BMS Institute of Technology and Management

Avalahalli, Yelahanka, Bengaluru-560 064

DEPARTMENT OF MCA

"SAMSHODHANA"

RESEARCH COMPENDIUM

Volume-8, August-2020 to July-2021

"Research is to see what everybody else has seen,
and to think what nobody else has thought" ***-Albert Szent Gyorgyi***

Editorial Committee

BMS Institute of Technology and Management

Avalahalli, Yelahanka, Bengaluru – 560 064.

Department of Master of Computer Applications

Vision

To develop quality professionals in Computer Applications who can provide sustainable solutions to the societal and industrial needs

Mission

Facilitate effective learning environment through quality education, state-of-the-art facilities, and orientation towards research and entrepreneurial skills

Programme Educational Objectives (PEOs)

PEO1: Develop innovative IT applications to meet industrial and societal needs

PEO2: Adapt themselves to the changing IT requirements through lifelong learning

PEO3: Exhibit leadership skills and advance in their chosen career

Programme Outcomes (POs)

1. Apply knowledge of computing fundamentals, computing specialization, mathematics and domain knowledge to provide IT solutions
2. Identify, analyse and solve IT problems using fundamental principles of mathematics and computing sciences
3. Design, develop and evaluate software solutions to meet societal and environmental concerns
4. Conduct investigations of complex problems using research-based knowledge and methods to provide valid conclusions
5. Select and apply appropriate techniques and modern tools for complex computing activities
6. Understand professional ethics, cyber regulations and responsibilities
7. Involve in life-long learning for continual development as an IT professional
8. Apply and demonstrate computing and management principles to manage projects in multidisciplinary environments by involving in different roles
9. Comprehend and write effective reports and make quality presentations
10. Understand the impact of IT solutions on socio-environmental issues
11. Work collaboratively as a member or leader in multidisciplinary teams
12. Identify potential business opportunities and innovate to create value for the society and seize that opportunity

BMS Institute of Technology and Management

Avalahalli, Yelahanka, Bengaluru – 560064

Department of Master of Computer Applications

(Accredited by the National Board of Accreditation, New Delhi)

The MCA program is intended to provide a modern industry-oriented education in applied computer science, thereby focusing on providing a sound theoretical background as well as good practical exposure to students in the relevant areas.

The MCA Department was established in the year 2003 with an approved intake of 60 students with an excellent Library and Laboratory facilities. It has 11 qualified, experienced and dedicated teaching staff (04 Ph.D. holders and 07 are pursuing Ph.D.) and 2 technical staff creating an amicable teaching and learning environment. The faculty of the dept. have executed their responsibilities as coordinators/ members of the BOS/BOE in VTU, other universities and Autonomous institutions as well as editorial board members / reviewers of international journals. The department has an aggregate of VTU examination result of nearly 90%, secured **11 VTU Ranks** and placement of nearly 90% since its inception. The faculty members are involved in an array of research interests such as Wireless Networks (Cognitive, Ad-hoc and Sensor networks), Network security, Cloud Computing, E-Commerce, Data Science and Digital Image Processing among others.

The Department has organized series of Technical/Expert Talks, Workshops, Industrial Visits, Alumni Interactions, Parent-teachers Meetings, Project Based Learning Evaluation/Exhibition and Technical Competitions to enrich the students from different perspectives and weekly counselling through effective proctoring system to support slow learners and boost quick learners.

Faculty and Technical Staff

The Department of MCA is having highly qualified and well trained faculty members who strive to impart knowledge to the students who join MCA. Under the leadership of Dr. P. Ganesh, Associate Professor and HoD, the department is growing step by step with his vast experience and enthusiasm. The staff and students are performing well in academics, cultural and sports activities throughout the year. Below is the list of faculty members and support staff with their qualification and other details.

Sl No	Name of the staff member	Qualification	Designation	Research Area
1	Dr. P. Ganesh	MCA, Ph.D	Associate Professor & HOD	Cloud Computing
2	Dr. Aparna K.	MCA, M.Phil, Ph.D	Associate Professor	Data Mining
3	Dr. Nagabhushan S.V.	MCA, Ph.D	Assistant Professor	E-Commerce Modelling & Software Engineering.
4	Mr. Dwarakanath G.V.	MCA	Assistant Professor	Computer Networks
5	Mr. Shivakumara T.	MCA	Assistant Professor	Information & Network Security, Database
6	Mrs. Reshma C.R.	MCA	Assistant Professor	Cognitive Radio Networks
7	Mrs. Drakshaveni G.	MCA, M.Tech	Assistant Professor	Digital Image Processing
8	Mrs. Nirupama B.K.	MCA	Assistant Professor	Computer Networks
9	Mrs. M. Sridevi	MCA	Assistant Professor	Social Media Data Analytics
10	Mr. Venkatesh A.	MCA	Assistant Professor	Sensor Networks
11	Dr. P. Sudarsanam	MCA, M.Tech, Ph.D	Assistant Professor	Grid Computing
Technical Staff				
1	Mr. Shashikiran J.S.	Diploma CSE	Instructor	Computer Networks
2	Mr. Murulidhara K.N.	Diploma CSE	Asst. Instructor	Computer Networks (LAN & Wi-Fi), Firewall, Router

Research and Development Centre - MCA
Affiliated to VTU

Name of the Research Supervisors:

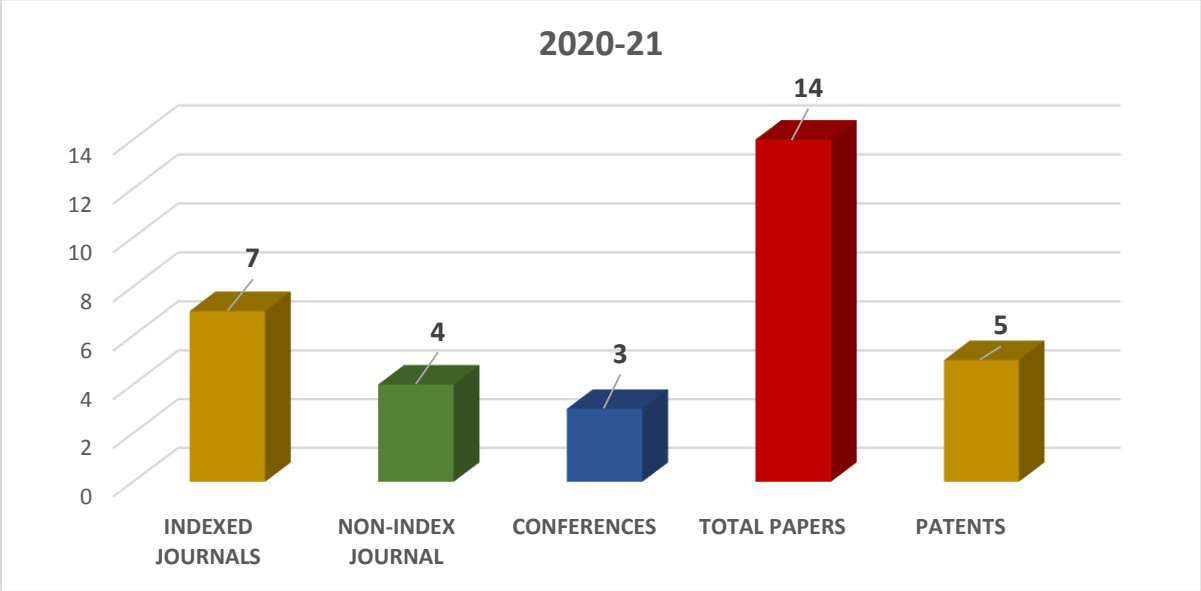
1. Dr. Arunkumar B.R.
2. Dr. Aparna K.
3. Dr. Nagabhushan S.V.

Department	MCA		
Year of Approval	2016-17		
Number of Research Supervisors	3		
Number of Research Scholars	4		
Status of Research Work	**Registered**	**Coursework Completed**	**CV Completed**
	4	0	3

Sl No	Research Scholar	Name of Guide	Year of Registration	Status	Research Publications
1	Komala R	Dr. Arunkumar B R	2013	Pre-Ph.D. Completed	Indexed - 0 Non Indexed - 2
2	M.Sridevi	Dr. Arunkumar B R	2015	Pre-Ph.D. Completed	Indexed -3 Non Indexed - 8
3	Reshma C R	Dr. Arunkumar B R	2015	Pre-Ph.D. Completed	Indexed -1 Non Indexed - 3
4	Vinod B Maniyat	Dr. Arunkumar B R	2018	Course work in progress	0

Research Publication Summary:

Research papers published/ presented by faculty in various Indexed & non indexed International Journals, Book chapters & International conferences.



Research papers published in Indexed Journal:

Sl No	Paper Title & Source	Author(s)	Page No.
1	**"Method of Designing and Implementing Outcome-Based Learning in Value Added Courses for Contemporary Skills which Enhances the Program Outcomes"** **SOURCE:** Journal of Engineering Education Transformations, Volume 34, No. 2, October 2020, ISSN 2349-2473, eISSN 2394-1707.	Dr. Arunkumar B R	1-14
2	**"Opinion based Recommendation System using Sentimental Analysis"** **SOURCE:** International Journal of Advanced Science and Technology, Vol. 29, No. 03, (2020), pp. 12657 – 12667. ISSN: 2005-4238 (Print), ISSN: 2207-6360 (Online) Scopus Indexed	Dr. Aparna K	15-25
3	**"Intrusion prediction and detection using support vector machine (SVM) and artificial neural network (ANN)"** **SOURCE:** European Journal of Molecular & Clinical Medicine, ISSN 2515-8260 Volume 7, Issue 08, December 2020, pp: 5459-5466	Mrs. Shwetha MS Mr. Muneshwara M S Dr. Chethan A S Mr. Shivakumara T Dr. Anil G N	26-33
4	**"Security Threat Identification and Prevention among Secondary Users in Cognitive Radio Networks"** **SOURCE:** IJCSNS International Journal of Computer Science and Network Security, Vol.21 No.5, May 2021.	Mrs. Reshma CR Dr. Arunkumar BR	34-40

Sl No	Paper Title & Source	Author(s)	Page No.
5	**"Naïve Bayes Filter for Communication & Enhancing Semantic in Email"** **SOURCE:** International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-9 Issue-4, November 2020.	Mr. Mariyan Richard A Dr. Prasad Naik Mr. Suhas A Mrs. Drakshaveni G	41-47
6	**"Ultrasound and thermal image enhancement technique using convolution neural network"** **SOURCE:** International Journal of Advanced Research in Engineering and Technology (IJARET) Volume 11, Issue 8, August 2020, pp. 769-781, DOI: 10.34218/IJARET.11.8.2020.075 Scopus Indexed	Mrs. Drakshaveni G Dr. Prasad Naik Hansavath	48-60
7	**"A framework for performance evaluation of machine learning techniques to predict the decision to choose palliative care in advanced stages of alzheimer's disease"** **SOURCE:** Indian Journal of Computer Science and Engineering (IJCSE), DOI : 10.21817/indjcse/2021/v12i1/211201140, Vol. 12 No. 1, Jan-Feb 2021 e-ISSN : 0976-5166 p-ISSN : 2231-3850	Mrs. M Sridevi Dr. Arunkumar BR	61-72

Research papers published in Non-Index Journal:

Sl No	Paper Title & Source	Author(s)	Page No.
1	**"Cyber World"** **SOURCE:** Indian Journal of Natural Sciences, Vol.12, Issue 66, June 2021, ISSN: 0976 – 0997	Mrs. Drakshaveni G Ms. Preethi A N	73-79
2	**"Mobile App for Accident Detection to provide Medical Aid"** **SOURCE:** Learning and Analytics in Intelligent Systems, Vol. 21, pp: 269-284, April 2021, **DOI: https://doi.org/10.1007/978-3-030-65407-8_23**	Mrs. Nirupama B K Dr. Niranjanamurthy Ms. Asha H	80-95
3	"**Using Video conference Applications to Conduct Interviews during Covid-19 Pandemic"** **SOURCE:** International Journal of Solid State Technology, Volume 63, Issue 5, ISSN 0038-111X, October 2020.	Mr. Venkatesh A Mr. Niranjanamurthy Mr. M Dayananda P Ms. Amulya M P	96-104
4	**Learning of advanced telecommunication computing architecture (ATCA) – based Femto gateway framework** **SOURCE:** Expert Clouds & Applications PP375-392, 7-2021, DOI https://doi.org/10.1007/978-981-16-2126-0_32, Print ISBN 978-981-16-2125-3 Online ISBN 978-981-16-2126-0	Dr. P Sudarsanam Mr. GV Dwarakanath Mr. Anand R Mr. Hecate Shah Ms. Jayashree CS	105-135

Research papers presented in the Conference:

Sl No	Paper Title & Source	Author(s)	Page No.
1	**Advanced Wireless techniques to avoid accidents on roads through wearing Smart helmet** **SOURCE:** Fifth International Conference on Intelligent Computing and Control Systems (ICICCS 2021) IEEE Xplore Part Number: CFP21K74-ART; ISBN: 978-0-7381-1327-2 May-2021 PP 258-264	Mr. Muneshwara M S Mr. Shivakumara T Dr. Chethan A. S Mr. Anand R Mrs. Swetha M S	136-142
2	**Fault Tolerant Cluster Head Selection Using Game Theory Approach in Wireless Sensor Network** **SOURCE:** International conference on Pervasive Computing and Social Networking (ICPCSN 2021), Narasu's Sarathy Institute of Technology, Salem, India. PP1-17	Mr. Anand R Dr. P. Sudarsanam Mr. Manoj Challa	143-159
3	**"Resilience Test case Automation for LTE Femtocell Networks"** **SOURCE:** Proceedings of the Fifth International Conference on Intelligent Computing and Control Systems (ICICCS 2021), IEEE Xplore Part Number: CFP21K74-ART; ISBN: 978-0-7381-1327-2.	Dr. P. Sudarsanam Mr. Anand R Mr. Sumanta Banerjee Mr. Hemanth R	160-166

Patents by MCA Faculty:

Sl No	Patent Details	Inventors	Page No.
1	**COVID-19 Thermal screening using smart helmet** Category: Publication Date: 11/9/2020	Mr. Dwarakanath GV Mr. Bhanu Prakash R Mr. Siddiq Iqbal Mrs.Vishakha Yadav Dr. P Ganesh Mr. Saneesh Cleatus T	167
2	**Catastrophe detection and Smart rescue system utilizing android smart phone with real time location tracking** Category: Publication Date: 20/11/2020	Dr. P Ganesh Mr. Dwarakanath GV Mrs.Vishakha Yadav Mr. Bhanu Prakash R Mr. Siddiq Iqbal Mr. Saneesh Cleatus T	168
3	**AI and IoT based dairy farm with high-quality milk productivity** Category: Publication Date: 16/7/2021	Dr. Vinayendra Mani Tripathi Dr. Raghvendra Subramanya Dr.P.Ganapathi Dr. Ganesh.P Dr. Chandragowda M Mr.Syed Mahaboob Dr. Ambica Prakash Mani Mr Nishant Chaturvedi Mrs.Manisha Sarwaliya Mrs.P Ajitha Mr. Vasudendra H K Mr Bharath M	169

Sl No	Patent Details	Inventors	Page No.
4	**Prevent the sensitive data leakage in rest** Category: Computer Science Published date: 18/9/2020	Mr. Shivakumara T Dr. Rajshekhar M Patil Dr. Shantakumar Patil Dr. Premjyothi Patil Ms. Nagashree N	170
5	**Smart wireless charging system for IOT devices in home automation** Category: Electrical Published date: 7/5/2021	Dr N P G Bhavani Mr. T CH Anil Kumar Mr. Haqqani Arshad Dr. Prathik Jain S Prof. Prerana Dr. Shantharam Nayak Drakshaveni G Vasanthamma H Shahida begum Manjula S Devargaon Dr. Kirankumar Y Bendigeri Dr. Santosh B. Kumbalavati	171

Consultancy work taken up by MCA faculty:

Sl No	Consultancy Details	Name of the Faculty
1	ILT Program on "Mathematics for Data Science" CTEA, L&T, Mumbai 8th to 12th Feb 2021, Fund: Rs.22500.00	Mrs. M Sridevi
2	Webinar on "Monetization of Data using Data Science Techniques" CTEA, L&T, Mumbai 28th Jul, 2021, Fund: Rs.4000.00	Mrs. M Sridevi

Research papers accepted in 2021:

Sl No	Paper Title	Name of the Faculty
1	**"A Framework for Analysing Social Media and Digital Data by Applying Machine Learning Techniques for Pandemic Management"** Advances in Data Science and Analytics: Concept and Paradigm Date of acceptance: 8th June, 2021	Mrs. M Sridevi
2	**"Fault Tolerant Cluster Head Selection using Game Theory Approach in Wireless Sensor Network"** at the International Conference on Pervasive Computing and Social Networking(ICPCSN-2021) organized by Narasu's Sarathy Institute of Technology, Salam TN, India on the 19th 20th of March 2021.(will be published in Springer) ,ISSN:2367-3370	Anand R, P.Sudarsanam, Monoj Challa
3	**"IOT Based Manhole Cover Management"** in the International Conference on Recent Trends in Electrical, Electronics and Computer Engineering for Environmental and Sustainable Development (ICRTEEC), Reva University held on the 22nd and 23rd of July 2021	Dwarakanath GV, P.Sudarsanam, Bhanuprakash R, Tanuj S, kushlappa Anthima Yadav
4	**"Smart test methodology for evaluating cognitive radio systems"** in Studies in Computational Intelligence(SCI) springer series ISSN: 1860-949X	Mrs. Drakshaveni G

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Volume 34 , No. 2, October 2020, ISSN 2349-2473, eISSN 2394-1707

Method of Designing and Implementing Outcome-Based Learning in Value Added Courses for Contemporary Skills which Enhances the Program Outcomes

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Abstract: The acceptance of outcome-based education (OBE) is increasing since the 1980s across different countries in the world. Implementation of OBE is essential right from primary education to postgraduate courses and even in research programs since the primary focus is on outcomes that are learner centric.

This paper analyses the OBE curriculum design, it reflects on the method of designing value-added courses (VAC) and its effectiveness. It is found that VACs are instrumental in reducing the curriculum gaps to attain program outcomes (POs) of any given curriculum along with targeted skills. This work demonstrates the curriculum gap analysis, determines sample of learners acquiring cognitive skills in randomly selected courses, presents a framework for Industry-endorsed open short-term courses, and introduces new formats for documenting VACs for project-based and case study-based learning. The VACs contribute to POs by nearly 20%. It may be noted that VACs implementation enabled all POs attainment and gives no room for the curriculum gap. This paper contributes a comprehensive idea for offering several VACs that boost the achievement of POs at the expected level along with contemporary skills by considering a postgraduate degree.

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Keywords: Course-Outcomes, Value-added courses, programme-outcomes, outcome-based education

1. Introduction

The biggest challenge of twenty-first-century education is students' engagement in the continuous learning process to acquire employability and or entrepreneurial skills. To face these challenges, the education system needs a proper framework such as outcome-based education (OBE) that results in effective learning. The frameworks of such practices were made across the countries by some reliable bodies without affecting the culture of learning in their native regions. National Board of Accreditation (NBA) in India is one such body that processes, defines parameters and criteria for accreditation that are in line with the best international practices. These practices oriented to assess the outcomes of the program. To achieve these outcomes, it is necessary to design an outcome-based curriculum that enables skills development. Inputs for defining the goals related to skill developments were provided by various stakeholders viz., industry, national policies, alumni, etc. Identified skills can be incorporated as course outcomes (COs) followed by the assessment, evaluation, and adaptation processes. In the context of ever-changing technological advancement, the curriculum needs periodical revisions with adoptions of innovative thoughts. This leads to meet the expectations of skills in contemporary areas which must help in revising the pedagogy in line with an effective OBE. In par with the skill development

mission of India, youths of professional courses need to acquire skills that enable employment and entrepreneur opportunities. To provide competent professionals as per the demand, All India Council for Technical Education (AICTE) is working with an approach that is distinctive by way of a model curriculum for various disciplines. Few of the best approaches identified were self-learning content through MOOCs, training of technical teachers, student induction program, and mandatory internship for students, etc. As a part of OBE, the teaching-learning process (TLP) includes new methods such as virtual laboratories, design of experiments, developing concept applications are introduced through Information Communication Technology (ICT) platform. Some special features included in the curriculum were audit courses, open electives and dissertation.

An OBE curriculum design starts by identifying a set of courses in line with guidelines given by AICTE, UGC and any other statuary body concerning components, total no. of credits and other guidelines given by the parent universities to which an institution is affiliated. Skills of the course goals are determined by inputs of all stake holders and limited by time and resources. Each course syllabus contents maybe decided by having a discussion with different relevant stakeholders based on COs defined, followed by this, finalize the COs for each course, define module and unit objectives based on Blooms' Taxonomy, define assessment tools (test items) and instructional strategies which are also important. The design of an OBE curriculum need to consider the documents, processes, criteria and other expectations of NBA and Washington Accord. An OBE curriculum of Tier-II institutions may be designed using the following processes as shown in Figure 1.

In the case of Tier-II institutions, where POs attainment has to be achieved for the given syllabus, value-added courses (VACs) may also be considered for PO mapping. VACs or value add-ons are the ones that may play a significant role in bridging the gap by enhancing the learning and building competency. Any professional program is an edge to enter the industry/ real world to work in a particular field, it is recommended to enrich the syllabus/curriculum, TLP, assessment, and evaluation in the perspective of the domain is proposed. It is equally important to focus on acquiring non-domain skills.

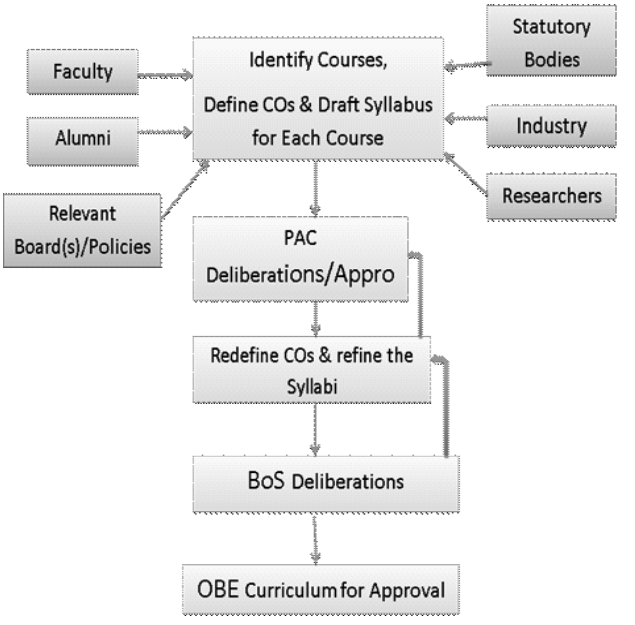

Fig. 1: Processes for designing OBE curriculum

In case of an affiliated system where the course coordinator is not able to decide the syllabus, he can add topics beyond the syllabus which are relevant for CO attainment and hence PO. In other words, the University syllabus is the only indication that gives you what is to be covered at the minimum. Whenever required, keeping University syllabus as a minimum standard, a set of value-added programs (VAP) may be added to reduce the gap but not overloading the students. It is a challenge to offer VAC for all students which are introduced in addition to the syllabus except motivating them. Every course is offered should be given an overview of the course objectives as a part highlighted rather than mentioning topics of the syllabus. In the case of VAC design, COs need to focus on specific skills required to achieve at the expected cognitive levels. It is a set of challenges a teacher has to address and mitigate them to successfully implement OBE. Therefore, teacher diplomatically, innovatively, contextually needs to adopt a customized methodology for implementation and get the learners achieve the desired skills.

Today, delivering content available in the text/reference book with a mere intention of the pouring of information does not encourage student engagement in learning. In the VAC syllabus, the links of the global/regional experts and the industries who directly or indirectly use the tools/ skillsets of the VAC Course may be included as a reference along with the textbooks, reference books, journals, and useful

websites. Therefore, the content and mode of delivery need to be improved / innovative. Instructional strategies need to facilitate learning at higher Bloom's cognitive level to acquire both domain skills, interpersonal skills with an orientation towards application to industry, society, and environment. Conceive, design, implement, and operate (CDIO) an approach is a suitable approach for Project Courses preferably when academic project outcome is a deployable product. OBE curriculum design is a continuous process with the active participation of various stakeholders such as Industry, Alumni, Academia, and in line with norms/guidelines of statutory bodies including concerned board such as CSAB (Computer Science Accreditation Board). Curriculum gap, strategies to overcome them in terms of a set of VAC and course contents are to be deliberated in meeting such as Board of Studies (BoS) or Department Advisory Board (DAB) for finalization/approval. DAB may consist of members from different domains namely experts from Industry, Research, Alumni, Parents, Senior Students, and Senior/junior professors.

COs are foundation stones for the effective OBE approach, they must be designed with at most care based on the present needs, resources (internal and external), and the available framework of time. COs need to be achievable, specific, and measurable (Arun Kumar B.R, 2019). In practice, while defining COs, non-scalable terms, and abstractive words such as understand, know, learn, appreciate, and comprehend must be avoided. Set targets for learning outcomes start with the scalable term 'Apply' which avoids the practice of evaluation using the terms 'explain, describe, and another list of common terms which are in practice in the regular exam pattern. Further, with a higher cognitive level of COs, the teacher must know the limitations in the time frame and resources. For example, 'Design a sensor for measuring bacterial infection on a tooth' is measurable but not achievable for a six-month course because of the short time and limitations of resources. Therefore, CO defined has to be verified to know whether it is achievable, specifications are given, and measurable within the scope of the program.

