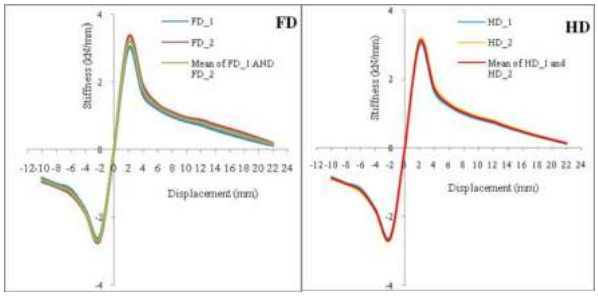


(a)Envelopes for FD (b) Envelopes for HD

Fig. 9: Envelopes for FD* and HD*

D. Stiffness degradation

Stiffness is load required to create unit deformation at the tip of beam. Slope of line joining peak of each cycle to origin is stiffness for that cycle. Stiffness thus calculated for each cycle is shown in Fig 10(a) and (b). It was observed that stiffness was highest for FD* (ductile detailed) specimens as compared to HD* (ill-detailed) specimens. Also stiffness degradation was comparatively more steep for HD specimens compared to FD specimens.



(a)FD Specimen (b) HD Specimen

Fig. 10. Stiffness degradation

E. Displacement Ductility

Ratio of Ultimate load to yield load is termed as displacement ductility. Table 5. depicts ductility ratios for FD* and HD* specimen. Mean ductility of FD and HD specimens was 1.42 and 1.34 respectively. Displacement ductility of FD specimen was 5.57% more as compared to those for HD specimens. Displacement ductility is measure of inelastic deformation capacity of the specimen.

Table 5. Displacement Ductility

Specimen	Displacement (mm)				Displacement Ductility		Average Ductility	Mean Ductility	% rise
	Yield		Ultimate						
	Positive Direction	Negative Direction	Positive Direction	Negative Direction	Positive Direction	Negative Direction			
FD_1	7.01	7.89	10	10.88	1.27	1.55	1.41	1.42	5.6
FD_2	6.67	7.45	9.46	10.59	1.59	1.27	1.43		
HD_1	6.03	7.06	8.33	8.77	1.18	1.45	1.32	1.34	
HD_2	6.33	7.4	9.12	9.56	1.23	1.51	1.37		

F. Joint Shear Stress

Capacity of a connection to resist horizontal shear stress is given by (1)[2].

$$\tau_{jh} = \frac{P}{A_{core}^{h}}\left[\frac{L_b}{d_b} - \frac{L_b + 0.5D_c}{L_c}\right] \quad \text{---------- (1)}$$

τ_{ACI} is calculated as $0.083*\gamma*\sqrt{fc}$ Mpa, where fc is compressive strength in MPa and γ is 15 for exterior joints. Joint shear capacity of FD specimen was more than HD specimen by about 14.39% . Table 6 shows Joint shear stress for all specimens.

Table 6: Joint Shear Stress

Specimen	Positive Ultimate Load P_u kN	τ_{jh}	τ_{jh} / τ_{ACI}	Negative Ultimate Load P_u kN	τ_{jh}	τ_{jh} / τ_{ACI}	Avg. Shear Stress	Mean	% rise
FD_1	10	3.47	0.60	10.88	3.78	0.65	3.63	3.55	14.39
FD_2	9.46	3.68	0.63	10.59	3.29	0.57	3.48		
HD_1	8.33	2.89	0.50	8.77	3.05	0.53	2.97	3.11	
HD_2	9.12	3.17	0.55	9.56	3.32	0.57	3.24		

VII. CONCLUSIONS

Aim of this exercise was to evaluate performance of exterior connections as constructed at site conditions. Two discrete sets of connections were manufactured. One designed and ductile detailed as per the IS 13920 and other ill detailed as constructed at site.

All specimens ultimately failed due to the cracks at interface of beam and column.

– The connection region was free from cracks except for some hairline cracks in case of connections detailed as per IS 13920.

– Specimens having special confining reinforcement as per IS 13920 had improved resilience as compared to those with ill detailed reinforcement.

– Diagonal cracks were seen in joint region of ill detailed specimen indicating inadequate shear and rotation capacity of the joint.

– Concrete spalling and cracking was seen around hooked bar region indicating slip of reinforcement due to inadequate anchorage in ill detailed specimen.

– It was concluded from the observations that overall energy dissipation and ultimate load characteristics of a connection improves substantially due to ductile detailing of reinforcement as per IS 13920.

– Ill detailed connections as built at site have inadequate capacity to act as a rigid interfacing element for beam and columns.

– Ductile detailed connections have better inelastic deformation capacities and hence would perform better during seismic activity.

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Intelligent Transportation using Deep Learning

Vijay Bhanudas Gujar

Abstract: ***The goal of this paper is to advance intelligent transportation program through the creation of a data collection system, a Convolutional Neural Network (CNN) model for intelligent transportation, and a simulator to test the trained CNN model. The data collection system collects data from a vehicle-steering wheel angle, speed, and images of the road from three separate angles at the time of the data collection. A CNN model is then trained with the collected data. The trained CNN model is then tested on a simulator to evaluate its effectiveness.***

Keywords: ***Convolutional Neural Network (CNN), Data Collection System, Deep Learning, Neural Network, Simulation.***

I. INTRODUCTION

The field of intelligent transportation is currently one of the most prominent and popular fields in the industry, it is a field with lots of room to grow and develop. This paper creates a wide variety of possible future directions. The first possible direction being the completion of the real world 3D simulator, at task that proved to be out of the scope of this project-however it is a task that would be well suited as the focus of a future project building on the progress completed here. Another obvious and compelling direction being the implementation of the trained CNN model not only on a simulator but also a real active vehicle. Furthermore, a small car model could also be used to collect and test data from, barring access to a fully sized active vehicle. The goal of this project was to advance intelligent transportation program through the creation of a data collection system, a Convolutional Neural Network (CNN) model for intelligent transportation, and a simulator to test the trained CNN model. By developing these tools, it was our aim to further enhance, advance, and aid intelligent transportation program.

A. Current State of the field

Intelligent transportation has become a very prominent field in the automotive industry. This has led to a huge influx in funds allocated to researching and developing new and more efficient technologies for intelligent transportation, Convolutional Neural Network models, and intelligent transportation simulators similar to this paper.

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Data from three front facing cameras and a vehicle's steering wheel angle; both project then proceed to feed this information to a neural network that utilizes pattern recognition to train itself. However, the two projects differ in terms of simulation. While NVIDIA utilizes prerecorded video to approximate how its network model would operate, this paper evaluates its progress through the use of a 3D real time simulation. In addition, this paper is also capable of 3 training its neural network through the use of data collected in-simulation as well as real world data.

B. Proposed Design and Contributions

This paper was composed of three major core components: (1) the creation of data collection system, (2) a Convolutional Neural Network (CNN) model, and (3) a simulator. (1) The data collection system proposed would be used to collect data from an active vehicle in real time, it would collect the steering wheel angle, speed, and images of the road from three separate angles. (2) The CNN model proposed would then be trained with the collected data from the vehicle. (3) The simulator would test/evaluate the effectiveness of the data collection system trained CNN model in a safe and controlled environment.

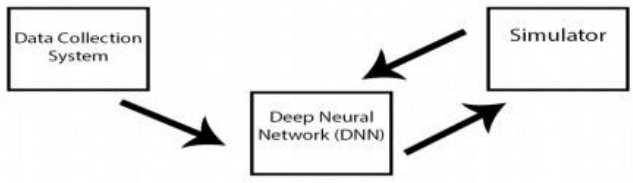


Figure 1 Proposed Design

The result of this paper was proposed to be a modular collective system for intelligent transportation that could be implemented and tested in a variety of different vehicles to collect data, create models based of the data, and then test the data in the controlled environment of a simulator.

C. Main Goal

The goal of this paper was to advance intelligent transportation program through the creation of a data collection system, a Convolutional Neural Network (CNN) model for intelligent transportation, and a simulator to test the trained CNN model. By developing these tools, it was our aim to further enhance, advance, and aid intelligent transportation program. This paper was composed of three core components: the data collection system, a Convolutional Neural Network (CNN) model, and a simulator.

The data collection system was used to collect data from an active vehicle in real time; it collected the steering wheel angle, speed, and images of the road from three separate angles.

The CNN model was then trained with the collected data from the vehicle or with available datasets online. Then, having collected the data and trained a CNN model with it, the trained model was then tested in a simulator to evaluate its effectiveness in a safe and controlled environment.

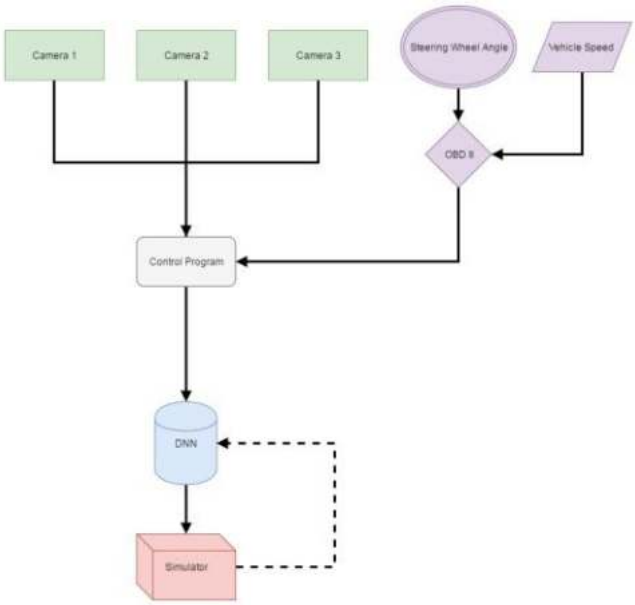


Figure 2 Main Goal

The main objective of this project was to create a modular collective system for intelligent transportation that could be implemented and tested in a variety of different vehicles to collect data, create models based of the data, and then test the data in the controlled environment of a simulator. This objective was broken down into three sub objectives.1 Data Collection System Create a data collection system modular in nature that can be placed on a test vehicle, used to collect data, then removed and taken back to the lab for either further 7 in-house testing, modifications, repairs, or safekeeping. Attaching and removing this data collection system should be quick and easy to accomplish. 2. Convolutional Neural Network Model Develop a Convolutional Neural Network model that can be trained to operate a vehicle through real data gathered by the data collection system. The Convolutional Neural Network should also be able to be trained by simulated data created in a simulation. The CNN model should be capable of navigating in clearly marked roads with good lighting conditions. 3 Simulator Develop a simulator to test a developed CNN model. The simulator should be capable of simulation a variety of driving conditions, obstacles, and road variations.

Data Collection System: Data Collection System Design When designing the data collection system one of the first design aspects that needed to be decided upon was the location of the cameras and the amount of cameras needed. While having cameras located throughout the perimeter of the vehicle (front, side, and back) would be beneficial for a production vehicle, the scope of this project would not permit it. Instead, the team decided to focus on the front of the vehicle for the data collection system. In this data collection system, three cameras would be placed near the front of the vehicle, providing ample coverage of the road in front of the vehicle. The cameras would be spaced out evenly on the vehicle, with one two cameras near the outer edge of the vehicle and one located in the center. This positioning of the cameras would provide the data collection system with a very wide view of the road when all three camera images were stitched together. final step in the data collection system design was determining a way of synchronizing the images collected by the cameras with the speed and steering wheel angle collected through the OBDII port.

In order to accomplish this, it was determined that the computer program for synchronizing the multiple cameras and the computer program for querying the vehicle for the speed and steering wheel angle would have to be merged together.

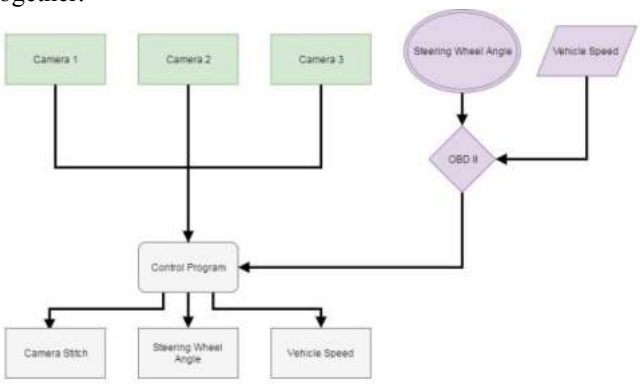


Figure 1 Data Collection System Overview

OBD II- On Board Diagnostics Background On-board diagnostics- commonly referred to as OBD- is a feature available in all modern vehicles which allow them to perform self-diagnosis and provide vehicle reports to the user and/or manufacturer. OBD provides the user with detailed vehicle information from a variety of topics including but not restricted to: car speed, steering wheel angle, fuel and air detection, ignition, emissions control, transmission control, and vehicle state (drive, reverse, park, neutral). Because of these capabilities, OBD technology is often used by car owners and car manufacturers to provide simple diagnostic codes which allow the user to quickly identify problems with the vehicle. OBDII are traditionally found and positioned in a location below the steering wheel and are usually hidden or covered by a removable compartment for ease of access. OBDII connectors are 16-Pin D-shaped connectors that transmit data over a CAN-bus protocol producing 4-digit hexadecimal PIDs (parameter IDs) for the user to read. While the method of transmission is standard, manufacturers are not required to standardize the description of each individual PID value. Resulting in a wide range of vehicle specific PID values that make it incredibly difficult to decipher the PID's description without direct information from the vehicle manufacturer.

II. CONVOLUTIONAL NEURAL NETWORK MODEL FOR LANE KEEPING

A. Introduction to End-to-End Learning for Lane Keeping

An end-to-end learning approach was implemented to obtain a steering wheel angle output based on an input frame. The Convolutional Neural Network model the team used was based on the network.

The model was trained on a Udacity dataset and was evaluated by using the output to control the car in autonomous mode- this was done on the Udacity simulator at a constant speed.

The parameters of the neural network are optimized automatically using backpropagation based on the mean squared error between the predicted angle and the labeled angle for the training image. Because the neural network is self-optimized, labeling the lanes on the image and extracting features manually is not needed, which makes pre-processing the images much easier. If training data for an abundant collection of road conditions are available, the prediction given by the neural network will be very accurate

In this portion of the project, the team set about to develop a Convolutional Neural Network model that could be trained to operate a vehicle through real data gathered by the data collection system and/or through pre-existing datasets. The goal of this portion of the project was to create a CNN model capable of navigating clearly marked roads or paths with good lighting conditions. The section of the project is broken up into two main sections. The first part details the creation of the CNN model as well as the training of the model. The second part consists of testing the CNN model created.

III. IMPLEMENTATION OF THE CONVOLUTIONAL NEURAL NETWORK

To implement this convolutional neural network, Keras, a high-level neural networks API, written in Python and running on top of Tensorflow, was used. The neural network structure was shown in the following image:

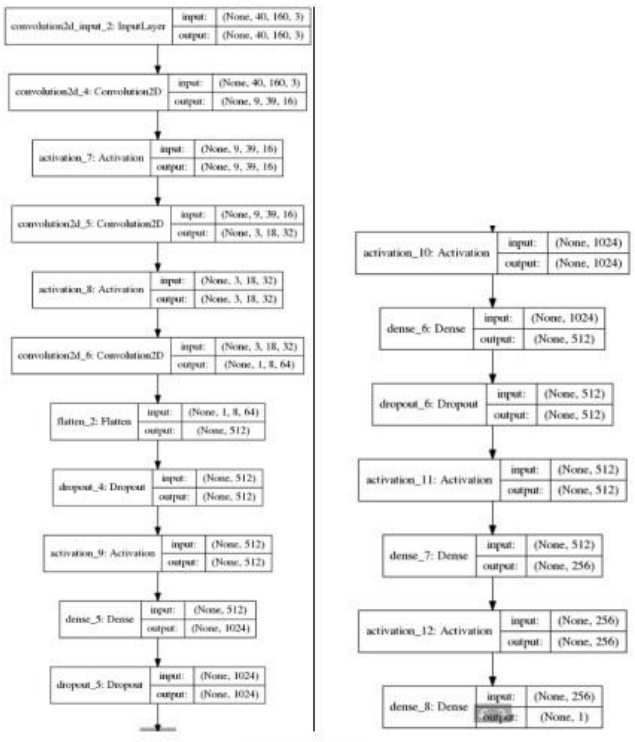


Figure : CNN Model

For this implementation, the input images were pre-processed before being fed into the neural network. First, in pre-processing, the upper half of the images were removed because the removed portion did not affect the result of lane keeping. Then the remaining images were shrunk by 0.5 to reduce memory usage and training time. Next, the images were converted from RGB to YUV. Finally, the images were adjusted to zero mean and unit variance to ensure 31 that convergence could be reached quickly. The code below shows the process of preprocessing images:

```
def processImg(img):
    yuv = cv2.cvtColor(img, cv2.COLOR_RGB2YUV)
    img = img[80:160, :, :]
    img = ndimage.interpolation.zoom(img, [0.5, 0.5, 1])
    mean = np.mean(img)
    img = img - mean
    s = np.std(img)
    img = img / s
    return img
```

Figure : Image Pre-Processing

Since three images were captured by left, center and right cameras at each frame, the steering wheel angle corresponding to the left image was decreased by 0.25 and the angle corresponding to the right image was increased by 0.25. By doing this, the captured images were able to be fully utilized. The code used to implement the convolutional neural network is shown in the following image:

Figure : CNN Implementation Code

.

The input image to the model has a size of 40 * 160. The first convolutional layer has a patch size of 8 * 8 with 16 output channels and a stride size of 4. Then, the outputs are passed through a rectified linear unit (ReLU) layer. The second convolutional layer has a patch size of 5 * 5, 32 output channels and a stride size of 2. This layer is also followed by a ReLU layer. The third convolutional layer has a patch size of 3 * 3, 64 output channels and a stride size of 2. Then, after flattening, a dropout rate of 20% was applied and another ReLU layer was added. Finally, four fully connected layers with 1024, 512, 256 and 1 neurons were added to output the steering wheel angle. Xavier initialization was used to initialize the weight for all the layers. Using xavier initialization ensures that the scale of initialization is based on the input and output neurons. To compile and train the neural network, the following code was used:

To compile and train the neural network, the following code was used:

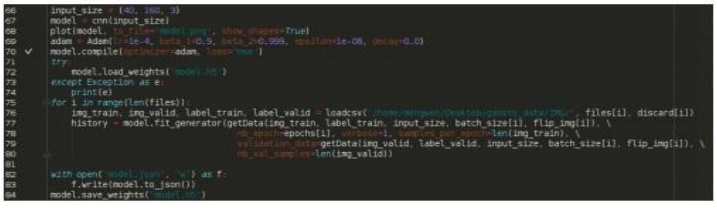


Figure : CNN Compilation

The Adam optimizer, which is a method for stochastic optimization, provided by Keras, was used to optimize the neural network.

And mean squared error between the predicted and labeled angle was used as a loss function. In order to train the network, training data captured 33 from Udacity simulator was used. A figure showing the steering wheel angle distribution of the training data was shown below:

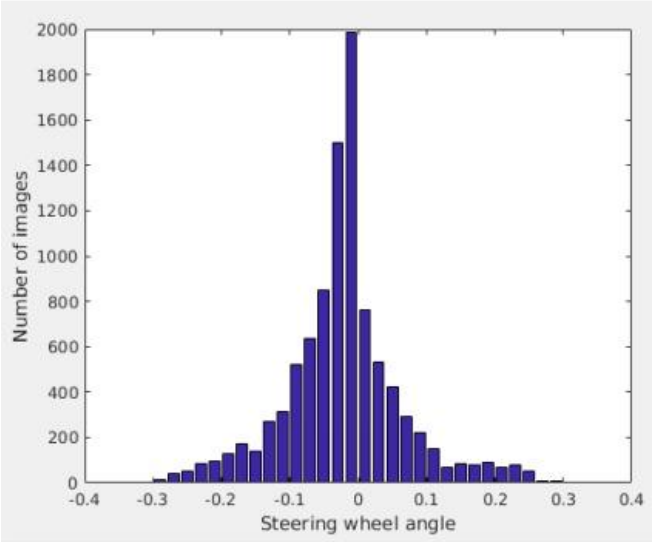


Figure 20 Steering Wheel Angle Distribution

From the distribution, we can tell that in most frames, the car is driving nearly straight, which means that the steering wheel angle is 0. Since there were not enough training data on sharp turns, the car did not perform very well when encountering a very sharp turn. Overall, 30 epochs of training were performed on all the training data with a batch size of 64 and 16 epochs of training were performed on the images with steering wheel angle not equal to 0.

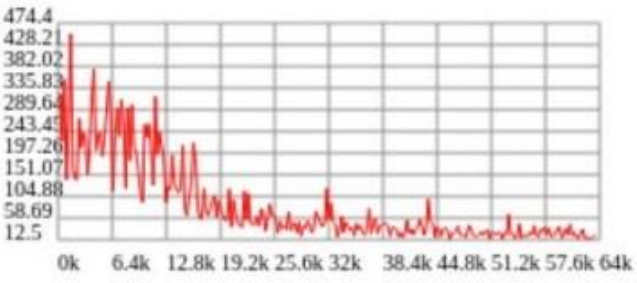
IV. RESULT AND DISCUSSION

In order to evaluate the convolutional neural network, a variety of test was conducted. The first test was done through the use of an online framework called 'DeepTesla' was used. DeepTesla is a online platform for testing end-to-end steering models. The code used in DeepTesla is shown in the following figure:

```
"network" : [
    { "type" : "input", "out_sx" : 200, "out_sy" : 66, "out_depth" : 3 },
    { "type" : "conv", "sx" : 5, "filters" : 16, "stride" : 2, "pad" : 2, "activation" : "relu" },
    { "type" : "pool", "sx" : 3, "stride" : 2},
    { "type" : "conv", "sx" : 3, "filters" : 32, "stride" : 2, "pad" : 2, "activation" : "relu" },
    { "type" : "conv", "sx" : 3, "filters" : 64, "stride" : 2, "pad" : 2, "drop_prob" : 0.2,
      "activation" : "relu" },
    { "type" : "fc", "num_neurons": 1024, "drop_prob": 0.5, "activation" : "relu"},
    { "type" : "fc", "num_neurons": 512, "drop_prob": 0.5, "activation" : "relu"},
    { "type" : "fc", "num_neurons": 256, "activation" : "relu"},
    { "type" : "regression", "num_neurons" : 1 }
],
"trainer" : { "method" : "adadelta", "batch_size" : 32, "l2_decay" : 0.0001 }
```

Figure : CNN Test Code

Since the input images from DeepTesla had different sizes than the training images the team used in the project, the patch size of the first convolutional layer was changed to 5 and a pooling layer with patch size 3 and stride 2 was added. The following plot shows the change of mean squared error as the number of training images fed to the neural network increased:



Mean Squared Errors

As the plot above shows, the mean squared error decayed as the network was fed by more images. After about 57k images were used for training, the error reached a stable value of less than 10. The following figures show visualizations of the images generated by the first and second convolutional layers along with the corresponding training image:

Figure Training image, actual angle and predicted angle

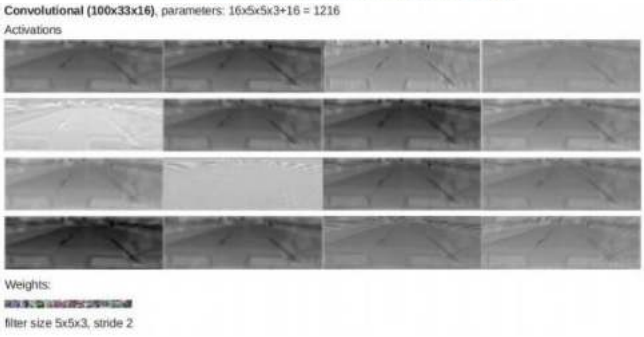
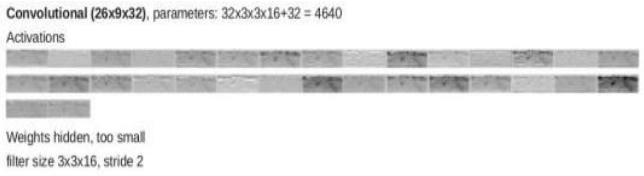


Figure Visualization of the images generated by the first convolutional layer



Convolutional (100x33x16), parameters: 16x5x5x3+16 = 1216

second, and it collects the steering wheel angle of the vehicle at a rate

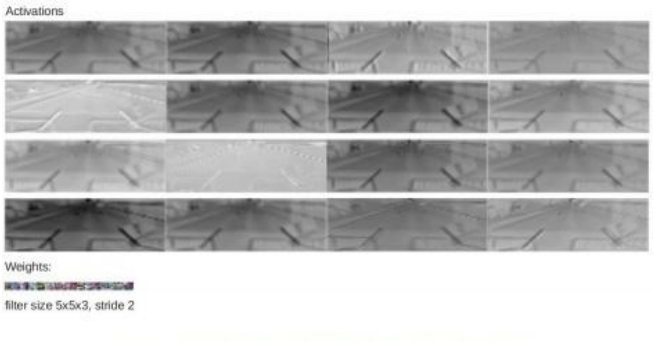


Figure Visualization of the images generated by the second convolutional layer

From the figures above, one can tell that lane markings were automatically extracted as features by the convolutional layers. And the predicted angle was almost the same as the labeled angle. After evaluating the convolutional neural network on Deep Tesla online platform, the team proceeded to do a second test, this time using the Udacity driving simulator. Udacity is a machine learning specific simulation tool with a simple design and environment; Udacity allows users to both test and train CNN models. For this project, Udacity driving simulator was used to determine whether the neural network can successfully keep the car in lane. The overall performance of the CNN model was good. The car was able to drive a whole loop around the simulated track without human intervention. The only problem experienced in the simulation occurred when the vehicle encountered sharp turns; in this case the steering wheel angle predicted by the neural network was sometimes smaller than the actual angle need so the car would drive out of lane for a very brief period time before automatically adjusting back. A video showing the convolutional neural network automatically keeping the car in lane of 30 frames per second. This data can then be used to construct a real-world driving simulator and can also be used as the training data for our neural network. The Convolutional Neural Network model also works as expected, it is able to accurately and correctly produce the correct steering wheel angle for any given image or frame of a video that it is provided with. When provided with many images at a faster than expected rate, the model does struggle and often makes mistakes, however this is a problem that can be fixed with more training epochs as well as some refinement of the code. The simulator portion of the project was begun, with the image calibration portion of the real world 3D simulator completed; however due to time constraints the rest of the real world 3D simulator was not able to be completed. However, the team was still able to test the CNN through the use of the Udacity simulator. Overall, this project has produced a cohesive system of data collection, network model training, and network model testing that can be used to advance WPI's intelligent transportation program.

Camera Calibration [Simulator]

1. Introduction To build a simulator using real world data, we need to be able to transform a 3D world coordinate to 3D camera coordinate, and also transform a 2cameracoordinateto pixel coordinates in the image frame. As a result, it is necessary for us to find the extrinsic matrix and intrinsic matrix for the cameras we used.

2. Intrinsic Matrix In order to map the camera coordinates to the pixel coordinates in the image frame, the intrinsic matrix need to be found. The intrinsic matrix can be expressed as the following:

$$\begin{bmatrix} f_x & 0 & 0 \\ s & f_y & 0 \\ c_x & c_y & 1 \end{bmatrix}$$

In this matrix, fx, fy represents the focal length in pixels. S represents the skew coefficient between x and y axis and cx, cy represents the offsets. To transform a camera based 2D coordinate to 2D point in the image plane, the following formula was used:

$$p_i = K \cdot p_c$$

where pi represents the homogenous pixels on the image plane, pc represents the camerabased 3D coordinate and K represents the intrinsic matrix.

3. Extrinsic Matrix Extrinsic matrix was used to transform a 3D world coordinate to a 3D camera coordinate. The extrinsic matrix can be represented as the following:

$$R_{w,c}\, t_{w,c}$$

Rw,c in the formula represents the rotation matrix of the camera system, and tw, c in the formula represents the translation of the optical center from the origin of the world coordinate. In order to transform a point from world coordinate to camera coordinate, the following formula was used:

$$p_c = \left(R_{w,c}\, t_{w,c}\right) p_w$$

where pc represents the 3D camera coordinate, pc represents the camera-based 3D coordinate, Rw, c represents the rotation matrix and tw, c represents the transformation matrix. Putting the intrinsic matrix and extrinsic matrix together, a 3D world coordinate can be transformed to pixel coordinate on image plane. The following formula was used for this operation:

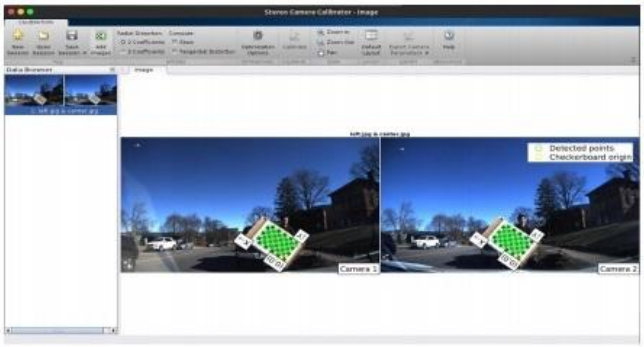
$$p_i = K \cdot \left(R_{w,c}\, t_{w,c}\right) p_w$$

In this formula, Kis a 3 by 3 matrix representing the intrinsic matrix for the camera, (Rw, ctw, c)is a 3 by 4 matrix represe the extrinsic matrix for the camera. Camera calibration was done to 40 find the intrinsic matrix and the extrinsic matrix using the measured image plane coordinates and the world coordinates.

4. Implementation for finding camera parameters

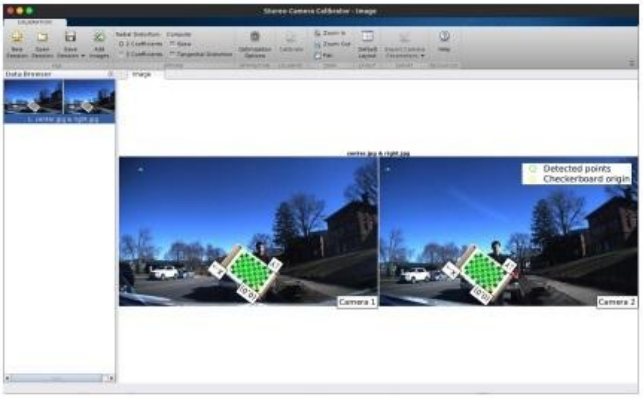
Initially, 'Camera Calibrator' application from computer vision toolbox in Matlab was used to find the camera parameters for individual cameras. A problem for this approach is that since there are small errors when calculating intrinsic and extrinsic matrices, when the camera' locations were calculated based on camera parameters we got, it didn't correspond to the actual location of the cameras. Since the relationships between cameras are already known, these three cameras are treated as two sets of stereo camera, and the 'Stereo Camera Calibrator' application was used. This application takes at least 10 images of checkerboard from a pair of cameras as well as the size of the checkerboard. It will automatically detect the cross points of checkerboard and calculate the camera parameters.

Also, the parameters needed to correct radial distortion will also be given. Because the camera locations were now found in groups, the result was more accurate.
The application with an image from left camera and one from center camera was shown in the following:



Calibration Example 1

The application with an image from center camera and one from right camera was shown in the following:



Calibration Example 2

Also, the translation matrices in world units and the rotation matrices of left camera relative to center camera and of right camera relative to center camera were found. Then, only the extrinsic matrices for the center camera need to be found to determine the extrinsic matrices for all three cameras. Initially, we tried to put a checkerboard on the ground and use the application to calculate the extrinsic matrix, but as the figure shown in the following, the checkerboard was too small to be clearly detected.

Calibration Example 3

We then decided to use the endpoints and cross points of lane markings on a parking lot as coordinates in world coordinate. The following image was finally used to calculate the extrinsic matrix of the center camera:

Extrinsic matrix center of camera

The coordinates of the endpoints and cross points were first calculated according to the distances measured. Then, radial distortion was corrected using the camera parameters calculated by the application. The resulting image was shown in the following

Image correction

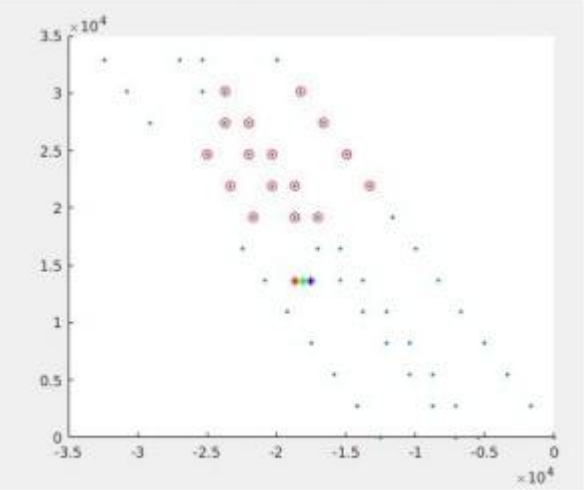
The following code was then used to calculate the extrinsic matrices for the cameras:

```
[rotationMatrix,translationVector] = extrinsics(img211(:,:),worldPoints(:,:),cameraParams{2});
cameraEx{2} = [rotationMatrix;translationVector];

cameraEx{1} = cameraEx{2}*r1to0;
cameraEx{1}(4,:) = cameraEx{1}(4,:) + t1to0;

cameraEx{3} = cameraEx{2}*r1to2;
cameraEx{3}(4,:) = cameraEx{3}(4,:) + t1to2;
```

Calculatina Extrinsic Matrices

The function ‘extrinsics’ from computer vision toolbox in Matlab was used to get the rotation matrix and translation vector for the center camera. This function takes in the coordinates of the points on the image without lens distortion, the world points we calculated and the camera parameters we got from the application. Then, based on the relationship between left, center and right cameras, all three extrinsic matrices were calculated.

The camera positions in the world coordinate were then plotted to make sure that the extrinsic matrices were accurate. The resulting plot was shown in the following:



Calculated Camera Positions

In this figure, the red circles represent the points we used, the red, green and blue stars represent the left, center and right cameras. The locations of the cameras shown in the figure were very close to the actual locations of the cameras in the chosen image.

V. CONCLUSION

The team succeeds in creating a data collection system and a Convolutional Neural Network (CNN) model for intelligent transportation. The simulator portion proved to be beyond the scope of this paper; however substantial advances in the simulator were made in the form of the camera calibration-progress that can be built upon by future projects. The data collection system produced excellent results, logging the speed, steering wheel angle, and stitching three different camera angles together. The Convolutional Neural Network model is able to produce the correct steering wheel angle for any given image it is provided with. The simulator portion of the project was begun, with the image calibration portion of the real world 3D simulator completed; however, the scope of the real world 3D simulator proved to be too large and was not able to be completed due to time constraints the rest of the real world 3D simulator was not able to be completed. By developing these tools, the team was able to enhance and advance intelligent transportation program. This would result in more efficient and robust data collection, CNN models, and true to life tests.

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Intelligent Transportation using Deep Learning

Vijay Bhanudas Gujar

Abstract: ***The goal of this paper is to advance intelligent transportation program through the creation of a data collection system, a Convolutional Neural Network (CNN) model for intelligent transportation, and a simulator to test the trained CNN model. The data collection system collects data from a vehicle-steering wheel angle, speed, and images of the road from three separate angles at the time of the data collection. A CNN model is then trained with the collected data. The trained CNN model is then tested on a simulator to evaluate its effectiveness.***

Keywords: ***Convolutional Neural Network (CNN), Data Collection System, Deep Learning, Neural Network, Simulation.***

I. INTRODUCTION

The field of intelligent transportation is currently one of the most prominent and popular fields in the industry, it is a field with lots of room to grow and develop. This paper creates a wide variety of possible future directions. The first possible direction being the completion of the real world 3D simulator, at task that proved to be out of the scope of this project-however it is a task that would be well suited as the focus of a future project building on the progress completed here. Another obvious and compelling direction being the implementation of the trained CNN model not only on a simulator but also a real active vehicle. Furthermore, a small car model could also be used to collect and test data from, barring access to a fully sized active vehicle. The goal of this project was to advance intelligent transportation program through the creation of a data collection system, a Convolutional Neural Network (CNN) model for intelligent transportation, and a simulator to test the trained CNN model. By developing these tools, it was our aim to further enhance, advance, and aid intelligent transportation program.

A. Current State of the field

Intelligent transportation has become a very prominent field in the automotive industry. This has led to a huge influx in funds allocated to researching and developing new and more efficient technologies for intelligent transportation, Convolutional Neural Network models, and intelligent transportation simulators similar to this paper.

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Data from three front facing cameras and a vehicle's steering wheel angle; both project then proceed to feed this information to a neural network that utilizes pattern recognition to train itself. However, the two projects differ in terms of simulation. While NVIDIA utilizes prerecorded video to approximate how its network model would operate, this paper evaluates its progress through the use of a 3D real time simulation. In addition, this paper is also capable of 3 training its neural network through the use of data collected in-simulation as well as real world data.

B. Proposed Design and Contributions

This paper was composed of three major core components: (1) the creation of data collection system, (2) a Convolutional Neural Network (CNN) model, and (3) a simulator. (1) The data collection system proposed would be used to collect data from an active vehicle in real time, it would collect the steering wheel angle, speed, and images of the road from three separate angles. (2) The CNN model proposed would then be trained with the collected data from the vehicle. (3) The simulator would test/evaluate the effectiveness of the data collection system trained CNN model in a safe and controlled environment.

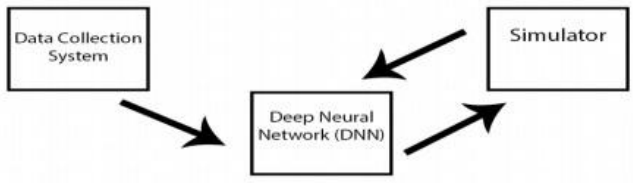


Figure 1 Proposed Design

The result of this paper was proposed to be a modular collective system for intelligent transportation that could be implemented and tested in a variety of different vehicles to collect data, create models based of the data, and then test the data in the controlled environment of a simulator.

C. Main Goal

The goal of this paper was to advance intelligent transportation program through the creation of a data collection system, a Convolutional Neural Network (CNN) model for intelligent transportation, and a simulator to test the trained CNN model. By developing these tools, it was our aim to further enhance, advance, and aid intelligent transportation program. This paper was composed of three core components: the data collection system, a Convolutional Neural Network (CNN) model, and a simulator.

The data collection system was used to collect data from an active vehicle in real time; it collected the steering wheel angle, speed, and images of the road from three separate angles.

The CNN model was then trained with the collected data from the vehicle or with available datasets online. Then, having collected the data and trained a CNN model with it, the trained model was then tested in a simulator to evaluate its effectiveness in a safe and controlled environment.

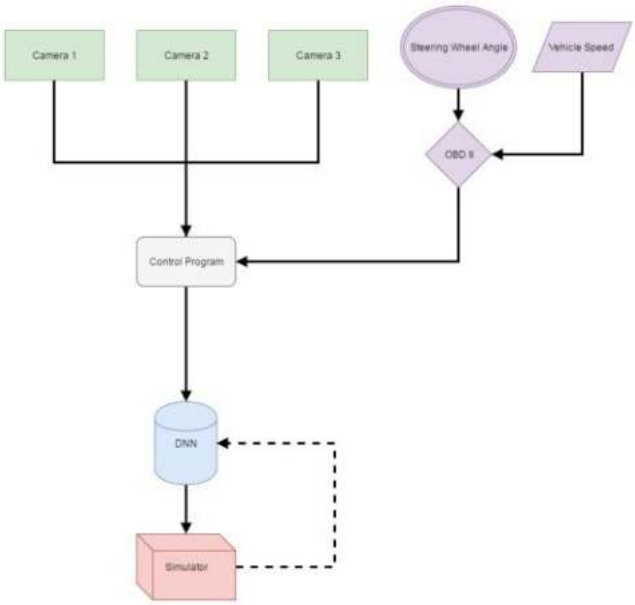


Figure 2 Main Goal

The main objective of this project was to create a modular collective system for intelligent transportation that could be implemented and tested in a variety of different vehicles to collect data, create models based of the data, and then test the data in the controlled environment of a simulator. This objective was broken down into three sub objectives.1 Data Collection System Create a data collection system modular in nature that can be placed on a test vehicle, used to collect data, then removed and taken back to the lab for either further 7 in-house testing, modifications, repairs, or safekeeping. Attaching and removing this data collection system should be quick and easy to accomplish. 2. Convolutional Neural Network Model Develop a Convolutional Neural Network model that can be trained to operate a vehicle through real data gathered by the data collection system. The Convolutional Neural Network should also be able to be trained by simulated data created in a simulation. The CNN model should be capable of navigating in clearly marked roads with good lighting conditions. 3 Simulator Develop a simulator to test a developed CNN model. The simulator should be capable of simulation a variety of driving conditions, obstacles, and road variations.

Data Collection System: Data Collection System Design When designing the data collection system one of the first design aspects that needed to be decided upon was the location of the cameras and the amount of cameras needed. While having cameras located throughout the perimeter of the vehicle (front, side, and back) would be beneficial for a production vehicle, the scope of this project would not permit it. Instead, the team decided to focus on the front of the vehicle for the data collection system. In this data collection system, three cameras would be placed near the front of the vehicle, providing ample coverage of the road in front of the vehicle. The cameras would be spaced out evenly on the vehicle, with one two cameras near the outer edge of the vehicle and one located in the center. This positioning of the cameras would provide the data collection system with a very wide view of the road when all three camera images were stitched together. final step in the data collection system design was determining a way of synchronizing the images collected by the cameras with the speed and steering wheel angle collected through the OBDII port.

In order to accomplish this, it was determined that the computer program for synchronizing the multiple cameras and the computer program for querying the vehicle for the speed and steering wheel angle would have to be merged together.

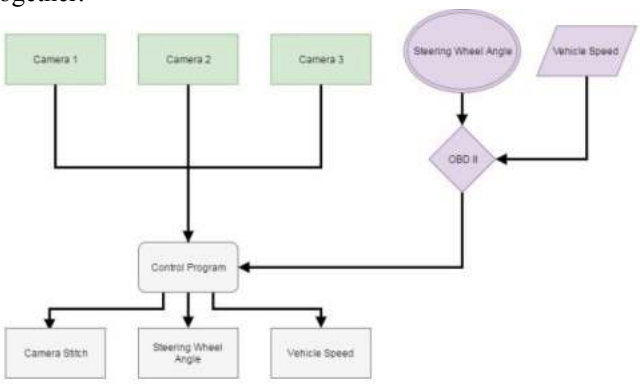


Figure 1 Data Collection System Overview

OBD II- On Board Diagnostics Background On-board diagnostics- commonly referred to as OBD- is a feature available in all modern vehicles which allow them to perform self-diagnosis and provide vehicle reports to the user and/or manufacturer. OBD provides the user with detailed vehicle information from a variety of topics including but not restricted to: car speed, steering wheel angle, fuel and air detection, ignition, emissions control, transmission control, and vehicle state (drive, reverse, park, neutral). Because of these capabilities, OBD technology is often used by car owners and car manufacturers to provide simple diagnostic codes which allow the user to quickly identify problems with the vehicle. OBDII are traditionally found and positioned in a location below the steering wheel and are usually hidden or covered by a removable compartment for ease of access. OBDII connectors are 16-Pin D-shaped connectors that transmit data over a CAN-bus protocol producing 4-digit hexadecimal PIDs (parameter IDs) for the user to read. While the method of transmission is standard, manufacturers are not required to standardize the description of each individual PID value. Resulting in a wide range of vehicle specific PID values that make it incredibly difficult to decipher the PID's description without direct information from the vehicle manufacturer.

II. CONVOLUTIONAL NEURAL NETWORK MODEL FOR LANE KEEPING

A. Introduction to End-to-End Learning for Lane Keeping

An end-to-end learning approach was implemented to obtain a steering wheel angle output based on an input frame. The Convolutional Neural Network model the team used was based on the network.

The model was trained on a Udacity dataset and was evaluated by using the output to control the car in autonomous mode- this was done on the Udacity simulator at a constant speed.

The parameters of the neural network are optimized automatically using backpropagation based on the mean squared error between the predicted angle and the labeled angle for the training image. Because the neural network is self-optimized, labeling the lanes on the image and extracting features manually is not needed, which makes pre-processing the images much easier. If training data for an abundant collection of road conditions are available, the prediction given by the neural network will be very accurate

In this portion of the project, the team set about to develop a Convolutional Neural Network model that could be trained to operate a vehicle through real data gathered by the data collection system and/or through pre-existing datasets. The goal of this portion of the project was to create a CNN model capable of navigating clearly marked roads or paths with good lighting conditions. The section of the project is broken up into two main sections. The first part details the creation of the CNN model as well as the training of the model. The second part consists of testing the CNN model created.

III. IMPLEMENTATION OF THE CONVOLUTIONAL NEURAL NETWORK

To implement this convolutional neural network, Keras, a high-level neural networks API, written in Python and running on top of Tensorflow, was used. The neural network structure was shown in the following image:

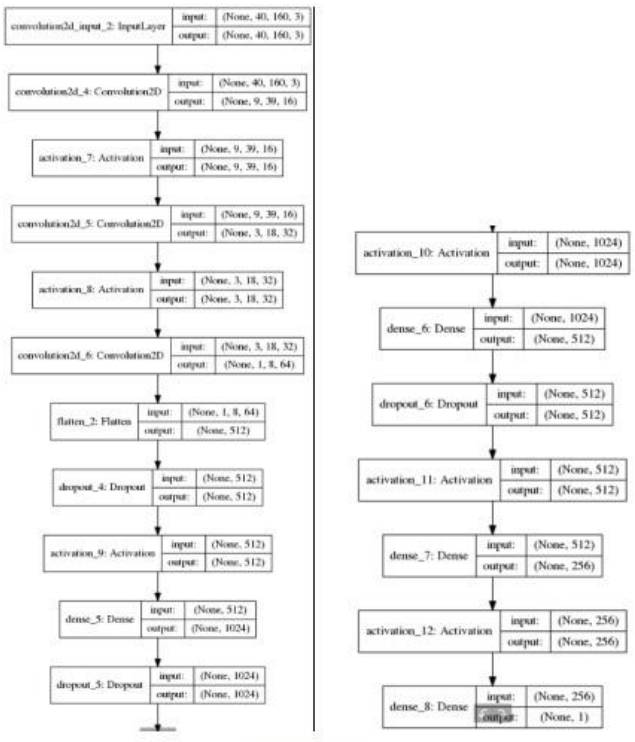


Figure : CNN Model

For this implementation, the input images were pre-processed before being fed into the neural network. First, in pre-processing, the upper half of the images were removed because the removed portion did not affect the result of lane keeping. Then the remaining images were shrunk by 0.5 to reduce memory usage and training time. Next, the images were converted from RGB to YUV. Finally, the images were adjusted to zero mean and unit variance to ensure 31 that convergence could be reached quickly. The code below shows the process of preprocessing images:

```
def processImg(img):
    yuv = cv2.cvtColor(img, cv2.COLOR_RGB2YUV)
    img = img[80:160, :, :]
    img = ndimage.interpolation.zoom(img, [0.5, 0.5, 1])
    mean = np.mean(img)
    img = img - mean
    s = np.std(img)
    img = img / s
    return img
```

Figure : Image Pre-Processing

Since three images were captured by left, center and right cameras at each frame, the steering wheel angle corresponding to the left image was decreased by 0.25 and the angle corresponding to the right image was increased by 0.25. By doing this, the captured images were able to be fully utilized. The code used to implement the convolutional neural network is shown in the following image:

Figure : CNN Implementation Code

.

The input image to the model has a size of 40 * 160. The first convolutional layer has a patch size of 8 * 8 with 16 output channels and a stride size of 4. Then, the outputs are passed through a rectified linear unit (ReLU) layer. The second convolutional layer has a patch size of 5 * 5, 32 output channels and a stride size of 2. This layer is also followed by a ReLU layer. The third convolutional layer has a patch size of 3 * 3, 64 output channels and a stride size of 2. Then, after flattening, a dropout rate of 20% was applied and another ReLU layer was added. Finally, four fully connected layers with 1024, 512, 256 and 1 neurons were added to output the steering wheel angle. Xavier initialization was used to initialize the weight for all the layers. Using xavier initialization ensures that the scale of initialization is based on the input and output neurons. To compile and train the neural network, the following code was used:

To compile and train the neural network, the following code was used:

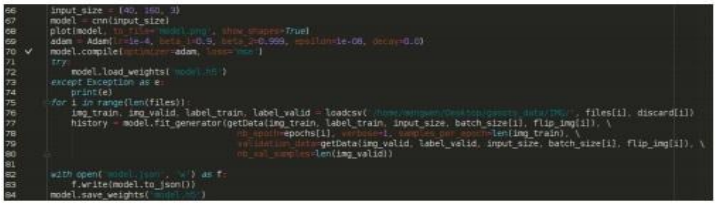


Figure : CNN Compilation

The Adam optimizer, which is a method for stochastic optimization, provided by Keras, was used to optimize the neural network.

And mean squared error between the predicted and labeled angle was used as a loss function. In order to train the network, training data captured 33 from Udacity simulator was used. A figure showing the steering wheel angle distribution of the training data was shown below:

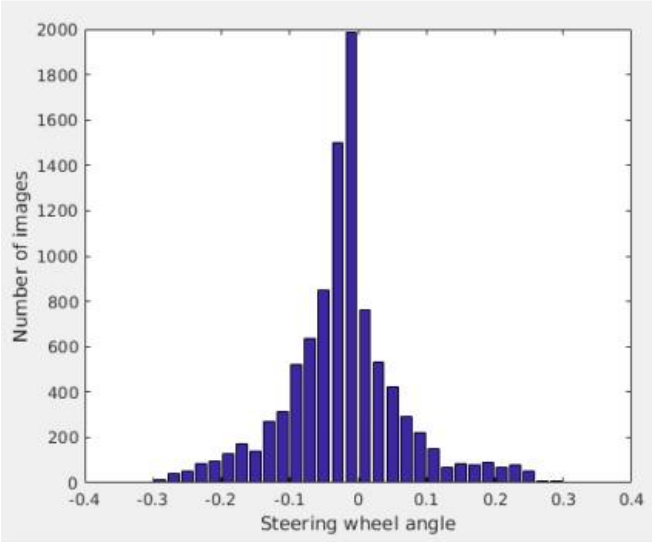


Figure 20 Steering Wheel Angle Distribution

From the distribution, we can tell that in most frames, the car is driving nearly straight, which means that the steering wheel angle is 0. Since there were not enough training data on sharp turns, the car did not perform very well when encountering a very sharp turn. Overall, 30 epochs of training were performed on all the training data with a batch size of 64 and 16 epochs of training were performed on the images with steering wheel angle not equal to 0.

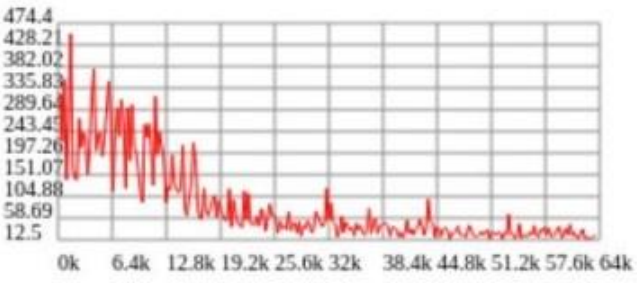
IV. RESULT AND DISCUSSION

In order to evaluate the convolutional neural network, a variety of test was conducted. The first test was done through the use of an online framework called 'DeepTesla' was used. DeepTesla is a online platform for testing end-to-end steering models. The code used in DeepTesla is shown in the following figure:

```
"network" : [
    { "type" : "input", "out_sx" : 200, "out_sy" : 66, "out_depth" : 3 },
    { "type" : "conv", "sx" : 5, "filters" : 16, "stride" : 2, "pad" : 2, "activation" : "relu" },
    { "type" : "pool", "sx" : 3, "stride" : 2},
    { "type" : "conv", "sx" : 3, "filters" : 32, "stride" : 2, "pad" : 2, "activation" : "relu" },
    { "type" : "conv", "sx" : 3, "filters" : 64, "stride" : 2, "pad" : 2, "drop_prob" : 0.2,
      "activation" : "relu" },
    { "type" : "fc", "num_neurons": 1024, "drop_prob": 0.5, "activation" : "relu"},
    { "type" : "fc", "num_neurons": 512, "drop_prob": 0.5, "activation" : "relu"},
    { "type" : "fc", "num_neurons": 256, "activation" : "relu"},
    { "type" : "regression", "num_neurons" : 1 }
],
"trainer" : { "method" : "adadelta", "batch_size" : 32, "l2_decay" : 0.0001 }
```

Figure : CNN Test Code

Since the input images from DeepTesla had different sizes than the training images the team used in the project, the patch size of the first convolutional layer was changed to 5 and a pooling layer with patch size 3 and stride 2 was added. The following plot shows the change of mean squared error as the number of training images fed to the neural network increased:



Mean Squared Errors

As the plot above shows, the mean squared error decayed as the network was fed by more images. After about 57k images were used for training, the error reached a stable value of less than 10. The following figures show visualizations of the images generated by the first and second convolutional layers along with the corresponding training image:

Figure Training image, actual angle and predicted angle

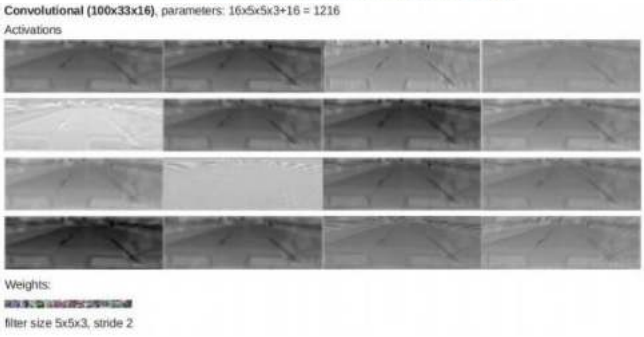
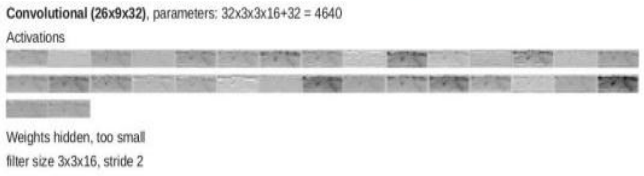


Figure Visualization of the images generated by the first convolutional layer



Convolutional (100x33x16), parameters: 16x5x5x3+16 = 1216

second, and it collects the steering wheel angle of the vehicle at a rate

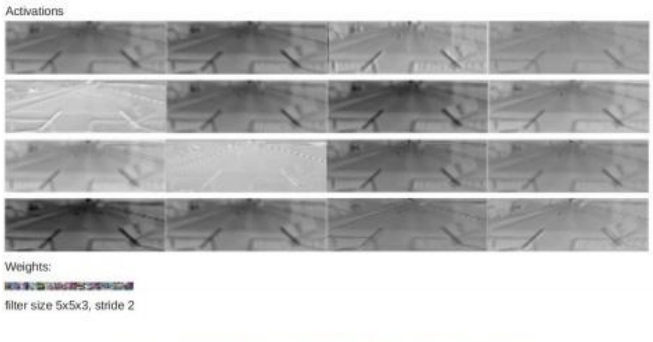


Figure Visualization of the images generated by the second convolutional layer

From the figures above, one can tell that lane markings were automatically extracted as features by the convolutional layers. And the predicted angle was almost the same as the labeled angle. After evaluating the convolutional neural network on Deep Tesla online platform, the team proceeded to do a second test, this time using the Udacity driving simulator. Udacity is a machine learning specific simulation tool with a simple design and environment; Udacity allows users to both test and train CNN models. For this project, Udacity driving simulator was used to determine whether the neural network can successfully keep the car in lane. The overall performance of the CNN model was good. The car was able to drive a whole loop around the simulated track without human intervention. The only problem experienced in the simulation occurred when the vehicle encountered sharp turns; in this case the steering wheel angle predicted by the neural network was sometimes smaller than the actual angle need so the car would drive out of lane for a very brief period time before automatically adjusting back. A video showing the convolutional neural network automatically keeping the car in lane of 30 frames per second. This data can then be used to construct a real-world driving simulator and can also be used as the training data for our neural network. The Convolutional Neural Network model also works as expected, it is able to accurately and correctly produce the correct steering wheel angle for any given image or frame of a video that it is provided with. When provided with many images at a faster than expected rate, the model does struggle and often makes mistakes, however this is a problem that can be fixed with more training epochs as well as some refinement of the code. The simulator portion of the project was begun, with the image calibration portion of the real world 3D simulator completed; however due to time constraints the rest of the real world 3D simulator was not able to be completed. However, the team was still able to test the CNN through the use of the Udacity simulator. Overall, this project has produced a cohesive system of data collection, network model training, and network model testing that can be used to advance WPI's intelligent transportation program.

Camera Calibration [Simulator]

1. Introduction To build a simulator using real world data, we need to be able to transform a 3D world coordinate to 3D camera coordinate, and also transform a 2cameracoordinateto pixel coordinates in the image frame. As a result, it is necessary for us to find the extrinsic matrix and intrinsic matrix for the cameras we used.

2. Intrinsic Matrix In order to map the camera coordinates to the pixel coordinates in the image frame, the intrinsic matrix need to be found. The intrinsic matrix can be expressed as the following:

$$\begin{bmatrix} f_x & 0 & 0 \\ s & f_y & 0 \\ c_x & c_y & 1 \end{bmatrix}$$

In this matrix, fx, fy represents the focal length in pixels. S represents the skew coefficient between x and y axis and cx, cy represents the offsets. To transform a camera based 2D coordinate to 2D point in the image plane, the following formula was used:

$$p_i = K \cdot p_c$$

where pi represents the homogenous pixels on the image plane, pc represents the camerabased 3D coordinate and K represents the intrinsic matrix.

3. Extrinsic Matrix Extrinsic matrix was used to transform a 3D world coordinate to a 3D camera coordinate. The extrinsic matrix can be represented as the following:

$$R_{w,c}\, t_{w,c}$$

Rw,c in the formula represents the rotation matrix of the camera system, and tw, c in the formula represents the translation of the optical center from the origin of the world coordinate. In order to transform a point from world coordinate to camera coordinate, the following formula was used:

$$p_c = \left(R_{w,c}\, t_{w,c}\right) p_w$$

where pc represents the 3D camera coordinate, pc represents the camera-based 3D coordinate, Rw, c represents the rotation matrix and tw, c represents the transformation matrix. Putting the intrinsic matrix and extrinsic matrix together, a 3D world coordinate can be transformed to pixel coordinate on image plane. The following formula was used for this operation:

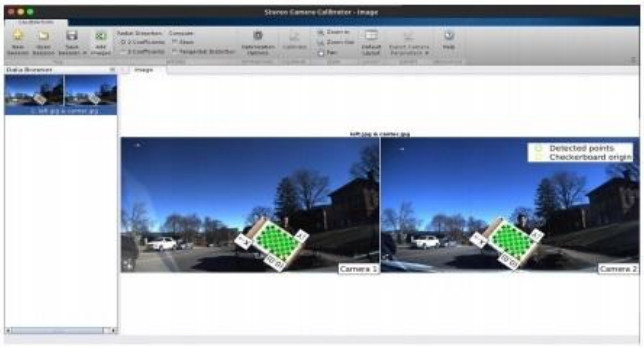
$$p_i = K \cdot \left(R_{w,c}\, t_{w,c}\right) p_w$$

In this formula, Kis a 3 by 3 matrix representing the intrinsic matrix for the camera, (Rw, ctw, c)is a 3 by 4 matrix represe the extrinsic matrix for the camera. Camera calibration was done to 40 find the intrinsic matrix and the extrinsic matrix using the measured image plane coordinates and the world coordinates.

4. Implementation for finding camera parameters

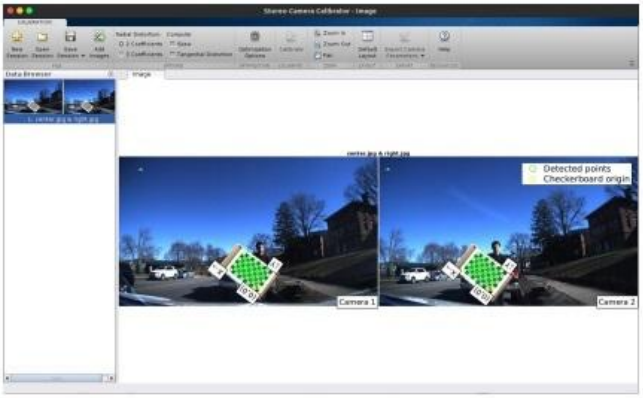
Initially, 'Camera Calibrator' application from computer vision toolbox in Matlab was used to find the camera parameters for individual cameras. A problem for this approach is that since there are small errors when calculating intrinsic and extrinsic matrices, when the camera' locations were calculated based on camera parameters we got, it didn't correspond to the actual location of the cameras. Since the relationships between cameras are already known, these three cameras are treated as two sets of stereo camera, and the 'Stereo Camera Calibrator' application was used. This application takes at least 10 images of checkerboard from a pair of cameras as well as the size of the checkerboard. It will automatically detect the cross points of checkerboard and calculate the camera parameters.

Also, the parameters needed to correct radial distortion will also be given. Because the camera locations were now found in groups, the result was more accurate.
The application with an image from left camera and one from center camera was shown in the following:



Calibration Example 1

The application with an image from center camera and one from right camera was shown in the following:



Calibration Example 2

Also, the translation matrices in world units and the rotation matrices of left camera relative to center camera and of right camera relative to center camera were found. Then, only the extrinsic matrices for the center camera need to be found to determine the extrinsic matrices for all three cameras. Initially, we tried to put a checkerboard on the ground and use the application to calculate the extrinsic matrix, but as the figure shown in the following, the checkerboard was too small to be clearly detected.

Calibration Example 3

We then decided to use the endpoints and cross points of lane markings on a parking lot as coordinates in world coordinate. The following image was finally used to calculate the extrinsic matrix of the center camera:

Extrinsic matrix center of camera

The coordinates of the endpoints and cross points were first calculated according to the distances measured. Then, radial distortion was corrected using the camera parameters calculated by the application. The resulting image was shown in the following

Image correction

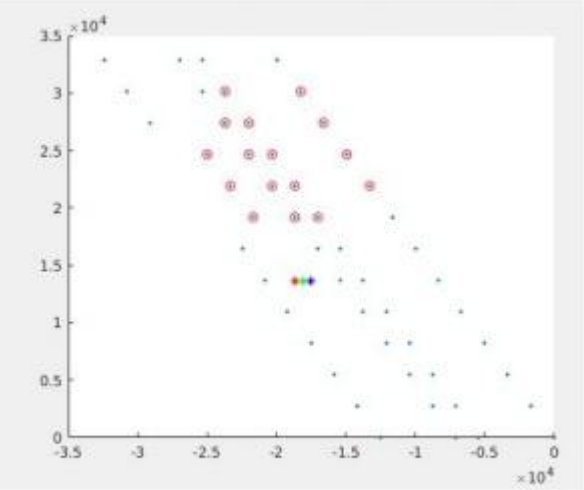
The following code was then used to calculate the extrinsic matrices for the cameras:

```
[rotationMatrix,translationVector] = extrinsics(img211(:,:),worldPoints(:,:),cameraParams{2});
cameraEx{2} = [rotationMatrix;translationVector];

cameraEx{1} = cameraEx{2}*r1to0;
cameraEx{1}(4,:) = cameraEx{1}(4,:) + t1to0;

cameraEx{3} = cameraEx{2}*r1to2;
cameraEx{3}(4,:) = cameraEx{3}(4,:) + t1to2;
```

Calculatina Extrinsic Matrices

The function ‘extrinsics’ from computer vision toolbox in Matlab was used to get the rotation matrix and translation vector for the center camera. This function takes in the coordinates of the points on the image without lens distortion, the world points we calculated and the camera parameters we got from the application. Then, based on the relationship between left, center and right cameras, all three extrinsic matrices were calculated.

The camera positions in the world coordinate were then plotted to make sure that the extrinsic matrices were accurate. The resulting plot was shown in the following:



Calculated Camera Positions

In this figure, the red circles represent the points we used, the red, green and blue stars represent the left, center and right cameras. The locations of the cameras shown in the figure were very close to the actual locations of the cameras in the chosen image.

V. CONCLUSION

The team succeeds in creating a data collection system and a Convolutional Neural Network (CNN) model for intelligent transportation. The simulator portion proved to be beyond the scope of this paper; however substantial advances in the simulator were made in the form of the camera calibration-progress that can be built upon by future projects. The data collection system produced excellent results, logging the speed, steering wheel angle, and stitching three different camera angles together. The Convolutional Neural Network model is able to produce the correct steering wheel angle for any given image it is provided with. The simulator portion of the project was begun, with the image calibration portion of the real world 3D simulator completed; however, the scope of the real world 3D simulator proved to be too large and was not able to be completed due to time constraints the rest of the real world 3D simulator was not able to be completed. By developing these tools, the team was able to enhance and advance intelligent transportation program. This would result in more efficient and robust data collection, CNN models, and true to life tests.

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DEEP LEARNING: EFFECTIVE TOOL FOR BIG DATA ANALYTICS

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Keywords

- Deep Learning; Big Data; Boltzmann Machine (BM); Auto-Encoders (AE); Deep Neural Networks (DNN); Deep Belief Networks (DBN); Deep Stacking Networks (DSN); Big Data Analytics.

Abstract

Due to deep learning is a very active research area in pattern recognition and machine learning society. It achieved extraordinary success in applications of necessary attributes such as Computer Vision, Speech and Natural Language Processing and Audio Processing. Every day there are large amounts of data generated by multiple sources. So the term of data is converted to Big Data which face challenges in information acquisition and decision-making processes. Dealing with these data can be supported by Deep Learning capabilities, especially its ability to deal with both the labeled and unlabeled data which are often collected abundantly in Big Data. So Deep Learning is recently coming to play a significant role in reaching solutions for Big Data analytics. This survey discusses how Deep Learning architectures differ from convolutional structured architectures by illustrating the structure and learning aspects of most common used Deep Neural Networks. We will give an overview of Big Data and identify specific data analysis problems that can be addressed by Deep Learning. We will present some studies in Deep Learning that are used as a solution for data analysis. Finally, some Deep Learning challenges due to specific data analysis needs of Big Data will be showed

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Evolutionary Computing Assisted Control Environment for Six-Step Mode High-Speed and Accelerating Induction Motor Drives

B. Meghya Nayak, Dr. Anupama A. Deshpande

Abstract

Exponential rise in induction motor applications, especially for high-speed drives and accelerating environment has alarmed academia-industries to develop more robust and potential control solutions. Current induction motor controllers either focus on speed or torque enhancement using different methods such as scalar or vector control methods and predictive control strategies Unfortunately, such applications lead to field-weakening conditions demanding achievement of high speed and high acceleration control. Hence the dynamic performance of induction motors under classical control is affected showing unstable Speed, Torque ripple and Harmonics in electrical parameters.

This paper, therefore, enlightens a robust control of speed as well as torque enhancement in the closed loop control system based on Evolutionary Computing and an Efficient Control strategy. The current research ensures high torque performance and overcomes field weakening problem by suggesting a novel six-step environment of induction motor and DC-link voltage respectively. The 6-step mode environment deals with SVPWM to reduce harmonics in electrical parameters. In addition, the current is controlled by proposed Flower Pollination Algorithm (FPA) in the inner loop to tune the authentic Proportional-Integral and Derivative (FPA-PID) controller. The FPA in-conjunction with a band stop filter and SVPWM also enables six-step inverter to control transient

response with assured ripple and harmonic suppression of speed within 0.4 seconds.

The Matlab simulation of the proposed Control algorithm has confirmed the robust control of uniform torque.

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Disturbance Observer Assisted Error Sensitive Predictive Control for Induction Motors in Sensor less Environment: A Vector Field Control Model

B. Meghya Nayak, **Anupama A. Deshpande**

Abstract: ***The exponentially rise within the demands of Induction Motors in several applications has revitalized academia-industries to develop more robust and efficient IM drives. Amongst the main classically available IM drives efforts are made either to regulate speed or torque. However, the problem inculcated due to parametric mismatch and resulting errors have much addressed. Though, predictive control based approaches are found potential to help current and torque control; however, ensuring optimal controllability under non-linear condition remained a tedious task. Filter based approaches to impose delay that eventually impacts overall control performance. Realizing it as motivation, during this research a highly robust Disturbance Observer Assisted Error Sensitive Predictive Control Strategy for IM control is developed. Subsequently, a completely unique Disturbance Observer-based Model Predictive Control strategy is developed that performs predictive current control and torque-control during a non-linear environment. Our proposed model exploits the concept of Prediction-Error to realize transient controllability. Exploiting the error information our proposed model identified the optimal voltage vector value to be injected to the 3-Ø inverter connected to the PI-based Space Vector Pulse Width Modulation system to perform transient controllability. Structurally, our proposed system encompasses SQIM motor, 3-Ø inverter, PI controller SVPWM, Flux-observer, Torque and Speed controllers, VSI units, etc. The MATLAB 2017a based simulation has revealed that the proposed model is able to do better current control, flux-torque control and torque-ripple suppression, which broadened its employability for varied applications demands fast-torque control during a noisy environment.***

Keywords: ***Induction Motor control, Model Predictive Control, Error-Prediction, Error-resilient control.***

I. INTRODUCTION

The exponential rise in electrical systems and allied demands have revitalized academia-industries to develop more efficient, productive and especially transiently controllable equipment. Amongst the major application environment ranging from the sophisticated home appliances to the industrial and /or scientific purposes, induction motors have irreplaceable significance.

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In the last few years, Alternative Current (AC) induction motors have been extensively employed in different industrial purposes, especially for motion control requirements. The key significance of employing induction motor over dc motor is rugged construction, high efficiency, and maintenance-free operation. Numerous electrical drives that need efficient dynamic performance to respond to the changes in command speed and torque. These requirements of AC

drives can be fulfilled by the vector control system. Undeniably, with the emergence of the vector control method, an induction motor has been controlled like a separately excited DC motor for high-performance applications. This approach can enable the control of the field and torque of induction motor independently by decoupling and manipulating corresponding field-oriented parameters. However, the efficiency of such systems gets limited in case of noise and interferences caused within the application environment.

In IM control, accurate and timely parameter estimation is of great significance, as it can help to achieve transient motor control. On the other hand, the predictive control paradigm too can have vital significance for IM control. Summarily, the optimal and accurate IM parameter estimation and enhanced model predictive control strategy can be of utmost significance for (adaptive) IM control. Undeniably, the optimal selection of the IM parameters and adaptive predictive control measure can be vital for IM control functions. However, estimating accurate (dynamic) parameters under interference and noisy environment, especially under a Sensorless environment is a highly complicated task. In the practical world, identifying IM parameters is a highly tedious task, which becomes even more complex due to the need for distinguishing data obtained during fast transient [1-3]. Such issues prevail even when the excitation power is exceedingly low [4]. Additionally, it impacts the functioning of the inverter drives, which are often influenced due to the intensive noise. Though authors have recommended using filters, such problems (noises) can't be alleviated or reduced by applying classical low-pass filters (LPFs). Furthermore, the signal-delay and allied (signal) deterioration too can be caused by LPF that eventually would result in estimation error and hence ineffective IM control decision.

Identifying the parameters can help to enhance dynamic control decisions by flux observers, flux estimators, speed estimators, and allied control designs [5-7].

Industries demand lightweight computational controller designs with high feasibility and low complexities. It becomes inevitable when the dynamic current measurement gets contaminated use to high interference and noises. Additionally, the literature reveals that in practice the changes in rotor resistance caused due to skin effect [8] can cause problems to the motor, even with non-load or locked rotor conditions. The majority of the conventional parameter estimation methods employ at standstill, while the recently developed inverter-fed motors employ self-estimation and control

concept which is applied in the single-phase mode. In this method self- commissioning, also called autonomous Observer and control can be applied in the single-phase mode that can maintain the motor shaft static automatically to avoid any use of rotary encoders [4]. Such control methods are also called the Sensor less method which can make overall control more computationally efficient and accurate. Considering it a motive, though efforts were made [9-11] where authors employed stator side impedances (on different frequency points) to obtain equivalent circuit parameters. However, the parameters might vary or fluctuate due to inappropriate selection of the test frequencies. As an enhanced solution, authors [12][13] designed a multi-level method in which during each phase one or two distinct parameters were selected by injecting varied excitation signals. Similarly, authors [14-17] made an effort to use the random signals and Ordinary Least Squares (OLS) method to obtain accurate IM control parameters. However, it remained vulnerable from noise presence which is common in numerous Sensorless IM application environments [4]. To alleviate such an issue, authors [18] applied a modified evaluation condition by employing non-linear least square (NLS) concepts to obtain dynamic IM parameters. However, distinguishing signal parameters from noise components remains the major issue with the state-of-art techniques. Recently, authors [19] developed an active damping based filtering model for the Rotor-Flux Oriented Control (RFOC) in IMs. Unfortunately, the delay and signal distortion introduced by such an approach might confine accuracy and might cause error-in-estimation [35]. Such limitations might affect the overall dynamic or predictive control based IM control.

To alleviate the above stated issues, in this research at first the focus is made on enhancing dynamic IM parameter estimation, which is followed by the implementation of a novel and robust Predictive Control Method for RFOC in IMs. As a solution, in this research at first, we assess the responses obtained from a step-voltage test and generate a sequence of pseudo-random signals which are injected to the stator at standstill (in single-phase mode). Noticeably, our proposed approach employs a non-linear optimization concept that reduces parameter "prediction-error" and thus minimizes the impact of measurement noise significantly. This approach not only reduces the delay but also achieves accurate IM parameters for further predictive control scheduling. In the last few years to achieve efficient controllability, especially under non-linear conditions, Model Predictive Control (MPC) methods have gained significant attention [34]. However, in MPC the focus has been made either to perform predictive current control [24] or torque control as individual tasks [36]. Additionally, authors have merely used cost-functions to predict voltage vector or magnitude of the voltage required to be injected to the inverter to perform torque or current control. However, the inclusion of classical deadbeat controllers often undergoes delay impacting overall control-efficiency or the transient control ability [32][35][40]. No significant efforts are visible which could address the parametric mismatch or measurement errors (such as flux error, current error or flux-torque error) sensitive control strategy, which seems significant for non-linear IM control purposes. Developing a vector control IM solution with MPC requires maintaining an optimal balance between computational overheads as well as multi-dimensional efficiency. To achieve it, the inclusion of a dynamic Observer control model can be significant to identify or keep track of the parametric mismatch and prediction-error. This, as a result, can help predict suitable control voltage for transient controllability. In this relation, the strategic conceptualization of the dynamic Observer model [38][39], flux controller, torque Observer and controller, speed controller (as vector control solution) with SVPWM can be vital for (prediction error-resilient) IM control in Sensorless, non-linear environment. Moreover, the inclusion of predictive current control and torque control as a combined solution can broaden the applicability of IMs in a non-liner environment. Considering the above-stated motives, in this research a novel strategic multi-phased effort has been made, where at first the focus is made on identifying optimal equivalent design parameters of the IM under predictive error condition or non-linear Sensorless environment [37]. In the subsequent research phase a novel Disturbance Observer assisted MPC control model is developed for IM vector field control. Unlike conventional efforts in this research, we focused on amalgamating both PCC as well as PTC as MPC paradigms. The overall control model has been named as "Observer Assisted Error Sensitive Predictive Control Strategy for Induction Motors in Sensorless Environment", which has been developed using MATLAB 2018a Simulink tool.

The remaining sections of the presented manuscript are given as follows. Section II discusses the snippet of the overall research contribution or intend. Section III presents the overall proposed model and its implementation, while the results obtained are discussed in Section IV. Overall research conclusion and allied inferences are presented in Section V and the references used in this research are given at the end of the manuscript.

II. RESEARCH CONTRIBUTIONS

Taking into consideration the overall research intend, existing approaches, and allied future optimization scopes, in this research the focus is made on employing a multi-phase optimization measure. In other words, in this research at first IM design parameter identification concept is derived that exploits prediction error information to achieve the optimal design parameters. In the subsequent phase, especially towards Sensorless IM control purpose with the optimally tuned IM model, a novel Model Predictive Control (MPC) concept is derived.

Noticeably, unlike conventional MPC strategies, this research intends to develop a dual objectives oriented control strategy encompassing both Predictive Current Control (PCC) as well as the Predictive Torque Control (PTC) scheme. Noticeably, in major existing efforts authors have either focused on PCC, Speed control or PTC; however, achieving a cumulative solution can be of vital significance. This research has contributed a novel approach encompassing both PTC as well as PCC under non-linear operating conditions, where there is a significantly high likelihood of

parametric mismatch and estimation errors due to non-linearity and interference/noises. The noticeable contribution of the proposed vector control strategy can be identified as the inclusion of "Prediction Error" and Parametric Mismatch based control strategy. Additionally, to consider non-linearity of the IM design, a Disturbance Observer model is introduces the tracks torque-flux changes and in conjunction with flux-controller, speed controller and torque observer ensure optimal voltage injection to the inverter for transient controllability. Structurally, the proposed system encompasses, Squirrel cage Induction Motor, fed with constant voltage VSI, in adjacency to a 3-phase inverter connected with SVPWM. The disturbance Observer model [38][39] enables the proposed model controlling injection voltage to achieve transient IM controllability.

Redefining the overall research and tentative implementation paradigm, the proposed system can be reframed as a questionnaire. These research questionnaires are given as follows:

RQ1: Can the use of the Prediction Error Method be effective to identify optimal IM design parameters so as to enable it operating efficiently under Sensorless and non-linear conditions?

RQ2: Can the use of Flux-Torque Observer unit, Flux-Torque Controller, Speed Controllers be efficient to achieve better and transient controllability of IM?

RQ3: Can the use of Disturbance Observer assisted error-sensitive MPC control model to be effective towards IM controllability under non-linear and interference/noisy conditions?

This research intends to obtain the justifiable answer for the above-stated questions and associated tentative solutions.

III. PROPOSED SYSTEM

As already stated, the predominant emphasis of this research is made on identifying optimal (control) parameters of the motor followed by dynamic Observer-based error-resilient vector control of the Induction Motor. To achieve it, we have performed a multi-phase implementation paradigm was at first the IM's design parameters are obtained while considering its use-environment as noisy and interference conditions. Additionally, to achieve a tuned design parameter "Prediction Error" information has been applied. In the later phase of implementation, a highly robust and efficient "Disturbance Observer-based Model Predictive Control (DOMPC) scheme is designed for IM control. Noticeably, our proposed DOMPC model exploits non-linear Predictive Current Control (PCC) and Predictive Torque Control (PTC) models together, which has been accomplished by means of a novel Observer unit and "Prediction Error" based control decision. DOMPC model encompasses dynamic speed and flux observer and allied controller, while the Observer model ensures exploiting error information to assist optimal (injection) voltage estimation for the three-phase inverter connected to the IM. Obtaining the error information (say, the difference between the predicted values and the estimated values), the SVPWM modulation pattern changes and thus helps to control the current and torque of the IM. This approach intends to achieve optimal (i.e., transient) current and torque controllability while assuring negligible ripple presence. The detailed discussion of the proposed dynamic "Observer Assisted Error Sensitive Predictive Control Strategy for IM in Sensorless environment" is given in the subsequent sections.

As stated, this research has been accomplished in two phases. These are:

Phase-1 Prediction Error based Dynamic IM Parameter Estimation for IM, and

Phase-2 Dynamic Observer-based Prediction-Error Sensitive Vector Control of IM.

The detailed discussion of these implementation models is given as follows.

A. Phase-1 Dynamic IM Parameter Estimation for Noise-Resilient Transient Controllability

Noticeably, the predominant motive of this inception research phase is to obtain suitable IM design parameters so as to retain reliable and dynamically controllable operating environment. Typically, the parametric mismatch in IM design often leads error in flux, speed and torque-flux information that eventually destabilizes the overall system. Unfortunately, so far authors have not addressed parameter selection followed by error-resilient control mechanism for IM. Considering it as gap and motivation, in this paper at first we focused on obtaining the optimal design parameters. For IM parameter identification we have applied the single-phase test concept. Though classically approaches like "no-load test and locked-rotor test" have been applied in a three-phase mode; however, methods like "no-load test" have been found highly intricate to perform especially when the rotor is already coupled to the loads. Furthermore, the skin effects in a locked rotor test can also impose high errors in rotor resistance that might influence the overall IM controllability. To alleviate such issues, the IM parameter update can be done in an asymmetrical manner, which is common in major IM based speed drives. Typically, to achieve it the two terminals (say B and C) of the three-phase IM are short-circuited, while a single-phase voltage is injected across the IM stator. The key significance of this method is that the rotor of the IM remains standstill as there is no electromagnetic torque generated (in offline mode). Now, replacing the value $\omega_r = 0$ in IM's dynamic model, we get the time-domain configuration as (1).

$$IM(s) = \frac{z(s)}{u(s)} = \frac{T_r s + 1}{\sigma L_s T_r s^2 + (R_s T_r + L_s)s + R_s} \quad (1)$$

In (1), $z(s) = 1.5 i_A(s)$, where i_A states the current in phase A. The component $u(s) = U_{AB}(s)$ is the linear voltage, while L_s and R_s signify the stator inductance and resistance, correspondingly. The other constant parameter called rotor-time constant is $T_r = {L_r}/{R_r}$, where L_r and R_r are the inductance and resistance of the rotor, respectively. The parameter called leakage factor σ, which is derived as (2).

$$\sigma = 1 - \frac{{L_m}^2}{(L_s L_r)} \quad (2)$$

In (2), L_m states the magnetization inductance. Now, we discretize (1) so as to obtain the Predictive Error assisted parameter estimation, and get (3).

$$z(k) = \frac{b_1 q^{-1} + b_2 q^{-2}}{1 + a_1 q^{-1} + a_{21} q^{-2}} u(k) = \frac{B(q)}{A(q)} u(k) \quad (3)$$

In (3), q signifies an operator called the z-transformation operator. The IM parameter vector to be obtained comprises an equivalent circuit parameters defined as (4).

$$\begin{bmatrix} a_1 \\ a_2 \\ b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} 2 - \left(\frac{L_s + T_r R_s}{\sigma L_s T_r}\right) \\ -1 + \left(\frac{L_s + T_r R_s}{\sigma L_s T_r}\right).T_0 - \left(\frac{R_s}{\sigma L_s T_r}\right){T_0}^2 \\ \left(\frac{1}{\sigma L_s}\right).T_0 \\ -\left(\frac{1}{\sigma L_s}\right).T_0 + \left(\frac{1}{\sigma L_s T_r}\right){T_0}^2 \end{bmatrix} \quad (4)$$

In (4), the parameter T states the sampling interval, which has a great role in SVPWM based vector control purposes. Noticeably, estimating the values of L_s, L_r, σ and T_r is an easier task. Once obtaining the vector values of (4), the above stated four parameters can be obtained from the vector. With such motive, the parameter update can be done online by injecting specifically calibrated voltage signals to the stator and then obtaining the values of a_1, a_2, b_1 and b_2 of (3) based on the estimated voltage value U_{AB} and current i_A.

The above section put a glance on the involved parameters of the IM. The detailed discussion of the Prediction Error based IM parameter estimation is given as follows:

1. Prediction Error Based Discrete Model Parameter estimation

The predominant issue in IM parameter estimation and update, especially with inverter-driven IM motors is "electromagnetic interference," which is often imposed due to the impulses caused by the semiconductor devices. Noticeably, such issues become prevalent in the case of Sensorless a drive that eventually degrades the significant embedded information due to excessive noise. In such conditions, obtaining optimal design parameters while considering such real-time uncertainties and interference conditions is a must. With this motive, we exploited the steady-state AC waveform that makes it resilient to the noise affects. Being a self-sovereign approach and integrated with vector control concept our proposed model can be stated as the "Self-Adaptive Filtering" based parameter estimation concept. The use of steady-state waveforms often embodies the signals which are easy to process and hence avoids synchronization and DC bias problems. Considering parameter's sensitiveness in IM we designed Prediction Error based parameter estimation and adaptive vector field control by using analog and digital LPFs for signal tuning which is a better alternative of the conventional OLS based method. To achieve it, we introduced a modified model by inheriting a noise model into the original transfer function as defined in (5).

$$z(k) = \frac{B(q)}{A(q)} u(k) + \frac{1}{A(q)} v(k) = \frac{C(q)}{A(q)} e(k) \quad (5)$$

In (5), $v(k)$ equals $C(q).e(k)$, which is also called moving average sequence for the noise component. Here, $e(k)$ is considered as white noise component while $C(q)$ be the temporarily unknown filter. Mathematically,

$$C(q) = 1 + c_1 q^{-1} + c_2 q^{-2} \quad (6)$$

With the random values of $A(q)$, $B(q)$ and $C(q)$, the respective error sequence $e(k)$ has been obtained as the difference of calculated output waveform (values) and the measured one. Here, we termed a component named Total Prediction Error (TPE), which is the sum of the aforesaid error sequence, $j = \sum e$. In our proposed method, to obtain the optimal control and IM parameters, we intended to minimize predicted error by adjusting $A(q)$, $B(q)$ and $C(q)$. Implementing Parseval concept, the TPE in frequency domain (i.e., j) would be asymptotically equivalent to [21].

$$J \to \frac{1}{2\pi} \int_{-\pi}^{\pi} \left(\frac{B_0(e^{j\omega})}{A_0(e^{j\omega})} - \frac{B(e^{j\omega})}{A(e^{j\omega})} \right)^2 \frac{A^2(e^{j\omega})}{B^2(e^{j\omega})} \Phi_u(\omega) d\omega + \frac{1}{2\pi} \int_{-\pi}^{\pi} \frac{A^2(e^{j\omega})}{C^2(e^{j\omega})} \frac{\Phi_v(\omega)}{{A_0}^2(e^{j\omega})} d\omega \quad (7)$$

In (7), parameter ${B_0(e^{j\omega})}/{A(e^{j\omega})}$ signifies IM's transfer function. The other parameters $\Phi_u(\omega)$ and $\Phi_v(\omega)$ are the corresponding power spectrum of the input u and disturbance v. The angular frequency is given by ω. Similarly, in the second component of (7), the parameter $A^2(e^{j\omega})/C^2(e^{j\omega})$ states the weighing function, which is a part of LPF. It is vital as it confines noise component v transiently in the high-frequency band. In a real-time scenario, while performing optimization and update $A^2(e^{j\omega})/C^2(e^{j\omega})$ is updated dynamically that helps to eradicate the interference issue and reduction of J.

To identify the IM's parameters, we applied the above stated single-phase mode by injecting sinusoidal voltages of different frequency combinations. It enabled parameter identification based on the stator side equivalent impedance information. Though this approach can be limited due to very minute information available in the frequency domain, we used a Pseudo-Random Binary Sequence (PRBS).

In major conventional voltage injection-based approaches as stated above, R_r and L_m are highly sensitive to noise that can impact overall controllability (due to improper frequency selection. However, selecting optimal frequency with suitable parameters is an NP-hard problem. The dependency on significantly large bandwidth to accommodate more information confines the employability due to increased cost and processing time. In IM parameter estimation and allied control, the selection of the optimal shape, size and amplitude of the excitation signal is vital. Injection signal must embody the sufficient harmonics with specific or targeted frequency band. Additionally, it should be of low frequency (as high frequency might behave like interference). Considering these facts, we applied PRBS,
which was generated by using Voltage Source Inverter (VSI). Here, RPBS iterated after a long interval, and during this interval the positive and negative values were generated randomly.

To achieve dynamic parameter estimation for better controllability, we generated PRBS in such a manner that it embodies ΔT (minimum interval), cycle period N and signal amplitude a. To ensure enough harmonics within the targeted frequency band or feature frequency, PRBS followed a condition given in (8) [23].

$$\begin{cases} \dfrac{2\pi}{3\Delta T} > \omega_{max} \\ N\Delta T > T_{0.95} \end{cases} \quad (8)$$

In (8), ω_{max} states the cut-off frequency of the motor while $T_{0.95}$ signifies the specific time when the step voltage response increases to 0.95 from 0. In practice $T_{0.95}$ can be obtained by means of DC voltage test, while ω_{max} too is obtained approximately as per (9).

$$\omega_{max} \approx \frac{0.7\pi}{T_{0.95}} \quad (9)$$

For ease of implementation, in the proposed model the excitation signal pattern is considered as per the IM motor responses to the DC voltage test. Additionally, the amplitude reference a is defined in such a manner that the peak value of the phase current becomes equal to the magnetization current. This approach avoids any possibility of deep saturation and over-current in IM. Thus, obtaining the tuned parameters of the IM, we designed a three-phase inverter connected IM model. The detailed discussion of the proposed IM model and its dynamic control strategy are given in the subsequent section.

B. *Phase-2 Observer assisted Model Predictive Controller for Induction Motor*

In the initial phase of the research, we focused on identifying the suitable SQIM design parameters that could make it more transiently controllable under noise and interference conditions. Our applied Predictive Error based approach resembles the "Self-Adaptive Filter" functional in between the Voltage Source Inverter (VSI) and SQIM. It intends to reduce the distortion caused in the output voltage of the VSI, surge of voltage in the motor terminal, core losses, interference, etc. Obtaining the parameter tuning, we focused on developing a novel and robust Rotor-Flux Oriented Control (RFOC) system for SQIM, which is often employed in Adjustable Speed Drives (ASD). Factually, the inclusion of filters might affect the operating point of the SQIM drives and can turn it into the unstable one, thus causing resonance frequency oscillations in stator current, voltage, etc. On the contrary, there are numerous application environments where providing fast torque response and current control is a must. To achieve it authors have proposed control strategies such as Field Oriented Control (FOC), Direct Torque Control (DTC), etc. These approaches apply controllers like Proportional-Integral (PI) controllers (PI-FOC). PI-FOC which has gained widespread attention across industries; however factors like limited bandwidth and iterative gain parameter tuning confine its applicability. In practice, the iterative gain update is a highly intricate task. Though DTC is simple, the presence of significantly large torque ripple and steady-state error confines its employability (in non-linear applications). To alleviate such limitations, in this paper a novel Disturbance Observer-based Model Predictive Control (DOMPC) model is developed. Unlike existing PI-FOC and DTC methods, our proposed "Observer Assisted Error Sensitive Predictive Control Strategy" enables transient controllability even with low computation and time consumption. Here, the prime goal is to achieve a fast dynamic response, better DC bus utilization and strong Zero-sequence current suppression along with swift Current/Torque response which is vital for the major real-time application environment.