After designing the COs, a teacher has to identify assessment tools/methods and use improved instruction methods. While demonstrating a concept use of real-world examples will enhance learning, especially if some activity is conducted in a team. There is a need for a resource platform where real-world problems are posted and discussed. It is very essential to focus on laboratories with hands-on real or virtual experiences the student can learn. Students can be given the task of exploring the kind of Block Box Experiment where the student needs to identify through learned basic skill sets. Laboratory assignment if focused on open-ended questions enables students to come up with multiple solutions and choose the optimal one. Concerning ICT usage, for example, while drawing the graph student may be asked to do using some new modern tools. While writing project reports, students can be asked to cite all relevant required references and manage them with the help of reference management tools. Future education and industry are driven by key disruptive forces such as globalization, changing demographics, and technological advancements. Students are to be prepared to face these challenges, build competencies to provide sustainable solutions, create and utilize the new opportunity which adds value to the society, environment, and industry. The industry environment is branded by high-performance work culture, intense competition, emphasis on quality and productivity, value addition, etc. In general, the industry is not ready to train graduates with these characteristics. Therefore, to meet the industry expectation, it is necessary to design and implement curriculum and instructional processes in collaboration with industry (Palomba, C., Banta, T. 1999).

To enable the students in this direction, it is the teacher who shows the path to learn contemporary knowledge, skills to be applied to new situations, analyse information based on the research literature, common sense, law perspectives, collaborate, solve problems, and make decisions. Facilitators implement important core competencies such as collaboration, digital literacy, critical thinking, problem-solving and self- learning (Palomba, C., Banta, T. 1999). Further, by applying different cognitive levels higher-order thinking skills can be implemented in learning.

Problem-based and technology-enhanced learning to improve engineering design competencies are also best practices that foster the attainment of POs with the required graduate skills (Palomba, C., Banta, T. 1999), (Elaine H.J. Yew, Karen Goh ,2016).

As the basis for life-long learning, "information literacy can be the core literacy of the twenty-first century, a kernel for all other literacies". To achieve this, an online game-based learning approach is

introduced in (Abidin, Z., Anuar, A., Shuaib, N. H. 2009), (Elaine H.J.Yew, Karen Goh 2016). Research-based teaching and learning is another strategy that can add value. This is because research and system of higher education can underpin the national development (Abidin, Z et al 2009), (Anderson, L. W., Krathwohl, D. R. (Eds.). 2001).

OBE the curriculum in its typical sense can motivate self-learning by individual and in a team. Curriculum and instructions are to be designed to meet the stated benchmark of achievements addressing all the types of learners. A literature study carried out revives that Tier-II institutions who offered VAC are not considered as a course with COs defined and direct assessment is done for PO attainment including the works mentioned in this article reference section.

In this paper, different best-practiced VACs that add values are narrated may be adopted along with ICT tools in different programs. This leads to better OBE curriculum design, instructional strategies, and assessment. It is organized into three sections. Section-1 presents a detailed description of outcome-based curriculum design, challenges to engage the learners, setting course goals, and initiatives of statutory bodies in India. In Section-2, different VACs are explained; a new framework for industry-endorsed open short term course is introduced. Further, this section explained enhanced program attainment due to VACs. Finally, the paper offers its conclusion and recommends best-practiced VACs.

2. Value Added Courses

The general approach for identifying VACs to reduce the curriculum gap is depicted in Figure 2. The given syllabus is analysed by taking inputs from all stakeholders to find the curriculum gap. With the approval of the Program Assessment Committee (PAC) followed by Department Advisory Board (DAB), VACs are identified for implementation. PAC consists of Head of the department (HoD) as a chair, program coordinator, Module coordinator for the syllabus components as per NBA/ accreditation board. DAB consists of members from different domain namely: academia, industry, alumni, research, parents, students, program coordinator, and senior professor of the program.

Once the curriculum gap is identified, to address the gap following value add-ons with COs may be implemented in case of programs offered by Tier-II institutions. They are Expert Talks, MOOCs, partial delivery of classes for a specific course and evaluation by industry experts, VACs with specific skills focus Industrial lab establishment to partially/completely address contemporary topics and motivate the students, "Focused seminar series" by students which focuses on society /industry and environment issues Arun Kumar B.R (2019), Arun Kumar B.R (2018). Abidin, Z., Anuar, A., Shuaib, N. H. (2009). Virtual industry laboratories may be established online and its sessions may be conducted jointly with industry experts. Open-ended questions as an extension of regular laboratory experiments defined by the university will enable learners to attain higher cognitive skills. All the above schemes are to be designed around the COs defined. Students' performance is evaluated through proper assessment tools; PO attainments are calculated through COs attainment computation.

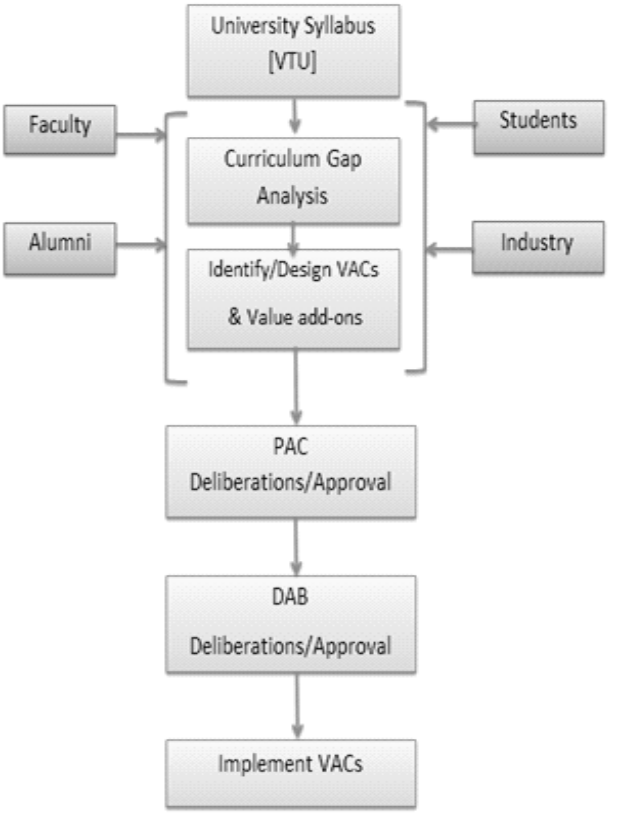

Fig. 2: Process for identifying VACs

POs were derived from NBA graduate attributes as per the SAR Jan. 2013 –old scheme of NBA for Master of Computer Applications program. The Table-1 represents the skills of the corresponding PO derived. In the next section, a new VAC is introduced.

Table 1: Skills representing POs derived from NBA graduate attributes

The graduates will have an ability to do the following with respect to providing IT solutions at the time of graduation	
PO1	Apply knowledge
PO2	Analyse / solve IT problems
PO3	Design, Develop / evaluate
PO4	Investigations of complex problems
PO5	Use techniques/ modern tools
PO6	Professional/Cyber ethics
PO7	Life-long learning
PO8	Play different roles in multidisciplinary environments
PO9	Communicate effectively
PO10	IT solutions for socio-environmental issues
PO11	Member/ leader in multidisciplinary teams.
PO12	Business opportunities/ value for the society

A. Industry endorsed Open Short-term Courses (IE-OSC) for PBL/Mini-project

In addition to above listed VACs, Open Short Term Courses for mini-project which facilities enhanced learning with specific skills designed by course coordinator with the involvement of industry experts, Alumni working in the relevant area/domain and current students, is considered as a part of OBE. This course was kept open for all discipline students. This was offered to enable learners to get the ability to demonstrate insights of contemporary topics that are interdisciplinary, and the outcome can also be product development using the CDIO approach. In the framework shown below, an attempt is made to depict the industry involvement at various stages which includes partial delivery of classes. Since it is treated as a course, COs are written in discussion with all the concerned stakeholders including Industry, Syllabus, and problem statements are defined in line with COs and the same to be documented with necessary approval. Assessment and evaluation have to be done jointly done by Course Coordinator and industry experts who involved. Example COs defined for the Course of duration 40 hours are shown in Table-2.

Industry representatives participate in syllabus design and framing problems relevant to society, environment, and industry. Internal resource persons

Table 2: COs for the open short-term course IoT& Cyber Security

CO1: Demonstrate the fundamental concepts of IoT & Cyber Security for the given problem.	PO1 PO2 PO7
CO2: Analyse potential opportunities in IoT & Cyber Security for societal and environmental needs and formulate the problems and list requirements.	PO1 PO2 PO4 PO7
CO3: Design and implement IoT / Cyber Security solutions to societal and environmental problems by developing products.	PO3 PO7 PO9
CO4. Develop the solution by applying appropriate techniques, software engineering and management principles and modern tools to meet the requirements either as an individual or by involving in a team.	PO3 PO5 PO7 PO9 PO11
CO5. Verify & validate the data and results to arrive at valid conclusions and communicate the work done effectively in terms of presentations, writing reports and research article as per the format given.	PO4 PO7 PO9

are generally assigned responsibility to take the active role in consultation with Faculty Council, industry, alumni, and inputs from HOD including Town-hall with students. Internal resource persons who are Course coordinators are responsible to write COs, discuss and design the syllabus/problem statements for projects, get the endorsement from at least any two organizations working on this domain and maintain documents.

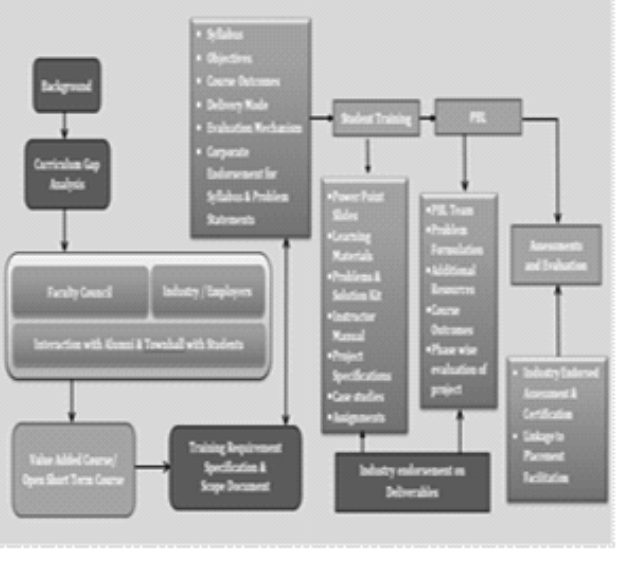

Fig. 2: Framework for designing an open short-term course endorsed by Industry experts

B. Project based Learning (PBL)

To achieve a higher cognitive level of learning PBL can be introduced as a course or as an extension of the regular course with the following plan as shown in Table 3.

Table 3 : Course Outcome with Attainment for computer Organization Course

Course Code	17MCA24	Program	MCA
Course Title	Operating Systems	Semester	2nd
Faculty Name	ABC	Academic Year	2017-18- Even Semester

Objectives of Project Based Learning (PBL):

- To improve the ability to analyze the given problem, design solution, implement and to arrive at the valid conclusions.
- To motivate self-learning.
- To be able to map the concept to programming.
- To bring awareness on integrity
- To promote teamwork with members of different backgrounds

PBL COs: At the end of the course students will be able to:

- CO1: Analyse and formulate the given problem, identify the methodology for implementation and list possible outcomes (PO1, PO2, PO7).
- CO2: Design solution to solve the given problem in terms of the design of algorithms/implementation of mechanisms (PO1, PO2, PO7)
- CO3: Implement and analyze/test the results to arrive at the valid conclusions (PO3, PO7, PO9)
- CO4: Write effective reports to make quality presentations and work in a team (PO3, PO5, PO7, PO9, PO11)
- CO5 : : Exhibit academic integrity and professional ethics followed during the project work (PO4, PO7, PO9)

Note:

1. Faculty/ student members have to discuss the selected problem and analyse its relevance in the context of the scope of competency enhancement with innovative ideas.
2. Project type may also be of intensive programming
3. A project report content can be 15 pages to be submitted along with plagiarism check report.
4. A faculty member to review the progress of the project at the end of every week.
5. The Good assignment can lead to the creation of innovative opportunity in industry/society and paper publication/patent.
6. Project complexity should be of 30 hours of work to 2nd semester and 40 hours of work to 4th-semester students.
7. Project synopsis and report are to checked in plagiarism check tool and maintain 90% uniqueness.

C. Project Work

Largely PBL is focused on the conceptual realization of a particular course in terms of project work whose complexity is less compared to Project Work. Project work is a course in the final year / 6th semester MCA where students work for the entire semester for 600 hours approximately. The project work integrated into the MCA curriculum of VTU has nearly 16%- 25% weight out of the entire curriculum.