- DOMAC: An Overview

Considering IM control purposes, MPC can be broadly classified into two types; PCC and PTC. Practically, in linear PCC model, a deadbeat controller [32][33][40] is applied especially to control and regulate the currents by generating the reference voltage using predicted current and predicted flux (EMF) [20][21]. On the other hand, for non-linear PCC, a cost-function is used that exploits the effort information between predicted current vector and the reference current that put a foundation for further switching conditions for expected controllability [22-27]. Similarly, linear PTC encompasses a deadbeat flux/torque controller [32][33][40], stator/flux and electrical torque prediction model that cumulatively generates the reference voltage for further IM control purpose. In the case of non-linear PTC, we define a cost-function that dynamically estimates the error of the values of Flux and torque so as to obtain the optimal switching pattern in SVPWM. Noticeably, in the case of non-linear PTC to perform SVPWM switching control we need an optimal set of weighing factors. Considering the significance and robustness of the non-linear PTC model, this research focus is made on designing a novel MDC (derived as a non-linear PTC) model for (RFOC) vector control. Noticeably, we implement non-linear PTC as well as Observer- based current control as well which makes our proposed system robust for numerous real-world applications.

Before discussing the proposed non-linear control model, a snippet of the IM with three-phase inverter is given as follows:

The electrical model of the IM in an arbitrary reference frame can be presented as (10).

$$\begin{bmatrix} v_s \\ v_r \end{bmatrix} = \begin{bmatrix} r_s & \\ & r_r \end{bmatrix} \begin{bmatrix} i_s \\ i_r \end{bmatrix} + p \begin{bmatrix} \psi_s \\ \psi_r \end{bmatrix} + \begin{bmatrix} J_3\,\omega_a & \\ & J_3\,(\omega_a - \omega_r) \end{bmatrix} \begin{bmatrix} \psi_s \\ \psi_r \end{bmatrix} \quad (10)$$

$$\begin{bmatrix} \psi_s \\ \psi_r \end{bmatrix} = \begin{bmatrix} L_s & L_m \\ L_m & L_r \end{bmatrix} \begin{bmatrix} i_s \\ i_r \end{bmatrix} \quad (11)$$

In (10) v_s, i_s, i_r, ψ_s and ψ_r state the state-variables with zero-sequence component. Noticeably, the term called zero-sequence component signifies that $v_s = [v_{sd} \quad v_{ssq} \quad v_{s0}]^T$. Similarly, the other parameters,R_s, R_r, L_s, L_r and L_m states the system parameters. Mathematically, these parameters, $R_s = diag[R_s \quad R_s \quad R_s]$, $L_s = diag[L_s \quad L_s \quad L_s]$ and $L_m = diag[L_m \quad L_m \quad L_0]$. Here, ω_a parameter signifies the random reference frequency, while ω_r presents the frequency of the rotor. In (10), the parameter p states the derivative operator. As depicted in (10), the coupling vector or matrix J_3 is (12).

$$J_3 = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad (12)$$

As depicted in the figure, different controller models apply distinct approaches to control "Inner-Controller" to achieve expected performance.

a). Predictive Current Control (PCC)

Considering above equations (10) and (11), it can be found that the derivative of the current vectors particularly under stationary frame (i.e., $i_s = 0$) can be presented as (12).

$$p \begin{bmatrix} i_s \\ i_r \end{bmatrix} = \begin{bmatrix} L_s & L_m \\ L_m & L_r \end{bmatrix}^{-1} \left(\begin{bmatrix} v_s \\ 0 \end{bmatrix} - \begin{bmatrix} r_s & \\ & r_r \end{bmatrix} \begin{bmatrix} i_s \\ i_r \end{bmatrix} - \begin{bmatrix} 0 & 0 \\ 0 & -J_3\,\omega_r \end{bmatrix} \begin{bmatrix} \psi_s \\ \psi_r \end{bmatrix} \right) \quad (13)$$

Now, applying (13), we derived stator current as (14).

$$pi_s = \frac{I_3}{L_s \sigma} \left(v_s - R_s i_s + \frac{I_m}{L_r} (R_r i_r - \omega_r J_3\,\psi_r) \right) \quad (14)$$

In (14), $\sigma = I_3 - \frac{{L_m}^2}{(L_s L_r)}$, while I_3 states the 3-dimensional matrix. Now, the flux (EMF) has been estimated as (15).

$$v_l = R_s i_s - \frac{L_m}{L_r} (R_r i_r - \omega_r J_3\,\psi_r) \quad (15)$$

We have applied an open loop flux estimator that measures the rotor flux using (15). Now, the rotor-flux in the rotor-reference frame ($\omega_a = \omega_r$) is obtained as (16).

$$p\psi_r = \frac{L_m}{L_r} i_s - \frac{I_3}{\tau_r} \psi_r \quad (16)$$

Noticeably, in (16), $\tau_r = {L_r}/{R_r}$. Now, assigning the values of (16) in (14), we get

$$pi_s = \frac{I_3}{L_s \sigma} (v_s - v_l) \quad (17)$$

Discretizing (17) by means of Forward Euler Method (FEM) results the stator current (18).

$$\hat{\imath}_{s,k+1} = i_{s,k} + T_s \frac{I_3}{L_s \sigma} (\hat{v}_{s,k} - \hat{v}_{l,k}) \quad (18)$$

In (18), T_s signifies the sampling period of the inner controller. Recalling the delay problem [35], we have estimated the sub-sequent iteration value (say, extrapolated value of (18)). Mathematically,

$$\hat{\imath}_{s,k+2} = i_{s,k+1} + T_s \frac{I_3}{L_s \sigma} (\hat{v}_{s,k+1} - \hat{v}_{l,k+1}) \quad (19)$$

Applying the Deadbeat Control Principle (DCP)[40], which states that $\hat{\imath}_{s,k+2} = i_s^*$, the reference voltage at time $t+1$ is (20).

$$\hat{v}_{s,k+1} = \frac{I_3}{T_s L_s \sigma} (i_s^* - \hat{\imath}_{s,k+1}) + \hat{v}_{l,k+1} \quad (20)$$

Here, we estimated the current reference value i_s^* from flux and torque reference values in the same way as is done with classical FOC methods. In the case of a non-linear PCC model, we applied a cost function that enabled the selection of the optimal voltage vector value to be applied to the inverter. Noticeably, in this research, the predominant focus was made on IM control with non-linear characteristics. Now, replacing $\hat{v}_{s,k+1}$ in (20) with 27 possible voltage vectors (in considered SQIM model with 3 phase inverter there are 27 feasible voltage vectors), we achieve (21).

$$\hat{\imath}_{s,k+2}(i) = \hat{\imath}_{s,k+1} + T_s \frac{I_3}{L_s \sigma} (\hat{v}_{s,k+1}(i) - \hat{v}_{l,k+1}) \quad (21)$$

where, $i = 1, \ldots, 27$. For non-linear PCC we derive the cost function as (22).

$$g(i) = \omega_\alpha \left| i_{s,\alpha}^* - \hat{\imath}_{s,\alpha,k+2}(i) \right| + \omega_\beta \left| i_{s,\beta}^* - \hat{\imath}_{s,\beta,k+2}(i) \right| + \omega_0 \left| i_{s,\beta}^* - \hat{\imath}_{s,0,k+2}(i) \right| \quad (22)$$

In (22), the parameters ω_α, ω_α and ω_α state the weighing factors of the current errors. Thus, with the obtained value of (22), the voltage vector (23) is obtained which was applied to the three- phase inverter for control functions.

$$v_{opt,k+1} = arg \min_{\{i=1,2,\ldots,27\}} g(i) \quad (23)$$

Unlike conventional PCC models, in this research, we have developed a novel and robust Observer-based PCC control strategy. The detailed discussion of the proposed PCC controller is given as follows:

- Disturbance Observer-based Deadbeat PCC (DO-PCC)

Being a non-linear system, IM often undergoes a situation where the measured values differ from the predicted values. On the contrary, there are numerous parameters such as rotor resistance (R_s), Magnetization Inductance (L_m), rotor-flux, etc where even a minute error might force IM to undergo adverse conditions. It can cause steady-state errors in electrical torque and rotor flux. Realizing this fact, as a contribution in this research a novel Disturbance Observer-based Deadbeat PCC (DO-PCC) Model has been developed. Noticeably, our proposed DO-PCC model intends to compensate for the errors and make control function more efficient. This section primarily discusses the proposed DO-PCC for IM. Considering the mathematical model for the stator voltage vector in terms of the stator current i_a and rotor-flux ψ_r, the stator current can be obtained as (24).

$$pi_s = \frac{1}{L_s \sigma} v_s + \left(-\frac{1}{L_s \sigma} \left(R_s + \frac{L_m^2}{L_r^2} R_r \right) - jw_e \right) i_s + \left(\frac{L_m R_r}{L_r^2 L_s \sigma} - jw_r \right) \frac{L_m}{L_r L_s \sigma} \psi_r \quad (24)$$

In above equation (24), the parameter $R = R_s + \frac{L_m^2}{L_r^2} R_r$,

L=$L_s\sigma$, $k_r = \frac{L_m}{L_r}$, $\tau_r = \frac{L_r}{R_r}$. Now, for $(d-q-0)$ the rotor-flux reference frame ($\psi_{rd} = |\psi_r|, \psi_{rq}$=0) has been obtained as (25-27).

$$v_{sd} = Lpi_{sd} + Ri_{sd} - \omega_e Li_{sq} - \frac{k_r}{\tau_r}\psi_{rd} \quad (25)$$

$$v_{sq} = Lpi_{sq} + Ri_{sq} + \omega_e Li_{sd} + k_r\omega_r\psi_{rd} \quad (26)$$

$$v_{s0} = L_{ls}pi_{s0} + R_s i_{s0} \quad (27)$$

Presenting (26) and (27) in state-space formulation, we derive

$$p\begin{bmatrix} i_{sd} \\ i_{sq} \end{bmatrix} = \begin{bmatrix} -\frac{R}{L} & \omega_e \\ -\omega_e & -\frac{R}{L} \end{bmatrix}\begin{bmatrix} i_{sd} \\ i_{sq} \end{bmatrix} + \begin{bmatrix} \frac{1}{L} & \\ & \frac{1}{L} \end{bmatrix}\begin{bmatrix} v_{sd} \\ v_{sq} \end{bmatrix} + \begin{bmatrix} \frac{k_r}{\tau_r L} & \frac{k_r}{L}\omega_r \\ -\frac{k_r}{L}\omega_r & \frac{k_r}{\tau_r L} \end{bmatrix}\begin{bmatrix} \psi_{rd} \\ \psi_{rq} \end{bmatrix} \quad (28)$$

Discretizing (28) using FEM, we derived the stator d-axis and q-axis currents as (29).

$$p\begin{bmatrix} i_{sd,k+1} \\ i_{sq,k+1} \end{bmatrix} = \begin{bmatrix} 1-\frac{R}{L}T_s & \omega_e T_s \\ -\omega_e T_s & 1-\frac{R}{L}T_s \end{bmatrix}\begin{bmatrix} i_{sd,k} \\ i_{sq,k} \end{bmatrix} + \begin{bmatrix} \frac{T_s}{L} & \\ & \frac{T_s}{L} \end{bmatrix}\begin{bmatrix} v_{sd,k} \\ v_{sq,k} \end{bmatrix} + \begin{bmatrix} \frac{k_r T_s}{\tau_r L} & \frac{k_r}{L}\omega_r T_s \\ -\frac{k_r}{L}\omega_r T_s & \frac{k_r T_s}{\tau_r L} \end{bmatrix}\begin{bmatrix} \psi_{rd,k} \\ \psi_{rq,k} \end{bmatrix} \quad (29)$$

$$A = \begin{bmatrix} 1-\frac{R}{L}T_s & \omega_e T_s \\ -\omega_e T_s & 1-\frac{R}{L}T_s \end{bmatrix} \quad (30)$$

$$B = \begin{bmatrix} \frac{T_s}{L} & \\ & \frac{T_s}{L} \end{bmatrix}$$

$$F = \begin{bmatrix} \frac{k_r T_s}{\tau_r L} & \frac{k_r}{L}\omega_r T_s \\ -\frac{k_r}{L}\omega_r T_s & \frac{k_r T_s}{\tau_r L} \end{bmatrix}$$

Consider that (30) presents the discrete domain parameter matrices, then the stator current value can be predicted as (31).

$$i_{s,k+1} = Ai_{s,k} + Bv_{s,k} + F\psi_{r,k} \quad (31)$$

As already stated, inclusion of MPD and allied filtering might cause steady state error and hence we extrapolated (31) to compensate the same. Thus, we obtain (32).

$$i_{s,k+2} = Ai_{s,k+1} + Bv_{s,k+1} + F\psi_{r,k+1} \quad (32)$$

Similar to (20), considering DCP over (32) we substitute $i_{s,k+2}$ by i_s^*, and thus we get (33).

$$i_s^* = A(Ai_{s,k} + Bv_{s,k} + F\psi_{r,k}) + Bv_{s,k+1} + F\psi_{r,k+1} \quad (33)$$

Now, similar to the discussion made above, the voltage (vector) to be injected at time $t+1$ is obtained as (34).

$$v_{s,k+1} = B^{-1}(i_s^* - A((Ai_{s,k} + Bv_{s,k} + F\psi_{r,k}) - F\psi_{r,k+1}) \quad (34)$$

In our proposed PCC model, considering the sensitivity towards error, to alleviate such issues, we designed a novel Disturbance Observer (DO) model that intends to explore and update dynamic parameters (error-resilient control) to retain better transient controllability. The detailed discussion of the proposed DO-PCC model is given in the subsequent section.

– *DO-PCC: The Design*

Considering (25) and (26), we can derive the augmented IM model as (35) and (36), respectively.

$$\begin{cases} v_{sd} = L\frac{d}{dt}i_{sd} + Ri_{sd} - \omega_e Li_{sq} - \frac{k_r}{\tau_r}\psi_{rd} + f_d \\ \frac{d}{dt}f_d = F_d \end{cases} \quad (35)$$

$$\begin{cases} v_{sd} = L\frac{d}{dt}i_{sq} + Ri_{sq} - \omega_e Li_{sd} - \frac{k_r}{\tau_r}\omega_r\psi_{rd} + f_d \\ \frac{d}{dt}f_q = F_q \end{cases} \quad (36)$$

In above equations, the parameters f_d and f_q signify the error or the disturbance imposed due to parametric differences or error. Mathematically, the disturbances are depicted in (37) and (38).

$$f_d = \Delta L\frac{d}{dt}i_{sd} + \Delta Ri_{sd} - \Delta L\omega_e i_{sq} \quad (37)$$

$$f_q = \Delta L\frac{d}{dt}i_{sq} + \Delta Ri_{sq} + \Delta L\omega_e i_{sd} \quad (38)$$

Considering the parametric mismatched or error in non-linear IM condition to retrieve the disturbances and to predict the stator currents we derived an Observer unit using (37) and (38). Mathematically, the observer can be defined as (39) and (40).

$$\begin{cases} v_{sd} = L\frac{d}{dt}\hat{\imath}_{sd} + R\hat{\imath}_{sd} - \omega_e Li_{sq} - \frac{k_r}{\tau_r}\psi_{rd} + \hat{f}_d + U_{ds} \\ \frac{d}{dt}\hat{f}_d = g_d U_{dsmo} \end{cases} \quad (39)$$

$$\begin{cases} v_{sq} = L\frac{d}{dt}\hat{\imath}_{sq} + R\hat{\imath}_{sq} + \omega_e Li_{sd} + k_r\omega_r\psi_{rd} + \hat{f}_q + U_q \\ \frac{d}{dt}f_q = g_q U_{qsmo} \end{cases} \quad (40)$$

In the above equations (39) and (40), the parameters $\hat{f}_d$ and $\hat{f}_q$ state the values of the parameter mismatch disturbances from f_d and f_q. Similarly, $\hat{\imath}_{sd}$ and $\hat{\imath}_{sq}$ state the obtained or measured stator currents while the measured voltages in the d-axis and q-axis are given as $v_{sd}$and v_{sq}, respectively. In our proposed method, we have applied a "Sliding-Mode Control Function (SMCF)" which is defined for both d-axis as well as q-axis distinctly, given as U_{dsmo} and U_{qsmo}, respectively. The gains associated with each SMCF (in individual d-q axes) are g_d and g_q (for sliding mode controller). Now, subtracting (35) from (39) and (36) from (40), we derive the following.

$$\begin{cases} 0 = L\frac{d}{dt}(\hat{\imath}_{sd} - i_{sd}) + R(\hat{\imath}_{sd} - i_{sd}) + (\hat{f}_d - f_d) + U_d \\ \frac{d}{dt}(\hat{f}_d - f_d) = g_d U_{dsmo} - F_d \end{cases} \quad (41)$$

$$\begin{cases} 0 = L\frac{d}{dt}(\hat{\imath}_{sq} - i_{sq}) + R(\hat{\imath}_{sq} - i_{sq}) + (\hat{f}_d - f_d) + U_{qsr} \\ \frac{d}{dt}(\hat{f}_q - f_q) = g_q U_{qsmo} - F_q \end{cases} \quad (42)$$

Now, we obtain the current errors in $d-q$ planes as e_{sd} and e_{sq}, respectively. The disturbance error is obtained as e_{fd} and e_{fq} for d-axis and q-axis, correspondingly. Mathematically, the errors are obtained as

$$e_{sd} = \hat{\imath}_{sd} - i_{sd} \quad (43)$$
$$e_{sq} = \hat{\imath}_{sq} - i_{sq} \quad (44)$$
$$e_{fd} = \hat{f}_d - f_d \quad (45)$$
$$e_{fq} = \hat{f}_q - f_q \quad (46)$$

The equations derived in (45) and (46) can further be given as

$$\begin{cases} \frac{d}{dt}e_{sd} = -\frac{R}{L}e_{sd} - \frac{1}{L}e_{fd} - -\frac{1}{L}U_{dsmo} \\ \frac{d}{dt}e_{fd} = g_d U_{dsmo} - F_d \end{cases} \quad (47)$$

$$\begin{cases} \frac{d}{dt}e_{sq} = -\frac{R}{L}e_{sq} - \frac{1}{L}e_{fq} - \frac{1}{L}U_{qsmo} \\ \frac{d}{dt}e_{fq} = g_q U_{qsmo} - F_q \end{cases} \quad (48)$$

In our proposed method, to implement SMC, we select a switching surface where a linear switching surface is considered. These switching surfaces are defined as (49) and (50).

$$s_d = \hat{\imath}_{sd} - i_{sd} \quad (49)$$
$$s_q = \hat{\imath}_{sq} - i_{sq} \quad (50)$$

To achieve it, we incorporated a "reaching-level", which are selected as per the following condition.

$$\frac{d}{dt}s = -k_1 sgn(s) - \lambda_s \quad (51)$$

Now, substituting (49) into (51), we get

$$\frac{d}{dt}e_{sd} = -k_1 sgn(e_{sd}) - \lambda_{e_{sd}} \quad (52)$$
$$\frac{d}{dt}e_{sq} = -k_1 sgn(e_{sq}) - \lambda_{e_{sq}} \quad (53)$$

Now, substituting the derivatives in (47) and (48) by employing (52) and (53), we get the following:

$$-\frac{R}{L}e_{sd} - \frac{1}{L}e_{fd} - \frac{1}{L}U_{dsmo} = -k_1 sgn(e_{sd}) - \lambda_{e_{sd}} \quad (54)$$

$$-\frac{R}{L}e_{sq} - \frac{1}{L}e_{fq} - \frac{1}{L}U_{qsmo} = -k_1 sgn(e_{sq}) - \lambda_{e_{sq}} \quad (55)$$

We have obtained the compensated voltages U_{dsmo} and U_{qsmo} using (56) and (57).

$$U_{dsmo} = (L\lambda - R)e_{sd} + k_1 L sgn(e_{sd}) \quad (56)$$
$$U_{qsmo} = (L\lambda - R)e_{sq} + k_1 L sgn(e_{sq}) \quad (57)$$

Discretizing (39) and (40), using FEM, we predict the stator current and parametric disturbances. The predicted values are,

$$\hat{\imath}_{sd,k+1} = \left(1 - \frac{RT_s}{L}\right)\hat{\imath}_{sd,k} + \frac{T_s}{L}v_{sd,k} + \omega_e T_s i_{sq.k} + \frac{k_r T_s}{\tau_r L}\psi_{rd,k} - \frac{T_s}{L}\hat{f}_{d,k} - \frac{T_s}{L}U_{dsmo,k} \quad (58)$$

$$\hat{f}_{d,k+1} = \hat{f}_{d,k} + T_s g_d U_{dsmo,k} \quad (59)$$

$$\hat{\imath}_{sq,k+1} = \left(1 - \frac{RT_s}{L}\right)\hat{\imath}_{sq,k} + \frac{T_s}{L}v_{sq,k} - \omega_e T_s i_{sd.k} - \frac{k_r T_s}{\tau_r L}\omega_r\psi_{rd,k} - \frac{T_s}{L}\hat{f}_{q,k} - \frac{T_s}{L}U_{qsmo,k} \quad (60)$$

$$\hat{f}_{q,k+1} = \hat{f}_{q,k} + T_s g_q U_{qsmo,k} \quad (61)$$

In major existing efforts, authors have either focuses on current control or torque control. On the contrary, applications demand efficient transient control for torque-flux as well as current that as a result can optimize the overall transient-controllability of the IM. Considering it as a motive, in this paper, we employed observer-based PTC. Noticeably, our proposed model employs flux observer, flux controller, speed controller, etc that in conjunction with PI-based SVPWM enables efficient torque control in IM. The detailed discussion of the proposed PTC model is given as follows.

b). Predictive Torque Control (PTC)

Discretizing the rotor-flux equation using FEM, we predict the rotor-flux value at $k+1$ (62).

$$\hat{\psi}_{r,k+1} = \frac{L_m}{\tau_r}T_s i_{s,k} + \left(I_3 - \frac{I_3}{\tau_r}\right)T_s\psi_{r,k} \quad (62)$$

Now, to predict the stator flux at $k+1$, we applied stator current equation. Mathematically, the stator-flux is predicted as (63).

$$\hat{\psi}_{s,k+1} = T_s v_{s,k} + \left(I_3 - T_s\left(\frac{I_3}{\tau_{s\sigma}} + J_3\omega_{\alpha,k}\right)\right)\psi_{s,k} + \frac{k_r}{\tau_{s\sigma}}T_s + \psi_{r,k} \quad (63)$$

$$\hat{T}_{e,k+2} = \frac{L_m P}{\sigma L_s L_r}\left(\hat{\psi}_{sq,k+2}\hat{\psi}_{rd,k+2} - \hat{\psi}_{sd,k+2}\hat{\psi}_{rq,k+2}\right) \quad (64)$$

In (64), P signifies the pole pairs. With the rotor-flux orientation frame we get $(\omega_\alpha - \omega_e, \psi_{rd} = |\psi_r|, \psi_{rd} = 0)$, where ω_e presents the synchronous frequency of the rotor flux. Applying the above discussed deadbeat control principle (DCP) $\hat{\psi}_{rd,k+2} = |\psi_r^*|, \hat{T}_{e,k+2} = T_e^*$, we predict the d-axis and q-axis voltages to be injected at t + 1 (65).

$$\hat{v}_{sd,k+1} = \frac{1}{T_s}|\psi_r^*| + \left(\frac{R_s}{\sigma L_s} - \frac{1}{T_s}\right)\hat{\psi}_{sd,k+1} - \hat{\omega}_{e,k+1}\hat{\psi}_{sd,k+1} - \frac{R_s L_m}{\sigma L_s L_m}\hat{\psi}_{rd,k+1} \quad (65)$$

In other way,

$$\hat{v}_{sd,k+1} = \frac{\sigma L_r}{P T_s}\frac{T_e^*}{|\psi_r^*|} - \left(\frac{1}{T_s} - \frac{R_s}{\sigma L_s}\right)\hat{\psi}_{sd,k+1} + \hat{\omega}_{e,k+1}\hat{\psi}_{sd,k+1} \quad (66)$$

Considering the non-linear IM environment we consider non-linear PTC realization where we define a cost function that reduces the parameter mismatch or errors, as discussed in the above section. To achieve optimal PTC our proposed model iteratively reduces the errors of torque, flux magnitude, and zero-sequence current, respectively. Thus, applying the above discussed DO concept and error reduction measure we obtain the voltage vector to be injected to the inverter for torque control. It helps to achieving ripple suppression, fluctuation and stability that makes IM operation more reliable. To suppress the Zero-Sequence current, it can be predicted as (67).

$$\hat{\imath}_{s0,k+2}(i) = \left(1 - \frac{T_s R_s}{L_{ls}}\right)\hat{\imath}_{s0,k+1} + \frac{T_s}{L_{ls}}\hat{v}_{sd,k+1}(i) \quad (67)$$

Thus, the cost function can be derived as (68).

$$h(i) = \omega_{te}\left|T_e^* - \hat{T}_{e,k+2}(i)\right| + \omega_\psi\left||\psi_r^*| - \hat{\psi}_{s,k+1}(i)\right| + \omega_0\left|\hat{\imath}_{s0,k+2}(i)\right| \quad (68)$$

Though, in some recent research authors recommended avoiding iterative weighing for transient controllability [28].

In (68), the parameters ω_{te}, ω_{ψ} and ω_0 are the weight factors pertaining to the torque, flux (magnitude) and Zero-Sequence current errors respectively. Thus, employing above function, we apply the optimal voltage to the inverter for control.

$$v_{opt,k+1} = arg \min_{\{i=1,\ldots,27\}} h(i) \quad (69)$$

Thus, implementing the above discussed methodology we have achieved dynamic current and torque control for IM model. The simulation results and allied inferences are discussed in the sub-sequent section.

IV. RESULTS AND DISCUSSION

The overall implementation schematic of the proposed vector control scheme for IM is given in Fig. 1. To assess the efficacy of the proposed model, we applied the MATLAB/Simulink software platform. Here, the IM was interfaced with an ideal voltage source, with a controllable noise component. Here, initially, the voltage amplitude a and time interval ΔT of the pseudo-random bit stream were estimated by means of a ramp voltage and step voltage, correspondingly. Initially the value of a was maintained at 21.57V, as at this voltage the value or i_A reached the magnetization (rated) current level. We employed IM with V_{Dc} as 480 V, operating at the frequency of 50 Hz. Noticeably, we maintained the transition time $T_{0.95}$ as 0.24 seconds. Considering real-time implementation scenario, in this research, we select ΔT in such manner that it is sufficient enough to decrease the skin-effect and has the acceptable level of delay for (real-time) data acquisition. In this simulation, we assigned $\Delta T = 0.05\ s$. It was then followed by the injection of the PRBS voltage into the IM. To emulate the noise component, we mixed colored noises to i_A along with the DC bias. Initially we applied the following detuned parameters $R_s = 2.76\ (\Omega)$, $L_s = 11.8mH$, $T_r = 0.06$, $R_r = 3.11(\Omega)$. Additionally, we applied mutual inductance of $188.2mH$. We assigned the switching frequency of SVPWM as 5 kHz. In addition, we introduced dead-time compensation [25]. The DC link voltage was maintained at 480V. We interfaced motor-shaft to a DC generator, which was controlled using a DC motor speed driver so as to change in the load-torque value. To examine the performance of the proposed model, we have obtained measurements for voltage, current, rotor speed, torque, etc. To retain the efficient performance a motor requires maintaining an optimal voltage level while controlling speed and torque over a non-linear operating environment. The overall implementation schematic of the proposed IM vector control strategy is given in Fig. 1.

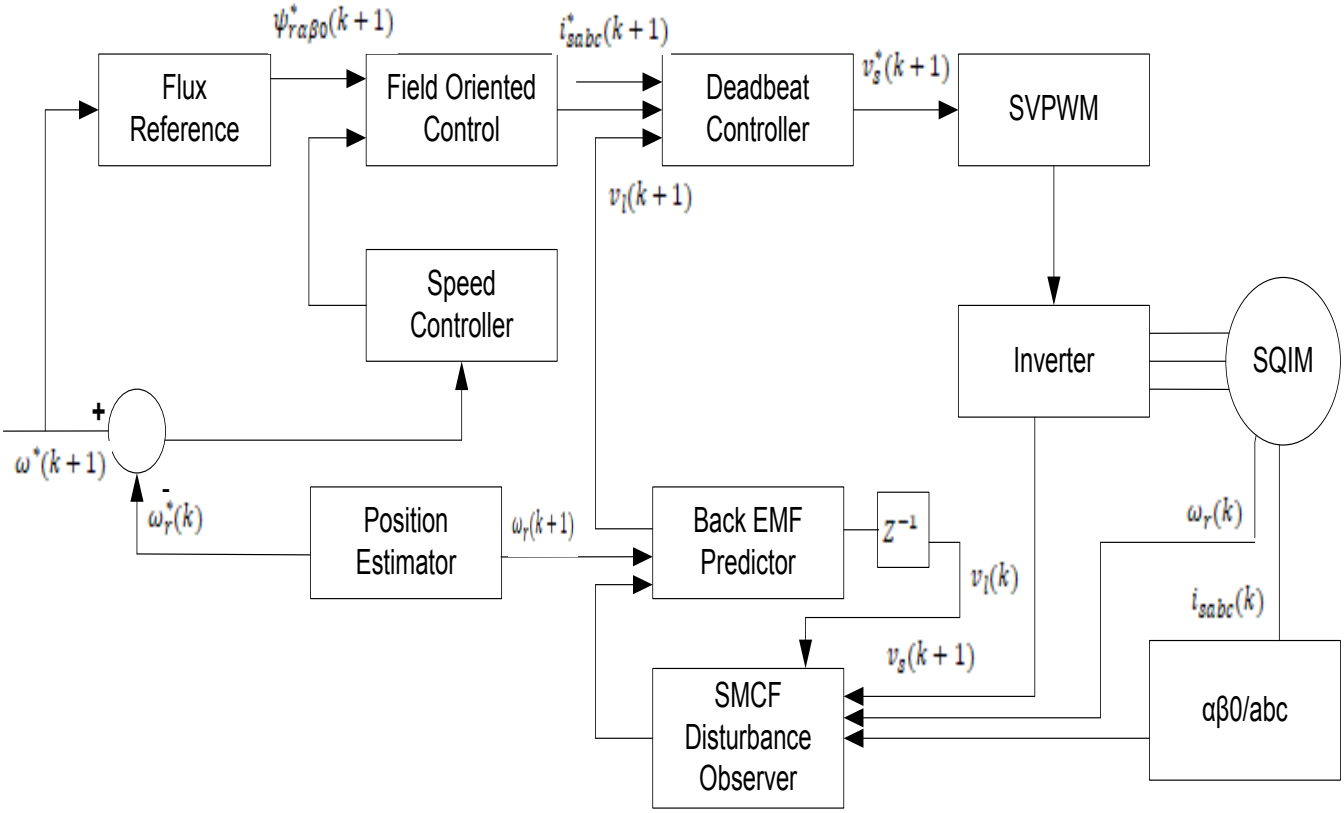

Fig. 1 Proposed vector control model for IM

Fig. 2 presents the DC voltage, which is almost linear and maintained at the 480V level. In Fig. 3 the current measured at the three phases are depicted. Observing the results it can be found that over the simulation period, varying the load and torque conditions, current does vary however maintained at least or negligible fluctuations. Noticeably, the simulation test has been done at the low-speed rotation (here we initialized with 55 (rad/s). Considering the fact that with high-speed rotation interference component increases that induce disturbances resembling noise component, we tested our model at relatively low-speed operation.

Noticeably, unlike Open-end wire IM (OEWIM) [29-31] where authors have applied multiple Inverters (dual inverter), which demands a significantly large number of switches to assist control, our proposed model applied a single 3-phase inverter. Thus, it can be computational more efficient as compared to doubly-feed (dual) inverter based SVPWM models. Fig. 4 presents the rotor speed, which can be found near stable even after a change in load and non-linear conditions. The torque generated over the simulation period is given in Fig. 5. The overall speed controllability feature of the proposed model can be visualized in Fig. 6.

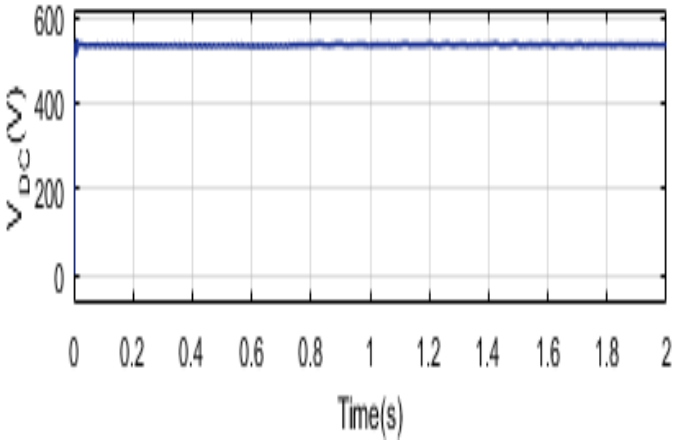

Fig. 2 V_{DC} maintained at 480 V

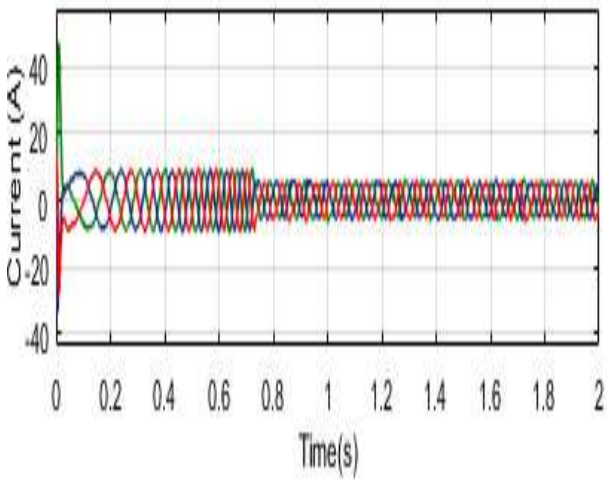

Fig. 3 $I_{abc}(A)$ current

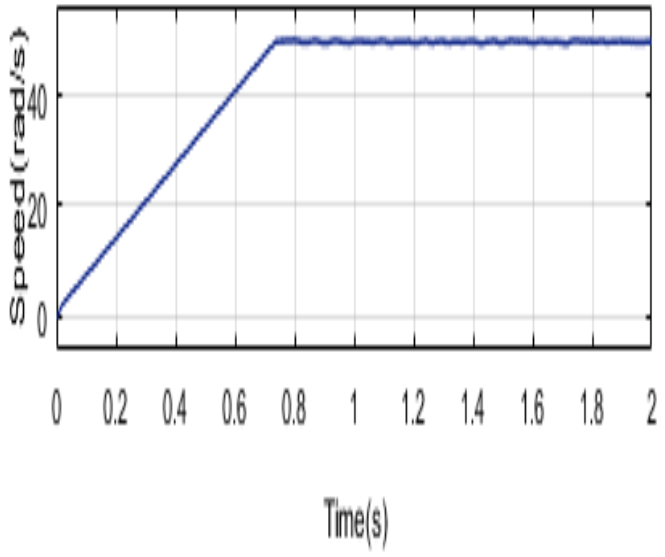

Fig. 4 Speed of the rotor (in rad/s)

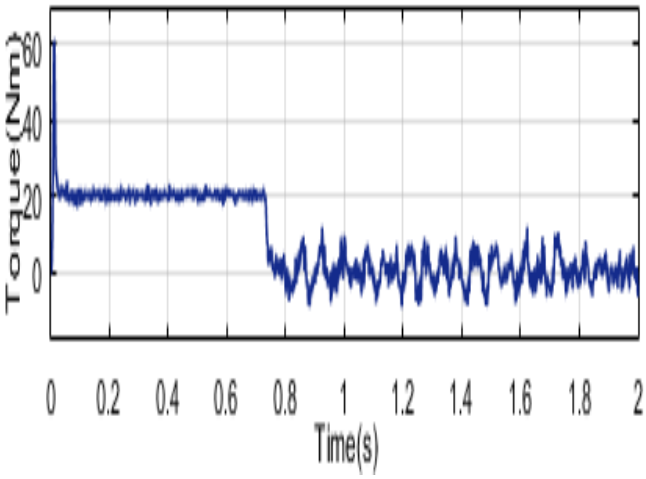

Fig. 5 Torque generated (Nm)

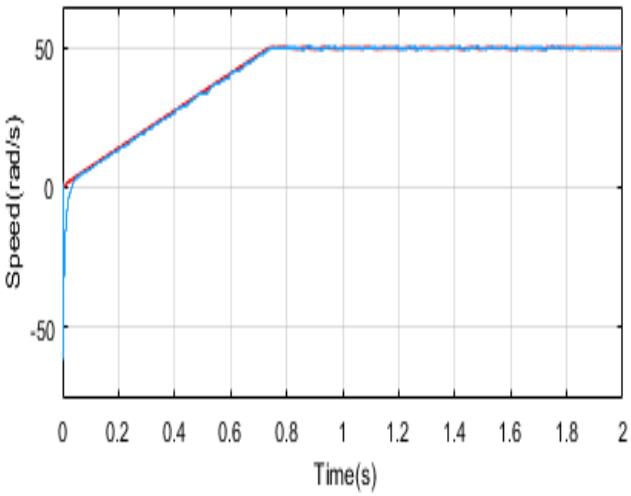

Fig. 6 Rotor Speed controllability (red-reference, blue-proposed)

Considering overall performance by the proposed model it can be stated that the inclusion of dynamic Observer unit and allied MPC concept could achieve satisfactory performance, especially to control the current, torque and speed of the IM. The results affirm that the proposed method can be efficient in better DC bus utilization and strong Zero-sequence current suppression along with swift Current/Torque response which is vital for major real-time drive applications. Observing the overall results and allied inferences, it can be found that the research questions, as framed in Section II affirms the acceptability of the proposed solution.

V. CONCLUSION

Realizing the significance of vector control in Induction motor, especially under noisy and interference conditions, this research focused on achieving a cumulative control approach. To achieve it, a multidimensional approach was formulated where at first motive was made on assuring optimal IM design parameter identification to be followed by Model Predictive Control implementation. Noticeably, the consideration of Prediction Error sensitive parameter identification helped to achieve optimal design for SQIM to be operated under noisy, interference environment in Sensorless set up.

The use of prediction error based IM parameter estimation strengthened the proposed model to ensure efficient motor design which further helped in alleviating parametric mismatch and errors. This way it achieved an error-resilient IM operating environment. Furthermore, exploiting the efficacy of MPC concept, this research employed Predictive Current Control followed by Toque control by employing a robust Observer model that dynamically estimates error in between the estimated and predicted flux-torque and current values, based on which it obtains the optimal voltage vector to be injected to the inverter for transient control. Noticeably, the proposed method considered dynamic parameters to make adaptive control decisions; it is suitable for non-linear IM applications. The used of SVPWM in conjunction with PI-based flux and current controller helped to achieve better and more efficient (transient controllability) while maintaining DC voltage consistent while torque-ripple suppression and current control. Unlike conventional efforts where efforts are made either to perform torque control or speed control, this research embodied both predictive current control as well as torque control in non-linear condition. It makes the proposed system novel and robust to meet contemporary IM control demands. In the proposed vector control model SVPWM was applied to control the signal patterns before feeding it to the inverter for transient controllability. The performance and allied inferences reveal that the proposed approach can be ready to implement for dynamic torque-current control of the IM used in applications like chassis dynamometers and engine dynamometers where IM is applied to provide load torque and imitate propulsion motors for electric vehicles.

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A Computable Study on Tactics towards Crime Prediction and Analysis using Machine Learning

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Abstract:
Crime is an unsocial and objectionable deed that causes an intense peril to humankind. Civilized societies make every effort to reduce crime under the rule of their influence. Why should crimes be predicted? Though it avoids all the lawbreaking acts of the society and ensures better civilization through avoiding happening crimes such as murders, rapes, thefts, drug smugglers, etc. Alerting the crime hotspots beforehand is one of the finest approaches to cause crime occurrences to halt. Utilizing the resources and identifying hotspots of crimes and allocating vigilante resources such as policemen, police cars, weapons, etc. in locations where the appropriate degree of intelligence has not been maintained. Rescheduling patrols according to the vulnerability of a place would also result in the degradation of the crime rate of that particular location. Building such an operational system would help to identify where and when crimes are most likely to occur so that you can effectively allocate your resources and prevent these evil acts accordingly. Safety while traveling can be considered as the major need in an unknown country, as New York is regarded as the city where you can find people from varying backgrounds and with a good amount of population, this project will focus on predicting crime in New York. The goal of this research is to employ data science and machine learning techniques to forecast crime. This research proposes a model that works in synergy with various steps that include crime data collection, and then analysis on that data to predict the crime hotspots which are specifically targeted to help citizens to distinguish between safe and unsafe areas while traveling.

***Keywords*:** XGBoost, KNN, SGD, LSTM, Naïve Bayes, Decision Tree, Random Forest, data-preprocessing**,** Machine Learning, crime prediction system, crime analysis, NYPD.

I. INTRODUCTION

The recent advent in technology has created Omni-applicable in each wake of life. With the appearance of the big data era and therefore the handiness of quick, economical algorithms for knowledge analysis, understanding patterns in crime from data is an energetic and developing domain of research. Crimes pose a severe threat to the community. Several crimes occur at regular intervals of time. Conceivably it's ever-increasing and spreading at a rapid and immense rate. The perception of a community as crime-ridden will deter individuals from going there and induce residents to maneuver away. Crime identification and prediction are the most important subjects for the police department as there exists a tremendous amount of data. There's a need for technology through that case-solving might be quicker.

The goal of this research is to form what's already publicly offered statistics accessible and unjust for residents. The purpose of extracting datasets from government websites via web

scraping is to create a system that will assist the police and other official bodies involved in national security operations to allocate an adequate number of resources based on locations, causing these illegal activities to eradicate before their incidence. Handling crime data is incredibly difficult because the size of crime knowledge grows in no time, therefore it will cause storage and analysis issues. Particularly, problems arise on the way to selecting correct techniques for analyzing data due to the inconsistency and inadequacy of those kinds of data.

The objective of this study is to use a machine learning algorithm to forecast if a city will have low, medium, or high violent crime rates using crime data. The XGBoost method, which is one of the elements of ensemble learning techniques based on Decision Trees, encourages the development of a system that can anticipate crime in areas where it is most likely to occur. XGBoost model has the best combination of prediction performance and processing time compared to other algorithms and techniques like Random Forest, SVM (Support Vector Machines), KNN, etc. This work helps law enforcement agencies of those particular cities to predict and detect crime with improved accuracy and thus reduces the crime rate.

II. Literature Survey

For the proposed problem, several systems have been developed. The offered procedures had produced the intended outcomes, although they had some disadvantages. Because most datasets were not detailed, most systems lacked adequate datasets (3,5,7). Some features, such as population, habitat, and transportation data, were left out. Unbalanced datasets were employed (7). The models also fail to provide in-depth mapping of crime within the country's internal cities (5). The papers are mainly concerned with comparisons between different algorithms, but they do provide a full analysis of the algorithm's performance (2). The model constructed with Multi-Linear Regression, on the other hand, had a minor mistake during training. However, the limitations covered by alternative models are not explicitly stated in this study. Although the accuracy of KNN and decision tree classifiers was found to be the highest, the analysis was limited to KNN and not decision tree classifiers (1). The same classifiers did not produce relevant results when dividing violent and nonviolent offenses. Because the initial data set lacked sufficient predictability to attain high accuracy, researchers discovered that dividing crime categories into smaller, larger groupings was a more relevant method (15). When it comes to prediction, the model's accuracy is lacking. The accuracy of both methods was less than 50% (8). In places with few recorded crime events, generalized mistakes were observed as a result of overestimation. The dataset that was employed was a mixture that resulted in noise (9). Some studies analyze crime at a granular level using the newest equalization and boosting ensemble techniques from machine learning (13), however there is an insufficient comparison between models and no clear description. Certain strategies provided a solution that would be too costly to develop in real life (11).

III. System Workflow

A. Features

The crime data is gathered using an API given by the New York City Police Department (NYPD) on the NYC Open Data portal which is reserved for free federal data to involve civilians in the reports generated and managed by the city administration. This data set contains all valid offenses delivered to the NYPD. The data set is updated every quarter. The data is in CSV format and contains over 4.5 million records.

Below tables depict the brief description of attributes used for analysis (Table I) and prediction (Table II).

TABLE I. *ATTRIBUTE SELECTION FOR ANALYSIS*

Attribute	Description
CMPLNT_FR_DT	Date of crime occurrence
CMPLNT_FR_TM	Time of crime occurrence
BORO_NM	Name of borough where crime occurred
LAW_CAT_CD	Level of offense: felony, misdemeanor, violation
LOC_OF_OCCUR_DESC	Specific location of crime occurrence
PREM_TYP_DESC	Specific description of premises
OFNS_DESC	Description of offense
SUSP_AGE_GROUP	Suspect's Age Group
SUSP_RACE	Suspect's Race

	Description
SUSP_SEX	Suspect's Sex Description
VIC_AGE_GROUP	Victim's Age Group
VIC_RACE	Victim's Race Description
VIC_SEX	Victim's Sex Description
Latitude	Midblock Latitude coordinate
Longitude	Midblock Longitude coordinate

TABLE II. *ATTRIBUTE SELECTION FOR PREDICTION*

Attribute	Description
CMPLNT_FR_DT	Date of crime occurrence
CMPLNT_FR_TM	Time of crime occurrence
BORO_NM	Name of borough where crime occurred
LAW_CAT_CD	Level of offense: felony, misdemeanor, violation
OFNS_DESC	Description of offense
Latitude	Midblock Latitude coordinate
Longitude	Midblock Longitude coordinate

B. Data Preprocessing

Data preprocessing involves reconstructing the original data to proper data-sets since machines cannot utilize data that they cannot interpret. Typically, the original data is incomplete and formatted inconsistently. The adequacy or inadequacy of data preparation is associated with the success of every project that requires analysis or prediction of data. Validation and imputation of data are both part of data preprocessing. The goal of validation is to determine whether the data is complete and accurate. The purpose of the imputation of data is to rectify errors and input missing values.

For the preprocessing of the data-set, the data that wasn't required for analysis or prediction was first dropped. Then the dataset was split into two, one data-set for analysis and the other for prediction. For the analysis data-set, there were quite a few missing values. Instead of dropping entire rows, missing values were replaced with "UNKNOWN" values to avoid the loss of data. For better analysis, the date and time were used to include the year, month, day of the week, part of the day, and hour at which the incident occurred.

For the prediction data-set, features like the date, time, latitude, longitude, category, and description of the crime were selected. Since analysis prefers the data to be in numerical format, the categorical variables were converted into numerical format for crime categories and descriptions. The date and time properties were also used to add the year, month, day of the week, part of the day, and the hour in a numerical format.

C. User Interface

The UI is a web application deployed using Streamlit, Streamlit is an open-source framework for machine learning and developing data-driven web applications seamlessly. The entire application is built using Python and its libraries such as Pandas, Numpy, Plotly, and Folium. The data for both crime analysis and prediction is extracted using NYC open data API. Python Folium is used for displaying the prediction results; the result is displayed in form of maps with latitude-longitude marked over it. The user can also view the results by hovering over the map.

The Crime Analysis is displayed in form of interactive maps and charts, the user gets the option to filter the analysis result by selecting the "boro_nm" i.e., the city name. The system also has a user review system where users can input the query, as well as view reviews made by others, the SQLite database stores the responses obtained from the reviews. This can be later used for performing analysis.

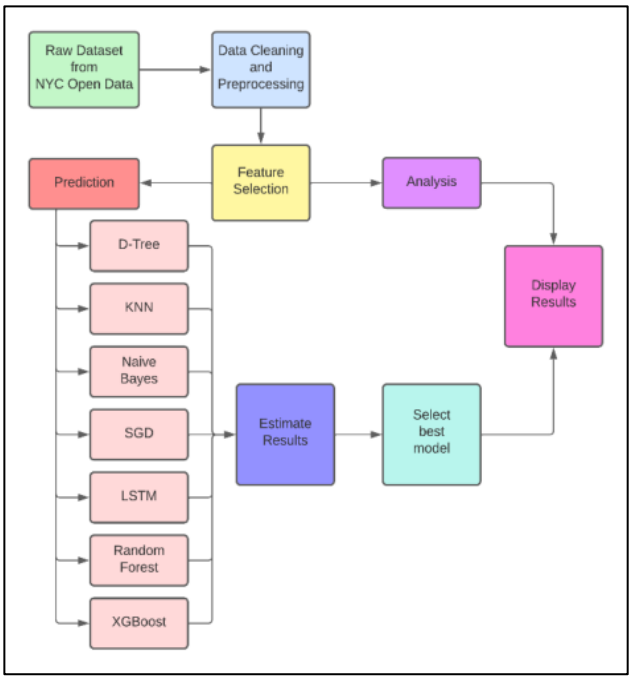

Fig. 2. System Workflow

IV. ALGORITHMS

Several machine-learning algorithms for predicting crime have been developed and applied. as follows:

A. Decision Tree (D-Tree)

By using non-parametric supervised learning methodologies, the Decision Tree algorithm produces prediction models. Here, from the training data, simple decision rules are presumed for the creation of training models that can predict the classes and the values of actual variables. This approach gradually generates an associated decision tree by slabbing down a dataset into smaller chunks. The tree that results has decision nodes and leaf nodes. The instance here uses a simple D-Tree class that receives training data as an input.

B. K-Nearest Neighbor (KNN)

By measuring the Euclidean distance between two points, the KNN algorithm captures similarity between them. In this algorithm, there are no assumptions about data, making it very useful for nonlinear data. The computation aspect of the algorithm is a bit expensive since the training data is stored. It is, nevertheless, a versatile approach because it may be used for both classification and regression. For this study, a simple KNN class is called with a k-value assigned to the number of notable crimes in the dataset, and the results are estimated accordingly.

C. Naïve Bayes (NB)

Naive Bayes is a multi-class binary classification method. The computation of the probability for each hypothesis is untangled to make their computation tractable, hence the name Naive Bayes.

1) Gaussian:

Naive Bayes can be applied to real-valued attributes if a Gaussian distribution is assumed. The name for this augmentation of Naive Bayes is Gaussian Naive Bayes. Gaussian Naive Bayes is a variation of Naive Bayes that handles continuous data and follows the Gaussian normal distribution. Other functions can be used to approximate the data distribution, but the Gaussian or Normal distribution is the most straightforward since you only need to estimate the mean and standard deviation from your training data.

2) Bernoulli:

Bernoulli Naive Bayes is based on the Bernoulli distribution and is used for discrete or continuous data. Independent Booleans, or binary variables, such as success or failure, true or false, 0 or 1, yes or no, and so on, are properties of the multivariate Bernoulli event model. When binary term occurrence characteristics, such as whether or not a word appears in a document, are used instead of term frequencies, such as the frequency of a word in the document, this technique is favored.

D. Stochastic Gradient Descent (SGD)

SGD Classifier is a simple stochastic gradient descent learning technique that supports a variety of classification loss functions and penalties. Stochastic gradient descent is an optimization approach for reducing a prediction model's loss across a training dataset. SGD Classifier supports multi-class classification by combining multiple binary classifiers in a "one-versus-all" approach. For each class C, a binary classifier is learned to distinguish it from all other C-1 classes. Here, 'modified_huber' for loss parameter is selected with a random state of 50 as it is competently appropriate for one-vs-all classification since they encourage the creation of a probability model.

E. Long Short-Term Memory (LSTM)

In LSTMs, long-term dependencies are learned. By default, LSTM can retain information for a long time and use time-series data for analysis, prediction, and classification. In this implementation, the activation is set to 'sigmoid' with 'Adam' as an optimizer and is 'mean_squared_error' as the loss. Before updating the internal model parameters, the model runs through 50 samples. Furthermore, the algorithm

will iterate over the entire training dataset 50 times.

F. Random Forest

The Random Forest method is a superior classification system based on the decision tree algorithm's foundation. It enables to dodge overfitting and deals excellently with the missing values in a dataset. It involves the bagging or bootstrap aggregation approach of ensemble learning techniques to solve complicated problems by compressing several classifiers concurrently and taking the intermediate or mean of the results. In this research, the model builds 100 trees randomly by bootstrap aggregation with 100 minimum samples splitting an internal node.

G. Extreme Gradient Boost (XGBoost)

XGBoost is an optimized disseminated gradient boosting framework consisting of Decision Tree as its roots designed to possess high efficiency, flexibility, and portability. XGBoost provides a parallel tree boosting that solves numerous data science problems swiftly and precisely. 'gbtree' booster is used here, which uses tree-based models and 'gpu hist' (GPU implementation of hist algorithm) for tree method, and thus 'gpu predictor' is used to provide GPU-based prediction without copying training data to GPU memory; 'multi: softmax' tells XGBoost to use the softmax objective for multiclass classification. 'mlogloss' (Multiclass log loss) serves as an evaluation metric for validation data with a 'cyclic' feature executing a deterministic selection through features individually.

V. RESULT AND ANALYSIS

A. Prediction Results

Eight types of machine learning models were used; Decision Tree, Random Forest, K-Nearest Neighbor, Stochastic Gradient Descent, Bernoulli Naïve Bayes, Gaussian Naïve Bayes, Long-Short Term Memory, and Extreme Gradient Boost.

The observed results showed that neither SGD nor Gaussian NB is appropriate for this problem. In this problem, XGBoost is suitable since it has 2% more accuracy than Random Forest (Table III).

A map showing prediction results (Fig. 5.1), with red spots indicating crime descriptions plotted using the latitude and longitude for those particular offenses.

TABLE III. *PREDICTION ACCURACIES OF ALGORITHMS*

Predicted → / Algorithm ↓	Severity	Offense Type
D-Tree	44%	21%
Random Forest	51%	26%
KNN	48%	21%
SGD	51%	12%
Bernoulli NB	49%	21%
Gaussian NB	50%	12%
LSTM	32%	18%
XGBoost	51%	28%

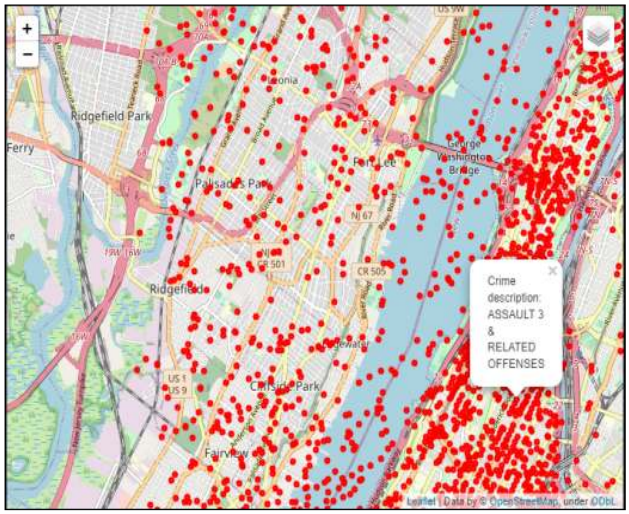

Fig. 5.1. Prediction results

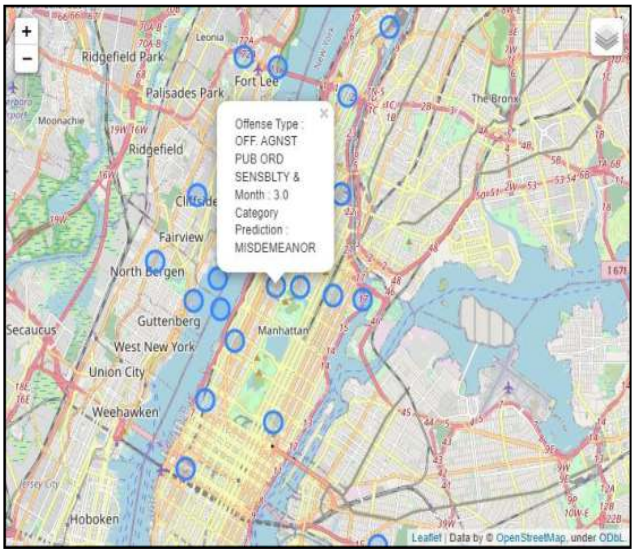

Fig. 5.2 Crime clusters

The blue circle on the map (Fig. 5.2) indicates the clusters formed based on offense types. Depending on the type of crime, the offense can be classified as ASSAULT, ROBBERY, etc. The months in this example range from 1 to 12 where 1 indicates January and 12 indicate December.

B. Analysis Results –

The Crime Frequency by Month graph (Fig. 5.3) displays the crime frequency by dayparting over the course of a month. Day, night, evening, and afternoon are the four sorts of dayparting attributes here. The months from January to December are included here. The months are on the X-axis, and the crime count is on the Y-axis.

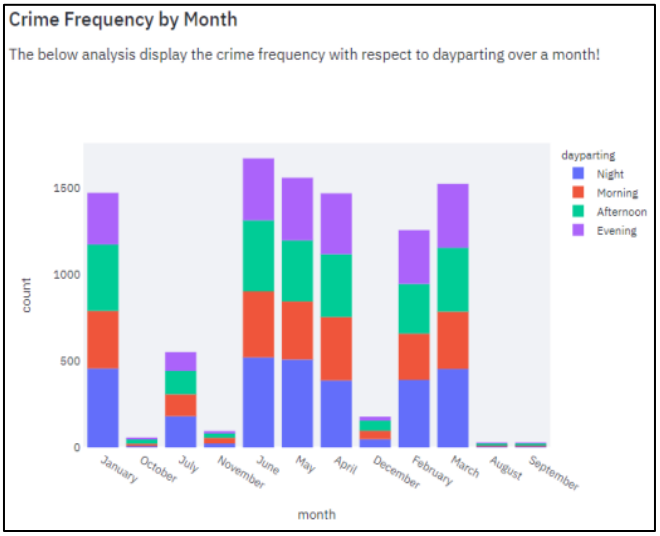

Fig. 5.3. Crime Frequency by month

There are seven features for the suspect race, including "Unknown", "Black", "White Hispanic", "White", "Black Hispanic", "Asian/Pacific Islander", and "American Indian", with the % of crime committed by individuals belonging to that race (Fig. 5.4).

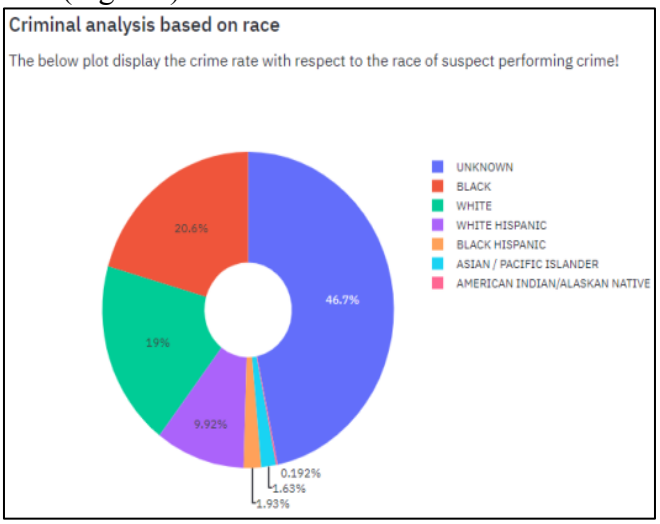

Fig. 5.4. Criminal analysis based on suspect race

Crime study based on a day-by-day count of crimes (Fig. 5.5), with days ranging from Monday to Sunday, and the quantity of crime committed on each day expressed as a percentage.

The crime analysis is shown as a bar plot (Fig. 5.6) based on the gender of the victims. The gender attribute is divided into four types: Male, Female, Diverse, and Others. The "victim sex" is on the X-axis, while the "count" is on the Y-axis.

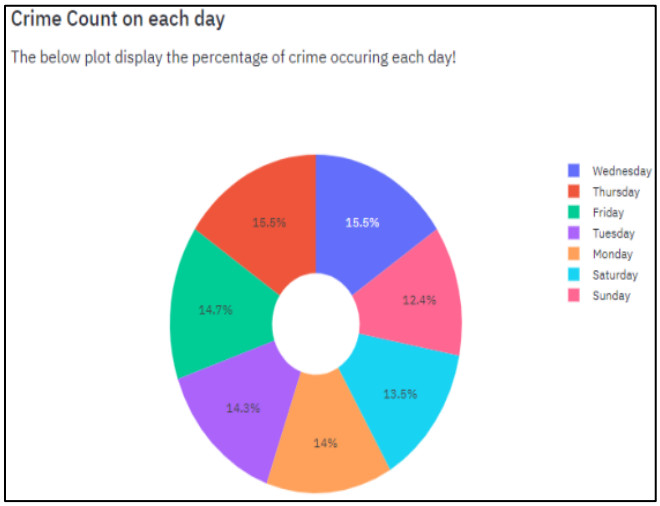

Fig. 5.5. Crime count on each day

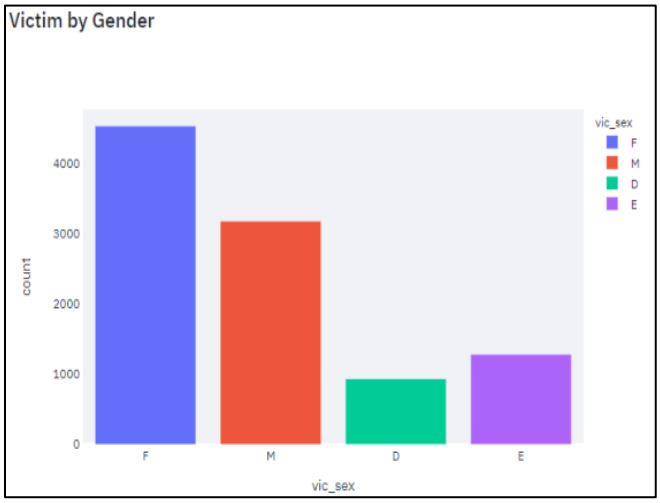

Fig. 5.6. Victim by gender

The box plot (Fig. 5.7) indicates the following result, The suspect race, here there are 7 attributes for suspects race i.e "Unknown", "Black", "white Hispanic", "White", "Black Hispanic", "Asian/Pacific Islander" and "American Indian", with the crime description i.e. crime performed by their race. On the X-axis is the "suspect-race" and on the Y-axis is the "offense description".

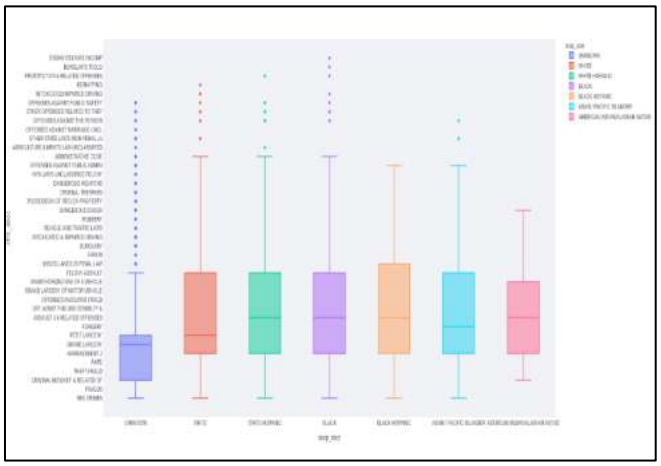

Fig. 5.7. Crime type based on suspect race

The pie chart (Fig. 5.8) shows the crime analysis based on the percent of crime done with respect to offense type, here the offense type or law category is divided into 3 types: “Misdemeanor”, “Felony”, “Violation”.

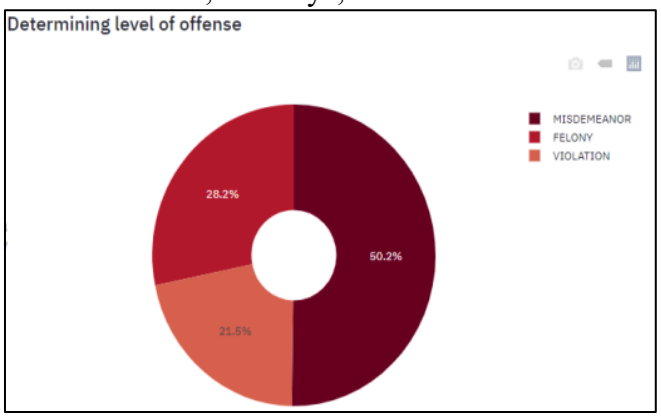

Fig. 5.8. Level of offense

The bar plot (Fig. 5.9) depicts the crime analysis based on victims’ age group, the age-group attribute is categorized in six types respectively “45-64 age”, “65+ age”, “25-44 age”, “Unknown”, “less than 18”, “18-24 age”; on the X-axis is the “victim age group” and on the Y-axis is the “count”.

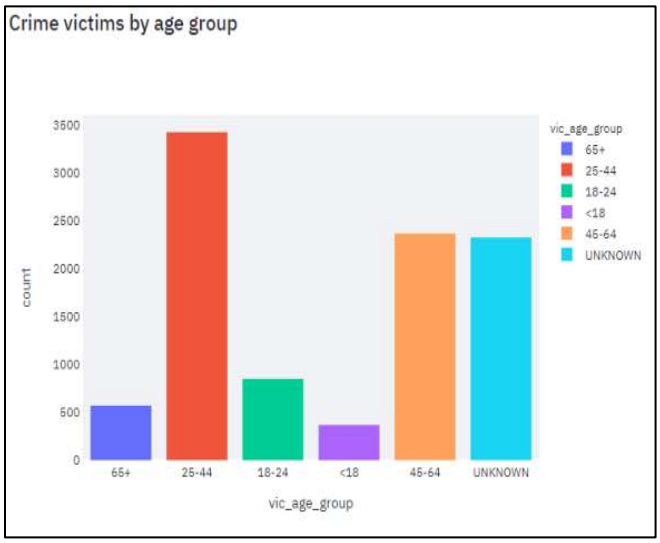

Fig. 5.9. Crime victims by age group

The bar plot (Fig. 5.10) represents the criminal analysis in terms of hours, with the hour attribute having 24 hours ranging from 0 to 23, for a total of 24 hours. The “Hour” is on the X-axis, while the “count” is on the Y-axis.

The plot (Fig. 5.11) showcases a criminal analysis based on crimes committed each day in relation to hours; the day runs from Monday to Sunday, and the hour goes from 0 to 23, totaling 24 hours; the X-axis represents the “weekday”, and the Y-axis represents the “count”.

With the help of the “red-spot” that appears when hovering over these areas on the map (Fig. 5.12), the crime description, i.e., type of crime committed in the specific location, is shown.

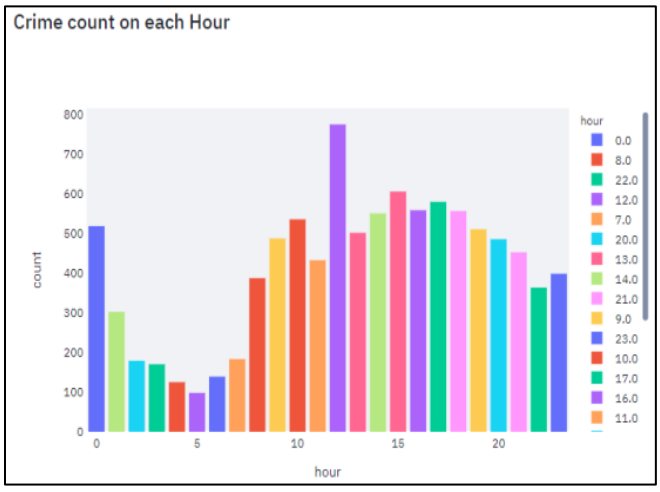

Fig. 5.10. Crime count on each hour

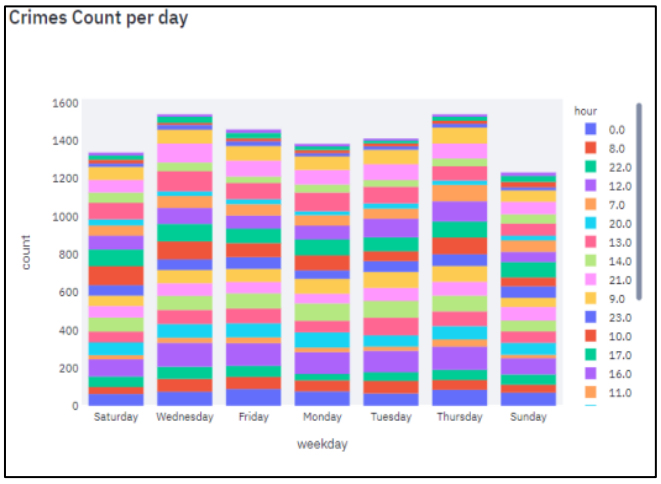

Fig. 5.11. Crime count per day

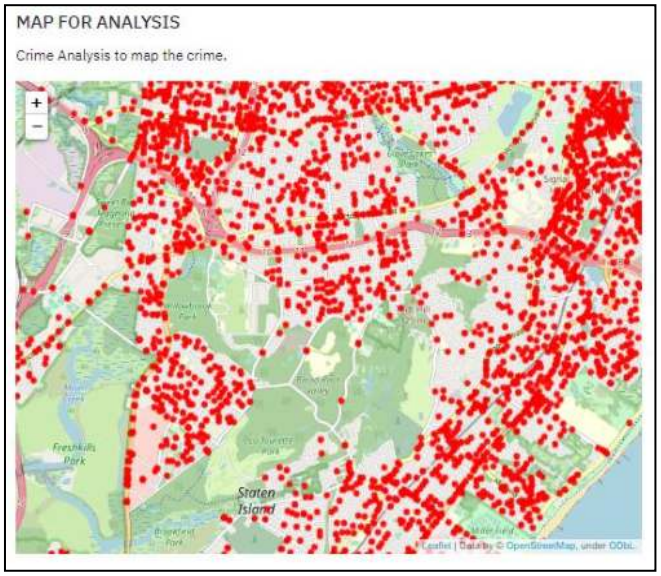

Fig. 5.12. Map Analysis

The map (Fig. 5.13) presents the crime index vise, which is categorized using pin codes. The data is mapped here based on their location index, therefore it depicts similar crimes that occur in those clusters.

Fig. 5.13. Map for index vise crime

VI. Conclusion

Throughout this study, the primary objective was to determine ways to utilize statistics to predict the overall number of crimes committed in a particular metropolitan city. The clustering method was employed to find the spatial patterns and density of crime in each city during the spatial analysis procedure. Although the Random Forest is the most effective predictor of crime severity, it fails to deliver a precise result since the latest prediction output depends on the mean of the previous ones. In this case, the best results were acquired by the XGBoost Classifier because boosting suppresses the drawbacks of bagging by dealing with underfitting or biasing parts of the dataset. Likewise, it was effective in predicting crimes likely to occur in the future.

The results of this research can help police officials in finding the most optimal places for locating the police stations in a city and to determine the strategies to reduce the crime rate. This work should be expanded by studying a temporal analysis of criminal data and developing a model that could predict not only the number but also the severity of crimes.

VII. Future Scope

This project can be enhanced by including the sentiment analysis that enables the prediction of future crimes in major cities via GPS-tagged Twitter data. Through the analysis of publicly available sources of data, such as social media postings, it is often possible to commence recognition of those issues of greatest concern to those less engaged through other means—to hear those voices that are often overlooked. There is a great opportunity to be gained by learning to

understand those concerns and be responsive to them, and great peril in ignoring those concerns.

Future work will involve using neural network algorithms such as ANN (Artificial Neural Networks), MLP (Multilayer Perceptron), RNN (Recurrent Neural Networks), GRU (Gated Recurrent Unit), etc. by converting classification problem to regression and possibly improve the prediction accuracy and acquire more reliable results.

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FTmRP-NCS: Fault-Tolerant And Reliable mRPL Routing Protocol For W-NCS Communication

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Abstract- ***The exponential rise in the demands for reliable and fault resilient communication over Wireless Network Control Systems (WNCS) across industrial monitoring and control ecosystems has alarmed academia-industries to develop more efficient wireless transmission solutions. On the other hand, the emergence of cloud-assisted Internet-of-Things (IoT) also has broadened the demands for reliable WNCS systems. To cope up with such irreplaceable needs, WNCS has exploited different wireless communication paradigms including IPv6 Routing Protocol for Low Power Lossy Networks (RPL) based WSN that enables reliable communication across the industrial setup to make optimal real-time process decision. However, being dynamic in nature WNCS with often undergo link-outage due to dynamic topology, node death, congestion etc. Though, a few researchers have addressed the routing problem in WNCS; however, integrating RPL with mobility to enable optimal communication has remained untouched. Additionally, no significant research addressed fault-resilient routing decision over WNCS setup, which motivates us to develop a highly robust Fault-Tolerant and Reliable mobile-RPL Routing Protocol for W-NCS (FTmRP-NCS). Unlike classical WNCS models, FTmRP-NCS employs dual objective-based routing decision by considering the Received Signal Strength Indicator (RSSI) and the number of control packets required (ETX). Here, the inclusion of RSSI ensures forwarding path formation with most reliable link condition, while ETX objective function helps maintaining low control packets and hence low energy exhaustion, low redundancy and high efficiency. FTmRP-NCS applies link-sensitive mobile node movement for data gathering across WNCS, which makes overall communication more reliable as well as time-efficient. Furthermore, fault-sensitive routing decision strengthens our proposed FTmRP-NCS protocol helps WNCS to yield optimal performance. FTmRP-NCS has been applied over standard IEEE 802.15.4 protocol stack and functions in parallel to the link and network layer, which retains backward compatibility with native RPL and hence assures easy implementation with real-time WNCS environment.***

Keywords: Wireless Network Controlled System, RPL Routing, Fault Tolerant and Reliable Routing.

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I. INTRODUCTION

Development of technologies demands innovative and effective solutions for communication in various applications of industries, academia, scientific communities as well as government agencies.

Amongst major applications, industrial communication has emerged as one of the most demanding sectors where enabling reliable and fault-tolerant data transmission is inevitable [1].

Network Control Systems (NCS) being one of the most used technologies in industrial communication demand efficient and reliable transmission protocol to collect sensed data from plants and send it to the automation controller to make transient control decision [2]. Towards these objectives, wireless NCS (WNCS) has emerged as a potential solution that not only augments reliable communication but also reduces complexities [3]. The use of WNCS systems in industrial automation has strengthened industries to augment their productivity while assuring maximum fault-resilience, where the role of a robust transmission system is irreplaceable. WNCS comprises sensor nodes deployed across the physical plant to collect event information. The deployed sensor nodes transmit their targeted local information to the controller through the gateway using a wireless channel. On the other hand, controllers compute control commands on the basis of the retrieved sensor data and send it to the actuators for timely actuation control of action control in the physical plant [4, 5]. The major use of WNCS is predominantly because of the large scale rise in the embedded computing, wireless networks and cloud computing, which gets further augmented due to diverse applications such as automotive [6, 7], avionics [8], building management [9] and industrial automation [10]. In the last few years, massive use of WNCS has surfaced for Industry 4.0 assisted Smart Manufacturing [12].

In practice the cluttered and noisy network environment influence overall WNCS performance significantly. On the other hand, the classical static node deployment based Wireless Sensor Networks (WSNs) are confined to alleviate major at hand issues such as link-outage, network condition changes, node death cause packet loss etc [13]. It demands certain more efficient transmission protocols with mobility feature that could assist timely and reliable data delivery from the deployed sensor nodes to the Network Gateway (NGW), automation controllers and actuators [14]. Unfortunately, native IEEE 802.15.4 standard based WSN doesn't employ mobility model due to classical reactive routing characteristics.

Dynamic topology and link variations are the key issues in mobile-WSN. However, introducing mobility with WSN, often called mobile-WSN has surfaced as one of the broad research areas for research communities. It can be considered as one of the prime motives of this research. Additionally, performing an in-depth study it can be affirmed that in the last few years the evolution of WNCS and cloud technologies have introduced the concept known as Smart Factory or Smart Manufacturing [15]. Smart Manufacturing exploits technologies like advanced communication system, cloud computing, BigData analysis,

Internet of Things (IoT), WNCS and advance automation control [16]. Summarily, this model requests certain robust data transmission scheme with high reliability and timely data delivery at the NGW or automation controllers to make early actuation control or allied decisions [16]. Thus it can be noted that NCS has a decisive role in achieving reliable performance in Smart Factory. Even, it has been identified as one of the inevitable needs for Industrie 4.0 assisted Smart Manufacturing concept. With this motive, in the last few years numerous international organizations such as Wireless Avionics Intra-Communications Alliance [8], International Society of Automation [17], Zigbee Alliance [18], Z-Wave Alliance [19], Wireless Industrial Networking Alliance [20] etc have been working on WNCS optimization to enhance industrial communication.

Being a large scale distributed network industrial process control or automation system demands reliable, timely [11] and fault-resilient communication across the system to meet Quality of Service (QoS) provision. However, the cluttered and noisy environment in industries confines major classical communication protocols to undergo loss condition that adversely affects overall control function, productivity and QoS provision. In such case the use of an enhanced IPv6 Routing Protocol for Low Power Lossy Network often called RPL can be of paramount significance [21].

Realizing the significance of mobility feature in sensor networks, IoT in smart factory concepts and RPL as a robust routing protocol, in this research the predominant emphasis have been made on enhancing aforesaid constructs to accomplish a novel and robust solution towards optimal WNCS communication purposes. As a contribution, to enable mobility based sensitive data gathering solution, we have applied link sensitive mobility control or mobile node positioning which ensures maximum possible or optimal data gathering from the connected wireless sensor nodes. On the other hand to ensure optimal routing decision over mobile-RPL (here onwards called mRPL), we have designed a novel multi-objective function based RPL routing decision model, which considers both RSSI as well as ETX as an objective function. Noticeably, the inclusion of RSSI ensures that the proposed WNCS routing model will constitute forwarding path with the best link quality while ETX objective function retains low computational overheads or redundant communication (of control packets) to enable communication across distributed WNCS. It makes WNCS communication cost and computationally efficient. Thus, the inclusion of link-sensitive mobility control and data gathering, multi-objective function (RSSI and ETX) based routing decision ensures QoS centric, timely and reliable data transmission across WNCS to meet real-time communication demands. As a noticeable contribution, in this research a fault-sensitive alternate forwarding concept is developed which ensures timely data delivery without imposing significant (iterative) node discovery, retransmission and resource consumption. It strengthens our proposed WNCS set up to achieve optimal communication across WNCS (distributed) nodes to make timely and efficient real-time decisions. Thus, inheriting above stated contributions (multi-objective function based routing model, link-sensitive mobility control and data gathering, and fault resilient communication), we introduce our proposed routing protocol as "Fault-Tolerant and Reliable mRPL Routing Protocol for WNCS (FTmRP-NCS)". FTmRP-NCS protocol has been applied over Contiki simulation tool where its performance has been examined in terms of Packet Delivery Ratio (PDR) and Low Packet Loss Rate (PLR) and delay. The simulation results affirm robustness of our proposed FTmRP-NCS to meet contemporary WNCS demands. Furthermore, since the proposed routing protocol is applied in parallel to the link and network layers of the native RPL, it ensures preserving backward compatibility. It confirms its suitability with real-time WNCS communication environment.

The other sections of the presented manuscripts are divided as follows. Section II discusses the related work which has been followed by the detailed discussion of the proposed system in Section III. Section IV presents the results and discussion and the overall research conclusion is given in Section V.

II. RELATED WORK

This section primarily discusses some of the key literatures pertaining to NCS communication and allied routing protocols.

In the last few years the emerging communication complexities and fault proneness has forced industries to exploit wireless networks in control applications, also called "wireless automation", which can revitalize the overall automation industry as well as smart factory paradigm [22]. Undeniably, unlike classical NCS, the use of Wireless-NCS (WNCS) delivers cost-effective, flexible and more reliable communication for transient decision process [23]. Ploplys et al [24] designed WNCS comprising a plant and a controller exhibiting point to point wireless communication between them, where they found that the overall control efficiency predominantly depends on the transmission efficacy, where wireless communication with better routing provision is a must. Ploplys et al also stressed on incorporating fault-tolerant transmission system which could perform reliably under the cluttered plant or network environment. A similar inference was made in [25] where Antsaklis et al stressed on incorporating efficient communication amongst controllers, system sensors, actuators etc. Considering the implementation of WNCS Willig et al [26] found that there the predominant issues influencing overall network performance and controllability are time delays, packet losses while during transmission [27]. With this motive, the authors recommended better network protocols, transmission scheduling [28] congestion control [29] and estimation [30] for both wired and wireless control systems. In a few kinds of literature it is found that there is an inevitable need to augment communication scheduling to retain the stability of controller [31].

In [32] authors explored different at hand technologies and allied complexities in industrial communication and found that WNCS can be of vital significance that could support transient and reliable industrial controllability as well as home automation even with cluttered plant (say, network) conditions [22]. Furthermore, the authors focused that the predominant problem with WNCS is the uncertainty of communication, co-existence with other wireless networks and security and Quality of Service (QoS) provision. To mitigate these issues, Baronti et al [33] applied Wireless Sensor Networks (WSN) as communication technology between sensor nodes and controller or actuator.

Majority of the classical wireless communication WNCS paradigms apply wireless devices such as Bluetooth, ZigBee (based on IEEE 802.15.4 radio) and WLAN (IEEE 802.11) that often undergo link outage due to exhaustive network condition and link outage [34] and hence recommended MAC enhancement to reduce communication losses. Understanding the limitations of ZigBee [35], Neumann et al [23] recommended using certain an enhanced wireless hardware as well as heterogeneous networks; however such approaches can lead huge computational overheads and hence reduced QoS provision. As enhanced solution, Branicky et al [36] recommended augmenting both MAC as well as link layers which are highly vulnerable to getting error or vulnerabilities. With this motive, later a fault tolerance model for sensor node was proposed in [37] where Prasenjit et al applied the multipath routing scheme. Recently to achieve efficient communication in WNCS, Winter et al [38] recommended IPv6 Routing Protocol for Low Power and Lossy Networks (RPL). The noticeable inferences were found in [39], where Tsiftes et al observed that predominantly data packets are lost during selecting an alternate path. Besides, higher payloads, hop-counts, mobility and resulting topological changes were found key reasons for reduced packet delivery rate (PDR). In this relation, Pavkovi et al [40] focused on enhancing RPL path selection using an opportunistic routing protocol. To enhance the reliability of the data transmission and low delay communication authors used multipath transmission scheme over native RPL with default objective function (OF) [41]. However, this approach could not address the link outage due to rapidly changing topology. As a solution for these issues, Lee et al [42] developed mobile RPL concepts, where the prime focus was made on enabling mobility feature with native RPL. Hong et al [43] developed mobility-based RPL routing protocol using link quality index; however computational complexities and overheads could not be addressed. In their approach [44] mobile nodes find multiple paths or alternate path in case of a route failure. In [42] ETX was used as OF to perform routing decision, especially the best neighbouring node to form DAG. However, these approaches suffer significantly high control traffic and link-failure caused packet loss [47]. As a solution, Korbi et al [47] developed a dynamic DIS management model for mobile RPL protocol, where ETX was used as OF. Korbi et al [47] narrowed down their research to reduce computational overheads. RSSI was used in [48] to perform routing decision or OF for DODAG formation. In [49] CO-RPL was proposed that used the concept of Corona for mobile node placement. In these classical approaches, mobility management has always been the issue and hence in [50] Bayesian model-based mobility prediction RPL was developed. Safdar et al [44] found that the inclusion of both reactive, as well as proactive methods can be vital to augment RPL for mobile communication environment. In [51] Lee et al focused on enhancing trickle timers for DIO optimization, where they found it suitable in the range of 2-10 seconds.

By observing the above key kinds of literature, it can be found that WNCS system requires highly robust and efficient wireless routing protocol that could ensure reliable and timely data deliver (say, communication) across NCS (amongst sensors, controllers, actuators or automation controllers etc). To achieve it, classical WSN systems can't be sufficient, especially under cluttered and noisy environments such as plants. On the other hand, the use of mobility with native RPL can be vital to achieve time-efficient and reliable communication across WNCS. However, mobility management required efficient routing and hybrid network management strategy (including reactive as well as proactive node management with link-sensitive route update). Considering these facts, this research primarily focuses on developing a robust fault-tolerant and reliable mobile RPL routing protocol for WNCS communication purposes.

III. PROPOSED ROUTING PROTOCOL

As discussed in earlier sections WNCS encompasses many sensor nodes distributed or allocated across the region of interest (say, network region), and therefore retrieving sensing data reliably from each node within deadline time becomes inevitable. On the other hand, Industrie-4.0 standard based smart factory too demands reliably and timely data delivery to the cloud infrastructures to ensure decentralized monitoring and control. Observing Fig. 1, it can also be found that to enable efficient NCS assuring optimal data transmission from sensors to the Network Gate Way (NGW) or control models is must. It needs a certain suitable networking solution, especially wireless communication paradigm to accomplish the above -stated objectives. Towards these objectives, a wireless communication protocol with fault-tolerant, reliable data transmission and internet adaptivity can be of utmost significance. With this motive, in this research paper the predominant emphasis has been made on developing fault-tolerant and reliable data transmission system between sensor nodes and the gateway (also the network controllers). Towards this objective, in this paper we have exploited IPv6 routing protocol for Low Power Lossy Networks (LLNs) also called RPL protocol which has been augmented to accomplish better performance. Noticeably, the cluttered environment with numerous noise presences across industrial scenarios, the use of LLNs becomes inevitable. On the other hand, in modern communication paradigms, mobility of nodes has broadened the horizon for reliable communication even across a large scale network. With this motive, in this paper a robust fault-tolerant and reliable data communication paradigm is developed for WNCS system. Considering RPL as a potential solution for WNCS this research intends to optimise classical or native RPL with a novel mobility feature supported by a suitable link-outage resilient routing mechanism.

As already discussed in previous sections, most of the existing approaches targeting mobile-RPL have applied timers such as handoff timers, response tracking timers, connectivity timers, etc so as to ensure that the link exists in a suitable range or appropriate. However, such inclusions make overall protocol computationally bulky and resource exhaustive and delayed, which cannot be recommended for WNCS that on contrary demands timely data delivery so as to make early control decision.

Unlike classical routing approaches, in this paper the focus is made on reducing additional components or functional entities such as the different timers, as mentioned above (except trickle timers that help scheduling network discovery at a definite interval). We intend to design an autonomous link monitoring and transmission control model over WNCS to retain QoS provision and reliable communication. Considering the fact that dynamic topology within a large scale network might cause iterative link outage or congestion, in this research a fault-tolerant and reliable link-outage repair paradigm is developed. In fact, the proposed work encompasses multiple contributions, such as multi-objective functions based routing decision, mobility control or management under dynamic topology and QoS sensitive link-repair model. These contributions could ensure optimal data transmission over WNCS to accomplish QoS provision. The overall contribution of the proposed routing protocol can be stated as a Fault-Tolerant and Reliable mRPL Routing Protocol for WNCS (FTmRP-NCS). Our proposed FTmRP-NCS contributed the following:

1. RSSI assisted mobile-sensor node placement across WNCS to retain reliable and fault resilient data transmission,
2. Multi-objective function (RSSI and ETX) based routing decision or best parent node selection,
3. Fault-tolerant alternate path formation and link repairing model for QoS centric reliable data delivery over industrie-4.0 WNCS.

A graphical abstract of the proposed routing protocol is given in Fig. 1.

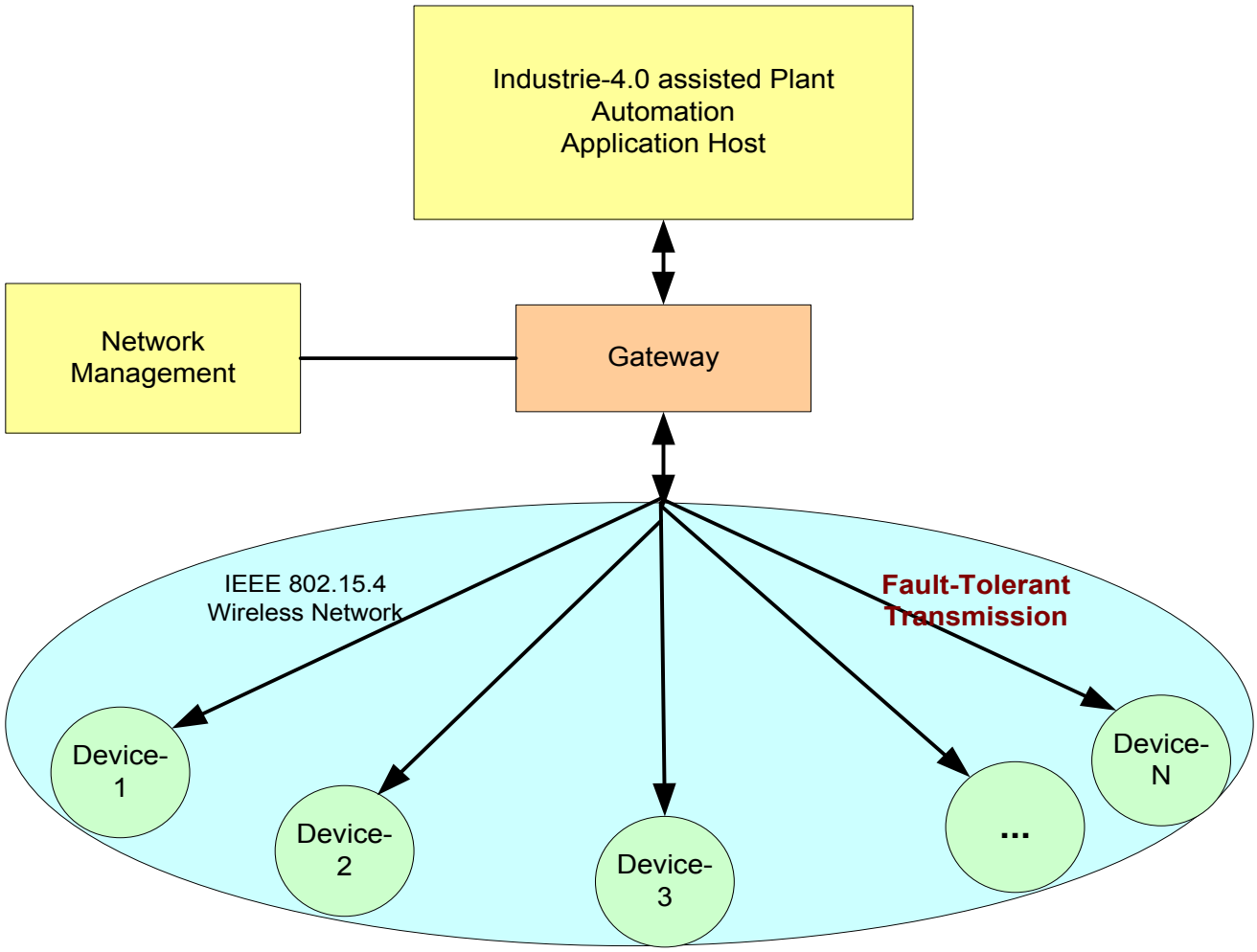

Fig. 1. An illustration of the need of fault-tolerant and reliable communication system in Industrie-4.0 assisted industrial automation

The detailed discussion of our proposed NCS routing model is given as follows:

Detecting any link-outage FTmRP-NCS routing protocol at first initiates' link repair functions that comprise two key functions named Local Link Repair (LLR) and Global Link Repair (GLR). Here, the LLR operates once identifying or detecting sensor malfunction or death and when parent node undergoes same situation or fault. On the contrary, GLR is initiated by a parent node when the network is needed to be re-constituted after Destination Oriented Distributed Acyclic Graph (DODAG) formation. LLR operates once identifying any node failure during communication.