This course may be mapped to all program outcomes (Pos). It plays a very significant role in

Table 4: COs of Project Work Course

Cos	POs
CO1: Review the existing literature to identify and formulate the problem in contemporary technologies/ issues related to society/environment which leads to the development of IT solution.	PO1, PO2, PO7
CO2: Analyse the requirements and prepare Software requirement specifications (SRS) document as per IEEE format in line with the problem defined.	PO1, PO2, PO7
CO3: Create models that are consistent with the requirements specified in the SRS.	PO3, PO7, PO9
CO4: Develop the solution by applying appropriate techniques, software engineering and management principles and modern tools to meet the requirements either as an individual or by involving in the team.	PO3,PO5, PO7,PO9, PO11
CO5: Verify & validate the data and results to arrive at valid conclusions and communicate the work done effectively in terms of presentations, writing reports and research article as per the format is given.	PO4, PO7, PO9
CO6: Follow ethical principles in all stage s of project work by avoiding plagiarism.	PO6
CO7: Articulate the impact of IT solutions developed in the project work with respect to societal, environmental and industrial issues at large.	PO10, PO12

building several engineering skills in MCA graduates. This course has been set with 7 goals mapping to all Pos.

Essentially this course needs Rubrics-based assessment/evaluation. Students carry out a project work largely in Industry in different domains under the guidance of a faculty member and industry expert(s). In general, every guide feels his student project as the best one and all students expect equal marks as a team member. But they might not have contributed/ acquired skills equally. Hence it is necessary to use the rubrics for evaluation. Rubrics will be useful even to identify the best projects. As an evaluator, it is necessary to set benchmarks for our evaluation [8].

D. Internship as a VAC

The Internship helps in getting better exposure to the Professional learning experience, COs defined for Internships may map on to both domain-dependent and independent skills of program outcomes. Internship in vacation period (summer/winter breaks) motivates students to focus more. An internship may be of different complexity and domain. It is always not necessary to do an engineering internship; it can also be just societal or environment concerned. Students may be encouraged to do an internship in some NGOs also. Generally, an internship of 600 hours is appreciated. The internship is evaluated through reports and seminars. To improve the quality of the internship, it is recommended to take feedback on student internship.

E. Case study as a value add on

Case study plan is shown in the Table 5 where case studies identified are mentioned along with objectives, and internal tests to which learners have to get prepared. Each case study may be given a source of information availability (web link/ paper reference). Each case study may be considered as a compulsory question with 20% weightage.

Table 5: Case study plan as a value addition

Course Code	17MCA24	Program	MCA
Course Title	Operating Systems	Semester	2nd
Faculty Name	ABC	Academic Year	2017-18

Sl.No.	Title	Objective	Test No.
1	A Case study of process management in Linux	Implementation of process creation and management	1
2	The Amoeba distributed OS	Key features and Design of OS for distributed systems	1
3	A Small Memory RTOS, EMERALDS	Motivation – Overview of EMERALDS – Minimizing Code Size – Minimizing Execution Overheads	2
4	Mobile Applications Development in Nigeria	To explore the Mobile Internet Value Chain	2
5	Security Enhanced Linux (SELinux)	Latest Security features in Linux OS & Its comparison with windows	3
6	Android OS security	To explore mobile application security issues	3

Table-6 given below shows the Case study question asked in the internal test. In this case, 40% of the marks are allocated to innovative and case study questions.

Table 6: Case Study Question in operating system course internal test

Example Question	CO , K-Level
Case Study Question: For the case of EMERALD OS, analyse Process Management and Memory management components. Compare them with the Linux Operating System. If EMERALD OS to be embedded in handheld device where memory is a constraint, then which OS architecture will you suggest and why?	CO6, K4 CO3, K4

COs : Students will be able to

1. Apply the fundamental concepts of the operating systems (OS) for a given problem and discuss its performance issues.

2. Apply graph theory concepts to model OS problem and give valid conclusions.

3. Analyse the given problem and solve using OS management techniques.

4. For the given case study of the operating system, apply the concepts of networking, file systems, protection and computer security and analyse its design principles.

5. Design algorithms for the given problem & compare its performance with existing ones

6. Identify the scenario of Real-time OS in the industry and write a report on the design of process/ task management, security, and protection.

K1: Remember, K2: Understand K3: Apply

K4: Analyse K5: Evaluate K6: Create

F. Certification Courses as Value ad-on

It is necessary to ensure that students stay abreast of the latest industry standards. To achieve this purpose it is required to impart professional knowledge with relevant certifications to increase their employability. Example certifications are Information Security ISO 27001, AWS Certified Cloud Practitioner, and Risk Assessment: ISO 31000, Product Management, Power BI and DevOps. If feasible certification courses may be introduced as a part of the program structure.

3. Check List for a Course Plan

Once a detailed OBE TLP plan is ready, a checklist as shown in Table-7 can be prepared and maintained in Course File [2].

4. Curriculum gap analysis

Any given curriculum if it does not contribute to at least one PO, then it can be claimed that there exists a curriculum gap. This curriculum gap can be addressed by offering a VAC. On the other hand, given the appropriate curriculum, if course coordinator does not have set the proper goals which are specific, measurable, attainable within the specific time period, then there may exist gap and hence outcomes may not be achievable. Another possibility is learner engagement if not up to the expected level, and then also CO-PO attainment may not happen. In higher

Table 7: Readiness of Lesson Plan for the academic year 2017-18 [odd]

Sl. No.	Teaching / Learning Methods	Module / Topic	Yes / No
1	Title of Innovative Teaching Method [ITM]		
2	Title of Cooperative Teaching / Learning Method [CLM]		
3	PDC by Industry Experts		
4	Project Based Learning [PBL]		
5	Problem Based Learning [PRBL]		
6	Open Ended Question		
7	Virtual Labs as applicable to the Course		
8	Case Study Questions in Specific Format		
9	Simulation Software as applicable to the Course (C)		
10	Digital space Material Upload [Lecture Notes, Case Studies, MOOC / NPTEL based assignments] (C)		
11	Tutorial / Remedial Classes as applicable		
12	Tools Introduced Beyond Syllabus		
13	Specific Strategy to get 100% POs		
14	URLs [Beyond Syllabus]		
15	Assignment K4 / K5 / K6 level		
16	Modification to lab programs		
17	Educational Videos as applicable to the Course		
18	Any others Please Specify		

Course Coordinator Signature with date

education focus on PO1-PO3 is not sufficient, higher cognitive levels, as well as all POs attainment, are necessary. It may be noted that teacher/students if the focus on understanding/ remembering skills, it is not useful for professional courses. PO starts with apply skill, COs should focus on multiple feasible skills, project-based learning, open short term course with the mini project, internship as a course, skill development workshops as a course can map to higher cognitive levels. In a non-autonomous system, when given the syllabus is not sufficient to attain all POs, to ensure PO attainment it is recommended to adopt VAP. In order to achieve PO attainment at the expected level, assuming the content of the syllabus is well designed, if the course coordinator does not set higher cognitive goals, then all POs may not be having mapping. Further, VAP with higher cognitive skills enhances the contributions to POs.

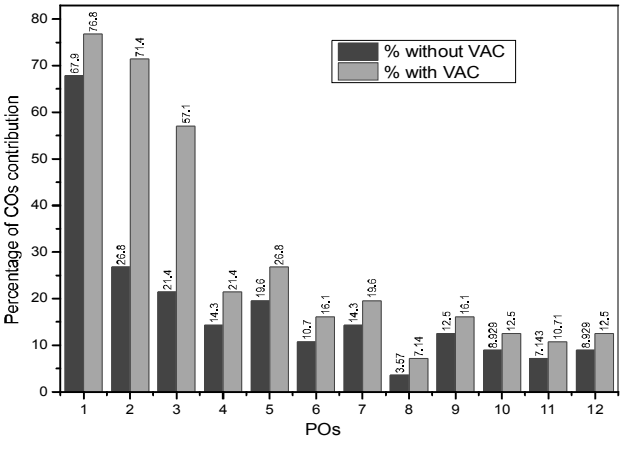

Fig. 3: Comparison of Cos contributions to POs

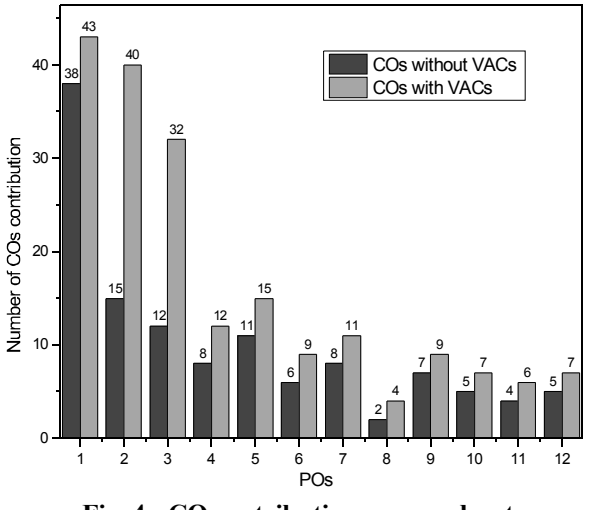

Fig. 4 : CO contributions are moderate with moderate Cos

All course outcomes defined for theory/ practical and project courses are mapped to POs. The COs contributions without VACs for the Scheme and Syllabus of 2018-21 in the academic year 2018-19 is shown in Figure-3. It can be noted that no. of courses contributing to PO attainment may be strengthened by defining 5 to 6-COs of different cognitive levels for a course of 40-50 hour syllabus. Further by adding VACs, PO mapping can be improved as shown in Figure-3. It implies that defining COs of higher cognitive level mapping to the optimal number of POs in case of regular theory/practical courses and VACs strengthens the POs attainment.

5. Sample analysis of skills acquired in theory courses.

Method of analysis:- The right data collection method is one of the major steps to provide proper insights and can avoid time-wasting misdirection. In our case, the method of data collection is quantitative, where the sampling method is the mixture of random sampling for the course selection and followed by cluster sampling for the CO-PO mapping. In random sampling, all the core subjects of the program were considered and elective subjects were considered for analysis only if those electives were opted by more than 70% of students. All the data obtained was the primary data, except in a few cases where the other teachers taught those subjects whose secondary data was drawn from the department documents. All the secondary data collected were checked and verified before considered for the analysis.

Analysis of 310 students samples data was collected which spread across three years from August 2013 to November 2017 who participated in the learning of eight theory courses. For the analysis, the target level set was 70 % and above. During this duration, 51.38%, 59.16%, and 24.44% of students have achieved in the apply, analyze, and create/design levels of the set target respectively. Table-8 indicates

Table 8 : Analysis of skills acquired in 8 different theory courses

Sl No.	Course Title	Period	Total No. of students	CO1- Apply level>= 70%		CO2 - Analyse Level>=70%		CO3 - Design Level > = 70%	
				No. of students	%	No. of students	%	No. of students	%
1	Operating System	Feb-2014 to July-2014	41	38	93	0	0	0	0
2	Java programming	Aug-2015 to Nov-2015	46	28	65	35	75	0	0
3	System Simulation	Aug-2015 to Nov-2015	40	7	17	34	86	0	0
4	Data structure using C	Aug 2016 to Dec 2016	53	43	81	38	73	23	49
5	Computer organisation	Sep-2016 to Dec-2016	53	0	0	24	45	0	0
6	Cryptograhy	Feb-2017 to May-2017	22	20	90	20	90	20	90
7	Operating System	Feb-2017 to May-2017	31	23	74	15	50	0	0
8	Intellectual Property Rights	Sep-2017 to Nov-2017	24	3	13	22	90	0	0

Table 9:Segregation of learners at different levels

August 2013 to November-2017		
Sl.No.	Total students	310
1	CO1 at Apply level	185
2	CO2 at Analyse Level	213
3	CO3 at Design Level	88

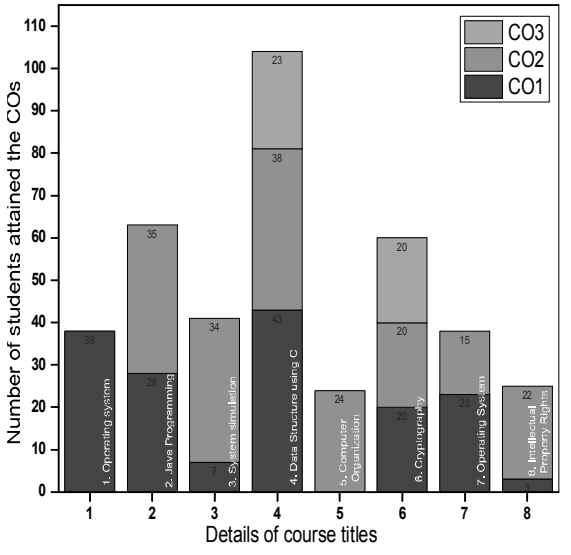

Fig. 5: Number of students attained Cos in 8 theory courses

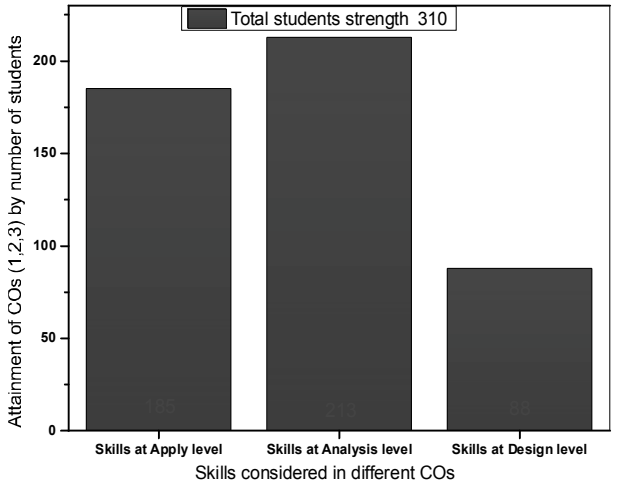

Fig. 6: Graph showing seggreagtion of learners at apply,analyse and design level

the data collected for the analysis. It was found that these courses were only theoretical based having lack of design skills. Therefore, it is necessary to implement more skills which are on design oriented.