In this scenario, FTmRP-NCS identifies an alternate path towards the NCS-gateway or the controller to ensure reliable and QoS provision. FTmRP-NCS is designed in such a manner that even in the case when there doesn't exist any alternate node or path to accommodate NCS sensor's data, the device may function as a new node or autonomous device that could multicast DODAG Information Solicitation (DIS) to perform a suitable alternate path formation for reliable data delivery. Noticeably, our proposed routing protocol ensures that the node or network discovery during link-outage doesn't impose significantly high computational overheads.

However, in practice, especially in the network environment with mobile sensor nodes there can be iterative congestion and the link-outage probability that could force FTmRP-NCS to undergo link-outage condition regularly. To avoid such issues, in this paper, proactive network management strategy has been taken into consideration where different dynamic network parameters such as Received Signal Strength Indicator (RSSI) and Expected Number of Control Packets (ETX) have been considered for topology management. This as a result helps to ensure a reliable link for successful data delivery. In this process, once initiating node discovery often called ND the node features for each participating node is collected and stored in a priority-based hash table. In later stage, detecting any link-outage or node-failure FTmRP-NCS assesses each node in the table for its superior RSSI and ETX feature values so as to select the best parent node. Noticeably, in our proposed FTmRP-NCS routing protocol a node with the highest RSSI and the minimum ETX is selected as the parent node to constitute DODAG for successful data transmission to the NCS-gateways, here onwards called NCS-GW. To be noted, our proposed FTmRP-NCS routing protocol has been applied at the top of the native link-layer of the RPL that ensure both time efficiency, as well as backward compatibility of the IETF, recommended RPL. This approach can allow FTmRP-NCS to execute link-repair and ND (if required) once detecting any link outage at the link-layer of the IEEE 802.15.4 protocol stack. In case of a re-constituting best forwarding path, it can obtain the best possible (available in proactively managed node set) parent node. In case there is no alternate parent node available FTmRP-NCS initiates ND and thus avoids iterative ND execution for best forwarding path selection. In addition to the above stated features, recalling the fact that the proposed system employs both RSSI and ETX as an objective function to make a routing decision, FTmRP-NCS protocol exploits these link quality parameters dynamically to perform mobility management. The implementation of our proposed routing model for WNCS control is depicted in Fig. 2. Noticeably, the proposed routing model is implemented on each participating node of the network (Fig. 1.

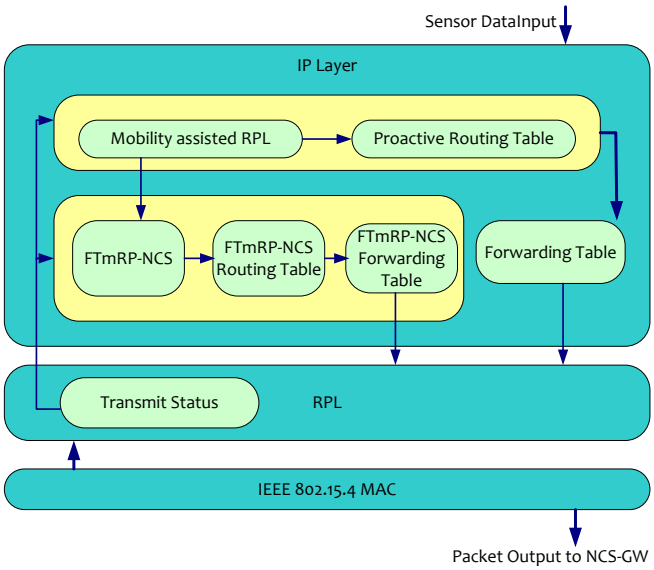

Fig. 2. Implementation schematic of the proposed FTmRP-NCS routing protocol

A. RSSI LQI assisted Topology Sensitive Route Control for Fault-Resilient WNCS

Considering the fact that the native-RPL doesn't have any sophisticated model to deal with mobility or dynamic topology conditions, we consider the sensor node's mobility as the challenge and exploit link-quality parameters such as RSSI and allied Packet Delivery Ratio (PDR) information perform mobile node localization so as to ensure outage-resilient reliable data delivery. In contrast to the conventional random movement-based mobility management model, we defined an approach called Definite Communication Range (DCR) which is used to perform mobility control. In practice, WNCSW with different autonomous operating nodes can have sensors of both static as well as mobile characteristics. Here onwards we refer static nodes as anchor nodes. Our proposed FTmRP-NCS protocol implements proactive node table management (PNTM) that estimates RSSI of each node dynamically, which is used further to decide optimal movement pattern by mobile nodes. Noticeably, such features can be easily implemented in large network region with multiple nodes and in multi-hop communication approach. In another way, there can be an open network environment where a mobile node such as Drones can be applied to collect real-time senor data to make control decision. In such an environment the use of dynamic per-node RSSI can help a network controller to assist best routing decision and forwarding path selection. PNTM executes beaconing to collect RSSI information of each node, which is updated in node table where nodes are prioritized with respect to its link quality values or RSSI.

To perform node localization FTmRP-NCS protocol exploits DCR information in which the mobile sensor node obtains its geographical location by overlapping DCR of the different anchor nodes. Here, it estimates the effect of each static or anchor node on the link reliability so as to ensure optimal forwarding path selection. It ensures reliable data transmission across the network.

Noticeably, the RSSI value obtained for an anchor close to the mobile node would always be more in comparison to the RSSI of the node existing at a farther distance. Thus, the reliability of the link with initial cases (having higher RSSI) would always be better than the other (link with lower RSSI). In such cases augmenting the mobility management by assisting mobile node to the target sensor across the network can help to avoid link outage problem due to improper path formation. Here, we hypothesize that the DCR factor functions on the basis of an assumption that the mobile node has the knowledge about the time-varying link conditions using long-distance path model. Now, applying this method, the RSSI value at a node at a certain time instant t can be obtained as (1).

$$\mathrm{RSSI}^{t} = S_{1m} - 10\alpha \log_{10} d \quad - \beta \tag{1}$$

In (1), the variable S_{1m} states the signal obtained at the distance of 1 meter and α signifies path-loss exponent with D meter radio range. In addition, $\beta \sim \mathcal{N}(0, \sigma_{\gamma}^{2})$ refers to the zero- mean Gaussian noise. Here, we estimated the distance between the anchor node and the mobile node using (2).

$$\hat{D}_{\mathrm{RSSI}}^{t} = 10^{\frac{\mathrm{RSSI}^{t} - S_{1m}}{10\alpha}} \tag{2}$$

Noticeably, because of the exponential relationship between distance value (2) and its link quality information (in terms of RSSI), $\hat{D}_{\mathrm{RSSI}}^{t}$ applies Gaussian distribution function. Applying log-normal distribution function for inter-node distance estimation we obtain,

$$\ln \hat{D}_{\mathrm{RSSI}}^{t} \sim \mathcal{N}(\ln D^{t}, \sigma_{d}^{2}) \tag{3}$$

In (3), the variable D^{t} states the distance between the anchor node and the mobile node at tth time instant. Here, the standard deviation (σ_{d}) is obtained using (4).

$$\sigma_{d} = (\sigma_{\gamma} \ln 10) = (10\alpha) \tag{4}$$

Now, applying the above derived values, the probability density function (PDF) has been obtained using (5).

$$\mathrm{PDF}(\hat{D}) = \begin{cases} \dfrac{1}{\sqrt{2\pi}\sigma_{d}\hat{D}} \exp - \dfrac{(\ln \hat{D} - \ln D)^{2}}{2\sigma_{d}^{2}} & \text{if } \hat{D} > 0 \\ 0 & \text{if } \hat{D} \leq 0, \end{cases} \tag{5}$$

In (5) D signifies the distance. Once estimating PDF, we have derived DCR of a-th anchor node, where a new attribute C_{a}signifying DCR is estimated where the mobile node f is supposed to exist to gather data reliably. Let, the mobile sensor node exists within the DCR, and then the confidence likelihood be$\mathrm{DCR}_{\mathrm{prob}}$. Typically, in major NCS environment sensor nodes are armoured with omni-directional antennas that make DCR as a circular periphery with the communication range, denoted by r and centred over a-th anchor node. $\mathrm{DCR}_{\mathrm{prob}}$ is obtained as (6).

$$\mathrm{DCR}_{\mathrm{prob}} = \Pr\{D^{t} \leq r\} \tag{6}$$

Further,

$$\mathrm{DCR}_{\mathrm{prob}}\ (r) \simeq \int_{0+}^{r} \frac{1}{\sqrt{2\pi}\sigma_{d} x} \exp\left(- \frac{(\ln x - \ln \hat{D}_{\mathrm{RSSI}}^{t})^{2}}{2\sigma_{d}^{2}} \right) \tag{7}$$

In (7), m-th node defines its DCR value by overlapping different DCRs of the N closest anchor nodes. Mathematically, it can be presented as:

$$L_{f} = L_{1} \cap L_{2} \cap \ldots\ldots\ldots \cap L_{N}. \tag{8}$$

In (8) N states the total DCR formed with reference to the neighbouring anchor nodes. FTmRP-NCS enables localization of the mobile node to retain reliable communication. The optimal location $\hat{P}m$ within DCR is obtained using (9). Practically, it is achieved by identifying the location of the discrete points within L_{f}, as defined in (8). In our proposed routing protocol, the mobile node uses PDF value to assess the likelihood of a node to be available withinL_{f}. Now, hypothesizing that the anchor nodes are self-directed mobile node can identify its optimal location to perform reliable data gathering from the NCS sensor nodes. The mobile node location identified would be obtained as (9).

$$\hat{P}m = \max_{c} \prod_{a \in A^{p}} DCR_{prob}\left(D_{c,a}\right) \forall c \in L_{m} \tag{9}$$

In (9), $D_{c,a}$ signifies the Euclidean distance in between cth and ath anchor nodes. The other attribute A^{p}refers to the nodes participating during mobile node localization. Thus, it becomes possible to gather NCS sensor data reliably and timely by means of inducting mobile node (for data gathering). However, such an approach often causes topological variation resulting in packet loss probability. To alleviate this problem FTmRP-NCS applies multiple OF including RSSI and ETX to decide best parent nodes dynamically. The detailed discussion is given as follows.

B. Multiple Network Parameters assisted Best Parent Node Selection for FTmRP-NCS

Considering the overall functional characteristics of the WNCS system, it can be observed that it employs two way of communication, one performing transmission between two NCS (static) sensor nodes where it intends to transmit data to the gateway for autorotation control. The other mode of communication can be from a mobile sensor to the anchor or vice versa.

In NCS systems there can be multiple anchor sensor nodes that collect real-time process or event information and passes it to the network controller or automation control system through a network gateway. This process of communication within two or multiple static nodes can be stated as inter-anchor node (IAN) communication. In this case, the static nature of nodes deployed avoids any topological changes, until a participating node doesn't die. It retains the network more stable. In this transmission mechanism, a node can assess the neighbouring node for its suitability as the best forwarding node using distance and residual energy factor.

On the contrary, the communication between the mobile sensor node and an anchor node might undergo topological changes along with link quality (i.e., strength) variations. This as a result, could cause link-outage and hence can adversely affect QoS transmission over WNCS. Considering the above-stated condition, though the native RPL can be sufficient for IAN, its efficacy remains suspicious for mobile node based data gathering over WNCS. In such cases, optimizing native-RPL can be a potential solution by incorporating dynamic best forwarding path selection measures and DODAG formation while keeping computational overheads within the cap. In this approach, DADOG is constituted by means of DIOs messages where at first the transmitter node transmits multiple messages to the neighbouring nodes across WNCS that helps it receiving single DAO messages as a unicast message from multiple nodes. In this method, DAO packets are obtained as ACK that embodies key network information comprising RSSI information and ETX values, pertaining to each possible link. Obtaining these key factors each link can be inferred in terms of certain rank information (signifying efficacy of the node to become a parent or the best forwarding node). The node-rank of each participating sensor nodes helps to make a proactive node table characterizing possible parent node where each node is ordered in the decreasing order of respective rank values.

In this manner, the node with the highest rank (characterizing higher RSSI and minimum ETX) is selected as parent node that helps to form DODAG for reliable data transmission to the gateway or eventual NCS network controller or automation units. With the estimated RSSI value of i-th node available in proactive (parent) node table, the PDR of that corresponding link can also be obtained. In addition, it can help ETX estimation using (10).

$$\mathrm{ETX_i} = \frac{1}{\mathrm{PDR_{i,j}}} + \mathrm{ETX_j} \tag{10}$$

$\mathrm{ETX_i}$ in (10) signifies the total number of control packets required to communicate between i-th anchor node and jth forwarding node. Similarly, $\mathrm{ETX_j}$ refers to overall control messages required from j-th node to the anchor node. The overall PDR value between i-th and j-th nodes within WNCS is $\mathrm{PDR_{i,j}}$.

$$\left(\mathrm{ETX_{ij}} = \frac{1}{\mathrm{PDR_{i,j}}}\right) \tag{11}$$

Thus, exploiting RSSI and ETX values for any link or node FTmRP-NCS protocol perform best parent node selection for reliable data delivery over WNCS. Now, identifying the best parent node FTmRP-NCS protocol forms DODAG towards the network gateway, where the sensed data are collected and further processed by the network controller and automation controllers to make a transient decision. Furthermore, to assist above stated transmission decision, while transmitting data from the ath anchor node the overall ETX needed to transmit data via f-th mobile node is obtained by summing it to the ETX required from a-th anchor node (denoted by $\mathrm{ETX_{f,a}}$). Thus, the total ETX needed to be (12).

$$\mathrm{ETX_f} = \mathrm{ETX_{f,a}} + \mathrm{ETX_a} \tag{12}$$

$\mathrm{ETX_a}$ Can easily be estimated by using rank information of the a-th anchor node. Now, to estimate the likelihood of a node to become a parent node, DIO message is unicast by the sensor nodes that acknowledged RSSI and ETX information to the requesting node. In FTmRP-NCS PDR is estimated between mobile and the a-th anchor node at t-th time instant when the RSSI is higher than the transceiver's sensitivity ($\mathrm{RSSI_{th}}$). In other words,

$$\mathrm{PDR_{f,a}} = \Pr\left\{\mathrm{RSSI_{f,a}^t} \geq \mathrm{RSSI_{th}}\right\} \tag{13}$$

Now, with increase in inter-node distance and reducing RSSI, $\mathrm{PDR_{f,a}}$ would be (14)

$$\mathrm{PDR_{f,a}} = \Pr\left\{\beta \leq \mathrm{S_{1m}} - 10\log_{10} \mathrm{d_{f,a}} - \mathrm{RSSI_{th}}\right\}. \tag{14}$$

Considering β as a Gaussian distribution function $\mathcal{N}\left(0, \sigma_\gamma^2\right)$, the PDR in between the anchor sensor node and the mobile node can be obtained using (15).

$$\mathrm{PDR_{f,a}} = \Pr\{\beta \leq \mathrm{X}\} = \int_{-\infty}^{\mathrm{X}} \frac{1}{\sqrt{2\pi}\sigma_\beta} \exp\left(-\frac{\beta^2}{2\sigma_\beta^2}\right) \mathrm{d}\beta, \tag{15}$$

In above derived PDR estimation model (15), the condition with X signifies higher precision than the classical $\mathrm{S_{1m}} - 10\alpha\log_{10}\hat{\mathrm{D}}_{\mathrm{f,a}} - \mathrm{RSSI_{th}}$ based approach. In our proposed FTmRP-NCS routing protocol $\mathrm{D_{m,a}}$ has been substituted by $\hat{\mathrm{D}}_{\mathrm{m,a}}$. Thus, exploiting dynamic RSSI and PDR information, the $\mathrm{f}-$th mobile sensor node performs parent node, $\mathrm{a_f}$ selection so as to ensure reliable and fault resilient transmission. Mathematically,

$$\mathrm{a_f} = \arg\min_{\mathrm{t}}\left(\frac{1}{\mathrm{PDR_{f,t}}} + \mathrm{ETX_t}\right), \quad \forall \mathrm{t} \in \mathcal{K}_\mathrm{f}. \tag{16}$$

The above discussed approach enabled our proposed FTmRP-NCS routing protocol to exhibit reliable data transmission even under dynamic topology. Though, above discussed approaches strengthen FTmRP-NCS protocol to assure reliable and timely data delivery to the NCS network gateway, it requires armouring with a certain fault-resilient approach where even in case of a certain fault it may assure delivering data to the gateway timely. With this motive, in this paper, we have developed a link repair model comprising GLR and LLR concepts.

C. Link-Repair and Supplementary Path Formation for QoS provision over WNCS

In order to strengthen the robustness of the proposed routing protocol and preserve the concept of "Backward Compatibility", in this paper we have inherited native RPL protocol which has been further enhanced to achieve the targeted goal. Here, to perform IAN (Internet Area Network) communication the native RPL functions conventionally; however to perform mobile to anchor node or vice versa communication we implemented our proposed FTmRP-NCS routing protocol.

In the case of native RPL implementation we applied ETX and RSSI information to form DODAG so as to assure reliable communication. Mobile nodes require dealing with link instability due to both Spatio-temporal variations that force the link to vary over time or distance. In WNCS the environment there can be numerous sensors deployed across the network region to collect event data or process variables where it might use anchor nodes as well to forward data to the gateway for transient decision. Moreover, dynamic topology might cause insufficient information availability that might cause link outage. In addition, continuous link quality changes may also affect best parent node selection and DODAG formation that could affect overall network performance. Though reducing DIO frequency can help to minimize computational overheads, however, it may confine node information exchange so as to retain sufficient dynamic link quality monitoring. In case of insufficient information there can be iterative link outage causing QoS degradation. To adapt with such dynamism and allied link update mechanism we scheduled trickle timer at 2 seconds for DIO transmission. As stated our proposed FTmRP-NCS routing protocol is applied in parallel to the link-layer of IEEE 802.15.4, once detecting any link outage at the link layer, it executes link-repair model that helps to identify the best alternate parent node from the proactive node table to form an alternate forwarding path.

Exploiting RSSI and ETX information FTmRP-NCS ranks each node in the table and tries to select the best parent node to update DODAG for successful data delivery. Since this process doesn't execute node discovery iteratively and hence avoids computational overheads and energy exhaustion. Unlike conventional routing approaches, FTmRP-NCS protocol disables trickle timer once forming the alternate forwarding path or DODAG with suitable parent node. This, as a result, avoids resource exhaustion as well as iterative route update thus making communication more reliable even over dynamic network conditions. Considering a scenario where there is the probability of data getting dropped due to link outage, our proposed FTmRP-NCS routing protocol applies backup based supplementary data transmission where once detecting any link-outage it transmits undelivered data through the newly formed alternate forwarding path. In addition, our proposed FTmRP-NCS protocol maintains backup of the data (clone of the original data) under transmission and once detecting any packet loss or data drop it transmits a backup data without requesting native transmitter. Performing such a novel effort it not only reduced retransmission cost or delay but also avoid unwanted resource exhaustion without compromising with QoS delivery over WNCS. Thus, this approach enables fault-tolerant and reliable data transmission over WNCS.

The simulation results obtained and their respective inferences are presented in the subsequent section.

IV. RESULTS AND DISCUSSION

In this research, the predominant focus was made on developing a novel wireless routing protocol to be used in WNCS communication purposes. Realizing the fact that WNCS may often undergo cluttered and noisy environment classical noise-sensitive routing approaches could not be an optimal solution. On the other hand, realizing the need for an optimistic approach to accommodate Industrie 4.0 assisted Smart Manufacturing process, in this research RPL routing protocol was taken into consideration. Recalling the definition, RPL signifies IPv6 Routing Protocol for Low Power Lossy Networks; it seems suitable for real-time application where the sensed data can be collected to the cloud to enable decentralized monitoring and control. However, considering the fact that the native RPL can't be a suitable solution for modern NCS communication where timely and reliable data communication is inevitable, in this paper a novel Fault-Tolerant and Reliable mobile RPL (say, mRPL) Routing Protocol was developed for WNCS (FTmRP-NCS). Unlike classical WNCS routing approaches FTmRP-NCS applied multiple optimization measures such as multiple objective functions based best forwarding node (say, parent node) selection, RSSI assisted (link sensitive) mobile node localization, fault sensitive link repair model etc. In addition, the focus was maintained on retaining optimal performance without imposing any significant computational overheads, which is a common issue in major wireless communication protocols. In existing work, major efforts have been made by using either ETX or RSSI as link characterizing parameter. On the contrary, in this paper both RSSI as well as ETX was taken into consideration to perform routing decision. Recently, authors [58] tried to use this combination for routing decision; however the use of multiple timers imposed computational overheads significantly that confines its suitability for WNCS communication where maintaining minimum overheads, minimum delay and higher Packet Delivery Ratio (PDR) is a must. In addition, existing works still exploit reactive route management that seems confined, while in FTmRP-NCS protocol we have used proactive node management that updates parent nodes dynamically at the interval of defined trickle time, which is selected as 2 ms in this paper. Noticeably, FTmRP-NCS protocol uses 5kb flash memory that makes it suitable to be used under resource-constrained communication environment and even it can be cost-effective for NCS purposes. The overall proposed system has been developed using Contiki operating system with Cooja network simulator. To simulate the developed model, Ubuntoo 14.4 was considered as an operating system. Here, each node was deployed with Unit Disk Graph Medium (UDGM) radio property that follows the distance loss pattern during communication. Its consideration is well justifiable due to changing topology and respective inter-node distance variation that eventually influences signal strength or link loss. Noticeably, the proposed FTmRP-NCS protocol was applied in parallel to the link-layer of native RPL (with IEEE 802.15.4 MAC) and hence no major changes were made in IETF recommended standards [17]. Therefore, our proposed routing protocol follow backward compatibility concept and hence can be used for real-time application. Considering the mobility feature of the mobile sensor node, we assigned 5m/s as the speed of node during the simulation.

Considering the fact that so far no justifiable effort is made to exploit mobile RPL protocol for WNCS routing, in this paper to assess the efficiency of the proposed routing protocol we compared its performance with native RPL. On the other hand, in WNCS reliable data delivery and delay-resilient transmission is inevitable and therefore the performance of both FTmRP-NCS as well as (native) RPL was obtained in terms of PDR, Packet Loss Ratio (PLR) and delay.

To present the comparative performance the log-performance obtained by Contiki simulation was processed using MATLAB and different graphs with varying network density and payload conditions were obtained. In a typical industrial application environment, a set up can be different than others, especially in terms of the number of sensors, the size of data being communicated etc. Undeniably, increasing the number of sensor nodes can have an impact on the performance of any routing protocol. Similarly, the nature of communication (i.e., data under transmission), the severity of transmission or payload condition can vary. This factor too can have an impact on the overall network performance, since higher payload often causes contention and/or congestion in the network and thus reduces overall PDR performance (due to increased packet drop or PLR). Considering this fact, in this paper we focused on assessing performance by varying node density (here, node signifies a wireless sensor node with definite radio range and memory capacity) and payload (data size/severity under transmission).

A. Performance under varying Network Density

To examine the efficiency of our proposed FTmRP-NCS routing protocol we have assessed performance by varying node density where each node was following UDGM and distance loss pattern. In addition, nodes were deployed uniform radio range of 100 meters. Here, each node was configured as T-mote sky. Simulating our proposed routing protocol, PDR, as well as PLR,

were obtained for each simulation case (by varying node size at 10, 20, 30, 40, 50 and 60). The respective PDR values were obtained from log outputs and were plotted using MATLAB 2017a tool. As depicted in Fig. 4, the maximum PDR by FTmRP-NCS was almost 98%, where the average PDR performance was obtained as 89.10% while the classical RPL could exhibit merely 72.7% of the PDR over the same simulation environment. Similarly, PLR performance by FTmRP-NCS routing protocol exhibits that it exhibits an average PLR of 10.84% which is lower than the native RPL protocol (27.13%) (Fig.4). It can be because of unavailability of mobility management feature and hence due to dynamic topology and link variations it could have undergone significantly high packet losses (Fig. 4). The effect of such unwanted packet losses can be visualized in Fig 5 where the classical RPL exhibits higher delay than the proposed FTmRP-NCS routing protocol. Noticeably, FTmRP-NCS exhibits higher PDR and hence the minimum probability of retransmission that eventually avoids any delay incurred.

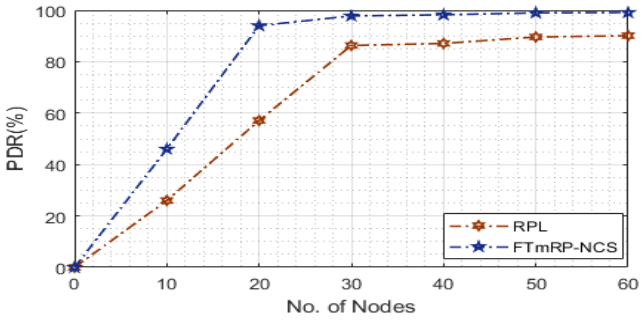

Fig. 3. PDR performance under varying network density or node of nodes

Observing overall results (Fig. 3 to Fig 4) it can be found that though both protocols undergo packet loss by increasing node density; however the proposed FTmRP-NCS protocol exhibits relatively lower PLR than native RPL. Interestingly, with increasing nodes FTmRP-NCS exhibits better PDR which can be due to the sufficient number of nodes available to form a forwarding path. In other words, there can be a scenario over NCS environment where nodes can be deployed across the network region however due to low node density mobile nodes or even anchor nodes may lack forming best forwarding path. And therefore it can undergo packet losses. On the contrary, with an increase in node density, both anchor nodes, as well as a mobile node, get sufficient nodes in proactive parent node-set (table) to form forwarding path, even under link-outage condition. It helps to enable reliable (Fig. 3) and timely (Fig. 5) data delivery over WNCS.

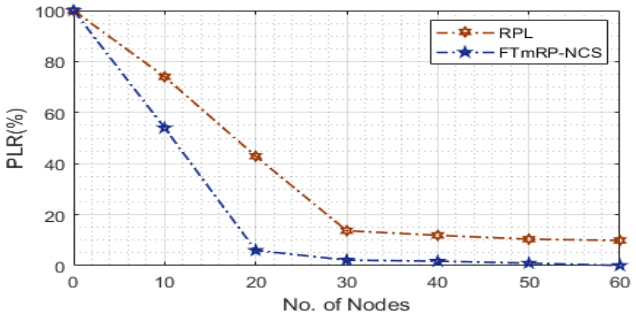

Fig. 4. PLR performance under varying network density or node of nodes

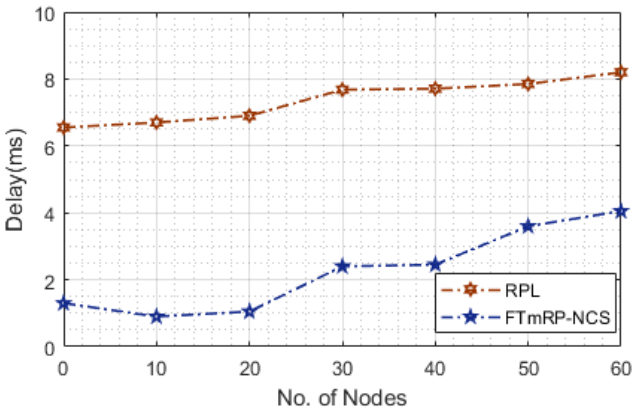

Fig. 5. Delay performance under varying network density or node of nodes

B. Performance under varying Load Conditions

In any network, the successful data delivery often depends on network condition such as buffer availability, congestion, link quality etc. However, buffer availability at a node plays a decisive role in accommodating data to forward towards its destination. In other words, an increase in the payload can have an impact on a node whether it can transmit data successfully. The probability of congestion or resulting data drop can increase significantly due to an increase in payload or packet size. In real-time NCS environment, the dynamic payload can be a common event where a routing protocol is expected to accommodate payload without affecting overall performance.

With this motive, we examined FTmRP-NCS protocol's PDR, PLR and delay performance by changing payloads. Here, we considered payloads with 1000 bits/second (bps), 2000 bps, 3000 bps, 4000 bps and 5000 bps. The respective performance was obtained in a different payload condition. Fig. 6 presents the PDR performance by our proposed FTmRP-NCS routing where it has exhibited better performance than the native RPL. Similarly, PLR performance (Fig. 7) to confirm that our proposed routing protocol exhibits less PLR deviation due to an increase in payload. Its influence on delay performance can be observed in Fig. 8, where FTmRP-NCS exhibits lower delay than the native RPL protocol.

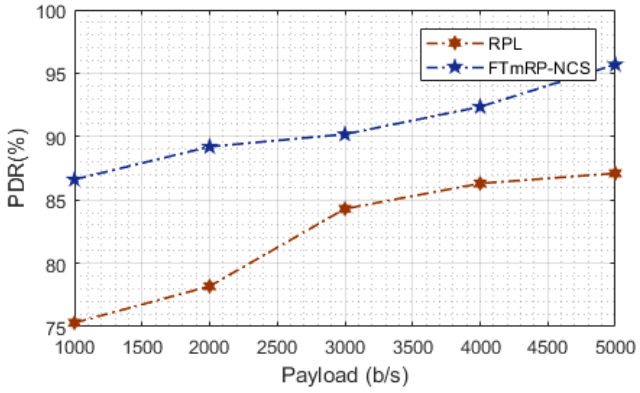

Fig. 6. PDR performance under varying payload condition

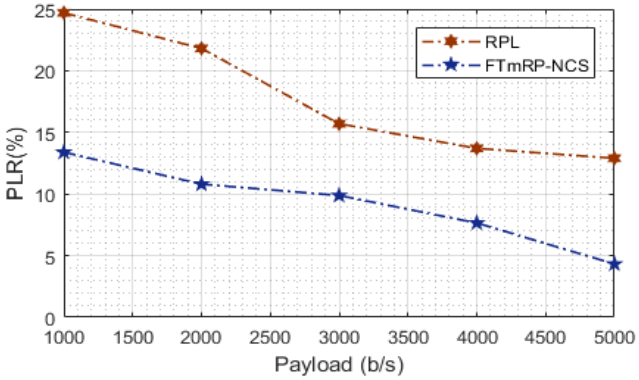

Fig. 7. PLR performance under varying payload condition

Thus, observing overall performance it can be found that the proposed FTmRP-NCS routing protocol exhibits better than the native RPL while preserving the concept of backward compatibility and hence can be a potential communication paradigm for WNCS applications that primarily demands high PDR (reliable data transmission) and low delay. Considering fault resiliency, FTmRP-NCS is implemented in parallel to the link-layer of IEEE 802.15.4 and hence once detecting any link outage or fault it executes link repair function where at first it tries to re-constitute alternate forwarding path by selecting the best alternate parent node from proactively arranged parent node-set. As GLR solution, once identifying that there is no sufficient alternate parent node available in the parent node-set, it executes node discovery. This overall process reduces iterative node discovery and hence computationally more efficient than the classical approaches.

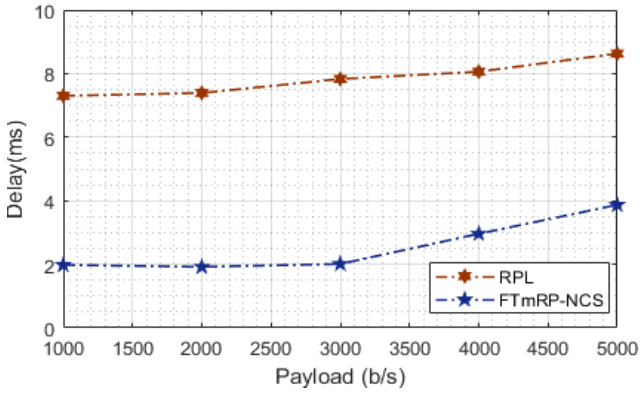

Fig. 8. Delay performance under varying payload condition

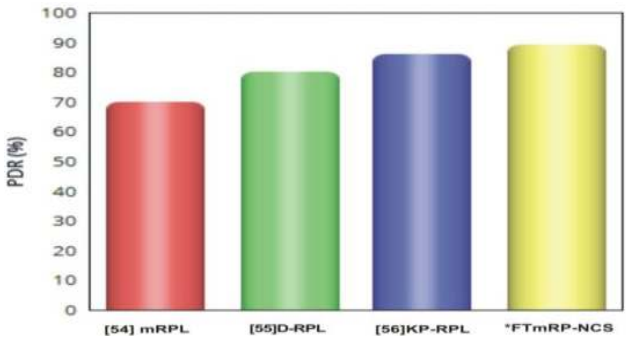

Fig. 9. Comparative performance

To examine the performance of the proposed FTmRP-NCS routing protocol, we have performed the qualitative assessment by reviewing other existing mobility assisted RPL protocols [52][54-56]. In [52] [54] authors applied multiple timers and handoff optimization to achieve mobility based RPL; however, authors could not address the computational overheads imposed. It confines their suitability for our intended WNCS communication. On the other hand, authors [55] developed a dynamic RPL for multi-hop routing in IoT where they used RSSI as OF to perform routing decision. Authors [55] could achieve average PDR of 80%. Similarly, in [56] authors used mobile position metrics assisted RPL routing to achieve link sensitive routing. Since, their proposed system employed multiple value additions such as dynamic mobile node localization, blacklisting it used ETX as OF to perform routing decision. Unlike [56], our proposed FTmRP-NCS protocol applies both ETX as well as RSSI to make a routing decision. In addition, we implement proactive network management followed by a computationally efficient link-outage repair system. Such novelties have augmented our proposed routing protocol to exhibit 89.1% average (Simulated) PDR which is higher than the existing KP-RPL that could achieve a maximum 86% of the PDR. It affirms robustness of our proposed model over the classical approaches. The overall conclusion of the presented research work is given in the subsequent section.

V. CONCLUSION

In the last few years, an NCS system has emerged as one of the most demanding technologies serving industrial communication and control. However, increasing complexity and allied fault proneness has alarmed academia-industries to achieve a reliable and QoS oriented wireless transmission system to enable timely network and automation control.

Considering the overall functional scenario of WNCS system, it is important to sense different process or even parameters from plant and transmit it to the network controller or automation controller. In this process, assuring timely and reliably data transmission from sensors to the gateway and automation controller is a must. On the other hand, the emergence of IoT assisted smart production system too demands timely and reliable data gathering at the automation controller in NCS. Majority of the classical routing approaches lacks incorporating mobility and internet connectivity under lossy network conditions. Considering this as motivation, in this paper a robust routing protocol named Fault-Tolerant and Reliable mRPL Routing Protocol for WNCS (FTmRP-NCS) was developed. Unlike classical routing approaches, the proposed FTmRP-NCS protocol incorporated multiple robustness such as RSSI assisted mobile-sensor node placement across WNCS, Multi-objective function (RSSI and ETX) based routing decision and QoS centric (fault-tolerant) alternate path formation and link repairing model that as a combined solution achieved better performance. Noticeably, the use of RSSI based mobile node localization enabled reliable and time-efficient data gathering from the sensor nodes across NCS. On the other hand, the inclusion of both RSSI as well as ETX accomplished routing decision by balancing the optimal trade-off between link quality as well as computational overhead.

This strengthened proposed routing approach to assure reliable communication without imposing computational costs. During the process, the use of proactive node management reduced iterative node discovery to form alternative forwarding path or DODAG during link outage. The link-outage repair model and allied efficiency strengthen FTmRP-NCS to retain computationally efficient routing which can be of great significance for WNCS system where there used to be huge cooperatively functional autonomous sensor nodes demanding timely data delivery to the network gateway and hence automation controller (or vice versa). The Contiki based simulation has exhibited that the proposed FTmRP-NCS routing protocol outperforms native-RPL in terms of Packet Delivery Ratio, Packet Loss Ratio and delay etc. Noticeably, the use of proposed FTmRP-NCS routing protocol in parallel to the link-layer of native-RPL enabled retaining backwards compatibility and hence can be applied for real-time communication.

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Investigation of Thermal Properties of Epoxy Composites Filled with Alluminium Nitride (AlN)

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Abstract :Investigation of thermal properties of epoxy composites embedded with Aluminum Nitride (AlN) micro-fillers is estimated in the present thesis with help of the experimental and ANSYS results. Thermal conductivity of AlN powder filled epoxy composite is calculated by measuring temperature difference at two surfaces by using instruments thermal heater and thermal laser gun. The samples of composites prepared with AIN for three different sizes of AIN powder particles [AIN particles size 1)70µm 2)80µm 3)90µm]. For each size three samples are prepared with different concentration of AIN powder[AIN concentration by wt. 1)10 gm 2)20 gm 3)30 gm].The numerical results obtained by using the ANSYS software. The effective thermal conductivity values obtained from experimentally validate with ANSYS results. It is observed that The conductivity values measured experimentally are compared with the ANSYS results. These Epoxy composites with AlN and glass fiber have been fabricated and thermal conductivities of the samples are calculated by using experimentally obtained temperature values. Observations can be made that with At highest testing temp. 80ºC for size 70µm of AIN particles we get thermal conductivity of epoxy composites for sample 20weight %(30gm AIN powder out of total weight of sample) has increased by 30 times than epoxy. Epoxy composites with 80µm size of AIN particles the sample with 20 % of AIN gives thermal conductivity at heater temp.80ºC has increased by about 32 times than epoxy. For 90 µm size AIN particles samples at heater temp.80ºC we found better thermal conductivity for sample with 20%AIN particles out of the nine samples the thermal conductivity of epoxy has increased by 34 times as compare to epoxy. A conclusion to draw from the measured values we got better thermal conductivity of epoxy composites with 20% of AIN with size of 90µm.Increase of thermal conductivity of epoxy composites with increase of size and percentage of AIN powder.

Keywords — **Epoxy Composites, Aluminum Nitride, ANSYS, Glass fiber, Thermal Conductivity.**

I. Introduction

1.1 Definition of composite:

A composite (or composite material) is defined as a material that consists of at least two constituents (distinct phases or combinations of phases) which are bonded together along the interface in the composite, each of which originates from a separate ingredient material which pre-exists the composite. Composite refers to a material, as opposed to a structure or a component, as such a composite material is used for the fabrication of components of various shapes or functions, thus it should be distinguished from a wing or other structure made of several components bonded together and from an electronic device or packaging structure made of layered materials (although one of the materials in the packaging could be considered a composite). Composites are combinations of two materials in which one of the materials called the reinforcing phase is in the form of fiber sheets or particles and is embedded in the other material called the matrix phase.

1.2 Epoxy:-

Epoxy is found in both liquid and solid form. Epoxy is formed by step growth polymerisation reaction between biphenol and epichlorohydrin. Thermal conductivity of epoxy alone is very low (0.363W/m. K).

1.3 Glass fiber :-

Glass fiber is a material consisting of numerous extremely fine fibers of glass. Glassmakers throughout history have experimented with glass fibers, but mass manufacture of glass fiber was only made possible with the invention of finer machine tooling. In 1893, Edward Drummond Libbey exhibited a dress at the World's Columbian Exposition incorporating glass fibers with the diameter and texture of silk fibers. Glass fibers can also occur naturally, as Pele's hair.Glass wool, which is one product called "fiberglass" today, was invented in 1932–1933 by Russell Games Slayter of Owens-Corning, as a material to be used as thermal building insulation. It is marketed under the trade name Fiberglas, which has become a genericized trademark. Glass fiber when used as a thermal insulating material, is specially manufactured with a bonding agent to trap many small air cells, resulting in the characteristically air-filled low-density "glass wool" family of products.Glass fiber has roughly comparable mechanical properties to other fibers such as polymers and carbon fiber. Although not as rigid as carbon fiber, it ismuch cheaper and significantly less brittle when used in composites. Glass fibers are therefore used as a reinforcing agent for many polymer products; to form a very strong and relatively lightweight fiber-reinforced polymer (FRP) composite material called glass-reinforced plastic (GRP), also popularly known as "fiberglass". This material contains little or no air or gas, is more dense, and is a much poorer thermal insulator than is glass wool.Glassfiber is formed when thin strands of silica-based or other formulation glass are extruded into many fibers with small diameters suitable for textile processing. The technique of heating and drawing glass into fine fibers has been known for millennia; however, the use of these fibers for textile applications is more recent. Until this time, all glass fiber had been manufactured as staple (that is, clusters of short lengths of fiber).The modern method for producing glass wool is the invention of Games Slayter working at the Owens-Illinois Glass Co. (Toledo, Ohio). He first applied for a patent for a new process to make glass wool in 1933. The first commercial production of glass fiber was in 1936. In 1938 Owens-Illinois Glass Company and Corning Glass Works joined to form the Owens-Corning Fiberglas Corporation. When the two companies joined to produce and promote glass fiber, they introduced continuous filament glass fibers.[2]

1.4 General Introduction:-

For real-world engineering problems in electronic industry, composites with high thermal conductivity are required. To overcome the difficulty some conventional metallic filler is added with resin. This improves the conductivity of composites for the microelectronic application.[1] Thermal conductivity of neat-epoxy resin is one of the lowest among all known solid materials. In order to increase the thermal conductivity the addition of filler particles with high thermal conductivity into epoxy resin is used as common method. The properties of obtained epoxy composite depend on properties of used filler, i.e. size, shape, surface area or dispersion in a matrix. The filled epoxy composites are broadly used in power and microelectronic industry. The heat management in the electronic and power

devices is a crucial issue. It is an important problem to be solved in order to prevent such devices from malfunction. The effective heat dissipation is thus one of the main challenging problems to be solve.[2] As microelectronic devices become increasingly integrated at high power and high frequencies, a large amount of heat is generated and thus it should be dissipated quickly through printed circuit boards and/or electronic devices.[3] The latest miniaturization of electronic devices and integrated circuits has caused an increase of power densities. The current trend in the field of microelectronic parts requires an epoxy resin with high thermal conductivity for encapsulating these heat-dissipating electronic components. Epoxy resin has a low thermal conductivity, about 0.15 to 0.25W/mK, which can be increased by the addition of particulate inorganic filler materials with a high thermal conductivity. Since the thermal conductivity of the inorganic filler is much larger than that of the epoxy resin, the addition of fillers is an effective way of raising the thermal property of the epoxy resin.[4] Polymer composites filled with particulate i.e polymers filled with highly conductive particulate are coming up to cope with such heat transfer issues with a cost effective way.

1.5 Overview of filler :-

Aluminium Nitride (AlN) is a unique ceramic material that combines high thermal conductivity with high electrical resistivity. "Thermal conductivity" is the ability of a material to transfer heat on application of a temperature gradient across its surfaces. In ceramic powder like AlN, heat transfer is through lattice vibrations in micro level. For heat dissipation applications, a high thermal conductive particle is needed to be reinforced with polymer material. The actual thermal conductivity of a material is influenced by factors that reduce the propagation of lattice vibration. Temperature distribution, impurities, particle size and distribution, grain size and orientation all affect the lattice vibrations and therefore thermal conductivity. AlN with an excellent combination of these unique qualities proves itself a desirable material for making composites for micro-electronics applications.

II. LITERATURE GAP

1. The past research shows that the filler materials are BN, AIN, mixture of AIN and BN,SiliconNitride,Copper and various types of the conductive materials used to improve thermal conductivity of the epoxy composites.
2. In past research size of the AIN particles are same and also AIN embedded with epoxy weight by volume ratio But In present thesis three different types of size AIN particles used to fill with epoxy.
3. In present thesis three sizes AIN used .For each size of AIN three samples prepared with different wt.% percentage of AIN.
4. In past study shape of AIN powder is spherical also in present thesis shape is same but three sizes of AIN particles are used it helps to find out optimum results out of this three sizes.
5. In present study each size having three samples with different concentration of AIN(wt.in grams).

III. RESEARCH METHODOLOGY

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study,Data and Sources of Data, study's variables and analytical framework. The detailsare as follows;

3.1Problem Statement

Heat dissipation in the electronic device is very important. Epoxy material used in printed board circuits but thermal conductivity of the epoxy is very less .Due to this heat dissipation rate is very less board components and board melt . In past research various size particles of AIN used in epoxy composites with mixture of multiple numbers of filler materials. also In past research single AIN particles used for filler but only one size of the AIN particles is used and result find out on basis percentage variation of AIN in epoxy composites. Copper ,Gold, Silver having better thermal conductivity but costly. In past research the the spherical shape AIN embedded with epoxy in cubic form. Different sizes of the AIN powder also affects on thermal properties of epoxy composites but only one size used in past research.

3.2 Aim and Objective

The objectives of this work are given as follows:

1)To investigate effect of micro sized Aluminum nitride on the heat conductivity of epoxy.

2)To find out thermal properties of epoxy composites filled with Aluminum nitrides for different sizes, composition of AlN but same shape by experimentally and ANSYS software.

3)To validate the Experimental results by comparing the results with ANSYS results.

3.3 Methodology

●The composite samples with fixed spherical shape of AIN but three different size of AIN For each size 3 samples made with different content AIN with epoxy composites.

●Samples are made from 10 gm to 30 gm are made by conventional hand-lay-up technique for each size. The samples used are rectangular sheet-shaped.

●The glass fiber one layer added in each samples for strength purpose but glass fiber also affects on thermal properties of epoxy composites. To measure the thermal conductivity of these composite samples thermal heater and thermal laser gun are used.

●One surface of samples is heated with the help of heater at constant temperature and temperature measure at another surface by the thermal laser gun at different locations. Thermal conductivity of each samples calculated by theoretically by using the experimentally obtained temperature difference.

●Each samples tested at different temperature of heater from 40°C to 80°C and other surface temperature measure by thermal laser gun at five different point of sample. All samples are tested at the condition of constant heat transfer rate.

●After experimental testing we calculate thermal properties for each samples at every testing temperature by using obtained output temp.

●After the experimental testing find out the optimum solution for thermal conductivity at highest testing temp 80ºC.

●Also Find out ANSYS results for each samples at Testing temp. 80ºC only. because of the 80ºC is highest Testing temperature. By using the ANSYS software obtained output temp. for each samples we calculate thermal properties at 80°C.

●Validate Experimentally obtained thermal conductivity with ANSYS result. also find out the error percentage between two results.

3.3.1Details of implementation are as follows

In electronic device heat dissipations is big problem because of material used for electronic packaging system like epoxy, various types of polymers having low thermal conductivity already discuss in past study. Due to low thermal conductivity of

epoxy AIN particles used to increase thermal conductivity of epoxy. In past research AIN particles should be same size and shape embedded with epoxy. But in present research we used same shape of AIN with three different sizes of particles. Procedure for making and testing of samples of epoxy filled with AIN particles are as below.

3.3.2 Method of making of Samples

A very simple of composite processing called Hand lay-up technique has been used to prepare physical model. The processing steps are very simple.

- Hand layout technique is used to prepared samples of epoxy composites filled with AIN particles. Samples with dimensions of length 260 mm ,width 100 mm and 5 mm thickness are made
- Firstlymold release spray applied on surface of the mold to avoid steaking of epoxy composites.
- Take amount of epoxy and AIN powder weighed carefully on weighing machine.
- One layer of Glass fiberadd in each sample of composites for strength purpose.
- Epoxy composites samples having contains three different sizes of AIN particles (Information provided by manufacturer 70µm,80 µm,90 µm).For each size having three samples of composites made with different weight of AIN particles (10gm,20gm,30gm)
- Each samples should be five layer of epoxy and one layer of glass fiber. On one layer of epoxy resin AIN powder particles spread uniformly.
- After making of 9 samples of epoxy filled with AIN particles. mold was left at room temperature for 30 hr.
- After 30 hr. samples take for testing.

Table 3.3.2 Designation of materials in epoxy composites

SAMPLES	COMPOSITION [For AIN particles size 70µm,80 µm,90µm]
1	75gm Epoxy+ 75gm Glass fiber + AIN 6.66 wt%(10 gm)
2	75gm Epoxy+ 75gm Glass fiber + AIN 13.33 wt%(20 gm)
3	75gm Epoxy+ 75gm Glass fiber + AIN 20 wt%(30 gm)

Thermal conductivity of composites calculated by using the measurement of temperature taken by using the thermal heater and thermal laser gun(laser thermometer).

3.4Infrared Thermometers

3.4.1 Introduction:-

An infrared thermometer is a device that measures the infrared radiation – a type of electromagnetic radiation below the visible spectrum of light - emitted by an object. The most basic design of infrared thermometers consists of a lens to focus the infrared thermal radiation onto a detector, which converts the radiant energy into an electric signal. This configuration facilitates temperature measurement from a distance, without the need for contact with the object to be measured. The device is useful for measuring temperature under circumstances where thermocouples or other probe type sensors cannot be used.

There are many types of infrared temperature sensing devices available today, including configurations designed for flexible and portable handheld use as well as for mounting in a fixed position to serve a specific purpose.

Fig.3.4.1 Infrared Thermometer

3.4.2 Operating principle of laser thermometer:-

Laser thermometers are actually infrared thermometers. The laser simply provides a means to aim the thermometer. The molecules that make up objects are vibrating constantly; the hotter the molecule is, the faster it vibrates, producing invisible light in the form of infrared energy. Infrared (IR) thermometers measure the infrared energy given off by all objects. To display the temperature, the thermometer converts the infrared energy it measures into an electrical signal, which is then displayed as a temperature.

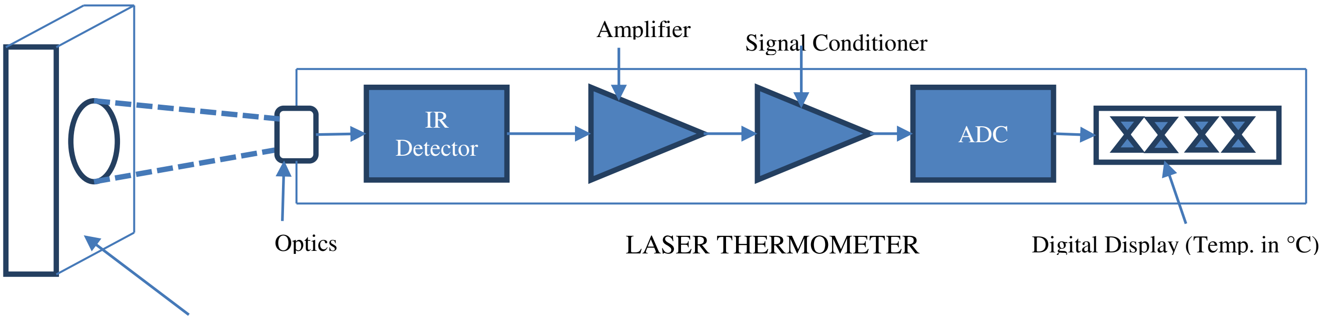


Fig.3.4.2 Operating principle of laser thermometer

3.4.3 Applications of Infrared Thermometers

The major applications of infrared thermometers are given below:

1)Heating and air conditioning – Detection insulation breakdown, heat loss and gain and furnace and duct leakage

2)Industrial/Electrical – Monitoring motor/engine cooling systems performance, boiler operations, steam systems and detection of hot spots in electrical systems and panels

3)Food safety – Checking equipment performance, sanitation and process temperature conditions, and scanning refrigerated display cases, trucks, storage areas and cooling systems

4)Agriculture – Monitoring plant temperatures for stress and animal bedding to detect spoiling.

3.5 Thermal heater [plate type]

Plate type heater used to test the epoxy composites samples. Dimension of heater is 255*105 mm

The specification of heater are as follows:-

Current (I)=5.22 Ampere

Voltage=230 Volt

Heat Transfer Rate(Q)=1200 W.

Fig. 3.5Plate Type Heater

3.6Testing Procedure of epoxy composites samples

Test samples is put on the surface of thermal heater. Heat flows from bottom, passes through the thickness of sample to top, and hence a temperature gradient is established along the thickness of the test specimen. Once the steady state is achieved temperature drop across the test sample is measured by laser thermometer at five different locations on samples surface. Heat transfer rate during the testing of each samples should be constant. Each samples tested at different temperature of heater from 40°C to 80°C and other surface temperature measure by thermal laser gun at five different point of sample. Experimental setup diagram shown below.

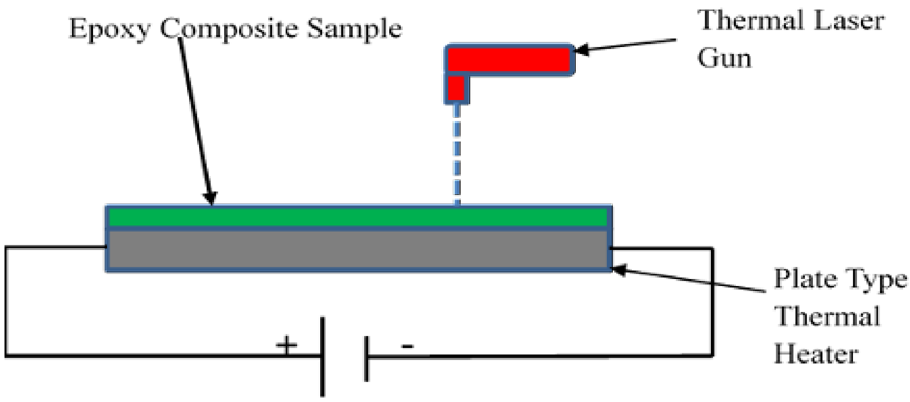


Fig.3.5 Experimental Setup Diagram

For one-dimension heat flow, the equation is given as:

$$Q = kA\frac{T1 - T2}{x}$$

The thermal conductivity of the sample is given as:

$$k = \frac{Qx}{A(T1 - T2)}$$

Thermal resistance of sample is R

$$R = \frac{x}{KA}$$

Thermal conductance(C)

$$\frac{1}{R} = \frac{x}{KA}$$

Heat transfer coefficient (h) is

$$h = \frac{K}{x}$$

IV. RESULTS AND DISCUSSION

The 9 samples of epoxy composites filled with AIN powder with different weight % and size. Three different sizes of AIN are 70µm,80µm,90µm are used. For each size three samples with different weight % of AIN powder prepared. Every samples contains same weight of epoxy and glass fiber. Each Samples should be tested at different temp. from 40ºC to 80ºC.Experimental and ANSYS Results sheet are as follows:-

4.1 Experimental Result Sheet

Table.4.1 Experimental Result Sheet

Experimental Result Sheet										
AIN Powder Size =70 µm										
Sample No.	**AIN Powder Content**	**Heater Temp.T1 in ºC**	**T2 in ºC**	**Q=Heat Transfer Rate in Watt**	**Thickness=x in m**	**Araa of Sheet in metre square**	**Thermal Conductivity K in(W/m.k)**	**Thermal Conductance [KA/X] in W/k**	**Thermal Resistance[x/Ka] in k/W**	**Heat Transfer Coefficient [K/x] W/m2.k**
1	10gm	80	50.4	1200	0.005	0.026	7.79	40.54	0.024666	1559.25
2	20gm		56.26	1200	0.005	0.026	9.72	50.54	0.019783	1944.13
3	30gm		58.5	1200	0.005	0.026	10.73	55.81	0.017916	2146.69
AIN Powder Size =80 µm										
Sample No.	**AIN Powder Content**	**Heater Temp.T1 in ºC**	**T2 in ºC**	**Q=Heat Transfer Rate in Watt**	**Thickness=x in m**	**Araa of Sheet in metre square**	**Thermal Conductivity K in(W/m.k)**	**Thermal Conductance [KA/X] in W/k**	**Thermal Resistance[x/Ka] in k/W**	**Heat Transfer Coefficient [K/x] W/m2.k**
1	10gm	80	52.44	1200	0.005	0.026	8.37	43.54	0.022966	1674.66
2	20gm		57.34	1200	0.005	0.026	10.18	52.95	0.018883	2036.79
3	30gm		60.32	1200	0.005	0.026	11.72	60.97	0.0164	2345.21
AIN Powder Size =90 µm										
Sample No.	**AIN Powder Content**	**Heater Temp.T1 in ºC**	**T2 in ºC**	**Q=Heat Transfer Rate in Watt**	**Thickness=x in m**	**Araa of Sheet in metre square**	**Thermal Conductivity K in(W/m.k)**	**Thermal Conductance [KA/X] in W/k**	**Thermal Resistance[x/Ka] in k/W**	**Heat Transfer Coefficient [K/x] W/m2.k**
1	10gm	80	53.48	1200	0.005	0.026	8.7	45.24	0.0221	1740.34
2	20gm		59.62	1200	0.005	0.026	11.32	58.88	0.016983	2264.66
3	30gm		61.42	1200	0.005	0.026	12.42	64.58	0.015483	2484.06

4.2 ANSYS Results :-

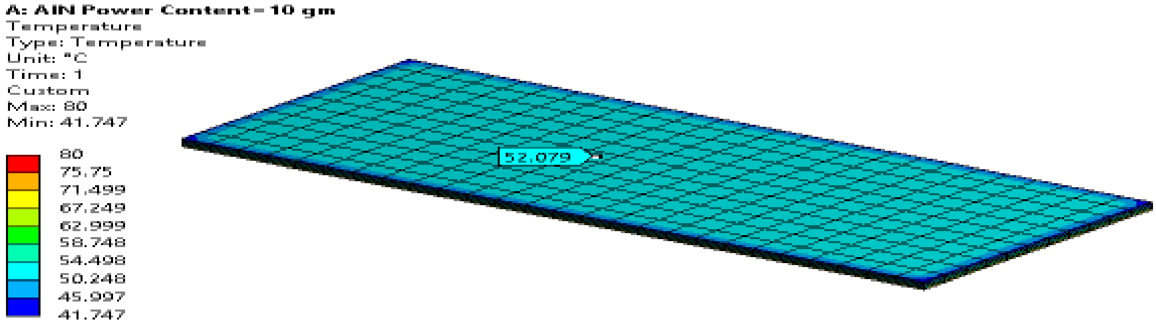


Fig.4.2a Temperature distribution of epoxy composite filled with 10gm AIN powder 70µm

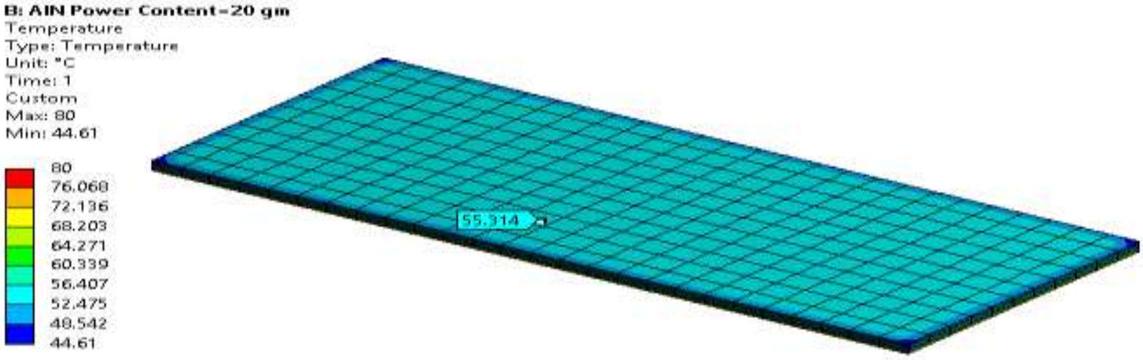


Fig. 4.2b Temperature distribution of epoxy composite filled with 20gm AIN powder 70µm

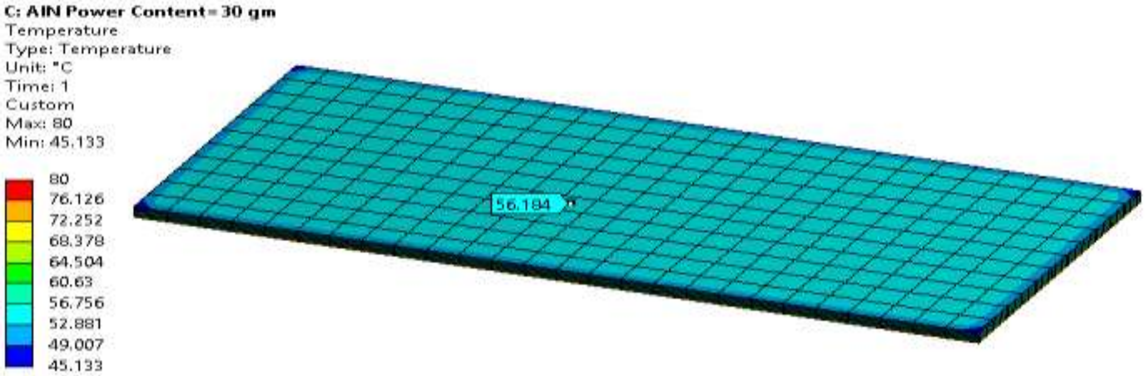


Fig. 4.2c Temperature distribution of epoxy composite filled with 30gm AIN powder 70µm

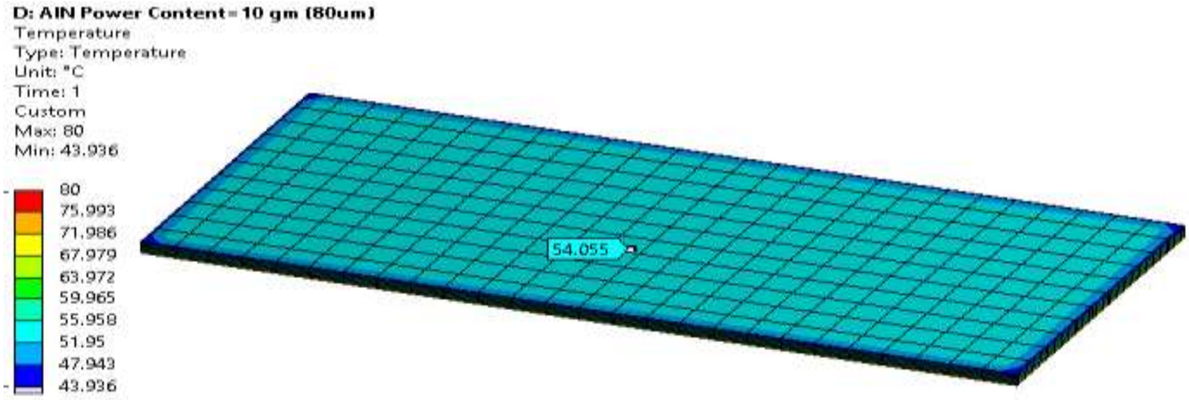


Fig. 4.2d Temperature distribution of epoxy composite filled with 10gm AIN powder 80µm

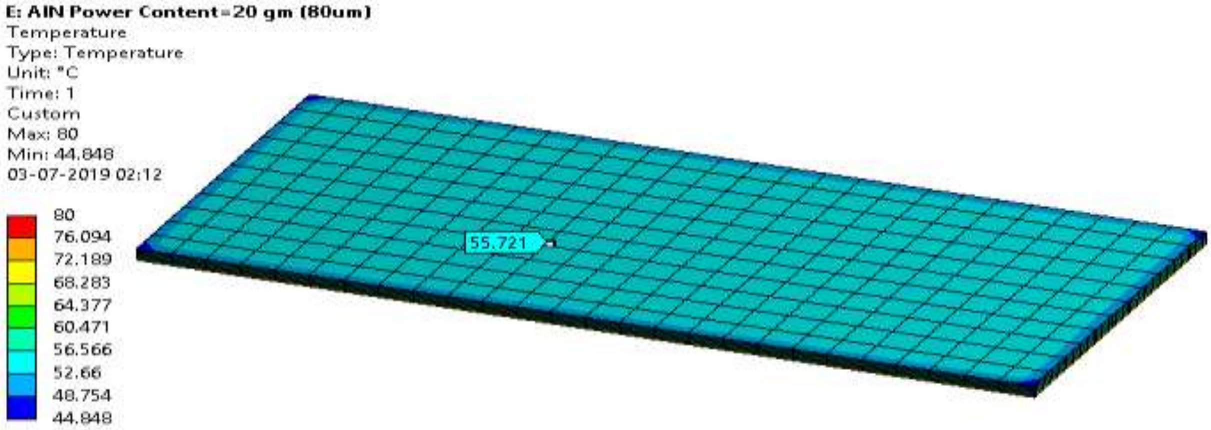


Fig. 4.2e Temperature distribution of epoxy composite filled with 20gm AIN powder 80µm

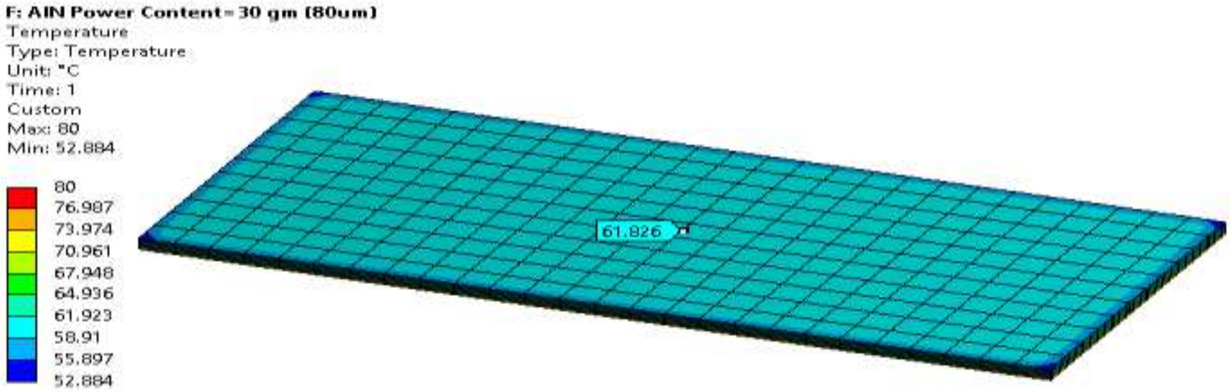


Fig. 4.2f Temperature distribution of epoxy composite filled with 30gm AIN powder 80µm

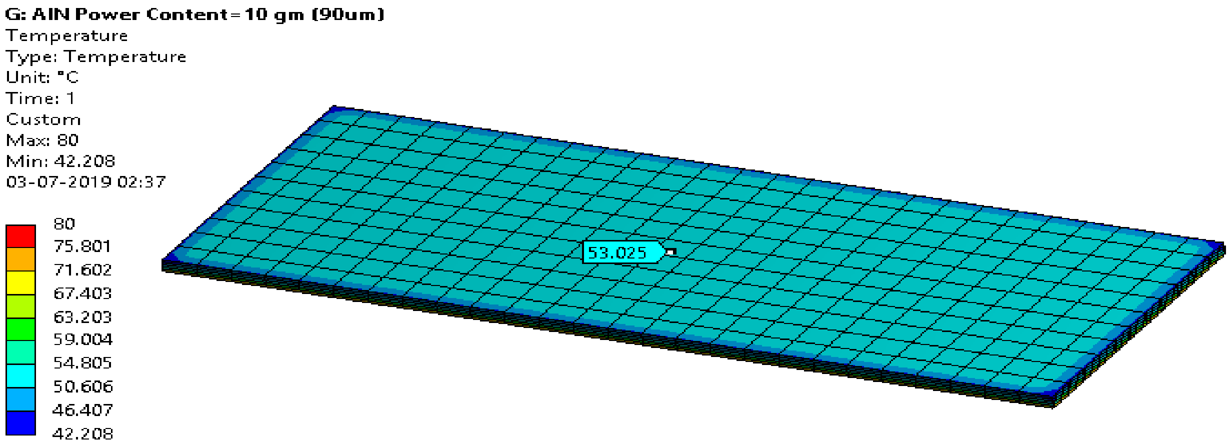


Fig. 4.2g Temperature distribution of epoxy composite filled with 10gm AIN powder 90µm

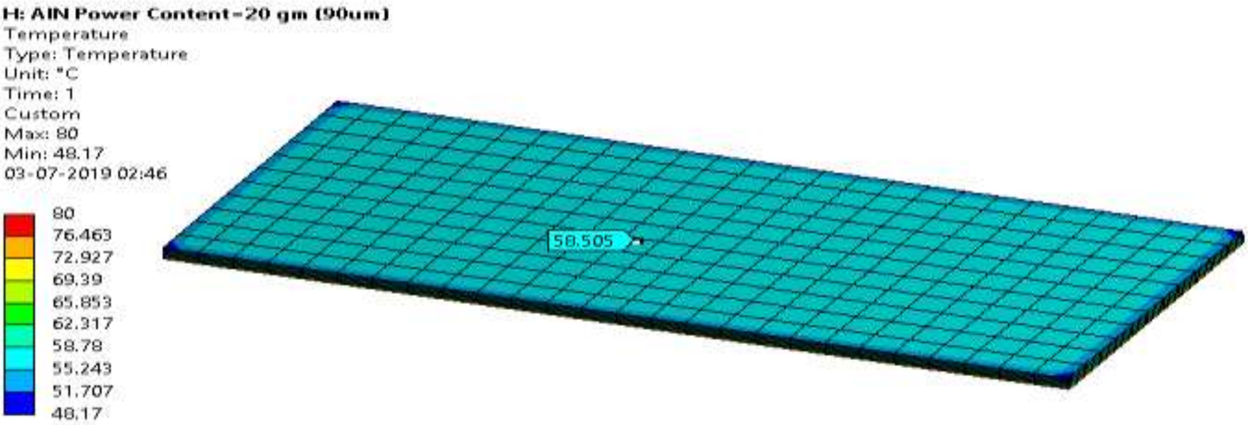


Fig. 4.2h Temperature distribution of epoxy composite filled with 20gm AIN powder 90µm

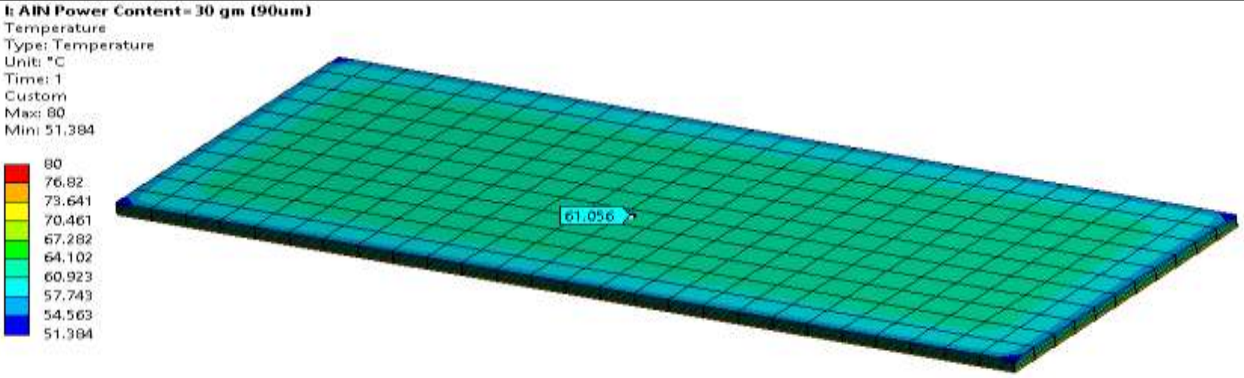


Fig. 4.2i Temperature distribution of epoxy composite filled with 30gm AIN powder 90µm

4.3 ANSYS Results Sheet

Table.4.2 ANSYS Result Sheet

ANSYS Result Sheet										
AIN Powder Size =70 µm										
Sample No.	AIN Powder Content	Heater Temp.T1 in °C	T2 in °C	Q=Heat Transfer Rate in Watt	Thickness=x in m	Araa of Sheet in metre square	Thermal Conductivity K in(W/m.k)	Thermal Conductance [KA/X] in W/k	Thermal Resistance[x/Ka] in k/W	Heat Transfer Coefficient [K/x] W/m2.k
1	10 gm	80	52.079	1200	0.005	0.026	8.26	42.97	0.02326	1653.01
2	20gm	80	55.31	1200	0.005	0.026	9.34	48.6	0.02057	1869.33
3	30gm	80	56.18	1200	0.005	0.026	9.68	50.37	0.01985	1937.6
AIN Powder Size =80 µm										
Sample No.	AIN Powder Content	Heater Temp.T1 in °C	T2 in °C	Q=Heat Transfer Rate in Watt	Thickness=x in m	Araa of Sheet in metre square	Thermal Conductivity K in(W/m.k)	Thermal Conductance [KA/X] in W/k	Thermal Resistance[x/Ka] in k/W	Heat Transfer Coefficient [K/x] W/m2.k
1	10 gm	80	54.05	1200	0.005	0.026	8.89	46.24	0.02162	1778.56
2	20gm	80	55.72	1200	0.005	0.026	9.5	49.42	0.02023	1900.89
3	30gm	80	61.82	1200	0.005	0.026	12.69	66	0.01515	2538.71
AIN Powder Size =90 µm										
Sample No.	AIN Powder Content	Heater Temp.T1 in °C	T2 in °C	Q=Heat Transfer Rate in Watt	Thickness=x in m	Araa of Sheet in metre square	Thermal Conductivity K in(W/m.k)	Thermal Conductance [KA/X] in W/k	Thermal Resistance[x/Ka] in k/W	Heat Transfer Coefficient [K/x] W/m2.k
1	10 gm	80	53.025	1200	0.005	0.026	8.55	44.48	0.02247	1710.98
2	20gm	80	58.505	1200	0.005	0.026	10.73	55.82	0.01791	2147.18
3	30gm	80	61.056	1200	0.005	0.026	12.18	63.34	0.01578	2436.33

4.4 Observations To Be Noticed

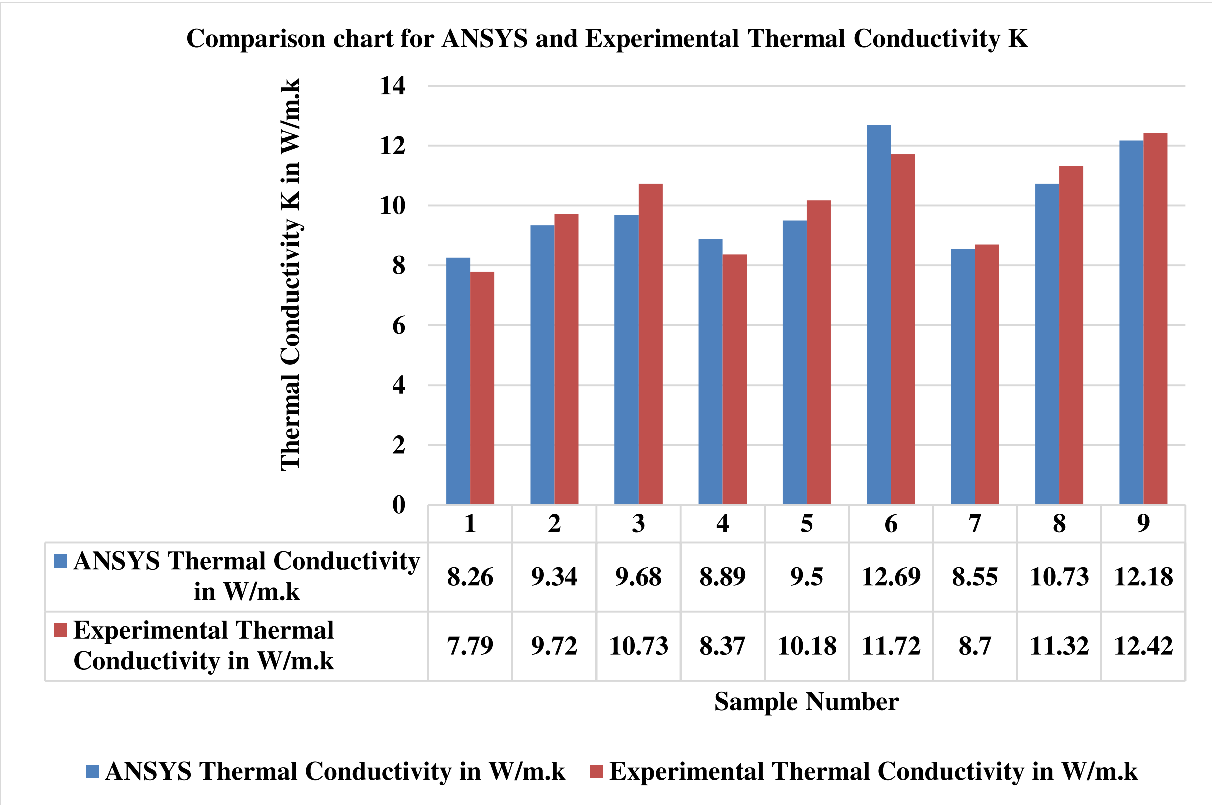
There is a sharp increase in thermal conductivity of Epoxy composite (Epoxy+ Glass Fiber +AIN Powder) when weight of AIN powder with particles size 90 µm is 30gm.The sample with 90 µm Particles size of AIN powder with 30 gm content shows better thermal conductivity out of the 9 number of samples at testing temp. 80ºC.

4.5 Validation

Validation Of Thermal Conductivity At 80c:

Table.4.3 Validation for Thermal Conductivity K

Validation Report				
Sample No.	**AIN Powder Content**	**ANSYS Thermal Conductivity**	**Experimental Thermal Conductivity**	**% Error**
AIN Powder Size =70 µm				
1	10 gm	8.26	7.79	5.69%
2	20gm	9.34	9.72	4.06%
3	30gm	9.68	10.73	10.84%
AIN Powder Size =80 µm				
1	10 gm	8.89	8.37	5.84%
2	20gm	9.5	10.18	7.15%
3	30gm	12.69	11.72	7.64%
AIN Powder Size =90 µm				
1	10 gm	8.55	8.7	1.75%
2	20gm	10.73	11.32	5.49%
3	30gm	12.18	12.42	1.97%



Graph 4.1 Comparison chart for ANSYS and Experimental Thermal Conductivity K

4.6Conclusion

1) From the experimental & analysis results, it is clear that the temperature readings obtained are almost same. So, thermal conductivity is also nearly equal. Thermal conductivity of AIN powder size = 90 µm (30gm) is more.

2) The AIN particles size influence on thermal properties of epoxy composites.Thermal conductivity of epoxy composites increased with increased size of AIN particles.Thermal conductivity of epoxy composites is directly proportional to size of AIN particles.

∴K α Size of AIN particles

3)Also thermal conductivity of epoxy composites increased with increase content of AIN. Thermal conductivity of epoxy composite directly proportional to weight %of AIN in composites.

∴K α wt.% of AIN particles in composites

4)Thermal conductivity of the epoxy composites increased by 34 times with addition of 20%of AIN particles with size 90µm.
5)The heater temp. increases thermal conductivity of epoxy composites goes on decreases. Thermal conductivity of epoxy composites is inversely proportional to heater temperature.

$$\therefore K \propto \frac{1}{T1}$$

4.7 Future Scope
Present work provides a good area of interest for future work investigation to explore thermal behavior of filler material filled epoxy composites in many other aspects.
Other parameters which can be affect the thermal properties positively such as,
1.Effect of different shapes of filler material can be investigated.
2.Effect of filler material on epoxy can be investigated theoretically.
3.Effect of different types of conductive material mixture used to filled with epoxy resin can be investigated.
4.Exploration of various new fillers for the new development of materials which is thermal more conductive with low cost.

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2. Number of Patents

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शासकीय जर्नल

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(57) Abstract :
The present disclosure relates to an IoT based water dispensing apparatus for dispensing water though faucet and shower controlled by GUI parameters like timer and temperature with smart feature for water saving. The apparatus consists of temperature sensor to control the temperature of water outlet by controlling the proportion of hot and cold water mixed. In addition to the electronically controlled valve, the faucet and shower can be manually start and stop using the handles provided. To save water, level measurement sensor and proximity sensors are used for faucet and shower respectively to start and stop water flow to ensure saving of water by reducing water wastage smartly even when the user is not around. The control between sensor and electronically controlled valve is done by the Logic Processor in the electronics control unit. This apparatus can be used in wash basin, bathroom or kitchen individually or both at once.

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IMPACT OF TIME AND COST OVERRUNS ON BUILDING CONSTRUCTION PROJECTS

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ABSTRACT

The construction industry plays an important role in Indian economics. Successful completion of project depends upon two major factor time and cost .Hence, there is need to overcome cost and time overruns in construction projects. The objective of this study is to identify the factors causing time and cost overruns. To achieve this objective, a case study of residential construction project is taken. The questionnaire survey for 50 respondents is carried out. The data analysis is done using relative importance index(RII) method and the factors causing major overruns are found out by ranking method. Suitable measures are suggested to minimize the impact of time and cost overruns on the building construction projects.

Keywords:*Time Overrun,Cost Overrun,Relative importance index,Impact,Construction project*

1. INTRODUCTION

Construction industry plays an important role for the economic development of any country. However this industry is facing severe problems which directly affects the time, cost and quality performances of construction projects. The construction projects are affected by number of factors during construction phase and post construction phase. As a result, successful completion of project within the desired time and cost is become a challenging task.

Cost overrun is described as the ratio of the change in the original contract amount to the original contract award amount. For the ease of comparison, the cost overrun can be converted into a percentage value. Mathematically it can be expressed as:

Cost overrun = Final Contract Amount – Original Contract Amount

Time Overrun is the phenomenon in which the project gets delayed beyond its expected completion time due to certain difficulties i.e. more time is required to finish the project than initially planned. The time overrun variable is defined as the difference between the estimated project duration and the actual time taken to complete the project. Time or Money used unnecessarily is of course 'time' and 'money' wasted.

Time and cost are the lifelines of every project. It is of supreme importance to study, analyze and evaluate the common factors leading to these constraints and suggest the best mitigation measures to overcome time and cost overrun constraints. Hence, an efficient control system must be employed to achieve desired results. Effective and meaningful control must begin at design stage and should be backed up by proper and scientific estimation and data analysis

1.1 Objective of the study:

The main objective of this study is to identify the major causes of delays of building construction projects using a case study in Satara city. Accordingly, possible ways of minimizing them are suggested. It is noted that the clients, consultants, and contractors don't give importance to evaluate the time and cost overruns at the end of project. Also research and studies in this field in Satara are few. The specific objectives of the study are as follows:

1) To study the concept of time and cost overrun from the available literature.

2) To collect data by conducting Questionnaire survey.

3) To carry out data analysis using Relative importance index and thereby ranking of factors using Likert's Scale.

4) To recommend possible Solutions/Prevention to avoid cost and time overrun.

1.2 Literature Survey:

Al-khalil & Al-Ghafly (1999), identify the main causes of delays in construction projects in Saudi Arabia. This research found that contractors considered as 1) Delay in claim settlement 2) Slow decision-making and 3) Delays in progress payments as the most important delay factors. Owners believed that 1) Poor early planning 2) Scope changes and 3) Financial difficulties by the contractors' were the major causes of delay.

Enshassi (2009) found that Construction projects located in the Gaza Strip, Palestine suffer from many problems and complex issues such as unavailability of competent staff, late delivery of materials and equipment, material shortage, waste rate of materials, escalation and fluctuation of material prices, quality of equipment and raw material, delay in progress payment, cash flow of project, cost of variation order, differentiation of currency prices, cost of rework, cost control system, poor site management, poor communication and coordination by owner and other parties, conformance to specification, project complexity.

S.Shanmugapriya & Dr. K. Subramanian [10] (2013), this research were carried out on studying significant factors causing time & cost overruns in Indian construction projects. Questionnaire for the survey was developed based on 76 factors. It was found that 5 most significant factors causing time overruns in Indian construction projects such as:1) Material market rate 2) Contract modification 3) High level of quality requirement 4) Project location 5) Depends on the fresher's to bear the whole responsibility and for Cost overruns the most significant factors were:1) High transportation cost 2) Change in material specification 3) Escalation of material prices 4) Frequent breakdown of construction plants and equipment's and 5) Rework.

Ismail Abdul (2013) found significant factor causing cost overrun in construction project are shortage of labour low productivity level of labours, lack of experience of contractor and subcontractor , equipment breakdown, financial difficulties by contractor, unclear and inadequate detail drawing, design change.

S. Subramani (2014), found that major causes of cost overruns such as:

a. Slow decision making
b. Poor schedule management
c. Increase in material/machine prices
d. Poor contract management
e. Poor design/ delay in providing design
f. Rework due to wrong work

Santosh Kumar Prajapati, Dr.Mukesh Pandey (2016) :This paper presents a study made on causes, effects and controls of change orders in large building construction in Morena city. Response from 50 consultants and contractors working in the field of large building construction were analyzed.The study also concluded that the owner is the major source of changes and that most changes are architectural. Change of plans and material substitution are first causes of change in large buildings. The study also concluded that responses from contractors and consultants agree about the causes, effects and controls of change orders and recommended to include the owner in future studies to verify the reasons behind changes made by the owners.

Dr. N K Gupta (2018): The main aim of this paper is to identify the major reasons for cost overruns in Residential construction projects of Western part of Pune, India as well as the critical success factors that are helping to avoid the cost overruns.. Statistical method (Relative Importance Method) was used to analyze the data. Investigation on the causes of cost overrun involves 44 common factors identified through the literature review and discussion with the experts. The finding of the paper will help the civil engineers to act on critical causes and further try to reduce cost overrun of project.

2. RESEARCH METHOD

Research method is the systematic stepwise process to carry out any survey work. This study is carried out through several phases that include literature reviews, research papers, data collection, discussion and conclusion. From the literature review 40 influencing factors were identified causing for time and cost overrun in residential construction projects.

For this purpose, a case study of residential construction project located in Satara city was selected.The data collection was carried out through questionnaire survey. The questionnaires were distributed to contractors, consultants and the staff involved in the respective project.The respondents involved in the survey had several years of experience in handling residential construction projects. Assessment of causes of time & cost overruns was carried out using 4-point Likert scale from 1 to 4 representing can be neglected, low influence, medium influence & high influence respectively. Data analysis was done calculating Relative Importance Index (RII) by following formula, adopted from Memon et al. 2002 as RII is best suitable method to do the ranking analysis.

$$RII = \frac{\sum_{i=1}^{4} W * X}{A * N}$$

Where, RII = Relative Importance Index
W = Weighting given to each factor by respondents and its ranges from 1-4
X = Frequency of it response given for each factor A =Highest weight (i.e. 4 in case)
N = Total no. of participants.
From RII results, the ranking for different factors was determined to discover the influencing factors causing time overrun in construction projects.

3. RESULTS

3.1 Data Collection:

For data collection, a total of eighty(80) sets of questionnaires were sent to the people working in the organization of the selected residential construction site located in Satara . Out of 80, fifty (50) completed sets were received back which were evaluated with Microsoft Excel program in order to find the importance factors causing time & cost overrun in construction.Significance of major influencing factors causing construction time & cost overrun was identified in the questionnaire survey. Respondents were asked to rank the factors with 4-likert scale as:

1. Can be neglected
2. Low influence
3. Medium influence
4. High influence

Table 1. Details of case study

SR NO	NAME	DETAILS
1	Name of the project	Residential building(ADVAIT RESIDENCY)
2	Name of the construction company	Vighnaharta Builders and Developers
3	Location	Karanje Peth,Satara
4	Planned start date	05-Oct-18
5	Planned finish date	16-Apr-19
6	Actual start date	25-Oct-18
7	Actual finish date	18-May-19
8	Delay in start date	20 days
9	Delay in finish date	24 days
10	Planned Cost	1,60,00,000 Rs
11	Actual Cost	1,73,11,000Rs
12	Cost Overrun	13,11,000Rs

3.2 Data Analysis:

Data were analysed by using Relative Importance Index method (RII); the factors were ranked by dividing the factors in various phases such as before construction, during construction, external reasons, management problem, and shortage in resources.

Following table shows the analysis of data by RII method and giving the ranks to each influencing factor. In table no.2, C & T means factor caused for Cost overrun & Time overrun.