6. Analysis of PO attainment considering VACs

Program outcomes of three batches namely 2012-15, 2013-16, and 2014-17 of the MCA program were analyzed. In each batch, there were 25 theory courses, 15 laboratory courses, and 6th-semester project work. Total data of 737 students from the academic year 2012-13 to 2016-2017 were considered. The no. of students in 2012-13, 2013-14, 2014-15, 2015-16 and 2016-17 were respectively as follows: 166, 154, 128, 154 and 135. In addition to regular courses, VACs namely Seminars, Case-Studies, PBL and IE-OSC were considered for the analysis. It is found that overall PO attainment was improved due to proper course goals defined and in line with the goals teaching-learning processes were conducted. As iterated several times VACs adopted enhanced the PO attainment as indicated in the tables below.

Correlation between course, outcome and program outcome is defined as follows. If 60% and above of the students have scored 70% and above marks then the correlation is the high level which is indicated by a numerical value 3. If 55% to 59% of the students have scored 70% and above marks then the correlation is said to be at a moderate level which is indicated by value 2. If 50% to 54% of students have scored 70% and above marks then the correlation is low which is represented by a numerical value 1. PO attainment is calculated by taking 60% of the direct assessment and 40% of the indirect assessment.

Table 10 : PO attainment for the batch 2012-15

Attainment	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
60% of Direct Assessment	1.28	1.22	1.23	0.82	1.50	1.23	1.26	0.95	1.27	0.94	0.72	0.62
40% of Indirect Assessment	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0	0	0
Final PO attainment	2.48	2.42	2.43	2.02	2.70	2.43	2.46	2.15	2.47	0.94	0.72	0.62

Table 11 : PO attainment for the batch 2013-16

Attainment	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
60% of Direct Assessment	1.28	1.25	1.25	1.13	1.22	1.23	1.06	0.95	1.28	0.94	0.72	0.62
40% of Indirect Assessment	1.2	1.2	1.2	1.2	1	1.2	1.2	0.8	1.2	0	0	0
Final PO attainment	2.48	2.45	2.45	2.33	2.22	2.43	2.26	1.75	2.48	0.94	0.72	0.62

Table 12 : PO attainment for the batch 2014-17

Attainment	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
60% of Direct Assessment	1.28	0.70	1.21	1.15	1.17	1.22	1.26	0.95	1.27	0.96	1.03	0.91
40% of Indirect Assessment	1	1	1	1	1	1.2	1	1	1.2	0	0	0
Final PO attainment	2.28	1.70	2.21	2.15	2.17	2.42	2.26	1.95	2.47	0.96	1.03	0.91

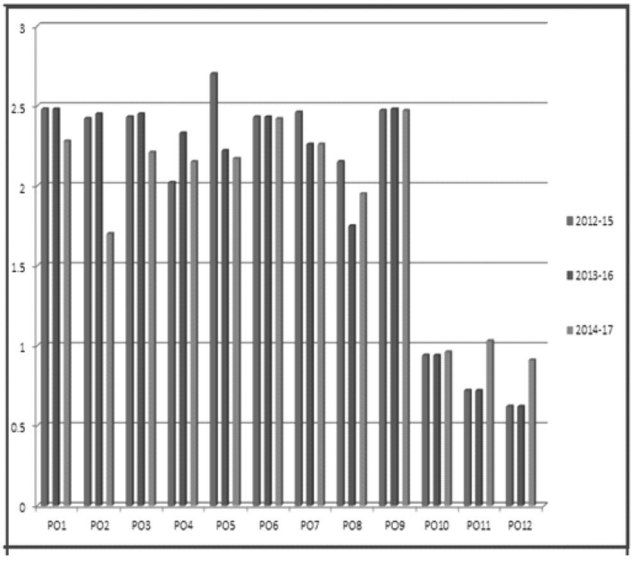

Fig. 7: Graph showing imorvements in PO attainment due to VACs, PBL,Case study etc

In other words, when the VACs are adopted with typical COs, and direct assessments were taken, CO attainments were computed and mapped to appropriate POs, then the process enabled the attainment of program outcomes as shown above. It can be noted that in 2014-17 there is a significant improvement from 0.94 to 0.96, 0.72 to 1.03 and 0.6 to 0.91 in PO10 (societal and environmental concern), PO11(individual and teamwork), PO12 (innovation and Entrepreneurship) respectively. During the analysis, it is found that PO attainment was able to achieve during the year 2014-2017 when compared to the previous two batches.

7. Conclusion

In this paper, OBE curriculum design, best practices such as partial delivery of classes by industry experts, and best-practiced VACs are introduced, a framework of IE-VAC design is presented, and course plans of different VACs/value add-ons are explained. Different formats designed help beginners to start implementing the OBE process and further gives an opportunity for experts to improve continuously. If adopted effectively VACs can reduce the curriculum gap, usage of ICT in TLP can further make OBE more meaningful and effective. The dept. of MCA, BMSIT&M, Bangalore has practiced several best practices and implemented VACs with OBE orientation which has improved POs attainment through course outcomes. The proposed VACs, value add-ons, framework, and different plans shall continuously evolve based on feedback and suggestions from various stakeholders.

Defining the COs with higher-order cognitive levels for regular theory, laboratory, VACs, project-based learning, case study, seminar, industry internship/project, technical competitions, implementing TLP strategies, taking the assessment, performing evaluation improves program outcomes attainment.

There are a total of 40 theory/practical courses and a project course in the MCA syllabus. By adding VACs namely PBL, CBL, Seminar, IE-OSC, Internship/ industrial visit, PDC by industry experts and open-ended assignments, Technical competitions for programs in Tier-II institutions can add 9-10 additional courses. The COs of VACs were defined after the curriculum gap analysis. Therefore, VACs can contribute to the enhancement of PO attainment by twenty percent. Further,5-6 COs of each course that can be mapped to different POs also improves PO attainment. It should be noted that in a semester scheme, it is challenging to implement VACs without burdening the students but engaging them in effective learning.

An outcomes-based education needs to adopt best practices, VACs that are customized and information communication technology as a tool to enhance the learning experience and move towards optimal attainment through learning outcomes. In this paper, different best practices that add values are narrated. Examples given may be adopted in different programs so that OBE curriculum design, assessment, and instructional strategies will become further effective. While designing the OBE curriculum these VACs/schemes may be considered as a part of the learning. It is the innovative strategies that can boost the successful implementation of OBE which keeps TLP evolving. It shall be noted that the evolution of OBE TLP is a continuous process.

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Opinion Based Recommendation System Using Sentimental Analysis

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Abstract

E-commerce is the modern electronic commerce that regularly customs the World Wide Web for the slightest portion of the deal's lifespan although it may also use other technologies such as e-mail. Regular e-commerce dealings comprise of purchase of music albums and the buying of online books etc. In the existing technique, a methodical statistical approach is adopted to study the recommendations using recommendation algorithms. The data exploration is based on the log data of a large e-commerce site. These data could be collected from IDs and cookies on the website, which is not a sufficient method to implement the real-time e-commerce recommender system. The proposed work collects the user rating and feedback report. Based on the feedback of the precise product the recommender system generates the product endorsement to the e-commerce users. The recommendations are made through the sentiment analysis, which takes the user feedback as the input and analyzes the data in order to predict if the input is good or bad. If the feedback is good, then the recommendation system allows the product to the recommendation list. Otherwise, the product is not added to the recommendation list.

Keywords: *E-Commerce, Recommender system, Recommendation list, User feedback, User rating*

1. Introduction

The unstable development in the aggregate of available online data and the huge number of people logging on to the Internet has formed a probable task of excess information which encumbers opportunity of the entry to entities of attention on the web. Information search engines like Google, AltaVista, and Devil-Finder have incompletely resolved the delinquent, but customization and ranking of information were lacking.

Several diverse algorithmic methods have been functional to the simple problem of building efficient and accurate RS. The initial "Recommender System (RS)" were filtering systems intended to combat information surplus in word-based domains. These frequently depended on outdated information filtering and retrieval systems. RS that integrate information recovery approaches are regularly used to fulfill short-lived desires (often initial needs) from comparatively immobile databases. For instance, demanding an endorsement for a document, arranging a sibling for a new family member etc. On the contrary, RS that integrates information-filtering methods is regularly castoff to fulfill consistent information (long-lived, often frequent, and specific) necessities from relatively constant databases in areas with a swift income or numerous additions.

Recommendation System (RS) are data (which are processed into useful knowledge) filtering methods that deals with the delinquent information surplus by filtering dynamic information portion from the huge quantity of vigorously made information conferring to

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end user's choices, or pragmatic performance of the object. RS can forecast if a specific end-user will choose an issue or not depending on the end-user's profile.

RS are valuable to both end-users and service providers. They decrease the transaction expenditures of the verdict and picking objects in an e-shopping setup. RS has also demonstrated to increase quality and the judgmental process. In an B2B setup, RS augment the returns, for the fact that they are adequate resources of retailing numerous products. Consequently, the requirement to utilize correct and effective recommendation methods within the system which will offer strong and applicable endorsements for end-users cannot be over-influenced [1].

RS usually apply methods and practices from other adjoining parts – such as Information Retrieval (IR) or Human-Computer Interaction (HCI). The progression of Data Mining (DM) is typically classified into steps such as Data Analysis and Data Pre-processing, carried out in succession with Result Interpretation. Real-life data naturally has to be pre-processed to be used by the machine learning methods in the exploration process [2].

The term DM denotes a software tool that allows the user to build models and to determine the patterns in data and in the wide-ranging field of mathematical modeling methods. In this framework of RS applications, DM is employed to label the entire group of analysis methods used to deduce recommendation procedures or build recommendation prototypes from big data sets. RS that integrate DM methods make their endorsements using knowledge obtained from the elements of users and actions. These methods regularly depend on the growth of user profiles which can be tenacious (based on demographic or item "consumption" history data), transient (based on the activities through the current period), or both. These algorithms comprise the group of connotation rules, classification techniques, clustering, and the development of resemblance graphs through methods such as Horting.

Classifiers are wide-ranging computational prototypes for conveying a class to an input. The inputs generally may be paths of topographies for the objects categorized or information about connections among the elements. It is basically a domain-specific arrangement authorized for security checks, agree/disagree for credit requests, non-benign/benign for tumor identification etc. The classifier uses the facts about the product and the client as the input to have the output class signify how intensely to endorse the item to the client /customer [3]. Classifiers could be pragmatic using numerous diverse machine-learning policies comprising of rule induction, Bayesian networks, and neural networks. In every case, the classifier is proficient in utilizing a training set in which pounded truth classifications are obtainable. It can further be pragmatic to categorize new objects for which the pounded truths are not attainable. The ensuing pounded revelations turn into available; the classifier may reinstruct over time.

The proposed work has the following contributions:

•To provide an efficient recommender system
•To offer a recommender system based on user feedback
•To upsurge the recommendation quality through sentiment analysis
•To upsurge the purchasing rate of e-commerce business.

2. Related Works

RS is well established as a decision building approach for end-users considered with intricate information surroundings. Also, RS is distinct from the view of E-commerce as a means that supports the users in searching through archives of acquaintance connected to users' interest and preference [4]. RS is detached as a way of supporting and enhancing the social method of utilizing others' endorsements to mark selections whenever adequate personal association or involvement in replacements is not available [5].

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RS handle the delinquent excess of information that customers typically encounter by offering them with service recommendations, special and personalized content. Of late, numerous methods for structured RS have been implemented, which can be used for various filtering methods such as content-based or hybrid filtering, exploit collaborative filtering etc [6].