Table 2. Data Analysis by RII

	INFLUENCING FACTORS	Weight (1-4)				N	WX	RII	Rank
		1	2	3	4				
	BEFORE CONSTRUCTION								
1	Inaccurate estimate of cost and time (C & T)	8	12	18	19	50	162	0.81	1
2	Poor bidding process (T)	19	9	14	8	50	111	0.555	8
3	Faulty designs (C & T)	8	11	13	18	50	141	0.705	2
4	Intentional low-bidding (C)	4	19	24	3	50	126	0.63	7
5	Improper site planning (T)	8	11	17	14	50	137	0.685	3
6	Delay in Approval of Drawings (T)	10	10	14	16	50	136	0.68	4
7	Land acquisition problem (T)	9	12	16	13	50	133	0.665	6
8	Errors in Contract Documents/ Schedule (T)	3	16	24	7	50	135	0.675	5
DURING CONSTRUCTION									
9	Redesigning (C & T)	5	12	27	6	50	134	0.67	3
10	Disputes and clashes on site (T)	8	18	12	12	50	128	0.64	4
11	Use of costly material/poor market survey (C)	8	13	15	14	50	135	0.675	2
12	Poor quality of work/ Rework (C & T)	10	5	15	20	50	145	0.725	1
13	Non adherence to the contract conditions (T)	6	27	13	4	50	115	0.575	7
14	Primitive technologies used (T)	15	10	9	16	50	126	0.63	5
15	Location of site/ lack of proper access(T)	11	16	18	5	50	117	0.585	6
EXTERNAL REASONS									
16	Irregular Flow of Finance (C & T)	2	10	27	11	50	147	0.735	1
17	Fluctuation in Price (C)	8	9	13	20	50	145	0.725	2
18	Cut in Water & Electrical Supply (T)	20	8	6	16	50	118	0.59	8
19	Weather Conditions (T)	3	24	14	9	50	129	0.645	7
20	Political & Other External Influence (T)	9	10	16	15	50	137	0.685	5
21	Wire/ Theft of Materials (T)	9	15	12	14	50	131	0.655	6
22	Government Influence (T)	12	9	8	21	50	138	0.69	4
23	Work Stay Due to Act of God (T)	8	10	16	16	50	140	0.7	3
MANAGEMENT PROBLEMS									
24	Lack of Experience (T)	8	12	15	15	50	137	0.685	7
25	Delay in Decision by Client (T)	12	10	8	20	50	136	0.68	8
26	Delay in Decision by Architect (T)	13	7	13	17	50	134	0.67	9
27	Delay in Decision by Consultant (T)	11	10	5	24	50	142	0.71	4
28	Delay in Decision by Contractor (T)	10	12	6	22	50	140	0.7	6
29	Delay in Payment for Work Order	4	8	4	34	50	168	0.84	1

	(T)								
30	Inadequate Safety Measures/ Accidents (C & T)	5	16	12	17	50	141	0.705	5
31	Lack of Supervision (C & T)	8	20	5	17	50	131	0.655	10
32	Lack of Co-ordination between Different Parties involved (C & T)	5	15	11	19	50	144	0.72	3
33	Lack of Efficient Staff (T)	7	6	19	18	50	148	0.74	2
SHORTAGE IN RESOURCES									
34	Delays in Purchasing of Materials (C & T)	10	12	8	20	50	138	0.69	4
35	Delay in Supply of Material (T)	5	15	12	18	50	143	0.715	3
36	Delay in Procurement/ Supply of Equipments (T)	8	18	14	10	50	126	0.63	6
37	Equipment Breakdown/ Non Availability (T)	7	22	11	10	50	124	0.62	7
38	Improper Material Management (T)	6	14	8	22	50	146	0.73	1
39	Improper Labour Management (T)	4	14	16	16	50	144	0.72	2
40	Labour Strike (T)	12	15	4	19	50	130	0.65	5

4 DISCUSSION OF RESULTS

4.1 Before Construction

Based on the ranking, Figure 1 shows the top three most influencing factors caused for time and cost overrun before construction were:

a. Inaccurate estimate of cost and time(RII= 0.81) (C & T)
b. Faulty design (RII= 0.705) (C & T)
c. Improper site planning (RII= 0.685) (T)

4.2 During Construction

From fig. 2, based on ranking, during construction the top three most significant factors caused for both cost & time overrun were:

a. Poor quality of work / rework (RII-0.725) (C & T)
b. Use of costly material/poor market survey (RII-0.675) (C)
c. Redesigning (RII- 0.670) (C)

4.3 External Reasons

From figure 3, based on ranking, following are the top three external significant factors caused for both cost & time overrun were:

a. Irregular Flow of Finance (RII-0.735) (C & T)
b. Fluctuation in Price (RII-0.725) (C)
c. Work stay due to Act of God (RII-0.7) (T)

4.4 Management Problem

From Figure 4, based on ranking, the top three factors caused for time & cost overrun regarding management problem were:

a. Delay in Payment for Work Order (RII-0.840) (T)
b. Lack of Efficient Staff (RII-0.740) (T)
c. Lack of Co-ordination between Different Parties Involved (RII-0.720) (C & T)

4.5 Shortage in Resources

From Figure 5, based on ranking, following top three factors caused for cost and time overrun because of shortage in resources were:

a. Improper Material Management (RII-0.730) (T)
b. Improper Labour Management (RII-0.720) (T)
c. Delay in Supply of Material (RII-0.715) (T)

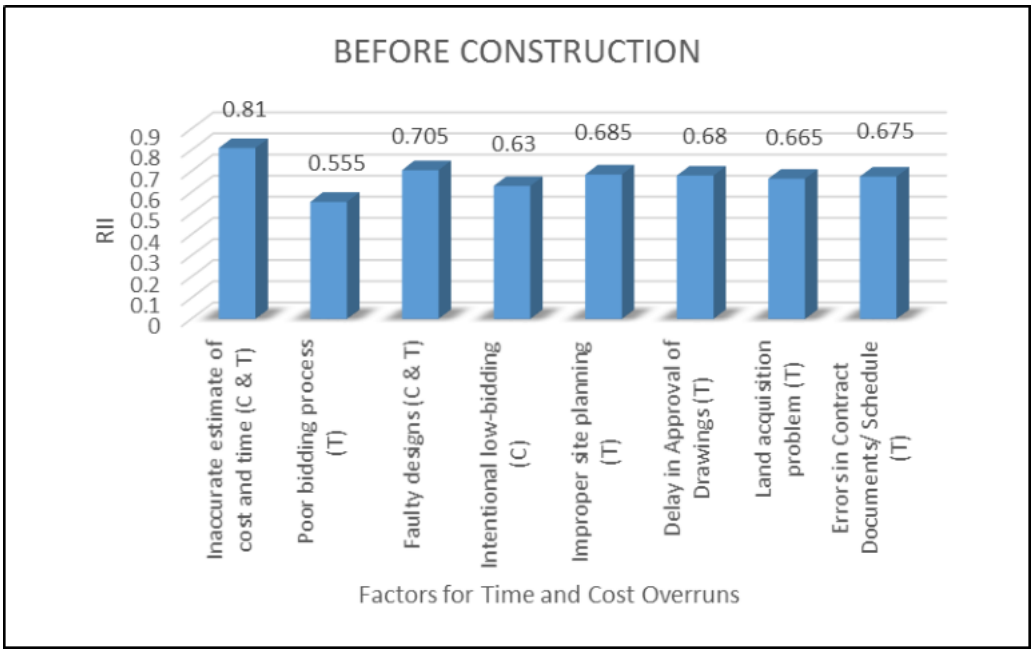

Figure 1. RII of influencing factors before construction

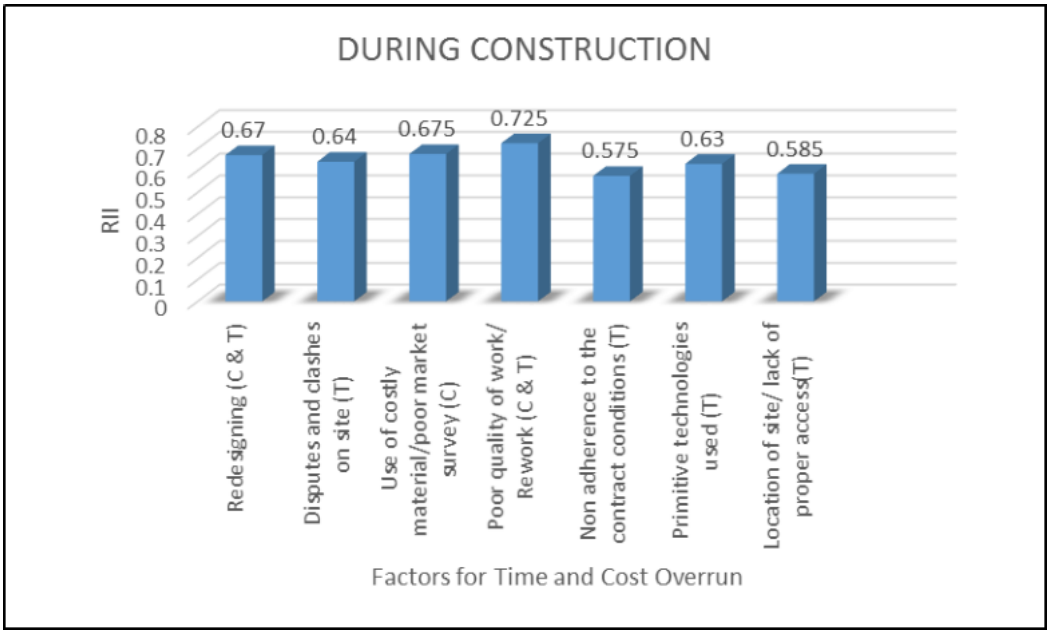

Figure 2. RII of influencing factors during construction

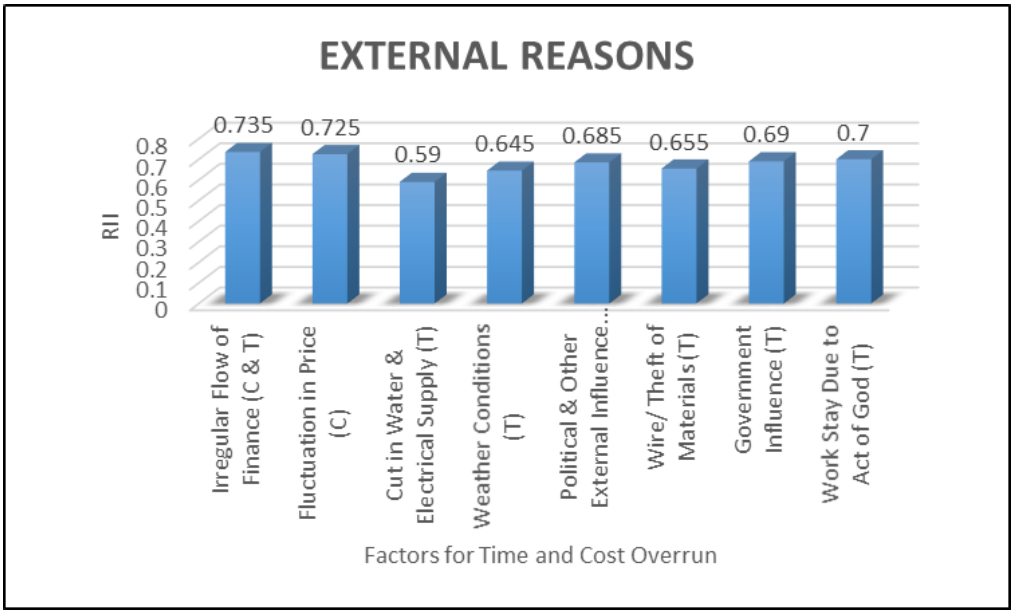

Figure 3. RII of influencing factors due to external reasons

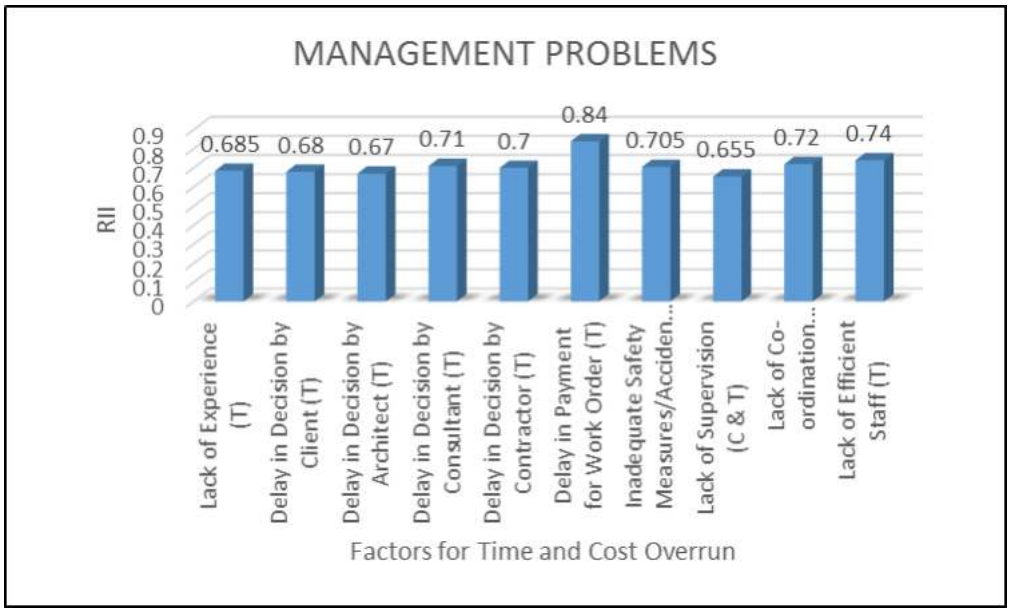

Figure 4. RII of influencing factors due to management problems

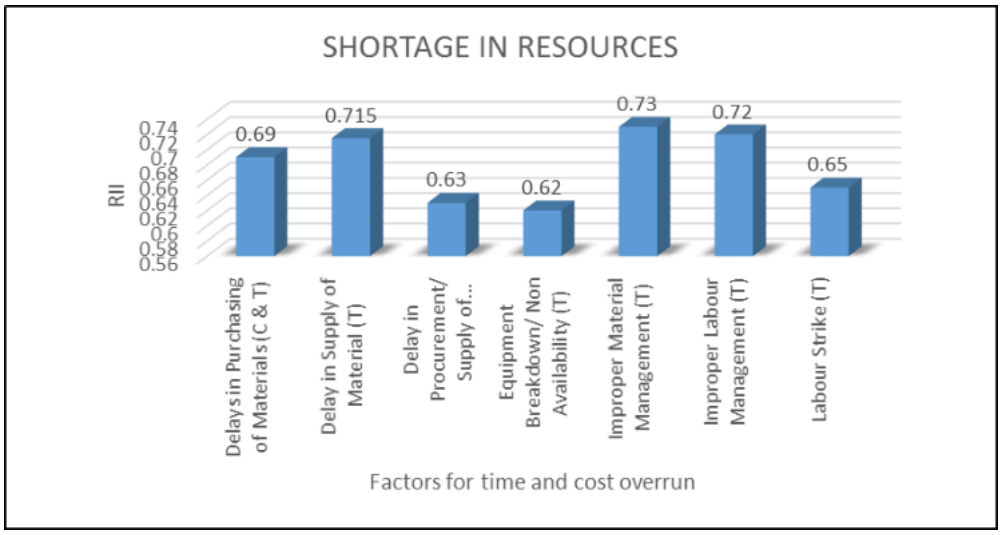

Figure 5. RII of influencing factors due to shortage in resources

5 CONCLUSIONS

After doing the analysis using case study, most influencing factors caused for time & cost overruns are provided. The relative importance index (RII) can be used as an effective tool for analysis on time & cost overruns.The following learnings with some remedial measures for the observed causes of time & cost overruns are:

- Most of the labours working in construction site are coming from other state and having a poor knowledge regarding the new techniques in construction. Proper training programs can be adopted to increase the efficiency and skill of labours.
- Finally management also needs to increase the efficiency of works by conducting labour welfare, recognition programs for the motivation of labours.
- It will not possible to execute the construction projects within the desirable time and cost without sound implementation of planning. Hence, management needs to focus on effective and sound planning.
- The project manager should record whether all the activities are completed according to the estimated schedule weekly and then take the sign of the contractor. This practice may reduce time as well as cost overrun considerably.
- Industrial engineering and management techniques such as method study, value engineering, etc., can help in reducing time duration of activities and giving up of unnecessary items/activities
- 'Monitoring groups' can be established, which may consist of representatives of the project as well as inter-linked agencies and the parties concerned. The groups could monitor and review the progress of the complete system -the project and the inter-linked activities/projects.

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International Congress and Exhibition "Sustainable Civil Infrastructures"

GeoMEast 2019: **Innovative Solutions for Soil Structure Interaction** pp 47–53

Impact Analysis of Soil and Water Conservation Structures- Jalyukt Shivar Abhiyan- A Case Study

Ajay Kolekar, Anand B. Tapase, Y. M. Ghugal & B. A. Konnur

Conference paper | First Online: 01 November 2019

Part of the Sustainable Civil Infrastructures book series (SUCI)

Abstract

In the state of Maharashtra, civilians from 188 talukas were facing the drought-like situations till 2014–15. The groundwater level was lowered by 2–3 m due to inadequate and uncertain rainfall. To overcome the situation, the state government

started to water and soil conservation works under Jalyukt Shivar Abhiyan scheme. In rural areas, various works like chain cement Nala bandh, desilting the reservoirs, repairs to K. T. weir bandhara, deep continuous contour trenches, compartmental bunding were carried out. As per the information received from the Water Conservation Department, more than 8000 crores spent in the last 4 years on this project. The expenditure is made village wise wherein from the data obtained it is noted that in around 15460 villages have received fund and 100% works were found complete, 80% works in 821 villages were found complete, 50% of works were found complete in 410 villages, 30% of works were found complete in 2,922 villages but still 2395 have still to start the work. The paper focuses on correlating the funds spend and the impact of various soil and water conservation works. Sample villages were assessed by conducting a survey at ground level. It is observed that in the number of villages the groundwater table was raised resulting in charging the wells from the nearby area. Conventional crop pattern was found improved with increased yield.

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AGCE Rainwater Harvesting System

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Abstract— **Water scarcity is serious problem throughout the world for both urban & rural community. The conventional water sources namely well, river and reservoirs, etc. are inadequate to fulfill water demand due to unbalanced rainfall, while the rainwater harvesting system investigate a new water source. The aim of the paper is to use rainwater and thus taking close to the concept of nature conservation. In this paper, the rain water harvesting (RWH) system is analyzed as an alternative source of water at campus of Arvind Gavali College of Engineering, Satara in the state of Maharashtra, India. The expected outcome of the project is the development of rainwater harvesting system for catchment area of campus from terrace. The developed system satisfies the social requirements and can be implemented in rural areas by considering almost all the technical aspect.**

Keywords- Harvesting, Cistern, Runoff, Drainage, etc

1.0 Introduction

Urbanization, industrial development & increase in agricultural field & production have resulted in overexploitation of groundwater & surface water resources and resultant deterioration in water quality. The aim of the present project is to use rainwater and thus taking close to the concept of nature conservation. In this project, the rainwater harvesting (RWH) system is designed as an alternative source of water at campus of Arvind Gavali College of Engieering, Satara (AGCES) in the state of
Maharashtra, India.

The expected outcome of the project is the development of rainwater harvesting system for catchment area of campus from terrace area of college building. The result analysis shows that the proposed RWH system is having the storage 3641040 lit/year and construction cost of Rs.3.65 lakhs respectively and is reasonably well in comparison with conventional water sources. The developed system satisfies the social requirements and can be implemented in rural areas by considering almost all the technical aspect.

A Rainwater harvesting system comprises of components for– transporting rainwater through pipes or drains, filtration, and tanks for storage of harvested water. The details of the components of rainwater harvesting system have shown in figure 1.

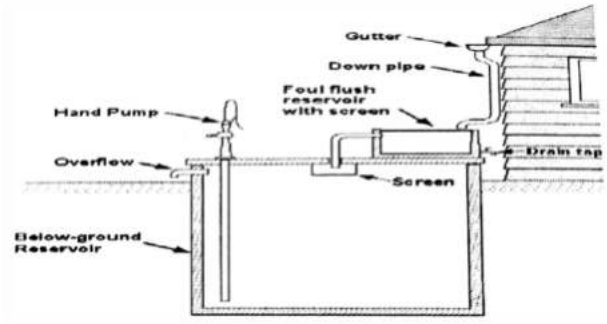

Figure 1: Components of Rainwater Harvesting System

2.0 Literature Survey

Following are the literature that we surveyed before our work for paper:

Boller, M- Water Science Technology

He did the tracking of heavy metals and revealed the sustainability deficits of urban drainage systems.

Clark, S.E., K.A. Steele, J. Spicher, C.Y.S. Siu, M.M. Lalor, R. Pitt, J.T. Kirby.- Irrigation and Drainage Engineering

They found the roofing materials' contributions to storm water runoff pollution.

Hicks, Bill.- Sustainable Water Management.

They worked on A Cost Benefit Analysis of Rainwater Harvesting at Commercial Facilities in Arlington County, Virginia.

Pitt, R., Clark, S., Talebi, L., Bean, R.- Water Environment Research

They tudied on Storm water Non-Potable Beneficial Uses and Effects on Urban Infrastructure.

3.0 Comparative Study

Fig.2 Top View of Terrace Area AGCE, Satara

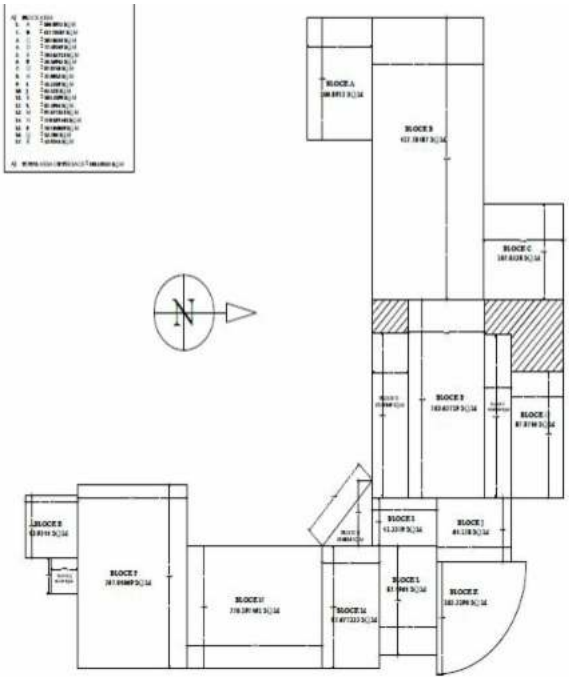

Fig.3 Terrace Plan for Arvind Gavali College of Engineering, Satara

3.1 Existing Method

Recent rainwater harvesting systems (e.g. rain barrels) are typically small volume systems designed to capture rooftop runoff. Due to their smaller sizes and ease of siting, passive systems are generally installed at grade, making impact from sunlight on the stored water a consideration. Direct and indirect sunlight will act as a catalyst for algae growth in the cistern, so exposure to sunlight should be limited where possible.

3.2 Proposed technology:

Active rainwater harvesting systems (e.g. cisterns) are larger volume systems. They capture runoff from roofs or other suitable surfaces (e.g., terraces, walkways, grassed areas and with proper pre-treatment, parking lots), provide water quality treatment, and use pumps or sufficient head to supply water to a distribution system. Cisterns may be fabricated from opaque materials to limit penetration of light and resulting promotion of algae growth.

4.0 Future Scope

- We can go for the future scope with particular focus on characterizing the current state of the practice in the areas of: (1) water conservation, (2) storm water volume and pollutant load reduction, (3) code and administration considerations, and (4) cost factors.

- One can use for site specific applications of water reuse through storm water capture. This includes project specific information including: type of demand or use (i.e. irrigation, toilet flushing, etc.), type of project (i.e. public or private), whether the project is new construction or a retrofit, key project benefits, and, where available, projected water savings.

5.0 Cost Estimation

SL. NO	PARTICULARS	SPECIFICATIONS	QUANTITY	PRICE IN RS
1	PVC PIPES	HORIZONTAL LENGTH (25 MM DIA.)	TOTAL LENGTH IS 155.74M RS. 142/M	22115
		VERTICAL LENGTH (25 MM DIA.)	TOTAL LENGTH IS 192.20M RS. 142/M	27792
		TOTAL COST		49407
2	WATER TANK	EXCAVATION	14.15 CU.M RS. 300/CU.M	4245
		BBM	28.81 CU.M RS. 1112/CU.M	32036
		PCC (1:4:8)	24 CU.M RS. 6245/CU.M	149880
		TOTAL COST		186161
3	CEMENT, SAND & COARSE AGGREGATE	ALL PARTICULARS USED FOR THE OVERALL WORK.	12.46 CU.M RS. 4377/CU.M	54570
4	PLASTER WORK	INCLUDING INTERNAL & EXTERNAL PLASTER.	28.8 CU.M RS. 900/CU.M	25920
			TOTAL COST IN RUPEES	**316058**

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AGCE Amphitheatre

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***Abstract*— This project deals with the analysis and design of the Amphitheatre. Planning and designing with cost estimation are enclosed in this report. Area and other specifications are taken from IS 2526:1963 (Code of practice for acoustical design of Auditorium and conference halls) and NBC (National Building Code). Design and analysis is done manually and the results are verified using Autodesk REVIT Architecture. We have used the AUTO CAD for planning.**

Keywords- Acoustic, Analysis, Slab, Auto Cad , Revit ,etc

1.0 Introduction

Amphitheatres are structures that have been used for entertainment and performances since the ancient Greek and Roman times. In order to develop the design of an amphitheatre, there are many factors that must be accounted for. Some of the considerations for the amphitheatre include the size, orientation, acoustics, stage, seating, and lighting. The goal of this project named design of amphitheatre is to
develop design solutions for the development of an amphitheatre, stage and seating arena for Arvind Gavali College of Engineering, Satara. This project represents layouts of amphitheatre, stage and designs as well as cost estimates. An amphitheatre is a space built to enable an audience to hear and watch performances such as theatres. Amphitheatre, Conference hall, Library is necessary for an Engineering college. In Arvind Gavali College of Engineering, Library, Conference hall are located at different locations and also there is no special arrangements for Amphitheatre. This project reports on the design of Amphitheatre in one separate block. All structural components for the building such as retaining walls, steps, seating space, stage etc are analyzed and designed.

1.1 Acoustical Requirements

- Halls Used for Speech -The clarity of speech is most important in this case. Optimum clarity depends on:
  1 correct reverberation time,
  2 absence of echo,
  3 correct loudness level at all parts of hall.
- Halls for music - Adequate reverberation is important to lend proper blending and fullness of music. The
  reverberation time is required to be higher than for
  halls meant for speech only.
- General Purpose Halls Used for Both speech and music- The reverberation time should be in-between that provided for in halls for music and speech.
- Cinemas (Sound Picture halls) - In view of the fact that a certain amount of reverberation is already present in the recorded sound, the reverberation time required in this case is lower than that required.

- Open-Air Auditoriums and Conference halls- While the general acoustical requirements are similar to those specified for halls additional requirements which arise are dealt with in 10.

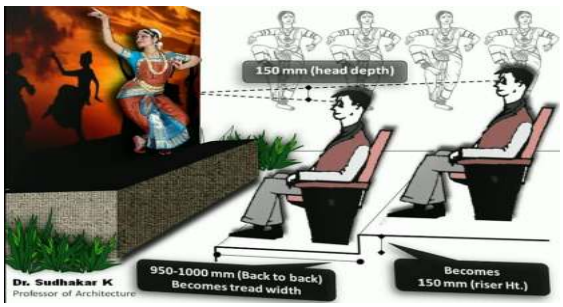
1.2 General Principles of Design

1.2.1 Seats

Seats should be staggered sideways in relation to those in front so that a listener in any row is not looking directly over the head of- the person in front of him .This is particularly important for halls where the audience provides the major part of the required sound absorption.

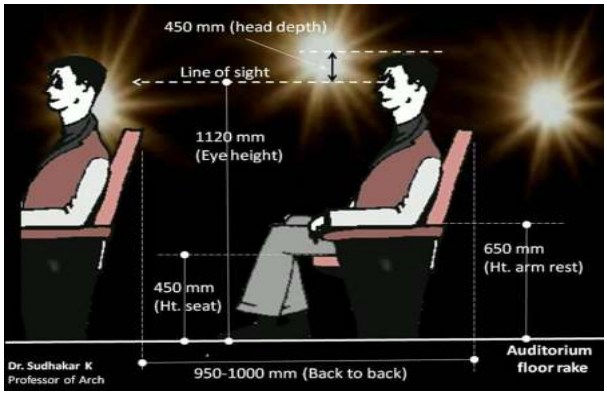
1.2.2 Sitting Arrangements

Seating arrangements in an auditorium seating layout (or assembly space) will either be identified as "multiple-aisle" *or* "continental.



1.2.3 Sitting Dimensions

The average seat width has grown from 450 mm to 650 mm, a grow of 12.7% that is related to a growing
human size as "Theatre Projects Consultants"



2.0 Literature Survey

Howard G. Latham, The signal to noise ratio for speech intelligibility – An Auditorium Acoustics design index

The Signal-to-Noise Ratio devised by Lochner and Burger contributed an objective design index for predicting
speech intelligibility. Their index provided a measure of useful and detrimental reflected speech energy according to the integration and masking characteristics of hearing, and enabled predictions to be made from impulse measurements
in models. However, it was necessary to extend the Signal-to-Noise Ratio theory to account for the effect of fluctuating
ambient background noise on speech intelligibility.

Howard G. Latham, The Measurement of Quality in Auditorium Acoustics by Subjective Scaling Methods - A Review of Developments in Theory and Practice

The effects of reflections: The terms 'reflection' and 'echo' have sometimes been confused, in that any perceptible reflection was called an 'echo'. It could be useful to identify three types of reflection by their subjective effects in complex sound fields:

- Imperceptible but contributing towards sound impression.
- Perceptible but not disturbing, and not perceived as an echo or new source.
- Perceptible and disturbing.

The threshold of perceptibility has been defined as the level at which 50 per cent of subjects noticed a difference in the sound field. The critical level of a reflection was determined when 50 per cent of listeners were disturbed.

Chan H. Haan & Fergus R. Fricke, Statistical Investigation of Geometrical Parameters for the Acoustic Design of Auditorium

Volume/seat: Sabine la showed that the reverberation time of an auditorium is directly proportional to the room volume and inversely proportional to the total absorption in the auditorium. As the total absorption is largely dependent on the number of seats in the auditorium the reverberation time will be dependent on the volume/seat ratio.

3.0 Methodology

Fig.1 Location of AGCE Amphitheatre

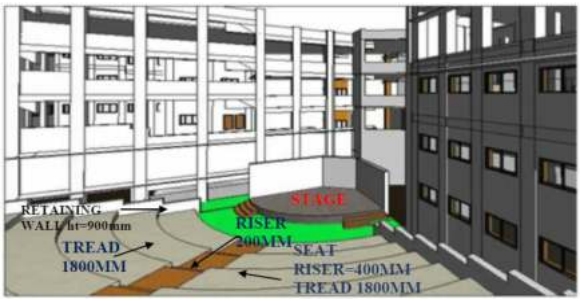


Fig.2 Components of AGCE Amphitheatre


Fig.3 3D Side View of Seating Arena


Fig.4 3D Front View of Seating Arena

The design and execution of Amphitheatre for AGCE, Satara includes following:

1. Surveying of the site
2. Design & estimate of amphitheatre
3. Execution work of amphitheatre

With above literature it is found that the design of amphitheatre can be developed with the qualitative and quantitative approach for the project under consideration. This project mainly aims to explore the economic benefit of amphitheatre and the methodology has been demonstrated through application to the Arvind Gavali College of Engineering, Satara in the state of Maharashtra, India.

4.0 Results and Discussions

The seating area might look like the stone steps outside the central library. Riser heights should be 400mm. The tread width should be 1800mm. The stage is half circular in shape having radius of 7000mm. The height of the stage GL is 1200mm. The stairs provided to the stage have riser of 600mm and the tread of 300mm. The details of the components of amphitheatre have shown in figure 2.

Design of amphitheatre for AGCE, Satara campus is done using manual design and planning as well as computer software (Autodesk AUTOCAD). The estimate has been calculated by using manual calculations as well as computer software (MS Excel).


Fig.5 3D View of Retaining Wall

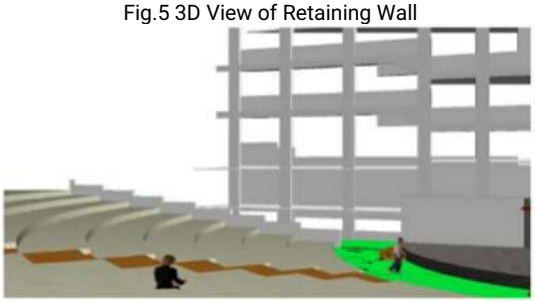
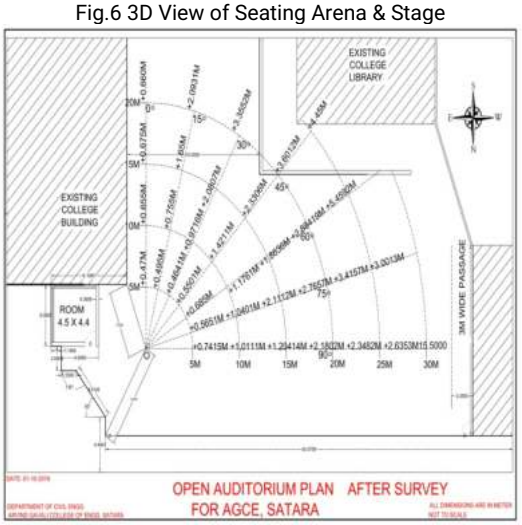
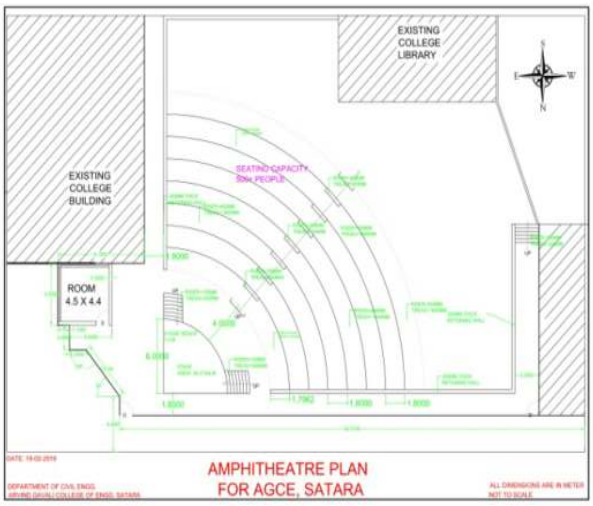


Fig.6 3D View of Seating Arena & Stage





5.0 Conlcusions

Design of amphitheatre of AGCE, Satara campus using Geographic Information System (GIS). For this we took the sloping area of campus from Central library frontage to annex point of the college building. Demarcated and Calculated area by using GIS. The slope of the site is being checked by Theodolite. Analyzed the potential of seating area as well as the space for sufficient Stage and suggested suitable locations and also measurements for the design of Amphitheatre.

6.0 Acknowledgement

We would like to express gratitude to our advisors Dr. Thombare V. R. Sir for their continued guidance and support throughout the course of the paper. We would also like to thank Dr. Pharande V. A. Sir from Arvind Gavali College of Engineering, Satara for giving us the opportunity to work on this paper.

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"A STUDY ON HOLLOWCORE FOAM CONCRETE WALL"

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Abstract-

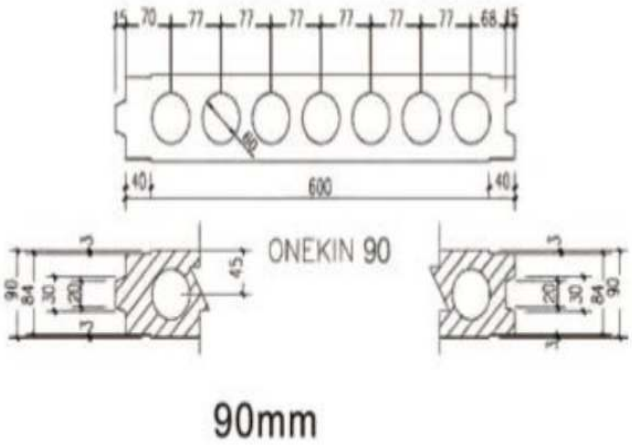
Now a days the construction time, improving the quality of concrete work, durability and cost of construction of any structure plays important roll to compensate the cost of project. There are number of new technique and innovative method used, hollowcore foam concrete wall is one of them. Foam concrete is either a cement paste or mortar, classified as cellular light weight concrete, in which air voids are entrapped in mortar by suitable foaming agents. In this study, we are carried out mechanical properties of cellular light weight concrete wall, which made from ordinary Portland cement, fly ash, water and foaming agent admixture .This building methodology for low cost housing and economical advantages achieved by its adoption.

Key words: **Foamed concrete, Cellular lightweight concrete, Fly ash, Foaming agent, Hollowcore wall, Mechanical properties.**

INTRODUCTION:

Foamed concrete is produced by the mixing of Portland cement, water and foam. The foam is produced with the help of a foaming generator by using foaming agent. The air content is typically between 30 to 80 percent of the total volume. The bubbles vary in size from around 0.1 to 1.5 mm in diameter.

Hollowcore wall is an environmental-friendly panel which is widely used in wall construction, especially wall partition. It is a new type of non-flammable material made of lightweight materials.



When compared with other similar materials, a number of benefits such as completely green material and no asbestos, higher fireproof, sound installation, easier decoration, and lower the total cost of the project.

Fly ash is fine powder that is a byproduct of pulverized in electric generation power plant. Fly ash is pozzoloan, a substance containing aluminous and siliceous material that form cement in the presence of water. When mixed with water and lime, fly ash forms a compound similar to Portland cement. This makes fly ash suitable as a prime material in blended cement, mosaic tiles, and hollow blocks, among other building material. When using concrete mixes, fly ash improves the strength and segregation of the concrete and makes it easier to pump.

1.1 Materials:

1.1.1 Cement:

Concrete is the most used material in the world because of its available at cheaper price and large quantity. It is the basic ingredient of concrete, mortar and plaster. Portland cement grade 53 is used in this experimental work.

(FIGURE 3-CEMENT)

1.1.2 Foaming agent:

Foam is a substance foamed by trapping pockets of gas in liquid or solid. A bath sponge and the head on a glass of beer are example of foam. In most foam, the volume of gas is large, with thin films of liquid or solid separating the region of gas. Foaming agents is materials that facilitate formation of foam. The role of foaming agents in foamed concrete is to create small and enclosed air bubble by reducing the surface tension of a solution and increasing the stability of air bubble.

1.1.3 Fly Ash:

Fly ash can be a cost effective substitute for Portland cement in many market. Fly ash is also recognized as an environmentally friendly material and embodied energy. Fly ash is poorly graded particles, generally spherical in shape and range in size from 0.5 micrometer to 300 micrometer.

1.1.4 Fiberglass mesh net:

With high strength, durable service and excellent property against acid and alkali, fiberglass mesh net is the alternative to steel mesh for exterior and interior concrete wall rendering. Fiber reinforcement mesh enjoys easy operation, material saving, long life, it is the ideal energy - saving insulation materials.

1.1.5 Water:

Water is most important material required for concrete. Portable water is used for mixing the material with each other.

1.1.6 Chemical composition and Physical properties of OPC and Fly Ash

Table 1: A typical chemical composition of Portland cement and fly ash.

Chemicals	**Portland cement (OPC)**	**Fly Ash**
Chemical composition (% by mass)		
Silicon dioxide	16.39	63.6
Aluminum oxide	3.85	28.19
Ferric oxide	3.48	2.99
Magnesium oxide	0.64	0.54

Calcium oxide	68.48	1.54
Sodium oxide	0.06	0.05
Potassium oxide	0.52	0.003
Sulphur oxide	4.00	0.26
Silicon oxide + Aluminum oxide + Ferric oxide	23.73	94.78
Physical properties		
Loss of ignition (% by mass)	1.7	0.85
Specific gravity	3.2	2.09

1.2 Equipment:

1.2.1. Mounding machine:

The concrete wall panel machine is high degree of automation equipment, hydraulic opening and closing.

Speification:

Annual output	20 panels per moulds(90mm)
Hydraulic power	4 KW
Hydraulic pressure	5 Mpa
Machine size	3.7*3.3*1.2m
Machine weight	4500kg
Product width	600mm
Partition steel plates	Q235, thickness 4mm
Steel plates leveling tolerance	≤1mm
Product length	Can be adjustable within 3m
Moving motor power	4KW

1.2.2. Foam generator machine:

One of the most ingredient required to produce foamed concrete is the aqueous stable foam. The foaming generator acts as a medium which transforms the liquid chemical into stable foam.

1.2.3. Overhead crane

To move extremely heavy or bulky loads through the overhead space in a facility, instead of through aisles or on the floor, on overhead crane.

Literature Review:

2.1 Roz-Ud-Dia Nassar and Shazim Ali Memon et.al (2018) [1] has submitted thesis on "Characteristics of foam concrete produced from Detergent used as foaming agent."

In this study, the possibility of production of low cost foam concrete using locally manufactured detergent powder was experimentally investigated.

They concluded that, The production of low cost foam concrete using locally manufactured detergent as replacement of commercially available FA is a feasible practice. Strength and durability characteristics of foam concrete mixers produced with detergent as foaming agent are quite comparable to that of control foam concrete mixers produced with FA as the air-entering agent.

The result of the study are encouraging and various properties of the foam concrete produced with detergent as air-entraining agent can be further improved by fine-tuning the mix proportioning.

2.2 Vidya jose and Dr. P. Rajeev kumar et.al (2014) [2] has submitted thesis on "Hollow Core Slabs in Construction Industry."

A hollow core slab is precast prestressed concrete member with continues voids provided to reduce weight and cost. They are primarily used as a floor deck system in residential and commercial buildings as well as in parking structures because they are economical, have good fire resistance and sound insulation properties, and are capable of spanning long distance with relatively small depths.

Hollow core slabs can make use of prestressing strands, which allow slabs with depths between 150 to 260 mm to span over 9 meters. The small gap that is left between each slab is usually filled with a non-shrink grout.

Hollow core slabs are used for a variety of applications in low and high-rise commercial, residential and industrial buildings. It provides an answer to most of the present market demands and challenges for the building industry: structural efficiency, low material consumption, highly automated an environment friendly production process, high concrete strength, slender floor thickness, and possibilities for reuse and recycling at the end of the life cycle.

2.3 R. Yuvanesh Kumar, K. Vinobalaji and M. Naveen Prasad et.al (2018) has submitted thesis on "Experimental investigation of hollow core slab using different fiber.

Total weight of the building mainly depends on the reinforcement concrete. Large portion of buildings weight caused due to dead load. In order to reduce the self-weight, hollow core slabs are used. Hollow core slab makes the slab much lighter than the massive solid concrete floor slab of equal thickness and strength. Concrete bring brittle is strong in compression but very week in tension, the weakness make it to crack at the tensile end. The tensile property can be induced by adding fibers.

Fibers have the ability to arrest cracks, increase the extensibility and tensile strength. Fibers are able to the matrix together even after extensive cracking. Glass fiber which improves the flexural and split tensile strength of concrete. By adding the fiber to the mix will have ductile failures.

Hollow core slab reduces the dead weight to a great extent. It is observed that compressive strength increases up to 12.95 % with addition of 0.06% glass fiber to the volume of concrete. Flexural strength increases up to 6.96% with addition of 0.06% glass fiber.

2.4 K. M. Monisha, G. Srinivasan et.al (2017) has submitted thesis on "Experimental behaviour of prestress hollow core slab, Rc hollow core slab and normal Rc solid slab.

The project consist of experimental behaviour of hollow core slabs and comparison of this result with different makes and casting. Reinforced hollow slab is casting by making the hole in mold then the prestress hollow core slab is casted with zero slump concrete in factory. The slab has dimension of 1 cubic meter.

The load test is done in this slabs by loading frame. Reinforced hollow core slab, prestress hollow core slab is tested and ultimate load, cracking load and efficiency of slab is tabulated. Cost efficiency of prestress hollow core slab is high compare to reinforced concrete hollow core slab. Load caring capacity of slab is 20% less when compare to prestress hollow core slab.

Hollow core slab are precast, prestress concrete element that are generally used for flooring. A hollow core slab consist of continues voids provided to reduce weight and cost. This hollow core slab are primarily used as a floor deck system in residential and commercial buildings as well as in parking structures because this slabs are more economical , have good fire resistance and sound insulation properties , and also capable of spanning long distances with relatively small depths.

3.Methodology-

- Collection of literature about foamed concrete and fly ash
- Material procurement and collection: Cement, Foam, and fly ash
- Testing: Specific gravity, Absorption test etc.
- Concrete mix design
- Experimental set up
- Wall Casting, Curing and testing of walls
- Observation
- Result and Discussion
- Conclusion and Future work

Step 1 – Raw Material Preparation- hollowcore wall manufacturing process starts with raw material preparation. List of raw materials and relevant details are mentioned below-

1. POURING MIXTURE
2. BLOCKS CASTING ON MOULD
3. DEMOULDING
4. STEAM CURING FOR 12 HOURS
5. HOLLOWCORE WALL READY FOR SALE

Cement- 53-grade Ordinary Portland Cement (OPC) from r manufacturer is required for manufacturing hollowcore wall.

Fly ash – Fly ash is mixed with water to form fly ash slurry.

Foaming agent - Foam is a substance foamed by trapping pockets of gas in liquid or solid. A bath sponge and the head on a glass of beer are example of foam. In most foam, the volume of gas is large, with thin films of liquid or solid separating the region of gas. Foaming agents is materials that facilitate formation of foam. The role of foaming agents in foamed concrete is to create small and enclosed air bubble by

reducing the surface tension of a solution and increasing the stability of air bubble.

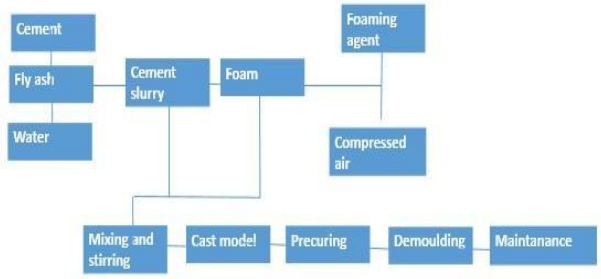
Fiberglass mesh net- With high strength, durable service and excellent property against acid and alkali, fiberglass mesh net is the alternative to steel mesh for exterior and interior concrete wall rendering. Fiber reinforcement mesh enjoys easy operation, material saving, long life, it is the ideal energy -saving insulation materials.

Step 2 – Dosing and Mixing- After raw material preparation, next step of wall manufacturing process is dosing and mixing. Process of dosing and mixing means the quality of final products. A dosing and mixing unit is used to form the correct mix to produce hollowcore wall. Fly ash is pumped into a container. Once the desired weight is poured in, pumping is stopped. Foaming agent is mixed with fly ash by using foam generated machine .Dosing unit releases this mixture as per set quantities into molds.

Step 3 – Casting, Rising and Curing- Once mix of raw materials is ready, it poured is in molds. High degree of automation equipment, hydraulic opening and closing Simple operation and high efficiency, low labor intensity. The machine can also be equipped with vibrator system for thick mortar. Using Q235 steel, thickness 4mm, it will be welded on Horizontal worktable with pressing system to leveling tolerance ⩽1mm. The leveling tolerance after all the Q235 steel plates after assembling will be ⩽ 3mm.The bottom steel plate for tongue, The aluminum part with plastic coating for tongue profile to guarantee the precision of tongue. The aluminum part will be fixed on 6mm steel plates. Mound layer for top groove, The aluminum part with plastic coating for tongue profile to guarantee the precision of top groove. The Pipes, using steel pipes inside. PVC pipe fixed outside.

Step 4 – Demoulding and Cutting –After 2 days, it is ready to be demoulded and cut as per requirements. Once a mould is out of pre-curing room, it is lifted by a crane for demoulding operation. While all previous processes like raw material preparation, dosing & mixing and casting are pretty much same across all technologies, demoulding and cutting process vary vastly depending on technology provider. Differences in demoulding and cutting process are also evident from different types of molds required by different technology provider.

Flow chart -



4.Result and discussion:

Test result of hollow core foam concrete wall having size (2800x600x100 mm), weight (45kg), Density (1400kg/cubic meter)

No.	Particulars	Result	Unit
1.	Compressive strength	5.56	mpa
2.	Flexural strength	0.492	mpa
3.	Sound insulation	40	dB
4.	Thermal conductivity	0.1739	w/ mk
5.	Cost reduces	30	%

5.Conclusion:

- The light weight concrete wall is suitable for sound and heat insulation.
- Most important advantages of light weight concrete for the wall panel construction to form any shape and size.
- The cost of the light weight concrete panel wall is very low as compare to normal wall.
- The raw material for our panel are green material it's without asbestos and no radioactivity.
- It is easy to install any storied building.
- It is very economic, construct in less time.

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GPS BASED FIELD FORCE TRACKING SYSTEM

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ABSTRACT:

GPS tracking system is widely used by many organizations in today's world. This is a web application with a cloud-based admin panel to track GPS location of sales employees and manage their day to day activities by capturing updated and authentic data from point of execution. It is used to improve the productivity of an organization and save the time of the working process. When your sales employees check-in and check out of customer visits, their location is recorded and details are mapped out by the system. This system makes work easy for the owner of an organization to check whether the task is carried out smoothly or not. Hence, he/she can have access to all the data and information from any point of location.

Keywords-GPS, GOOGLE MAP, tracking,

Latitude, Longitude

I. INTRODUCTION

The Field Force tracking system is designed to put up the current location of your jobs or employees, at all times on a particular map. For any business, getting productive information and time to time status reports from our employees or workers is very important. Tracking of location helps to optimize our resources and use time efficiently. Field Force tracking is easy to use software or application in the industry and market. We update real-time information to manager with the help of technology platform. This system becomes so easy for employers and organization to concentrate and aim for the right things for the growth of an organization. It helps in improving the revenue of an organization by saving time. This system improves the market sales of an organization and builds up team performance. It gives a complete solution for publishers, FMCG, Pharmaceuticals, foot-wear manufacturing, and garments manufacturing units. This Application covers almost all the tasks which a sales executive does daily like:

- Meeting with the customers
- Giving the samples to the owner
- Taking orders from customer
- Collecting the payments from customer
- Taking feedback from customer

II. LITERATURE REVIEW

In the field of GPS tracking, a lot of researchers have been done by various researchers. Rajeev Kumar and Dr. Harish Kumar[1] have presented through their work that the raw data can be extracted, analyzed and formatted for conclusions with tracking. This data is converted into a workable format for getting information. Wireless communication can be done using LBS to extract the information. The analysis

report is generated using SPSS for the position and movement. Tracking is done using latitude and longitude with respect to time.

H. A. A. Dafallah [2] contributed through his work that a computer with GSM modem is used to receive the SMS. This SMS contains latitude and longitude of the mobile tracking unit, and by using many other interface programs and this location is displayed on the Google Maps, IIS (internet information server) software is installed to make PC web server. OZEKI-NG SMS gateway software is used to establish a connection between GSM and PC. J.-Y. Lin, Y. Do [3] presented through their work the use of the GPS function in the android phone to retrieve the location information and to send that data to the server. The Bluetooth connection with environment sensing capacity device is used. As GPS tracking does not match the road track, so modifying the algorithms, exact mapping of the track is tried to carry out. Hutabarat [4] contributed through his research the use of RFID and GPS is done to track human indoor as well as outdoor location. RFID is used by the user for reading continually when a human is accessed in a room. Whereas GPS will automatically get activated when a human leaves the room. Mangla [5] presented the system which consists of GPS antenna that generates the latitude and longitude coordinates, for receiving request from the user and sending the coordinates GSM modem is used. An Atmega microcontroller as an interface and application to point out location is used. Rana [6] presented the web mining technology and the impact of semantic web, the information available on the web can be interpreted. It creates an environment to interpret the available information. L. Tu[7] contributed the customer relationship management on new product design is used to obtain, analyze and mine customer data for marketing management. Y. Ping[8] contributed through his work database backup and recovery system, we prevent the data loss and error in MySQL database. It also ensures normal and efficient operation of the system. Bagali [9] presented the handling of data received through a GPS device. Using this technology the data which we receive through the device is handled carefully so that the user gets relevant and exact information.

III.METHODOLOGY and EXPERIMENTATION

The location of the employee will be tracked using the mobile device which is with the employee. The user will be updating the information on the web application and using satellite the location will be tracked and sent to the server. The information updated by the employee on the web application will be saved and sent to the server and stored for future use. The web application includes registration and other details of the employee. These details are sent to the server and stored for later use. There are three users of the project namely:

1. Super admin (admin)
2. Office admin
3. Employee

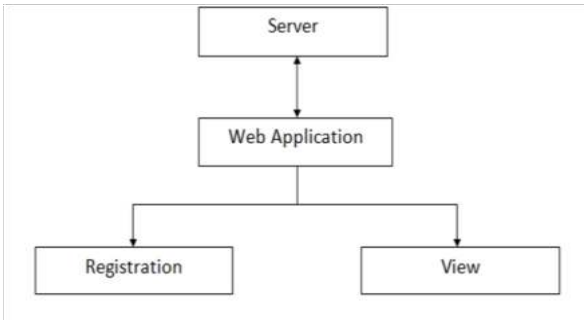

Fig. (1).System Architecture.

The above diagram gives a conceptual overview of the project. It shows the flow or manner in which the project will be working and how the information transfer will be taking place in different modules of the project. It gives a clear idea about the working of the system and the flow of the work.

A. SUPER ADMIN MODULE: The use of the super admin is to login using its user id and password, and check or view the active users. It also adds the location details according to the sales of its product to be done in a particular area. The main job is that it can track the location of the employee and view the updated information of the sales given by the employee and thus manage all activities.

B.OFFICE ADMIN MODULE: The use of the office admin is to login using its user id and password, its checks or view the details of the employee working under its location and updates the task accordingly. It also tracks the location of the employee active in its location and manages the information and makes a record of the data.

C.EMPLOYEE MODULE*:* The use of the employee is to register by filling all the details and create a user id and password for it. Later on, using this user id and

password it can log in. It has to view its profile and check for the task to be done which are pending or new and update related data in it. It has to visit stores for sales and update the information and mark down the status and work accordingly.

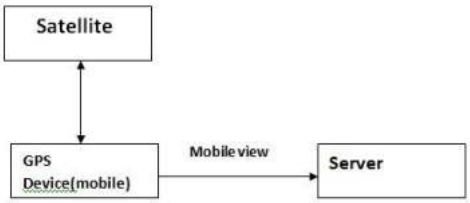

Fig. (2): Working of GPS

Internet information server software is installed in the tracking centre for PHP execution and Google Maps service. Extraction and retrieving of latitude and longitude are done using writing PHP code to connect to MySQL database. Different code in PHP is written for the conversion of coordinates in order to plot or display on Google Maps. JavaScript code is included to connect Google maps.

IV. RESULT AND DISCUSSION

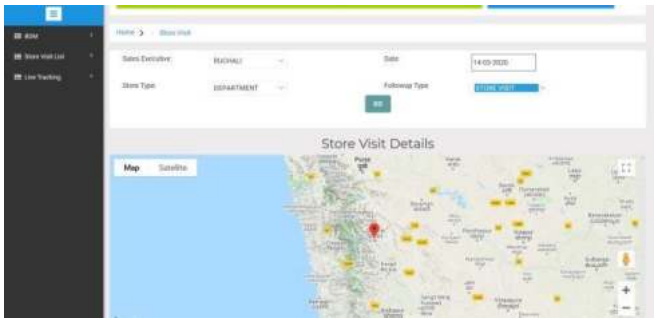

Fig. (3). Mapping of live location on Google map.

After completion of the project, all objects will be displayed according to the area accomplished with reliability and quality. The GPS based field force tracking system is successfully implemented. The system is evaluated by its accuracy and delay. The accuracy of the system is based on satellite coverage. Here Google map is considered as a reference to the accuracy for all possible conditions. The system delay occurs due to GSM network and may also be affected due to the speed of the internet. It can be improved by achieving the required speed and network. The coding of the system is done flexible to access the coordinates.

V. CONCLUSION

This web application helps to track the on-field location of the sales employee for the owner. It helps to make the working of any organization smoothly and efficiently. It brings revenue growth for the organization by effective time management policy and on moment work status report generation. It helps in a way, such that further decisions can be taken for the welfare of an organization. The location of the employee will be tracked efficiently using latitude and longitude coordinates. Data can be analysed efficiently from the point of execution.

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A REVIEW OF GPS SYSTEM

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ABSTRACT:

GPS tracking system is widely used by many organizations in today's world. This system is efficient in aspects such as vehicle tracking, employee tracking and as any spy mission or equipment. The GPS system uses co-ordinates to plot the location of the tracked device or equipment. The co-ordinates are received by the device through the GPS. These co-ordinates are send to tracking center that is PC with different interface that plots location on the google maps using google maps API. This GPS based field force tracking system is real time, adaptive and reliable.

Keywords- GPS,GOOGLE MAP, tracking, Latitude, Longitude

I. INTRODUCTION

In the field,of business and corporate sector, the need of tracking is increased to monitor the task or work of the employee during the work days.The evolution of wireless systems with location dependent services needs more accurate and efficient data for the purpose of tracking .Field force tracking system is designed to put up the current location of your jobs or employees, at all time on particular map. For any business, getting productive information and time to time status reports from employees or workers is very important. Tracking location helps to optimize resources and use time efficiently. The main purpose of this system is consistent and reliable tracking and provide timing services to all users. In this system GPS is used for location tracking. Here GPS receiver connect to satellite when it continuously sends radio signals towards the earth. Transmitting includes the location of GPS satellite and the time signal was sent as each of its satellite has atomic clock onboard. GPS receiver listens signals from more than four satellites. When signals closer from the satellites will arrive sooner than, while signals farther from the satellite will arrive later.

II. LITERATURE REVIEW

In the field of GPS tracking lot of researchers has been done by various researchers. Rajeev Kumar and Dr. Harish Kumar[1] have presented through their work that the raw data can be extracted, analyzed and formatted for conclusions with tracking. This data is converted into workable format for getting information. Wireless communication can be done using LBS to extract the information. Analysis report is generated using SPSS for the position and movement. Tracking is done

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III. COMPARATIVE STUDY

The Existing system of GPS Based tracking system consist of data handling using follow up from customer, feedback scheduling of activities on monthly basis with help ongoing surveys,for the employees.

The proposed system consists of the handling follow up as per the customer choice, such as on meet. It also contains feedback systemi in the form of status update.

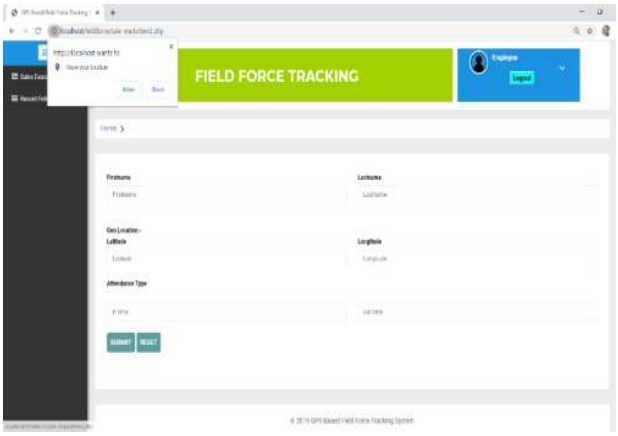

Fig.(1). Location Sharing Message

In our system the following steps are done for mapping and accessing the location of employee

[1] A Java script code is used for displaying location sharing message on employee login page is load.

[2] Salesman can click on allow button then PHP code is written for saving the longitude and latitude of that location in database.

[3] A PHP code has been written to connect to database.

[4]Another PHP code has been written to display longitude, latitude on google map on our local web server. [fieldforce.inv95.com]

[5] Java script program has been included tom connect to google map.

IV. FUTURE SCOPE

GPS technology is reaching to new heights in upcoming days. It is advancing in different fields like geofencing beacons etc and getting powerfull day by day. Field force tracking will increase widespread usage in business world, for the purpose of employee tracking. It will be used to make assessment of the employees and also to keep the track of executive on the business tour. GPS is proving to be powerful tool for productivity and efficiency for business in upcoming days. GPS tracking will be considered as expensive technology, it will be affordable by large companies, due to its importance and widespread usage. It has worldwide market.

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Intelligent Video Surveillance using Deep Learning

Vijay Bhanudas Gujar, Arbaaz Shaikh, Alim Bagwan, Pooja Dixit, Nidhi Todkar

Abstract: ***Now days, Big data applications are having most of the importance and space in industry and research area. Surveillance videos are a major contribution to unstructured big data. The main objective of this paper is to give brief about video analysis using deep learning techniques in order to detect suspicious activities. Our main focus is on applications of deep learning techniques in detection the count, no of involved persons and the activity going on in a crowd considering all conditions [9]. This video analysis helps us to achieve security. Security can be defined in different terms like identification of theft, detecting violence etc. Suspicious Human Activity Detection is simply the process of detection of unusual (abnormal)l human activities . For this we need to convert the video into frames and processing these frames helps us to analyze the persons and their activities. There are two modules in this system first one Object Detection Module and Second one is Activity Detection Module .Object detection module detects whether the object is present or not. After detecting the object the next module is going to check whether the activity is suspicious or not.***

Keywords: Big data, Video surveillance, Deep learning, Crowd analysis, Machine Learning; Violent Activities Detection; Convolutional Neural Network; Recurrent Neural Network; Long Short-Term Memory.

I. INTRODUCTION

The interest and use of image processing and video analysis has been increased now a day and it has been unprecedented due to its importance in finding out and summarization and recognizing of actions [7].

This paper explains about hoe to process the videos and images in order to find difference between them.

We developed a system which classifies a video into three classes:

1. illegal or aggressive activity
2. Potentially doubtful
3. secure

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Our plan to resolve this difficulty is an structural design base on convolutional and recurrent neural networks

Throughout this paper, it will easy to find general description and solution, it also tells about the method that we agree to the dataset we used, how we implement it, and the outcome that we achieve.

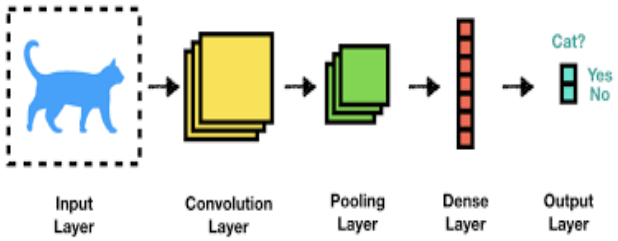


Figure 1: Convolutional Neural Network

II. LITERATURE REVIEW

The primary neural network is also known as convolutional network. The reason of this arrangement is extract high-level facial appearance of the metaphors and tumbling the difficulty of the contribution [8]. We are using a labeled form called inception which is created by Google. Its v3 model is taught on the ImageNet dataset. It is the most typical task, this layout used to categorize whole imagery into 1,000 classes.

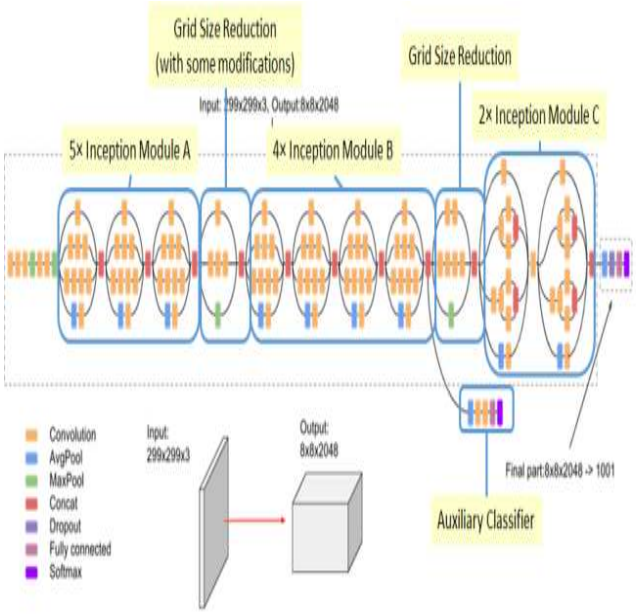


Figure 2: Inception Model

This replication of video images is used to transfer learning. Recent detection of objects replica capable to recognize number of factor and can take many days to entirely train. To correct a lot of this work we used Transfer learning. This technique reduces the work and time needed for completely trained model for categories like ImageNet and keep hold on fresh classes [7].

The neural network is the second network we used. The main purpose of this net is to find out the logic in the series of the events. This LSTM cell present in the first layer of this network and this two hidden layers follows this layer (one which having around one thousand neurons and relu activation and the additional which having fifty neurons with a sigmoid activation), and the final production level is also known as three-neuron layer which creates software that produces the last categorization.

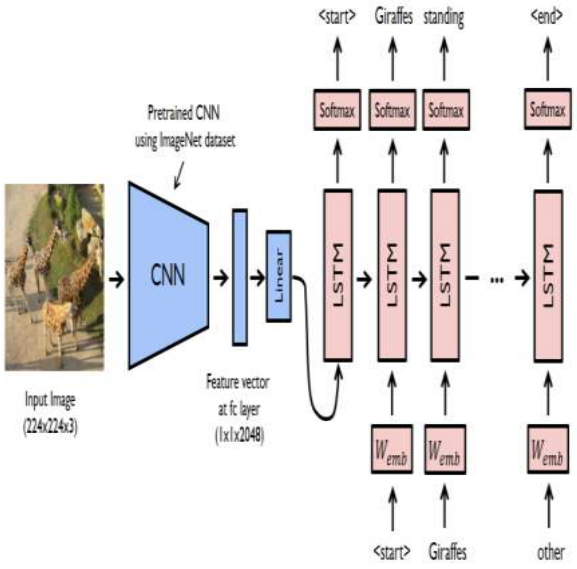


Figure 3: LSTM Network

III. METHODOLOGY

Initially we are extracting the frames from the video. We take out each and every frame at every fraction of time. We use this edge to create a guess by the initiation copy [7]. By using the transfer learning technique; Instead of extracting the last categorization of the beginning model, we are going to extract the effect of the previous common layer, which is a vector of 2,048 values (high-level attribute chart). However, we had a single frame characteristic chart. We are giving our system a sense of the sequence. For this, It's not enough to consider only single frame to make our final guess this is why we take a collection of edge in arrange to categorize the section of the visual images of stationary or moving objects [8].

To make a good guess its sufficient to analyze three to four seconds of video at a time. The inception model generates fifteen feature maps. We take these frames and three seconds of video corresponding them. Now we need to form a one single pattern to join this set of characteristic. And we are ready with input of our second neural network [6].

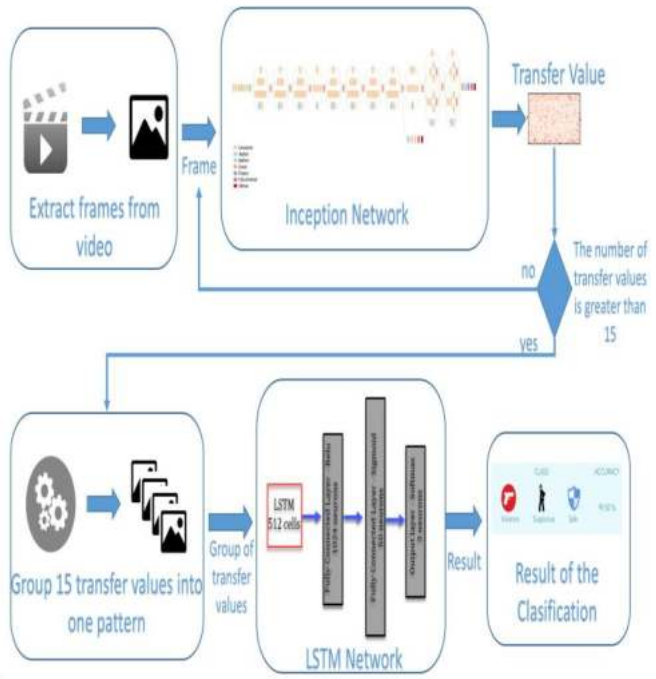


Figure 4: Classification Network

As output, what we observe is going to characterize the video in real-time for where every three seconds. Carectrization factors are — secure, doubtful, or against the law activity [9].

IV. DATASET TRAINING

We used dataset which of around two hundreds minutes of videos divided into 38 videos. We take the majority of the inputs from security cameras. We are taking each frame at 0.2 sec which makes a dataset of 45,000 edges for coaching — the equivalent of 3000 sections of film, consider so as to each a segment of a video stand for three seconds of it.

The last dataset is in fact somewhat little. We can get good quality consequences with less data Because of the transfer learning.

Figure 5: Data class's example

V. IMPLEMENTATION

We used python 3.5 to imlepemnt this whole system.

To section the video we used OpenCV for Python. Sectioning includes the conversion of videos into edges and makes the size more appropriate to them. From available, using each of them that we make a forecast on the inception model [4]. We used transfer values variable to save that into its appropriate space.

From available variables, we are going to split them into group of 15 edges and result is in the reassign to variable.

```
frames_num=15
count = 0
joint_transfer=[]
for i in range(int(len(transfer_values)/frames_num)):
    inc = count+frames_num
    joint_transfer.append([transfer_values[count:inc],labels_train[count]])
    count =inc
```

Here we are having the relocate values with respective tag; from this data we train neural network. The implementation of this network is as follows:

```
from keras.models import Sequential
from keras.layers import Dense, Activation
from keras.layers import LSTM
chunk_size = 2048
n_chunks = 15
rnn_size = 512
model = Sequential()
model.add(LSTM(rnn_size, input_shape=(n_chunks, chunk_size)))
model.add(Dense(1024))
model.add(Activation('relu'))
model.add(Dense(50))
model.add(Activation(sigmoid))
model.add(Dense(3))
model.add(Activation('softmax'))
model.compile(loss='mean_squared_error', optimizer='adam',metrics=['accuracy'])
```

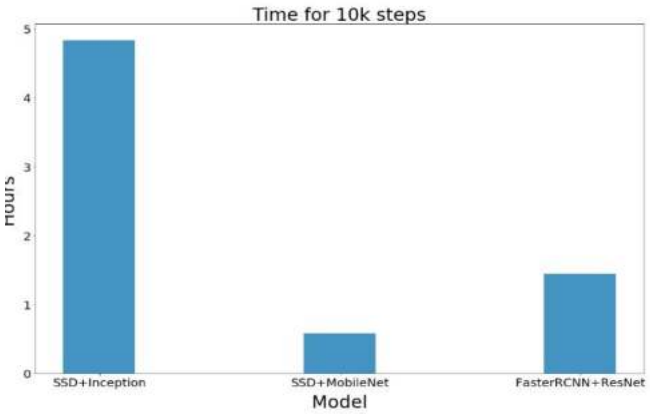
Above code describe the structure of the representation. The next step is about training it [3]:

```
data =[]
target=[]
epoch = 1500
batchS = 100
for i in joint_transfer:
    data.append(i[0])
    target.append(np.array(i[1]))
model.fit(data, target, epochs=epoch, batch_size=batchS, verbose=1)
```

After training need to save it as follows:

```
model.save("rnn.h5", overwrite=True)
```

This model is fully trained now; we can start to categorize videos [1].



VI. RESULTS AND OTHER POSSIBLE APPLICATIONS

Following experiment by means of dissimilar system layouts and alteration overexcited parameter, the most excellent result that we could obtain is 98% correctness.

We have the user side for to put video into server. Then classify it in instantaneous. The alteration of classes you can see now continually [2]. These values always bring up to date each three seconds waiting the video is over.

In addition what we can do is connect video classifier it to a safety astrograph to analyze the record in instantaneous, and when notice disbelieving movement scheme, it might attentive us.

	R-CNN	Fast R-CNN	Faster R-CNN
Test time per image (with proposals)	50 seconds	2 seconds	**0.2 seconds**
(Speedup)	1x	25x	**250x**
mAP (VOC 2007)	66.0	**66.9**	**66.9**

VII. CONCLUSION

Deep learning is a marvelous tool that offers excellent outcomes easily. But, to what limit can we trust our inspection structure to act on its own? There are a few instances where automation is questionable.

A. Adversarial Attacks
B. False positives
C. Similar faces
D. Lack of diversity in datasets

VIII. FUTURE SCOPE

Effectively tracking of suspicious person's on-demand: To ensure the performance and accuracy of suspicious tracking. Suspicious tracking across multiple cameras based on correlation filters leverages entry and exit locations within the protected environment, so that a suspicious person can be tracked across cameras uniquely by a relay. Only adjacent cameras are candidates used for re-identification process, and it will reduce the computation time and cost as well as increasing tracking performance and accuracy in daily operations.

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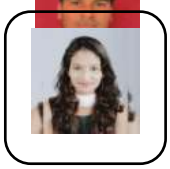

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Online Platform for Managing Advertise Agencies Activities

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Abstract— **The "Online platform for managing advertise agency activities" system reduces the manual efforts of an advertising agency and its customers. By providing a digital platform that manages activities such as placing quotations of advertisements, get material required to making advertisements that may be text, images, etc. from the customer, provide advertise demo to the customer, view advertise demo, send advertise contents, customer payment handling, offers advertise to the customer, view response of advertise ordering, payment processing and finally get ordered advertise. In this way "Online platform for managing advertise agency activities" provides the best digital platform that manages all activities that are required from placing an order of advertising to getting ordered advertisement.**

Keywords- E-commerce, Suggestion tool, advertise agency, PHP, MySQL.

I. INTRODUCTION

Nowadays no system provides facilities to advertisement agency customers to order advertising for their product from anywhere and at any time, online payment platform and ordered advertisement delivering platform. Currently, no software provides a platform that allows advertising agencies to maintain their customer details as well as advertise ordering details. It does not give any suggestions about the frequently demanded advertisements as well as a recommendation for seasonal advertisements. To provide a solution to this problem we have designed an “Online platform for managing advertise agency activities” system.

To use this system customers first need to register themselves on the system. Once registration is done then customer able to do activities such as placing an order of advertisement, payment processing, receive ordered advertisement, etc. Whenever the customer sends an order for making an advertisement, this request reaches an advertising agency, a reply is sent back to the customer. After receiving that reply customer sends the advertisement material in the form of text, image, pdf file to the agency. Then based on received material, the agency creates advertisement and send demonstration to the customer. Based on this demonstration the customer again sends feedback and suggestions if necessary to the advertising agency. Depending on the feedback and suggestion, the advertising agency makes changes in the advertisement. If required otherwise sends the advertisement to the customer. Customers cannot download that order until payment processing is not done. Once payment is done then the customer can download the ordered advertisement. The system also suggests the advertising agency regarding frequently ordered advertise as well as seasonal advertise recommendations. We use the payment gateway technique for providing a digital platform for payment processing. We have implemented the algorithm which provides the best suggestion to advertise agency regarding frequently ordered advertise as well as seasonal advertise recommendation. It provides the platform which allows the customer to receive ordered advertise based on payment status.

In this way, the "Online platform for managing advertising agency activities" system is very helpful to advertising agencies as well as their customers by doing all procedures digitally that are required for placing an order of advertisement.

II. LITERATURE REVIEW

Khampheth Bounnady, Khampaseuth Phanthavong, Somsanouk Pathoumvanh , Keokanlaya Sihalath compare the performance processing speed of two common technologies for developing web applications namely PHP and ASP.NET. Where ASP.NET using IIS will be compared with PHP using IIS as well as the PHP using Apache [1].

Ali Bazghandi has guides web database connectivity methods, for three different platforms namely PHP, Perl, ASP.NET on windows platform. It also compares the database connectivity speed among these three different technologies [2]. Grandhi Sampath Kumar, Jasmin T. Jose discuss the background for developing an Electronic – commerce application, principles and methods involved in developing an Electronic Commerce application[3]. Abdulreza Salahi, Hussein H. Fakhry present a modified CRM information system for small and medium-size businesses. Also, this paper

examines the impact of applying CRM strategies on business entities [4]. Anal Kumar, A.B.M. Shawkat attempt to examine how customers attitude towards e-commerce sites has been changed that is how smart shopping is capable to change customer attitude [5].

III. PROPOSED SYSTEM

A. Existing System:

The traditional advertising agency takes all the details of the advertising agency manually, i.e., customer details, advertisement details, etc. It requires more time as well as money and it is more critical and difficult to find out the details of the advertisement that are required in any season.

B. Proposed System:

The "online platform for managing advertising agency activities" is such that the system provides a digital platform for managing all advertising agency activities, as well as saving time of customers by providing an online platform for placing the order in an advertising agency.

This system also reduces the manual efforts of the advertising agency, by converting all manual activities into a digital format using 'Electronic Commerce Platform' such as providing advertisement demo to a customer, get material required to make the advertisement that may be images, text, pdf, etc from customer, payment handling process, delivering the advertisement to the customer.

This system also provides the data of all customers, as well as of the advertising agency. It also defines the seasonal advertising to the agency. It reduces the manual efforts, as well as time, required for placing order. The system is user friendly to the customer.

C. Architecture:

1. Technology:

a. (PHP)

PHP is used for developing static and dynamic web pages. When the user enters the URL in the browser of the advertising agency, If the content is in HTML or as a text file then it changes, otherwise, it does not change. It accepts all request of the customer and saves into the databases, securely. The front end of a system is designed using PHP, javascript, CSS, HTML, bootstrap. The back end of a system is designed using MYSQL to store the data.

b. MySQL

MYSQL is used for database connectivity. It is used on the web, and run on a server. It uses the standard SQL. It's is very fast, easy to use, reliable, and ideal for small as well as large applications.

2. Adopted Architecture

This system consists of advertising agency and customers. It contains two types of users such as Advertising agency and the customer. Some authorization is given to the customer to place the order of advertisement. Advertising agency is also given the authorization to access the database and generate the various report.

System Architecture: System Contains Mainly Two Modules.

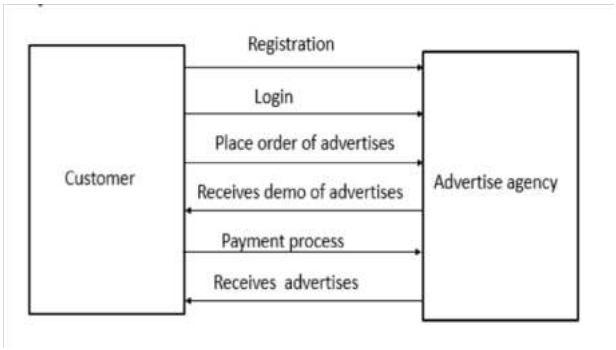

Figure 1. Architectural diagram

System Architecture: System Contains Mainly Two Modules.

a. Customer

b. Advertise Agency

a. Customer:

Customer module contains the following activities:

- Registration
- Login
- Send an advertisement quotation.
- View reply to advertisement quotation.
- Send advertising material (in form of text, image, and pdf file)
- Receive demo of advertising and send feedback
- Payment processing
- Download ordered advertise

b. Advertising Agency:

Advertise agency module contains the following activities:

- Maintain customer details
- Send advertisement quotation reply to the customer
- Send advertisement demo to the customer
- View reply of the customer to the advertisement demo
- View customer payment status
- Send developed advertisement to the customer
- Receives suggestion regarding frequently Ordered advertisement as well as seasonal advertisement recommendation.

3. Proposed system modules:

The following modules included in the project are:

- Customer Registration management:

The customer registration module contains the registration page for registration of the new customer, update their profile,

change the password, and add the order to the advertising agency.

- Service management:

The service management module contains the services provided by the advertising agency that is banner advertising, audio advertising and video advertising. Its also provides the demonstration of prepared advertisement to the customer.

- Advertise Order management:

The advertising order management module contains the order page to place the order of advertising to advertising agency. It provides three option pages for placing advertising that is in the form of a banner, audio, and video format.

- Contact Management:

The module contains information about the advertising agency and also customers can give feedback and suggestions to advertising agencies.

IV. PROPOSED SYSTEM DESIGN

A) Account module:

Account module is used for customer registration in the advertising agency using the registration page. In this module we have included the functionality to edit, update the profile and also the customer can view details about the ordered advertise in the system.

The customer information is checked and validated using email, phone number, etc.

I. Customer panel: It contains information about the customer itself. It stores the customer information, ordered advertise and their status, etc.

II. Dashboard/ Overview:
It contains the business detail of customer and customer can change the business detail and update into the profile, updated time and date is also defined in the system.

III. Order details: It contains three types of order and their details.

- Banner advertises:

The banner advertising is of two types - static and dynamic banner advertising are placed in our system. It defines the payment status of the order, order date, delivery date, view and receipts of payment when it's completed.

- Video advertise:

It contains the category of advertising that is 2 dimensional or 3-dimensional advertising, sound and images, ordered date, the status of payment and status of the order, demo file of order and detail of the order.

- Audio advertises:

It is the same as a video advertise but it does not display the images or file. It contains the order status, payment status, and demonstration file.

B) Service module

The service module is designed for the customer. In this module customers can place the order for banner, audio, video advertises and also give information necessary to create advertise in the format of text, image, pdf, etc. Then the order of the advertisement is placed. The service module receives useful information from the customer and makes advertise. It shows the demonstration of the advertisement to the customer.

If the customer wants any changes in the advertise, the module sends the request to the advertising agency. After making requested changes in the advertisement, when the customer orders the advertisement by clicking on the "order now" button, then it goes to the payment process.

C) Payment module:

When the customer orders the advertise then the module will go the payment process. For the payment process, payment gateway is implemented by taking a link of payment gateway.

Payment module contains two methods for the payment:

- Net banking
- Cash on delivery
- Net banking:

In net banking, we transfer the money using the Credit card, Debit card, Google pay, Phone pay, etc. When we choose net banking we can enter our account detail, residential address, email, and Mobile no. to get delivery of advertising. After payment process is done we can download the pdf, audio or video file of advertisement.

➢ Cash on delivery:

In the cash on delivery process customers can provide detail to the agency to deliver the advertise using these details. When customer has done payment then he gets the advertisement.

D) Administrator Module:

The advertising agency uses the administrator module for the admin login in the system. It handles all the activities in the system. The advertising agency is given the special authority to control the system.

- Manage customer information:

The advertising agency gives the unique identity number for every customer order to identify the exact number of advertisements. Using this number it defines whether the advertisement is completed or not. It defines the status of the placed advertise. It also keeps a record of the number of orders placed and completed per customer in this advertising agency. When the customers visit the advertising agency daily, their names are displayed on the home page or login page of the system.

- Order management:

It has the authority to delete the advertise and define cost of advertising. When an order is completed then it changes the status of payment and then the customer can download advertisement.

- Manage report:

It displays two tables, one table defines the order details using id and their completed status and another table defines the unique customer entry and their order up to date.

- Manage Pages:

The advertising agency takes the authority to change some information of the customer. It also gives authority to access the information, not the change.

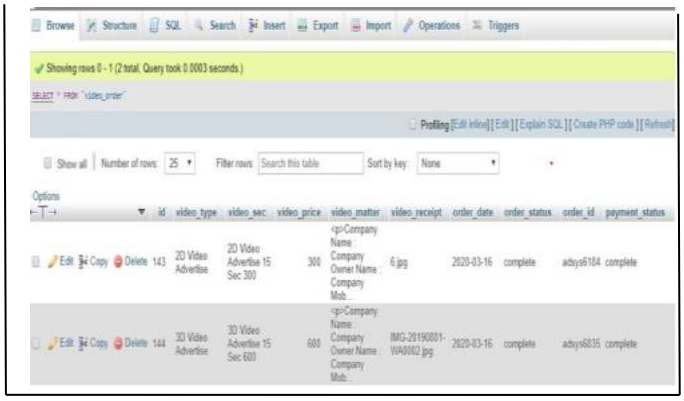

Figure 3. Video order

V. RESULT AND DISCUSSION

Currently, we have developed the website of "Online platform for managing advertise agency activities" which provide a platform as per the requirement of an advertising agency, and the system covers all activities digitally. It generates the report using all details of the customer and the ordered advertisement. The systems store all the records in the databases, generate the report digitally, and reduce the manual efforts as well as time required. It is a very user-friendly system which reduces efforts, time and money for both advertising agency and customer.

Customer places the order of advertisement digitally in the form of banner, audio or video, and the advertising agency deliver the advertisement order to the customer as per specification and requirement of the customer when the payment process is completed. It also generates a seasonal advertisement report to give information to the advertising agency.

After placing the order and payment process is done through the payment gateway. Figure: 2 shows that acknowledgment comes from the agency. After receiving the payment of the advertisement, customer can download advertisements. Our system reduces paperwork and makes the entire process automated.

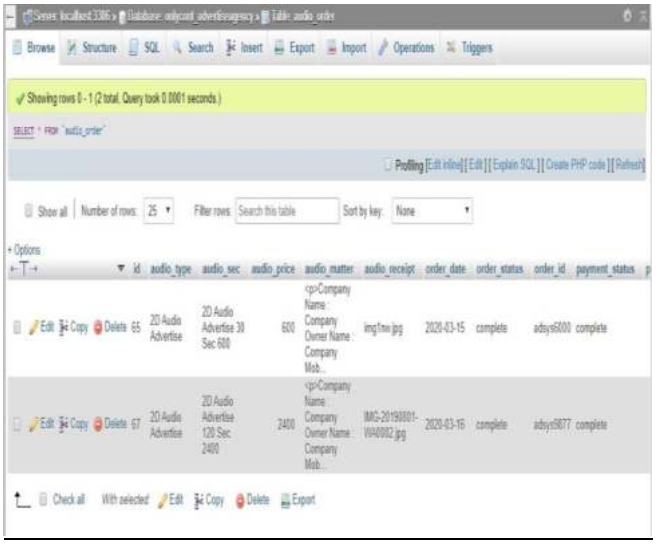

Figure 4. Audio order

Figure 2. Registration

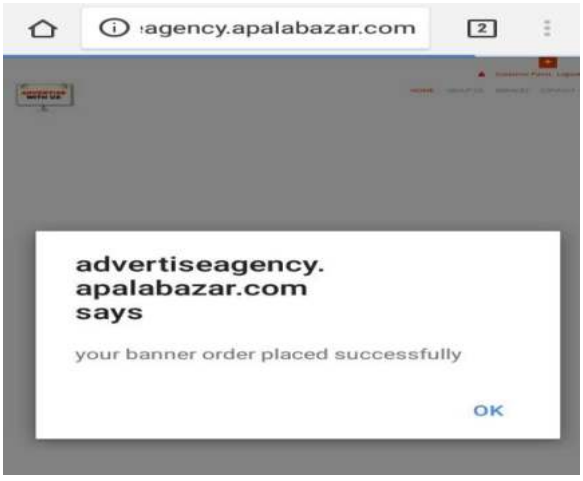

Figure 5. Banner order

VI. CONCLUSION

The "Online platform for managing advertise agency activities" system is very helpful for advertising agencies as well as its customers by doing all procedures digitally that are required from placing an order of advertising till ordered advertise has been received. The system saves the manual efforts and time required for placing an advertise order. Apart from this, the system also helps the advertising agency regarding the idea about which advertise has been in more demand in specific seasons.

VII. ACKNOWLEDGEMENT

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WebAR: Mobile Augmented Reality

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Abstract- Mobile WebAR is becoming a popular technology in business, education as well as in the gaming industry. In Chrome 67, Google announced the WebXR Device API for Augmented Reality (AR) and Virtual Reality (VR).By enabling this API we can perform Augmented and Virtual Reality (AR/VR) on Web browsers. There is no required special web browser and application, it just used as a web. It is accessed via Web Browser instead of any other applications. A user just has to open the camera and point it towards the code and get access to Augmented Reality into the web.This project focuses on developing an web application with Augmented Reality. This system shows the nearest places to the user with AR facility. And also experience the marker based AR for education and learning purposes. This system interacts with the objects in real word. The proposed work is more interactive by using augmented reality.

Keywords: *WebAR,AugmentedReality,Virtual Reality*

1.INTRODUCTION

The phenomenal growth in AR attracted developers and researchers towards this industry. The growth of augmentedreality(AR)overthe significant research,development and industry.Inrecent years ,advanced technologies are invented such as google maps which provide more interaction.AR offers different benefits such as advertisement,education,maintenance etc.The best example of AR is PokémonGo,is a location based AR game which reached upto millions of users.

The limited computing capabilities on the web makes it more challenging to achieve high performance.Users can find any place information on the map, website etc. During any visit, people need to be able to obtain information in a correct manner. But there is no any separate application is thereto provide correct information.Especially new people who are on it for the first time have in a new city hard time to find places and communicate local users.In nowadays most of the buildings are connected to each other, due to this people have difficulty to find places. Even if there are maps at some points, users have not continuous help to get their destination correctly. People used maps to find places.But as soon as they walk to their destination, it does not work properly. So there is a way to remove these difficulties and help new people and inexperienced people to access location information with new technology that is “WebAR(Augmented Reality)”.

Atypical AR process shown in above fig.The camera and sensors are used to gather user information.Camera analyze and capture the information(e.g image and location etc)for real world recognition.User interaction information is gathered by sensors and then analyzed for the purpose of tracking.

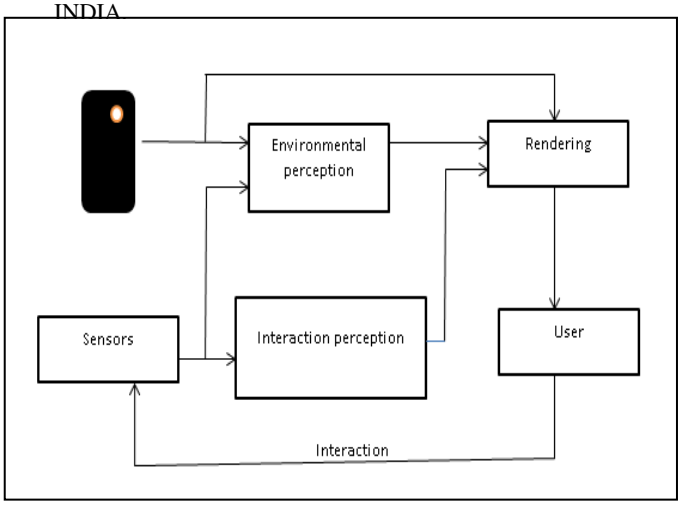

Figure*1*:TypicalARProcess

2.LITERATURE REVIEW

[1] Feng Zhou, Henry Been Designed paper based on Trends in Augmented Reality, Tracking ,Interaction and Display:Augmented Reality(AR)is a Technology whichAllows users to virtual imaginary to physical objects. AR provides users to interact with the imaginary world.it combines real world and imaginary world. The first AR designed in 1960 by Sutherland. The paper focuses on the research on experience in existing systems in which highly effective AR features are used.It also analyzes the three main questions such as (1)Which areas have been explored in AR? (2)What are the developments and key problems in AR?(3) What are important future trends in AR?

[2] Xiuquzn Qiao,Pei Ren and Schahram dustdardesigned paper on Web AR: A Promising Future For Mobile Augmented Reality -State of the art, Challenges, and Insights.Mobile Augmented reality (MAR) is becoming popular in business as well as industry.There are two main mobile AR technologies such as Hardware based Mobile AR and App-based Mobile AR technology.Some advanced Web technologies interactively meet the basic requirements of Web AR and provide performance improvement approaches.

(1)WebRTC-WebRTC provides real-time communication with Browsers; it is a very important technology for WEB AR. The camera captures the environmental factors in the form of video, image by using WebRTC technology.

(2)WebAssembly-WebAssembly is used to simplify the programming process and achieve speed.

(3)Web Workers-Web Workers technology is used to multithread technology for JavaScript.

(4)Web GL-Web GL provides the hardware based (GPU)rendering approach on the web.

[3] Mayuri Tamhane, Chirag Gupta Designed paper based on Campus Navigator with Augmented Reality:This focuses on developing an android application. The purpose of this system to provide mobile application to manage and control the user information using AR-Navigator and Indoor Navigator.Purpose of this system is to reduce time wastage and gaining efficiency and accuracy. Provide useful, informative mobile based navigation applications which are designed for specific campus,inside campus information provided by using an AR navigator.

3. METHODOLOGY

To develop any system, selecting proper methodology is an important role in a project which provides basic guidelines about the project.Technology used in this web application which is AR(Augmented Reality)Navigator.AR-Navigator uses cameras to find places.it is the latest technology mostly used in e-commerce projectsAugmented Reality is adding imaginary worlds to real world objects. To achieve Web AR technology to require enables web technologies:

1)WebRTC-WebRTC provides real-time communication with Browsers; it is a very important technology for WEB AR. The camera captures the environmental factors in the form of video, image by using WebRTC technology.Now days the large no of browsers support the WebAR technology.

2)WebAssembly-WebAssembly is used to simplify the programming process and achieve speed. Chrome, Firefox alsosupports this technology. Web Assembly solves the problem of JavaScript congestion.it not only improves web performance but also makes it an easy development process.

3)Web Workers-Web Workers technology is used to multithread technology for JavaScript.Web Workers simply provides the parallelization of Web AR

Applications.

4)Web GL-Web GL provides the hardware based (GPU)rendering approach on the web.GPU is used in mobile devices makes presentation attractive,smoother and realistic on the web.these technologies provide basics for Web AR.

4. SYSTEM ANALYSIS AND DESIGN

The website of Augmented Reality is used to assist users to provide correct places and their information. It easily provides destination information and it allows the user access to the camera. By using camera it provides location information. The user holds the mobile front of the walking location; the system automatically detects the location and provides information.

4.1 SYSTEM ANALYSIS

Analysis is done on existing systems and their problems and how to recover such problems that are not covered in existing systems. Such systems are very expensive to use and implement and not work 100% as per user requirement.

Existing system uses maps and directions to provide information to the user ,but there are problems in such situations in which some places have changed their locations but not updated so users have faced this problem.

There is also an android application available but there is a problem in installation, such as this analysis we work on a website which provides direct access.

4.2SYSTEM DESIGN

The website Mobile Augmented Reality is used to assist users to provide correct places and their information.it easily provides destination information.This system has a vision based mechanism;similarly, the camera captures the surrounding area but here it provides the vision based object recognition,detection and tracking.

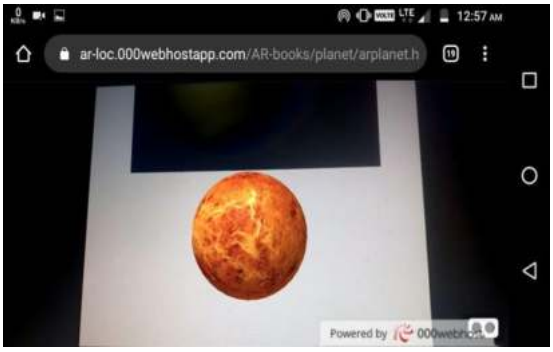

Figure2:Marker Based AR

In this system marker based method is used which uses the predefined markers to meet the tracking requirement. Themarkers have predefined shape,size, color and properties.It allows users to use or access cameras. By using camera it provides location information. The user holds the mobile front of the walking location; the system automatically detects the location and provides information.

Figure3: Location Based AR

5. FUTURE SCOPE

The scope of proposed project work depends on the

required time, resource and user requirements. Scope of project is limited because of range; provide places by Mobile Augmented Reality (AR). When a user searches the places by using an Mobile Augmented Reality (AR) provide information by arrows.

- Offers an optimal experience for different websites and applications.
- Can access this website from any mobile browser with real time data.

ACKNOWLEDGEMENT

We are thankful to our Project Guide Prof. Miss Mulla S.Y and Project Coordinator Prof. Mr Pathak P.A and other staff for guidance whenever required. We have like to express my heartfelt gratitude towards our parents and all those who encouraged us to support our project.

6. CONCLUSION

In this Project, we present an implementation of a Website which is Based on Mobile Augmented Reality Technology. Based on existing problems such as inaccurate location information, also buildings within regions are not located on the map. Another main problem when user search location by typing spot name there is not convenient some times as per some problem Mobile Augmented Reality based website is implemented which is user friendly web application which provides user searched location information using Web AR.It is implemented based on user's requirement concern.The problem of mistakes typing any location on map is reduced by vision based method which allows the access the camera directly on web.The user holds the mobile front of walking location, the system automatically detect the location and provide information.

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REVIEW ON APPLICATIONS DESIRED BY SUGAR INDUSTRIES

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Abstract— **In this paper, we have studied the need and current practices adopted by the sugar factories. The current websites of sugar factories provide only static data. Upon this analysis, we are creating a dynamic website that provides various services for farmers, members, and transporters. In our model, there are some different features compared to current practices.**

Keywords:-CRM, Dynamic, Webpage

I. INTRODUCTION

CRM technology gives the advantage to several leading factories to expand their markets sharply. These factories have established a CRM system to create valuable marketing opportunities and increase customer value. The factory enhances customer satisfaction for business purposes. In a sugar factory sugar is the main product. In the sugar development process, there is a lot of wasted water and raw material. Using that water and raw material the factory develop bi-products like CNG, Kiveej, Electricity, Fertilizers, and Distillery. These bi-products are sold to customers. Therefore to manage all such activities there should be some application.

To achieve real-time implementation of the CRM system to have the right technology automating and improving the factory processes associates with managing the factory relations with its customers. This project is based on Analytical technologies. In this part, we review and analyze the technology process architecture of some important CRM systems in industries. We try to understand the implicit design architecture of these systems and to present them explicitly.

II. LITERATURE REVIEW

Mingfeng Ye [1] has researched the method of attribute reduction based on rough set theory, this method can find the more effective attributes for decision support. Above that, this paper gives the data mining algorithm on knowledge dependence, this algorithm can yield a decision tree which puts forward more effective decision-support information. This algorithm is practical for a single decision information system.

Uladzimir Parkhimenka [2] has research gave a customer online purchase prediction for preliminary results. These features are unclear as it needs what exact set of data instances should be incorporated for enough prediction and its models, which method is to be used for best data mining (algorithm) and the stability of this model as the model is transferable from one online store to another.

Shasank Chavan [3] has research Oracle Database In-Memory Option allows Oracle to function as the industry-first dual-format in-memory database is an option that allows oracle to function. The row format for OLTP workloads uses indexes to limit the data access to a small set of rows, though the column format suited for Analytic operations which are beneficial for a small number of columns from a large number of rows typically examines a small number of columns from a large number of rows.

Peng Gao [4] has a research Software pattern which is the solution of some fixed issues in software development. And it improves development efficiency. This paper raises the concept of C# blueprint pattern based on a wealth of program model examples. And the formalized definition framework of C# blueprint action pattern is summed up. The framework defines the rules of structure, semantics and so on.

Huyam AL-Amro [5] has research El-Qawasmeh The owner of the website which is developed using ASP.NET provides better security vulnerabilities. This paper gives information about the algorithm that is the detection of security vulnerabilities. This algorithm performs a scanning process for all website/ application files. The application depending on ASP.NET files and the code behind files mainly relies on studying the

source code which is our scanner tool. To describe the leaks and vulnerabilities types these programs are written to generate a report. This report helps to fix the vulnerabilities and gives a high priority security level.

S. Rezaiian Fardoie M.A Saniee Monfared [6] has researched a new design architecture for e-CRM systems. Despite the recent interests in the development of e-CRM1 systems in different organizations, system designers suffer from a lack of systematic approach in the design and development of CRM systems. In this paper, we examine and compare the mostly ad-hoc design architecture employed and used by major players in CRM industries. Upon this analysis, we found that the different design architecture has many elements in common.

III. GAP IDENTIFICATION

The Business world has shifted focus from product to customer. In a sugar factory, overall work is done manually. The customer has to always visit the factory for inquiry of cane bill, sugar information, and membership approval. Also, the cane registration, member registration, transporter registration processes are attained manually, so the customer has to visit that factory and fill-up the registration form manually. After some duration customer gets approval for membership of sugar factory. So there should be an application that will control all these activities to help customers completing all the processes without visiting the factory frequently. Now website/online application overcomes these drawbacks, they provide the various registration facility online. The Customer does not need to visit the factory for the registration process.

By designing and developing the website that handles all the activities is a better solution to help customers and sugar factories to process all the activities smoothly without efforts spent on visiting the sugar factory for every activity. The website should have dynamic web pages to accept the data details from customers. All the customers should get the individual login to access all the functions that are needed for processing in the sugar factory. The website should provide information about all the activities that are currently manually done. This helps the customer to keep track of the activities and take necessary initiatives accordingly.

Mingfeng Ye [1] suggested the theory related to fetching a large amount of data for processing with decision-making abilities. This study could be used for the development of websites/application for sugar mills by providing customers with decision-support.

Uladzimir Parkhimenka [2] mentioned about the applicability of a framework to find the prediction of online customer's behavior. This study can be useful to predict the tonnage of Sugarcane. This will give customers a preview of the raw material they are transporting to the factory.

Peng Gao [4] mentioned the C# blueprint action pattern. This pattern will help to fix the issues in software development that is being followed for developing the application or website.

The proposed approach should be more user friendly to provide details such as inquiry facility, option for checking the factory products, sugarcane bills, sugar information.

Most of the sugar mills use static websites for displaying their data. But there is no provision to register the customers, farmers, retailers. The dedicated dynamic website or application can be the best approach to improve the efficiency of overall processing as well as increase customer satisfaction. In the current system, there is a lot of documentation needed to be maintained. All this documentation is done manually. The dynamic website or application must have the provision to generate the reports. This can be done by using the crystal report features in web development.

Huyam AL-Amro [5] has discussed the crystal reports which can be beneficial to generate reports and maintain the documentation.

IV. FUTURE SCOPE

This website helps in developing digital India in the agricultural area. Admin can store the data from the web which can be accessed anytime. Our website also helps the environment to reduce paperwork and also to reduce manpower.

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CUSTOMER RELATIONSHIPMANAGEMENT APPLICATION FORSUGAR MILL

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Abstract—**This web application provides an effective Solution for Kisan Veer Satara Sahakari Sakhar Karkhana. This application is effectivefor various services of mill that are provided to farmers as well as members of mill. There is a procedure for farmer registration where new member can register easily. It also stores inflicted result of the sugar which is purchased by the member of mill, display the rest of the sugar and cane bill. Transporter can register their vehicles for mill. Here all clients'data can be displayed online. All product details and also the placement details of mill are available online. In this application we use latest technology for web hosting that is GoDaddy and HostGator.This website will have a attractive design as per requirements of mill. This website is compatible for any browser. The information related to the bi-products of the sugar mill as well as the details of the various events that are organised by mill are available on the web application.**

Keywords—Crystal Report, CRM, Transporter, Sugarcane, Kisan Veer, Sugar Mill, Karkhana Bhuinj.

I. INTRODUCTION

Over the past ten years, the responsibility of runningsugar mill in as per the government norms is a tedious task.Many people are involved in many processes. These processes may include registration of farmers, members, transporter and sugar caneregistration facilities.

All these processes are maintained and documented manually. These processes are quite time consuming as well as farmers have to visit the sugar mills. Farmers have to go through many processes which have been manually controlled. This was not an easy task.

If there is provision that allows the farmers as well as mill administrative authorities process their work, then it will be more effective and time saving as timely decisions boosted financial growth. Current website of Kisan Veer Satara Sahakari Sakhar Karkhana is static which give information about the mill events, projects & reports. We are doing dynamic website which provides various services for farmers, member of mill, workers and account staff of mill and transport services. Here in registration process, new member can register easily. It is a web based application for sugar mill that covers all the aspects of E-commerce for Kisan Veer Satara Sahakari Sakhar Karkhana Bhuinj. This web application provides an effective Solution mill, farmers, member of mill and transport services. Transporter can register their vehicles for mill. Accordingly they will get loading orders from sugar mill. The various functions of the sugar mill are controlled and monitored through this web application.

II. LITERATURE REVIEW

Mingfeng Ye [1] has researches the method of attribute reduction based on rough set theory, this method can find the more effective attributes for decision support. Above that, this paper gives the data mining algorithm on knowledge dependence, this algorithm can yield a decision tree which puts forward more effective decision support information.This algorithm is practical for a single decision information system.

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III. METHODOLOGY AND EXPERIMENTATION

Technology used in this web application is .Net Framework and database is oracle 10g.In case of business model, the majority of specialist is being moved from product concentration to the farmer, member and transporter. The companies are establishing the Electronic Customer Relationship Management (CRAG / E-CRM) more than conventional CRM which is easily accepted by farmers, members of mill, transporters (customers).

Here, we have implemented the model of e-CRM. In the process of development of a CRM system, so many procedures are involved and connected to each other. An Informative Technology based CRM system i.e. e-CRM combines the customer information with series of procedures which includes the data mining, data warehousing, data analysis in order to convert that information into decision making calls. In this application there is bridge between technological and functional components.

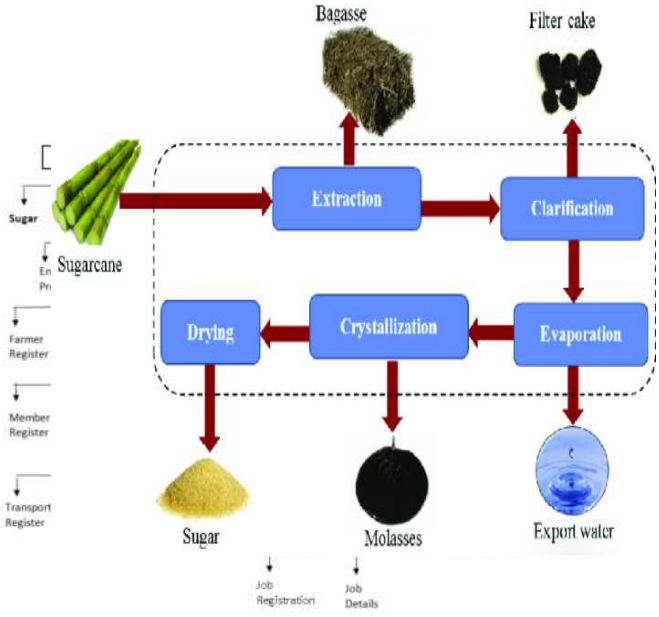

Figure1. Sugar Processing

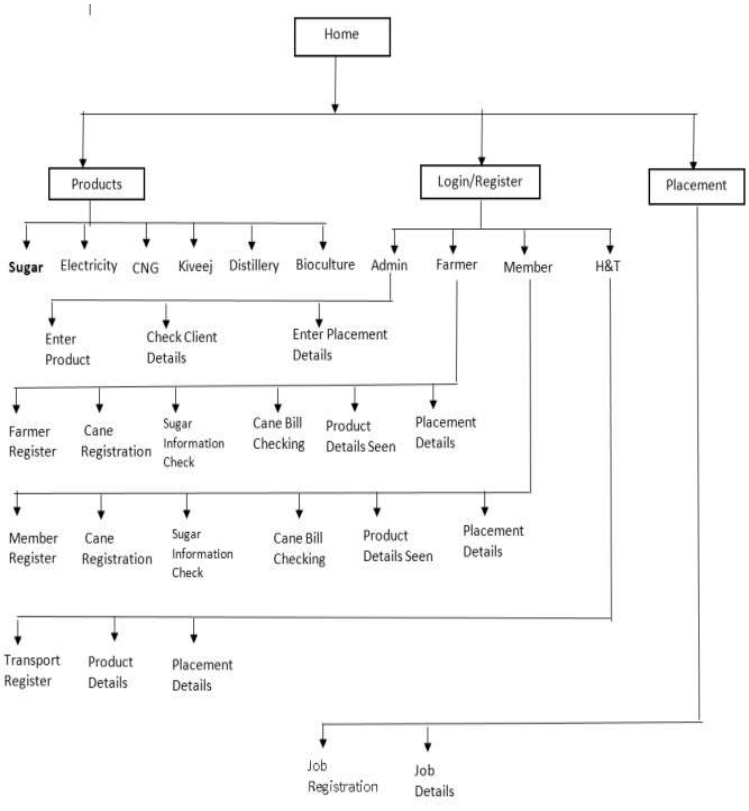

Figure 2. Flow Diagram

Because of this there is strong connection between front-end of the system and back end of the system. Also the main advantage of this system is that architectural design can help to integrate desired components and manage the flows between them.There are three parts of this model;

Collaborative technologies, operational technologies, analytical technologies. In our web application, registration of farmers, registration of members of sugar mills, registration of transportation vehicles are the processes which belong to the collaborative technologies.

In Collaborative technologies module, admin, farmers, members and transport agents can do their registration and have individual accounts. In operational technology module, the sugar mill can display the range of products as well as monitor the requests for the products. This also includes contact management, sales management monitoring of interactions with consumers. It also deals with queries, complaints that occur after-sales. Here admin has given the authority to handle all the affairs related to operational modules.In analytical technologies module, integration and processing of all the details that are provided through the farmer, member and transport agent's accounts. Here admin will process the information received and updates the status of various functions that are followed in sugar mill.In this module data is analyzed and appropriate action is takensugar information such as weight, sugarcane type, cane yard , vehicle availability, etc. are assessed, accordingly the details are updated to the farmers, members and transport vehicles. For documentation purpose we have used the crystal reports. These will cover all the information which processed or which is input by the farmers, vehicle agents.

IV. RESULT AND DISCUSSION

In this paper we have presented the web application for the processes involved in Kisan Veer Sakhar Sahakari Karkhana, Bhuinj, Satara. We have provided the individual accounts for farmers, members and transport agents. All these have to register to the web application in order to be the part of the processes of sugar mill.

The admin will monitor, control and process all the activities based on the information available from different accounts.

This online process will help farmers, members and transport agents to track the activities without visiting the sugar mill. Also this application will produce the reports which indeed help in proper documentation. This is really time effective and exact solutions for the problems faced by the farmers. It also helps to predict the actual tonnage which is measure of the profit for mill. This system is time consuming for farmers and employees of that mill.

V. CONCLUSION

This web application helps to sugar mill by providing digital platform to maintain customer details. Also to display the overall data for farmer easily. Farmer and Member can easily check the information about sugar and cane bill. Member can apply easily to membership of that mill without any visit to mill. It makes all the tasks of sugar mill online.

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REVIEW ON APPLICATIONS DESIRED BY SUGAR INDUSTRIES

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Abstract— **In this paper, we have studied the need and current practices adopted by the sugar factories. The current websites of sugar factories provide only static data. Upon this analysis, we are creating a dynamic website that provides various services for farmers, members, and transporters. In our model, there are some different features compared to current practices.**

Keywords:-CRM, Dynamic, Webpage

I. INTRODUCTION

CRM technology gives the advantage to several leading factories to expand their markets sharply. These factories have established a CRM system to create valuable marketing opportunities and increase customer value. The factory enhances customer satisfaction for business purposes. In a sugar factory sugar is the main product. In the sugar development process, there is a lot of wasted water and raw material. Using that water and raw material the factory develop bi-products like CNG, Kiveej, Electricity, Fertilizers, and Distillery. These bi-products are sold to customers. Therefore to manage all such activities there should be some application.

To achieve real-time implementation of the CRM system to have the right technology automating and improving the factory processes associates with managing the factory relations with its customers. This project is based on Analytical technologies. In this part, we review and analyze the technology process architecture of some important CRM systems in industries. We try to understand the implicit design architecture of these systems and to present them explicitly.

II. LITERATURE REVIEW

Mingfeng Ye [1] has researched the method of attribute reduction based on rough set theory, this method can find the more effective attributes for decision support. Above that, this paper gives the data mining algorithm on knowledge dependence, this algorithm can yield a decision tree which puts forward more effective decision-support information. This algorithm is practical for a single decision information system.

Uladzimir Parkhimenka [2] has research gave a customer online purchase prediction for preliminary results. These features are unclear as it needs what exact set of data instances should be incorporated for enough prediction and its models, which method is to be used for best data mining (algorithm) and the stability of this model as the model is transferable from one online store to another.

Shasank Chavan [3] has research Oracle Database In-Memory Option allows Oracle to function as the industry-first dual-format in-memory database is an option that allows oracle to function. The row format for OLTP workloads uses indexes to limit the data access to a small set of rows, though the column format suited for Analytic operations which are beneficial for a small number of columns from a large number of rows typically examines a small number of columns from a large number of rows.

Peng Gao [4] has a research Software pattern which is the solution of some fixed issues in software development. And it improves development efficiency. This paper raises the concept of C# blueprint pattern based on a wealth of program model examples. And the formalized definition framework of C# blueprint action pattern is summed up. The framework defines the rules of structure, semantics and so on.

Huyam AL-Amro [5] has research El-Qawasmeh The owner of the website which is developed using ASP.NET provides better security vulnerabilities. This paper gives information about the algorithm that is the detection of security vulnerabilities. This algorithm performs a scanning process for all website/ application files. The application depending on ASP.NET files and the code behind files mainly relies on studying the

source code which is our scanner tool. To describe the leaks and vulnerabilities types these programs are written to generate a report. This report helps to fix the vulnerabilities and gives a high priority security level.

S. Rezaiian Fardoie M.A Saniee Monfared [6] has researched a new design architecture for e-CRM systems. Despite the recent interests in the development of e-CRM1 systems in different organizations, system designers suffer from a lack of systematic approach in the design and development of CRM systems. In this paper, we examine and compare the mostly ad-hoc design architecture employed and used by major players in CRM industries. Upon this analysis, we found that the different design architecture has many elements in common.

III. GAP IDENTIFICATION

The Business world has shifted focus from product to customer. In a sugar factory, overall work is done manually. The customer has to always visit the factory for inquiry of cane bill, sugar information, and membership approval. Also, the cane registration, member registration, transporter registration processes are attained manually, so the customer has to visit that factory and fill-up the registration form manually. After some duration customer gets approval for membership of sugar factory. So there should be an application that will control all these activities to help customers completing all the processes without visiting the factory frequently. Now website/online application overcomes these drawbacks, they provide the various registration facility online. The Customer does not need to visit the factory for the registration process.

By designing and developing the website that handles all the activities is a better solution to help customers and sugar factories to process all the activities smoothly without efforts spent on visiting the sugar factory for every activity. The website should have dynamic web pages to accept the data details from customers. All the customers should get the individual login to access all the functions that are needed for processing in the sugar factory. The website should provide information about all the activities that are currently manually done. This helps the customer to keep track of the activities and take necessary initiatives accordingly.

Mingfeng Ye [1] suggested the theory related to fetching a large amount of data for processing with decision-making abilities. This study could be used for the development of websites/application for sugar mills by providing customers with decision-support.

Uladzimir Parkhimenka [2] mentioned about the applicability of a framework to find the prediction of online customer's behavior. This study can be useful to predict the tonnage of Sugarcane. This will give customers a preview of the raw material they are transporting to the factory.

Peng Gao [4] mentioned the C# blueprint action pattern. This pattern will help to fix the issues in software development that is being followed for developing the application or website.

The proposed approach should be more user friendly to provide details such as inquiry facility, option for checking the factory products, sugarcane bills, sugar information.

Most of the sugar mills use static websites for displaying their data. But there is no provision to register the customers, farmers, retailers. The dedicated dynamic website or application can be the best approach to improve the efficiency of overall processing as well as increase customer satisfaction. In the current system, there is a lot of documentation needed to be maintained. All this documentation is done manually. The dynamic website or application must have the provision to generate the reports. This can be done by using the crystal report features in web development.

Huyam AL-Amro [5] has discussed the crystal reports which can be beneficial to generate reports and maintain the documentation.

IV. FUTURE SCOPE

This website helps in developing digital India in the agricultural area. Admin can store the data from the web which can be accessed anytime. Our website also helps the environment to reduce paperwork and also to reduce manpower.

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CUSTOMER RELATIONSHIPMANAGEMENT APPLICATION FORSUGAR MILL

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Abstract—**This web application provides an effective Solution for Kisan Veer Satara Sahakari Sakhar Karkhana. This application is effectivefor various services of mill that are provided to farmers as well as members of mill. There is a procedure for farmer registration where new member can register easily. It also stores inflicted result of the sugar which is purchased by the member of mill, display the rest of the sugar and cane bill. Transporter can register their vehicles for mill. Here all clients'data can be displayed online. All product details and also the placement details of mill are available online. In this application we use latest technology for web hosting that is GoDaddy and HostGator.This website will have a attractive design as per requirements of mill. This website is compatible for any browser. The information related to the bi-products of the sugar mill as well as the details of the various events that are organised by mill are available on the web application.**

Keywords—Crystal Report, CRM, Transporter, Sugarcane, Kisan Veer, Sugar Mill, Karkhana Bhuinj.

I. INTRODUCTION

Over the past ten years, the responsibility of runningsugar mill in as per the government norms is a tedious task.Many people are involved in many processes. These processes may include registration of farmers, members, transporter and sugar caneregistration facilities.

All these processes are maintained and documented manually. These processes are quite time consuming as well as farmers have to visit the sugar mills. Farmers have to go through many processes which have been manually controlled. This was not an easy task.

If there is provision that allows the farmers as well as mill administrative authorities process their work, then it will be more effective and time saving as timely decisions boosted financial growth. Current website of Kisan Veer Satara Sahakari Sakhar Karkhana is static which give information about the mill events, projects & reports. We are doing dynamic website which provides various services for farmers, member of mill, workers and account staff of mill and transport services. Here in registration process, new member can register easily. It is a web based application for sugar mill that covers all the aspects of E-commerce for Kisan Veer Satara Sahakari Sakhar Karkhana Bhuinj. This web application provides an effective Solution mill, farmers, member of mill and transport services. Transporter can register their vehicles for mill. Accordingly they will get loading orders from sugar mill. The various functions of the sugar mill are controlled and monitored through this web application.

II. LITERATURE REVIEW

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III. METHODOLOGY AND EXPERIMENTATION

Technology used in this web application is .Net Framework and database is oracle 10g.In case of business model, the majority of specialist is being moved from product concentration to the farmer, member and transporter. The companies are establishing the Electronic Customer Relationship Management (CRAG / E-CRM) more than conventional CRM which is easily accepted by farmers, members of mill, transporters (customers).

Here, we have implemented the model of e-CRM. In the process of development of a CRM system, so many procedures are involved and connected to each other. An Informative Technology based CRM system i.e. e-CRM combines the customer information with series of procedures which includes the data mining, data warehousing, data analysis in order to convert that information into decision making calls. In this application there is bridge between technological and functional components.

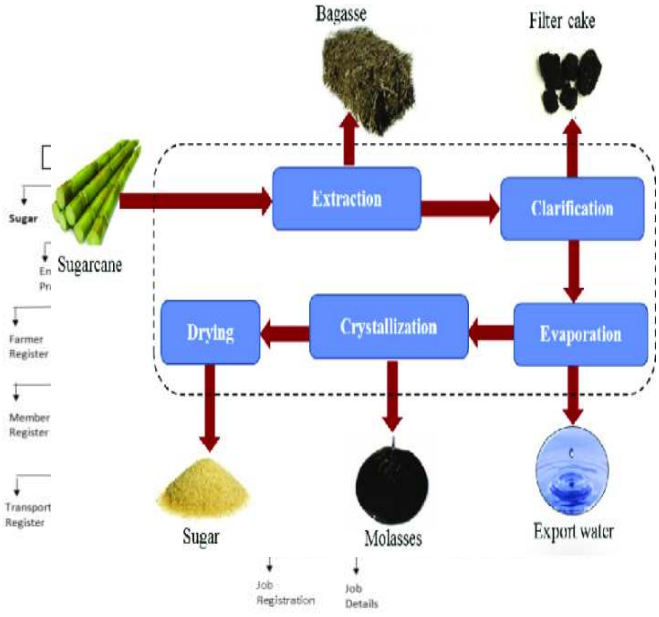

Figure1. Sugar Processing

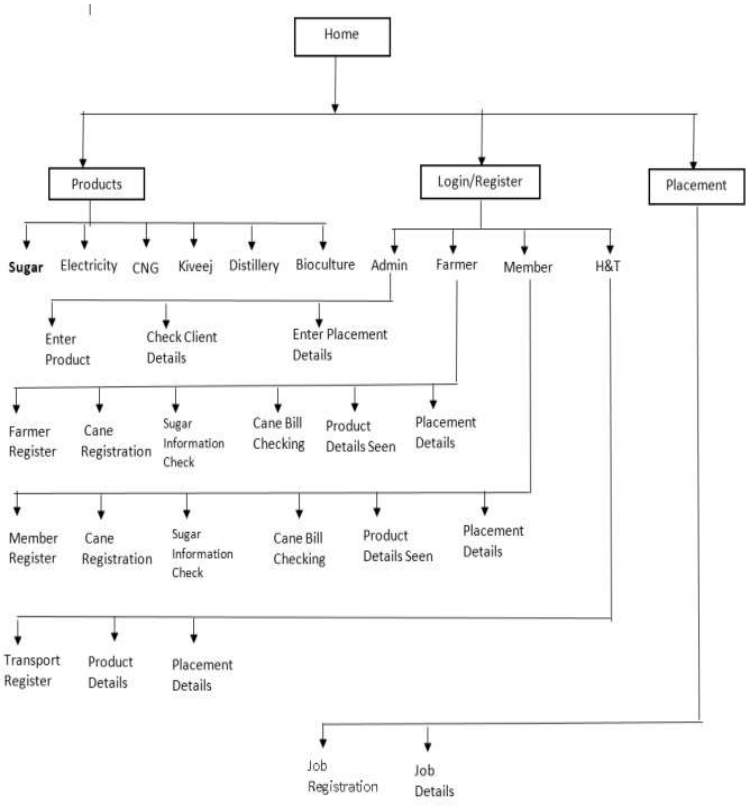

Figure 2. Flow Diagram

Because of this there is strong connection between front-end of the system and back end of the system. Also the main advantage of this system is that architectural design can help to integrate desired components and manage the flows between them.There are three parts of this model;

Collaborative technologies, operational technologies, analytical technologies. In our web application, registration of farmers, registration of members of sugar mills, registration of transportation vehicles are the processes which belong to the collaborative technologies.

In Collaborative technologies module, admin, farmers, members and transport agents can do their registration and have individual accounts. In operational technology module, the sugar mill can display the range of products as well as monitor the requests for the products. This also includes contact management, sales management monitoring of interactions with consumers. It also deals with queries, complaints that occur after-sales. Here admin has given the authority to handle all the affairs related to operational modules.In analytical technologies module, integration and processing of all the details that are provided through the farmer, member and transport agent's accounts. Here admin will process the information received and updates the status of various functions that are followed in sugar mill.In this module data is analyzed and appropriate action is takensugar information such as weight, sugarcane type, cane yard , vehicle availability, etc. are assessed, accordingly the details are updated to the farmers, members and transport vehicles. For documentation purpose we have used the crystal reports. These will cover all the information which processed or which is input by the farmers, vehicle agents.

IV. RESULT AND DISCUSSION

In this paper we have presented the web application for the processes involved in Kisan Veer Sakhar Sahakari Karkhana, Bhuinj, Satara. We have provided the individual accounts for farmers, members and transport agents. All these have to register to the web application in order to be the part of the processes of sugar mill.

The admin will monitor, control and process all the activities based on the information available from different accounts.

This online process will help farmers, members and transport agents to track the activities without visiting the sugar mill. Also this application will produce the reports which indeed help in proper documentation. This is really time effective and exact solutions for the problems faced by the farmers. It also helps to predict the actual tonnage which is measure of the profit for mill. This system is time consuming for farmers and employees of that mill.

V. CONCLUSION

This web application helps to sugar mill by providing digital platform to maintain customer details. Also to display the overall data for farmer easily. Farmer and Member can easily check the information about sugar and cane bill. Member can apply easily to membership of that mill without any visit to mill. It makes all the tasks of sugar mill online.

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Review on Development of the Web Application for the User Bike Servicing

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Abstract –In this paper, we have studied the need and current practices adopted by the servicing centers. The current website of the servicing center provides only the registration and customer has to go physically at vehicle servicing center. Upon this analysis we are creating a website which provides the various services for the bike/ vehicle users. We have proposed the dynamic web application to serve the customers of servicing centers. For that we have studied different CRM approaches.

I. INTRODUCTION

Online Bike servicing is to be developed for maintaining the service center activities like, Bike maintenance, bike service and spare parts repair. Customer submit their details and proceed to next level. The system is efficient in generating the total bill of bike maintenance. This project is very helpful for customer who want to repair or service their bike. Related to our system implementation we refers some of the papers, websites and books. Customer Relationship Management (CRM) is an approach to manage developers interaction with current and potential customer. It uses data analysis about customer's history with a company to improve business relationships with customers.

It is stored in the table system to create a dynamic interface. There are some limitations and possibilities for access the metadata [1].Vijay Rana suggested that for making meaningful web pages there is need of data mining. It is an innovation for making the knowledge oriented web pages. It is the concept in which web mining is the future of world wide web where it provides the lots of feactures for storing the meaningful data[2].The Hongtao Z hu suggested the stages of knowledge flow in that stages first information is collected and knowledge captured ;then organizing and storing of information is helpful to utilization and retrivel of knowledge. In this stage the Lifeng Tu[7] has research on effect on CRM on new product.PHP is the most popular scripting language for web development. By using this technology we implement our web application. By using Mysql Database tools we can easily create Mysql user and a database, and create one or more table in same database for storing purpose. For storing customers information, employee details and servicing centers details we use Mysql.

II.LITRATURE REVIEW

The Mohamad A meheder suggested that by using and captured knowledge is stored with techniques including categorization, classification, abstract ,index and navigation. Information retrieval and knowledge extraction are useful to find out knowledge and Information for other levels. Knowledge creation level is used for producing a new knowledge such as design and methods. Knowledge application is the end of whole knowledge flow[3]. The zhang wenyu ,yin jianwei, Cai ming, Wu jian, lin lanfen [4] suggested that new ontology based manufacturing knowledge , integration framework are designed for emerging semantic web , deep web and SOA techniques. Ontology based web services uses two stages. Semantic service discovery and semantic knowledge retrieval to handle the complex queries[4]. The hong yu, Xiaolci huang, Xiaoron g hu suggested that applying data mining technologies to support enterprise knowledge management to achieve competitive advantage. They designed architecture of collecting and mining data out of E-Commerce platform [5].The Ching yu huang suggested some encryption and authentication mechanisms for resetting the passwords. In that paper,they provided security concern for password validation because, people can easily find the verification algorithm. Users login and password should be stored in database for authentication by the programs running on the web server[6].The purpose of lifeng tu is to examine the role of CRM strategies in new product design. The performance of new product has a significant impact on firm performance. The product which is important mediator of the CRM which has a number of references for business practice[7].

III. COMPARATIVE STUDY

There are different websites implemented related to bike servicing. We design a web application for reduce their disadvantages. We first study of all bike related websites such as bro4u.com, bikemaintanance.com, bikegallery.com etc. we do Some of the comparative study on that. In that the existing system there is no advance payment facility, so there is loss of servicing center if user can't take the service after booking. In proposed system there is advance payment facility so it is beneficial for servicing center. Disadvantage of the existing system is fake user can register in the system. Fake users registration is avoided in proposed system by using advance payment feature. In existing system user only allocate the slot online but he/she has to go physically at the servicing center for bike servicing. In proposed system user allocate the slot but they have not go physically at servicing center. Instead of that the employee of that servicing center comes at the mentioned location to take of the bike. This type of system are implemented in metropolitan cities only like Pune, Bangalore, Delhi and Hyderabad. Now we provide this service in small city like in Satara.

IV FUTURE SCOPE

This proposed system is only useful for the bike users. By using this system we can also design a web application or implement in same system for other vehicles. In this system we use Online payment facility without using payment gateway. In future we use the payment gateway for online payment. In future we can provide the barcode method for security purpose.

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SURVEY ON ELECTTRICITY DEMAND DUE TO ELECTRICAL VEHICLES

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Abstract:

With the increased awareness of green environment and depletion of fossil fuel resources. Due to increased population there is need to find an alternative for the use of Internal Combustion Engine (ICE) vehicles for transportation sector. This makes Electrical vehicles is the attractive option for the transportation sector. This paper discusses the impact of electrical vehicles on electric energy consumption. The estimation of daily and annual energy demand of an electric vehicle is investigated and expressed as probability of energy required to charge electric vehicle in future. The result demonstrates that in spite of significant increase of electrical vehicles in future. The estimated energy demand by the vehicles will be increased in future due to increase number of charging station to charge the Electrical Vehicles.

Keywords:

Electrical vehicles(EV),charging stations ,impact on Electricity demand.

Introduction:

The retail prices of petrol and diesel are high enough in India to make electricity driven vehicles relatively economical the retail price of diesel was 65.00 Rs/litre in 2018-19, and the retail price of petrol was 70.00 Rs/litre. The electricity retail price to replace diesel would be 12.21 Rs/Kwh (860 Kcal/Kwh at 75% input electricity to shaft power efficiency versus diesel's net calorific value of 8572 Kcal/litre at 40% fuel energy to crank shaft power efficiency), and the comparable number to replace petrol would be 17.79 Rs/Kwh (860 Kcal/Kwh at 75% input electricity to shaft power efficiency versus petrol's net calorific value at 7693 Kcal/litre at 33% fuel energy to crank shaft power efficiency). In 2012-13, India consumed 15.744 million tons of petrol and 69.179 million tons of diesel, both mainly produced from imported crude oil.

India has plan to make a major shift of electric vehicles by 2030. In this respect, the electricity demand in 2030due to electrical vehicles has initiated a project that investigates the consumption of electricity due to different electrical vehicles as possible to meet consumption of energy. A survey on electricity demand in 2030 due to electrical vehicles has been conducted to ensure the successes of the project development. Specifically, the survey is focused on four aspect related to electric vehicles namely safety, rechargeable method, speed limitation and return of investment. Following are reasons for the shifting to clean mobility. Air quality indices related to India indicate that the air in many cities of India is no longer healthy. Automobile related pollution has been one of the causes for this. Aspects related to global warming needs a shift to automobile solutions that reduce / do not produce greenhouse gas emissions.The need to reduce dependency on a fossil-fuel based economy. People living in some Indian cities are being affect:ed by noise pollution. Some of the Indian cities have the worst noise pollution levels in the world. Electric vehicles may contribute to a reduction in noise pollution levels in the cities. Energy efficiency and emission reduction has improved in automobiles. Yet, the growth in total number of vehicles on road, and the resulting total pollution and total energy consumption removed all gains made by betterment in energy efficiency and emission reduction by automobiles. Energy efficiency measures and pollution control measures did not keep pace with the sales growth in vehicles.

Electricity driven vehicles are expected to become popular in India when energy storage/battery technology offers improved range and lower maintenance Vehicle to grid options are also attractive, potentially allowing electric vehicles to help to mitigate peak loads in the electricity grid. The potential for continuous charging of electric vehicles through wireless electricity transmission

technology is being explored by Indian companies and other.

In the context of transportation, this could cause an increase in price of both private and commercial transportation. Therefore, electrical vehicles seems to be future of transportation and it is best possible solution for green environment. Electrical vehicles consumes less energy than then the cars powered by ICE (internal combustion engine). The electrical vehicles are much environment friendly than the ICE cars. Electrical vehicles are powered by the electric engine which does not burn fuel and no any harmful gases are are releases into the environment.

Literature Survey:

M. Marwan , G. ledwich , A. Ghosh and F. Kamel “Integrating Electrical Vehicles to Demand Side Response Scheme in Queensland Australia”,(IEEE, 2011) This paper develops a demand side response scheme for properly integrating EV’s in electrical netwoks It adopt internet relays and solid state switches to cycle charging and discharging of EV. The scheme is expected to mitigate excessive picks on the electrical network with all associative technical, economic and social benefits. The scheme is aimed to develop an integrating energy scheme that enable electricity comsumption and energy saving in Australia.2.) Maximillian Bucher,Yuriy Vagapov, department of engineering and applied physics,Glyndwr university,Plas coch,Mold Road,Wrexham,LL112AW,UK “Estimation of electrical energy demand by electrical vehicles from household :A UK perspective” (IEE ,2015)This paper discusses the impact of EV on household electric energy consumption.the estimation of average household is investigated an expressed as propability of energy required to charge EV.the performance for present and future were analyzed by using matlab simulation.the data used for simulation is based on UK travel pattern and national travel survey.3) Antti Rautiainen and pertti Juventus,”load control system of an EV charging station group”, This paper Corresponds to control methods are discussed in general and an example of practical and generic control algorithm is presented and stimulated in detail. This paper investigates controlling on an Ev Charging Station. The phase and charging current of car is simulated But they did not discussed about the fulfillment of the load demand they only tries to control the load by Ev charging Controlling in two ways. By switching online off (only option for mode or By restriking mode 3 or mode 4 charging current. 4)Author:Elsevier.B.V, "Modelling the weekly electricity demand casued by electric car", (conference paper-2015). This paper discuss about instead of increasing battery size of EV , use Plug in hybrid vehicles (PHEV). Increasing demand of electricity due to charging of battery electric vehicles (BHV) or extended range EV. During this additional demand covered by gas fuel power plant thus, using fossil fuel. But there is limitations of storage of conventional energy sources like petrol, diesel, coal etc. 5)Author: Jong Ryul won yong - beum yoon , prediction of Electricity Demand due to PHEVS distribution in karia by using diffusion model ,(IEEE 2009)In This paper the praposed it's electricity future demand prediction by Using Bass diffusion formula referencing U.S sales data .plug in hybrid care are main target of ev's.In this paper prediction is depend on statistical analysis method and bass diffusion formula and hence coefficient of innovation and coefficient of imitation is Difficult to find this survey predict the future electricity demand due to only plug in hybrid EV in korea. In future no HEV are running in korea then prediction can be changed.6)AuthorNieolo daina, aruna sirakamar, John w. Polak., "modelling electric vehicles use: a survey on the method".This papar reviewed the technique that have been used to model the demand of EV acquisition, use and charging, overview of this paper is classified in various approach. But it tends to neglect some important aspects of charging behavior such as range anxiety or the denial of spontaneous use which is important. 7) Author N shukal, B khan, M C.A method, T. Khan, U Forid, M Majid, S.M. Anwar.A survey on EV transportation within smart grid system. This survey emphasized on V2G mode in implementation of EV transportation in smart grid. The On board and Off board charging infrastructure for EV’s were presentedpresented. V2G provides an economic benefit but locks in real implementation due to unproven economic model and commutation bottle necks.The energy crisis and carbon emissions are too critical issues for PS in this survey.

Comparative study:

The push towards electrification of road, according to the plan in 2012, hence many authors published research paper on the survey of electricity demand due to electrical vehicles. Electrical vehicles are the

attractive option on the conventional vehicles. it is necessary to predict the future electricity demand brought by EV is very important for the utility companies to forecast energy consumption.based on forecast the utility company can analyse generation capablity and plan modernization to increase the power production.

1)The proposed article "load control system of an EV charging station group" which control the load demand by controlling EV charging station but paper did not discuss about the fulfillment of load demand.

In present scenario usage of vehicles are common to every human being, due to huge usage demand of fuel is increased. So, every country moving towards the EV system. Due to the EV system demand of Electrical Energy demand also increased. In this article demonstrated solution for fulfillment of future load demand of EV.

2)The paper " plug in EV as demand response to absorb local wind generation in power distribution network" which utilizes regulating surpluse wind power to charge the EV, but this type of charging station is suitable for hilly areas. The uncontrolled supply from wind and load imbalance will affect the power system.

In above literature survey implemented only one renewable source, but due to large demand by EV we need large scale generation to fulfill the demand. In this article includes various renewable electricity generation sources(hydro, wind, solar).

3)The paper" prediction of electricity demand due plug in hybrid electrical vehicle distribution in Korea by using diffusion model",which predict future electricity demand in korea only for PHEV but paper did not consider hybrid vehicle and there is possiblites of hybrid vehicles in future.

Due to hybrid electric vehicle, commercial and industrial usage demand of electric energy harness from different renewable resources.

4) The paper "the survey on electrical vehicles transportation within smart grid system"which contain V2G mode for EV but it had lack of proper implementation.

Article will demonstrate and discussed on proper implementation of charging stations also.

5) The paper "modelling electrical vehicles use:a survey on the method",divided into various approach but they neglect some aspects such as charging behaviors of battery.

This paper presents, survey and discussed on range of batteries and other aspects regarding charging also.

6) The paper"modelling the weekly electricity demand caused by electric cars ",IEEE 2015, if extend range of battery, increase the size of battery hence cost of EV an electricity demand increases to cover the additional demand by using fossil fuel but storage of fossil fuel is limited

Based on above literature survey paper is developed on the economic method like renewable energy sources through mobi-topp (microscopic travel demand model).

All above survey paper determined the impact of electrical vehicles on the electricity demand in future.

Future scope :

we assess the impact on a range of stakeholders of electrification of all passenger vehicle sales (cars and two-wheelers) in India by 2030. Specifically, we can disscuss the following questions:

(a) how does the total vehicle ownership cost of BEVs compare with the conventional vehicles, (b) what is the additional load due BEV charging, (c) what is the impact on the power sector investments, costs, and utility revenue, (d) how can smart BEV charging help renewable energy grid integration, (e) what is the impact on the crude oil imports, and (f) what is the impact on the GHG emissions.

We will use a comprehensive travel demand survey in the Satara region and make assumptions that by 2030, the travel demand pattern in rest of the city is the same. We then use the manufacturer labeled fuel efficiency numbers for ICE as well as BEVs (2019) and adjust them to reflect the technology improvements by 2030 based on a vehicle technology assessment in the US. Using the assumptions on travel demand in 2030, total BEV penetration and efficiency, and agent-based modeling of the charging behaviour, PEVI estimates the BEV charging load for each hour of the year. Using official government data and historical trends, we can predict hourly electricity demand in the country from sources other than BEVs.Due to increased no. of EV in future the available energy in satara city is not sufficient to fulfill the future electricity demand .from this survey we can find out the solutions to fulfill this demand by renewable energy sources.the achievements on future goals related to eletectrification and

enhancing the domenstic production yields higher per capita consumption of electricity ,which is likely to double between by 2030 compared to 2015.

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OPTIMAL PLACEMENT OF PMU FOR COMPLETE AND INCOMPLETE OBSERVABILITY

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***Abstract*--In this paper, a novel technique for optimal placement of phasor measurement units (PMUs) with minimum number of branch current phasor measurements for complete and incomplete observability has been presented. In the proposed algorithm, first the optimal placement of PMU was determined using binary genetic algorithm, then this result was used to minimize the number of current phasor measurement using genetic algorithm.**

Keywords
Binary integer linear programming (BILP), optimal branch current phasor, genetic algorithm (GA), Phasor measurement unit (PMU), optimal PMU placement.

I. INTRODUCTION

The invention of the Phasor Measurement Unit (PMU) in mid-1980's enabled the synchronized measurements of voltages and currents in real time that has become the foundation of today's wide area measurement, protection, and control (WAMPAC) systems. Several algorithms/methods for optimal PMU placement has been introduced to minimize the system cost while achieving full observability of a power system with a minimum number of phasor measurements. Observability of power system is a necessary condition for state estimation. State estimation provides the voltage and phase angle of all the buses in the power system, which is used for online operation and management of power system. Traditionally state estimators use Weighted Least Square (WLS) method to solve system state estimation problem with conventional measurements such as voltage magnitude, real and reactive power injection, real and reactive line power flows which is a nonlinear – iterative method and its computation time is considerably more than linear method.

Synchronized phasor measurements elevate the standards of power system monitoring, control, and protection to a new level [1] and [2]. Since the voltage and current phasors are measured, the state estimation equations become linear and it is easier to find the solution than the nonlinear system state estimation [3].In [4] the author has proposed a strategic PMU placement algorithm is developed to improve the bad data processing capability of state estimation by taking advantage of the PMU technology. The problem of PMU placement becomes an important issue in the power system state estimation as this device is increasingly being used for state estimation. Several PMU placement algorithms using different techniques have been proposed by different researchers across the world. An algorithm, which finds the minimal set of PMU placement needed for power system state estimation, has been developed in [5] and [6] where the graph theory and the simulated annealing method has been used to achieve the goal. In [7], the author has proposed a new integer linear programming based algorithm with and without considering conventional measurements, which is computationally effective. In [8], the author proposed a generalized approach for integer programming based method for optimal PMU placement for complete and incomplete observability with and without considering conventional measurements. In [9], the author proposed placement of PMU with channel limit with considering zero injection bus. Similarly there are number of PMU placement algorithms proposed by different researchers across the world using non dominated genetic algorithm [10], particle swarm optimization [11] etc.

Different optimal PMU placement method discussed so far provides only the optimal bus locations in power system where PMUs has to be placed. A branch current phasor measured by a PMU is for calculating the voltage phasor of the other end bus using KVL. In order to measure the line current phasors, the scheme requires as many numbers of auxiliary equipments to connect current transformer and PMU as the number of lines connected to the bus. This will increase the overall installation cost. But measuring the current phasor of all the connected lines is also unnecessary because, the bus being

observed by one PMU through its current phasor might already be under observation by another PMU in the same power system. Hence, number of current phasors need to be measured by a PMU can be reduced. This reduces the number of auxiliary equipments required for branch current phasor measurement and hence, reduces the overall installation cost.

In this paper, a new technique for the optimal placement of Phasor Measurement Units (PMUs) with minimum number of optimal current phasors measurements for complete and incomplete observability has been proposed. The ultimate goal is to find the minimum number of PMUs and their corresponding locations with optimal current phasor measurements so that the state estimation could be performed with measured phasor data at the lowest possible cost. For assessment of network observability, topological approach has been considered. The problem is formulated as a generalized integer linear programming problem [8] and Genetic algorithm is used to solve integer linear programming and for deriving the optimal configuration.

II. PMU PLACEMENTS FOR COMPLETE OBSERVABILITY ANALYSIS

Here the problem is solved in two sections. The first section explains formulation for the optimal locations of PMUs using genetic algorithm for complete and incomplete observability. Second section utilizes the results of first section to obtain the optimal set of branch current phasor measurement for complete and incomplete observability. A genetic algorithm has been developed to solve second problem.

Unlike traditional meters, the ability of PMU is to measure the voltage phasor of a bus at which it is placed and the current phasors of all lines connected to that bus. That means PMU can make the installed bus and its neighboring buses observable. This makes the PMU placement problem very important because placing PMU to all the bus in the system is not economical. The objective of placing PMUs is to determine a minimal set of PMUs such that the whole system is observable.

A. Optimal PMU Placement Problem

A PMU, different from conventional measurement devices, is capable of measuring voltage phasor of the installed bus and the current phasors of all the branches connecting to the PMU bus [2].The PMU placement problem is to find out the minimal set of PMUs such that a bus must be observed at least once by the set of PMUs. This gives an idea to define a matrix A_{PMU} .Elements of this matrix can be defined as explained in Eq. 1

$$a_{i,j} = \begin{cases} 1, & if i = j \\ 1, & if i and j are connected \\ 0, & otherwise \end{cases} \quad (1)$$

The matrix A_{PMU} can be called as Bus Connectivity Matrix, which can be obtained directly from the bus admittance matrix for a given system by transforming the entries into binary form. The optimal PMU placement problem for N bus system can be formulated as shown in Eq. 2, 3, and 4

$$Minimize \sum_{i=1}^{N} x_i \quad (2)$$

Such that

$$A_{PMU} X \geq b_{PMU} \quad (3)$$

Where

$$X = \left[x_1 x_2 ..... x_n \right]^T ; x_i \in \{0,1\}$$

$$b_{PMU} = [111....]^T_{Nx1} \quad (4)$$

and x_i is the PMU placement variable.

B. Optimal Branch Current Phasor Placement Problem

Let us define a matrix B_{co} whose rows correspond to the buses in the system and the columns correspond to the initial set of branch current phasors of the PMU set obtained from the optimal PMU placement problem. The entries of B_{co} can be defined as explained in Eq. 5.

$$B_{co(i,j)} = \begin{cases} 1, & if\ bus\ is\ observed\ by \\ & branch\ current\ phasor\ j \\ 0, & otherwise \end{cases} \quad (5)$$

Therefore, the optimal branch current phasor measurements problem is to find out the minimum set of branch current phasors such that a bus must be observed at least and at most by one branch current phasor and can be formulated as a binary integer programming problem as shown in Eq. 6, 7, and 8.

$$Minimize \sum_{j=1}^{NB} y_i \quad (6)$$

Such that

$$B_{co}Y = b \tag{7}$$

Where
$$Y = [y_1 y_2 .... y_{NB}]^T, y_i \in \{0,1\}$$
$$b = [111 \quad .....1]^T_{N-NP} \tag{8}$$

and N is the number of buses, NP is the number of optimal PMUs, NB is the number of initial set of branch current phasor; and y_i is the branch current phasor variable. Since there is no need of branch current phasors to observe the PMU buses as they are being already observed by PMU installed on them, the rows correspond to PMU buses can be removed from the matrix BCO. Hence, the size of matrix BCO will be $((N-NP)X\ NB$ and the length of vector b will be $(N-NP)$.

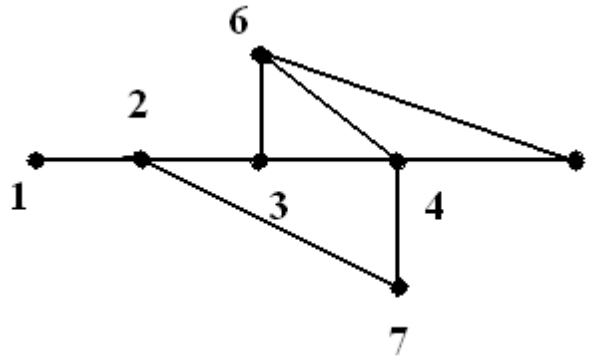

Figure 1: Example

The above formulation of integer linear programming for full observability can be explained using an example as shown in figure 1. It is assumed that there are no conventional measurements in the system. Example As explained in Eq. 1, A_{PMU} can be written as

$$A_{PMU} = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix} \tag{9}$$

Therefore, the optimal PMU placement problem for this example can be formulated as linear integer programming problem as:

$$Minimize \quad \sum_{k=1}^{7} x_k \tag{10}$$

Such that

$$\begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{bmatrix} \geq \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \tag{11}$$

This BILP Problem is solved using Genetic Algorithm. The optimal solution is X = [0 1 0 1 0 0], which means PMUs are placed at buses 2 and 4. So the initial set of branch current phasors are 2-1, 2-3, 2-7, 4-3, 4-5, 4-6, and 4-7 as shown in Figure 1. In this system, 7 branch current phasors are to be monitored. Therefore, the matrix B_{cuo} defined in Eq. 5 can be written as:

$$B_{co} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix} \tag{12}$$

Therefore, the optimal branch current phasors problem for the example system can be formulated as integer programming problem.

$$Minimize \sum_{j=1}^{NB} y_i \tag{13}$$

Such that

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

This BILP is solved using Genetic Algorithm. The optimal solution is $Y = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 1 & 0 \end{bmatrix}^T$

This means that the branch current phasors needed to be monitored are 2-1, 2-3, 2-7, 4-5 and 4-6.

III. PMU PLACEMENT FOR INCOMPLETE OBSERVABILITY ANALYSIS

Incomplete observability refers to the network condition in which number and location of the PMUs are insufficient to determine the complete set of bus voltage phasors. A detailed discussion on incomplete observability is given in reference [5]. Incomplete observability may be of two types:
1) Depth-of-one unobservability, and 2) Depth-of-two unobservability

B. Optimal PMU Placement Problem for Depth-of-one unobservability

The depth-of-one unobservability can be modeled as a set of linear inequalities and can be formulated as shown in Eq. 15, 16 and 17.

$$Minimize \sum_{k=1}^{N} x_k \tag{15}$$

Such that

$$A_i A_{PMU} X \geq b_1 \tag{16}$$

Where

$$X = \left[x_1 x_2 \cdots x_N \right]^T ; x_i \in \{0,1\}$$
$$b_1 = [1 \quad 1 \quad \cdots 1]^T_{M_1 X 1} \tag{17}$$

M_1 is the total numbers of branches, x_k is the PMU placement variable, and A_i is the branch-to-node incident matrix.

C. Optimal PMU Placement Problem for Depth-of-two unobservability

The depth-of-two unobservability can be modeled as a set of linear inequalities and can be formulated as shown in Eq. 18, 19 and 20

$$Minimize \quad \sum_{k=1}^{N} x_k \tag{18}$$

Such that

$$BA_{PMU} X \geq b_2 \tag{19}$$

Where

$$X = \left[x_1 x_2 \cdots x_N \right]^T ; x_i \in \{0,1\}$$
$$b_1 = [1 \quad 1 \quad \cdots 1]^T_{M_2 X 1} \tag{20}$$

M2 is the total numbers of possible combinations of three connecting buses, x_k is the PMU placement variable, and B is the matrix, in which each row corresponds to three connecting buses and contains all of the possible combinations of three connecting buses.

D. Optimal Branch Current Phasor Measurements Problem

Optimal branch current phasor measurements problem for incomplete observability is same for both type of incomplete observability. Let us define a matrix B_{cuo} whose rows correspond to the buses in the system and the columns correspond to the initial set of branch current phasors of the PMU set obtained from the optimal PMU placement problem. The entries of B_{cuo} can be defined as explained in Eq. 21.

$$B_{cuo(i,j)} = \begin{cases} 1, & if\ bus\ is\ observed\ by \\ & branch\ current\ phasor\ j \\ 0, & otherwise \end{cases} \tag{21}$$

Therefore, the optimal branch current phasor measurements problem is to find out the minimum set of branch current phasors such that a bus must be observed at least and at most by one branch current phasor. This problem can be formulated as BILP as shown in Eq. 22, 23 and 24.

$$Minimize \sum_{j=1}^{NB} y_i \tag{22}$$

Such that

$$B_{cuo} Y = b \tag{23}$$

Where

$$Y = [y_1 y_2 \cdots y_{NB}]^T ; y_i \in \{0,1\}$$
$$b = [1 \quad 1 \cdots\cdots 1]^T_{(N-(NP+NUB))} \tag{24}$$

and, N is the number of buses; NP is the number of optimal PMUs; NB is the number of initial set of branch current phasor; NUB is the number of unobserved buses and y_i is the branch current phasor variable.
Since there is no need of branch current phasors to observe the PMU buses as they are being already observed by PMU installed on them and the unobserved buses, the rows correspond to PMU buses and unobserved buses can be removed from the matrix BCUO. Hence, the size of matrix BCUO will be $((N-(NP=NUB))XNB)$ and the length of vector b will be ((N-NP + NUB)).
The formulation of section 3 can be explained by considering the system shown in figure 1. A_{PMU}

is same as given by the equation (9) and the branch-to-node incident matrix A_i is given as

$$A_i = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{bmatrix} \quad (25)$$

Therefore, the problem can be formulated as

$$Minimize \quad \sum_{k=1}^{7} x_k \quad (26)$$

Such that

$$\begin{bmatrix} 2 & 2 & 1 & 0 & 0 & 0 & 1 \\ 1 & 2 & 2 & 1 & 0 & 1 & 1 \\ 1 & 2 & 1 & 1 & 0 & 0 & 2 \\ 0 & 1 & 2 & 2 & 1 & 2 & 1 \\ 0 & 1 & 2 & 2 & 1 & 2 & 0 \\ 0 & 0 & 1 & 2 & 2 & 2 & 1 \\ 0 & 1 & 1 & 2 & 1 & 1 & 2 \\ 0 & 0 & 2 & 2 & 2 & 2 & 1 \\ 0 & 0 & 1 & 2 & 2 & 2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{bmatrix} \geq \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \quad (27)$$

This BILP is solved using Genetic Algorithm. The optimal solution is X= [0 0 1 0 0 0 0], which means PMUs are placed at buses 3 and the unobservable buses are 1, 5 and 7. Therefore, the initial set of branch current phasors is 3-2, 3-4 and 3-6 as shown in Figure 1. In this system, 3 branch current phasors are to be monitored. Therefore, the matrix B_{cuo} can be written as:

$$B_{cuo} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (28)$$

Therefore, the optimal branch current phasors problem for the example system can be formulated as integer programming problem as:

$$Minimize \quad \sum_{k=1}^{7} x_k \quad (29)$$

Such that

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \quad (30)$$

This BILP is solved using Genetic Algorithm. The optimal solution is $Y = [1 \quad 1 \quad 1]^T$. This means that the branch current phasors needed to be monitored are 3-2, 3-4 and 3-6.

IV. GENETIC ALGORITHM APPROACH

Genetic algorithm is one of the effective meta-heuristic methods developed in order to solve nonlinear and non-convex optimization problems. Genetic algorithm cannot give binary output directly. In present work MATLAB Genetic Toolbox has been used to simulate the formulated problem. As the tool box functions like creation, mutation, crossover cannot be used directly for the formulated problem, therefore these functions has been modified to solve the optimal PMU Placement problem. Modification in these functions is explained below.

The creation function has been developed so that the initial population vector created should be in a binary form. For creating next generation, the crossover and mutation function has been developed, so that the child generated should also be in binary form. The GA starts with a randomly generated initial population of individuals, each of them representing a possible solution of our problem. The Creation function is defined to generate the initial population in binary form. More appropriated the fitness value of an individual is more probability for being selected as a parent for the next generation it has. The crossover operator exchanges substrings between two individuals; once two individuals are selected, a position (the crossover position) is randomly obtained; horn this position the exchanges between the substrings take place to yield two new offspring, which replace to the parents. The mutation operator randomly changes the value of one gene of the individual. This operator first randomly selects a gene of the individual, and then changes its value. After these operators are applied, a new generation is obtained and the fitness value of its individuals must be calculated. With phasor measurement, the

observability implies that each bus of the network must have one phasor voltage measurement or a phasor voltage pseudo-measurement. From the measurements supplied by the available PMUs, applying Kirchhoff's and Ohm's laws, the remaining variables can be calculated (pseudo-measurement). Proposed method uses the following rules: a pseudo-measurement can be assigned to an unobservable bus if one of its neighbors has a phasor voltage measurement and the line between both has a current phasor measurement or pseudo-measurement. When the buses at the end of a branch are observables, a current phasor pseudo measurement can be assigned to this branch. Finally, if a bus has all their branches observable except one, a pseudo-measurement can be assigned to this branch.

The placement problem is resolved through the followings steps:
Step 1. Given the power network, build connectivity matrix.
Step 2. Create the initial population.
Step 3. For each individual, calculate its fitness function
Step 4. Apply selection operator.
Step 5. Apply crossover operator.
Step 6. Apply mutation operator.
Step7.Go to step 3 until total generations are completed.

Once computed the fitness value (step 3) for each individual, the algorithm proceeds selecting individuals for reproduction (step 4) on the basis of their relative fitness (in present case, smaller is the fitness value better is the solution represented by an individual). The default selection strategy works by a roulette wheel mechanism to probabilistically select individuals based on the relative fitness value associated to each individual. In step 5, individuals are selected and mutually crossed to produce new individuals that take part of both parent's genetic material. Mutation (step 6) is applied to produce a new genetic structure. In present case, mutation and crossover function has been coded for generating new population. The algorithm works during all iterations (step 7).

V. SIMULATION RESULT

The formulation for optimal placement of PMUs and optimal current phasor measurements for complete and incomplete observability has been simulated using Genetic Algorithm. Developed algorithm has been tested for IEEE-14 and IEEE-30 bus systems. Result for the different cases considered for simulation has given below. Table 1, shows the results for optimal PMU placement without any conventional measurements. And Table 2 shows the result for optimal current phasor measurements for complete observability.

Table-1
NUMBER AND LOCATIONS OF PMUS FOR COMPLETE AND INCOMPLETE OBSERVABILITY

Bus system	*Complete observability*		*Depth-1 Unobservability*		*Depth-2 Unobservability*	
	No.Of PMU's	*Location of PMUs*	*No.Of PMU's*	*Location of PMUs*	*No.Of PMU's*	*Location of PMUs*
IEEE-14	*4*	*2,6,7,9*	*2*	*4,6*	*2*	*4,6*
IEEE-30	*10*	*1,2,6,9,10,12,19,24,25,27*	*4*	*2,10,15,27*	*3*	*6,15,27*

Table – 2
INITIAL AND OPTIMAL BRANCH CURRENT PHASORS FOR COMPLETE OBSERVABILITY

Bus system	Initial set of Branch Current Phasors		Optimal Branch Current Phasors	
	No. of current phasor measurements	Location of current phasor measurements	No. of current phasor measurements	Location of current phasor measurements
IEEE-14	15	2-1,2-3,2-4,2-5,6-5,6-11,6-2,6-13,7-4,7-8,7-9,9-4,9-7,9-10,9-14	10	2-1,2-3,2-4,2-5,6-11,6-12,6-13,7-8,9-10,9-14.
IEEE-30	40	*1-2,1-,2-1,2-4,2-5,2-6,6-2,6-4,6-7,6-8,6-9,6-10,6-2,8,9-6,9-10,9-11,10-6,10-9,10-17,10-20,10-21,10-22,12-4*	20	*1-3,2-4,2-5,6-7,6-8,6-28,9-11,10-17,10-20,10-21,10-22,12-13,12-14,12-16,15-18,15-23,25-*

VI. CONCLUSION

In this paper, an optimal PMU placement technique for complete and incomplete observability has been proposed. The proposed technique also minimizes the branch current phasor measurement. The formulated problem is of Binary integer linear programming type. A Conventional genetic algorithm approach has been modified in this paper to solve this BILP problem. Develop algorithm has been tested for IEEE-14 and IEEE-30 bus systems. It is clear from the result that using the optimal approach, No. of current phasor measurements can be reduced to a considerable amount, hence the overall cost can be reduced. Simulation result also shows that this method is computationally effective and can be used in practice for installation of PMU and monitoring its branch current phasors.

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IOT BASED POWER THEFT IDENTIFICATION SYSTEM

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I ABSTRACT

Power theft detection &control system using Internate Of Things present an efficient &less costly way to transfer the power consumed by consumer wirelessly as electricity consumer dishonesty is a serious problem faced by all utilities. Electricity theft is a major concern for the utilities. Many times power theft has been major impact on the economy as well as the development of the country. At present to monitor the various parameters like power consumption, the amount of load and to prevent theft of electricity, we planned to develop an intelligent device, it would come handy to solve the problem for the power company and the clients. Application of techniques of power monitoring allows to power monitoring systems to receive the information remotely and in relation to the coordinates and time. In this project we are using smart power meter which are fitted on both at the transmission and load side. These meters are capable of measuring power sent over the load sand power consumed by the load over the time respectively. Both the parameters are sent to the base station wirelessly. Whenever there is a mismatch above the tolerance level parameters, then power theft is detected. The system will trigger the alarm to intimate to the concern authority so that they take necessary legal action and prevent power theft in the future.

Keywords –

Power Theft, web server, Arduino, IOT module.

II INTRODUCTION

Nowadays in the society usage of electricity in illegal manner become a popular technique to every human being. The only criteria of every consumer are to get free energy without paying any extra bills to the electricity department, about Rs.3000 crores of money are wasted per year in India due to power theft. Using of power in an illegal way is non-ignorable crime in any ware in the world. We should have to know about the quantity of fossil fuels on the earth surface is limited, so we have to use them efficiently and limitedly to leave some of them for future generation survival. With the use of electricity in unauthorized way may leads to high transmission losses results loss of economy to government. So, in this paper a power theft detection system is proposed to identify the burglary which is made by the most well-known method for doing the robbery and that is, by using excess power beyond the limit of meter. Now of mechanical improvement, the issue of unlawful use of power can be settled electronically with no human control alongside that meters are associated with the web utilizing IOT idea. In this paper the proposed method is efficient in working compared to others. In this method IOT technology is used to detect frauds committed by the consumers with continuous monitoring of consumption of power in mobiles.

Ways of Power Theft

Power Tapping: Often power theft is done during transmission by illegal tapping of the power lines to divert the power to the required destinations.

Fraud in Meter : The person is often bribed to give false readings in many areas where manual reading of the meter is done, and thus the amount paid is for lesser amount of power compared to the power actually consumed.

III LITERATURE SURVEY

In the system proposed by R.Sowndarya, Dr.P.Latha, Artificial intelligence Technique is used to identify the persons who are going to commit fraud. In this system ETD (Electrical Theft Detection) algorithm and smart energy meters used, one meter is placed at the distribution side and one meter is placed at each and Every House So it can detect the NTL in the particular area by taking the difference between these two-meter readings. The problems with this system is little bit complex and identification of the location of power theft is difficult.

In the system proposed by Anshu Singhal, Anupriya Tomar, Neha Kumari, S Hena Kauser, Mrs. Savitha. In this system of the location of power theft is also found. This system consists of a camera and IR sensor to detect theft of power. It works when the IR sensor tripped or when a person approaches the electric pole. The camera used to capture the pictures of the person who committed fraud activity. The problem with this system is

by using the IR sensor it gives faulty results in sometimes, it trips for any heat signal and it is not possible to place the camera at every electric pole.

In the system proposed by N Kunan, Poornima BK real time power transfer data is stored in an online database, which can be viewed by logging in the website. The detection of power theft is by finding the difference of power transferred and power consumed. The Problem with this system is the location of the theft is not determined.

This paper is about "The Internet of Things :A survey ,"Computer Networks ,Vol,54, pp. 2787-2805, 2010, it is connected many physical devices over the internet ,having exchange information between two or more devices .Now due to technology changes the current scenario, all devices are converted into smart devices, which can learn and take this decision by self-configuration properties.

In this paper "Efficient and Autonomous Energy Management Techniques for the Future Smart Homes"- IEEE Transactions on Smart Grid(Volume: 8, Issue: 2 , March 2017)-A modern energy system installed at the user end that is used to examine, calculate, optimize, and manage the flow and use of energy, a HEMS module is connected with the meter at one end and to all the appliances at the other end, the user has fixed ten number of appliances, these devices will remain ON during each time slot, while collecting the data HEMS identifies the electricity usage, and it calculates the price of used electrical power in kwh, and it gathers the data based upon the consumers utilization.

IV METHODOLOGY

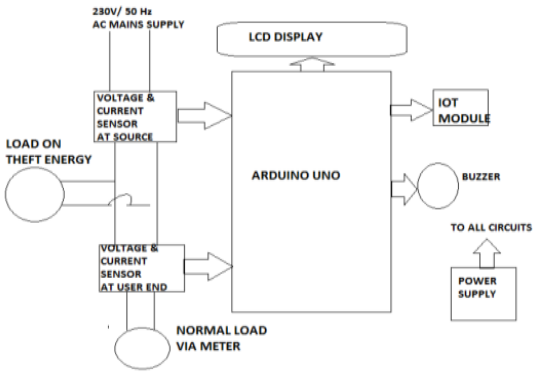

Fig.A.Block of system

In the society it was seen lot of people doing illegal power theft like unauthorized tapings from lines during functions and meter bypassing etc. These led us to do something to stop power theft as much as we. IoT is the recently evolving technology. Here the prototype has been developed to identify the energy theft using iot for the industrial purpose. Iot was selected due to the rapid growth in technology and utilization of iot become drastic. At present the system are controlled through manual operations and we cannot know amount of energy consumed. In this work machine learning is used. The proposed system is used to identify the power theft in industries .Here the load is connected in series with current transformer and parallel with potential transformer. This current transformer is used to measure the current consumption. Potential transformer is used to measure the voltage across the supply. The supply from the source is AC and bridge rectifier is used as a converting unit. This converting unit transforms the ac supply to dc supply. Here the filter is used for removing unwanted dc signal. The dc supply produced by the bridge rectifier is in the form of analog values. The produced analog values is converted to digital values by using A/D converter. Then it is connected to IOT module in which the threshold voltage range is fixed. The fixed voltage will be monitored continuously in the system. If the measured voltage and current is greater than the fixed threshold voltage. Due to the increase in voltage and current the buzzer start alarming. Since, it is connected to the internet of things(IOT) a webpage is created .By using this web page mail will be displayed to the consumers.

A. WORKING:

This system is basically build to detect power theft so as to stop financial loss of electricity department. In this system we are going to measure power transmitted from the source itself and also we will measure the power received at user door step.

If Received power = transmitted power-losses.

Then there is no any theft over that line but if received power less than that of transmitted +losses then these is highest probability of power theft.

Current and voltage sensor connected at source will measure current n voltages at source and send that data to controller then as per formula ,

Power=voltage X current

Will calculated transmitted power and then current and voltage at user end will also be measured and similarly power is calculated. Then losses are deducted from transmitted power and if then calculated power is same as received power then there is no any difference between them hence no theft if there is difference then theft detected.

Normally for communicating the data we have used an IOT module hence it will continuously send the data via internet to server. Every server has unique IP address our system send data to server using this IP address.

If theft detected then automatically an alarm will be generated at server end happy hence electricity department will came to know about theft with address or location of theft and they will immediately take the action.

All this system needs power supply to work so we need 12v and 5v power supply to run these devices.

V MAIN PARTS

A. Arduino Uno:

The heart of this project is Arduino Uno controller. It receive voltage signal from two transformers by means of bridge rectifier. Than it compares the voltage magnitude with the voltage drop an intend for that locality.

If there is no theft, than the voltage drop will be very low so there is no theft in the system. If theft occurs then the voltage drop will be high. The bridge rectifiers used to convert the AC to pulsating DC then the capacitor based filter circuit smoothens the DC power. Potentio meter and resistors are provided to reduce the voltage level and setting to 5 volt.

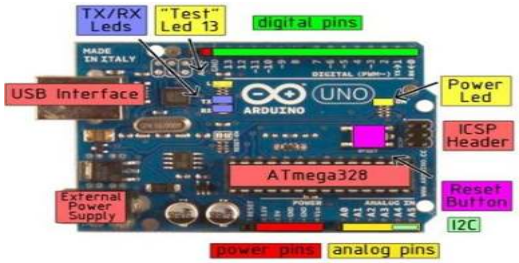

Fig.1. Arduino Uno

The voltage given by the transformer is multiply by a value to represent the real voltage value being supplied. If the voltage shown by the transformers drops below a particular value mentioned, it means the load in the area has increased and so there is theft occurring. Than the control moves to the alert function such as SMS.

B. IOT module

Fig.2. IOT module

ESP8266 is transforming the world with its low cost and high features which makes it an ideal module for Internet Of Things (IOT). It can be used in any application where you need to connect a device to your local network or internet.

An online data base is created by making use of THINGSPEAK server where the data of voltages of different areas are stored and updated automatically..It gives us a graphical view of the change in voltage in an area.

C. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These module are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

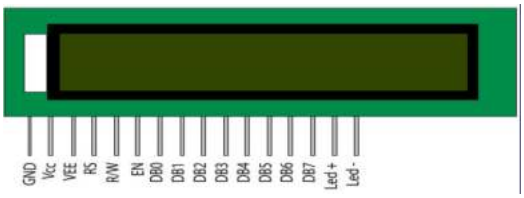

Fig.3. LCD Display

VI RESULT AND DISCUSION

The output of this system can be monitor through mobile, it displays the current and power values continuously. when theft detected it displays “theft detected” message on the one of LCD. and also, we get the theft occurrence place through IOT to mobile.

VII ADVANTAGES

Considering current economic issue on the power/ electricity theft this system provides a secure way of monitoring the power across the line. The data from both the monitoring system would be sent to the server at every regular interval. The authority can have continuous access to the data on the power delivered over the time and the received power at load side remotely.

Fig.4.output result


Connection succesfull

Sl_No	Date_Time	Total_Power	Legal_Power_Received	Tolerance
92	2017-05-16 16:54:03	385.11	270.95	114.16
91	2017-05-16 16:53:49	383.27	264.29	118.98
90	2017-05-16 16:53:35	390.86	256.82	134.04
89	2017-05-16 16:53:20	403.40	268.63	134.77
88	2017-05-16 16:53:05	370.72	269.36	101.36
87	2017-05-16 16:52:51	376.00	265.20	110.80
86	2017-05-16 16:52:41	390.76	264.87	125.89
85	2017-05-16 16:52:23	379.47	272.59	106.88
84	2017-05-16 16:52:07	390.93	263.02	127.91
83	2017-05-16 16:51:56	378.29	264.36	113.93

VIII CONCLUSION

IOT based power theft detection & control system were proposed in this paper .the system would provide a simple way to detect an electrical power theft without any human interference. in the system we are looking forward to implement smart meter. as the Indian government has also proposed formation of smart cities which will have a effective energy management & resource conservation strategy using primarily internet of things based sensors as done globally.

IX FUTURE SCOPE

This system can be further be improved in future be cause of its high usage factor. For instance a system can be design in which instead of knowing the consumer load be forehand we can install smart energy meter in the consumer premises so that we can know the real time load of the consumer. With this we can detect the theft of power more precisely.

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Speed Control Of BLDC Motor Used In Electrical Vehicle By Using Arduino Microcontroller

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Abstract— **Brushless direct current (BLDC) motor is one of the popular permanent magnet synchronous motors in the industry and automotive. BLDC motor has own unique characteristics such as, good efficiency, long life, remarkable starting torque, low maintenance, reliable operation, etc. In automotive, this motor is often used in an electric vehicle (EV) due to high efficiency. Electric Vehicles is always best than ordinary vehicles and it proved on the basis of EV's lesser running cost, maintenance cost, environmental friendly, etc. But major aspect of BLDC motor in EV is to maintain its speed. We work on smoothly speed control, excellent performance of speed control, low cost, low maintenance, reliable speed controlled system of BLDC motor. BLDC motors are sensor and sensor less. Sensor BLDC motor used Hall Effect sensors to detect rotor position where as sensor less BLDC motor used BEMF (Back Electromotive Force). This topic shows how to drive a sensor less BLDC motor using ARDUINO UNO board. The commutation of the BLDC motor is controlled electronically. The stator winding should be energised in a sequence in order to rotate the motor. Rotor position should be known in order to switch the winding sequence. "Back EMF and current sensing" gives enough data to know the rotor position and, along these lines to work the motor with synchronous phase current.**

Keywords-BLDC motor, Speed control, Back EMF, Arduino UNO, current sensing.

I. INTRODUCTION

This project introduces the speed control of BLDC motor used for electric vehicle. Electric vehicle is always best than the ordinary vehicles and it proved on the basis of EV's lesser running cost, maintenance cost, environmental friendly, etc. but the major aspect of EV is to maintain its speed. In this project we work on the smoothly speed control of BLDC motor with the help of digital controller and hall sensors. BLDC motor overcomes many problems of brushed dc motor and gives reliable operation, excellent performance of speed control, low cost. Compared with a DC motor, the BLDC motor uses an electric commutator rather than a mechanical commutator, so it is more reliable than the DC motor. In a BLDC motor, rotor magnets generate the rotor's magnetic flux, so BLDC motors achieve higher efficiency. It has become possible because of their superior performance in terms of high efficiency, fast response, and weight, precise and accurate control, high reliability, maintenance free operation, brushless construction and reduced size, Torque to motor size ratio is high, Thermal overload & under load protection is provided. Microcontroller has more advantages than microprocessors. These ICs are cost effective and can be used for any applications ranging from appliances to automobile engines to text or data processing equipment. The aim of this project is to design microcontroller-based BLDC motor drives for electric vehicle. Based on several PWM switching schemes the performance of converter parameters will be tested and observed closed loop speed control of the system is done and the results are tabulated which verify the effective developed drive operation.

II. LITERATURE SURVE

PRESENT SYSTEM

In the system proposed by Hanif F.Prasetyo, Arief S. Rohman 'control of BLDC motor in electric vehicle testing simulator'. BLDC motor is popular motors in the industry and auto motive. In auto motive this motor is use in electric vehicle due to high efficiency. Applying in-wheel BLDC technology increase the overall safety and efficiency of electric vehicles. Better dynamic stability control of electric vehicles if possible by using four in-wheel motors. The test motor control sub module can simulate the speed of electric motor of EV up to around 1800 RPM and load motor control sub module can simulate downhill road with loading current up to around

9A and able to simulate uphill road with loading current around 10 to 18A.

In the system by Ebin Joseph T, **Sreethumol M. V.** '**Speed control of BLDC motor drive under direct torque control scheme with modified integrator**.' Speed control of BLDC motor drive, operated under DTC scheme, is discussed in this paper. From the simulation result, it has been shown that this scheme can use for high performance application.

P. Suganthi and S. Nagapavithra proposed 'Modeling and simulation of closed loop speed control for BLDC motor.' In this work speed control of BLDC motor under various load conditions are verified by simulation using PID and Fuzzy based controller. Speed of motor is controlled via controlled voltage obtained from inverter. Triggering gate signal is given for various load conditions. The dynamic characteristics such as speed, current, back EMF are analyzed under various load condition using MATLAB/SIMULINK software. Simulation result shows improved performance when the proposed control is used a wide range of operating conditions comparatively.

Naveen V. and T. B. Isha proposed 'A low cost speed estimation technique for closed loop control of BLDC motor drive.' They are proposes a low cost speed estimation technique for BLDC motor drive. This method was found to be working for the entire range of speed below the rated speed. The performance of the system was comparable with that of the conventional speed encoder based control technique.

Sagar B Pawar, Nikhil Kumbhar and Seema P Diwan proposed 'Single ended primary inductance converters based control of BLDC motor drive.' The effective working of BLDC motor driveith SEPIC converter over the conventional control scheme of BLDC motor. The dc link voltage of VSI which is feeding the motor is controlled to control speed of motor. The VSI used only to commutate motor electronically with fixed width pulse. The PWM switching which applied only for MOSFET switch of converter, hence the switching losses are minimized.

III. PROBLEM IN PRESENT SYSTEM

In existing technology brushed DC motor drive have bulky construction, low reliability and need higher maintenance mainly due to presence of mechanical commutator and brushes. BLDC motor has electronic commutator, so its construction is simple. In BLDC motor variuos electronic controller are used for speed control. But that methods are costly due to it required high maintenance cost. Due to in this project we prefer microcontroller Arduino because of it is reliable, simple operation, low maintenance cost.

IV. PROPOSED SYSTEM

Compared with DC motor BLDC motor uses and electric commutator rather than mechanical commutator due to that its simple construction, more reliable than DC motor. BLDC motor are brushless due to that reduces size, losses. BLDC motor has maintenance free operation. In this system for controlling speed of motor we use Arduino microcontroller. The control of BLDC motors can be can be done in sensor or sensor less mode, but to reduce overall cost of actuating devices, sensor less control techniques are normally used. Position sensors can be totally disposed of, in this way decreasing additional size and cost of motor assembly, in those applications in which just variable speed control(i.e. no positioning) is required and system elements is not especially requesting. The commutation of the BLDC motor is controlled electronically. The stator winding should be energized in a sequence in order to rotate the motor. Rotor position should be known in order to switch the winding sequence. "Back EMF and current sensing" gives enough data to know the rotor position and, along these lines to work the motor with synchronous phase current. A BLDC drive that does not require position sensors but rather just electrical estimations is known as sensor less drive.

V. CONCLUSION

This project speed control of BLDC motor used for electric vehicle. Electric vehicle is always best than the ordinary vehicles and it proved on the basis of EV's lesser running cost, maintenance cost, environmental friendly, etc. But the major aspect of EV is to maintain its speed. In this project we work on the smoothly speed control of BLDC motor with the help of digital controller and ZCD. BLDC motor overcomes many problems of brushed dc motor and gives reliable operation, excellent performance of speed control, low cost.

VI. FUTURE SCOPE

- *By 2030 we are expecting only electrical vehicles on our road and if we can convert the existing conventional vehicles to electrical vehicles that will more cost efficient and totally pollution free.*
- *Furthermore the storage capacity and charging time can also be improve the entire reliability and efficiency of the system.*
- *In future this speed control technique can be used for solar pumps, solar powered car and other solar -wind powered applications*

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Design and implementation of slip ring induction motor control panel

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ABSTRACT:

Now a day different types of Drives like automobile, mechanical etc. are replace by Electrical Drives due to its characteristics like high starting torque, good speed regulation, high torque /weight ratio, noise reduction, environmental friendly etc. The use of Squirrel Cage Motor for Traction has revolutionized the motive power of industrial loads. The Asynchronous Motor is rugged, has high starting Torque, very smooth Voltage and Speed control as compared to a DC Series Motor. When looking at the heavy load perspective, a Wound Rotor Induction Motor can be an alternative to the Squirrel Cage Motor as it has higher starting Torque at lower starting current and better efficiency than a Squirrel Cage Motor. The Slip Power Recovery scheme also plays a proactive role as there can be substantial savings of energy in case of a Wound Rotor Induction Motor as the Slip Power recovered can be used to drive the Auxiliary Loads. A detailed design and analysis of a Drive System with Wound Rotor Induction Motor is presented in this Paper.

Index Terms— Design of experiment, Optimal design parameter, Premium efficiency levels, 3 Phase slip ring induction motor.

Introduction

The Inverter driven Induction Motor maintain a low-slip operation even during starting [1]. As a result, the Three-phase Squirrel Cage Induction Motor became very popular as an industrial application Motor because of its properties of ruggedness, high starting torque, easy Motor Control through Microprocessor, regeneration up to zero speeds, efficiency of operation. It is also observed that a WRIM can produce more starting torque as compared to a SQIM at lesser starting current. Also the Braking capability of WRIM has been found superior to SQIM [2]. In near future one might find industrial load capacity of heavy approximately 9000HP of industrial loads in various in Industries. When it comes to ratings of Motors for this kind of ultra-high power, the Motors could be rated at order of 900 kW to 1 MW. In this given scenario, if one can harness the Power wasted due to 'Slip', the energy savings can be substantial. It has been proved in the case of high capacity Roller Mills, that the high initial cost of a Slip ring Induction Motor is overcome by the Slip Power Recovery Scheme implemented by a simple Kramer Drive. The Slip Power thus harnessed can be pumped back to the supply bus bars through a step up Transformer. This has resulted in energy savings of the order of 360 kW worth $300,000 per annum for a 5000 HP Wound Rotor Motor running at 90% full speed in the grinding Mills used in large Cement Plants [3]. Also, as the starting Torque developed by the Wound Rotor Motor is directly proportional to 'Slip", the Machine develops higher starting Torque as compared to a Squirrel Cage Motor at lower values of Current. Hence, a Drive system is designed and

analysed with Wound Rotor Machine as Traction Motor in this paper.

II. Literature Survey

G. M. J. Parsley" Controlling the Speed of an Induction Motor by Resonating the Rotor" This article describes the possibility of obtaining various torque-speed characteristics from a wound rotor induction motor by operating such a motor close to its rotor resonance. It is shown that, by the use of reactive rotor networks, high starting and braking torques may be obtained. An induction motor operating with this proposed technique of speed control also reacts favorahly to non-sinusoidal supply voltages and has an improved power factor.

Kwang Yong Jang, "Design of Premium Efficiency Level Single Induction Motor" .In this paper the efficiency which leads the basic design of the premium class single-phase induction motor it analyzes a various parameter and the addition which improves more the efficient improvement which is and tight it respects form of the rotor experimental design it leads and addition it designs. Also compares the basic design model and the optimization model with by the core loss and the copper loss the reduction woman efficiency improving, it proved. But it makes the optimum model and to following experiment it leads and feed with the fact that must be verified it becomes.

C. Nagamani "Design and Analysis of Drive System with Slip Ring Induction Motor for Electric Traction in India" The use of Squirrel Cage Motor for Traction has revolutionized the motive power of a Locomotive. The Asynchronous Motor is rugged, has high starting Torque, very smooth Voltage and Speed control as compared to a DC Series Motor. When looking at the Traction perspective, a Wound Rotor Induction Motor can be an alternative to the Squirrel Cage Motor as it has higher starting Torque at lower starting current and better efficiency than a Squirrel Cage Motor. The Slip Power Recovery scheme also plays a proactive role as there can be substantial savings of energy in case of a Wound Rotor Induction Motor as the Slip Power recovered can be used to drive the Auxiliary Loads of the Locomotive and also for powering the trailing Passenger Cars. A detailed design and analysis of a Drive System with Wound Rotor Induction Motor for Electric Traction is presented in this Paper

G.H. Rawcliffe, "Slip-Ring P.A.M. Induction Motors For Two Synchronous Speeds", The detailed design of Pole amplitude modulation (P.A.M) windings has been sufficiently improved to enable these windings to be used on slip-ring motors, as well as on squirrel-cage motors; and the extra control gear requirement, compared with that for a squirrel-cage P.A.M. motor or with that for a single (synchronous) speed slip-ring motor, has been shown to be very modest. A number of large machines are already in service. It is expected that the slip-ring P.A.M. induction motor will soon become a standard item of industrial machinery, in the same way as the squirrel-cage P.A.M. induction motor has already done.

J.D. van WYK "Variable-speed a.c. drives with slip-ring induction machines and a resistively loaded force commutated rotor chopper" The paper deals with variable-speed drives using an induction machine with wound rotor, controlled by variation of an external rotor resistor by a parallel electronic chopper. After tracing the historical development of this type of controlled drive, the power-flow relationships are investigated to arrive at the fundamental characteristics of this type

of system. Considerations leading to the selection of a variable-slip system with rotor control rather than stator control are covered, leading to a discussion of the structure for a simple variable-speed drive using a force-commutated rotor chopper. The system is modelled by idealizing the power switches and analysing their behaviour as function of slip, and the switched induction machine is modelled by a torque directly proportional to chopper input current. A second-order total system model is arrived at by taking only a speed-loop time constant and a mechanical time constant into account. Particular attention is given to establishing design relationships for this kind of drive.

III. METHODOLOGY

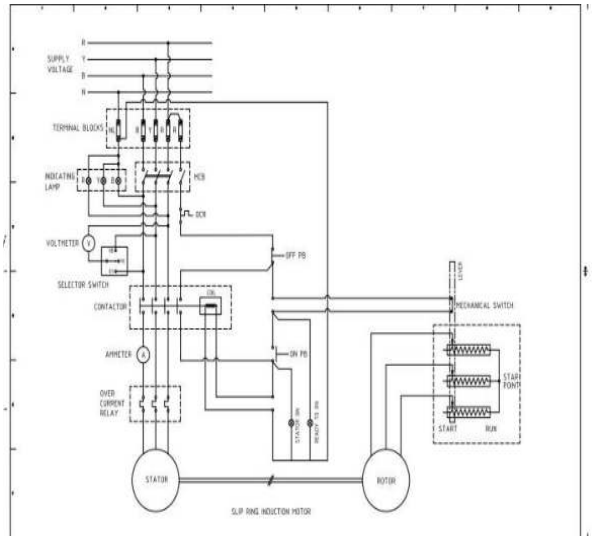

Fig. 1 Internal wiring diagram of panel

The panel consists of electrical components such as overcurrent relay, contactor, MCB, on-off push button. The function of following equipment's is given below:

A) MCB-Miniature Circuit Breaker

The function of MCB is to break the circuit whenever a high voltage is flowing through the conductor .It also provides protection to wiring against overcurrent and short circuit faults.

B) Contactor- It is an electrically controlled switch used for switching an electrical power circuit .A contactor is controlled by a circuit which has a lower power level than a switched circuit such as 24 volt coil electromagnet controlling a 230 volt motor switch .

C) Overcurrent Relay –It is used to sense the current and gives the information to the circuit breaker, the circuit breaker opens the contact at abnormal conditions.

D) On-Off Push Button –It is a type of switch consisting of a simple electric mechanism or air switch mechanism to turn something on or off.