The system developed an endorsement method to solve several issues and sparsity. They integrated the supplementary information from the customers and social network. The semantic area information is used for the endorsement precision and attention [7].

The collaborative filtering method is the utmost employed and most matured method that endorses objects by recognizing other users with related taste; it utilizes their estimation of commendable objects to the active customer [8]. Collaborative RS has been employed in diverse application regions. Group-Lens is a news-based design that engages joint methods in assisting users to search documents from huge news database [9].

Some of the sources that are very effective in obtaining useful recommendations include evidence on interaction data such as social contacts, implicit remarks, clicking on various links, interaction record etc. A thorough investigation has led to prevailing methods that have engaged CF to realize the applications of responses received from users, Data mining and AI (Artificial Intelligence) methods on CF recommendation systems by going through the articles that have been published and to provide the researcher and practitioner community with more insight and fore-thought for CR-RF. Moreover, the study provides a complete literature between the periods 2010-2016 encompassing 36 journals and proposes a classification scheme of recommendation databases, feedback received from users' activities and AI and DM methods to categorize the articles that are published. [9].

Clustering bands are used for Clustering Features (CF) and content-based endorsement approaches. Self-Organizing Maps (SOM) and K-Means were used for the task of clustering. MovieLens dataset was employed for their try-outs and it was shown that the groups formed by the clustering methods did perform better than the recommendation systems which do not rest on collaborative learning [10].

One of the online information filtering technique dealing with social media is Ringo that customs collective filtering to form profile of users depending on their scores on albums related to music. Amazon customizes subject variation algorithms to expand its endorsement. The system uses a concerted filtering procedure to address the scalability problem by creating a matrix of same items offline over the usage of the item-to-item table. The process further suggests additional items which are similar based on the users' buying history [11]. Content-based filtering methods typically depend on their forecasts on user's data, and they overlook aids from other customers as with the situation of common methods [12].

Several other methods that practice content-based filtering are used to aid users to determine the information obtained on the Internet [13]. The method brands use of a UI which supports end-users in surfing the Internet; it is capable of tracking the surfing pattern of an end-user to forecast the web-pages that these users may be fascinated in [14]. Consider a smart agent which tries to foresee the web pages that will catch the attention of a user by implementing a naive Bayesian classifier. The agent permits a user to deliver training occurrences by ranking each of the unique pages as either hot or cold [15].

3. Methodology

In the proposed method, RS is employed to get the feedback of the specific product. RS generates the product references to the e-commerce users. The recommendations are made

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through the sentiment analysis, which takes user feedback as the input and then investigates the data to predict if the input is good or bad. If the feedback is good, then the recommendation system allows the product to the recommendation list. Otherwise, the product is not allowed to the recommendation list. The figure 1 shows the architecture of a recommender system.

3.1. Information Collection Stage

In this stage, pertinent information of users is gathered to produce the model and a user profile to forecast the tasks including user's attribute and behavior. An endorsement agent cannot operate precisely until the user or client's profile has been well built. The scheme wants to know up to the maximum extent from the user to give sensible recommendation or references right from the inception.

RS depends on various kinds of input, for instance, the most suitable excellent clear feedback, which comprises of precise input by end-users concerning their liking in the object. This data involves learning styles, thinking skills, intellectual abilities and communication with the system [16]. The end-user profile is typically utilized to obtain the required data to figure up the prototype of the end-user. Therefore, a user profile defines a simple user prototype. The accomplishment of any RS is mainly based on its capability to denote the end-user's present interests. Precise prototypes are vital for attaining accurate and relevant endorsements from several forecast methods.

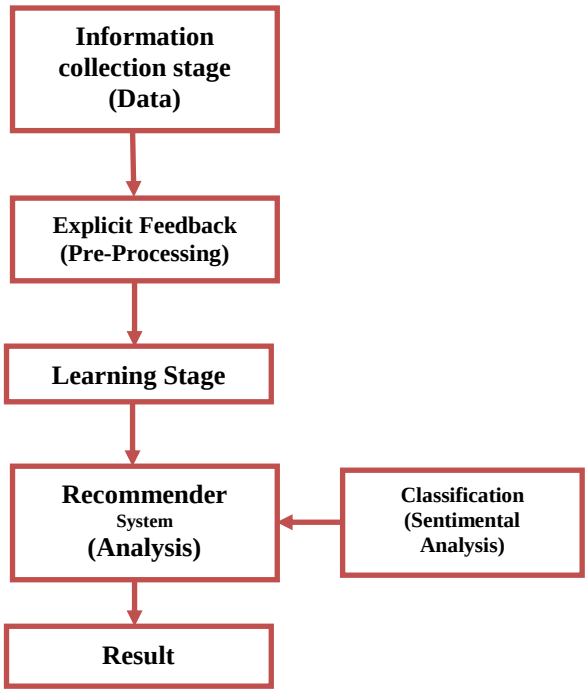

Figure 1. Architecture Diagram of a Recommender System

3.2. Explicit Feedback

The method typically stimulates the user over the system interface to offer rankings for objects to build and enhance the prototype. The precision of reference is based on the number of scores given by the end-user. The only inadequacy of this process is, it needs an initiation from the end-users, and moreover, end-users are not continuously prepared to provide sufficient information. Although public feedback entails extra effort from the user, it is still observed as giving more consistent data, as it does not encompass mining priorities from activities, and it also offers clarity into the recommendation method that

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moves towards providing an apparently higher recommendation excellence and additional guarantee in the endorsements.

3.3. Learning Stage

In this stage, the learning algorithm is employed to separate out and achieve the user's topographies from the comments collected in the data acquisition stage.

3.4. Hybrid Recommendation System

It endorses or foresees what sort of objects the customer may select and can be directed to indirectly depend on the dataset obtained in the information gathering stage which is possibly by the system's practical events of the end-user and also it recovers the top-k identical outcomes matching the users' choices by endorsing the most appropriate items to target users by investigating users' communication with objects and several other users [17]. The RS system comprises of two phases - in the first phase, analyse the product rating given by the user and in the second phase sentimental analysis of the user feedback is done. Figure 2 represents the Hybrid Recommendation System.

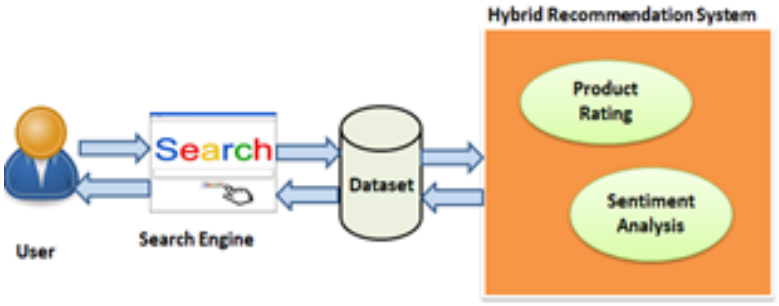

Figure 2. Schematic Representation of Hybrid Recommendation System

In this proposed method, if the user is looking for a product in the search engine, the search engine approaches the database. Hybrid recommendation system collects the datasets from the database, and it gives the accurate suggestion for the user about the product by using the product rating given by the user and sentimental analysis of the user feedback. The representation in figure. 3 shows that the rating of the product given by the users is compared with the rating of the sentimental analysis in order to produce the results.

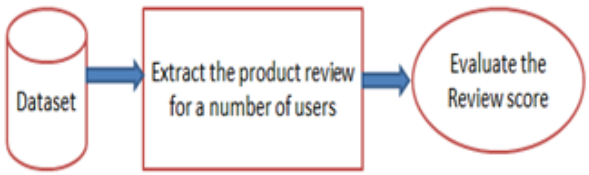

Figure 3. Representation of Product Rating

3.5. Sentimental Analysis

The sentimental analysis is based on positive or negative words comprised in the user feedback by using the sentiment formula (1),

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$$\text{Sentiment (P)} = \sum_{i=0}^{m} \frac{\text{sentiment(w)}}{length(P)} \qquad (1)$$

When the product is suggested to the user, for Happy score "W" indicates the count of positive sentimental words and for Unhappy score "W" indicates the count of negative words and "P" indicates the total count of words.

Part-of-speech tagging (tagging for short) is the method of marking every word in the given input text based on their relationship with other words. Understanding if a word is a noun or a verb indicates more about immediate neighboring words (nouns are led by determiners and adjectives, and verbs are led by nouns) and also provided an indication about the syntactic arrangement of the word (nouns are usually a portion of noun phrases), that makes part-of-speech tagging as a vital element of syntactic parsing. From part-of-word punctuation (like in abbreviations such as, e.g., and etc.), the input to a tagging algorithm is a series of words and a tag set, and the output is a series of tags. [18].

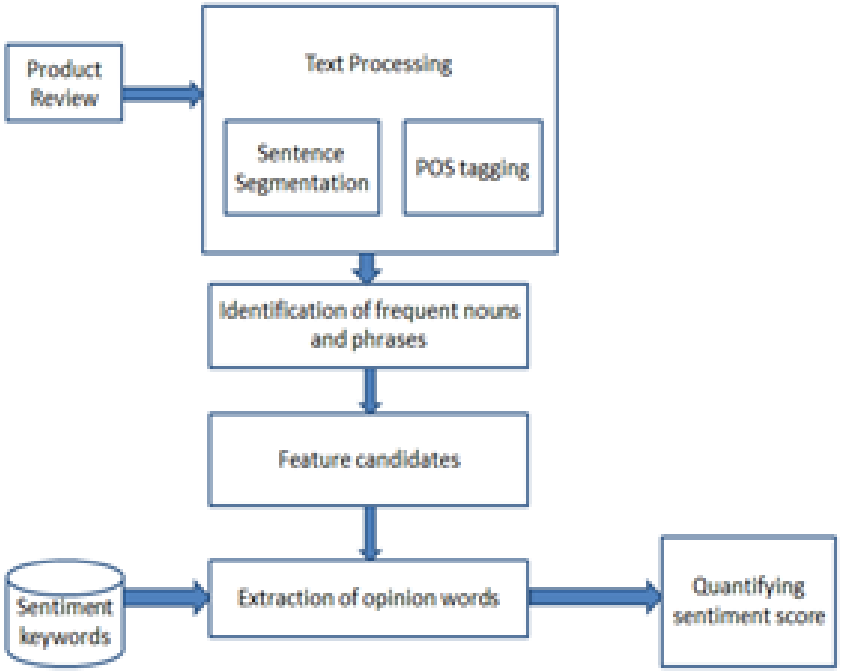

Figure 4. Diagrammatic Representation of Sentimental Analysis

In the sentimental analysis, product review will be processed in the text processing and in the text processing, the sentence will be segmented to find the nouns and phrases. From the nouns and phrases, the proposed system extracts the positive or negative words from the sentiment keywords. The algorithm calculates the happy score and unhappy score which is used to recommend a better product to the user. The figure 4 represents the schematic representation of Sentimental Analysis.

4. Results and Discussions

The hybrid Recommendation system is implemented for a dataset containing reviews of Amazon mobile phones. Rankings made by the reviewers with the review are taken from the website using crawling, and the analysis is done offline. Each product is given user ratings and some feedback on the social sites for business development. The following rules are considered that in the syntax of rule-based classification, if the left-hand side antecedent condition is true only then the consequent result will produce.

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The datasets are pre-processed and the condition checks upon the actual rule set framed depends upon the application that we are using. Then the actual rule set has a number of rules to process that can be optimized and reduce the rule set. In the antecedent condition, if the product rating is more than 4.5 and also if, the feedback is excellent (as given in the trained dataset), then that product is selected for recommendation list. The feedback keywords such as good, bad, super, excellent are kept as a trained dataset. If any one of the condition fails, then the product is not recommended.

4.1 Product Rating Dataset

These datasets for product rating do not include any metadata or reviews, but only include (user, item, rating, timestamp) tuples. These datasets are taken from the Amazon website as CSV file to analyze the product and recommend the user.

4.2 Dataset for Product Feedback

The data collected have been condensed to fetch the k-score, such that every remaining user and item have k reviews each.

Table 1. Datasets for Sentimental Analysis

Review ID	Happy Score	Unhappy Score	Ratio
A30TL5EWN6DFXT	7/6	9/6	Unhappy
ASY55RVNIL0UD	4/3	0	Happy
A2TMXE2AFO7ONB	1	0	Happy

Table 2. Result Analysis for the datasets

Reviewer ID	Seed Words	Happy score	Unhappy score
A30TL5EWN6DFXT	look good stick good	2/4	0/4
	don't like bumping irritating	1/4	3/4
	won't buy like	1/3	2/3
ASY55RVNIL0UD	stickers work like	1/3	0/3
	great stay phone.	1/3	0/3
	super stylish share	2/3	0/3
A2TMXE2AFO7ONB	awesome phone look stylish	2/4	0/4
	Great quality	1/2	0/2

4.3 Sentimental Analysis

The product review has been collected, and the feedback keywords are segmented from the feedback as the dataset is pre-processed. In the pre-processing stage, the stop words are extracted and only the seed words are taken into consideration. The happy score and unhappy score has been calculated by using the below (2) and (3) formula to find out the sentiment. The happy library is maintained that contains the positive words. The unhappy library contains the negative words.

$$\text{Happy Score} = \sum \text{HSw}/\text{TNS} \quad (2)$$

$$\text{Unhappy Score} = \sum \text{USw}/\text{TNS} \quad (3)$$

Where,

HSw is the number of seed words that matches with the happy library.