II. ANALYSISMODEL

The initial model which is used aluminium it has 3hp to design the drive electric motor and it designed with the 4pole electric motor which has 36/44 structures which are a slot union of standard form. Namely premium class the efficient electric motor to make the model initially design method of the single-phase induction motor which is general with aim it led and it tried.

A. design directions

Normal induction motor design the element which is experience operates most plentifully. The design process follows the electric motor part before consequently and partially, it applied the smethod of general it is efficient design. Design of the whole is in Fig 1, efficient electric motor to flowing; additionally it presented the optimization design direction of the stator and the rotor. The design at the

time of first after analysing the efficient quality of the parameters which the stator are basic optimum form of the rotor slot leads and the premium class which optimizes will design the efficient induction machine.

B. High efficient motor designs

The design method of the induction motor mainly uses the equivalent circuit law or the grudge element law after basic design and it judges the propriety yes or no of design. If efficient etc. the user it wants it does not arrive to the price where again to execute the case basic design, premium class it accomplishes the basic design of the efficient electric motor. The result it follows the design method which is basic and the parameters which the premium single-phase induction motor where the efficiency is 84.9% are basic it gets.

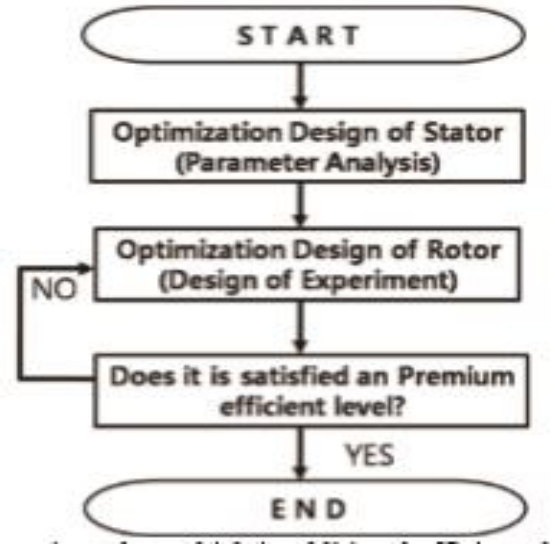

Fig. 2 The premium class which is additional efficient electric motor design Flow chart

MACHINE DESIGN

The main purpose of designing an induction motor is to obtain the complete physical dimensions of all the parts of the machine as mention below to satisfy customer specifications the following design details are required

- The main dimensions of the stator.
- Details of the stator winding.
- Design details of rotor and its winding.
- Performance characteristics.

MAIN DIMENSIONS: The armature diameter (stator bore) D and armature core length L are known as the main dimensions of the rotating machine.

Output equations -

Vph = Phase voltage
Kw= Winding factor
Ns = Synchronous speed in rpm.
n = efficiency
P= No of Poles
cosq = Power factor
Is= Phase current
Tph = No of turns.
Co= Output coefficient
Bav= Average flux density
ac= specific electric loading
L= Gross core length.

Output equation of a induction motor =
KVA Q=Co*D^2*Ln.
Co= 3.33*Kw*Bav*ac*10^-3

Stator turn per phase

Flux per pole Qm= Bav*t*L=

Bav*(#D*L/P)

- Stator voltage per phase = 4.44 *f*Qm*Ts*Kws
- Stator turns per phase = Es/4.44*f*Qm*Kws
- Total number of stator slot =3*P*Slots.

- Stator current per phase Is= Es/3* Vph*pf*n

Rotor Design

- Area of the rotor conductor-

Ir= Is *Ts*0.85/Tr

Rotor conductor per slot =

Conductor per slot*frequency /rotor slot .

No of rotor slot = Phase*pole

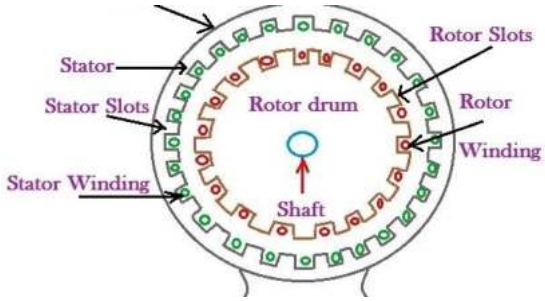

Fig 3. Internal structure of stator and rotor.

- Performance characteristics

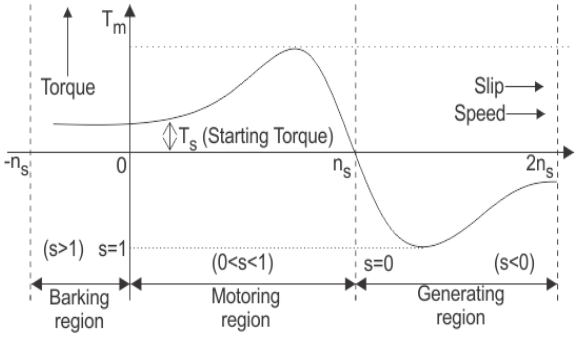

Fig 4. Torque speed characteristics of slip ring induction motor

IV.RESULT AND DISCUSSION

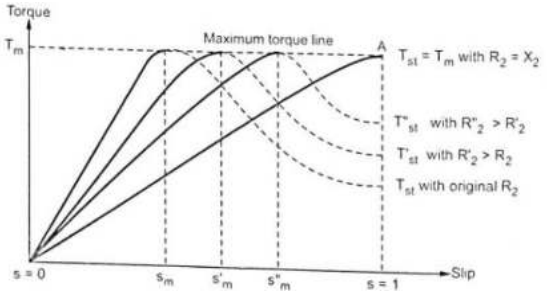

Fig 5. Torque slip characteristics

CONCLUSION: Speed control of an induction motor by having the rotor circuit close to resonance is a distinct possibility. The disadvantages of the rotor resonant speed control are firstly the high costs involved. A wound rotor machine is more costly than a squirrel cage machine and reactive components capable of conducting large currents and withstanding high voltages are relatively expensive. Secondly, some form of control system will be needed to master the reactive component switching strategy. This however could be relative simple, because switching would not need to take place at a high speed. The advantage of speed control using the proposed technique is the large torques available, particularly at standstill and low speeds.

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A REVIEW PAPER OF SMART FLOOD CONTROL AND INTELLIGENT DAM COORDINATION SYSTEM

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Abstract - Flooding is a natural disaster occurs in many countries. Many occasions are responsible for flooding such as heavy rainfall or dam fractures. In case of flooding or dam fractures, it rapidly releases a huge quantity of water and floods the river banks and surrounding areas. It causes loss of life and property also. Flood monitoring and alerting systems are helpful for monitoring and to reduce the losses faced by the society.

Key Words: optics, Flood monitoring, Flood detection.

I. INTRODUCTION

In Recent years flooding became one of the major natural disasters occurring in India. India is among the top 10 in the world's most food-threatened country. There are many effects of floods where the material, human, economic and social losses are considered as some of the main effects of floods. Heavy rains are also one of the major aspects for the causes of flash floods. In order to reduce the human and economic losses there are some necessary steps to be followed. One of the most and the preliminary step is to alert the people before the occurrence of the disaster.There are some places with early flood alert systems but most of them are not most

efficient as they can usually send the information to only some respective organizations with limiting distances. So, in case of floods it is taking more time for passing the message to the people living in the nearby areas so that the people could not save most of their belongings as water rises rapidly within less time. Usually, the flooding cannot be abandoned but the early detections can be made i.e., early alerting system with help of continuous monitoring can be used to reduce the losses faced by the society [1].

II. LITERATURE SURVEY

Flood is one of the major problems in India. It occurs mostly in some populated areas. This may be attributed to climate change which causes high rate of rainfall, placing many cities at increased risk of flooding as we aware during flash floods that kill more people than other natural disaster in an average a year, everyone is known during flood the peoples assets like roads, houses, farms etc. are destroyed and many people become homeless, it cause the millions of dollars of property damages and it will take lots of time to recover all the things flood warning is when an official announcement is given by radio or tv of an impending flood or an already flood that has already occurred. We are designing a system such a way the people can get the alert messages in advanced so they can move a safer location to save their life.

S Vara Kumari, O Sailaja, N V S Rama Krishna[1] has been Proposed the system using water flow sensor and ultrasonic sensor to get the flood water measurement. In this Proposed system the correspondence between node MCU,Thingspeak web server and Thingspeak to IFTTT are successfully achieved. Pallavi C B1, Chandrakala V2[2] presents the design & implementation of WSN based flood monitoring & detection system using relative temperature,water level & rate of rainfall as flood indicators,whose values are detected by sensors in the sensor field.The flood monitoring &detection system monitors the floods & then send flood notification, SMS to the inhabitant of such zones for necessary action.] Kalpesh R. Dashpute, Nilesh S. bawa, Vishal B. Gaikwad [3] has been proposed the system consist of ultrasonic sensor and float sensor for detection of water level.This system sends an audible signal and graphical messages towards smart phone about the water level. Sonali Patil, Jija Pisal, Aishwarya Patil, Siddhi Ingavale [4] proposed the system having three major stages including sensors , controller and Wi-Fi interface to upload the information on the server and stored on the database. The stored data is routed to the front end web applications and mobile applications. Kavitha.r1 ,kavitha.r2 , jayalakshmi .c3 , senthil kumar.k4 [5] proposed system consists of node MCU & Ultrasonic sensors to collect and transfer data to cloud (Thingspeak).When water level reaches threshold ,the alert is given to public through GSM module.

III. COMPARATIVE STUDY:

The Existing system is flood monitoring using IOT application[1].This system consist of various sensor to get the flood water measurement. This system is useful for single dam or river.This system is useful to find out the water level of the flood to make the people alert from disaster flood. This system continuously send the messages towards control room about the level of the flood when water level will change.

The proposed system is also IOT based system. This system is useful for multiple dams.This system alerts the river side people by establishing the coordination between two dams. This system continuously send the SMS , Notification to the highest authority of particular area when water level increases. Pumping station facility is provided in city for pumping water when water level rises above threshold.

IV.CONCLUSION

The main objective of this research work is to develop a real time flood monitoring and warning system for a selected area.The system employs the use of advance sensing technology in performing real time monitoring of water information .The developed system is composed of three major components : 1)sensor network 2)processing and transmitting modules, and 3)database and application server .These system with highly reliable sensors and effective IOT platforms will critically be used for large scale environment monitoring and disaster prevention.

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Execution of different commands by using 3G/4G network with GSM

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Abstract—**Mobile phone is basically works on the GUI. It is very difficult to shown the GSM is how to work so how the attention (AT) commands in GSM system and it is very difficult to show the AT commands can be run. The commands can be understand the very effective by using AT command. The system can be performing by using AT commands and they will be very important to show the system will worked as a connection less commands. In the GSM modem the modem can be used very effectively set of instructions to operate the system. In this paper execution of different commands by using 3G/4G network with GSM is presented.**

Keywords- gsm modem; sim card; ethernet cable

I. INTRODUCTION

In this world of connectivity and collaborative work environment, it is necessary to connect to the network from anywhere, with anybody, at any timeGSM represents the global standard for mobile communications. It is developed by European Telecommunications Standards Institute in early 1990s to describe the protocols for the 2nd generation of digital cellular networks. A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. GSM modem must support an "extended AT command set" for sending/receiving SMS messages. AT Command is a set of commands or instructions which can be used to communicate (talk) with a GSM modem/mobile phone.

AT commands are used to automatically receive the call on system from the preconfigured number and system also sends the message to preconfigured number about the intrusion indication through AT commands AT Commands are used to control a modem. AT means "Attention Commands". Every command line starts with "AT". These are of two types of commands i.e.Basic and Extended. These extended AT commands are defined in the GSM standards and it supports some functions as Create, read and remove the SMS messages, send SMS messages ,ability to see the signal strength, the battery charged level and status of Charging and Read, create and search phone book information.

II. LITERATURE SURVEY

In this paper execution of different commands by using 3G/4G network using GSM system has been presented.The proposed system consist of various applications that can control the modem behavior,

execute various functionalities related to GSM domain, Network, etc using AT Commands. Using AT as proactive command, we can also build various applications on SIM card that can instruct modem enabled phone to execute various tasks such as change the vibrator mode to ringer mode, change the display characteristics of Handset, access all the messages that is stored on phone memory or SIM memory, etc. As it is evident from the above research that AT commands can be useful to build several applications.[1]

The objective of the project isthe paper presents several applications of AT commands supporting learning, some implemented and others just designed theoretical. The most important educational role of these commands is that they eases the programming work, providing a quick success of the interfacing with wireless data modules, which is very stimulating for students engaged in a project. As the wireless applications are, is important in Programming Based Learning. [2]

In this paper the proposal of the microprocessors laboratory exercise has been presented. The proposed exercise gives the opportunity to familiarize student with mobile phone's features unavailable when using the Graphical User Interface (GUI). Also a detailed insight into SMS messaging scheme is given, including explanation of the two SMS modes and coding issues related to it. Moreover, students familiarize with assembler programming by implementation of the serial transmission driver. The given instructions have been tested using two mobile phones and DSM-51 microcontroller kit and turned out to be a very illustrative method of learning about the GSM technology.[3]

In this paper, the data stored in mobile phones and AT commands are introduced. Then a mobile phone software system is developed. This system may be used as a separate investigative tools for mobile forensic, and can also investigate and forensic as part of the software such as Encase, WinHex, SIMcon, etc.[4]

The display boards are one of the major communications medium for mass media. Local language can be added as a variation in this project. This can be achieved by using graphics and other decoding techniques. Also we realize that this project saves time, energy and hence environment. Cost of printing and photocopying is also reduced as information can be given to a large number of people from our fingertips.[5]

In this paper gsm modem is used for the data acquisition and data acquisition is used for data process control.Collecting data from various processes present at distant places. System uses AVR microcontroller ATmega 644P.this microcontroller interfacing to the gsm and the controller inbuilt the ADC module so the converts the analog into digital.in this paper the GUI functionality discussed in the report is operational.The GSM Modem is tested using HyperTerminal on pc and run the AT commands. Read four analog channels and 8 bit digital and display it on serial port, LCD and send it through SMS. Receive SMS and display it on LCD. Received SMS display on pc using VisualC#.net and form a database (MS Access) to store it.[6]

In this proposed system the idea of wireless Digital Notice Board Using GSM Technology has been presented. The GSM module which is located at Digital notice board receives the message from authorized user and displayed on notice board which is situated at remote location, at same time this message will be sent to different user's mobile numbers that are stored in microcontroller memory. The display boards are one of the major communications medium for wide area. The graphics and decoding tech is used I this paper for digital system. This project is a just idea of communication and it updated in next level.[7]

Mobile phone can serve as powerful tool for world-wide communication. In this paper use Learning Vector Quantization Neural Networkmethod isfor recognition of various words used in the command. The accuracy of spoken commands is about 98%. A text message is generated and sent to control system mobile in form of SMS. On receipt of SMS, control system mobile informs AVR micro-controller based card, which performs specified task.So know about the Remote control of devices and retrieval of information relating present status of inputs using spoken commands demonstrated through SMS based message transfer between user mobile and system mobile. Here is scope related to the IOT based system.[8]

In this paper understand Security related important issue in everywhere. Home security now days problems in day to day life. A traditional home security system gives the signals in terms of alarm. But in this paper the based security systems provides enhanced security as whenever a signal from sensor occurs, a text message is sent to a desired number to take necessary actions. The user can get alerts anywhere through the GSM technology thus making the system location independent. A simple way to control and explore the services of the mobile, AT commands is used in the system. The communication of home is only through the SMS which has been tested with the mobile networks and is working on any mobile network.[9]

In this paper Auto-Monitoring and Short Messaging-Service System is a real-time monitoring system for any critical operational environments.

They use gsm and arm controller for the real time monitoring purpose. The arm is main controller to interact sensors through the world.Ideal low cost surveillance system.In this paper the entire system is a prototype. Its operation and the results satisfy the functional requirements.[10]

III. METHODOLOGY

In the system can be divided as software and hardware modules .the methodology discussed as follows:

A. Block Diagram

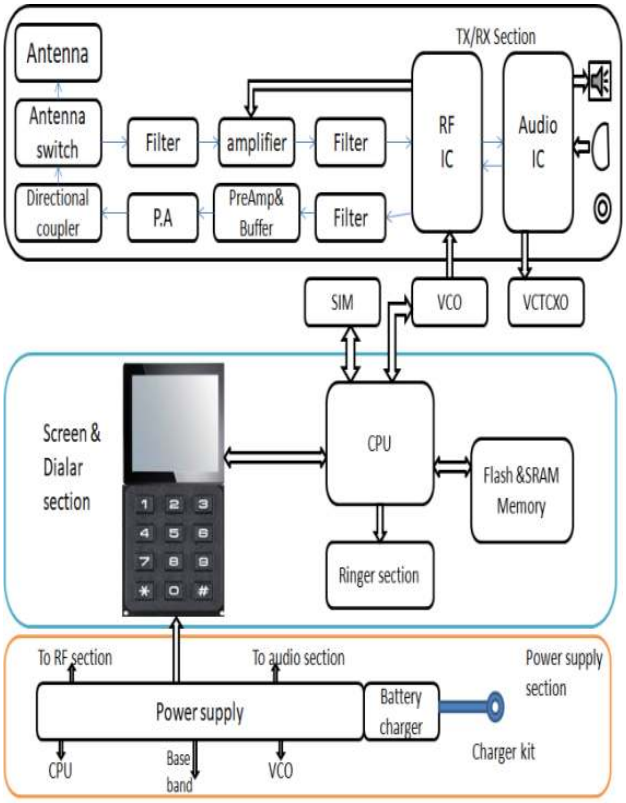

Figure 1. Block Diagramof mobile Phone Section Unit.

The block diagram of mobile phone unit system shows the different sections. In this project we are using different AT commands to control the GSM modem. Existing technology complete arrangement of 2G Dual SIM GSM Modem. This technology is a Scientech-2133 global system by using single 3G/4G SIM.

a. Antenna

Mobile communication requires small, low-cost, low-profile antennas. In some mobile handsets, semiconductor based diodes or detectors are used as antennas. They are much like p-n diode photo-detectors but work at microwave frequency. Many times Omni-directional or horn antenna is used in mobile phones.

b. RF IC

This electronic component found near the PFO in the Network Section of a Mobile Phone. It is also called RF signal processor. It works as transmitter and receiver of audio and radio waves according to the instruction from the CPU. The RF receiver are called RX, this circuit is design to receives, and process the data signals from the airwaves during transmission process the RF transmitter are called TX which is the one that process, amplify the data signals from a mobile phone .

c. Audio IC

An audio power amplifier (or power amp) is an electronic amplifier that amplifies low-power electronic audio signals such as the signal from radio receiver or electric guitar pickup to a level that is high enough for driving loudspeakers or headphones. Audio power amplifiers are found in all manner of sound systems including sound reinforcement, public address and home audio systems and musical instrument amplifiers like guitar amplifiers.It is the final electronic stage in a typical audio playback chain before the signal is sent to the loudspeakers

d. Ringer Section

Ringer, Buzzer or Speaker in most mobile phones are connected with the audio amplifier IC to obtain loud sound. The amplifier IC amplifies the sound or audio signal received from the CPU of the audio section.

e. Display and Dialer Section

The display section is directly connected with the CPU to receive following signals – LCD Data Signal, LCD Reset Signal, LCD WR Signal, LCD RD Signal, LCD FLM Signal, LCD HSYN Signal etc. These signals are given to the LCD Module through the CPU. 2.8V power supply or 1.8V power supply is given to the LCD for functioning. LCD signal interface filter are connected in many mobile cell phones for interfacing these signals of LCD Module.

A GSM Module is used for Sending Message. Arduino is used here for controlling the whole process. Also Alpha / Numeric Keypad is used in this Circuit which is used for Entering or Deleting Messages and Cell Number. Here 4×3 Numeric Keypad is used.

f. Power supply Section

Charger and system interface connector is made together in most modern mobile cell phones. Regulator section is made separately for the battery charging section. In some mobile phones, the battery charging section is made inside the Power IC.

g.Software

ScienTech and Hyper terminal is the terminal emulation software included with the Microsoft windows operating system. Hyper terminal is delivered together with most versions of windows, including windows 95/98ME, Windows NT, windows 2000 and windows XP. Hyper Terminal is a communications software developed by Hilgraeve and is included in all versions of Microsoft Windows. With Hyper Terminal, the user can connect and transfer files between the two computers.

IV. RESULT AND DISCUSSION

Single SIM card using with 3G/4G operating frequency. Network connection and data transmission speed is average. Power supply required is low.AT commands also display by using software platform. If any error is generated in the system then they will be show in format of AT commands.

V. CONCLUSION

So, we can implement various AT commands that can control the modem behaviour, execute various functionalities related to the GSM modem.

Using AT as proactive command, we can also built various commands on SIM card that can instruct modem enable the installation and activation, various setting for connecting networks, call control at commands, phone book at commands, network control at commands, message and data handling at commands.

VI. FUTURE SCOPE

We have study the GSM system or GSM Modem so we have to design mobile phone for experiment purpose to understanding much more AT commands and its various features.

VII. ACKNOWLEDGEMENT

This paper describes the research conducted at Electronics and Telecommunication Engineering of Institute of Arvind Gavali College of Engineering. We are thankful to our project Guide “Mr. Khade V. C.” for providing us with valuable advised and guidance during the publication of paper.

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Greenhouse monitoring, controlling and automation by using 8051 microcontroller

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Abstract— **This paper presents a monitoring and control system for greenhouse through Internet of Things (IOT). It is necessary to design a control system to monitor various parameters like Temperature, Humidity, Soil moisture, Light Intensity. Here controlling process takes place effectively by both manual and automatic manner. And greenhouse is basically a place or we can call it an environment where plants like vegetables and flower and grown and they are usually covered with glass or "translucent plastic roof". The purpose of this project is to design and easy ,easy to install, user friendly to monitor and trace the value of parameters such as temperature, humidity, natural sunlight which are continually monitored and controlled with an aim to optimize them for getting maximum possible plant increase and yield.**

Keywords- Internet of Things, 8051 Microcontroller, Sensors, Greenhouse

I. INTRODUCTION

The rising demand for crop production and quality has significantly increased the utilization of high quality greenhouse. The increased in population demands for large amount of a crop production we can cultivate the crop which need some specific environmental conditions in the greenhouse. This system which closely monitor and control the climatic parameters of a greenhouse for cultivation of crops or specific plant species which could maximize there production over the whole crop growth season and to eliminate the difficulties involved in the system by reducing human intervention to the best possible varieties in production. The system comprises of sensor analog to digital converter microcontroller and actuators. When any of the climatic parameters cross a safety threshold which has to be maintained to protect the crops, the sensor sense the change and the microcontroller reads this from the data at its input ports after being converted to a digital form by the ADC. The microcontroller then performs the needed action by employing relays until the strayed out parameter has been brought back to its optimum level. Since a microcontroller is used as the heart of the system, it makes the setup low cost and effective nevertheless. As the system also employs and LCD display for continuously alerting the user about the condition inside the greenhouse, the entire setup becomes user friendly. Thus, this system eliminates the drawback of the existing setups and is designed as an easy to maintain, flexible and low cost solution.

II.LITERATURE SURVEY

The demand for the food crops is more in the present scenario. Now a day the cultivation of the crops in the greenhouse under specified conditions which is suitable for the crops is increased.

This paper describes an IOT based green house monitoring system. The system is profitable as it optimizes the green house parameters. The complete system is low cost and is of low power operation.[1].Automated greenhouse monitoring system consists of various sensor namely soil moisture sensor, temperature sensor, and light sensor. These sensors sense various parameters soil moisture, temperature, and light intensity and are then sent to the microcontroller and control action taken by the microcontroller to compare with preset values[2].This paper describes about the various aspects of green house monitoring using IOT. Farming activities, even in urban zones are on an ascent as of late, in remarkable structures. Innovative advance makes the agrarian area develop high, which here is made by the IOT. The IOT will be playing a great role in changing the day to day life experience[3].The designing of the microcontroller based system for measurement and control of the four essential parameters for plant growth, i.e. temperature, humidity, soil moisture, and light intensity, has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate[4]. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of maintaining the environment.[5].In this system this will reduce the time of using the manual way of watering. Fewer workers are needed to maintain the plants or crops. The sensors such as temperature sensor (Thermistor) and soil moisture probe are used to control the temperature and watering in the greenhouse[6].This project offers a design of fully automated greenhouse management system. From the experiment it could be seen that it is fulfilling all requirements related greenhouse monitoring. The automatic greenhouse sensor design could help in increasing the productivity of plants[7].This paper describes the design of a greenhouse monitoring system based on IOT. Agriculture projects even in urban areas are on a rise in recent times, in unique forms. Technological progress makes the agricultural sector grow high, which here is made by the IOT[8]. This project is designed to implementation of IOT using image processing in greenhouse to control and monitor the climatic parameters to image processing technique[9].The paper "Greenhouse monitoring and controlling of System Based on Embedded System" has been successfully designed and tested. 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 and with the help of growing technology the paper has been successfully implemented.[10].

III. METHODOLOGY

The Greenhouse monitoring controlling and automation using 8051 microcontroller can be divided as hardware and software modules. The methodology discussed as follows:

A. Block Diagram

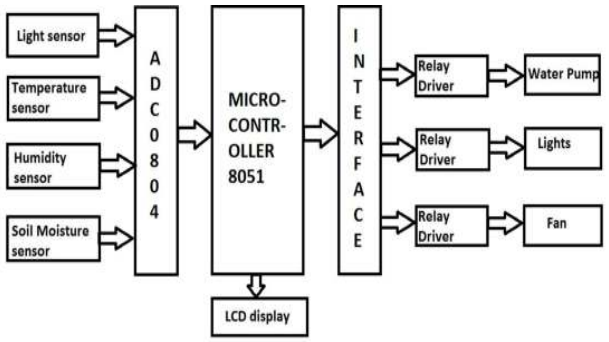

Fig 1. Block diagram of Greenhouse monitoring controlling and automation using 8051 microcontroller

Fig 1.shows the block diagram of greenhouse monitoring and controlling and automation using 8051 microcontroller. This project involved the implementing of greenhouse control device in order to control monitor and maintain desired temperature in the greenhouse by turning on the heater or cooler system as when due also study the soil moisture content (when water is needed) by turning the water valve ON or OFF. Similarly light sensor is used to detect amount of sunlight inside the greenhouse if sunlight above the desired value then this reading of the sensor is send to the microcontroller then microcontroller would send the signal to turn on relay. Similarly, humidity sensor is used to detect humidity in the air.

B. Microcontroller

A microcontroller receives data on greenhouse environment conditions from a number of sensors. The heart of the automated green house system is the AT89C52 microcontroller. The 89C51 has 4 different ports, each one having 8 input/output lines providing a total of 32 input/output lines. Those ports can be used to output DATA and orders do other devices, or to read the state of a sensor, or a switch. There are two different memory types: RAM and EPROM. Shortly, RAM is used to store variable during program execution, while the EPROM memory is used to store the program itself, that's why it is often referred to as the 'program memory'. It is clear that the CPU that will read the program from the FLASH memory and execute it by interacting with the different peripherals.

Fig 2.Microcontroller

C. Temperature Sensor

National Semiconductor's LM35 IC has been used for sensing the temperature. The temperature can be measured more accurately with it than using a thermistor. If temperature exceeds beyond the limit set then a fan will be automatically switched ON as a coolant to reduce the temperature. When it reaches the desired temperature the fan will be automatically switched OFF with the help of relay. But I f the temperature decreases below the optimum temperature a bulb as a heater will be switched ON to set the temperature within the desired range.

Fig 3. Temperature sensor

D. Light sensor

Light sensor sense the light and set an optimum light in the greenhouse for the plants. An artificial light will be switched on automatically by the light sensor with the help of relay if there is insufficient light for the plants in the greenhouse. And the light is switched OFF automatically when the plants get sufficient light from the sun.

Fig 4.Light Sensor

E .Humidity sensor

Humidity sensor is used to check the humidity of the air in the greenhouse. If the humidity exceeds the limit set then an exhaust fan will be switched ON with the help of relay to throw the humid air out of the greenhouse to maintain the suitable environment for the plants.

Fig 5.Humidity Sensor

F. Soil moisture sensor

Dry condition- The probes are placed in the soil under dry conditions and are inserted up to a fair depth of the soil. As there is no conduction path between the two copper leads the sensor circuit remains open. The voltage output of the emitter in this case ranges from 0 to 0.5V.

Excess water condition- With the increase in water content beyond the optimum level, the conductivity of the soil increases drastically and a steady conduction path is established between the two sensor leads and the voltage output from the sensor increases no further beyond a certain limit. The maximum possible value for it is not more than 4.2V.

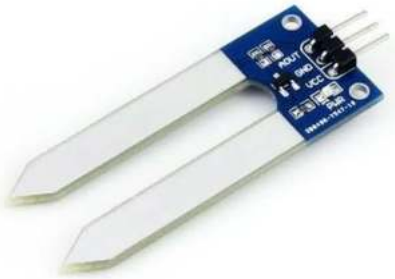

Fig 6. Soil Moisture Sensor

G. Relays

Relay is simply an electromagnetic switch which helps in opening and closing of circuits electronically. It has four important components-electromagnet, an armature, a spring and set of electrical contacts. In short it is a magnetism device for remote or automatic management that's motivated by variation in conditions of an electrical circuit which operates successively alternative devices (such as switches) within the same or a special circuit. The sensors gives the accurate value or status of temperature, humidity, light and soil inside the green house.

Fig 7.Relays

H. LCD Display

LCD screen is an electronic display module and find a wide range of applications. A 16X2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segments and other multi-segment LEDs. The reason being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16X2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5X7 pixel matrix. These LCD has two registers, namely, command and data.

Fig 8.LCD Display

I. ADC0804

In physical world parameters such as temperature, pressure, humidity, and velocity are analog signals. A physical quantity is converted into electrical signals. We need an analog to digital converter (ADC0804), which is an electronic circuit

that converts continuous signals into discrete form so that the microcontroller can read the data. Analog to digital converters are the most widely used devices for data acquisition .

J. Flow Chart

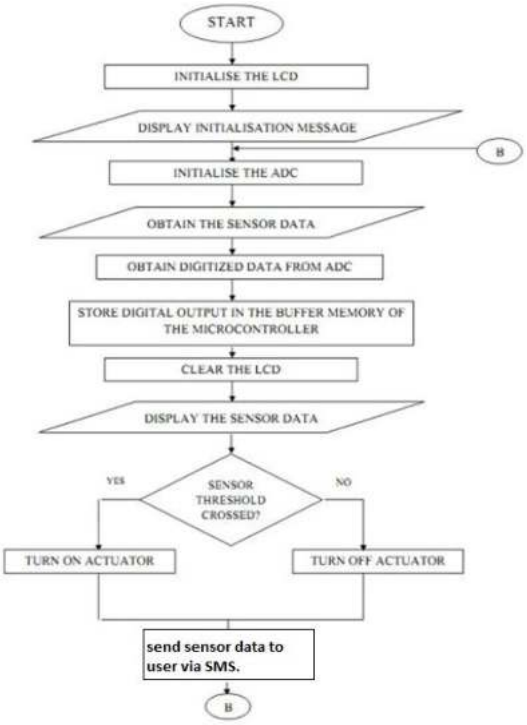

Fig 9.Flowchart

IV. Result and Discussion

We design this project to monitor and control the environmental parameters. we got result based on effective management of greenhouse environment by both automatic manner. This system is very useful in all climatic conditions and this is safest and no manpower is required. The parameters considered for monitoring the greenhouse were measured using the sensor and the data was updated on the customized display.

V. Conclusion

The main advantage of this project is that , all the functions to be performed by fan and water pump to control the climatic conditions like temperature relative humidity and soil moisture level in the greenhouse environment are all automated and it does not required any human intervention. Temperature, heat, moisture and light sensors are the four main sensors used in the project which give the exact value of temperature, heat, moisture and light respectively these sensors give the correct result according to the plants condition, this result can be displayed on the lcd screen that present live data monitoring.

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AGRICULTURE BASED ROBOT BY USING IOT

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ABSTRACT: India is an agricultural based country. With rapid population growth and increasing food demand, boosting farm productivity and yield is essential. To overcome this challenge, this paper proposes an automated control system of a farm using a cloud based IoT solution to monitor and control multiple areas of the farm which play crucial role in the entire farming process. The system uses a network of several NodeMCUs (ESP8266) micro-controllers to monitor and control multiple systems over the cloud. The NodeMCUs constantly monitor the respective states of various elements of the farm and report the data to the central control unit. The user can then take appropriate actions from analyzing this data, i.e. assign their desired tasks to each of the microcontrollers separately.

The Discovery of Agriculture is the first big step towards civilized life, advancement of agricultural tools is the basic trend of agricultural improvement. Now the qualitative approach of this project is to develop a system which minimizes the working cost and also reduces the time for digging operation and seed sowing operation. Wi-Fi interface operated on Android Application to manoeuvre robot in the field. This brings down labour dependency. Seed sowing and digging robot will move on various ground contours and performs digging, sowing the seed and covers the ground by closing it. The paper spells out the complete installation of the

agribot including hardware and software facet.

Keywords -

IOT, Microcontroller, Soil Moisture Sensor, Agribot, Arduino, Android application, Seed sowing, Wi-Fi

I. INTRODUCTION

The main motive for developing Agricultural Automation Technology is decreasing labor force, a phenomenon common in the developed world. The reasons are the need for improved food quality. Robotics and artificial intelligence achievements offer solutions in precision agriculture to processes related to seeding, harvesting, weed control, grove supervision, chemical applications, etc. to improve productivity and efficiency [1]. The applications of instrumental robotics are spreading every day to cover further domains, as the opportunity of replacing human operators provides effective solutions with return on investment. When more conservative issues are granted by robotics, heavy chemicals or drugs dispensers, manure or fertilizers spreaders, etc. are activities more and more concerned by the deployment of unmanned options. All kinds of agricultural robots have been researched and developed to implement a number of agricultural products in many countries. This Agribot can performs basic elementary functions like harvesting, planting and spray the pesticides. The application of agricultural machinery in precision agriculture has experienced an increase in investment and research due to the use of robotics applications in the machinery design and task executions [2]. Precision autonomous farming is the operation, guidance, and control of autonomous machines to carry out agricultural tasks. It motivates agricultural robotics. The goal of agricultural robotics is more than just the application of robotics technologies to agriculture [3].

The multipurpose agricultural robots are designed to perform the basic functions required to be carried out in farms. These robots are used for agricultural operations perform autonomously such as ploughing, seed sowing, mud closing and water spraying [4]. The objectives of the proposed system are to dig the soil depending on moisture level in the soil, to plough the seeds with teeth's like structure at the end to turn the top layer of soil down, to close the seeds and level the ground automatically and to provide irrigation system by spraying water with a pump in the field. .

II. Literature Survey

The robotics fields are gradually increasing its productivity in agriculture field. Some of the major problems in the Indian agricultural are rising of input costs, accessibility of skilled labors, lack of water resources and crop monitoring. To overcome these problems, the automation technologies with robots were used in agriculture. The automation in the agriculture could help farmers to reduce their efforts [2].

The robot which performs operation like soil, moisture testing, seeding, spraying pesticides [2]. The robot is controlled using cell phone using IOT technique. Because of using IOT technique it overcomes the range or distance problem of using IOT [7]. Agribot integrated system which uses Wi-Fi to communicate between robot section, farm section and user section which perform activities like seeding, weeding, spraying of fertilizers and insecticides. It is controlled using Arduino Atmega328 controller and powerful Aurdino to control and monitor working of robot. It has hexapod body which can move in any direction as per required. It can dig a hole in soil plant seed in it and necessary pre emergence fertilizers applies on it, and

move on along with communicating with user using Wi-Fi [8]. Command based digging and seed sowing, a sensor guided for digging, precise seed positioning and sowing has been proposed to reduce the human effort and also to increase the yield. It uses arduino Atmega328 controller and soil moisture sendor. It is controlled using wireless module that can be control by PC/ TAB/ Mobile. It gives acknowledgement massage of seed tank empty or full to the farmer [5]. To drop the seed stepper motor is used and to dig a hole, spike wheel is used [6].

Motivation for the research is to decrease harvesting cost and increase the productivity. Conventional harvesting method is highly labor intensive and inefficient in terms of both economy and time. Machine harvesting systems by robot are a partial solution to overcome these issues by removing fruits from the trees efficiently. Thus reduce the harvesting cost to about 35-45% of total production cost. An Agribot is designed to reduce harvesting cost [8].

III. METHODOLOGY

The Agriculture Based Robot by using IOT can divided as software and hardware modules. The methodology discussed as follow**:**

A. BLOCK DIAGRAM

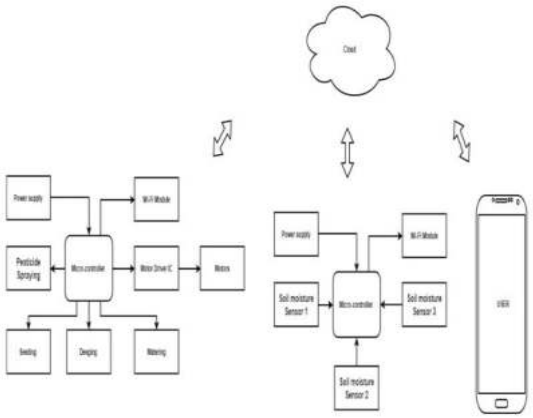


Fig.1: System Block Diagram

Robotics and artificial intelligence achievements offer solutions in precision agriculture to process related to seeding, harvesting, weed control, grove supervision, chemical applications etc. to improve productivity and efficiency.

In our robot we are going to add various hardware components to perform various tasks like seeding, watering, digging, and pesticide spraying. The components such are atmega 328 microcontroller, DC motors, L293D motor driver IC, dc water pump, robot chassis, soil moisture sensors, ESP 8266 WIFI module .

If the user want a particular task or work done by the robot then the user sends command to ESP 8266 module then this WIFI module sends that command to microcontroller then microcontroller will perform only one work like seeding, digging, watering, and pesticide spraying.

In another circuit include three soil moisture sensors which are connected to microcontroller, the soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measures the volumetric water content indirectly by using some other property of the soil such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content

B. Atmega 328

The atmega 328 is a low power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instruction in a single clock cycle, the atmega16 achieves outputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

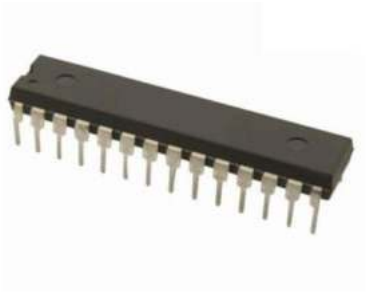


Fig 2 :Atmega 328

C.Motor Driver IC(L293D)

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC motors instantaneously in any direction.

Fig 3: L293D Motor Driver IC.

D.DC Motor

The DC motor is a machine that transforms electric energy into mechanical energy in form of rotation. Its movement is produced by the physical behavior of electromagnetism. DC motors have inductors inside, which produce the magnetic field used to generate movement. The basic working principle of a DC motor is: "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". When armature windings are connected to a DC supply, an electric current sets up in the winding.

Fig 4: DC Motor

E.DC Water Pump

DC 12V Pneumatic Diaphragm Water Pump Motor R365 is the perfect choice for any project that requires water to be moved from one place to another. The pump is supplied with 1M of silicon hose that you can cut to your requirements, the hose provides a good seal and will not leak.

Fig 5: DC Water Pump

F.ESP Module (8266)

This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. Integrated low power 32 bit microcontroller. Integrated 10 bit analog to digital converter. Integrated full TCP/IP stack. Supports Station, Soft Access Point, Station + Soft Access Point modes.Operating Voltage 3.0 ~ 3.6V.Average Operating Current : 80Ma

.

Fig 6: ESP Module 8266

G.Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measures the volumetric water content indirectly by using some other property of the soil such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

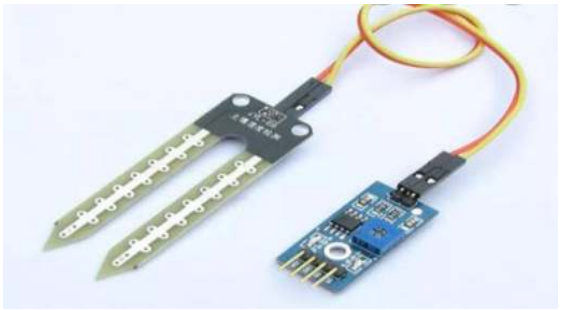


Fig 7: Soil Moisture Sensor

H. Robot Chassis

Chassis is a load bearing framework of an artificial object in its construction and function. An example of chassis is vehicle frame, the under part of motor vehicle, on which the body is mounted, if the running gear such as wheels and transmission, and sometimes even the driver's seat, are included, then the assembly is described as a rolling chassis.

Fig 8: Robot Chassis

I. Proteus software

It is a software suite containing schematic, simulation as well as PCB designing. ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation. For programming we are used the Aurdino Software Aurdino is a proprietary freeware integrated development environment for the development of embedded applications on Atmega 328 microcontrollers, and is developed by Microchip Technology. For PCB designing and simulation we are used the Proteus software.

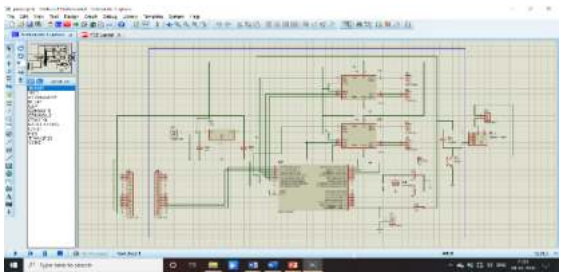


Fig 9 : Circuit Diagram

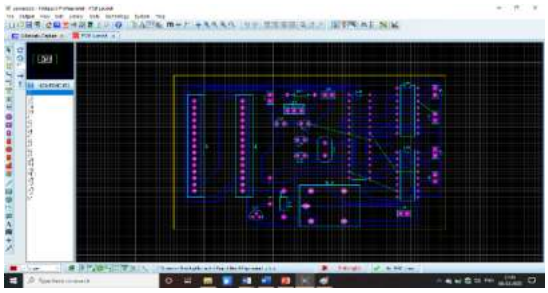


Fig 10: layout

J. Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code is compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

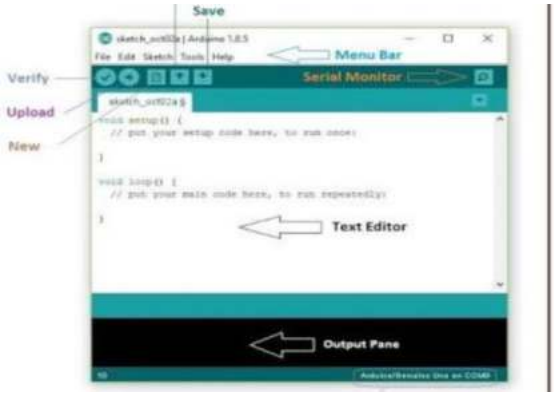
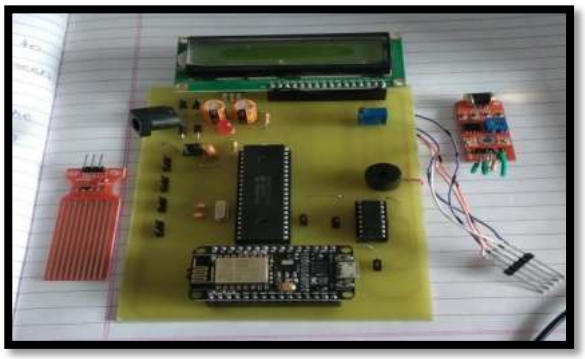


Fig 11. Arduino IDE

IV.RESULT AND DISCUSSION



Our project result is Human efforts are not needed. The person can check the work by using app anytime and from anywhere.The robots do not get sick or tired and they do not need the time off, They can operate with closer tolerances (so, every round is at full field capacity)Energy required for this machine is less as compared with tractors or any agricultural instrument pollution is also a big problem which is eliminated by using robot

V.CONCLUSION

The project concludes that robot is based on cloud system so all process regarding to farm are controlled by human anytime and from anywhere. All the work related to the farm will be done by robot perfectly rather than manually. Time consuming for the robot is less. The efficiency will increase by using the project.

VI.ACKNOWLEDGMENT

This paper describes the research conducted at Electronics & Telecommunication Engineering of institute of Arvind Gavali

college Of Engineering. We are thankful to our project guide “Mr. Barkade V. T.” for providing us with valuable advice and guidance during the publication of paper.

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BRIDGE ANALYSIS AND PREVENTION

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ABSTRACT:

In this paper, we propose a system implementing a bridge monitoring system using the Internet of Things (IoT). This system detects the water level and the load of vehicles. If the flex sensor, water level and load sensor cross its threshold value then it generates the alert. A Bridge monitoring system is significant to the health diagnosis of bridges and flyovers. A Lot of bridges in the cities built on the river are subject to deterioration as their lifetime is expired but they are still in use. These types of bridges are dangerous to use by people. Due to the high water level, earthquake, heavy rains, the heavy load of vehicles, these bridges may get collapse which in turn leads to disaster. That's why these bridges are requiring continuous monitoring using the Internet of Things. So I am proposing a system which consists of a water level sensor, vibration sensor, Load sensor, Flex sensor, PIC microcontroller

Keywords: IoT, PIC Microcontroller, Load Sensor, Water Level Sensor, Vibration Sensor, Flex Sensor.

I. INTRODUCTION

In Recent years flood has become one of the major natural disasters occurring in India. Many bridges have collapsed due to their usage over several decades. It is critical to have an analysis of bridges and also report when and where maintenance operations are needed. In this project, an idea of bridge analysis and disaster prevention system using a wireless system is implemented. This enables the bridge maintenance engineers to monitor the condition of the bridge in real-time. The sensors installed on various parts of the bridge monitors the bend, traffic, weight of the vehicles, etc. At any point in time if any of these parameters cross their threshold value the communication system informs the management center giving an alarm for taking precautionary measures. The complete parameters of the bridge are taken by PIC Microcontroller and sent to another module which is located in a short distance. Here the communication established is using IoT that uses wireless transmitter and receiver circuitry. The receiver module takes the parameters from the transmitter and sends a message with all the parameters to a database center. The communication established between the intermediate module and the database center is using ESP technology.

II. LITERATURE SURVEY

[1] “Bridge Monitoring System” Mr. Anand Kumar Jha, The GSM used for communication established between sensors and operator. This system can help in monitoring the bridge in an efficient, cost-effective and reliable manner. The proposed system continuously monitors the bridge parameter values and judges whether the bridge is safe or not for traveling. This implementation is greatly useful to provide safety for human lives.

[2]“Bridge Health Monitoring System Based on Wireless Sensor"., LIU Miao Lanzhou Jiaotong University, China. The health monitoring of bridge

has important significance for the safe operation of the bridge. In this paper, we analyze the bridge health monitoring system and wireless sensor network and apply the wireless sensor network to the bridge health monitoring system.

III. METHODOLOGY

The Bridge Analysis And Prevention System can be divided into software and hardware modules. The methodology is discussed as follow**:**

1. Block Diagram:

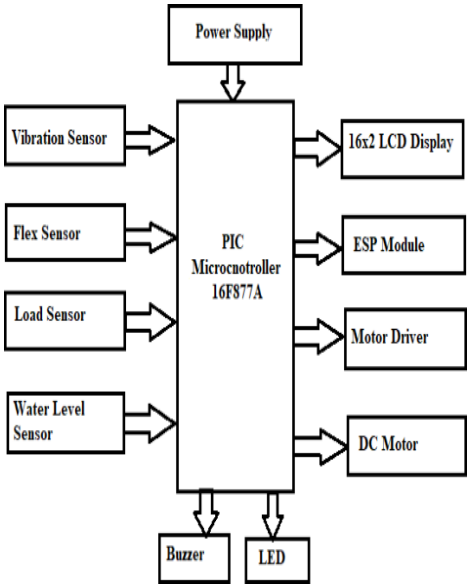


Fig. 1 System Block Diagram

The sensors are installed on various parts of the bridge as shown in the block diagram. They monitor the bend, weight, vibrations on the bridge and water level of the bridge, etc. At any point of time if any of this
parameter cross their threshold value the communication system informs the monitoring house and giving an alarm for taking precaution. The complete parameters of the bridge are taken by a PIC microcontroller and send to ESP module. Here the communication is established using ESP module that uses wireless transmitter and receiver circuitry. The receiver module takes the data from the sensors and sends the message to monitor house and continuous analysis takes place.

a.Vibration Sensor

The Vibration Sensor module vibration switch sw-420 is based on the vibration sensor sw-420 and comparator LM393 to detect if there is any vibration beyond the threshold. The threshold can be adjusted by the onboard potentiometer. If the sensor does not detect the vibration, then the module outputs logic low and it is indicated through the LED, and vice versa.

Fig. 2 Vibration Sensor

b.Load Sensor

A load cell is a “load transducer” which converts the weight or load acting on it into electrical signals. A load cell is composed of an aluminium alloy spring element, strain gauges (serving as sensors) and a bridge circuit. The strain gauges themselves are bonded onto four areas, which become considerably distorted in the spring element. The load cell detects the force of the distortion as a voltage change

Fig. 3 Load Sensor

c.Flex Sensor

Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance - the more the bend, the more the resistance value. They are usually in the form of a thin strip from 1" -5" long that varies in resistance. Flex sensors are Analog resistors. They work as variable Analog voltage dividers. Inside the flex sensor are carbon sensitive elements within a thin flexible substrate, more carbon means less resistance. When the substrate is bent the sensor produces a resistance output relative to the bend radius.

Fig. 4 Flex Sensor

d.Water Level Sensor

A water sensor is a device used in the detection of the water level for various applications. A level sensing device is designed to measure the level of flow substances including liquids, slurries, and granular materials. There are also continuous level sensors; however, these sensing modules can only detect the level of flow of a substance with a specific range**.**

Fig. 5 Water Level Sensor

e.ESP Module (8266)

This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. Integrated low power 32 bit microcontroller. Integrated 10 bit analog to digital converter. Integrated full TCP/IP stack. Supports Station, Soft Access Point, Station + Soft Access Point modes.Operating Voltage 3.0 ~ 3.6V.Average Operating Current : 80Ma

.

Fig. 6 ESP Module 8266

f.Microcontroller (PIC 16F877A)

This microcontroller is very convenient to use, the coding or programming of this controller is also easier. PIC microcontrollers are electronic circuits that can be programmed to carry out a vast range of tasks. They can be programmed to be timers or to control a production line and much more. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device. Many types of PIC microcontrollers exist, although the best are probably found the range of programmable microcontrollers. It can be write-erase as many times as possible because it uses FLASH memory technology.

Fig. 7 PIC Microcontroller (16F877A)

g. DC Motor

The DC motor is a machine that transforms electric energy into mechanical energy in the form of rotation. Its movement is produced by the physical behavior of electromagnetism. DC motors have inductors inside, which produce the magnetic field used to generate movement. The basic working principle of a DC motor is: "whenever a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force". When armature windings are connected to a DC supply, an electric current sets up in the winding.

Fig. 8 DC Motor

h. Motor Driver IC(L293D)

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive in either direction. L293D is a 16-pin IC that can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a

single L293D IC. L293D IC is a typical Motor Driver IC that allows the DC motor to drive in any direction. This IC consists of 16-pins which are used to control a set of two DC motors instantaneously in any direction.

Fig. 9 Motor Drive IC (L293D)

i. Buzzer13

The buzzer consists of two pins an connect it to power and ground. When current is applied to the buzzer it causes the ceramic disk to contract or expand. Changing the causes of the surrounding disc to vibrate. That's the sound that you hear. Piezo buzzers are simple devices that can generate basic beeps and tones. They work by using a piezo crystal, a special material that changes shape when voltage is applied to it. If the crystal pushes against a diaphragm, like a tiny speaker cone, it can generate a pressure wave that the human ear picks up as sound.

Fig. 10 Buzzer

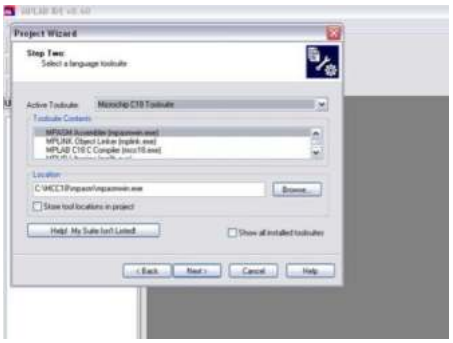
j. 6x2 LCD Display

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in different circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In our project LCD is used to display the message which sends the ESP module

Fig. 11 16x2 LCD Display

k. Proteus software

It is a software suite containing schematic, simulation as well as PCB designing. ISIS is the software used to draw schematics and simulate the circuits in real-time. The simulation allows human access during run time, thus providing real-time simulation. For PIC programming we are used the MPLab Software. MPLAB is a proprietary freeware integrated development environment for the development of embedded applications on PIC and PIC microcontrollers and is developed by Microchip Technology. For PCB designing and simulation we have used the Proteus software.



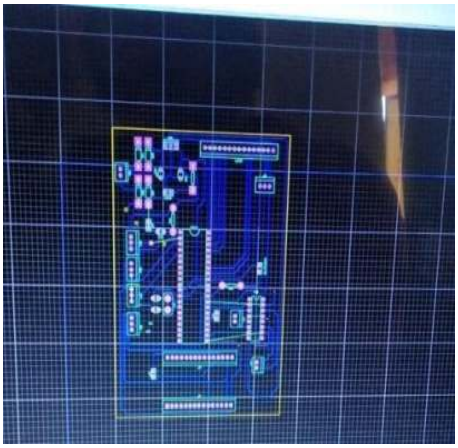


Fig. 12 circuit diagram

IV. RESULT AND DISCUSSION

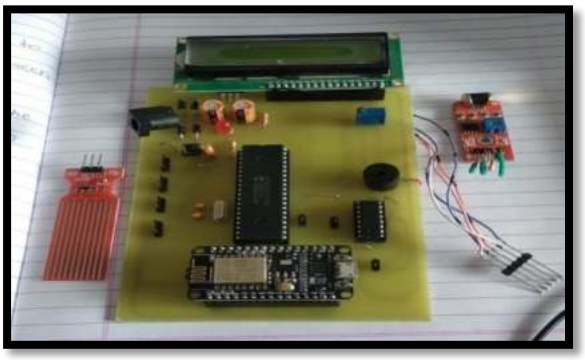


Fig. 13 Result and Discussion

When the system is powered up, there will be a display of "Bridge Analysis and Prevention" on LCD. Also, information is sent to the monitoring house via ESP Modules.

V. CONCLUSION

This system can help in monitoring the bridge in an efficient, cost-effective and reliable manner. Our project is needed for public safety. The proposed system continuously monitoring bridge parameters, values, and judges whether the bridge is safe or not for traveling. This implementation is greatly useful to provide safety for human lives.

VII.ACKNOWLEDGMENT

This paper describes the research conducted at Electronics & Telecommunication Engineering of Arvind Gavali College Of Engineering. We are thankful to our project guide “Ms. Shivdas S.S.” for providing us with valuable advice and guidance during the publication of the paper.

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Coal mine safety monitoring and Alerting system by using IOT

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Abstract- **Today, safety of miners is a major challenge. Miner's health and life is vulnerable to several critical issues, which includes not only the working environment, but also the after effect of it. To increase the productivity and reduce the cost of mining along with consideration of the safety of workers, an innovative approach is required. Coal mine safety monitoring system based on wireless sensor network can timely and accurately reflect dynamic situation of staff in the underground regions to ground computer system and mobile unit.**

To overcome this problem the system, provide emergency alert to the supervisor if person fall down by any reason. This system also provides an early warning, which will be helpful to all miners present inside the mine to save their life before any casualty occurs.

Keywords-Alert system, IOT, mikroC, Miner Safety, Monitoring system

I. INTRODUCTION

Safety and security is a vital component of all in the mining industries. All mining industry takes after some essential protection to stay away from any sorts of undesirable frequencies. Correspondence is the most vital effect today, is to screen distinctive parameters, for example, temperature, expanding dampness, and carbon monoxide, methane gas, and so forth., consistently utilizing sensors, for example, LM35, water level pointer and carbon monoxide gas sensor MQ4 and to stay away from any sorts of dangers identified with security utilizing signal fundamental moves are made. Most dependable correspondence framework must be utilized in the underground to upgrade security in the underground mines. That is, it must be set up between workers, who are moving in the mine, and a settled base station. The correspondence system must not be sporadic at any minute and at any condition. The wired correspondence system framework is not all that dynamic in the Inside underground mines. Inside the underground mines, because of uncomfortable condition the establishment cost and in addition support expense is high for wired correspondence systems. For the fruitful remote information transmission, in the mine work the IOT plan is utilized in switches. A practical IOT based remote mine managing framework with ahead of schedule

cautioning knowledge on carbon monoxide, methane, temperature, expanding stickiness and number of persons in the mining region is proposed in (Zhang, 2001; Qiang, 2009; Wei, 2009; Dai Wei Chen Jianhong, 2011).

II. LITERATURE SURVEY

The planned system consists of the device modules that since all the information around the mine setting and logs the information onto the cloud-controlled server page the IOT module. The sever page is maintained IOT module.

Pranjal Hazarika presented implementation of safety helmet for coal mine workers. This helmet is equiped with methane and carbon monoxide gas sensor. This sensor sense the gas and the data is transmitted to the control room wirelessly, through a wireless module called Zigbee connected with the helmet. When the methane or carbon-monoxide gas concentration is beyond the critical level, controller in the control room triggers an alarm and keeps the plant and the workers safe by preventing an upcoming accident.[1]

Madhu et al developed a coal mine safety monitoring system by utilizing Temperature, humidity and the amount of carbon-dioxide present are checked. If any uncertain condition occur then message is sent with the help of GSM to the forest and fire departments.[2] In this system is made of low power Wi-Fi module and control light with PWM strategy, degree of force usage is cut down, which is basic for any device that is energized by battery. Additional prosperity can be passed on to data servers and kept up exact information of mines.[3]

This system is done by using Zigbee and GSM. This system not only can monitor all kinds of parameters under the coal mine, but also can alarm automatically when environment parameters are abnormal to exceed the limitation, which help improve the level of monitoring safety production and reduce accident in the coal mine. Therefore, the coal mine Safety Monitoring system put forward in this article quite meets the need of coal mine safety monitoring.[4]

In this paper, for the present situation of gas concentration monitoring system, a Bluetooth-based coal mine gas concentration monitoring system design was developed, which describes the ideas about wireless network communication.[5]

III. METHODOLOGY

In the system can be divided as software and hardware modules. The methodology discussed as follows:

A. Block Diagram:

The block diagram of coal mine safety monitoring and alerting system shows the different sections. In this project we are using different sensors, pic microcontroller, and IOT module.

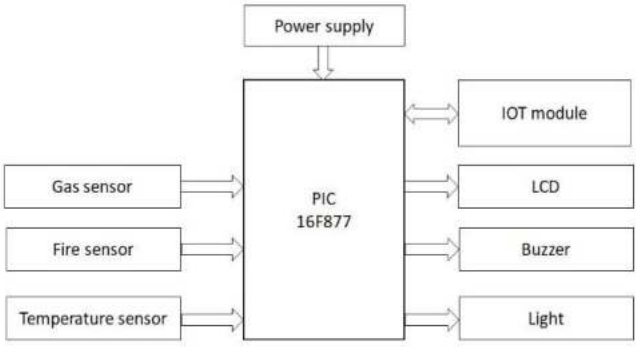

Fig.1 Block diagram of coal mine safety monitoring and alerting system by using IOT

B. Component parts of coal mine safety monitoring and alerting system by using IOT

1. Pic Microcontroller:

Fig. 2 : Pic Microcontroller

PIC stands for Peripheral Interface Controller. PIC microcontroller was developed by microchip technology 1993. It was developed for supporting PDP computers to control its peripheral devices and that's why it was named Peripheral Interface Controller. PIC microcontrollers are of low cost, very fast and easy for the programming and execution of program. Their interfacing with other peripherals is also very easy. PIC Microcontroller architecture is based on Harvard architecture and supports RISC architecture (Reduced Instruction Set Computer). PIC microcontroller architecture consists of memory organization (ram, rom, stack), CPU, timers, counter, ADC, DAC, serial communication, CCP module and I/O ports. PIC microcontroller also supports the protocols like CAN, SPI, UART for interfacing with other peripherals.

2. *Fire Sensor:*

Fig. 3: Fire sensor

Fire sensor will distinguish warm radiations in condition. The sensor is used to recognize any trace of fire and it will give meddle with banner when it recognizes Fire in underground locale. It tackles the standard of IR bars or Heat radiation recognizable proof.

3. *Gas Sensor:*

Fig. 4: Gas sensor

MQ-2 Semiconductor Sensor for Natural Gas For acknowledgment of most customary gases like Methane, in like manner to Propane and Butane which are the major risky gases in underground coal mines this gas sensor interfaced. It has 6 pins; 4 of them are acclimated with bring signals and other 2 are used for giving warming current.

4. *Temperature Sensor:*

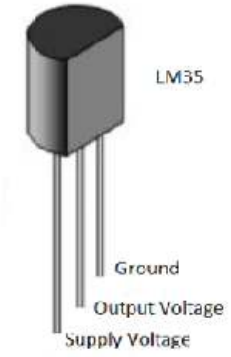

Fig. 5: Temperature sensor

A Linear LM35 is used to record temperature at steady between time of time. It is an exact temperature sensor with a yield voltage specifically in respect to Centigrade temperature. The straightforward voltage to cutting edge precedent data change is dealt with by controller and the procured automated regard will be sent on the LCD demonstrate related with PIC microcontroller 16F877.

5. *IOT Module:*

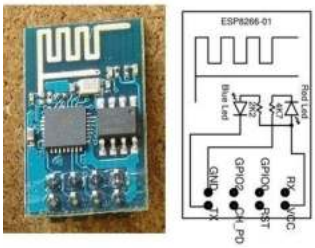

Fig. 6: IOT module

The reviving web data through ESP8266 modem when interfaced with microcontroller or PC is much less troublesome as differentiated and Ethernet module since ESP is a SoC and Integrated TCP/IP tradition stack. AT firmware is offered easy to use bearing set with which it will in general be orchestrated or worked at various Baud Rate (Supported 9600, 115200 or 57600). Plain Text may be sent through the modem by interfacing only three indications of the successive interface of modem with microcontroller (TxD, RxD and GND). In this arrangement RTS and CTS indications of successive port interface of ESP Modem are related with one another. The transmit banner of successive port of microcontroller is related with of the consecutive interface get signal (RxD) of ESP Modem while get banner of microcontroller successive port is related with transmit hail (TxD) of successive interface of ESP Modem.

6. *Power supply:*

The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

C. Software requirements:

1) mikro c compiler.
2) pickit3 programmer.
3) proteus for simulation and PCB designing.

IV. RESULT AND DISCUSSION

The concept of "IOT" breaks traditional thinking and introduces new idea, technology and method for safety supervision and management, corresponds to the scientific and security development concept, and reflects essential connotation of guidelines of "Safety and prevention first, comprehensive treatment". Through adopting IOT technology for remote dynamic supervision, coal mine supervising pattern can be innovated, tracking inspection on illegal action can be achieved, capabilities of emergency response and accident investigation can be increased, situation of safe production can be further improved, and safe and stable development of coal industry can be promoted.

V. CONCLUSION

We conclude that this system is displaying the parameters on the monitoring unit, it will be helpful to all miners present inside the mine to save their life before any casualty occurs.
This system also stores all the data in the computer for future inspection.

VI. ACKNOWLEDGEMENT

This paper describes the study conducted at Electronics and Telecommunication Engineering department at Arvind Gavali College of Engineering.
We are thankful to our project Guide Ms. Pratima Mahamuni for providing us with valuable advised and guidance during the publication of paper.

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Design & Develpoment of Special Purpose Jig

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Abstract –

As we all going towards industry 4.0, now we using the most advance technology where time and quality of product is the main perspective. This paper gives detailed information of jig and also gives information about 3-2-1 principle which helps us for time reduction in whole cycle up to 30-40% which used for jig design.

The number of advantages that are associated with the use of jig in manufacturing process which includes: increase in production rate, cost reduction, interchange ability and high accuracy of parts, reduction of accident as safety is improved by adding multiple clamps on jig, easy machining of heavy components, also having low variability in dimension which gives us consistent quality of manufactured products. Also jig is used for minimizing work piece deformation by using clamping, drilling force is essential for accurate drilling operation on work piece. This jig is used for accurate drilling as it required parallel as well as perpendicular drill to pipe surface. So there is need to develop system which consume less time which helps to improve reduction in cycle time and increase in productivity.

Keywords- *3-2-1 Principle, Drilling jig*

I. INTRODUCTION

Over the past century, manufacturing has made considerable progress. New machine tools, high-performance cutting tools, and modern manufacturing processes enable today's industries to make parts faster and better than ever before. Although work holding methods have also advanced considerably, the basic principles of clamping is still same.

Jig is a device which performs function of holding as well as guiding tool. It is special purpose tool which is used to increase the production when work pieces are to be produced on a mass scale. The mass production of work pieces is based on the concept of interchange ability according to which every part will be produced within allowable tolerance. A jig for the aforesaid purpose has been designed and developed under the project done in company at Satara (Maharashtra).

Once a jig is set up properly, any number of another part may be easily produced without any additional set up. The jig is the simple way to produce a component in large quantity. So jigs are used and work as one of the most important thing for mass production system, Jig is special work holding device. Quality of jig is directly affected to performance of processes. Jig is production tool used for accurately manufacture duplicate and interchangeable parts. The current problem in industry is drilling a number of small diameter hole's perpendicular as well as parallel to that of seamless pipe which is used in cooling tower. Mass production methods demand a fast and easy method of positioning work for accurate operations on it.

Increasing the productivity and accuracy are the two basic aims of mass production. As we know the solution to this is by reducing the set up cost of the machine. In this case we design & develop the special purpose jig.

Jig is work holding devices that holds supports and locates work piece and guides one or more tools to perform a specific operation. Jig is that type of tool which is used to control the location or motion of another tool. A jig which is used to perform the specific operation this type of Jig is called as “Special Purpose Jig.”

The economical production of engineering components is greatly facilitated by the provision of jig. The use of a jig makes a fairly simple operation out of one which would otherwise require a lot of skill and time. Jig’s model under the components accurately positioned; and hold rigidly component rigid and prevent movement during working in order to impart greater productivity and part accuracy.

Jig hold or grip a work piece in the predetermined manner of firmness and location, to perform on the work piece a manufacturing operation. Jig is devices used to facilitate production work, making interchangeable pieces of work possible at a savings in cost of production. A jig is a guiding device and a fixture a holding device. Jig is used to locate and hold the work that is to be machined.

II. LITERATURE REVIEW

1] Mahendra H.S., et.all [1] in this paper authors have developed a jig bracket for setting arrangement. Designed bracket to hold a work piece in the pre-determined manner and location. The milling jig designed to hold alignment between the tool and work piece. The milling jig designed fulfills all the Effective degree of freedom considering all 6 DOF was considered. Jig has less wear capacity hence production is increased. Designed jig will be able to produce more than 10,000 components.

2] H Radhwan, et.all [2] in this paper it uses principle of von misses theory applied in jig development process. Eliminate the manual handling, the cycle time can be improved from12.15 seconds to 8 seconds this will result the time to produce the required quantity of part are shorted to 34.16%.

3] Kataria Mahendra & Bhimani Jasmin [3] in this paper authors is use principle of minimum location point. Total cycle time is reduced by 750 seconds to 231 seconds. Rectangular clamp use to reduce operation time reduces, accuracy increases and also production rate increases.

4] Uday C. Agashe, et.all [4] this paper provides an overview of the different type of fixture used for clamping the component correctly. Also provided the comparison between manually operated fixture used in earlier and the modern fixture which reduces the production cycle time and increases the productivity. Also, this paper includes the various types of clamping devices and their functions.

5] S. Prabhakar & B. Shivaji [5] in this paper authors is used 3-2-1 principle of 6 DOF are used. Then reduces the efforts of marking, measuring and setting of work piece on a machine and maintains the accuracy of performance. The work piece and tool are relatively located at their exact positions. So it reduces product cycle time.

6] Shailesh Pachbhai & Laukik Raut [6] this paper includes the various methodology used for clamping operation used in different application by various authors are reviewed. Also it includes the various methods used for location.

III.METHODOLOGY:

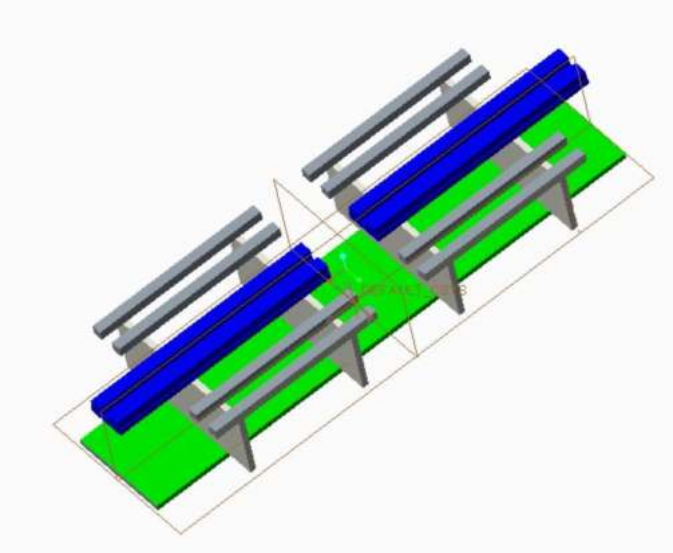

Fig. 1: Creo 3D Design of jig

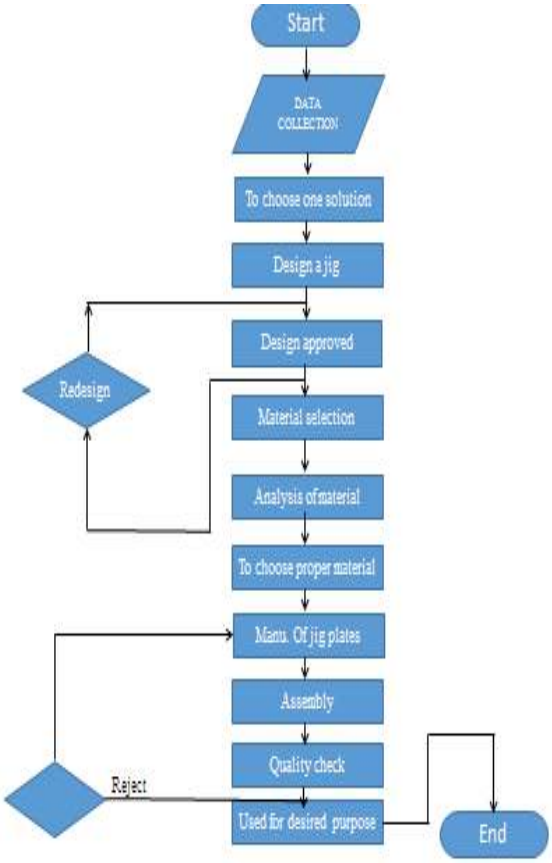

Fig 2: Flowchart

For Design special purpose jig:

1. Material Removal Rate (MRR)

$$= \pi \times d^2 \times fN/4$$

$$= \pi \times d^2 \times 0.05 \times 400/4$$

$$= 22.61\, mm^3/min$$

2. Total Depth: (L)

$$L = Total\ height + 2 \times 0.29 \times d$$

$$L = 12.5 + 2 \times 0.29 \times d$$

$$L = 13.96\ mm$$

3. Drilling Time: (T)

$$T = L/N.R$$

$$= 13.96/400 \times 0.05$$

$$= 39.58$$

$$= 40\ sec$$

40 sec for one drill.

4. Loading & Unloading = 5 min

5. Clamping & Declamping = 20 *min*

6. Total time required for first part: (T1)

$$T1 = Loading\ \&\ Unloading + Clamping\&Declamping + 40 * No.of\ holes$$

$$= 5+20+ (40 \times 82)$$

$$= 79.67\ min$$

$$= 80\ min$$

7. Total time required for middle part: (T2)

$$T2 = Loading\ \&\ Unloading + Clamping\ \&\ Declamping + 40*Number\ of\ holes$$

$$= 5+20+ (40 \times 144)$$

$$= 121\ min$$

8 Total time required for last part: (T3)

$$T3 = Loading\ \&\ Unloading + Clamping\ \&\ Declamping + 40*Number\ of\ holes$$

$$= 5+20+ (40 \times 82)$$

$$= 79.67\ min$$

$$= 82\ min$$

9. Total time for all parts: (T)

$$T = T1+T2+T3$$

$$= 80+121+80$$

$$= 281\ min$$

PARAMETERS	FIRST PART (T1)	MIDDLE PART (T2)	LAST PART (T3)
No.of holes	82	144	82
Marking & Machining	39 Min	49 Min	39 Min
Drilling	60 Min	104 Min	60 Min

Table No 1- Existing time

Total time required = 351 Min

PARAMETERS	FIRST PART (T1)	MIDDLE PART (T2)	LAST PART (T3)
No.of holes	82	144	82
Loading & Unloading	5 Min	5 Min	5 Min
Clamping &Declamping	20 Min	20 Min	20 Min
Drilling	55 Min	96 Min	55 Min
Total	80 Min	121 Min	80 Min

Table No 2- Proposed time

$$Total\ time\ required\ = T1 + T2 + T3$$

$$= 80 + 121 + 80$$

$$= 281\ Min$$

Time reduced 70 min from actual time.
Hence 20% time will be reduced.

III. APPLICATIONS.

- Drilling Purpose
- Full proofing of component

IV. RESULT AND DISCUSSION.

- By using such type of jig the drill holes perpendicular as well as parallel and accurate to the pipe surface.
- All holes are accurate in size and the loading and unloading of the job will be easy process so skilled workers will not be required.
- Design of jig is full proof.

V. CONCLUSION.

- After this project we conclude that operation time reduces, accuracy increases and also production rate increases.
- Jigs eliminate the individual marking, positioning, and frequent checking. This reduces operation time increases productivity.
- The total time required for operation is 350 minutes and with using the jig, operation time will be 280 minutes.
- Jigs simplify locating and clamping of the work pieces. Tool guiding elements ensure correct positioning of the tools with respect to work pieces.
- There is no need of skillful setting of the work piece of tool. Any average can be trained to use jigs the replacement of the skilled work man with unskilled labor can effect substantial saving in labor cost.
- Higher production, reduction of scrap, easy assembly and savings in labor costs results in substantial reduction in the cost & time of the work pieces produced with jigs.

VII. FUTURE SCOPE

Scope of project is to divise a method of reducing of cost of production by eliminating the setting of tool and work peace and thereby enhancing the overall efficiency of clamping system. Another purpose that it serves is that the heavy and complex shaped parts are machined by holding rigidly work piece to a machine. It also reduces quality control expanses. Moreover, fool proofing is attained and less skilled labour requirement exists.

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Automation Mechanisms for Centerless Grinding Machine: A Review

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Abstract- This paper mainly deals with low cost automation in centerless grinding machine. The manual feeding of work pieces can be replaced by designing and developing of automatic feeding system which helps to feed the work pieces automatically into the centerless grinding machine. Also many of the operations like truing, face cutting, gauging can be automated so as to save the set up time. The objective of this work is to reduce the cycle time, consistency in the quality of job and to reduce the production cost. Also many of the risky operations can be automated which ensure the safety of the opearatos.

Keywords: - Automation, Centerless Grinding Machine, Cycle Time, Production Cost.

I. INTRODUCTION

Grinding is a abrasive machining process in which grinding wheel is used as a cutting tool. Many types of machines are used for grinding. Grinding wheel is made up of abrasive grains like aluminum oxide, silica carbide, boron carbide, diamond, etc. There are various types of grinding depending upon size, shape, features & the desired production rate as follows:

- Form grinding
- Internal grinding
- Surface grinding
- Cylindrical grinding
- Creep feed grinding
- Centre less grinding
- Pre grinding

Centerless grinding is a machining process that uses abrasive cutting to remove material from a workpiece. In centerless grinding; the workpiece is secured between two rotary grinding wheels and the rate at which material is to be removed from the workpiece is determined by speed of rotation of two grinding wheels. Centerless grinding is typically used in preference to other grinding processes for operations where many parts must be processed in a short time.

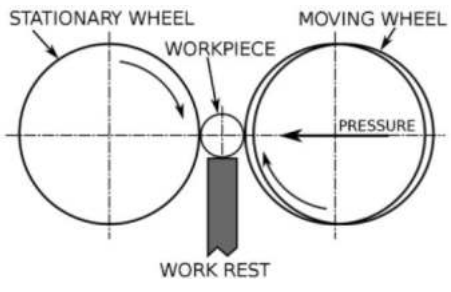

Figure 1: Working of centerless grinding machine [5]

The figure 1 shows working of the centerless grinding. Grinding wheel and regulating wheel rotates in opposite direction and workpiece rotates corresponding to wheels rotation.

By considering production cost and quality; centerless grinders are highly suitable for small variety and large volume production. Automation in these grinding machines reduces the use of energy of worker, production cost, keeps consistency in quality of product and increases the productivity.

There are many drawbacks in manual working procedure of in feed centerless grinding like manpower fatigue, availability of manpower, labor cost, quality issues and more cycle time causing less productivity. With the help of this automation; labor cost is reduced which ultimately reduces the production cost. Due to which economy of scale is increased approximately three times more than the current one as well as consistency in quality is also achieved. The burning of job, poor surface finish, ovality in pipe etc issues regarding quality are reduced. Many of the researchers have optimized the high quality process, high productivity process with reduced cycle time. With these easy-to-use and high-performing part-feeding machines, customers from varied industrial sectors have achieved lower error rates, less power consumption, better profits, better rates of efficiency and less dependency on manpower.

II. LITERATURE REVIEW

Jadhav et al. [1] discussed that centerless grinding machine automation is possible in minimal cost and improves economy of scale. They have developed automation technique for the job having multiple diameter, steps or projections on the job. In this new method of automation hydraulic cylinders, sensors besides a control panel, pressure gauge, and a hydraulic power pack added. Relay control is used for the electrical control. It gives maximum performances, reliability, robustness, modularity, user friendliness, portability and reusability. This mechanism is designed to reduce the cycle time, consistency in the quality of job and to reduce the production cost. Gurusiddayy et al. [2] demonstrated that by automating the centerless grinding machine; labor cost is reduced i.e. two operators were required for this grinding machine. One operator at loading of rods and another operator at unloading side. For automatic loading and unloading of components from the centerless grinding machine mainly requires the mechanism. The mechanism mainly consist of inclined plate

for placing of the rods, pneumatic cylinder for lifting of rods and belt drive for transporting of rods up to the work rest blade. Saka et al. [3] demonstrated the model of vibratory bowl feeders which are used to feed small parts into various stations. At each station parts will be rejected, accepted or send for the further machining processes depending upon the orientation of the part. The objective of this work was to increase the production by increasing the part feed rate by using vibratory bowl feeder. The Scope of this analysis is to produce detailed analysis of the vibration system required to move the parts through the system and show how different spring configurations would affect the flow of the part through the system.

Chandrakar et al. [4] discussed about the results which indicate that the dynamic behavior of the mechanical system is quite sensitive to the crank speed. The contact force is increased when the crank speed increases and the decrease in crank speed tends to make the results more noisy. The method presented in this thesis can be utilized for optimizing the performance of mechanical systems with joint clearances. In the design of the single slider crank mechanism a method of artificial neural network applied for the solution of performance indices to predict the output values. The input layer in NN has three nodes which take the joint reaction forces and power consumption as the input and the output layer also has three nodes to give the outputs as design parameters and crank speed. Joshi et al. 5] developed three types of fixture mechanisms as oscillating type, rotary type and through feed type. These mechanisms help to reduce the fatigue of the workers due to repetitive work. Also it avoids the injuries which were take place during manual operation. The type of fixture is utilized depending on the type of operations to be performed. e.g. The oscillating type fixture is used when there is heavy stock removal and extreme accuracy is required. Similarly rotary type fixture is used for medium and small size parts where high production and accuracy is required. Also through feed type fixture is used for producing accurately ground parts at the highest production rates Fernandes et al. [6] have carried out the ishikawa analysis and as well as the statistical quality analysis of 4-axis angular centreless grinding machine and identified the improvements need to be implemented in order to improve the process capability index of angular centreless grinding machine. To improve the process capability the four various modifications have done like implementation of In-Process gauging, implementation of flagging unit for face cut, implementation of servo mechanism for regulating wheel dresser, implementation of servo mechanism for drive feed. Shirsath et al. [7] have automated the dressing and truing operations of grinding wheel by design and development of template assembly.

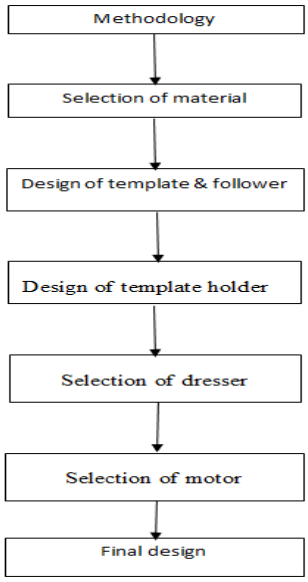

Figure 2: Adopted methodology [7]

Stepwise methodology is shown in figure 2. Due to this the time required for manual truing and dressing operation gets reduced and accuracy of grinding operation also get improved.

III. CONCLUSION

Industrial sector is focusing on increasing the automation in every machining operation to reduce the labor fatigue, to cut down the labor cost and also to increase the profit. While achieving these tasks; industries also focusing on maintaining the quality and hence the accuracy in the production processes. Grinding operation is one of the most precise operations in manufacturing industries. Grinding machines are required for fine finishing of the product and also for machining of very small parts with high accuracy. While completing this operation many of the things needed to do manually for which these highly costing machines are required to keep idle for set up purpose.

In many of the cases; automation is carried out by simple mechanisms like template and follower so as to reduce the cost of automation. Many of the modern techniques such as artificial neural network, Ishikawa analysis, statistical quality analysis etc are used to identify the various modifications needed to improve the process capability. Most of the repetitive and risky work is automated so as to increases the productivity. Also many of the activities like gauging, face cut operation, truing and dressing are also automated to save the time.

IV FUTURE SCOPE

Though many of the simple mechanisms are used for the automation in the grinding machine; still there is scope to implement low cost automation e.g. by maximum use of gravity force instead of servo motors. Various scratch resistant materials can be used in the conveyors of material feeding

mechanism which will ensure the fine surface finish of the product.

Many of the researchers have implemented the automatic feeder mechanism to only input side of the machine while it can be implemented on both the sides i.e. on input as well as output side to save the time and increase the productivity. The various drives like servo motors, belt drives, chain drives, gear drives can be implemented for automation purpose depending on the application. Along with the techniques like Ishikawa, statistical quality analysis used to identify the various modifications to be done; techniques like pokayoke should be used to avoid the accidents which may be happened while using the automation.

CONFLICT OF INTERESTS

The author states that there are no conflict of interest about this paper publication.

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Complaints Solving Using Design Change Note and Quality Control Tools

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***Abstract*- Today's competitive environment has, lower manufacturing cost, more productivity in less time, high quality product, defect free operation are required to follow to every industry. Research was carried out about centreless grinding machine manufacturing industry to address the quality related problems and improve their quality level by implementing different types of tools of quality. Here we were going to review on these papers and identify the different way of uses of those tools in manufacturing industries to increase the quality of the product. There are so many defects in the manufacturing process and these defects directly affects on productivity, profitability and quality level of organization. This study is aimed to review the research work made by several researcher and attempt to get technical solution for the various defects and to improve the entire process of the manufacturing.**

Keywords- *Quality Tools, Quality Improvement, PDCA & DMAIC, Centreless Grinding Machine, Cost Reduction, Time Reduction.*

1. Introduction

This no one can refuse the value of quality in modern world competitive market where only those survive, who can provide better quality products. According to Sulaman Muhammad's international journal of engineering research paper in April 2015 [1]. Edward Deming explains "when the quality is improved, the cost decrease (because of less rework, fewer mistakes, fewer delays and better use of machine, time and material), when cost decrease productivity improves, when productivity improves they capture the market with better quality & low price and in this way they stay in the business, increases their business and provide more jobs". These tools are easy to implement and suitable for people and required less formal training statistics and because they can be used to solve the major quality related issues. For solving quality related problems quality control tools used are flow chart, cause and effect diagram, why why analysis.

Tools of quality can be applied through many ways in the process industry but PDCA cycle and DMAIC methodology are the most famous and widely used technique through quality tools can be implemented in industrial process. DMAIC methodology is also same as PDCA cycle but the steps of DMAIC are a bit more explanatory than the PDCA cycle.

2. Literature review

The literature survey consists of eight papers which explain the flexibility of different Quality tools and its scope. Here, in survey we are going to review on different Quality tools which are used in small scale industries. The importance of QC tools is explained by various authors in this survey.

Nikunjkumar A. Parmar, et al [1] in their paper, Today's competitive environment has, lower manufacturing cost, more productivity in less time, high quality product, defect free operation are required to follow to every foundry man. For the improvement of products quality there are diff-diff quality tools used in various review papers. Here he was going to review on these papers and identify the different way of uses of those tools in manufacturing industries to increase the quality of the product. There are so many defects in the manufacturing process and these defects directly affects on productivity, profitability and quality level of organization. This study is aimed to review the research work made by several researcher and attempt to get technical solution for the various defects and to improve the entire process of the manufacturing.

Behnam Neyestani [2] explained, Dr. Kaoru Ishikawa was first total quality management guru, who has been associated with the development and advocacy of using the seven quality control (QC) tools in the organizations for problem solving and process improvements. Seven old quality control tools are a set of the QC tools that can be used for improving the performance of the production processes, from the first step of producing a product or service to the last stage of production. So, the general purpose of this paper was to introduce these 7 QC tools. This study found that these tools have the significant roles to monitor, obtain, analyse data for detecting and solving the problems of production processes, in order to facilitate the achievement of performance excellence in the organizations.

Deepa Sanjay Pandey [3] presented in their paper, research is focusing in implementing Quality control tools activities for solving the customer complaint in an industrial sector. The study is carried out in a Label Manufacturing industry which is now facing problem in establishing new printing Machines in their Plant, and also maintaining it to reduce downtime due to maintenance issue. Due to some faults in the quality of few products there is rise in customer complaints. The approach is directed in the direction for finding the root cause of the problem, due to which quality

issues rise in a manufacturing sector in Indian industries. The work includes solving the customer complaints by doing root cause analysis (RCA) of the problem by doing why why and fishbone analysis of individual customer complaint and Corrective action and Preventive action (CAPA) is made and given to the individual customers for their satisfaction. The study highlights the contributions of Quality Control tools which initiatives to organisational performance and also the need for the successful management of Quality control programmes for establishing sustained quality improvement initiatives. By doing why why and fishbone analysis, quality issues of the customers are reduced by 50%.

Pranay S. Parmar, et al [4] in their paper, In today's world of globalization and competitive environment, small scale industries have to develop economically sustainable plan which can provide them competitive edge. In this scenario customer satisfaction is replaced by customer delight by providing those products of their requirements at reduced cost. To attract the customers and making more profit a company must concentrate on quality of its product. Quality of the product depends on the reduced variation in the process during production. So if the process is under control than the quality of the product will be good but if it is out of control than it results in rework, rejection, scrap etc. which is indication of poor quality. So to reduce the variation in process the statistical process control techniques are used. This paper presents a case study of implementation of statistical process control (SPC) techniques for reduction of rework cost in a transformer radiator manufacturing small scale industry which is located in Vadodara, Gujarat, India. With the help of different tools and techniques such as 7 basic quality control tools, cost of quality etc. the rework cost of the radiator is reduced with improvement in quality and productivity.

Abhishek Rana, et al [5] author says, recently in a competitive manufacturing sector, lead time is the most important factor in order to compete in the market. This leads every manufacturer to decrease production time and increase quality of the product. Due to improper work cycle delay of a product occurs. The major changes required are operation sequence, flow of material in the workshop, work cycle, etc. In this paper, the authors have delved into the causes of excessive lead time and suggest practical inexpensive strategies for reducing it. Recommendations are based on detailed study of manufacturing facility and processes for a time period of 6 months in the industry. After describing the relationship between lead time, material flow time and variance and reviewing potential methods for reducing lead time by reducing mean flow time of material and operation time of an automated gas fired kit fitting box (hereafter termed as “box”). The aim of this paper is also to demonstrate the use of QC tools and Kaizen in the industry as to tool for improvement in manufacturing sector especially in small to medium scale industries.

Sulaman Muhammad [6] in their paper, “Quality Improvement of Fan Manufacturing Industry by using basic seven tools of Quality: A Case Study” investigate about total five type of defect occurring in fan manufacturing process of “Fecto Fan Company”. Who are specialized in manufacturing all type of ceiling Fans. There were two sections in plant, manufacturing and assembling. After identifying the problems now, the goal was to eliminate all these problems and to ensure flawless manufacturing process. For this purpose, basic seven tools of quality were implemented. Tools were implemented through DMAIC methodology. Every tool was used in different step of DMAIC methodology for better results. This better result was get because of managerial staff of the company who removes these defects from the manufacturing process. After the removal of defects from manufacturing process control chart was implemented to make it sure that process is now under control. At the last author of this paper was Strengthen the famous statement of quality guru Dr. Ishikawa that “95% of quality related industrial problems can be solved simply by applying seven basic tools of quality.”

Varsha M. Magar, et al [7] investigate in their paper about the systematic use of 7QC tools. The main aim of this paper is about to provide an easy introduction of 7 QC tools and to improve the quality level of manufacturing processes by applying it. QC tools are the means for collecting data, analysing data, identifying root causes and measuring the results. These tools are related to numerical data processing. All of these tools together can provide great process tracking and analysis that can be very helpful for quality improvements. These tools make quality improvements easier to see, implement and track. The work shows continuous use of these tools upgrades the personal characteristics of the people involved. It enhances their ability to think generate ideas, solve problems and do proper planning. The development of people involved. It enhances their ability to think generate ideas, solve problem and do proper planning. The development of people improves the internal environment of the organization, which plays a major role in the total quality culture. Statistical QC is chiefly concerned in making sure that several procedures and working arrangements are in place to provide for effective and efficient statistical processes, to minimize the risk of errors or weaknesses in procedures or systems or in source material seven QC tools are most helpful in troubleshooting issues related to quality. All processes are affected by multiple factors and therefore statistical QC tools can be applied to any process. The continuous use of these tools upgrades the personal characteristics of the people involved. it enhances their ability to think generate ideas, solve problems and do proper planning.

B.R. Jadhav, et al [8] in their paper, casting production involves various processes which include pattern making, moulding, core making, melting pouring, shell breaking, shot blasting etc. It is almost impossible to produce defect free castings. Occurrence of the defect may involve single or multiple causes. These causes can be minimised through systematic procedure. The paper represents procedure to analyse and minimise casting defect Cold shut in automobile cylinder block of grey cast iron Grade FG150. Gaiting systems are not always responsible for the defect

occurrence; this paper represents the defect reduction by controlling alloy composition and pouring temperature. The seven quality control methodology is used to analyse and reduce defects which includes check sheet, pareto analysis, cause effect diagram, flow chart, scatter diagram, histogram and control chart.

3. Proposed Methodology for Solving Complaints

1. PDCA
2. DMAIC
3. Cause and Effect Diagram/Fishbone Diagram
4. Flow Chart
5. Why Why Analysis
6. Existing Methodology

1) PDCA-

- Plan - analysis of what needs to be improved by taking into consideration areas that hold opportunities for change. Decision on what should be changed.
- Do - implementation of the changes that are decided on in the Plan step.
- Check- Control and measurement of processes and products in accordance to changes made in previous steps and in accordance with policy, goals and requirements on products. Report on results.
- Act - Adoption or reaction to the changes or running the PDCA-cycle through again. Keeping improvement on-going

2) DMAIC-

DMAIC is the shortened form of word Define, Measure, Analyse, Improve and Control. DMAIC technique is used for process improvement. DMAIC is well ordered way of improving process by identifying the problem then measuring its impact, examining why the problem is occurring, then improving the process by removing the problem and at the end control the process so that no more problems come.

3) Cause and effect diagram

Purpose-

- Graphical representation of potential causes of a problem

Figure1 shows the example of cause and effect diagram

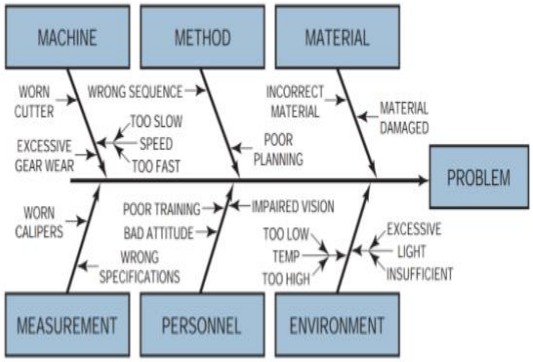

Fig.1 Cause and effect diagram

Benefits-

- Break problems down into bite size pieces to find root cause
- Fasters team work
- Common understanding of factors using the problem
- Follows brain storming relationship

4) Flow Chart-

Purpose-

- Visual illustration of the sequence of operations required to complete a task
- Schematic drawing of the process to measure or improve
- Potential weakness in the process are made visual
- Picture of process as it should be

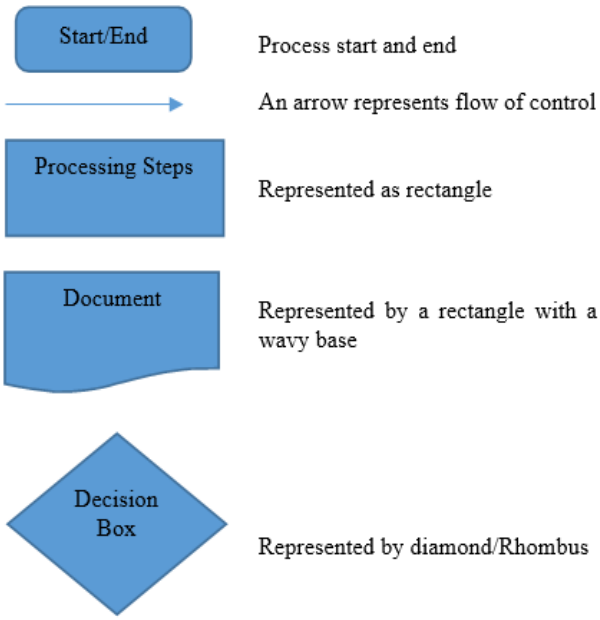

Fig.2 Flow Chart

Benefits-

- Identify process improvements
- Understand the process
- Shows duplicated efforts and other non-value added steps
- Clarify working relationships between people and organisation

5) Why Why Analysis

- One of the most useful tool for finding the root cause is to asking “Why”? until the root cause is reached
- The process is referred to as five why’s, since change are that asking “why’s”? five times will uncover the root cause

6)Existing Methodology/Current practice

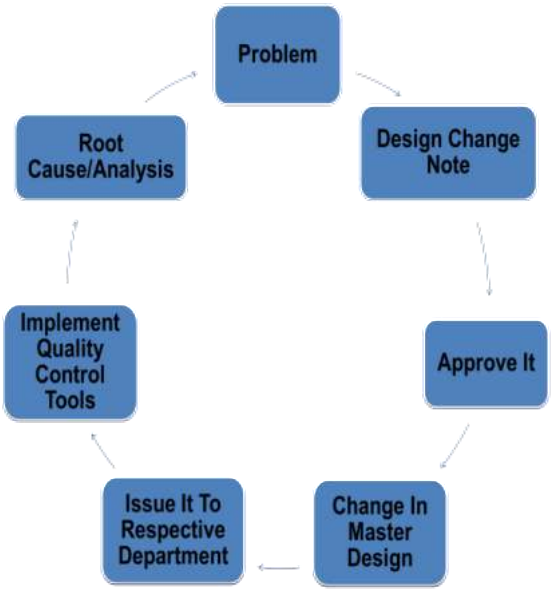

Fig.3 Flow Chart of Existing Methodolody

3.1 Problem Solving Using Why Why Analysis

(1)

Part Name: Motor base shaft (Housing)
Defect: Motor base shaft was failed
Solving Method: Why Why Analysis

WHY	• Why motor base shaft was failed? • Motor base shaft locking was not properly
WHY	• Why motor base shaft locking was wrong • Motor base shaft locking system was wrong
WHY	• Why motor base shaft locking system was wrong? • Design was wrong
WHY	• Why design was wrong? • Need experinced designer in design department

Fig. 4 Why Why Analysis for Component Motor Base Shaft

Root Cause: Its humen error.
Failure in Detection Mode-
Why- In design department designer was fails to take advice from experienced person.
Corrective Action- To improve locking system 8 × 1.25P tapping is added from both side.
Preventive Action- Cross verification would be done by head to avoid accidental issues.

(2)

Part Name: Wheel guard cover
Defect: Size of grinding wheel head cover is large
Solving Method: Why why analysis

WHY	• Why size of grinding wheel head cover is large? • There was manufacturing defect
WHY	• Why there was manufacturing defect? • Employee was falied to read drawing
WHY	• Why employee was falied to read the drawing? • M have lack of knowledge about work
WHY	• Why employee have lack of knowledge about work? • Employee have poor training about work

Fig.5 Why Why Analysis for Component Wheel Guard Cover

Root Cause: Absence of skilled worke/employee
Failure in detection mode:
Why: While manufacturing the wheel guard cover there is absence of skilled worker on that machine.
Corrective Action: Rework is done.
Preventive Action: On job training is provided to operator who is working on milling machine and always appoint skilled workers to minimize the rework, mistakes and delays.

Cost Saved:
Part Name: Wheel Guard Cover
Material: Aluminium
Density: 2700 kg/m^3
Volume = $length \times width \times height$

$$\text{Density} = \frac{Mass}{Volume}$$

Cost = $Mass \times Kg$

Table 1 Cost Calculation for Component Wheel Guard Cover

Before	After
Volume = 0.315 × 0.165 × 0.04 = 2.079×10^{-3} m^3 Mass = Density × Volume = 2700 × 2.079×10^{-3} = 5.51 kg Cost = Mass × Per kg Rate = 5.51×154....Rs. 154/- per kg(Al) = 848.54 Rs.	Volume = 0.305 × 0.155 × 0.03 = 1.41825×10^{-3} m^3 Mass = Density × Volume = 2700 × 1.41825×10^{-3} = 3.829 kg Cost = Mass × Per kg Rate = 3.829×154.....Rs. 154/- per kg(Al) = 589.66 Rs.

Total Cost Saved = Before Cost – After Cost
= 848.54 – 589.66
= 258.88 Rs.

(3)

Part Name: C Bracket
Defect: Fastener holes are mismatched during assembly
Solving Method: Why why analysis

WHY
- Why bottom hole of C bracket are mismatched with top hole of the grinding wheel guard cover?
- C Bracket was not assembled as per assembly drawing

WHY
- Why C Bracket was not assembled as per assembly drawing?
- Worker was not understand the assembly drawing

WHY
- Why Worker was not understand the assembly drawing?
- There is lack of knowledge and communication gap between worker and superviser

Fig.6 Why Why Analysis for Component C Bracket

Root Cause: Lack of knowledge and communication gap between worker and supervisor.
Corrective Action: C Bracket assembled as per assembly drawing.
Preventive Action: Minimize the communication gap between worker and supervisor and clear communication is necessary to avoid rework and delays.

3.2 Problem Solving Using Cause and Effect Diagram/Fishbone Diagram

(1)

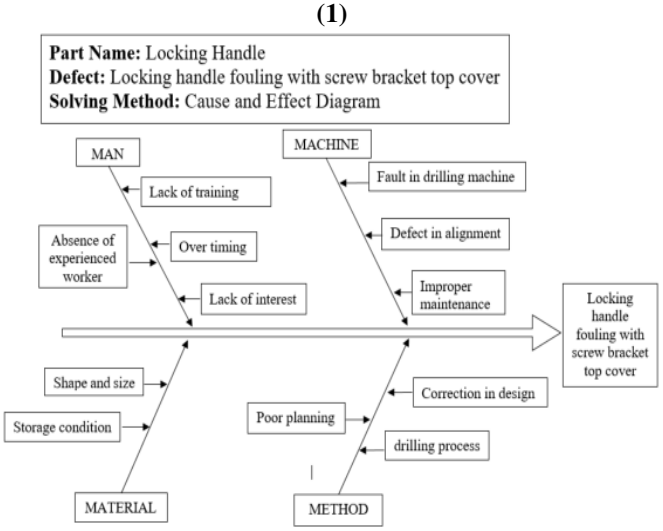

Fig.7 Fishbone Diagram for Component Locking Handle

Corrective Action: Rework is done, Locking handle angle changes from 30^0 to 45^0 for easy and safe handling.
Preventive Action: Design department should take care of all dimensions are suitable and verification should be done with the help of layout.

(2)

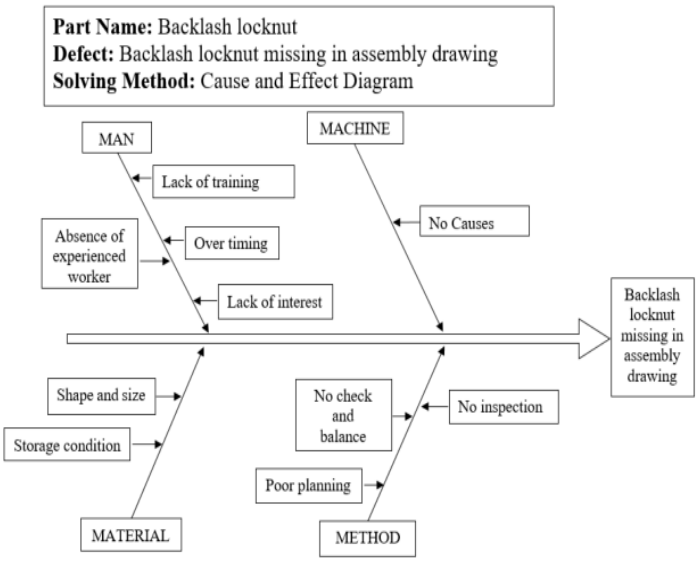

Fig.8 Fishbone Diagram for Component Backlash Locknut

Corrective Action: Change note is done. Backlash locknut is added in assembly drawing and new updated assembly drawing is issued to respective departments.
Preventive Action: Cross verification would be done by head of the department to avoid this type of problems and also designer should take care of all assembly parts should display in assembly drawing.

4. Conclusion

By doing why why analysis 3 complaints were solved and by doing fishbone analysis 2 complaints were solved. So out of 7 complaints at least 5 are been solved. Hence the given target to reduce the customers complains by 50% was achieved. By doing analysis of customer complaint and taking preventive and corrective actions for the same, sale of centerless grinding machine increased due to increase in productivity and reducing customer complaints.

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Design and manufacture of Engine lifting crane

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***Abstract*- This project deals with the fabrication of Hydraulic floor crane. The aim of this project work is to lift the heavy component from automobile workshop . This machine is very useful for lifting and transporting heavy jobs up to 1000 kg for all types of jobs such as automobile repairs and service shops of central workshops, production industries, material handling units etc. In material handling, the cranes play a vital role in modern manufacturing industries. The hydraulic floor crane consist of base truck, hydraulic jack, wheels, hydraulic hoses, levers, horizontal beam and hooks. There the beam is placed vertical can also called as support arm. .is connected to the base plate and the hydraulic jack touching the hook used to lift the heavy industrial load. The hydraulic jack is lifted or operated outward with the help of reciprocating movement of lever connected to the hydraulic jack. The crane is fabricated with complete clear front, small compact frame, good reach, high lift and with low center of gravity. The crane has the capacity of lifting 1000 kg with wide spread application in the shop floor.**

Keywords- *Design; Fabrication; Hydraulic Crane; Loads; Correlation Values; Performance*

I. INTRODUCTION

A 'crane' is a type of machine, generally equipped with a hoist, wire ropes or chains and sheaves that can be used both Used for lifting heavy things and transporting them to other places. It uses one or more simple machine to create advantage and thus move loads beyond the normal capability of a man. Cranes are commonly employed in the transport industry the loading and unloading of freight, in the construction industry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment. In material handling, the cranes play a vital role in modern manufacturing industries.

Hydraulic cranes are heavy equipment used primarily for lifting. These Hydraulic floor Cranes, provide an efficient low cost alternative to other material handling equipment. Strong, robust, study and built to very standard. Laden, these cranes are maneuverable and loading, unloading and shifting of heavy load. Crane structure consists of chassis, vertical column, inner boom and outer boom, and the hydraulic pump with cylinder assembly. The box frame can take heavy loads effectively, avoids and damage under rough and unskilled handling. Inner and outer boom is suitably reinefoast the bow structure for better distribution of force.

Moving on 6 Nos wheels, two wheels are fixed and wheels are on swivel castors easy directional movement and all wheels are equipped with sealed ball bearing / tapper roller bearings for better mobility. 2 Nos screw disc ground arrested are provided to prevent movement when transfer of load track. An engine hoist also known as an engine crane, cherry picker, or an engine lift is a device that is applicable in the lifting or lowering process of load by means of a drum or lift-wheel by wrapping rope or chain (which is an integral Part of the hoisting device) around the object to be lifted An engine hoist consists of a strong support structure that is most often made out of welded steel or aluminum. It incorporates a cantilever beam that extends from the frame that has chain attachments designed to connect the tool to the anchored point of the engine. Its operation may be achieved manually, electrically or pneumatically and may use chain, fiber or wire rope while lifting a given load from one point to another. The load is anchored to the hoisting device by means of a hook.

II. DESIGN

F. Material Selection

Material selection is a means of selecting material that best suited for the member of machine to be designed. As a designer material selection should be done carefully in order to design each components, that will serve till the end of service life. The basic considerations done in selecting materials are; Strength, Machinability, Toughness, Ductility, Hardness…etc. for each components of the crane.

Material for vertical column

Load that the vertical column subjected to is compressive, and material for the column is selected to be mild steel, because it has low cost, good casting, and high compressive stress.

Material for the boom and base plate

Since the load applied on these components is high the material used to make these components should be strong and hard, thus the best material suited for is mild steel which has carbon content of up to 1.5% which results in an increased strength and hardness.

Material for the crane hook

Thus the crane hook is subjected to both tensile and compressive stress, and wrought iron is selected for it, because it is malleable tough and ductile material. It has carbon content of0.02%, 0.12%

silicon, 0.018% of phosphorus, 0.07%of slag, and the remaining is iron [2].

Material for Bolt

The material for the bolt is subjected to tensile and shearing stress and mild steel best fit the criteria to resist these stresses and is selected as a material for bolt.

Material for the Pins

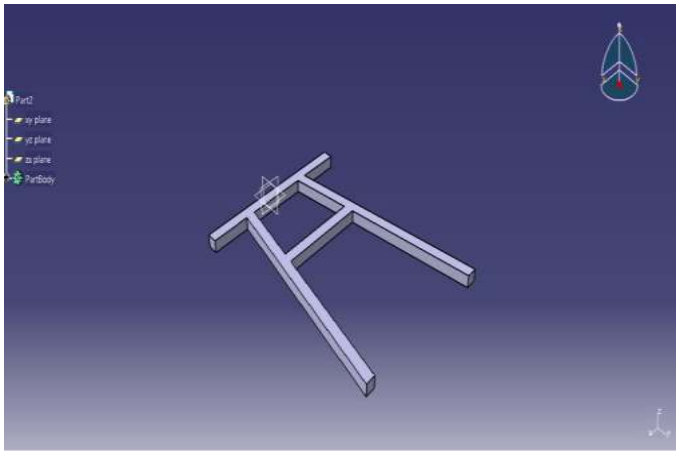
In our project pins are subjected to tensile and shearing. The material selected for the pin should be ductile and we have selected mild steel.

DESIGN

Fig. Engine Lifting Crane

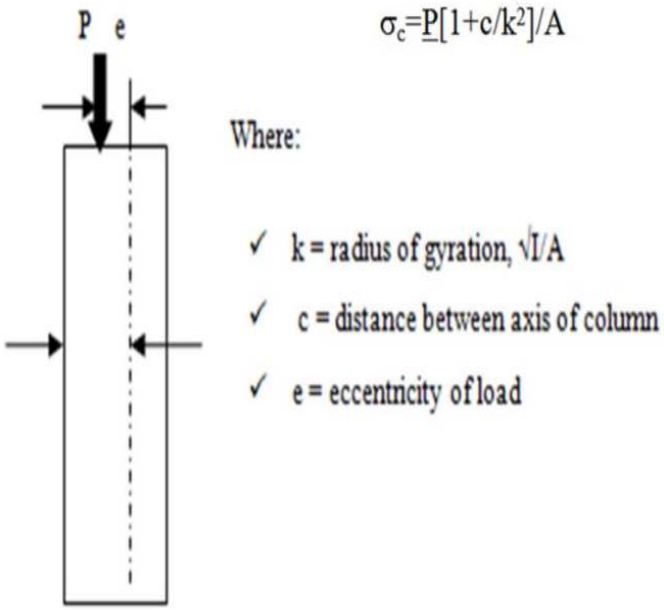
❖ Design procedure of crane

➢ Design of base crane:



Bar 1 and bar 2 are side bar on which the center connecting bar is supported over . The other is end bar which is provided at the back end of the two side bars to give extra strength.
Dimensions :
bar 1 and bar 2 : 1750cm
end bar : 800mm
center bar : 500mm

Design of inclined vertical column :



Therefore : c= 50/2 mm= 25mm= 0.025m

e= 650mm = 0.65m

The area of column cross section is,

A = (a×b) = 0.9×10 ^-3m2

Moment of Inertia

Ixx = a3/12= 0.000960×10^-5 m4

Iyy = 0.000960×10^-5 m4

Radius of gyration

k = √Ixx/A = 0.0326599m

σc = Pvc/A[1+(ec/k2)]

P = 1000×9.81

= 9810N

= 9.81 Kn

Pvc = 11.63kN

σc = Pvc/A

= 12.922 N/mm2

σc = Pvc/A[1+(ec/k2)]

= 209.18MPa

the maximum value of crushing stress that will be developed in the mild steel is given to be 350MPa. Since the induced compressive stress due to the applied load is not greater than the maximum crushing stress developed in the mild steel. Therefore the vertical column is designed safe.

Working Principle:

Hydraulic cranes work on the concept of transmitting forces from one point to another through a fluid and only due to this they are able to lift the heavy loads. In the essence, a hydraulic crane works on optimizing the strength that is produced by the liquid under pressure. Generally the liquid is water or light oil that works with the system of pistons. These pistons are attached to the system of levers and thereby used to lift heavy load.

III. RESULTS

y

- The hydraulic crane is tested under various loading conditions. The maximum weight is 1000kg is successfully suspended height up to 1.25m.
- The assembled crane was tested to evaluate function and reliability of the crane. The test was carried with various load ranging from 500-1000 kg and test showed that as the load increases the effort required for actuating the cylinder increased.

IV. CONCLUSION

In this project critical study and analysis of the working principle of a hydraulic crane was carried out with detailed analysis of the machine component. From the result obtained it can be conclude that the hydraulic crane will do a lot of good to technician and maintenance engineers automobile and vehicle repair workshop. Because it would save the time and cost which might be expended on the crude way of lifting and moving heavy load within the workshop.

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Design And Development Of Drilling Jig

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Abstract— **The Moto of this paper is to show how the improvement in the design of the jig and the change in the pattern were made, so as to meet the requirements. By making some minor changes in the design of the pattern, a new masterpiece can be developed and through that further production can be made. Also by changing the design of the jig, the fitment on the jig was much easier. The objective of this project is to design and development of drill jig for holding motor casing parts for mass production of drilling operation. Drilling jig is used whenever is necessary to drill hole to exact location. It identified the numerous advantages that are associated with the use of jigs in manufacturing to include: production increase, cost reduction, interchangeability and high accuracy of parts, reduction of the need for inspection and quality control expenses, reduction of accident as safety is improved, automation of machine tool to an appreciable extent, easy machining of complex and heavy components, as well as low variability in dimension which leads to consistent quality of manufactured products. There are many types of jigs and fixtures are used in industries.**

Keywords- Work-Holding, Manufacturing, Production, Operation, Devices, Machining, WorkPiece, Clamping, Bushes

I. INTRODUCTION

Mass production aims at high productivity to reduce unit cost and interchangeability to facilitate easy assembly. This necessitates production devices to increase the rate of manufacture and inspection device to speed-up inspection procedure. A fixture is a production tool which is mainly used to locate, hold and support the work piece firmly to the table. Set blocks and feeler are sometimes used to provide reference of the cutter to the workpiece. The main concern is the fastening of the fixture. The fixture should be so chosen that the fastening of the job to the table is done quickly. It is mainly used in milling operation. But nevertheless it can also be used extensively in drilling machine also for holding the job during the drilling operation and pressing operation. Size of the fixture varies from being simple to expensive and complicated. It largely depends on complication of workpiece. These fixtures also help in simplifying the network operations which are performed on special equipment. Project work aim to design and fabricate a jig for drilling hole of mm diameter in mild steel material.

II. LITERATURE REVIEW

[1] **Shubham Misal, Kalpesh Tatar**-The main purpose of a fixture is to locate and in the cases hold a work piece during an operation. A jig differs from a fixture in the sense that it guides the tool to its proper

position or towards its proper movement during an operation in addition to locating and supporting the work piece. The target of the mass production is to increase the productivity and increase the accuracy. This is done by reducing the set up cost and manual fatigue. Thus mass production can be achieved by the use of jigs and fixture. For large scale production of different material, a lot of time is wasted in set up of the device and clamping the device.

[2] **Mr. Prof. Mr. Uday C. Agashe1, Mr. Adwait Ranpise**- This paper provide an overview of the different type of Jig used for clamping the component correctly. Also provided the comparison between manually operated Jig used in earlier and the modern Jig which reduces the production cycle time and increases the productivity. Also, this paper includes the various types of clamping devices and their functions

[3] **Kataria Mahendra B, Bhimani Jasmin**- Jig is device which is used to hold the work piece or fix the work piece and guide the cutting tool. The purpose of the jigs is to provide strength, holding, accuracy and interchangeability in the manufacturing of product. The objective of this project is to design and development of drill jig.

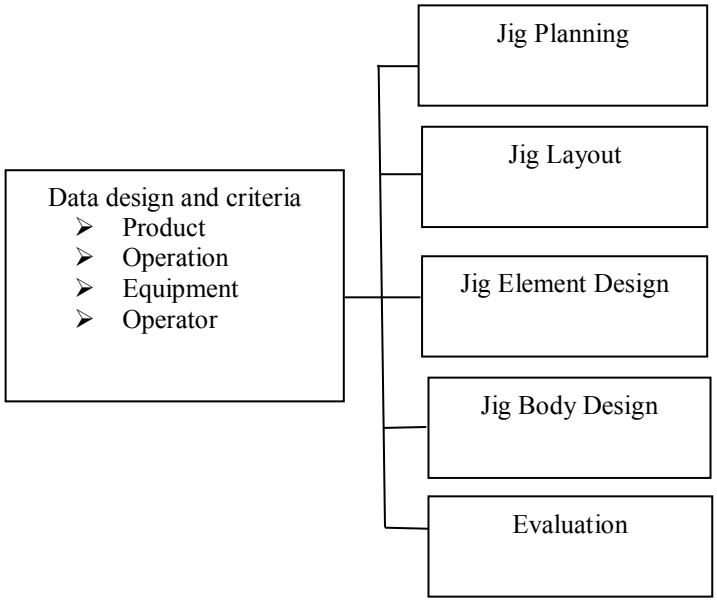
[4] **Sylvester jacob, Santosh jaju, Vijay kiware** - The Moto of this paper is to show how the improvement in the design of the jig and fixture and the change in the pattern were made, so as to meet the requirements. Drill jig increases productivity by eliminating individual positioning, marking and frequent checking. The work also explained that since the design is dependent on numerous factors which are analyzed to achieve an optimum output, that jigs and fixtures should be made of rigid light materials to facilitate easy handling

[5] **Smit Patel, Sahil Vasoya, Ankur Joshi**-Tthe paper gave a detailed definition of jigs and fixtures, and also identified the numerous advantages that are associated with the use of jigs and fixtures. Drill jig increases productivity by eliminating individual positioning, marking and frequent checking. Also jig reduces the repetitive nature required for drilling holes, because the locating, clamping and guiding of the tool is done by the jig itself.

III. PROBLEM SUMMARY

Today's business scenario is characterized by increase demand of product, faster response and mass production. To meet the current challenges it has become imperative for companies to increase the production rate. Industry manufactures pressure plate. In the manufacturing of pressure plate different operations and process like casting, inspection, drilling, chamfering is done. In drilling operation, marking and punching are done manually. So more time is required for marking and punching. . Moreover the setting and holding of job during machining is difficult and time consuming task. Also more time required for inspection of diameter.

IV. METHODLOGY



V. PRINCIPLES OF LOCATIONS

This project comes under the mechanical engineering under tool development section.

Principles of Location

3-2-1 principle & 12 degrees of freedom.

For a jig designer, the major portion of design time is spent deciding how to locate the work piece in the fixture. You know that any free body has a total of twelve degrees of freedom as below:

6 translational degrees of freedom: +X, -X, +Y, -Y, +Z, -Z

And 6 rotational degrees of freedom:

- Clockwise around X axis (CROT-X)
- Anticlockwise around X axis (ACROT-X)
- Clockwise around Y axis (CROT-Y)
- Anticlockwise around Y axis (ACROT-Y)
- Clockwise around Z axis (CROT-Z)
- Anticlockwise around Z axis (ACROT-Z)

You must fix all the 12 degrees of freedom except the three transitional degrees of freedom (-X, -Y and -Z) in order to locate the work piece in the fixture. So, 9 degrees of freedom of the work piece need to be fixed. But, how? By using the 3-2-1 method as shown below in fig

VI. ELEMENT DESIGN

CLAMPING DEVICES

There are different types of clamps which help in clamping of the jig at the required position. Clamps hold the work piece firmly. This helps in better engagement of job during the operation. Various forces develop during the cutting operation. The clamping should be such that it will sustain these forces during the operation. At the same time if clamping is so tight that it damages the work piece then it must be avoided. The timing required for clamping and unclamping of the device should be as less as possible. These clamping must also restrict vibrations and chatter during the cutting operation.

C-CLAMP

It gives additional support to the clamping of the component. It is fitted with the toggle clamp by bolted connection. The material used are MS.

LOCATING PIN

Locating pin used for locate the holes of the one side of face to same place as the another side of hole to be drilled. It enables the fast location. The dimension are ϕ35×65. The material used are MS.

DOWEL PIN

Dowel pin are available in variety of sizes. It is used for prevention of rotating of plates between them. We have used the standard size of M8×32. The material of dowel pin are also MS.

- **Element design**

RAW MATERIAL

- **Base plate (145*125*20)mm**
- **Resting pad (ϕ12*10)**
- **Bottom pad (ϕ 22*15)**
- **Jig plate (147.5*41*10)**

Base plate:

- First take base plate of (145*125*20) mm, milling, and surface grinding is carried out on the base plate for straightness.
- Then jig boring operation is done of diameter 22&12
- Then drilling of two hole (dia3.33&5) at the base plate. After that taping is done.

Resting pad:

- First take round bar ϕ15 *15.Facing and turning operation is carried out. Then facing on second side11mm is done.
- Drilling of ϕ4.5 and then counter drill of ϕ 7 and deep 6mm.

Jig plate:

- The jig plate made up of medium carbon alloy steel. The size of plate (155*50*15)
- First of all milling operation is carried out of all faces, then chamfer operation is done.

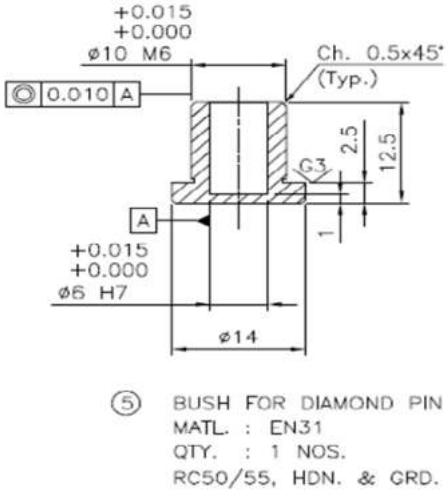


Fig: bush for Diamond pin

Bottom pad:

- The bottom pad up of medium carbon steel (EN8).
- The size of pad (ϕ25*20) and facing, turning, drilling, counter drilling and grinding operation is done.

VII. JIG BODY DESIGN

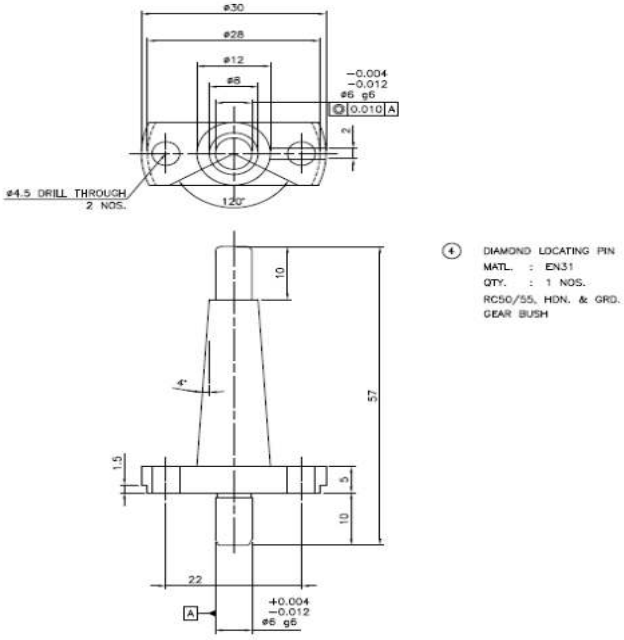


Fig: Diamond pin locator

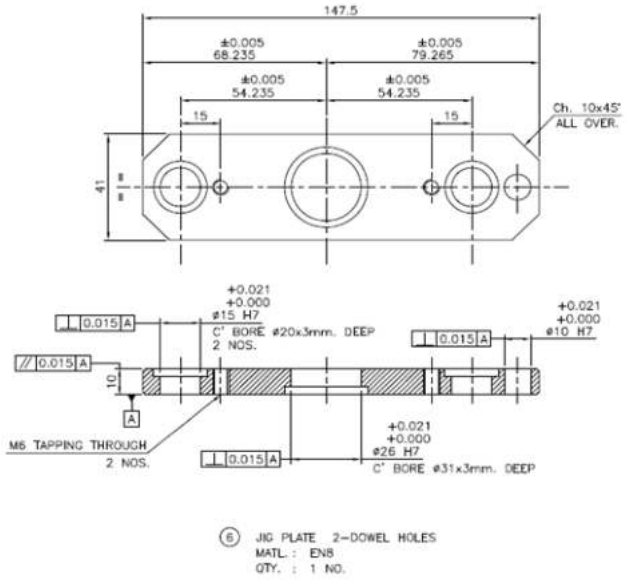


Fig: Jig plate

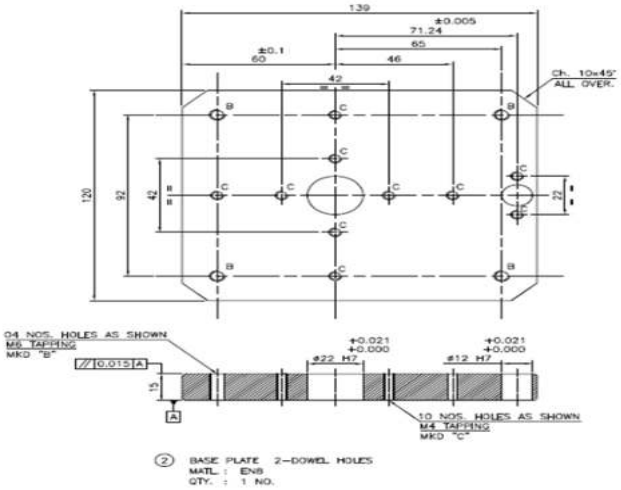


Fig: Base plate

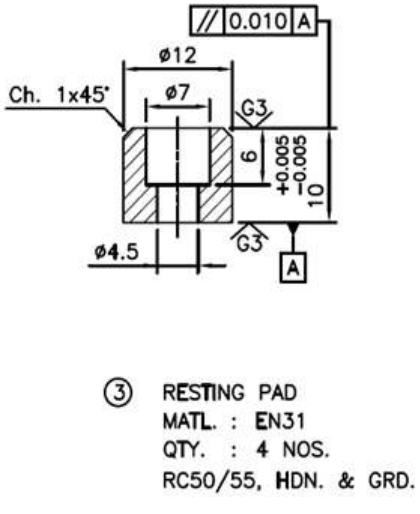


Fig: Resting pad

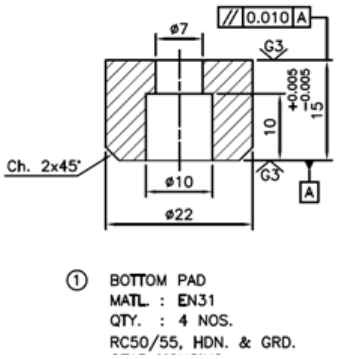


Fig: Bottom Pad

VIII. COST ESTIMATION

Element of costing

The following are the main elements which are to be consider while costing.

- **Material cost :**

Material cost is the cost of material and commodities use in the organization material can be direct or indirect.

1)Direct materials:

Direct materialds are those which can be identified with the ibndividual cost matrial and components which are purchased from outside from out side source or manufatured in company's owwn plant.

2)Indirect material:

Indirect material indirect material are those which are cannot be identify with the individual cost centers. They do not form an integral part of the final product.

- **Labour cost:**

Labor cost is the cost of remuniration ie. Wages, salaries etc. paid to employees.

1)Direct labour cost:

Direct labor cost is that labor cost which can be identify with the individual centers and is usually

incurred for those employees who are engaged in the manufacturing process.

***2)Indirect labour cost**:*

Indirect labor cost cannot be identify with the individual cost centers and generally incurred for those employees who are not engaged with manufacturing process but assist other e.g. salary paid foreman, managers etc.

IX. Expenses:

Expenses are the cost of servises provided to the organisation and the organisation and national cost of the assest owmn by the organisation.

1)Direct experness:

Direct expenses can be identify with the perticular job or with the individual cost centers.

2)Indirect expenses:

Indirect expenses are identify with the individual cost centers or perticular job e.g. rent of the building, telephone bill, insurance and lightning.

X. CALCUTION

Compressive stress:

$F=W\times9.81$

$F=2.6487$ N

Compressive stress= $F\times A$

$2.6487\times615.75=4.3\times10^{-3}$ N/mm

Dia =10 RPM = 800

Cutting speed

$V= (\phi\times10\times800)/1000$

$V=25.12$ mm/min

Material remove rate

$= \pi\ d^2\ fn/4$

$= \pi\times10^2\times34.65\times1100/4$

$= 2993.54\times10^3$

Drilling time calculation

Drill size ϕ =10

- *Existing time*

Alignment time =50.22sec

Drilling time = 30.20

Total time = alignment time + drilling time

= 50.22+30.20

= 80.42×4

Total time = 321.68 sec

- Current time

Alignment time = 25.10sec

Drilling time =30.20 sec

Total time = alignment time + drilling time

Total time =145.9sec

XI. Result and discussion

In this project we reduces the total time which be wasted on alignment of work piece by using Jig plate. The alignment time for previous method was 200.88sec and by using jig we can reduce this alignment time for 100.40sec. as the operation time reduce the production is increase also the expenses are reduced . For operating this jig this is not required skilled labor. So using this tool is profitable.

Parameters	**Existing time**	**Current time**
Alignment time	200.88sec	100.4sec
Drilling time	30.20sec	30.20sec
Total cycle time	321.68sec	145.9sec

Production rate	**Existing rate**	**Current rate**
1Hour	12	25

- **CONLUSION**

In this project we develop drilling jig helps to easy for operation and reduce the loading and unloading time.

Also operation time reduce, accuracy increase and production rate increase. When we using the jig for drilling operation the time is reduced by 50% and accuracy increased.

We are developed drilling jig for a gear base. This was done as company's requirement. We have succeed in design of jig as per company's specification.

We have done this with the optimum cost of efficiency; the accuracy of work piece produce by using jig is to the satisfaction of the company. This has resulted in case of operation and handling without affection the accuracy of work piece.

This project work has given us experience about overall design and manufacturing activities that take place in engineering industry.

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Design And Development Of Rice Transplanting Machine

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Abstract—**Agriculture is most important sector of the Indian economy. Manual hand transplanting consumes a lot of energy and time and full of fatigue but the socio-economic condition of the farmers does not allow them to adopt power operated transplanter. The cost price of imported planter has gone beyond purchasing power of most of our farmers. This paper provides direction for growths in rice planter used in India. Use of Rice Transplanter machines is increased but current machines are expensive. So the main focus of this machine in this project is to reduce the cost of that machine. This machine has a simple mechanism and it is eco-friendly. This machine requires only one person for its operation. This machine can bring revolution in rice production. So, the main aim of this to design and develop a rice planting machine which will help the farmers to make the whole rice planting process mechanical resulting in reduction of labour, cost and time to a large extend.**

Keywords-Rice planter; cost minimization; design and development;

I. INTRODUCTION

India is known to be farming country. About 71% of the population of India is dependent on farming direct or indirect manner. Agriculture plays a vital role in the Indian economy. There are basically five steps that a farmer needs to do properly to get increased productivity. These five steps namely are: Ploughing, Seed Sowing, Irrigation Process, Harvesting, Threshing. Labour scarcity is a major problem and there is need of explore establishment methods for rice that require less labour but still allow the crop to be transplanted on time. The use of mechanical transplanter is one alternative to address this issue. The Indian Government has also in progress taking steps in the form many initiatives in which the farmers are made aware about the different farming techniques. Farm women perform hard physical work in planting crops with care and maintenance, harvesting, processing, marketing and bartering of product simultaneously. As we know that the rice is one of the primary food of the India. A large number of farmers is carry the cultivating process and rice production. Presenting the newer method to a rice farming will result in the many advantages such as: Better production, Good quality, less labour require, Saves time, Low cost. The current situation of the Indian farmers is not well sufficient to purchase the planters to use it. India is facing a big problem of child labour along with the farming. The highlighted point is that child labour and farming are interrelated to a great extent. If the technology in farming increases, the requirement of labour will decrease.A manual rice planter is being developed in India so reduce the cost of planter. In manual method of rice planting requires, 8-11 labours are required for one acre planting. Though, if automated rice planter is used, 3 people can transplant able to 4 acers in a day.

II. LITERATURE REVIEW/SURVEY

Prof. S.G. Kolgiri, Mayur Bansode, Sachin Mahanavar, Sandeep Bansode, Ajay Bhosale, Design and Fabrication of Rice Planting Machine, International Journal of Research and Analytical Reviews May 2019, Transplanting of seedling at the optimal age (24-30 days) is possible constant spacing and optimum plant density can be maintained so that its output can be increased.

D.N.V. Chaitanya, Arunkumar S*, Bhanu Akhilesh, G. Saikiran Kumar, K.N.V.S. Avinash Babu, .Design of rice Transplanter, International Conference on Mechanical, Materials and Renewable Energy IOP Conf. Series: Materials Science and Engineering (2018),The seedling has vertical to the ground at sufficient depth, avoids the extrication of the seedlings and uniform ripening of the rice plants.

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Uttam Patel, Purva Patel, Parth Rana, Alay Shah, Parthiv Mehra, Design and Development of Rice Planting Machine,

International Journal of Technical Innovation in Modern Engineering & Science Issue 4, April -2017, The farmers to make the whole rice planting process mechanical resulting in reduction of labour, cost and time to a large extend.

S.K. Pawar, Mishra Akshay Arvind, Modi Akshay Anil, Prasad Alokhkumar Ajay, Tarange Rameshwar Anudas, Rice Planting Machine, Journal of Information, Knowledge and Research in Mechanical Engineering Nov 16 to Oct 17, Seedling tray is used to carry the seedling so as to direct the plants to the planting arm. Basic factors such as width, length, angle, etc. must be considered for designing the tray mechanism.

Rajib Bhowmik, Anidita Sharma, Hirjyoti Kalita, Jobin Sultan, Juena Gogoi, Design and Fabrication of paddy Transplanter, Engineering Science and Technology: An International Journal , July-August 2016, The power transmitting Mechanism the paddy tansplanter is achieved by means of simple four bar chain, also known as quadric cycle chain.

The various information regarding the rice planter taken from various research articles. The literature review is distributed into dissimilar field of examination like Ergo-Economical analysis of different paddy planting operation, performance of self-propelled rice planter and its effect on crop yield and growth of rice machine. The development and experiments of this machine where conducted which gives the parameters, specification, problems arising in already exists planter and process and design procedure of planter. The unobtainability of the rice planter in Western Maharashtra zone gave the reason to find proper research in this zone and designing planter. The research and literature on the design analysis of hand cranked.

III. DESIGN

The main components of rice planting machine are base wheels, chain drive, gear pair, mechanical arm and paddy support plate.

Base wheels: Wheels are basic yet important part of the whole rice planting mechanism. The power is generated from wheels. As the wheel rotates the power will be transmitted to mechanical arms. The wheels are given guide rods so that wheel can move easily in wet lands. The guide rods are placed such that the holes made by it are actually the place where the paddy seedlings are planted by the mechanical arms.

Chain Drive: It is used to transmit the power produced by base wheels to the mechanical arms as a result of which it oscillates.

Gear Pair: It is used to reverse the rotational direction from anticlockwise to clockwise direction.

Mechanical Arm: The mechanical arms are placed parallel to the wheels. The work of the mechanical arms is to grasp the paddy seedlings from the paddy support plate and plant it in the field. The reason to place the mechanical arms parallel to the wheels is that the mechanical arms plant the paddy seedlings in the holes made by the guide rods of the wheel.

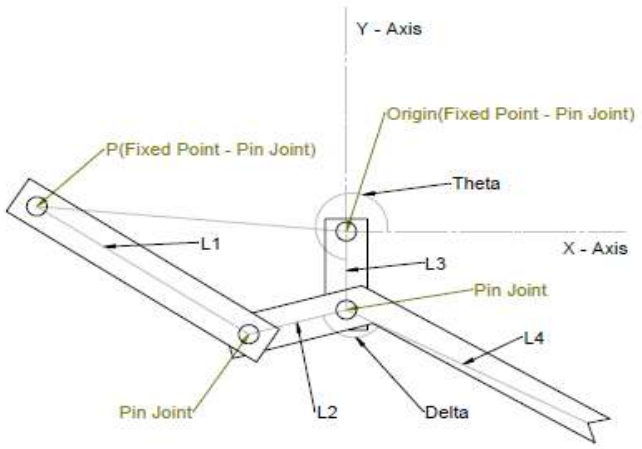

Fig.1: Mechanical Arm

Paddy Support Plate: The paddy support plate is used to place the paddy seedlings. The main objective of it is to place seedlings such that the seedlings do not fall off while plantation process and the mechanical arms can grasp it easily and the seedlings are not damaged.

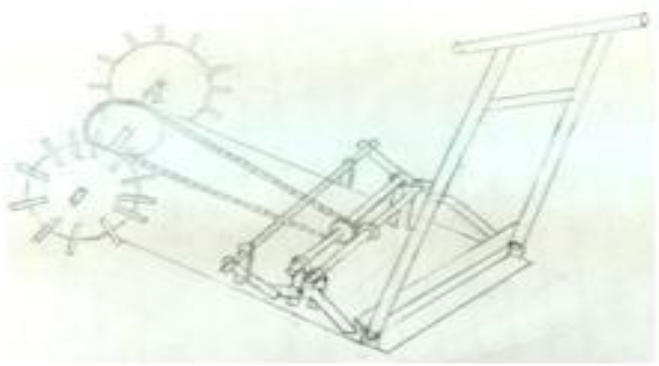

Fig.2: Isometric View of Rice Planting Machine

IV. CALCULATION

Design of Shaft:

Material used Mild Steel(C45)

Take FOS = 2

Sut = 540 N/mm^2

6t = 6b = Sut/FOS

= 540/2

= 270 N/mm^2

6s = 0.5 6t

= 0.5 x 270

= 135 N/mm^2

Let the Farmer pulling the Rice Transplanter machine with, 5 km/hr = 1.39 m/s

So, V = 1.39 m/s

Size of wheel 300 mm dia.

V = 3.14DN/60
1.39 = 3.14 x 0.3 x N / 60
N = 88 rpm
1 hp = 746 watt
Considering human powered equipment human can produce about 1.2 hp is 895.2 watt
P = 2 x 3.14 x N x T / 60
895.2 = 2 x 3.14 x 88 x T / 60
T = 97.12 N-m
The total weight on shaft coming is,
W = 25 kg = 25 x 9.81 = 245.25 = 250 N
Bending moment,
M = F x L / 4
= 250 x 500 / 4
= 31250 N-mm
Equivalent Torque,
Te = (T^2 + M^2)^(1/2)
= (97.12x 10^3)^2+ 31250^2
= 102023 N-mm
Te = (3.14 / 16) x d^3 x 6s
d^3 = (16 x 102023) / (3.14 x 135)
d = 15.67 mm
But we are using 20 mm Shaft dia., So design is safe.

Design of chain, sprocket & selection of pitch of sprocket:
RPM of pinion sprocket is variable is normal and it is 132 rpm
Select pitch value by using this RPM 132 = 12.7
Small sprocket = 18 teeth = Z1
Big sprocket = 44 teeth =Z2
Transmission Ratio = 44 / 18 = 2.4 Which is less than 3
So from table,
Dia. Small sprocket
d = Pitch / sin (180 / Z1)
= 12.7 / sin (180 / 18)
= 73.136 mm
Dia. Big sprocket
D = pitch / sin (180 / Z2)
= 12.7 / sin (180 / 44)
= 178.02 mm

V. WORKING

In the present experimental set up when the machine is pushed from paddy support plate in the field for operating it, the base wheels rotate in anticlockwise direction. This produces power which is transmitted towards mechanical arms with the help of chain drive. Here, gear pair plays a vital role as it changes the rotational direction from anti-clockwise to clockwise direction. The mechanical arms start oscillating on its axis. While oscillating it grabs the paddy seedlings from paddy support plate and plants it in the field. So, finally rice planting of rice seedlings can be performed.

Fig.3: Experimental setup of rice transplanting machine

VI. ADVANTAGES

1. It saves the labour charge.
2. It saves working time and saving on cost of operation as compared to conventional method of previous country plough.
3. It is light in weight as compared to present device.
4. It reduce the use of man power up to 50-60 percent.
5. It is cheaper so poorer farmer can also afford this new devices

VII. RESULT AND DISCUSSION

There were some points to be redesigned. As the tension is high the chain, the nylon sprockets get easily damaged. It is better to use motor cycle chains and sprockets for power transmission.

In this machine ground wheels supplies the power to operated transplanting arm, pulling the machine will rotate the wheel and seedling can uniform stand.

Rice planting machine pushed up to 300mm the total seedlings transplanted were 20 hence we can obtained uniform spacing and optimum plant density of seedling. In traditional method it may not be consistent. Rice transplanting machine use the farmer then his net income will be increases. The opportunities of rural youth for the development of custom service business.

VIII. CONCLUSION

- Reduce the human effort to a maximum extent.
- Simple design Compared to the existing model.
- Easy to repair by farmers itself and maintenance is less.
- Pulling force is greatly reduced by decreasing the weight of the model.
- The materials selected here are according to the capacity and load it is acting upon the design and fabrication of the machine is done economically.

IX. FUTURE SCOPE

This project in the future can come across some changes like an automatic or semi-automatic system with motor which runs at constant speed attached to the shaft Instead of giving power by hand.

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Plastic Injection Molding Machine

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Abstract

Injection Molding is the one of the most common methods in producing plastic products for many purposes. This work is concerned with the design of parts and manufacturing, Prototype of Bench top Injection Molding Machine. A simple experimental approach suggested the difference in quality of product cavity.

The aim of our project is to "Design and Fabricate Bench Top Injection Molding Machine". The project deals about the injection molding machine. The main principle is to compress the plastic material in a barrel and pneumatic loading develops the compressing motion. The pneumatic circuit consists of a compressor, air tank, control valves and a cylinder. The compressor gives power to the system. The control valves controls the Air flow in the system. According to the valve position the piston moves downwards and upwards. The plastic materials are poured in a barrel. The heater surrounding the barrel heats the plastic material. Then it is converted into molten state. The molten plastic is injected through the nozzle in a barrel to the die by the compressing force. Different shape of the component can be made according to the die what are used. Commercial products can be produced.

Keywords-Plastic, Pneumatic Cylinder, Mold, Design.

I. INTRODUCTION

Injection molding machine is a machine that always been use in the competitive industries such as automotive industry, electrical and electronic industries, medical industry and etc. Injection molding machine offers many advantages compare to others manufacturing methods such as minimal losses from scrap due to recycled plastic and minimal finishing requirement.

Molding operation is carried out with the help of compressed air in pneumatically operated plastic injection molding machine. It is cheaper than the hydraulic machine and more efficient as compared to the manual machine, hence, the problem of small and medium scale industries solves in well manner. In pneumatically operated plastic injection machine

One cylinder are used for injection of plastic. Commonly used materials in teaching the process of producing near net shape components in manufacturing lab are low cost materials such as plastic and polymer-composite although sometimes low-melt temperature metals or alloys and ceramics are used as well.

All these materials can be produced, machined, fabricated and assembled by equipment such as, CNC machining, 3D printing, casting, and injection molding machines. Printing, Casting and injection molding machines. The injection molding process is primarily a sequential operation that results in the transformation of plastic pellets into a molded part. Identical parts are produced through a cyclic process involving the melting of a pellet or powder resin followed by the injection of the polymer melt into the hollow mould cavity under high pressure Common process to produce polymeric components is by using injection molding machine. After a product is designed, usually by an industrial designer or an engineer, moulds are made by a mould-maker (toolmaker) from metal, usually either steel or aluminum, and precision-machined to form the features of the desired part. Injection molding is widely used for manufacturing a variety of parts, from the smallest components to entire body panels of cars. For thermo sets, typically two different chemical components are injected into the barrel. These components immediately begin irreversible chemical reactions which eventually crosslink the material into a single connected network of molecules.

As the chemical reaction occurs, the two fluid components permanently transform into a viscoelastic solid. Solidification in the injection barrel and screw can be problematic and have financial repercussions; therefore, minimizing the thermo set curing within the barrel is vital. The residence time can be reduced by minimizing the barrel's volume capacity and by maximizing the cycle times. These factors have led to the use of a thermally isolated, cold injection unit that injects the reacting chemicals into a thermally isolated hot mould, which increases the rate of chemical reactions and results in shorter time required to achieve a solidified thermo set component. The injection molding machine is designed for lab work purposes with main considerations for inexpensive, small size, capable of producing small number of products for prototype testing, able to accommodate up to medium size specimens, and have similar operational procedure as in commercial large injection

molding machine. In order to accommodate those constrains, the injection molding machine is designed as a bench top size, vertical type and having four main components that can be modified for experimental works.

II. LITERATURE REVIEW

There are different types of Compressed Injection Molding machines are available in market, but they are mainly used for mass production in large scale industries due to high cost of machine components, high pressure and more space required. According to customer reviews the needs have been identified as mainly cost, easy to operate, better product quality and suitable for used in small scale industries. The pneumatic Moulding Machine Consist of various components. There are mainly two cylinder used upper Cylinder & Lower Cylinder, Compressor, pressure regulator, Direction control Valve, clamping holder, nozzle, cylinder guide, coupling, Flow control Valve. The Computational analysis using 3 D Modeling CAD and Pro-E in manufacturing of machine is help to design perfect components and parts with minimum modification and also reduce the time and cost. Analysis provides an insight into the nature of processing and consequently offers valuable input towards the design of mold.

[1] M. Dastagiri, and M. M. Annamacahrya: Present work attempts applying the axiomatic design & its software Accelerate DFSSV5 to process design of the component in injection molding process. By this the number of process design iterations are reduced in design aspect as well as manufacturing aspects. The accurate war page in the model predicted using Mold flow Plastic Insight (MPI) 5.0 software. [2] E. O'Neill, C. Wilson and D. Brown: This paper seeks to outline the benefits of the solid model within the injection molding industry in greater detail. Solid modeling used as a fundamental tool for communicating geometric information. Solid modeling has become a core communication of concurrent engineering. The major benefit of CAE tools is reduced 'time to market'. The reduced design time is an outcome which is a more important benefit of CAE is higher product quality.

[3] C.G. Li and Y. Wu: This research paper well facilitate the automation of plastic injection mold cooling system design. The cooling system is one of the most important systems in a plastic injection mould. It affects the quality and productivity of the molded part. Adcock evolutionary operators and parameters adapting to the characteristics of cooling system design are devised. An experimental system is implemented to verify the feasibility of the approach, and the results of case study confirm the validity. [4] C. T. Wong, S. Sulaiman, N. Ismail and A.M.S. Hamouda: This paper presents the design of plastic injection mold for producing a plastic product. Before proceeding to injection machine and mold design, this part was analyzed and simulated by using mold flow. The analysis and simulation can define the most suitable injection location, material temperature and pressure for injection. The predicted weld lines and air trap were also found and analyzed. [5] Shukla, P.G., Shukla, G.V.: The use plastic is increased now a days in many industries like automobile, packing, medical, etc. The reason behind this is that the plastic goods manufacture, handle and reliable to use. So the plastic goods manufacturing, industries are striving hard to produce good quality product at large scale and cheaper cost. The hydraulically operated machine solve the problem, but they are too costlier for small scale and medium scale industries. [6] Fauzun, M. Hamdi, A.E. Tontowi, T. Ariga: This paper presents a formula based on simulation Results using fluent software to determine the size and Position of spiral cooling channel in a plastic Injection mold that yields the maximum effect on the Ratio of product cooling rates and coolant pumping Energy (CR/PE). Step by step optimization using CR/PE parameter on the simulation results by considering uniformity of product temperature during Cooling.

[7] R. Dubay, B. Pramujati and J. Hernandez: A new approach for controlling part cooling in plastic injection molding is developed using a Plastic Injection controller and coolant flow rate as the manipulated variable. The method uses an average part surface temperature within the mold as the set point parameter. A mechatronic system was developed for providing variable coolant flow rates.

III. METHODOLOGY:

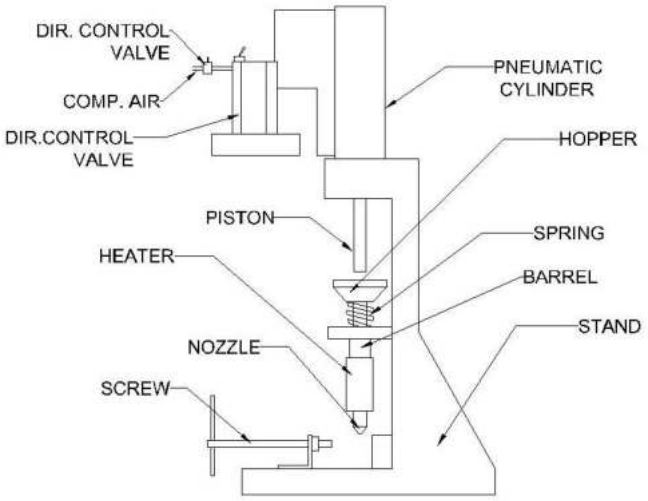

Fig. 1 Pneumatic Injection Plastic Molding Machine.

1. Component or the required product is can be manufactured, by the plastic injection molding machine.
2. Plastic was melted with the help of heater used, the temperature range of heater varies as plastic material changes, and temperature range depends on the plastic material.
3. Plastic resin or plastic pallets poured in the barrel which is surrounded by band heater.
4. By the heat of band heater the poured plastic is melted in the barrel, with the help of pneumatic piston cylinder

arrangement the required pressure is exerted on the molten plastic.
5. Before applying the force or pressure on it, mold is place under the nozzle .
6. By the pneumatic cylinder piston applies the force on the molten plastic. Then the molten plastic runs through the molding cavity and fills it up with the molten plastic.
7. Various types of product can be generated in the molding machine by designing the various molds as per requirements.

For Design piston rod:

- To design piston rod, assume pressure acting on piston rod= 6 Bar.
- Assume material used for rod C45 and Yield stress (σy)= $36\ \frac{N}{mm^2}$.
- Factor of safety 2.

1. Force acting on piston rod: (P) = Pressure x Area

$$= p \times (\frac{\pi \times d^2}{4})$$

$$= 6 \times (\frac{\pi \times 40^2}{4})$$

$$= 7539 N/mm^2$$

2. Minimum Diameter of piston rod: (d)

$$d = \sqrt{\frac{4p}{\pi[\sigma y]}}$$

$$d = \sqrt{\frac{4 \times 7.539}{\pi[18]}}$$

$$d = 23.09\ mm$$

3. Minimum thickness of cylinder: (t)

$$t = ri\{\sqrt{\frac{Ft + p}{Ft - p}} - 1\}$$

$$t = 20\{\sqrt{\frac{625 + 6}{625 - 6}} - 1\}$$

$$t = 2.48\ mm$$

We assume thickness of cylinder = 2.5 mm

a. Inner diameter of barrel = 40 mm

b. Outer diameter of barrel

$$= 40 + 2t$$
$$= 40 + 2(2.5)$$
$$= 45 \text{ mm}$$

The Inner and Outer diameter of barrel are 40 mm and 45 mm respectively.

4. Length of piston rod: To calculate length of piston rod following parameters has to be consider:

i. Approach stroke = 125 mm

ii. Length of thread = 2×20mm

= 40 mm

iii. Extra length due to front cover =12 mm

iv. Extra length Accommodate head =20 mm

v. Total length of piston rod (L) = 197mm

IV. APPLICATIONS.

- The daily using plastic components can be easily made.
- It is very useful in small scale molding industry.
- Plastics gears.
- Medical products.
- Plastic toys.
- By changing proper die, we can produce any shape of plastic material with low cost.

V. RESULT AND DISCUSSION.

1. The problem of product or moulding that was not fully injected; and this was due to the melt temperature either too low or injection has been started before the necessary temperature has been reached. It may also be due to either the sprue channel is too weak, and or difficulty in the air escaped from mould.

2. The problem of sinks or blisters on the product or molding was due to the melt temperature too high, the sprue channel too weak or unsuitably located, and the mould is insufficiently cooled.

3. Also, the problem of product discolors observed may be due to the overheated of the melt and the color fastness of the material.

VI. CONCLUSION.

The bench top pneumatic operated machine is most suitable for small and medium size industries. It eliminates all the drawbacks of manual machine. The productivity is increased, Manual labour required is less. Hydraulically operated machine could solve the problem, but cost is too high to bear for small and medium sized industries. By using or by replacing the hydraulics with the pneumatic it minimizes the maintenance cost and also it is simple to use.

The hydraulic machine is used where large-scale production is required. Pneumatic machine solve the problem very well. And if there is a breakage occurs it is easy to repair as compare to hydraulic mechanism. Also it is very cheap for rapid prototypes means that for testing purpose product can also be generate for that we need to design the mould for that product.

VII. FUTURE SCOPE.

The scope of this project is to design and fabricate a bench top injection moulding machine, cost effective and environmentally friendly bench top injection moulding machine for the production of small plastic product that is less than one gram of weight The bench top injection moulding machine is simply function by using the Pneumatic cylinder the injection plunger in order to inject the molten plastic in to the mould cavity. Speed up all the moulding machines. For this point we need to be sure that our machines are suitable for high speed running.

Even if our machine are high speed, but if w are in shortage of automation system in our injection moulding plants, then we need a lot of labour to pick up the moulded plastic components from the machine and we need to stack or collect them before packing. All these need labours and this will reduce the production capacity, in the same time the labour cost will be highly increased. It can be easily modified into hydraulic mechanism.

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HHO Gas Generator Unit For Petrol engine

(Hydrooxyl gas as Additive Fuel)

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***ABSTRACT*— Brown's Gas (HHO) has been introduced to the auto industry as an new source of energy. The motive of this project to design and construct a simple HHO generation system and test it on suitable IC engine by introducing it with the conventional fuel. The effect of hydroxyl gas (HHO) addition into Gasoline fuel will be evaluated on engine performance and emission. The HHO cell should be designed, constructed and optimized for maximum productivity of cell in producing HHO gas per unit power. Literature studies show that the parameters on which the Productivity of the cell depends are number of neutral plates, distance between them and type and quantity of solutes that is Potassium Hydroxide (KOH). The results are estimated as increment in power, reduction in consumption, reduction CO, reduction in HC and reduction in NOx. The addition of HHO gas into gasoline is an effective way of improving the engine performance and maintain the exhaust emissions to an environment friendly limit compared to meat gasoline operations.**

Keywords-(HHO, Electrolysis, Dry Cell, Resrviour, Additive fuel,)

1. INTRODUCTION

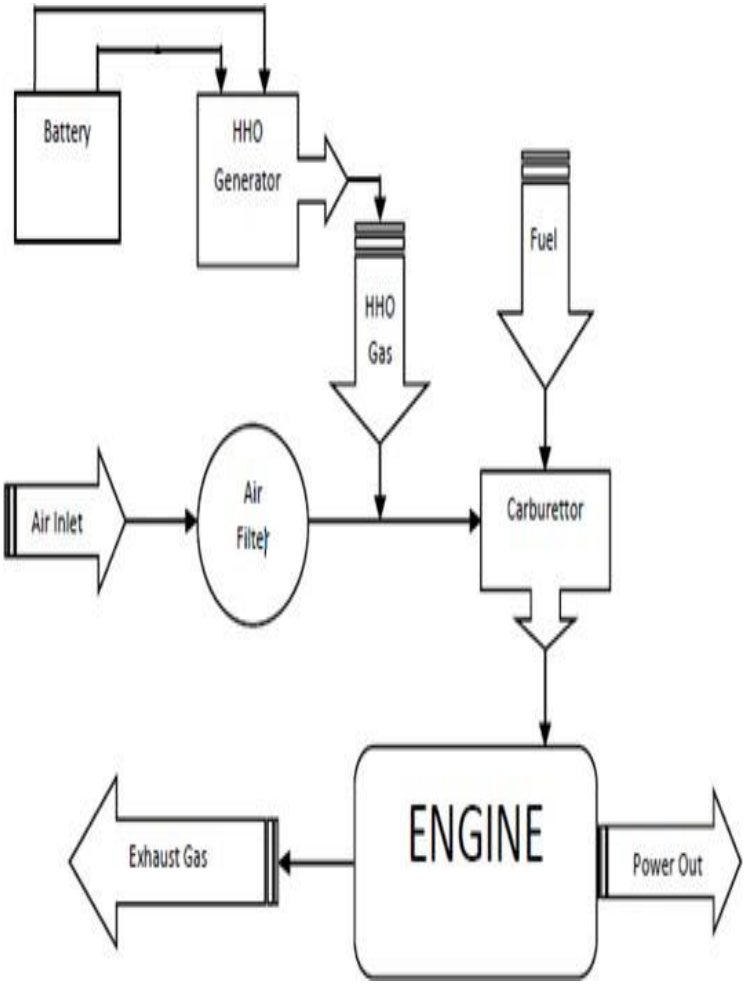
In the present scenario the growing concern of the people living in every part of society is the ever increasing price of fuel and the harmful effects caused due to higher level of pollutants in the atmosphere. The increasing demand for petroleum fuel associated with limited non-renewable stored quantities has resulted in a huge increase in crude oil prices. Consequently we have seen a shift toward automobiles that consume less fuel. We spend one third of our income for our vehicle fuelling and the vehicle gives harmful decomposed materials like CO, NOx, HC etc. in the form of smoke. These materials are all effects of the engine's performance and pollute the environment[1]. It is explicit that we use fuel in abundant amount and pollute the atmosphere. This has encouraged researchers to seek an alternative fuel that can be used in engines without the need for a dramatic change in the vehicle design. To avoid these drawbacks, a thought was given to add an alternative to improve the combustion efficiency of the engine, reduce operating cost and increase its productivity. The Secondary fuels that we use should have the same efficiency or greater efficiency of the engine when used with ordinary fuel. Contemporary research into secondary sources of energy for transportation focuses mainly on electric/battery, hybrid and hydrogen powered vehicles. Such focus assumes that the current technology has to be discarded and cannot be improved. However, it is possible to introduce interim technology to alleviate the current challenges arising from continued reliance on fossil fuels. Such challenges include increased greenhouse gas (GHG) emissions with consequent global warming and climate change impacts.[2]

The scientific community is addressing these problems by an attempt to replace fossil fuels with cleaner and renewable sources of energy. The research conducted so far indicates the biomass-based fuels to be the best option because they do not require changes in the existing technologies in use. Probably the best alcohol that can be an alternative to petroleum is ethanol. Thus a new path has been opened for flex-fuel engines, i.e. engines that can operate with gasoline blended with anhydrous ethanol (18–25% vol/vol), 100% hydrous ethanol (4.0–4.9% vol/vol of water) or any blend of these fuels. Compare to other kinds of fuel around the world, water is one of the free recourses and by applying the technique, it can be converted into hydrogen with Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as inoxygen, its chemical term is HHO and in general "Free Energy". It is cheaper, safer, tremendous explosive and never pollutes the atmosphere. While crossing a gas or diesel operated car we can feel the smell of

the respective fuels, it shows that the fuel is not completely burnt[3]. It is explicit that we waste fuel and pollute the atmosphere. To avoid these drawbacks, some level of HHO is mixed with filtered air, which is after the air filter system and before the engine in take system of the car. This mixed HHO ignites releasing the extra electrons into the igniting fuel and thus the added extra energy from the HHO leads cent percent of complete burning of the fuel. The HHO has Polymorphism that is it acts differently - before burning, while burning, and after . Before burning of Hydrogen, which is a lightest gas with one proton and one electron and more efficient fuel three times of the explosive power when compared to fuel gas and five times than petrol. Actually, the Hydrogen requires little bit of energy of ignition to produce wide level of tremendous flammable temperature in the speed of lighting and there is no chance to compare with other fuel in this world. As a result of fact it increases the engine performance, torque, and mileage and minimums fuel consumption. During burning the HHO into the engine with a tremendous explosion on that area and gives off high power of energy and automatically reverts to water vapour at once. Due to this action the engine not only getting higher torque but also gets easily cooled from 10 to 20 times faster than other fuels. For example after combustion of fuel in the engine the level of temperature is approximately 250^{o}F, but on the other hand mixing of HHO with same fuel means the engine temperature reduces approximately from 150^{o}F to 200^{o}F only because of vapours formations after combustion. Thus the engine life period gets wider, and reduces lubricating oil degradation beyond the limit of Km. Then oil changing period also gets lengthened. It leads in decrease of the maintenance cost and increase of interval of maintenance. After burning the HHO, the engine gives steam and some percentage of oxygen on the exhaust side and the stream is automatically converted into water form in the atmosphere. Thus the exhausts emission also controls from 10% to 50%. The pollution also reduces and remaining Oxygen comes out from the exhausts. In this study one of the goals was to test if the addition of HHO gas as source of active intermediate substances would result with measurable effects on engine operation and fuel consumption.[4]

2. LITERATURE REVIEW

Al-Rousan et al. [1] in his research explained that studies on the electrolytic separation of water into hydrogen and oxygen date back to the 19th century. More recently, there has been considerable research in the separation of water into a mixture of hydrogen and oxygen gases. These studies were initiated by Yull Brown in 1977 via equipment generally referred to as electrolysers and the resulting gas is known as “Brown’s gas” or



HHO. Also research and development, incentives and regulations, and partnerships with industry had sparked isolated initiatives. But stronger public policies and educational efforts are needed to accelerate the process. Decisions made today will likely determine which countries and companies seize the enormous political power and economic prizes associated with the hydrogen age now dawning.

Al-Rousan et al. [1] after reviewing the existing literature on acceptance, risk

perception and customer satisfaction, described the development of a model that illustrates important aspects in influencing a person's attitude toward a new product. "Values", "wants" and "perception" are the three components found to influence acceptance. The consumers themselves are affected by "social background" and "experience". He also gave suggestions on how to use marketing methods, education projects and product exposure in order to maximize the likelihood of a successful introduction of hydrogen as an alternative fuel. His paper focused on the analysis of the main technological trends, the role of governments in steering the transition and the evaluation of the speed and direction of the transition to hydrogen. He showed that the interest in hydrogen is increasing rapidly and that overall the variety in research projects is increasing. Different governments play an active role in stimulating research and development, which broadens the variety of research topics

He also described a long-term hydrogen-based scenario of the global energy system in qualitative and quantitative terms illustrating the key role of hydrogen in a long term transition toward a clean and sustainable energy future. They showed that FC and other hydrogen-based technologies play a major role in a substantial transformation toward a more flexible, less vulnerable distributed energy system which meets energy needs in a cleaner, more efficient and cost-effective way. Hydrogen is the most abundant element in our universe. In addition to being a component of all living things, hydrogen and oxygen together make up water, which covers 70 percent of the earth. In its pure form, a hydrogen molecule is composed of two hydrogen atoms (H2) which is a gas at normal temperature and pressure with only seven percent the density of air. Moreover, it is not a corrosive gas and can be used in engines with no toxic effects to humans. It ranks second in flammability among other gases, but if and when it leaks, hydrogen rises and diffuses to a non flammable mixture quickly. Hydrogen ignites very easily and burns at a high temperature, but tends to burn out quickly. A mixture of hydrogen and air will burn when it contains as little as four percent up to as much as seventy five percent of hydrogen in the mix. This is a very wide flammability range.

Al-Rousan et al. [1] form his experimental results conducted on FC for HHO gas generation which was designed, manufactured and tested and attached on Honda G 200 engine concluded that; the use of HHO in gasoline engines enhances combustion efficiency, consequently reducing fuel consumption an thereby decreasing pollution. The optimal size of the FC is when the surface area of an electrolyte needed to generate sufficient amount of HHO is twenty times that of the piston surface area. Also, the volume of water needed in the cell is about one and half times the engine capacity. The FC which can be used is simple, easily constructed, and easily integrated with existing engines at low cost (approximately 15 US dollars for each cylinder).

El Kassaby et. al. [2]in his research work constructed a simple innovative HHO generation system and evaluate effect of hydroxyl gas HHO addition, as an engine performance improver, into gasoline fuel on engine performance and emissions. The HHO cell was designed, fabricated and optimized for maximum HHO gas productivity per input power. The optimized parameters were the number of neutral plates, distance between them and type and quantity of two catalysts of Potassium Hydroxide (KOH) and sodium hydroxide (NaOH). The performance of a Skoda Felicia 1.3 GLXi gasoline engine was evaluated with and without the optimized HHO

El Kassaby et. al. [2] in his research work constructed a simple innovative HHO generation system and evaluate effect of hydroxyl gas HHO addition, as an engine performance improver, into gasoline fuel on engine performance and emissions. The HHO cell was designed, fabricated and optimized for maximum HHO gas productivity per input power. The optimized parameters were the number of neutral plates, distance between them and type and quantity of two catalysts of Potassium Hydroxide (KOH) and sodium hydroxide (NaOH). The performance of a Skoda Felicia 1.3 GLXi gasoline engine was evaluated with and without the optimized HHO cell. In addition, the CO, HC and NOx emissions were measured using TECNO TEST exhaust gas analyzer TE488.

The stated advantages of CO2, CO and HC reduction, while NOx increased, with higher H2 %, would be reasoned as follows: reduction of these 3 was attributed to enhanced combustion kinetics, as H2 combustion produces the oxidizing species of OH and O

radicals that benefit the chemistry of Hydrocarbons (HCs) combustion. Besides, gasoline fuel flow was reduced with H2 enrichment – to maintain constant global mixture equivalence and compare the engine performance with pure gasoline – so, lesser HCs content is in the fuel, which cuts the formation of CO, CO2 and HC and promotes economic fuel consumption. Furthermore, hydrogen has a higher diffusion coefficient than that of the gasoline, and so, the gaseous H2 can disperse thoroughly in the charge and allow for greater mixture homogeneity and combustion completeness. On the other hand, NOx increase was attributed to the higher adiabatic flame temperature of hydrogen. Hydrogen has higher flame speed and its gasoline blend can be combusted faster. Still, as H2 addition widen the mixture flammability limit to leaner fuel equivalence, the reaction rate will be reduced and combustion would be prolonged in lean conditions.

The conducted laboratory experiments to investigate the effect of HHO gas on the emission and performance of a Skoda Felicia 1.3 GLXi engine yielded certain positive results. They used a new design of HHO fuel cell to generate HHO gas required for engine operation. The generated gas is mixed with a fresh air in the intake manifold. The exhaust gas concentrations were sampled and measured using a gas analyzer. The following conclusions were drawn.[2]

HHO cell can be integrated easily with existing engine systems.

The engine thermal efficiency has been increased up to 10% when HHO gas has been introduced into the air/fuel mixture, consequently reducing fuel consumption up to 34%.

The concentration of NOx, CO and HC gases has been reduced to almost 15%, 18% and 14% respectively on average when HHO is introduced into the system.

The best available catalyst was found to be KOH, with concentration 6g/L

Arat et. al. [3] conducted research experiments on Hydroxyl (HHO; Oxy-hydrogen) - CNG (Compressed Natural Gas) fuel mixtures using it as an additional fuels in a non- modified diesel engine via intake manifold by substitution of diesel fuel. Three cases of experiment performed in a 3.6 L, four cylinders, four stroke diesel engine; first case is non-substitute liquid fuel, neat diesel operation; second case is HHO (5.1 lpm) addition to air mixture and operated under substituted diesel engine and third case is 25HHO-CNG mixture (25% Hydroxy-75% CNG (5.1-15.3 lpm)) inducted the intake manifold and running with substituted diesel engine. The effects of HHO and HHO- CNG fuels relative to neat diesel operations were investigated in between 1200 and 2600 rpm engine speeds and expressed on both engine performance values like; brake torque, brake power, brake specific fuel consumption and brake thermal efficiency; and exhaust emissions; NOx, CO2, CO and exhaust gas temperature (EGT). Results showed that the addition of HHO-CNG mixture is most effective in improving the engine performance and providing more environmentally friendly attitude on exhaust emissions compared to neat diesel operations.

The following conclusions were made on the basis of experimental results:-

The addition of HHO-CNG mixture has a positive effect of combustion process enhancement. Brake torque, brake power and brake thermal efficiency outputs are improved in connection with the combustion characteristics of hydrogen and natural gas. BSFC values are reduced with the helped of pilot diesel injection. All engine exhaust emissions are improved (including NOx) in all cases. Both of BSFC and emissions reduction and increased engine performance were major goal of this study. 25HHO-CNG plus pilot diesel fuel mixture is more superior to HHO plus pilot diesel from fuel economy, power and torque point of view due to better combustion. Overall, the results from the study indicate that Hydroxy (HHO) and CNG fuel mixtures improved the engine characteristics and give more efficient combustion duration with promising emission results.

Daniel M. Madyira et. al. [4] conducted research work to determine if the partial inclusion of hydrogen gas (HHO) in a petrol fuelled spark ignition (SI) internal combustion (IC) engine would improve engine performance. An HHO generator was designed, constructed and mounted in the engine compartment of a 1989 Ford Laser vehicle. This system allowed partial inclusion of HHO

gas on demand into the combustion process through the air supply stream. Detailed and comprehensive experimental investigations were conducted for engine speeds ranging from 1000 to 3500 rpm while parameters such as the power output, exhaust gas emissions and fuel consumption were monitored. Results obtained indicated a decrease in hydrocarbon emissions and an increase in power output with an increase in the HHO gas for certain engine operating conditions. However, performance improvement cannot be claimed for all operating conditions, especially under higher loads where the engine ran with a rich fuel mixture. Hence, further work is required, through HHO generator refinement alongside better engine management, to improve the experimental performance and hence further understanding of this technology.

S. Bari et al. [5] in his research stated that using hydrogen as an additive to enhance the conventional diesel engine performance has been investigated by several researchers and the outcomes are very promising. However, the problems associated with the production and storage of pure hydrogen currently limits the application of pure hydrogen in diesel engine operation. On-board hydrogen–oxygen generator, which produces H2/O2 mixture through electrolysis of water, has significant potential to overcome these problems. There paper focuses on evaluating the performance enhancement of a conventional diesel engine through the addition of H2/O2 mixture, generated through water electrolysis. The experimental works were carried out under constant speed with varying load and amount of H2/O2 mixture. Results show that by using 4.84%, 6.06%, and 6.12% total diesel equivalent of H2/O2 mixture the brake thermal efficiency increased from 32.0% to 34.6%, 32.9% to 35.8% and 34.7% to 36.3% at 19 kW, 22 kW and 28 kW, respectively. These resulted in 15.07%, 15.16% and 14.96% fuel savings. The emissions of HC, CO2 and CO decreased, whereas the NOx emission increased.

V. Jose et al. [6] conducted trials on LPG-HHO engine set up consisting of four stroke Kawasaki Bajaj100cc,single cylinder engine. Engine was attached to the bed of LPG-HHO engine set up by the help of fasteners. A 12V battery was fixed in the frame and power from the battery was used to start and power the HHO kit. The output HHO was connected to the bubbler through hose pipe. From which supplied to the flash back arrestor and air filter and before the carburetor with the help of hose pipe.

LPG gas is supplied from the cylinder to the gas kit. The gas is supplied with the help of flash back arrestor which is used to control the flow of gas and resist from back fire of gas. Then gas is supplied to the air filter and before the carburetor, from the carburetor the intake of lpg gas + hho gas + air to the engine cylinder during the suction stroke. During power stroke the crank shaft is driven by the piston and the crank shaft is coupled to the gear box by the help of clutch. A sprocket is attached at the output of the gear shaft.

C. Naresh et al. [7] in his paper described the present scenario as growing concern of the people living in every part of society towards ever increasing price of fuel and the harmful effects caused due to higher level of pollutants in the atmosphere. One of the closest solution to control the above two concern is the evolution of the hybrid vehicle .Any vehicle that combine soneor more sources of on board power that can directly or indirectly provide propulsion power is a hybrid vehicle. The hybrid vehicle attempts to significantly increasing the mileage and reduce the emission levels of a gasoline powered engine and Diesel Engines. The water hybrid vehicle uses an HHO (Oxy Hydrogen) generator to supply hydrogen on demand by electrolysis. The Electrolysis process is carried out in HHO Dry Cell, when the current starts flowing through the stainless steel plates electrolysis process is carried out between the 2 terminals of the plate by which water molecules get separated as HHO gas. The integration of this produces great results. The IC Engine of hybrid vehicle during operations simultaneously charges the battery using alternator which run through generator. The water hybrid system is an attempt to provide an affordable low emission fuel efficient vehicle with performance standards better than most of the conventional Engines.

3. FUTURE SCOPE

The scope of this work is to introduce some of the hydrogen advantages while maintaining the original specifications of the engine. This may be attained by introducing an HHO cell to the fuel supply system, so that a fuel mixture of gasoline and HHO gas is obtained. A compact unit for generating HHO gas was designed to

fit the engine specifications and to be installed in the engine compartment next to the radiator.

During burning the HHO into the engine with a tremendous explosion on that area and gives off high power of energy and automatically reverts to water vapour at once. Due to this action the engine not only getting higher torque but also gets easily cooled from 10 to 20 times faster than other fuels. Thus the engine life period gets wider, and reduces lubricating oil degradation beyond the limit of Km. Then oil changing period also gets lengthened. It leads in decrease of the maintenance cost and increase of interval of maintenance. After burning the HHO, the engine gives steam and some percentage of oxygen on the exhaust side and the stream is automatically converted into water form in the atmosphere. Thus the exhausts emission also controls from 10% to 50%. The pollution also reduces and remaining Oxygen comes out from the exhausts.

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Review paper on design and manufacturing of fertilizer mixing machine

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Abstract **- This paper contains the study of fertilizer mixer. Mixer widely used to make a fertilizer mixture which used in industry to make homogeneous mixture and to spray fertilizers in farms. It is mainly used to mix different fertilizers using different types of blades to make a good quality homogeneous mixture. The time taken for mixing the fertilizer by this mixer is less as compared to existing process. The fertilizer will take greater effect after mixing sufficiently, so this paper mainly researched the mixing mechanism. Here this machine performs this mixing operation not only by human power but also by electric power. The machine is so developed that it is economical, it save time and can be used by unskilled workers.**

Keywords- Precision agriculture, mixing mechanism, Organic fertilizer

I. INTRODUCTION

India is an agricultural country. About seventy percent of our population depends on agriculture. One-third of our National income comes from agriculture. Our economy is based on agriculture. The development of agriculture has much to do with the economic welfare of our country.

Our land was losing its fertility being put to cultivation continuously for years together. Cattle dung which is the best form of manure was being used as fuel. The use of manures and fertilizers helps to restore the fertility of the soil. Many new fertilizer factories are being built. Some chemical fertilizers are being imported from other countries. The Government is supplying sufficient fertilizers to the farmers. The use of these a chemical fertilizer has increased our agriculture produce manifolds.

Precision agriculture is the developing trend of modern agriculture, and the rational utilization of fertilizer is one of the key technologies in the precision agriculture, which needs to fertilize variably according to the crop needs and soil fertility conditions. Fertilizers enhance the growth of plants. This goal is met in two ways, the traditional one being additives that provide nutrients. The second mode by which some fertilizers act is to enhance the effectiveness of the soil by modifying its water retention and aeration. This article, like many on fertilizers, emphasises the nutritional aspect. Fertilizers typically provide, in varying proportions.

Three main macronutrients:

1. Nitrogen (N): leaf growth.
2. Phosphorus (P): Development of roots, flowers, seeds, fruit.
3. Potassium (K): Strong stem growth, movement of water in plants.

II. LITERATURE SURVEY

R. B. Chadge, P.S. Kulat et al. (2017): In order to improve both the mixing and time of mixing makes the surface layer known as the case significantly harder than the residual material known as the core and used mix different materials using shaft and different types of blades to make a good quality homogeneous mixture.

Sandeep Belgamwar et al. (2017): The mixing is certainly the most critical phase of the concrete production process and the quality of the concrete depends heavily on the quality of the mixer. Due to the efficiency of the compulsory mixing action, the planetary mixers meet the requirements of various production processes. The mixing flow is highly efficient due to integrated action of central stars combined with different peripheral scrapers. This research paper aims to study the various types of concrete mixers, discuss the advantages of the planetary concrete mixer over all the other type of mixers, and study the various components of the planetary mixer in detail.

M. S. Bachhav, S.S. Pachpore, Aniket Mahajan et al. (2017): A fertilizer manufacturing machine serves for various problems like moving from one place to another requires less space and is less bulky as compared to the existing bulky machines. He developed a new ―organic fertilizer manufacturing machine.

Aamod Gurao, Ajinkya Keskar, Ranjeet Mithari et al. (2017): The efficiency parameter of a mixer are affected by the order in which the various constituents of the concrete are introduced into this mixer, the type of mixer, and the type and magnitude of forces on the shaft and the direction they acted in and used to improve the mixing quality, to reduce the stirring resistance, to reduce the failure of shaft and blades and power consumption.

Richard Okwabi et al. (2016): Research is to design and construct a hand operated mixer machine that will homogenously mix maize flour together with a high concentrated micro-nutrient substance (premix) of a required quantity.

R.P. Parmar, N.R. Makange, N. Sungwa et al (2016): A satisfactory mixing process produces a uniform feed in a minimum time with a minimum cost of overhead, power, and labour. Some variation between samples should be expected, but an ideal mixture would be one with minimal variation in composition.

Amruta K. Wankhede, Dr. A.R. Sahu, Prof. V.D. Gulhane et al. (2015): The study of design, modification and analysis of concrete mixer. Mixer widely used to make a concrete mixture which used to building construction and industry to make a concrete block, pipe, sheets, etc. It is observed that there is a failure of shaft and blade in mixer thus, design modification and analysis of mixer have been done and presented.

Liming Chen and Liming Xu et al. (2012): The mixing mechanism. The simulation and analysis of the velocity field and flow field of the fertilizer for the two paddles worked, the spiral-type paddle and multiple fan-type paddle, are conducted respectively using Pro/E (Pro/Engineer) and CFD (Computational Fluid Dynamics) fluid dynamics analysis software.

Maria CristinaValigi, Silvia Logozzo, Mirko Rinchi et al. (2001): Performance optimization of a concrete mixer is an issue of great significance in many industrial technologies and wear is one of the main phenomena to forecast and test during the design and working of mechanical components. The wear effect is the progressive modification of surfaces' morphology that brings the mechanical components to inefficiency.

III. GAP IDENTIFICATION

Conventional method of mixing fertilizer which is harmful to human health because at the time of mixing their is a direct contact with human and in fertilizer chemicals have used and these chemicals affect the human health. To reduce human harmfulness and efforts the manual operation is converted into automatic operation and proper protection is done. Fertilizer mixing mechanism comes from the concept of concrete mixing machine.

In concrete mixing mechanism, for the mixing purpose the housing is rotated where as in the fertilizer mixing mechanism with the help of shaft the blades are rotated and homogeneous mixture is done.The time required in conventional process (manual) requires more as compared to fertilizer mixing machine (automatic). In rural areas load scheduling are there and because of that the fertilizer mixing machine may stop to avoid that stoppage the additional hand operated mechanism are attached to the machine.

IV. FUTURE SCOPE

- Provision for double helical ribbon blade for better productivity
- Provision of effective cooling system for reducing temperature
- Provision of sensors for measure weight

V. CONCLUSION

Nowadays it was observing the farmer facing the problem in mixing the fertilizers which are used to spray in his farm. So decide to develop a new fertilizer mixing machine. The farmer takes fertilizer from fertilizer shop and then he mixes different types of fertilizer on the mat. After that again that fertilizer fill in the bag and then it's sprayed on his farm. The traditional method of mixing fertilizer requires more time and effort. The use of this machine mixing of fertilizer required less time and effort as compared to manual mixing. This machine can help the farmers & small businessmen to be self-efficient & dependent for their everlasting need for fertilizers thereby ultimately bringing uplift in their own standard of living & economy.

VI. REFERENCES

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[2] Aamod Gurao, Ajinkya Keskar, Ranjeet Mithari - Horizontal Axis Electric Operated Concrete Mixer‖, International Journal of Innovative Research in Science, Engineering and Technology. 6, Mar (2017).

[3] R. B. CHADGE, P.S. KULAT - 3D Motion mixer for material: International journal of pure and applied research in Engineering & Technology.‖ Horizontal Axis Electric Operated Concrete Mixer. 301-393, (2017).

[4] Sandeep Belgamwar - Study of planetary concrete mixer: International journal of latest research in engineering and technology.‖ Horizontal Axis Electric Operated Concrete Mixer. 265-393, (2017).

[5] Richard Okwabi - Design and Construction of a Hand Operated Mixer Machine for Food Fortification‖, International Research Journal of Engineering and Technology (IRJET). 03, (2016).

[6] R.P. Parmar, N.R. Makange, N. Sungwa - Design and Fabrication of an Animal Feed Mixing Machine‖, Department of Farm Machinery and Power Engineering, Punjab Agricultural University Ludhiana, INDIA. 3710-3715, (2016).

[7] Amruta K. Wankhede, Dr. A.R. Sahu, Prof. V.D. Gulhane - Design, Modification and Analysis of Concrete Mixer Machine‖, International Journal on Recent and Innovation Trends in Computing and Communication. 3, (2015).

[8] Liming Chen and Liming Xu - Simulation and Design of Mixing Mechanism in Fertilizer

Automated Proportioning Equipment Based on Pro/E and CFD‖, College of Engineering, China Agricultural University. 4, (2012).

[9] Maria Cristina Valigi, Silvia Logozzo, Mirko Rinchi - **"**Wear resistance of blades in planetary concrete mixers. Design of a new improved blade shape and 2D validation.**"** Department of Industrial Engineering, University of Florence, Via Sant Marta, Firenze, Italy. 501-539, (2001).

"Design and development of electric cycle or E-bicycle "

Asst. Prof. Patil Suraj M.
Department of mechanical engineering,
Arvind Gavali College of Engineering Satara,
Satara, India

Chavan Omkar Ajitsing.
Department of mechanical engineering,
Arvind Gavali College of Engineering Satara,
Satara, India

Lawand Atul Yuvraj.
Department of mechanical engineering,
Arvind Gavali College of Engineering Satara,
Satara, India
Atullawand1997@gmail.com

Abstract: The main aim of this review paper is to present the idea of harnessing the various energy and use it in today's existence of human life .Now-a-days there are so many vehicles on road, which consumes more fuel and also hazards our environment. It is our responsibility to reduce the consumption of fuel and its hazardous emission products. Taking this into consideration it is our small step towards reducing the use of more fuel consuming vehicles and attract the eye of people towards its alternatives i.e. Electric bicycle. So we intend to design a cycle which would run on an alternative source and also reducing human efforts called as Battery Operated Cycle. In this paper we design an alternative mode of transport for betterment of social and environment.

Keywords-: Allows seniors or those physically unable to far travel longer distance.