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USw is the number of seed words that matches with the unhappy library.

TNS is the total number of strings present in the feedback after pre-processing (i.e., the length of the string is present in the feedback).

The happy score is the ratio of the number of seed words that match with the happy library to the total count of strings present in the feedback after pre-processing. The unhappy score is the ratio of the number of seed words that match with the unhappy library to the total count of strings present in the feedback after pre-processing. Once the happy and unhappy score is calculated, the system analyses maximum value between happy and unhappy. If the happy ratio is high, then the feedback is positive else if the unhappy ratio is high, then the feedback is negative. Then the system evaluates the number of reviews which have got positive feedback and the number of reviews which are having negative feedback. If the number of positive reviews (high happy score ratio) is higher than the negative reviews (low unhappy score ratio), then the product is recommended to the user.

4.4 Recommendation System

R1: If (Product rating>=4.5) And (Feedback=High positive sentiment) Then Recommendation=YES

R2: If (Product rating>=3) And (Feedback= High positive sentiment) Then Recommendation=YES

R3: If (Product rating<3) And (Feedback= High positive sentiment) Then Recommendation=YES

R4: If (Product rating<=3) And (Feedback= High negative sentiment) Then Recommendation=NO

R5: If (Product rating>=4) And (Feedback= High negative sentiment) Then Recommendation=NO

Table 3. Recommendations based on Rating and Review

Products	Product rating	Sentiment	Recommendation
Apple IOS Phone	5	Positive	YES
Moto x-play	2.5	Negative	NO
SAmsungS8	4.5	Positive	YES
LAVA	3	Positive	YES
SamsungS9	4.8	Negative	NO
Carbon	2	Negative	NO
Micromax	3.2	Positive	YES
Celkon	1.7	Negative	NO
One Plus	4	Positive	YES

4.5 Comparison of the Recommendation System with the Hybrid Recommendation System

The recommendation quality, information about the product usage, decision confidence, purchase intention, preference certainty and product knowledge are compared between the existing recommender systems and the hybrid recommender system. This is achieved by of considering the user review for the recommendation because some users may give high rating for the product and specify the drawbacks in the review while writing comments. So, the review is important than the rating of the product. By classifying based on the sentiments of the user, the hybrid recommendation system

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achieves a better accuracy. The quality of the Hybrid RS is 4.02 whereas the RS system reaches only 3.79 as shown in figure 5.

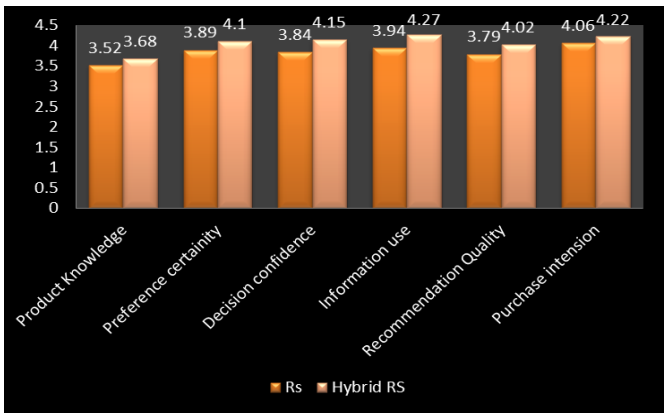

Figure 5. Comparison of RS with Hybrid RS

Table 5. Comparison of RS with Hybrid RS

Parameters	RS system	Hybrid RS system
Product Knowledge	3.52	3.68
Preference certainty	3.89	4.1
Decision Confidence	3.84	4.15
Information Use	3.94	4.27
Recommendation quality	3.79	4.02
Purchase Intention	4.06	4.22

4.6 Comparison of the Accuracy between the Recommendation System and Hybrid Recommendation System

Both the recommendation systems experience different precision for different number of users as shown in Fig. 5. The recommendation system achieves 85% of accuracy by considering only the product ratings for 1000 reviews and achieves 60% for 3000 reviews. Furthermore, the performance continues to diminish as the number of client reviews increases as seen in fig. 6. But, the hybrid recommendation system achieves 99% of accuracy by considering both the rating and opinions of the user for 1000 reviews and achieves 80% accuracy for 3000 reviews. The recommendation quality is very high than the normal recommendation system.

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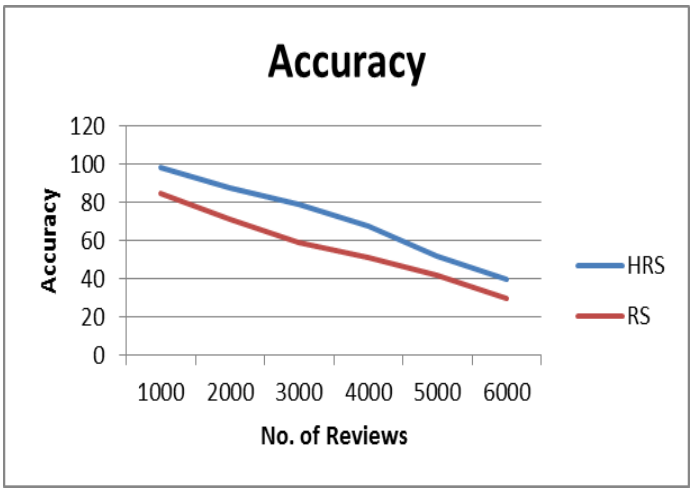

Figure 6. Comparison of Accuracy between RS and HRS

5. Conclusion

The user view upon the product is understandable based on their reviews in the social sites. This helps our system to analyze the opinion of the customer in the e-commerce sites. The existing system recommends the product to the customer based on the user rating alone that leads to lower the quality of the RS system. The proposed Hybrid RS predicts the sentiment of the user opinion and train those sentiment keywords in the training dataset. After analyzing the sentiment of the user, the happy score and unhappy score are calculated. From that result, the number of reviews having a high happy score is selected for recommendation. The rule set is framed considering the product rating also. Based on the conditions the Hybrid Recommendation System selects the product for recommending. The product with the good label is recommended for the customers by the recommendation system. The accuracy of the Hybrid RS is predicted to be effective when compared to the existing RS. The system can be integrated with the decision-making system for further applications in artificial intelligence, e-commerce, etc. in future.

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INTRUSION PREDICTION AND DETECTION USING SUPPORT VECTOR MACHINE (SVM) AND ARTIFICIAL NEURAL NETWORK (ANN)

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Abstract---Intrusion detection and prevention systems are widely researched areas, rightly so being an integral part of network. As with all recent computing trends, Machine Learning and Deep Learning techniques have become extremely prevalent in intrusion detection and prediction systems security. The Intrusion detection system is used to detect and notify any malware activities and try to stop them. Soft computing techniques have the ability in learning data sets which is provided and it can also categories the packets or file coming through the network or any other source as normal and abnormal. Here, we will focus more on using Support Vector Machine (SVM) and Artificial Neural Network (ANN). In the proposed method, we are using SVM and ANN algorithms for the detection of malware; the data set is processed through SVM and ANN algorithms and compares their performances with respect to accuracy metrics. Since accuracy does not give a clear picture about how well classification algorithms perform, we have also measured and compared the performances of these two algorithms using AUC score. The AUC score is a value that ranges from 0 to 1 and closest to 1 will be considered as a better one. The results show that ANN can be implemented effectively for malware detection and is comparatively better than SVM.

Index Terms-- Support Vector Machine (SVM),* Artificial neural networks *(ANN), Area under the ROC Curve (AUC)

I. INTRODUCTION

Malware detection can be broadly classified into Misuse/Signature Detection, Anomaly Intrusion Detection and Hybrid Detection. In Misuse/Signature Detection, each file is assigned with a signature or a hash which is added to a signature database. When a suspicious file is found, the program will look for patterns that will match with known family of malware. Due to constantly evolving malwares, this technique is not much used. Anomaly Intrusion Detection involves generating an alarm when there is a deviation from the normal behaviour that exceeds certain threshold. Certain machine learning and soft computing techniques are used for intrusion detection system to classify between normal and abnormal data. Hybrid Detection a blend of Signature Detection and Anomaly Intrusion Detection that can give better results. Machine learning and soft computing techniques are used here as well.

1.1 Support Vector Machine(SVM)

Support vector machines (SVM) which can be used for classification problems - support vector classification (SVC) and regression problems -support vector regression (SVR) is a supervised learning algorithm. It works well for smaller dataset as it takes too long to process for larger datasets. In this network dataset, we will be focusing on SVC.The main ideology behind SVM is to create a hyperplane and to classify the dataset given. To isolate the two classes of data points, there are numerous conceivable

Hyperplanes that could be picked. Our goal is to locate a plane that has the most extreme margin, i.e. the greatest separation between data points of the two classes. Expanding the margin enables the future data points to be classified with much more precession.

Hyperplanes are those that help in classifying the data. Data points or vectors that fall on either side if the hyperplane can be credited to different classes. Additionally, the hyperplane being built depends or relies on the number of attributes or features i.e. in other words depend on the number of independent features that define the dependent feature of a data set. If we have two independent features then our hyperplane will be three dimensional. If we have one independent feature then we will have a simple one dimensional hyperplane

Below is the figure from [3] that shows how hyperplane is built and can be used to classify the data points. H represents the hyperplane. H1 and H2 are the lines drawn parallel to hyperplane such that the distance between these two i.e. the margin is maximum.

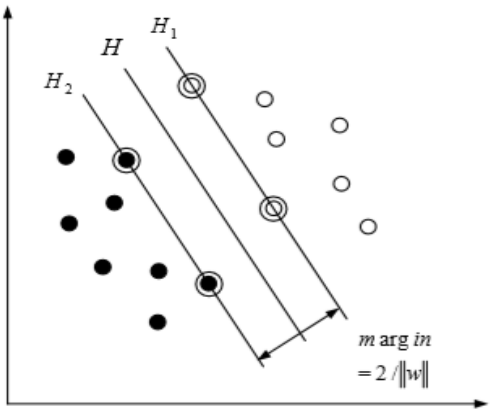

Fig 1: SVM Hyperplane

1.2 Artificial Neural Network (ANN)

Artificial Neural Networks (ANN) are multi-layer completely associated neural nets. They comprise of an input layer, numerous hidden layers, and an output layer. Each node in one layer is associated with each other node in the following layer. We make the system more profound by expanding the quantity of hidden layers.

A layer containing various nodes will receive weighted sum of the inputs fed to it and depending on the activation function, the layer's nodes get activated. Once the nodes get activated, these nodes act as inputs to the next layer. This happens from left to right i.e. from input to output layer. The final output from the output layer will be our predicted output. Training the network depends on number of times we propagate backwards and forwards to minimize the error.

We first need to train our model to really learn the weights, and the training method is as follows:

- We first assign random numbers/weights to all the nodes.
- Now once we assign the weights, we forward propagate for all the layers i.e. input, hidden and output layers where each of hidden layer's input will the output from the previous layer. Similarly the output layer's input will be output from the last hidden layer. The output that we get from the output layer is the predicted value.
- We then compare this predicted value with the actual value and calculate the error using loss function.
- Once we find out the error, we start backpropagation which acts exactly opposite to forward propagation and changes the weights accordingly in order to minimize the error.
- Below is a figure from [9] showing ANN with one input, two hidden and one output layer.

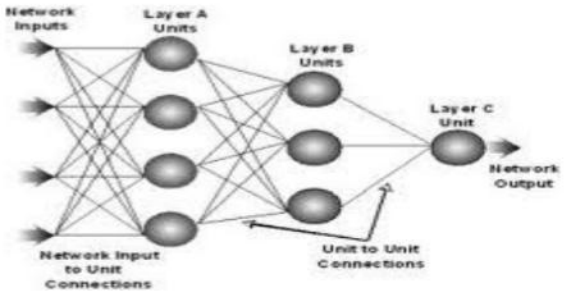

Fig 2: Artificial Neural Network

II. LITERATURE SURVEY

In [1], Intrusion detection System was implemented using SVM and Naïve Bayes and it was found that SVM outperformed Naïve Bayes and gave a better result. Intrusion detection and Intrusion prevention are required in current patterns. As ordinary occasions are principally subject to networks and information systems, intrusion detection and intrusion prevention are

fundamental. Numerous methodologies have been applied in intrusion detection systems. Among them AI assumes a crucial job. This investigation manages AI calculations like SVM and Naïve Bayes. It proposes while managing 19,000 examples SVM beats Naïve Bayes.