I. Introduction:

Electric cycles or E-Bike are with two or more power sources in the drive train. There are many different types E-cycles, although only the gasoline-electric E is currently commercially available. Classified by the division of power between sources; two sources may operate in parallel to charge the battery, or the cycle may be primarily driven by one source with the other only engaged during acceleration. Or in series-E, only electricity is used to propel the cycle via electric motors with a combustion generator set providing power to drive the cycle and charge the battery bank.

Battery or electric drive system to improve consumption, emission and performance. Electrically-assisted pedal bicycles are a form of E drive. Other combinations of energy storage and conversion are possible, although not yet in commercial production. Combustion electric have larger battery sets than what a normal combustion Batteries only cycle would have. Battery and super conductor technology is advancing. A potential advantage is that when these battery sets require renewing in the future, the newer battery sets will be potentially superior having higher energy storage giving greater ranges enhancing a cycle.

The growing automobile industry needs to satisfy the economic condition and also attain emission standards. Our team discuss about the both cases and find a new solution, for attaining is our project entitled E-BIKE (This idea is becomes comes from Old model of Luna). The suggestion is because of in India one year nearly 10 million of two wheeler that pour on to the market .

In our calculation, the project has the potential to halve each scooter's rest of life running cost. If applied to just 5% of the 67 million two wheeled cycles sold in India between 2003 and 2010, it could cut carbon dioxide emissions by a staggering 700,000 tons a year and save an astonishing 110 million gallons of fuel, 70% of it imported we had started this project in 6th semester 2018 .Our idea is to modify an already existing internal combustion Batteries –driven two wheeler and turn it into a plug in E- Bike was no less that brilliant.

E-cycles use a power from Battery to run The Cycle. An E-bike is a combination of small equipment's with battery and electric motor. There are many other combinations in E-cycle, i.e., using Lead acid batteries, electric motors, with belt and pulley arrangement. E bike power systems compensate the shortfall in battery technology. E bike cycles can be used for longer trips whereas batteries could supply enough energy for short trips only.

From the above it can be concluded that HEV's are an immediate solution until a better technology is completely developed to replace conventional cycles. The nature of emission is changing at an alarming rate due to advancement in technology. Therefore a rapid change in automotive and electronics sectors and its impact can be seen on combat cycle design. E System

In a series E system the Batteries is source and supplies power to hub motor, which in turn supplies electricity to the battery pack. Electric motors Connected to battery pack draws electric power whenever required and drives the wheels. There is no mechanical connection between Batteries and the wheels of motor. This is called series E system because the power flows in series. The Generic motor is used to generate energy for the charge the batteries, so a small Batteries is sufficient to serve the purpose compared to parallel E system. Some series is do not need transmission which reducing the gross weight.

II. Literature review:

A) *Urban Electric Bike*

In this paper, authors considered importance of easy vehicle mobility and compactness. In which they revealed that folding is the strategic feature of the e-bike which would not have been probable devoid of the folding arms. For the ease of sliding of the arms a bolt is provided. In order to provide rigidity to the bike a guide has been provided on the main frame.

Then about the accelerator or say throttle, author discussed below working. Working of a Twist throttle is based on the principle of potentiometer which is also called variable resistor. It is used to fluctuate the voltage passing through the throttle. In order to pass more through the throttle, the more twist should be provided as a result less is the resistance. Therefore twist throttle offers the signal to the BLDC hub motor controller to increase or decrease the current passed to the motor.

B) A Dynamic Model For The Performance And Environmental Analysis Of An Innovative E-Bike.

The authors have directed an ecological investigation of the considered vehicle, especially contrasting the e bicycle and a thermal moped, as far as ecological effect. This paper spoke to the natural examination of an electrically supported bike under genuine driving

circumstances of mimicked speed-time profiles.

In think about, trial results of roller test seat estimations completed on a warm moped utilized so as to assemble the apropos emission information amid genuine driving circumstances. The ecological appraisal was performed considering an examination with the emission execution of this moped by utilizing kinematic parameters that assign the reenacted driving elements; an unmistakable advantage of e-bicycle likened to thermal mopeds was appeared and figured as far as emanations spared of CO, HC and NOX, which was a general report finding of this paper

III. GAP IDENTIFICATION / COMPARATIVE STUDY :

1] The e-bike is not able to travel far due to shortage of the power.

2] The cost of the e-bike is higher as nearby to the motorcycle.

3] While pedaling the motor does not perform any task.

4] The battery is only charged by the power supply.

5] It is difficult to pedal up a hill if it run out of battery power.

IV. FUTURE SCOPE :

The feature scope in electric bike as reefer to others Bikes present in actual days, The following point can pick up the feature scope.

- To using the lithium ion batteries.
- To using the Generic motors as which produce high voltage without gearbox.
- To using the racing cycle as tire diameter is more than the ranger cycle to pick up in speed as well as in the torque.
- To applies the high torque and high watt motors as compare to the PMDC motor to the more HP of cycle.
- To using the less weight equipment's.
- The most important thing in the project as we are used in this Project or in advance technology in self-charging system is that "Super Capacitor.

V. CONCLUSION

In above I Made or study on the self-charging e bike The first thing in bicycle is the chassis.They have the less weight Than Other Bodies To act on the various drag,The components which is electrical is that PMDC Motor, System Controller, throttle Controller, Batteries, Switch , Generator, Self Charging Circuit , Reverse current circuit, Motor adapter, Wires, Battery Bracket , and battery charger.The most important thing in this project as per name Self charging E bike is "Self Charging system".

IV. References

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5. Sujit Kr. Nayak M.Tech ELDT Friction less Bicycle Dynamo.

6. W.C. Morchin, ―Battery-powered electric bicycles, in Prof. Northcon'94, Oct. 11–13, 1994, pp. 269–274.

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7. Number of New Externally Funded Research Projects Received

8. Funds Received During This Academic Year

J.W.INFRA

Address :
Bungalow No. 25At. Post Khawali,Tal,
DistSatara 415003.

RiteshAmale:9637910100

Ref No. JW/2020/12-11 Dade :- 15/02/2020

SPONSORSHIP LETTER

Subject.– **Project sponsorship for A Study on Hollowcore foam Concrete Wall**

This is to certify that company has offered sponsorship for above given project to following students studying in:

Arvind Gavali College of Engineering, Satara (B.E. Civil)

Name of the students:

1.SHINGATE HARSHADA HANMANT

2.SHINDE AISHWARYA S.

3.PATIL SANJEEVANI AMAR

4JADHAV VARSHA S.

5.CHAVAN SAGAR

J. W. INFRA

Proprietor

Dr. Babasaheb Ambedkar Technological University
(Established by Government of Maharashtra by Act No. XXIX of 2014)
OFFICE OF TEQIP-III PROJECT

No.01/TEQIP-III/CIRP/2019-20/GM/
Date: 23-08-2019

To
Dr. Gayatri Mirajkar
Arvind CoE Satara
Maharashra

Subject: Allocation Letter of Research Project Grant worth Rs. 2, 00,000/- (Rs. Three La only) under TEQIP-III funds for Research Project.

Reference: Approval of Hon. Vice-Chancellor, Dr.BATU, Lonere dated 22-08-2019

Dear Sir,

With reference to above subject, the Office of TEQIP-III, Dr. BATU, Lonere is pleased to sanction a grant of Rs.3, 00,000/- towards the research proposal as:

Title of the Project:	A semi-automatic method for Segmentation tum from MR images of Human Brain
Total Project Cost:	2.5 Lakhs
Sanction Amount:	2 Lakhs
Name and Affiliation of PI & CO-PI	PI: Arvind Gavali CoE, Satara Co-PI: Dr. S. B. Deosarkar, Dr. BATU, Loner

The aforementioned grant is subject to the condition of following conditions:

1. The project duration will be of one year from the date of its allocation.
2. The institute/college must contribute the excess project cost (if any). Such co will be over and above the allocated funds to ensure the active participati institution in the research work. No excess funds will be sanctioned under any c
3. The Institute/College shall maintain the separate account head and dead stock r the project.
4. The Utilization of the project grant is required to be certified by Charted Ac the completion of the project. The assessment fee of CA can be claimed max 1% of the allocated grant.
5. The progress of the project will be reviewed by University Project Assessmer Committee (PAC) of TEQIP-III after every 03 month.

6. The Patents/Publications that will result out of this project work and funding will be hypothecated to TEQIP-III cell of the University.
7. A detailed completion report shall be submitted to the University after the completion of the project.
8. The unspent grant shall be refunded to the University within 45 days after the completion of the allotted project duration.
9. An extension of the project duration will be granted for a period of maximum 03 month under valid reason certified by the Principal/Director of the Institute and approved by PAC of TEQIP-III.
10. The PI shall submit the acceptance letter through the Director/Principal of the Institute within 07 days after the receipt of this offer letter.
11. The distribution of allocated grants shall be as:

Sr.	Particular/Head	Amount in INR
1	Travel Grant: To present the paper based on the project work in the conference of Repute at National institutes of importance/Sponsored by technical societies/Universities/etc	50,000/-
2	Publication fee: To publish papers in SCI/ESCI journals, Patents etc	25,000/-
3	Consultancy/Testing and Analysis/CA charges	15,000/-
4	Procurement of Hardware/Software etc	1,00,000/-
5	Consumables (Postage/Stationary/Printer/Toner/HDD etc)	10,000/-

12. A collaborator from TEQIP-III Twinning Institutes with University, will be nominated by the office of the TEQIP-III
13. The unspent funds of one particular/Head of point No.11 may be utilized into another head/particular with prior permission of University PAC. All such request shall be forwarded and recommended by the Director/Principal of the Institute.

Dr. S. B. Deosarkar
Institute Project Director, TEQIP-III

Copy for information: Hon. Vice-Chancellor, Dr.BATU, Lonere

Cc:

1. FO, Dr.BATU, Lonere
2. Principal/Director of the concerned affiliated institute
3. Co-PI/Collaborator of the Project

तुळजाभवानी कन्स्ट्रक्शन

प्रमोद मा. जाधव
मु. पो. करंडी
ता. जि. सातारा
मोबा. नं. ९८५०८०७३७४
७०२०१२८८८४

Tuljabhavani Construction

Promod M. Jadhav
At/Post - Karandi
Tal. & Dist. Satara
Mob. 9850807374
7020128884

जावक नं.

दिनांक : 1 / 8 / 2019

To,

Arvind Gavali Collage of Engg.

Satara,Computer Department.

Panmalewadi Vary satara,

Subject: Letter approving the project Sponsorship.

Student Name:

1) Miss. Sima Hingane.
2) Miss. Komal Jadhav.
3) Miss. Rani Jadhav.
4) Miss. Apeksha Shinde.
5) Miss. Shraddha Shinde.

Sponsor Name: Tuljabhawani Constractions satara.

I agree to pay all expenses for above students at Arvind Gavali Collage of Engg. Satara. This sponsorship includes, but is not limited to tuition, books, health insurance, room and food.

This sponsorship will cover the student beginning on 10 /04/2019 and ending on 01/08 /2020

With the allotment of this sponsorship, student may utilize company resources and data set for building application. All Right regarding the application are reserved to the company. It is joint responsibility of both company and collage to maintain the confidentiality.

Sincerely,

(Sponsor's Details)

Sponsor's Name: Tulajabhawani Constractions Satara.

Sponsor's Address: At/post Karandi, Tal. Satara Dist. Satara.

Sponsor's City and Posted Code: Satara, pin: 415002.

Sponsor's Mo. No: 9850807374.

Tuljabhavani Construction
Proprietor

KISAN VEER SATARA SAHAKARI SAKHAR KARKHANA LTD., BHUINJ
P.O.- Kisanveernagar, - 415 530, Tal. Wai, Dist. Satara. (Maharashtra)
VAT TIN : 27220388700 V
C.S.T. TIN : 27220388700 C
ECC No. : AAAAKO947MXM001
PAN No. : AAAAKO947M
Gram : KISANSAKAR (Bhuinj)
Ph.: No. 285240 / 285243 / 285143
Mob.: 8600110005 / 6 / 7
Fax No.: (02167) 285147
E-mail : kisansugar@yahoo.com
kisanveersugar@gmail.com
Web.: www.kisanveerssk.com
(Subject to Satara Jurisdiction)

Ref. No. ADM/comp/2019-20/No 23493 Date : 16 AUG 2019

SPONCERSHIP LETTER

Subject: -**Project Sponsorship for "Customized web application for sugar factory"**

This is certify that Sugar Factory has offered Sponsorship for given Project to Following students studying in:

Arvind Gavali College of Engineering Satara. (BE-Computer)

1. Miss. Chavan Ankita Ramesh
2. Miss. Jadhav Shivani Prakash
3. Miss. Zanjurne Dipti Shrimant
4. Miss. Zanjurne Komal Vijay
5. Miss. Zanjurne Pooja Sanjay

Managing Director
Kisanveer Satara Sahakari Sakhar
Karkhana Ltd., Bhuinj, (Kisanveernagar)
Tal. Wai, Dist. Satara

ADITYA ENGLISH MEDIUM SCHOOL
BAVDHAN

Date:- 05/03/2020

SPONSORSHIP LETTER

Subject :- Project Sponsorship for "Digitalizing School Framework".

This is certify that Aditya English Medium School has offered Sponsorship for given project to

Following Student in:-

Arvind Gavali College Of Engineering Satara. (BE Computer Science)

1. Miss. Kudale Akshada Vinayak.
2. Mr. Kadam Prasanna Prakash.
3. Miss. Ithape Pooja Bhanudas.
4. Miss. Deshmukh Rilitka Ravindra.

Principal
Aditya Children's Academy
Bavdhan
Dhanashri Shinde.

Address:-At Post-Bavdhan, Tel-Wai, Dist-Satara,
412804 (Maharashtra).
Email :-adityacabavdhan@gmail.com
Contact:-9823000088.

inventive
infotech

Head office :82, A Pantacha Got RaviwarPethSataraTEL: 9028822117 / 9175585656

Web:www.inventiveinfotech.inEmail: info@inventiveinfotech.in

Date : 3-8-2019

SPONCERSHIP LETTER

SUBJECT: Project sponsorship for GPS based field force tracking Analysis System

This is to certify that Company has offered Sponsorship for above given project to Following students studying in :

Arvind Gavali College of Engg. Satara (BE- COMPUTER)

1. Aarti Mahesh Sonawale
2. Ruchali Hemant Pol
3. Komal Jaysing Pawar
4. Sayali Vasant Sutar
5. Puja Nandkumar Shinde

inventive infotech
Proprietor

Existence Solution Pvt.Ltd.
enlarging your satisfication

Address: Existence Software Solution Pvt. Ltd., 2nd floor dattaraj apt Ganesh corner Nashik, Pin-422005
Ph. 0753664145 Email: info@existencesolution.com Website: www.existencesolution.com

Date: 10-8-2019

SPONCERSHIP LETTER

SUBJECT: Project sponsorship For Online Platform for managing Advertise Agency Activities.

This is to certify that Company has offered Sponsorship for above given project to following students studying in :

Arvind Gavali College of Engg. Satara (BE – COMPUTER)

1. Miss.Kudale Komal J
2. Mr.Lamje Rahul M.
3. Miss.Mane Shraddha S.
4. Miss.Mankar Sneha M.

Existence Solution Pvt. Ltd.
Nashik

Date: 01 / 08 / 2019

To,
Arvind Gavali Collage of Engg
Satara, Computer Department.
Panmalewadi Vary satara.

Subject: Letter approving the project Sponsorships.

Student Name:

1) Miss. Supriya Ghadage.
2) Miss. Aishwarya Bobade.
3) Miss. Harsha Khot.
4) Miss. Aishwarya Mane.
5) Miss. Nikita Navale.

Sponsor Name: 3Star It Solution & Services Satara.

I agree to pay all expenses for the above student at Arvind Gavali collage Engg. Satara. This sponsorship includes, but is not limited to tuition, books, health insurance, room and foods.
This sponsorship will cover the student beginning on 10 / 04 /2019 and ending On 01 / Aug/2020.
With the allotment of this Sponsorship, student may utilize company resources and data set for building application. All Right regarding the application are reserved to the company. It is joint responsibility of both company and collage to maintain the confidentiality.
Sincerely,

01/08/19

3 Star IT Solution & Services OPC Pvt. Ltd. Satara

(Sponsor signature above)
Sponsor's Name: 3Star It Solution & Services
Sponsor's Address: molacha Odha, Satara.
Sponsor's City and Posted Code: Satara, pin: 415002.
Sponsor's Mail address: 3Staritsolution2017@gmail.com.
Sponsor's Mo. No. +91 9665713423

SHREE Surveyors & Loss Assessors

Suhas A. Pharan

B-202, "Venkatesh Niwas", Near Ashirwad Hotel, Mumbai-Banglore Highway, Pune

Date : 30-9-2019

SPONSORSHIP LETTER

SUBJECT : Project Sponsorship For SHREE Surveyors & Loss Assessors

This is to certify that Company has offered sponsorship for above project to following student studying in :

Arvind Gavali College Of Engineering . Satara (BE-COMPUTER)

Miss. Gujar Supriya C.

Miss. Shelar Vijaya P.

Miss. Shinde Snehal A.

Miss. Salunkhe Ravina R.

Pharande

Scanned with Oken Scanner

9. Other Achievements

TEQIP-3

Technical Education Quality Improvement Programme

Sponsored One Day Webinar

Certificate of Participation

This is to certify that

SAPKAL RAJENDRA NANDKISHOR

One Day Webinar on New Higher Education Policy and Digitization of Education

Jointly organized by Dr. Babasaheb Ambedkar Technological University, Lonere and

R. C. Patel Institute of Technology, Shirpur under TEQIP-III on May 17, 2020

Prof. Dr. S. B. Deosarkar
Coordinator
TEQIP-III IPD, Professor, DBATU, Lonere

Prof. Dr. J. B. Patil
Coordinator
Principal, RCPIT, Shirpur

Dr. D Y Patil Pratishthan's
Dr. D Y Patil Institute of Engineering, Management & Research, Akurdi,Pune-44
Department of Mechanical Engineering
In Association with
B.S. Abdur Rahman Crescent Institute of Science & Technology, Vandalur, Chennai-48
Department of Chemistry

CERTIFICATE OF PARTICIPATION

This is to certify that **Mr.Mr.SAPKAL RAJENDRA NANDKISHOR** from **Arvind Gavali College of Engg. Satara** has attended the online workshop on *"Corrosion and its Control"* organized by Mechanical Engineering Department, DYPIEMR,Akurdi,Pune-44 in Association with Department of Chemistry, B.S. Abdur Rahman Crescent Institute of Science & Technology,Vandalur, Chennai-48 from 2nd June 2020 to 4th June 2020.

Dr. Revathi Purushothaman,
Coordinator,Chemistry,BSACIST

Dr. D. Easwaramoorthy
HoD,Chemistry,BSACIST

Dr. S. Kutti Rani
Dean(SPCS),Dept of Chemistry
BSACIST

Mr. Aniket Kolekar
Coordinator,Mech,DYPIEMR

Dr. Sunil Dambhare
HoD, Mech, DYPIEMR

Dr. Mrs. A.V.Patil
Principal, DYPIEMR

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

C E R T I F I C A T E

This is to certify that Mr./Ms./Dr. **SAPKAL RAJENDRA NANDKISHOR** of **ARVIND GAVALI COLLEGE OF ENGG. SATARA** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-00664

KOLHAPUR LOCAL CENTRE

Pune Centre

Dalmia cement
FUTURE TODAY

CERTIFICATE OF PARTICIPATION

This is to certify that SAPKAL RAJENDRA NANDKISHOR has successfully completed One Week Webinar Series on "Metro Rail Technology-Practices & Issues" during 11-15, May 2020 organized by Department of Civil Engineering, Rajarambapu Institute of Technology, Rajaramnagar (RIT), Islampur, Dist. Sangli (MS, India) in association with The Institution of Engineers(I), Kolhapur Local Centre, Indian Concrete Institute, Pune Local Centre and Dalmia Cement Bharat Limited.

UUHD4C-CE000198

Er. Vipin Kaila
State Head, Tech. Services,
Dalmia Cement Bharat Ltd.

Dr. Mahesh Chougule
Chairman., IEI, Kolhapur

Er. Ujwal Kunte
Chairman, ICI, Pune Centre

Dr. Popat Kumbhar
Assoc. Prof. & Head,
Dept of Civil Engg RIT

Dr. Mrs. Sushma Kulkarni
Convener of Webinar Series
Professor & Director, RIT

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

SHARAD INSTITUTE OF TECHNOLOGY, POLYTECHNIC, YADRAV (ICHALKARANJI)

All Programmes are accredited by NBA, New Delhi

Participation Certificate

This is to Certify that,

Shri./Smt./Km. **Mr.SAPKAL RAJENDRA NANDKISHOR** has attended

One week webinar on **"Scientific approach to Vastushastra in Building Planning"** organized by Department of Civil Engineering SITP, Yadrav in association with ISTE on date 4th June, 2020 to 8th June 2020.

Mr. M. K. Chavan	Mr. A. B. Jadhav	Prof. B. S. Tashildar	Hon. Shri. Anil A. Bagane
Co-Ordinator	H.O.D. Dept. of Civil Engg. SITP Yadrav	Principal SITP, Yadrav	Executive Director SITP, Yadrav

AISSMS
COLLEGE OF ENGINEERING
ज्ञानम् सकलजनहिताय
Accredited by NAAC with "A+" Grade

Certificate of Participation

This is to certify that Dr / Prof / Ms / Mr **Mr.SAPKAL RAJENDRA NANDKISHOR** has successfully completed **One Week National STP** on **"A Smart and Sustainable World in Concrete and Structures"** organized by Department of Civil Engineering, AISSMS College of Engineering, Pune in association with *UltraTech Cement Limited, Pune* from 4 June 2020 to 8 June 2020.

Prof Shilpi Bhuinyan
Convener
AISSMS COE
Pune

Mr Hemant Jain
Regional Head Technical Services
UltraTech Cement Limited, Pune

Dr. U R Awari
Head
Civil Engineering
Department,AISSMS COE Pune

Dr. D S Bormane
Principal,
AISSMS COE
Pune

TERNA ENGINEERING COLLEGE

PLOT NO. 12, SECTOR 22, NERUL, NAVI MUMBAI 400706

In Association with Indian Institution of Industrial Engineering NHQ CBD Belapur,

E-CERTIFICATE

of participation

THIS CERTIFICATE IS PROUDLY PRESENTED TO

Mr.SAPKAL RAJENDRA NANDKISHOR

Arvind Gavali College of Engg. Satara

for his/her active participation in

One Week Online Faculty Development Program on

"Innovation, Entrepreneurship and its Relevance in Industry 4.0 Practices in the Post Covid-19 Situation"

conducted during May 25 – 29, 2020 & was organized by

Department of Mechanical engineering.

terna
Knowledge to Empower

Dr. Rajesh Jaware	Dr. C. M. Choudhari	Dr. L. K. Ragha
Convenor	HoD & Convenor	Principal

Verify at : tiny.cc/ternafdp

Coordinators have confirmed the identity of this Individual and the participation in this FDP.

K. E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

Islampur, Tal. Walwa, Dist. Sangli, Maharashtra

(An Autonomous Institute)

CERTIFICATE

This is to certify that Mr.SAPKAL RAJENDRA NANDKISHOR has successfully attended three days Webinar from 28th to 30th, May 2020 on

"DEVELOPMENT, EXECUTION AND MAINTENANCE OF EPC PROJECT"

Organized by

Department of Civil Engineering

Rajarambapu Institute of Technology, Rajaramnagar

In association with

Dhruv Consultancy Services Ltd., Navi Mumbai.

Mr. Milind Kulkarni, Joint Managing Director Dhruv Consultancy Services ltd.	Prof. Dhananjay Patil Dept of Civil Engg.	Dr. P. D. Kumbhar Head, Dept of Civil Engg.	Dr. Mrs. S. S. Kulkarni Director, RIT

Raosaheb Wangde Master Charitable Trust's

DNYANSHREE
INSTITUTE OF ENGINEERING AND TECHNOLOGY

Hon. Mr. Dnyaneshwar B. Wangde (BHAI)
Founder & Chairman
Raosaheb Wangde Master Charitable Trust, Mumbai

E-Certificate of Appreciation

This is to Certify that

Mr./Ms./Mrs. Mr. Gujar Vijay Bhanudas

of Dnyanshree Institute of Engineering and Technology Satara

for participation in the Webinar on **"Role of Engineers in Upcoming Industrial Revolution"** organized by,

Department of Electronics & Telecommunication Engineering , RWMCT's Dnyanshree Institute of Engineering and Technology, Satara, Maharashtra, conducted on 29th May 2020

Mrs. Sargar M. A.
Coordinator

Mr. Patil S. S.
Head, Department of Electronics & Telecommunication (Polytechnique)

Mr. Jamdade A. S.
Head, Department of Electronics & Telecommunication (Degree)

Raosaheb Wangde Master Charitable Trust's

DNYANSHREE

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Hon. Mr. Dnyaneshwar B. Wangde (BHAI)
Founder & Chairman
Raosaheb Wangde Master Charitable Trust, Mumbai

E-Certificate of Appreciation

This is to Certify that

Mr./Ms./Mrs. Mr.Vijay Bhanudas Gujar

of Dnyanshree Institute of Engineering and Technology Satara

for participation in the Webinar on **"Intellectual Property Rights"** organized by,

Department of Computer Science and Engineering , RWMCT's Dnyanshree Institute of Engineering and Technology, Satara, Maharashtra, conducted on 5/25/2020

Ms. P. M. Pondkule	**Mr. O. C. Nilakhe**	**Mr.D.D.Ubale**
Coordinator	**Head, Department of Computer Science & Engineering**	**Head, Research & Innovation Quality Circle**

Certificate of Participation

This is to certify that

Rajani Mandhare

from

Arvind Gavali College Of Engineering, Satara

participated in

One day Coordinators' Workshop on C and C++

on **15 February 2020**

This training was organised by the Teaching Learning Centre (ICT) at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre (ICT),
PMMMNMTT, IIT Bombay

Prof. Bhaskaran Raman
Department of Computer Science and Engineering,
Indian Institute of Technology Bombay

Spoken Tutorial

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

This training was made possible with help from Spoken Tutorial Project, at IIT Bombay.
funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE OF ENGINEERING , SATARA

Accredited by NAAC with "B++" Grade

Estd 1983

SPOKEN TUTORIAL IIT, BOMBAY &
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PARTICIPATION CERTIFICATE

This is to certify that

RAJANI MANDHARE

actively participated and completed

One Week Online Faculty Development Programme on

"BOSS LINUX - UBUNTU OPERATING SYSTEM"

from 15th April to 21st April 2020

This workshop was organized by Karmaveer Bhaurao Patil College of Engineering, Satara in association with Spoken Tutorial IIT, Bombay Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India.

Prof. Ganesh Dangat	Dr. Shabina Sayyed	Prof. Dipali Ghatge	Dr. A. C. Attar
Co-ordinator	Co-ordinator	Co-Convener	Convener
SPoC	Dean Students	HOD CSE	Principal

Certificate of Participation

This is to certify that

Rajani Mandhare

participated in

'One Day Workshop on Arduino'

held at Arvind Gavali College Of Engineering, Satara

on **8 February 2020**

This training was organised by the Teaching Learning Centre, ICT at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre,
PMMMNMTT, IIT Bombay

Prof. G. V. V. Sharma
Department of Electrical Engineering,
IIT Hyderabad

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ESSCI

This training was made possible with help from Spoken Tutorial and FOSSEE Projects at IIT Bombay.
These Projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

Certificate of Participation

This is to certify that

Rajani Mandhare

participated in

'One day Workshop on R'

held at Arvind Gavali College Of Engineering, Satara

on **09 November 2019**

This training was organised by the Teaching Learning Centre, ICT at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre,
PMMMNMTT, IIT Bombay

Prof. Radhendushka Srivastava
Department of Mathematics,
Indian Institute of Technology Bombay

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These Projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

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scan the QR code

Certificate of Participation

This is to certify that

Pranav Pathak

participated in

'One Day Workshop on Arduino'

held at Arvind Gavali College Of Engineering, Satara

on **8 February 2020**

This training was organised by the Teaching Learning Centre, ICT at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre,
PMMMNMTT, IIT Bombay

Prof. G. V. V. Sharma
Department of Electrical Engineering,
IIT Hyderabad

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These Projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

GOVERNMENT COLLEGE OF ENGINEERING KARAD

&

RAJKIYA ENGINEERING COLLEGE AZAMGARH

Jointly Organized

One Week Online Faculty Development Program on

"*Machine Learning and Deep Learning Applications in Engineering & Science*"

(16th May 2020 to 20th May 2020)

under

Technical Education Quality Improvement Program - III

CERTIFICATE OF PARTICIPATION

This is to certify that

Pranav Avinash Pathak

of

Arvind Gavali College of Engineering Satara

Registration Number 2190

has Participated in One Week TEQIP - Online Faculty Development Program on "Machine Learning and Deep Learning Applications in Engineering and Science (MLDLAES - 2020)" from 16th May - 20th May 2020 (Sponsored by Technical Education Quality Improvement Program -III) Organized by Civil Engineering Department, Government College of Engineering, Karad.

Prof. Amarsinh B. Landage	**Prof. B. A. Konnur**	**Prof. S. S. Valunjkar**	**Prof. A. T. Pise**
Coordinator	Convener & TEQIP III Coordinator	Chairman & Head of Department	Principal GCE Karad

MaTPO

GREYATOM

Certificate of Completion

This is to certify that

Pranav Pathak

has attended a webinar

"Future of Training & Placement is REMOTE" and

"Tools for TPOs in 2020 to increase productivity"

Date: 3rd May 2020

Mayuresh Shilotri

Certificate ID: 10000014179

Mayuresh Shilotri,
Co-founder GreyAtom

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr. / Ms. / Dr. **PRANAV AVINASH PATHAK** of **ARVIND GAVALI COLLEGE OF ENGINEERING SATARA** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-01875

Certificate of Participation

This is to certify that

Pranav Pathak

from Arvind Gavali College Of Engineering, Satara

attended the Python Workshop on 22 June 2019, at
Arvind Gavali College Of Engineering , Satara.

This training was organised by the Teaching Learning Centre (ICT) at IIT Bombay, funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT).

Prof. Kannan Moudgalya
Principal Investigator
TLC(ICT) PMMMNMTT

Prof. Prabhu Ramchandran
Co-Principal Investigator
FOSSEE

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This training was made possible with help from Spoken Tutorial and FOSSEE Projects, at IIT Bombay. These projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

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Certificate of Participation

This is to certify that

Shital Chavan

from Arvind Gavali College Of Engineering, Satara

attended the Python Workshop on 22 June 2019, at
Arvind Gavali College Of Engineering , Satara.

This training was organised by the Teaching Learning Centre (ICT) at IIT Bombay, funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT).

Prof. Kannan Moudgalya
Principal Investigator
TLC(ICT) PMMMNMTT

Prof. Prabhu Ramchandran
Co-Principal Investigator
FOSSEE

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To verify, scan the QR code or visit: https://fossee.in/certificates/verify
This is a computer generated certificate and requires no signature.

Jayawant Shikshan Prasarak Mandal's

JSPM Narhe Technical Campus

Department of Computer Engineering

Certificate of Appreciation

This is to certify that,

Mr. B. Meghya Nayak

has completed the "**Faculty Awareness Program on NBA and Outcome Based Education(OBE)**" organised by JSPM Narhe Technical Campus on 2-5-2020.

Certificate Id: 8M2RWS-CE000205

This is a digital certificate and does not require signature.

Dr. Babasaheb Ambedkar Technological University
Vidyavihar, Lonere, Dist. Raigad - 402 103

TEQIP

TEQIP-III SPONSORED
ONE WEEK ONLINE FACULTY DEVELOPMENT PROGRAMME

Certificate of Participation

This is to certify that **Mr. B. Meghya Nayak, Assistant Professor (Electrical Engineering),** of **Arvind Gavali College of Engineering, Satara** has participated in TEQIP-III sponsored **Faculty Development Programme (FDP)** on **"Industrial IoTs, Industry 4.0 & Disruptive Technologies"** organized by **Dr. B. A. Technological University, Lonere** (Maharashtrta) from **May 05-10, 2020,** which is conducted using online platforms and ICT tools.

Dr. Ajij D. Sayyad	Dr. Nilesh G. Patil	Dr. Shankar B. Deosarkar
Associate Professor, MIT Aurangabad (Course Coordinator)	Principal, Marathwada Institute of Technology, Aurangabad	Institute Project Director, (IPD), TEQIP-III, Dr, B. A. T. U., Lonere

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(ID No. PU/PN/ENGG/124/1998)
Accredited by NAAC with 'A' Grade

eCertificate of Participation

Mr. B. Meghta Nayak of Arvind Gavali College of Engineering, Satara

has successfully completed ONLINE QUIZ ON **"Renewable Energy Sources" ,**with a score of 95% organised by Renewable Energy Club, Electrical Engineering Department on 5/27/2020.

Mrs.K. S. Gadgil
REC Coordinator

Mrs.A.D Shiralkar
HOD

Dr. P. B. Mane
Principal

JAGADAMBHA
COLLEGE OF ENGINEERING & TECHNOLOGY , YAVATMAL

QUIZ ON INTERNATIONAL YOGA DAY

Organized By

Department of Electrical Engineering

E- CERTIFICATE

This is to Certify that, Mr. BANOTH MEGHYA NAYAK of Arvind Gavali College of Engineering, Satara Has successfully Passed National Level Online Quiz on International Yoga day, 21/06/2020,organised by Electrical Engg Dept, Jagadambha College of Engineering & Technology, Yavatmal, & scored 90%

Prof. Dr. Vijay G Neve
HOD, EE Dept

Dr. H. M. Baradkar
Principal

CERTIFICATE ID : R4UU2M-CE001467

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr. / Ms. / Dr. **MR. B. M. NAYAK** of **ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-02165

Dr. Babasaheb Ambedkar Technological University
Vidyavihar, Lonere, Dist. Raigad - 402 103

TEQIP

TEQIP-III SPONSORED
ONE WEEK ONLINE FACULTY DEVELOPMENT PROGRAMME

Certificate of Participation

This is to certify that **Mrs. Islavath Parvathi, Assistant Professor (Electrical Engineering),** of **Arvind Gavali College of Engineering, Satara** has participated in TEQIP-III sponsored **Faculty Development Programme (FDP)** on **"Industrial IoTs, Industry 4.0 & Disruptive Technologies"** organized by **Dr. B. A. Technological University, Lonere** (Maharashtrta) from **May 05-10, 2020,** which is conducted using online platforms and ICT tools.

Dr. Ajij D. Sayyad	Dr. Nilesh G. Patil	Dr. Shankar B. Deosarkar
Associate Professor, MIT Aurangabad (Course Coordinator)	Principal, Marathwada Institute of Technology, Aurangabad	Institute Project Director, (IPD), TEQIP-III, Dr, B. A. T. U., Lonere

Datta Meghe Institute of Engineering, Technology & Research

Sawangi (Meghe) Wardha (Maharashtra)

MEGHE GROUP
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Certificate

RESEARCH METHODOLOGY

This is to certify that,

Eva Gupta

has participated in "Faculty Awareness Programme on Research Methodology" organized by Research & Development Cell, Datta Meghe Institute of Engineering,Technology and Research Sawangi (Meghe),Wardha on 14 th May, 2020.

Dr. Rajendra M. Rewatkar
Incharge R & D Cell

Dr. Prasanna L. Zade
Principal

Certificate of Participation

This certificate is presented to

Eva Gupta

for Participation in Faculty Awareness Program on

"NAAC Revised Accreditation Framework 2020"

Organized by

JSPM Narhe Technical Campus

From 11/05/2020 to 15/05/2020

Dr. D. V. Bhise	Dr. M.M. Sardeshmukh	Dr. R. K. Lad
NBA Coordinator	IQAC Coordinator	Director

C4KWFI-CE000293

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CERTIFICATE OF PARTICIPATION

This is to certify that ***Eva Gupta*** *of* ***Arvind Gavali College of Engineering, Satara*** *has successfully participated in the* ***Online Training Program*** *for Three days from* ***14th to 16th April 2020*** *on* ***Ultra Low Power System Design*** *Under* ***Texas Instruments University Program*** *in association with* ***EdGate Technologies Pvt Ltd Bangalore.***

EdGate Technologies Pvt Ltd

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Sinhgad Institute of Technology and Science

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CERTIFICATE OF PARTICIPATION

This is to certify that

EVA GUPTA

has participated in One Week Online Faculty Development Program entitled

"OpenFOAM"

Organized by

Department of Mechanical Engineering

Sinhgad Institute of Technology and Science, Narhe, Pune-41 in association with Spoken Tutorial, IIT Bombay from 13th May 2020 to 17th May 2020

Mr. N.G. Chanshetti	Dr. K.R. Jagtap	Dr. R.S. Prasad
Coordinator	Convenor, HOD Mech	Principal

MaTPO

GREYATOM

Certificate of Completion

This is to certify that

Somesha Naik S R

has attended a webinar

“Future of Training & Placement is REMOTE” and

“Tools for TPOs in 2020 to increase productivity”

Date: 3rd May 2020

Mayuresh Shilotri

Certificate ID: 10000013966

Mayuresh Shilotri,
Co-founder GreyAtom

Dr. Babasaheb Ambedkar Technological University, Lonere

Certificate of participation

This Certificate declares that

Mr. Vishal Hingmire

from Arvind Gavali College of Engineering, Maharashtra
has successfully completed

NAAC Awareness Quiz-2020

On 17-5-2020 , with passing score of 94%

Prof. S. L. Nalbalwar
Dean Academics

DQD8CE-CE000281

Certificate of Participation

This is to certify that

Vishal Hingmire

from

Arvind Gavali College Of Engineering, Satara, Satara

participated in

'One Day Coordinators' Workshop on Arduino'

held at Indian Institute of Technology Bombay

on **18 January 2020**

This training was organised by the Teaching Learning Centre, ICT at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre,
PMMMNMTT, IIT Bombay

Prof. G. V. V. Sharma
Department of Electrical Engineering,
IIT Hyderabad

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PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

ESSCI

This training was made possible with help from Spoken Tutorial and FOSSEE Projects at IIT Bombay.
These Projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

Certificate of Participation

This is to certify that

Vishal Hingmire

participated in

One Day Workshop on C and C++

held at Arvind Gavali College Of Engineering, Satara

on **29 February 2020**

This training was organised by the Teaching Learning Centre (ICT) at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre (ICT),
PMMMNMTT, IIT Bombay

Prof. Bhaskaran Raman
Department of Computer Science and Engineering,
IIT Bombay

Spoken Tutorial

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

This training was made possible with help from Spoken Tutorial Project, at IIT Bombay.
funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

Samarth Educational Trust

Arvind Gavali College of Engineering, Satara

Certificate of Appreciation

This is to certify that,

Mr.Vishal Hingmire

has participated in online Quiz ***"Awareness about NBA Accreditation and OBE"*** organized by ***AGCE Satara*** on 16 May 2020.

Mr. Vijay Kadam
Coordinator

Dr. Vilas Pharande
Principal

Mr. Nishant Gavali
Secretary

STAY HOME. STAY SAFE. SAVE LIVES.

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr./Ms./Dr. **MR. VISHAL HINGMIRE** of **ARVIND GAVALI COLLEGE OF ENGINEERING** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-01648

Certificate of Appreciation

presented to

Vishal Hingmire

of Arvind Gavali College Of Engineering (1380)

in recognition of his/her contribution as a Course Coordinator
during the one day workshop on

Arduino

on 8 February, 2020.

This training was organised by the Teaching Learning Centre (ICT) at IIT Bombay, funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MoE, Govt. of India

8cfe5

Prof. Kannan Moudgalya
Principal Investigator
TLC(ICT) PMMMNMTT, IIT Bombay

Prof. G. V. V. Sharma
Department of Electrical Engineering,
IIT Hyderabad

fossee better education

Spoken Tutorial

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

ESSCI Skilling India in Electronics

Ministry of Education
Govt. of India

To verify, scan the QR code or visit: https://fossee.in/certificates/verify
This is a computer generated certificate and requires no signature.

This training was made possible with help from the Spoken Tutorial and FOSSEE Projects at IIT Bombay. These projects are funded by the National Mission on Education through ICT, Ministry of Education (MoE), Govt. of India.

DBATU TEQIP-III Sponsored

Online FDP on

"COMMUNICATION and ICT"

From 5th to 10th May 2020

CERTIFICATE

OF APPRECIATION

This is to certify that

MR. VIJAY TUKARAM BARKADE (DFDP2020075)

from ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA

has successfully completed One week Online FDP on "Communication and ICT" from 5th to 10th May 2020 sponsored by DBATU TEQIP-III

Dr. Shabina Sayyed
Coordinator
(KBPCOE, Satara)

Dr. S. B. Deosarkar
Institute Project Director,
TEQIP-III
(DBATU, Lonere)

AISHE CODE: C-30843

RDIC202002

Dnyanprassarak Mandal's

College and Research Centre

Assagao, Bardez- Goa

(Accredited by NAAC with 'A' Grade)

Inspiring, Igniting and Transforming to Excel

CERTIFICATE

This Certificate is awarded to ***Barkade Vijay Tukaram*** *for successfully completing the* ***One Week Online Certificate Course*** *on* ***Influenza Pandemics : Yesterday, Today and Tomorrow*** *from 22nd April 2020 to 26th April 2020. Course was conducted by Research, Development and Innovation Cell in association Unnat Bharat Abhiyan.*

Dr. Rajesh Pednekar
Convener , Research , Development & Innovation Cell

Dr. D.B. Arolkar
Principal

Certificate No: IETE - ML - 0901

PANTECH SOLUTIONS
Technology Beyond the Dreams

CERTIFICATE

OF PARTICIPATION

IS PRESENTED TO

Mr.Barkade Vijay Tukaram ,

ARVIND GAVALI COLLEGE OF ENGINEERING,SATARA

FOR PARTICIPATING IN THE WEBINAR " MACHINE LEARNING "

ON 2ND MAY 2020 HOSTED BY IETE (MUMBAI) IN ASSOCIATION WITH PANTECH

SRINIVASAN N, DIRECTOR
PANTECH E LEARNING

DR S S THAKUR, CHAIRMAN
IETE MUMBAI

PARAG WALINJKAR, HON. SECRETARY
IETE MUMBAI

PANTECH E-BYTES
2020

www.pantechelearning.com

Enroll No. PU/G/.66.../SS-.031

Certificate

This certifies that, Mr/Ms Barkade V. T. has successfully completed **One Day** Satellite Telecommunication Industrial Training Program at Institute of Satellite Telecom Pvt. Ltd. Pune.

Date: 4th Oct- 2019.

For INSTITUTE OF SATELLITE TELECOM PVT. LTD
Managing Director
ISTC Pune Director

F.No AICTE/FDP-SI/OnlineWorkshop/200/15996

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

NELSON MANDELA MARG, VASANT KUNJ, NEW DELHI

Certificate of Participation

This is to certify that Mr. Barkade Vijay Tukaram from Arvind Gavali College of Engineering, Satara has participated and successfully completed the online workshop on Universal Human Values on the theme "Inculcating Universal Human Values in Technical Education" during 10-14 April, 2020 as organized by All India Council for Technical Education(AICTE).

Dr. Rajneesh Arora
Chairman
National Coordination Committee for Induction Program

Prof. Rajive Kumar
Member Secretary, AICTE

Certificate of Participation

This is to certify that

Vijay Barkade

participated in

'One Day Workshop on Arduino'

held at Arvind Gavali College Of Engineering, Satara

on **8 February 2020**

This training was organised by the Teaching Learning Centre, ICT at IIT Bombay,
funded by the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT), MHRD, Govt. of India

Prof. Kannan Moudgalya
Project Coordinator, Teaching Learning Centre,
PMMMNMTT, IIT Bombay

Prof. G. V. V. Sharma
Department of Electrical Engineering,
IIT Hyderabad

Spoken Tutorial

fossee better education
Promoting Free/Libre and Open Source Software

PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

ESSCI

This training was made possible with help from Spoken Tutorial and FOSSEE Projects at IIT Bombay.
These Projects are funded by the National Mission on Education through ICT, MHRD, Govt. of India.

For details and verification,
scan the QR code

Dr. Babasaheb Ambedkar Technological University, Lonere

Certificate of participation

This Certificate declares that

Dayanand Bajirao Jagtap

from Arvind Gavali College of Engineering Satara , Maharashtra
has successfully completed

NAAC Awareness Quiz-2020

On 18-5-2020 , with passing score of 94%

Prof. S. L. Nalbalwar
Dean Academics

DQD8CE-CE000567

Samarth Educational Trust

Arvind Gavali College of Engineering, Satara

Certificate of Appreciation

This is to certify that,

Dayanand Bajirao Jagtap

has participated in online Quiz ***"Awareness about NBA Accreditation and OBE"*** organized by ***AGCE Satara*** on 16 May 2020.

Mr. Vijay Kadam
Coordinator

Dr. Vilas Pharande
Principal

Mr. Nishant Gavali
Secretary

STAY HOME. STAY SAFE. SAVE LIVES.

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr./ Ms. / Dr. *Dayanand Bajirao Jagtap of Arvind Gavali College of Engineering Satara* has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE, Karad.

Your Certificate No is:OBEGCEK-02633

Dr. Babasaheb Ambedkar Technological University

(Established by Government of Maharashtra and Governed by
Dr. Babasaheb Ambedkar Technological University Act No. XXIX of 2014)
www.dbatu.ac.in

DBATU/EXTC/CERTIFICATE/2020/ 454

Date : 31/01/2020

Certificate of Attendance

This is to certify that Mr. D. B. Jagtap has attended the one day Curriculam Development Program for Electronics &Telecommunication Engineering at Dr. Babasaheb Ambedkar Technological University Lonere on 27th November 2019.

Dr.S.L.Nalbalwar
Professor & Head
Department of E&TC

Dr. Sanjay Nalbalwar
Head
Dept. of Electronics & Telecommunication E
Dr. Babasaheb Ambedkar Technological University
Lonere - Raigad. (M.S.)

Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College of Engineering, Satara

Karmaveer Research Publication and Review Quiz

Certificate

This certificate declares that,

Suhas Prakashrao Patil

From Arvind Gavali College of Engineering Satara Has successfully completed "Karmaveer Research Publication and Review Quiz" on 30-5-2020 .

Prof. Dipali Ghatge
Coordinator

Dr. Anand Tapase
Coordinator

Dr. A.C Attar
Principal

Certificate ID: OXMLV0-CE000705

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

Certificate of Participation

RAJARAMBAPU INSTITUTE OF TECHNOLOGY

This is to certify that

Suhas Prakashrao Patil

from

Arvind Gavali College of Engineering, Satara

Has participated in an online One week Faculty Development Program on

Funding Opportunities for Engineering Teachers & Technical Paper Writing

scheduled from

15-19 June, 2020

Organized by Department of Mechanical Engineering

Prof. K. P. Powar	**Dr. A. P. Shah**	**Dr. S. K. Patil**	**Dr. S. S. Kulkarni**
Co-coordinator	Coordinator	HOD & Dean, Academics	Director

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE

(Accredited by NAAC with 'A' Grade)

(An Autonomous Institute under Kakatiya University)

WARANGAL -506015, Telangana

ESTD: 1980

Department of Mechanical Engineering

BMNN6Q-CE000448

This is to certify that

Mr SUHAS PRAKASHRAO PATIL, Assistant Professor

of

Arvind Gavali College of Engineering Satara (Maharashtra)

has attended A one-week Faculty Development Program on

"ADVANCED MATERIALS AND MANUFACTURING"

from 29/06/2020 to 03/07/2020

organized by Department of Mechanical Engineering, Kakatiya Institute of Technology and Science, Warangal, Telangana – 506015.

Dr. A. DEVARAJU
Associate Professor
Coordinator

Dr. G. SAIKUMAR
Assistant Professor
Coordinator

Dr. K. SRIDHAR
Professor & Head
Convener

Prof. K. ASHOKA REDDY
Principal

Shri Vithal Education & Research Institute's

College of Engineering, Pandharpur

Department of Mechanical Engineering

Certificate of Participation

One Week Online Faculty Development Programme

"Research Opportunities and Challenges in Manufacturing Sector"

This is to certify that

Mr.Suhas Prakashrao Patil of **Arvind Gavali College of Engineering Satara**

has attended One Week Online FDP on "Research Opportunities and Challenges in Manufacturing Sector" from 01st June to 06th June, 2020 Organized by *Department of Mechanical Engineering, SVERI's College of Engineering, Pandharpur, Maharashtra*.

(Prof. S. B. Bhosale)	(Dr. S. S. Wangikar)	(Prof. Dr. B. P. Ronge)
FDP Coordinator	*Convenor*	*Principal*

FT6SHY-CE000068

Kasegaon Education Society's

Rajarambapu Institute of Technology, Rajaramnagar, Islampur

(An Autonomous Institute)

One Week Online Training program on,

Implementation of Multi-objective Optimization Algorithm (NSGA -II) using MATLAB

Organized

Under RIT-Center for Teaching and Learning (RIT-CTL)

Certificate

This is to certify that, **Mr. Suhas Prakashrao Patil** of **Arvind Gavali College of Engineering Satara** attended one week online training program on, "**Implementation of Multi-objective Optimization Algorithm (NSGA -II) using MATLAB**" organized by Electrical Engineering Department under RIT-Center for Teaching and Learning (RIT-CTL) during 29th June to 03th July, 2020.

Mr. P. D. Bamane	**Dr. H. T. Jadhav**	**Dr. V. N. Kalkhambkar**	**Dr. S. K. Patil**	**Dr. S. S. Kulkarni**
Coordinator	Coordinator	HoD, Electrical	Dean Academics	Director

Certificate of Participation

This is to certify that,

Suhas Prakashrao Patil

of

Arvind Gavali College of Engineering Satara

has attended webinar on **"Job Opportunities in Manufacturing sector"** organised by Rajarambapu Institute of Technology, Rajaramnagar **(RIT)** on 24th June 2020.

Prof.A.M.Mulla
HOP, Mechanical - Manufacturing Engg.
RIT, Rajaramnagar

Dr. S. K. Patil
HOD, Mechanical
RIT, Rajaramnagar

Certificate ID:
HADRQQ-CE00007 5

(This is digital certificate and does not require signature)

Kasegaon Education Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

One Week Online FDP on

"Enhancing Research and Consultancy Skills"

Certificate of Participation

This is to certify that Suhas Prakashrao Patil of Arvind Gavali College of Engineering Satara has participated in the **one week online FDP on "Enhancing Research and Consultancy Skills"** organized by Department of Mechanical Engineering, Rajarambapu Institute of Technology, Rajaramnagar under RIT-Center for Teaching and Learning (RIT-CTL) from June 22 - 26, 2020.

Prof. R. V. Pawar	Prof. L. R. Patil	Dr. R. G. Desavale	Dr. S. K. Patil	Dr. Mrs. S. S. Kulkarni
Coordinator	Coordinator	Coordinator	Dean Academics & HOD	Director – RIT

in association with MHRD INSTITUTION'S INNOVATION COUNCIL IQAC SUSTAINABLE DEVELOPMENT GOALS 4 QUALITY EDUCATION

Sri SAI RAM INSTITUTE OF TECHNOLOGY
An Autonomous Institutions
Sai Leo Nagar, West Tambaram, Chennai - 44,
www.sairamgroup.in

Certificate of Participation

This is to certify that Mr. / Ms. / Dr **SUHAS PRAKASHRAO PATIL**

of ARVIND GAVALI COLLEGE OF ENGINEERING SATARA (MAHARASHTRA)

has actively participated in Seven Days **Faculty Development Program** on

" HEAT TRANSFER AND COMPUTATIONAL FLUID DYNAMICS TOWARDS INDUSTRIAL APPLICATIONS "

From 12 June 2020 to 18 June 2020 Organized by
Department of Mechanical Engineering,
Sri Sairam Institute of Technology , Chennai, Tamil Nadu.

Sairam INSTITUTIONS

NBA NATIONAL BOARD OF ACCREDITATION NAAC (A+) nirf

Dr.K.Palanikumar
Principal

MJF LN. LEO MUTHU Founder Chairman - Sairam Institutions

Sai Prakash Leo Muthu
Chief Executive Officer

ID NO: KQDFM8-CE000201

PIMPRI CHINCHWAD EDUCATION TRUST'S

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

NIGDI PUNE

CERTIFICATE OF APPRECIATION

Presented To

Suhas Prakashrao Patil

Arvind Gavali College of Engineering Satara

Noise Vibration and Harshness Webinar Series (Session 2)

Active Vibration Control in Truck System

On 12th JUNE 2020

Amit Panchwadkar	Dr. P. A. Deshmukh	Dr. N. R. Deore	Dr. G .V . Parishwad
Convener	Webinar Coordinator	HOD	Principal

PIMPRI CHINCHWAD EDUCATION TRUST'S

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

NIGDI PUNE

CERTIFICATE OF APPRECIATION

Presented To

Suhas Prakashrao Patil

Arvind Gavali College of Engineering Satara

Noise Vibration and Harshness Webinar Series (Session 1)

Noise Attenuation Strategies

On 11th JUNE 2020

Amit Panchwadkar	Dr. P. A. Deshmukh	Dr. N. R. Deore	Dr. G .V . Parishwad
Convener	Webinar Coordinator	HOD	Principal

PIMPRI CHINCHWAD EDUCATION TRUST'S

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

NIGDI PUNE

CERTIFICATE OF APPRECIATION

Presented To

Suhas Prakashrao Patil

Arvind Gavali College of Engineering Satara

Noise Vibration and Harshness Webinar Series (Session 3)

Acoustic Material Testing and Characterization

On 13th JUNE 2020

Amit Panchwadkar	Dr. P. A. Deshmukh	Dr. N. R. Deore	Dr. G .V . Parishwad
Convener	Webinar Coordinator	HOD	Principal

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering Yadrav- Ichalkaranji

Accredited by NAAC 'A' Grade An ISO 9001:2015 Certified Institute

NBA accredited programmes

Department of Mechanical Engineering

CERTIFICATE OF PARTICIPATION

This is to certify that

Suhas Prakashrao Patil

Arvind Gavali College of Engineering Satara

has actively participated in the online faculty orientation programme on "Recent Advances in Modeling and Optimization Techniques" organized by Department of Mechanical Engineering approved by ISTE ,New Delhi from 1st June to 5 th June 2020. Certificate number: LGLFMM-CE000196

Co-coordinator Coordinator HoD Principal Executive Director

Vel Tech High Tech
Dr.Rangarajan Dr.Sakunthala Engineering College

Certificate of Participation

This is to certify that **Suhas Prakashrao Patil, Assistant Professor**

from **Arvind Gavali College of Engineering Satara**

has participated in One Week Online International Faculty Development Programme on "Advanced Engineering Materials for Strategic & Societal Sectors – Current Perspectives", organized by Department of Mechanical Engineering, Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College, Chennai, Tamilnadu, India from 10.6.2020 to 15.6.2020.

Dr. R. Anbazhagan	Dr. R. Suresh	Dr. P. Vijayasarathi	Dr. E. Kamalanaban
Asso. Professor / Mechanical	*Professor / Mechanical*	*HoD/ Mechanical*	*Principal*

Certificate No.: **4HEMDO-CE000578**

Date: **6/16/2020**

Resource Persons

10.06.2020
Prof. Dr. Henri Stephan Schrekker,
Associate Professor, Institute of Chemistry – UFRGS, Universidade Federal do Rio Grande do Sul, Porto Alegre – RS, Brazil.

11.06.2020
Dr. V. S. Srinivasan,
Scientific Officer – G, Head - LIMS, SIRD & Professor, Homi Bhabha National Institute, IGCAR, Kalpakkam, Tamilnadu, India.

12.06.2020
Dr. S. Kavithaa,
Scientist – D, Sensors & Vision Technology Dept., Central Manufacturing Tech. Institute, Bangalore, Karnataka, India.

13.06.2020
Dr. T.P.D. Rajan,
Senior Principal Scientist, Materials Science & Technology Division, CSIR-National Institute for Interdisciplinary Science & Technology, Trivandrum, Kerala, India.

14.06.2020
Dr. Udayakumar. A,
Senior Principal Scientist – F, Materials Science Division, CSIR-National Aerospace Laboratories, Ministry of Science & Technology, Bangalore, Karnataka, India.

15.06.2020
Sri. K.Thomas Tharian,
General Manager –Materials, Materials & Manufacturing Engg., ISRO/LPSC, Trivandrum, Kerala, India.

V.K.R, V.N.B & A.G.K COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)
Eluru Road, Gudivada, Krishna District, Andhra Pradesh-521301
Phone: 08674-242188, Email: vkrvnbengineering@gmail.com, Website: http://www.vkrvnbcoe.org

DEPARTMENT OF MECHANICAL ENGINEERING

&

DEPARTMENT OF CIVIL ENGINEERING

Certificate of Participation

This is to certify that

Mr. Suhas Prakashrao Patil

From

Arvind Gavali College of Engineering Satara

has participated in **"Five Day Online Faculty Development Program on OpenFOAM"** organized by Departments of Mechanical & Civil Engineering jointly in association with Spoken Tutorials, IIT Bombay from 29/06/2020 to 03/07/2020.

ID:VKRFOAM222

Convener & HOD-Mech	Convener & HOD-Civil	Director	Principal
(Mr. G.V.N.B. Prabhakar)	(Mr. K. Durga Prasad)	(Sri. B. Kalyan Kumar)	(Dr. S.H.V. Prasada Rao)

AGTI'S DR. DAULATRAO AHER COLLEGE OF ENGINEERING, KARAD
AND
GOVERNMENT COLLEGE OF ENGINEERING, KARAD
DEPARTMENT OF MECHANICAL ENGINEERING
(Under AICTE Margadarshan Scheme)

CERTIFICATE OF PARTICIPATION

Certificate No.DACOE1492

This is to certify that

Suhas Prakashrao Patil

of

Arvind Gavali College of Engineering Satara

has attended a one day online webinar on *"Career Prospects in Mechanical Engineering after Covid -19 "* on Saturday, 30th May 2020 from 10.00 am to 5.00 pm.

Prof. S.J. Mulani	Prof. (Dr.) R. K. Shrivastava	Prof. (Dr.) A.M. Mulla	Prof. (Dr.) A.T. Pise
HoD, Mechanical Engg.,	HoD, Mechanical Engg.,	Principal	Principal
DACOE, Karad	GCE, Karad	DACOE, Karad	GCE, Karad

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr. / Ms. / Dr. **SUHAS PRAKASHRAO PATIL** of **ARVIND GAVALI COLLEGE OF ENGINEERING SATARA** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-01325

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr. / Ms. / Dr. ***SURAJ SAJJAN GHADAGE*** of ***ARVIND GAVALI COLLEGE OF ENGINEERING SATARA*** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-01247

V.K.R, V.N.B & A.G.K COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)
Eluru Road, Gudivada, Krishna District, Andhra Pradesh-521301
Phone: 08674-242188, Email: vkrvnbengineering@gmail.com, Website: http://www.vkrvnbcoe.org

DEPARTMENT OF MECHANICAL ENGINEERING

&

DEPARTMENT OF CIVIL ENGINEERING

Certificate of Participation

This is to certify that

Mr. Suraj Sajjan Ghadage

From

Arvind Gavali College of Engineering Satara

has participated in **"Five Day Online Faculty Development Program on OpenFOAM"** organized by Departments of Mechanical & Civil Engineering jointly in association with Spoken Tutorials, IIT Bombay from 29/06/2020 to 03/07/2020.

ID:VKRFOAM228

Convener & HOD-Mech	Convener & HOD-Civil	Director	Principal
(Mr. G.V.N.B. Prabhakar)	(Mr. K. Durga Prasad)	(Sri. B. Kalyan Kumar)	(Dr. S.H.V. Prasada Rao)

in association with MHRD INSTITUTION'S INNOVATION COUNCIL IQAC SUSTAINABLE DEVELOPMENT GOALS 4 QUALITY EDUCATION

Sri SAI RAM INSTITUTE OF TECHNOLOGY
An Autonomous Institutions
Sai Leo Nagar, West Tambaram, Chennai - 44,
www.sairamgroup.in

Certificate of Participation

This is to certify that Mr. / Ms. / Dr **SURAJ SAJJAN GHADAGE**

of ARVIND GAVALI COLLEGE OF ENGINEERING SATARA

has actively participated in Seven Days **Faculty Development Program** on

" HEAT TRANSFER AND COMPUTATIONAL FLUID DYNAMICS TOWARDS INDUSTRIAL APPLICATIONS "

From 12 June 2020 to 18 June 2020 Organized by
Department of Mechanical Engineering,
Sri Sairam Institute of Technology , Chennai, Tamil Nadu.

Sairam INSTITUTIONS

NBA NATIONAL BOARD OF ACCREDITATION NAAC (A+) nirf

Dr.K.Palanikumar
Principal

MJF LN. LEO MUTHU Founder Chairman - Sairam Institutions

Sai Prakash Leo Muthu
Chief Executive Officer

ID NO: KQDFM8-CE000233

Vel Tech High Tech
Dr.Rangarajan Dr.Sakunthala Engineering College

CERTIFICATE OF PARTICIPATION

This is to certify that

Suraj Sajjan Ghadage **Assistant Professor**

from **Arvind Gavali College of Engineering Satara**

has participated in Faculty Development Programme on "CFD Simulation of Thermal Management of Batteries and Power Converters", presented by Dr. R. Thundil Karuppa Raj (Professor & Head, Department of Automotive Engineering, VIT - Vellore), organized by Department of Mechanical Engineering, Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College on 28.05.2020.

Dr. R. Anbazhagan	Dr. R. Suresh	Dr. P. Vijayasarathi	Dr. E. Kamalanaban
Asso. Professor / Mechanical	*Professor / Mechanical*	*HoD/ Mechanical*	*Principal*

Certificate No.: SZUJAY-CE000189

www.velhightech.com

Government College of Engineering, Karad
&
Rajikiya Engineering College, Azamgarh

Jointly organised

One Week Online Faculty Development Programme on

"Applications of Finite Element Analysis (FEA) and Computational Dynamics (CFD) using ANSYS"

(June 13- 17, 2020)

Sponsored by

Technical Education Quality Improved Programme (TEQIP-III)

Certificate of Participation

This is to certify that

Suraj Sajjan Ghadage

Of

Arvind Gavali College of Engineering Satara

Registration Number 1869

[illegible] participated in the web based TEQIP sponsored online Faculty Development Programme on Applications of Finite Element Analysis (FEA) and Computational Dynamics (CFD) using ANSYS held from June 13-17, 2020 hosted by Mechanical Engineering Department of Government College of Engineering Karad, Maharashtra and Rajkiya Engineering College Azamgarh, U.P., India.

Prof. Abhinandan Kumar Jha	**Dr. Ramakant Shrivastava**	**Prof. Dr. A.T. Pise**
Coordinator	Coordinator, Professor & Head,	Principal
FDP	Mechanical Engineering Department	GCE Karad

CERTIFICATE OF PARTICIPATION

This is to certify that

Mr. Arjun Arun Kadam

Has actively participated in Three days online FDP on

“Acoustics Engineering - An Effective Use of Sounds & Vibrations”

held on 27th,28th,29th May 2020

organized by

Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra

Under Twinning Activity with

Himachal Pradesh Technical University, Hamirpur, Himachal Pradesh

Uttarakhand Technical University, Dehradun, Uttarakhand

In Association with Hexagon MSC Software & TeamSpringg Engineering Solutions LLP

Mr. Vikramsinh Desai Director, TeamSpringg Engineering Solutions LLP.	Mr. Yogesh Bochare Academic & Skilling Head Hexagon MSC Software, India	Prof. Dr. Sadaiah M. HOD, Mechanical Engineering. DBATU, Lonere	Prof. Dr. S. B. Deosarkar TEQIP-III Coordinator DBATU, Lonere

KIT/CADMW/0106

KOLHAPUR INSTITUTE OF TECHNOLOGY'S COLLEGE OF ENGINEERING (AUTONOMOUS), KOLHAPUR

Kolhapur Institute of Technology's

College of Engineering (Autonomous), Kolhapur

Accredited by NAAC with CGPA 3.12

APPRECIATION CERTIFICATE

This certificate is awarded to

Mr. ARJUN ARUN KADAM

Of

Agce,Satara

for successfully completed the one week webinar on

"AUTOCAD-2D BASIC"

organised by **Department of Mechanical Engineering** during 12th-16th June 2020 with a consolidated score of 53.33%.

Prof.Mayur Bhujbal	Dr.U.S.Bhapkar	Dr.V.V.Karjinni
Course Coordinator	Head	Director
KITCOEK	Dept.of Mechanical Engineering, KITCOEK	KITCOEK

SANDIP FOUNDATION

Department of Mechanical Engineering

NBA Accredited for three years w.e.f. 2020-21

Sandip Institute of Technology & Research Centre, Nashik

NAAC 'A' Grade Accredited with CGPA 3.11

SANDIP FOUNDATION'S SITRC

CERTIFICATE OF APPRECIATION

presented to

Arjun Arun Kadam

from Sandip Institute of Technology & Research Centre for passing in quiz on "Resume Writing Techniques" organized by 'Mechanical Engineering Department, Sandip Foundation's SITRC-Nashik" on 16/05/2020 with '100%' score.

Prof. P. S. Shirsath	Prof. S. B. Hase	Prof. V. A. Shaikh	Prof. (Dr). P. R. Baviskar
Co-ordinator	Co-ordinator	Co-ordinator	HOD

5/11/2020

Dr. Babasaheb Ambedkar Technological University, Lonere

CERTIFICATE OF COMPLETION

This certificate is presented to *Arjun Arun Kadam* .....

has participated on online Quiz for awareness Programme on **COVID-19** organised by **Dr. Babasaheb Ambedkar Technological University, Lonere.**

STAY HOME, PROTECT YOURSELF & SAVE LIVES

75%

Percentile Score

Prof. S. L. Nalbalwar

H.O.D. & Dean Academics

AISSMS

INSTITUTE OF INFORMATION TECHNOLOGY

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Approved by AICTE New Delhi, Recognized by the Government of Maharashtra
and Affiliated to Savitribai Phule Pune University.
Accredited by NAAC with A grade

Internal Quality Assurance Cell

eCertificate of Participation

This certificate declares that

Arjun Arun Kadam

from Arvind Gavali College of Engineering, Satara, Satara, Maharashtra

has Successfully Completed

NAAC Awareness Quiz - 2020

on 17-5-2020, with a passing score of **100%**

IQAC

Ms. Mousami Vanjale
IQAC Coordinator

Certificate ID IQAC/0N9DR8-CE001988

Dr. P. B. Mane
Principal

AISSMS
COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

Accredited by NAAC with "A+" Grade

National Level Online Quiz on " Mechanics of Material "

CERTIFICATE OF APPRECIATION

This is to certify that, ***Arjun Arun Kadam*** *of* ***AGCE, Satara*** *, has successfully completed National level Online Quiz on* ***"Mechanics of Material"*** *organized* ***by the Department of Mechanical Engineering*** *, AISSMS College of Engineering, Pune.*

Completed on: **16-5-2020** **Percentage Score:** **93%**

Dr Priya Gajjal
Co-ordinator

Dr B D Bachchhav
HOD Mechanical

Dr D S Bormane
Principal

AISSMS COLLEGE OF ENGINEERING * PUNE *

Certificate id: **G6PO9G-CE000509**

Mahatma Education Society's

Pillai HOC College of Engineering & Technology, Rasayani

NAAC Accredited with 'A' Grade

This certificate is presented to

Arjun Arun Kadam

of **AGCE, SATARA** has successfully completed the Online Quiz On **"Basic Knowledge Of Automobile Engineering"** **with 71%**

Competition Organized By

Pillai HOC College of Engineering & Technology, Rasayani, Dist: Raigad

on **15-5-2020.**

Mr. Saurabh Sirsikar	**Dr. S.S.Pawar**	**Dr. Madhumita Chatterjee**
Coordinator	**HOD, Automobile Engg.**	**Principal**

Certificate ID: 0DQD5Q-CE000564

Jayawant Shikshan Prasarak Mandal's

JSPM Narhe Technical Campus

Department of Computer Engineering

Certificate of Appreciation

This is to certify that,

Arjun Arun Kadam

has completed the "**Faculty Awareness Program on NBA and Outcome Based Education(OBE)**" organised by JSPM Narhe Technical Campus on 2-5-2020.

Certificate Id: 8M2RWS-CE000267

This is a digital certificate and does not require signature.

Approved by : AICTE | CoA and PCI,New Delhi | Recognized by : DTE (MS), Govt. of Maharashtra
Affiliated to University of Mumbai

ANJUMAN-I-ISLAM'S
KALSEKAR TECHNICAL CAMPUS

New Panvel - 410206

SCHOOL OF ENGINEERING & TECHNOLOGY | SCHOOL OF ARCHITECTURE | SCHOOL OF PHARMACY

Certificate of Appreciation

This certificate is presented to

Mr/Ms/Mrs. Arjun Kadam

of AGCE, SATARA

For successfully completing and securing **59%** in National Level Quiz on

"Basics of Engineering Mechanics and Engineering Drawing"

Organized by Department of Mechanical Engineering during 18th -23th May 2020.

Prof. Nawaz Motiwala
Co-ordinator

Prof Saad Shaikh
Co-ordinator

Prof. Zakir Ansari
Head of Department

Dr. Abdul Razak Honnutagi
Director, AIKTC

Certificate ID : OSXGE8-CE001859

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering Yadrav- Ichalkaranji

Accredited by NAAC 'A' Grade An ISO 9001:2015 Certified Institute

NBA accredited programmes

Department of Mechanical Engineering

CERTIFICATE OF PARTICIPATION

This is to certify that

KADAM ARJUN ARUN

Arvind Gavali College Of Engineering, Satara

has actively participated in the online faculty orientation programme on "Recent Advances in Modeling and Optimization Techniques" organized by Department of Mechanical Engineering approved by ISTE ,New Delhi from 1st June to 5 th June 2020. Certificate number: LGLFMM-CE000140

Co-coordinator Coordinator HoD Principal Executive Director

Dr. Babasaheb Ambedkar Technological University, Lonere

Certificate of participation

This Certificate declares that

Mr. Arjun Arun Kadam

from Arvind Gavali College of Engineering, Satara, Maharashtra
has successfully completed

NAAC Awareness Quiz-2020

On 17-5-2020 , with passing score of 100%

Prof. S. L. Nalbalwar
Dean Academics

DQD8CE-CE000066

Certificate

OF APPRECIATION

This certificate is proudly presented to

Mr. Arjun Arun Kadam

has attend online and successfully completed

National level online quiz on

'Product Design Engineering'

organised by

YSPM's Yashoda Technical Campus,

Department of Mechanical Engineering, Satara

on date: 26-5-2020 with performance Score: 80%

Prof. Vasim Maner
Co-ordinator and HOD Mechanical Engineering Department

Dr. Mrs. R. P. Kulkarni
Principal

Certificate ID: FKGMSS-CE000965

Certificate of Participation

This is to certify that,

Mr. ARJUN ARUN KADAM

of

AGCE,Satara

has attended webinar on **"Job Opportunities in Manufacturing sector"** organised by Rajarambapu Institute of Technology, Rajaramnagar **(RIT)** on 24th June 2020.

Prof.A.M.Mulla
HOP, Mechanical - Manufacturing Engg.
RIT, Rajaramnagar

Dr. S. K. Patil
HOD, Mechanical
RIT, Rajaramnagar

Certificate ID:
HADRQQ-CE000147

(This is digital certificate and does not require signature)

G.S. Mandal's

MARATHWADA INSTITUTE OF TECHNOLOGY, AURANGABAD

Department of Mechanical Engineering

National Level Online Quiz on "Non-Traditional Machining Processes"

CERTIFICATION OF APPRECIATION

This is to Certify that Mr. Arjun Kadam of AGCE,SATARA has successfully completed National Level Online Quiz on "Non-Traditional Machining Processes" organized by the Department of Mechanical Engineering, Marathwada Institute of Technology, Aurangabad.

Date : 20-5-2020

Percentage Score : 60%

Sandeep B. Pankade	Dr. Subhash V. Lahane	Dr. Nilesh G. Patil
Co-ordinator	Head of Department	Principal

MITA-US4I9G-CE000117

AGTI'S DR. DAULATRAO AHER COLLEGE OF ENGINEERING, KARAD
AND
GOVERNMENT COLLEGE OF ENGINEERING, KARAD
DEPARTMENT OF MECHANICAL ENGINEERING
(Under AICTE Margadarshan Scheme)

CERTIFICATE OF PARTICIPATION

Certificate No.DACOE0769

This is to certify that

Arjun Arun Kadam

of

AGCE,SATARA

has attended a one day online webinar on *"Career Prospects in Mechanical Engineering after Covid -19 "* on Saturday, 30th May 2020 from 10.00 am to 5.00 pm.

Prof. S.J. Mulani	Prof. (Dr.) R. K. Shrivastava	Prof. (Dr.) A.M. Mulla	Prof. (Dr.) A.T. Pise
HoD, Mechanical Engg.,	HoD, Mechanical Engg.,	Principal	Principal
DACOE, Karad	GCE, Karad	DACOE, Karad	GCE, Karad

CERTIFICATE OF PARTICIPATION

This is to certify that

Mr. Arjun Arun Kadam

Has actively participated in Three days online FDP on

"Professional Skilling – Advance Simulation Processes & Industry Platforms"

held on 27th ,28th,29th May 2020

organized by

Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra

Under Twinning Activity with

Himachal Pradesh Technical University, Hamirpur, Himachal Pradesh

Uttarakhand Technical University, Dehradun, Uttarakhand

In Association with Hexagon MSC Software & TeamSpringg Engineering Solutions LLP

Mr. Vikramsinh Desai Director, TeamSpringg Engineering Solutions LLP.	Mr. Yogesh Bochare Academic & Skilling Head Hexagon MSC Software, India	Prof. Dr. Sadaiah M. HOD, Mechanical Engineering. DBATU, Lonere	Prof. Dr. S. B. Deosarkar TEQIP-III Coordinator DBATU, Lonere

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr./Ms./Dr. **ARJUN ARUN KADAM** of **ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE**" from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-00860

PIMPRI CHINCHWAD EDUCATION TRUST'S

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

NIGDI PUNE

CERTIFICATE OF APPRECIATION

Presented To

Mr.Ankur Vilas Kamble

Arvind Gavali College of Engineering,Satara

Noise Vibration and Harshness Webinar Series (Session 1)

Noise Attenuation Strategies

On 11th JUNE 2020

Amit Panchwadkar	Dr. P. A. Deshmukh	Dr. N. R. Deore	Dr. G .V . Parishwad
Convener	Webinar Coordinator	HOD	Principal

Certificate Number
FDTP1740275

ISTE RIT CHAPTER
(MH - 084)

RAJARAMBAPU INSTITUTE OF TECHNOLOGY

CERTIFICATE
OF PARTICIPATION

An Online One Week Faculty Development Program

Mr.Kamble Ankur Vilas

of

Arvind Gavali College of Engineering,Satara

has successfully completed an Online One Week Faculty Development Training Program on "Outcome Based Education & NBA Accreditation Process" from 04th May to 08th May 2020 jointly Organized by Department of Mechanical and Automobile Engineering , Diploma 2nd Shift of Rajarambapu Institute of Technology , Rajaramnagar.

Prof P. A. Desai	Prof A. P. Gaurvadkar	Prof R. S. Sargar	Prof V. B. Choudhari	Prof A. B. Patil	Dr. H. S. Jadhav	Dr. Mrs. S. S. Kulkarni
Coordinator	Coordinator	HOD-Automobile Engg	HOD-Mechanical Engg	Chairman,ISTE RIT Chapter	Dean Diploma	Director, RIT, Rajaramnagar

Samarth Educational Trust

Arvind Gavali College of Engineering, Satara

Certificate of Appreciation

This is to certify that,

Mr.Ankur Vilas Kamble

has participated in online Quiz ***"Awareness about NBA Accreditation and OBE"*** organized by ***AGCE Satara*** on 16 May 2020.

Mr. Vijay Kadam
Coordinator

Dr. Vilas Pharande
Principal

Mr. Nishant Gavali
Secretary

STAY HOME. STAY SAFE. SAVE LIVES.

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr. / Ms. / Dr. ***MR. ANKUR VILAS KAMBLE*** of ***ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA*** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-02436

KJEI's

K J College of Engineering and Management Research, Pune-48

TRINITY

Accredited by NAAC, Affiliated to Savitribai Phule Pune University , Approved by AICTE, DTE, Govt. of Maharashtra.
Near Khadimachine Chowk, Kondhwa Annexe, Pune 411 048, Ph: 8446021199, www.kjei.edu.in/kjcoemr

Certificate of Participation

This is to certify that

Mr.Ankur Vilas Kamble

of ***Arvind Gavali College of Engineering,Satara***

has successfully completed **National Level E-Quiz on "Brain Teaser"** *organized by*

Department of Engineering Science, K J College of Engineering and Management Research, Pune-48, conducted online on 6/27/2020

Dr. P. N. Deshmukh
FE Coordinator

Dr. Suhas S. Khot
Principal

महर्षी कर्वे
स्त्री शिक्षण
संस्था

APPROVED | DTE CODE 4304 | ACCREDITED | BUSINESS INCUBATION CENTRE | 125 Years of WOMEN EMPOWERMENT | उन्नत भारत अभियान UNNAT BHARAT ABHIYAN

Maharshi Karve Stree Shikshan Samstha's
CUMMINS COLLEGE OF ENGINEERING FOR WOMEN NAGPUR

ASM INTERNATIONAL Pune Chapter | ISHRAE Nagpur Chapter

CERTIFICATE OF PARTICIPATION

This is to certify that

ANAND SUDHIR SHIVADE

Of ARVIND GAVALI COLLEGE OF ENGINEERING SATARA

has participated in **Online Faculty Development Program** on **Renewable Energy Sources: A Way Ahead**
organised by Department of Mechanical Engineering in association with
ASM International (American Society of Materials) Pune Chapter And
ISHRAE (The Indian Society of Heating, Refrigerating and Air Conditioning Engineers) Nagpur Chapter
during 15 May 2020 to 21 May 2020.

PRASANNA MAHANKAR	MR. UDAYAN PATHAK	MR. AJAY PANDEY	DR. B. P. JOSHI
Convener, FDP	Chairman, ASM International Pune Chapter	President, ISHRAE Nagpur Chapter	Principal, CCOEW Nagpur

CUMMINS_FDP_RES20-2536

Samarth Educational Trust

Arvind Gavali College of Engineering, Satara

Certificate of Appreciation

This is to certify that,

Anand Sudhir Shivade

has participated in online Quiz ***"Awareness about NBA Accreditation and OBE"*** organized by ***AGCE Satara*** on 16 May 2020.

Mr. Vijay Kadam
Coordinator

Dr. Vilas Pharande
Principal

Mr. Nishant Gavali
Secretary

STAY HOME. STAY SAFE. SAVE LIVES.

Bharati Vidyapeeth

College of Engineering

(Permanently affiliated to Mumbai University, Approved by AICTE, New Delhi and NBA Accredited)
Sector-7, CBD, Belapur, Near Kharghar Railway Station, Navi Mumbai-400614. www.bvcoenm.edu.in

CERTIFICATE OF APPRECIATION

This certificate declares that

Mr/Mrs/Dr/Prof. **Anand Sudhir Shivade**

Of Arvind Gavali College of Engineering,Satara
has successfully completed online

Faculty Program on NBA

on 5/15/2020, with a passing score of 85%
organized by **Bharati Vidyapeeth College Of Engineering, Navi Mumbai-400614.**

Certificate ID T3IWHA-CE006709

Prof. H. B. Sale
Coordinator

Dr. S. D. Jadhav
Principal

ATHARVA COLLEGE OF ENGINEERING

(Approved by AICTE, Recognized by Government of Maharashtra & Affiliated to University of Mumbai - Estd. 1999 - 2000, NAAC Accredited 2018, Malad West, Mumbai)

MHRD'S INNOVATION CELL (GOVERNMENT OF INDIA)

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative)

CERTIFICATE OF PARTICIPATION

This certificate is presented to

Anand Sudhir Shivade

for attending **2 days webinar** on **"Startup Lifecycle and Patent Registration"** jointly organised by **ACE Innovation Cell, IPR Cell, ACE Institution Innovation Council- MHRD, ACE- Incubation Center- MSME, IEDC-DST, ACE Ember Ecell NEN, Atharva College of Engineering** held on **18th - 19th May 2020.**

MS. DEEPALI MASTE	MR. SAMUEL JACOB	DR. SHRIKANT KALLURKAR
ICell Convener	Vice Principal, Technical	Principal

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (CSE,IT, EEE,ECE & ME)

Approved by AICTE, New Delhi & Affiliated by JNTUK, Kakinada

L.B.Reddy Nagar, Mylavaram, Andhra Pradesh 521230

Certificate of Participation

Certificate ID:
0APVDK-CE000435

This is to certify that

ANAND SUDHIR SHIVADE

ASST. PROFESSOR, ARVIND GAVALI COLLEGE OF ENGINEERING SATARA

has successfully completed One Week online Faculty Development Programme on **MODELLING AND OPTIMIZATION TECHNIQUES FOR MATERIALS AND MANUFACTURING PROCESSES** from 18/05/2020 to 22/05/2020 conducted at Lakireddy Bali Reddy College of Engineering (Autonomous), Mylavaram.

Dr. K.Murahari	Mr. J.Subba Reddy	Dr. S.Pichi Reddy	Dr. K.Appa Rao
(Co-ordinator-1)	(Co-ordinator-2)	(Convenor)	(Principal)

Sinhgad Technical Education Society's,

SMT. KASHIBAI NAVALE COLLEGE OF PHARMACY

S. No. 40/4 A, Near PMC Octroi Post, Kondhwa Saswad Road, Kondhwa, Pune-411048

Accredited by NAAC

Sinhgad Institutes

Certificate of Achievement

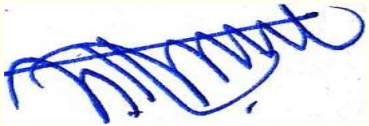
SMT. KASHIBAI NAVALE COLLEGE OF PHARMACY

This certificate is awarded to

Anand Sudhir Shivade

for participating in the "Online Workshop on Concept, Methodology & Implementation of Problem Based Learning (PBL)" on 05/05/2020

Dr. (Mrs) Jyotsana R. Madan
Co-ordinator



Dr. Sanjay D. Sawant
Principal

S. B. JAIN INSTITUTE OF TECHNOLOGY, MANAGEMENT & RESEARCH, NAGPUR

NAAC Accredited with 'A' Grade

One Week Online Faculty Development Program

On

"R"

Certificate

This is to certify that Mr. / Ms. / Prof. / Dr. **Anand Sudhir Shivade**

has successfully participated from **Arvind Gavali College of Engineering Satara**

in **One week online Faculty Development Program on "R"** organized by Department of Mechanical Engineering, S. B. Jain Institute of Technology, Management & Research, Nagpur in association with Spoken Tutorial Project, Indian Institute of Technology, Bombay from May 5th, 2020 to May 9th, 2020.

Prof. Amit Tajne
Convener
S. B. Jain Institute of Technology, Management & Research, Nagpur

Certificate No.: MJITEM-CE000127

Date: 11-5-2020

Dr. Sanjay Badjate
Organizing Chair
S. B. Jain Institute of Technology, Management & Research, Nagpur

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Vidyanagar Karad Dist.-Satara Maharashtra, PIN- 415 124.

Website: www.gcekarad.ac.in Email: principal@gcekarad.ac.in

AICTE-MARGDARSHAN SCHEME

CERTIFICATE

This is to certify that Mr. / Ms. / Dr. **ANAND SUDHIR SHIVADE** of **ARVIND GAVALI COLLEGE OF ENGINEERING SATARA** has attended one week online Faculty Development Program on "**OUTCOME BASED EDUCATION: A STEP TOWARDS EXCELLENCE"** from 11-15 May 2020 under Margdarshan Scheme of AICTE, New Delhi.

Please scan the QR code for validation this certificate.

Mr. K. K. Mate	Dr. S. S. Mulik	Dr. U. V. Patil	Dr. S. P. Deshmukh	Dr. P.M. Joshi	Dr. A. T. Pise
Coordinator, PCCOER, Pune	Coordinator, RMDSSOE, Pune.	Coordinator, GCE, Karad.	Convener, GCE, Karad.	Convener, GCE, Karad.	Principal, GCE

Your Certificate No is : OBEGCEK-00326

AISSMS
COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

Accredited by NAAC with "A+" Grade

ज्ञान-विज्ञान विमुक्तये

One Week Online Faculty Development Program on
"Promoting Quality Culture in Technical Institutions"

Certificate of Participation

This is to certify that

Anand Sudhir Shivade, Assistant Professor

from **Arvind Gavali College of Engineering Satara**

has participated in one week Online Faculty Development Program on

"Promoting Quality Culture in Technical Institutions" from 25th to 29th May 2020

Organised by Internal Quality Assurance Cell Under 'UGC Paramarsh Scheme'.

Coordinator
Dr C S Choudhari
Coordinator
Internal Quality Assurance Cell

Coordinator
Dr D G Bhalke
Head, Electronics & Telecommunication Department
Coordinator, NAAC Steering Committee

Convener
Dr D S Bormane
Principal

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering Yadrav- Ichalkaranji

Accredited by NAAC 'A' Grade An ISO 9001:2015 Certified Institute

NBA accredited programmes

Department of Mechanical Engineering

CERTIFICATE OF PARTICIPATION

This is to certify that

Anand Sudhir Shivade

Arvind Gavali College of Engineering,Satara

has actively participated in the online faculty orientation programme on "Recent Advances in Modeling and Optimization Techniques" organized by Department of Mechanical Engineering approved by ISTE ,New Delhi from 1st June to 5 th June 2020. Certificate number: LGLFMM-CE000160

Co-coordinator Coordinator HoD Principal Executive Director

Savitribai Phule Pune University

Spoken-Totorial

Bharati Vidyapeeth's College of Engineering for Women, Pune

(Dhankawadi, Pune-Satara Road, Pune-411043, Affiliated to Savitribai Phule Pune University & NAAC accredited)

Department of Computer Engineering

Certificate of Participation

This Certificate is presented to

Mr.Anand Sudhir Shivade

for successful participation in one week online Faculty Development Program on 'LATEX'

from 11 May 2020 to 15 May 2020 in association with IIT Bombay, Spoken-Tutorial

Co-coordinator	Co-coordinator	Coordinator	Convener
Prof.K.D.Yesugade	Prof.K.S.Warke	Prof. D.D.Pukale	Prof. Dr. S.R.Patil
Assistant Professor	Assistant Professor	HOD	Principal

Marathwada Mitramandal's
Institute of Technology (MMIT) Lohgaon
Website-mmit.edu.in

"येथे बहुतांचे हित"

ACCREDITED WITH GRADE A NAAC

Participation Certificate

This participation certificate is proudly presented to .

Pratik Manohar Tambe

Who has participated and passed in Online E-Quiz Program on "**Laplace Transform**" organized by Department of Mathematics (16.05.2020)in Marathwada Mitra Mandal Institute of Technology, Lohgaon, Pune.

Dr. Amita Pal
COORDINATOR

Dr. Umesh Moharil
HOD

Prof.Dr.R.V.Bhortake
PRINCIPAL

SAMARTH EDUCATIONAL TRUST

ARVIND GAVALI COLLEGE OF ENGINEERING, SATARA

UBA and NSS Committee Jointly Organized

"COVID-19 Pandemic Awareness Program"

Certificate

This is to certify that

Pratik Manohar Tambe

has actively participated and completed

"COVID-19 Pandemic Awareness Program" on 5/4/2020 22:10:18

with Score 80 / 100

Mr.Vijay Barkade	Mr.Ankur Kamble	Dr.Vilas Pharande	Mr.Nishant Gavali
(UBA Coordinator)	**(NSS Coordinator)**	**(Principal)**	**(Secretary)**

AISSMS
COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

Accredited by NAAC with "A+" Grade

National Level Online Quiz on " Mechanical System Design (MSD)"

CERTIFICATE OF APPRECIATION

This is to certify that, ***Pratik Manohar Tambe****of* ***Arvind Gavali College of Engineering Satara Maharashtra India****, has successfully completed National level Online Quiz on* ***"Mechanical System Design (MSD)"*** *organized* ***by the Department of Mechanical Engineering*** *, AISSMS College of Engineering, Pune.*

Completed on: **16-5-2020**

Percentage Score: **55%**

Mr S V Vadgeri	Dr B D Bachchhav	Dr D S Bormane
Quiz Coordinator	HOD Mechanical	Principal

Certificate id: **PRDHXM-CE000992**

Samarth Educational Trust

Arvind Gavali College of Engineering, Satara

Certificate of Appreciation

This is to certify that,

Pratik Manohar Tambe

has participated in online Quiz ***"Awareness about NBA Accreditation and OBE"*** organized by ***AGCE Satara*** on 16 May 2020.

Mr. Vijay Kadam
Coordinator

Dr. Vilas Pharande
Principal

Mr. Nishant Gavali
Secretary

STAY HOME. STAY SAFE. SAVE LIVES.

Shree Rahul Education Society's (Regd.)
SHREE L. R. TIWARI COLLEGE OF ENGINEERING
Kanakia Park, Near Commissioner's Bungalow, Mira Road (East), Thane 401107, Maharashtra
(Approved by AICTE, Govt. of Maharashtra & Affiliated to University of Mumbai)
NAAC Accredited | ISO 9001:2015 Certified
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Department Of Mechanical Engineering

Organised

National Level Online Quiz

Certificate of Participation

This Certificate is presented to Mr/Ms/Mrs **Pratik Manohar Tambe** of **Arvind Gavali College of Engineering Satara** for participating in quiz on ***"Basics Of Mechanical Engineering"*** Attempted on 5/17/2020

(Digital Signature)

Prof. Dhiraj R. Singh
HOD , Mechanical Engg. Dept , Shree L.R Tiwari College of Engineering

(Digital Signature)

Dr. S. Ram Reddy
Principal , Shree L.R Tiwari College of Engineering

(Digital Signature)

Shree Rahul L Tiwari
SECRETARY, RAHUL EDUCATION SOCIETY

QHXMA0-CE001988

Dr. Babasaheb Ambedkar Technological University, Lonere

Certificate of participation

This Certificate declares that

Pratik Manohar Tambe

from Arvind Gavali college of Engineering Satara Maharashtra India, Maharashtra

has successfully completed

NAAC Awareness Quiz-2020

On 17-5-2020 , with passing score of 100%

Prof. S. L. Nalbalwar
Dean Academics

DQD8CE-CE000154