In [2], the author discusses that the network data is extremely enormous, heterogeneous, exceptionally shifting and imbalanced. The greater part of the accessible machine learning approaches created for consistently dispersed data and doesn't stress on these qualities of system data that this data isn't ordinarily distributed in equivalent classes. As volume of network traffic data is extremely gigantic and has enormous number of qualities it is for all intents and purposes difficult to run exemplary machine learning calculation on entire data. Or maybe sampling, feature extraction and selection should be performed. In any case, these activities may change in general character of data. Some great and exact methodologies for feature selection, extraction and sampling are required.

In [3], the author tells that one of the upcoming areas in network security is Intrusion Detection System. The author also tries to explain how using ANN will lead to overfitting and this issue is not a problem in Support Vector Machines. SVM has better classification rates than ANN. The support vector machine classification model is thus introduced and applied to intrusion detection system to classify the data into normal and the one being attacked. Support Vector Machine's tendency to self-learn makes it a better model to be put in use for Anomaly or Intrusion Detection System. The results show from this paper was very good using SVM classifier was a success and hence the author tells that this strategy can be used for network security purpose.

In [4], the authors in their research focus on genetic algorithm (GA) for creating the detection features. Support vector machine and artificial neural networks are used for detecting and classifying the network data. Along with these techniques the author makes use of genetic algorithm to blend and create a hybrid machine learning models. The result of this was that genetic algorithm with artificial neural network showed better detection and classification rates. In this experiment, the KDD cup 99 dataset is being used to classify the data into four types of network attacks. One of the most import technique that comes into the picture while applying such model is feature selection and it was seen that genetic algorithm with neural network require 18 features to show 100% detection rates while genetic algorithm with svm required 24 features to show 100% detection rates. The author also discusses on using different model along with genetic algorithm in future..

In [5], the authors begin with introducing to us about what an Intrusion Detection System is. They discuss about two types of intrusion detection system. The first one being misuse or signature detection system and the other being anomaly intrusion detection system. Later on, they focus more on anomaly based intrusion detection system. The model being used in this paper is neural networks. They gave a small diagram on how these neural networks work in general followed by how it can be used in intrusion detection systems.

In [6], targeting missing report rate and false alert rate which exist for the most part in the intrusion detection framework , this paper talks about an astute intrusion detection model. Based on the attributes of worldwide prevalence of genetic algorithm and region of nerve, the model optimizes the weights of the neural network utilizing genetic algorithm. Test results show that the wise way can improve the effectiveness of the intrusion detection.

In [7], the authors in this paper tell us how important the security is in network and how it is a big concern. Information or data is the most important resource of any company or organization and proving security for these against the hackers and attackers is a major concern. For the same purpose, Intrusion Detection Systems are being used to provide security and to classify and detect the data whether it is normal or malicious. In this paper, the author showed how neural networks along with backpropagation can be used for intrusion detection system. Although it did not perform well, the author plans on using elm technique in future for better detection rated.

In [8], the authors in this paper inform us that classifying the network data into normal and malicious has been their main ideology and main point for their examination. Various classification models are being utilized to effectively detect and classify the data into normal and malicious and attain high accuracy level by increasing true positive rates and decreasing false positive rates. In this paper, author has made used of different models for IDS like SOM, SVM, J48, back propagation using neural networks, and RBF. After thorough usage and data preprocessing, it was found out that J48 performs way more better than the rest of them in classifying and detecting the data into malicious and normal. In addition to it, principal component analysis was used as preprocessing step which improved the detection rates of SOM and back propagation.

III. PROPOSED SYSTEM

A smart Intrusion Detection System is the one that classifies the network data into "normal" and "attacked" data with AUC and accuracy values between 0.9 and 1. Using Soft Computing techniques like Support Vector Machine and Artificial Neural Network we will try building the best Intrusion Detection System with the best AUC and accuracy scores such that it classifies the network data into "normal" and "attacked" appropriately. We will try using some techniques like data pre-processing, feature selection and reduction using Principal Component Analysis (PCA), standardization and normalization in order to improve the AUC and accuracy scores of our model. We will also try comparing the results of these two methods based on their AUC and accuracy scores and try concluding which is better.

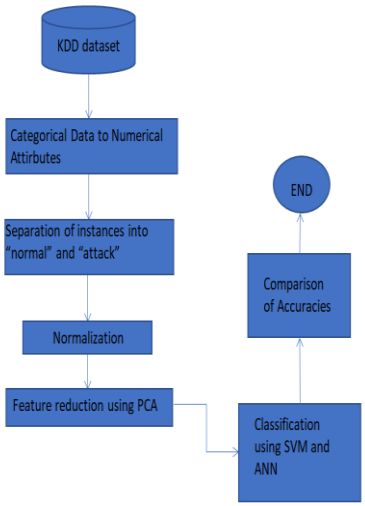

Fig 3: Flowchart of the proposed system

- KDD99 train and test data set is taken from KDD99 website for implementing Intrusion Detection System.
- All the categorical data is converted to numerical data using one hot encoding technique for better performance of SVM and ANN.
- The data is then classified into two features i.e. 'normal' and 'attack'. This in turn is converted into numerical data where "0" represents "normal" and "1" represents "attack" data.
- The whole data set in normalized using Standard Scaler which subtracts each attributes with mean and then divides it with standard deviation. The purpose of this is to give better results of our model.
- The next step is to reduce the features and dimensionality of the data set by feature reduction using PCA (Principal Component Analysis). The purpose of this is to give better results of our model.
- Use Support Vector Machine (SVM) and Neural Network (ANN) algorithms to classify the malicious data i.e. to classify 'normal' i.e. '0' and 'attack' i.e. '1' in the data set.
- Use these classifiers on the KDD99 test data set and calculate and compare the accuracies and AUC scores between SVM and ANN and conclude which model outperforms the other.

IV. METHODOLOGY

1. Datasets

The training and test data set contain around 42 columns where 41 of them are independent variables and the last column that is the 42nd column-"Class" is a dependent variable which tells us whether the data is attacked or normal.

	Duration	protocol_type	Service	Flag	src_bytes	dst_bytes	Land	wrong_fragment	Urgent	Hot	...	dst_host_srv_count	dst_host_same_srv_rate	dst_host
0	0	udp	private	SF	105	146	0	0	0	0	...	254	1.0	
1	0	udp	private	SF	105	146	0	0	0	0	...	254	1.0	
2	0	udp	private	SF	105	146	0	0	0	0	...	254	1.0	
3	0	udp	private	SF	105	146	0	0	0	0	...	254	1.0	
4	0	udp	private	SF	105	146	0	0	0	0	...	254	1.0	

st_rate	dst_host_serror_rate	dst_host_srv_serror_rate	dst_host_rerror_rate	dst_host_srv_rerror_rate	Class
0.0	0.0	0.0	0.0	0.0	normal
0.0	0.0	0.0	0.0	0.0	normal
0.0	0.0	0.0	0.0	0.0	normal
0.0	0.0	0.0	0.0	0.0	attack
0.0	0.0	0.0	0.0	0.0	attack

Figure 4: Data sets

2. Datasets After data preprocessing

The training and test datasets are converted as follows:

- First we apply one hot encoding to all categorical data and make them numeric.

- Then we convert the last column to numeric such that 'normal' will be represented by '0' and 'attack' will be represented by '1'. At this point we will have 118 columns in our datasets.
- We then perform standardization such that each feature is subtracted by its mean value and divided by standard deviation. The purpose of doing this is for better performance while applying a model for prediction.
- Finally we perform feature reduction using Principal Component Analysis (PCA) to reduce the dimensionality of the data set. From second step we get around 118 columns and these many columns will slow down the prediction made by models and hence PCA is used to scale it down to 29 columns in our data set.

	0	1	2	3	4	5	6	7	8	9	10
0	1.009547	2.721875	4.319461	-0.359954	0.624127	-0.243856	-0.945141	0.634793	-0.414786	0.561018	-0.682229
1	1.011112	2.700872	4.300598	-0.367219	0.626373	-0.238986	-0.988315	0.592740	-0.414861	0.547776	-0.686330
2	0.992844	2.675120	4.273205	-0.365069	0.626115	-0.235235	-1.026092	0.581218	-0.405217	0.550211	-0.696940
3	0.968220	2.648060	4.242250	-0.363249	0.622382	-0.232364	-1.059025	0.568749	-0.399322	0.551307	-0.706360
4	0.944913	2.620482	4.211396	-0.360868	0.620974	-0.228747	-1.094363	0.558314	-0.391142	0.553512	-0.716480

	11	12	13	14	15	16	17	18	19	20	21
	0.298186	-0.157484	-0.173936	-0.009943	-0.078714	0.029837	0.035032	0.016762	0.031956	-0.057640	0.011043
	0.302964	-0.173132	-0.191300	0.016423	-0.109007	0.019629	0.082441	0.048013	0.030239	-0.059209	0.009552
	0.302606	-0.175488	-0.187616	0.016669	-0.115658	0.021965	0.080942	0.041007	0.029036	-0.055469	0.008384
	0.302111	-0.179553	-0.187547	0.021557	-0.124006	0.022137	0.085613	0.039500	0.027880	-0.052532	0.007433
	0.301459	-0.182150	-0.184540	0.022971	-0.130544	0.024005	0.084955	0.033468	0.026698	-0.048943	0.006385

	22	23	24	25	26	27	28
	0.056779	0.022042	0.019839	-0.034443	-0.001649	-0.028527	0.000915
	0.053228	0.030041	0.016264	-0.027058	-0.009677	-0.019701	-0.002900
	0.051865	0.029643	0.015652	-0.025926	-0.009943	-0.021004	-0.003122
	0.050450	0.030254	0.014723	-0.024073	-0.011231	-0.020994	-0.004027
	0.049096	0.029981	0.014040	-0.022836	-0.011629	-0.022047	-0.004390

These are the first 5 rows of first 28 columns.

	0	1
	0	1
	1	1
	2	1
	3	1
	4	1

This is the 29th column representing whether data attacked-'1' or normal-'0'.

Fig 5: Datasets after Data Preprocessing.

3. Support Vector Machine:

We make use of svc i.e. Support Vector Classifier model from sklearn package present in python library to implement support vector machine for our network dataset. Below is the small snippet of how svc is used.

- We get accuracy score around 90.833(out of 100).
- We get AUC score around 0.84(out of 1).

SVM

```
In [22]: lin = svm.SVC()
         lin.fit(train_data_pca_df_1, train_target_decoded[0])
         lin_predict = lin.predict(test_data_pca_df_1)
         print(lin.score(test_data_pca_df_1, test_target_decoded)*100)
         print("Number of support vectors for each class", lin.n_support_)

         90.82047011693444
         Number of support vectors for each class [1200 1047]
```

```
In [23]: from sklearn.metrics import roc_curve, auc
         fpr, tpr, thresholds = roc_curve(test_target_decoded[0], lin_predict)
         roc_auc = auc(fpr, tpr)
         print(roc_auc)

         0.8371146233486747
```

```
In [26]: label = 'Support Vector Classifier AUC:' + ' {0:.2f}'.format(roc_auc)
         plt.plot(fpr, tpr, c = 'g', label = label, linewidth = 4)
         plt.xlabel('False Positive Rate', fontsize = 12)
         plt.ylabel('True Positive Rate', fontsize = 12)
         plt.title('Receiver Operating Characteristic', fontsize = 12)
         plt.legend(loc = 'lower right', fontsize = 12)

Out[26]: <matplotlib.legend.Legend at 0x278003d0908>
```

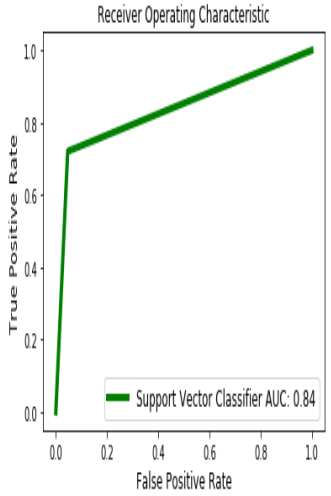

Fig 5: SVM process

4. Artificial Neural Network

We make use of keras model present in python library to implement Artificial Neural Network. The activation functions used are relu and softmax. Our ANN consists of one input layer with 29 input nodes, 2 hidden layers one with 16 nodes and the other with 12 nodes and finally 1 output layer containing two nodes. Below is the snippet of implementation of ANN.

- We get accuracy score around 93.159
- We get AUC score around 0.951

ANN

```
In [29]: import keras
         from keras.models import Sequential
         from keras.layers import Dense
         # Neural network
         model = Sequential()
         model.add(Dense(16, input_dim=29, activation='relu'))
         model.add(Dense(12, activation='relu'))
         model.add(Dense(2, activation='softmax'))

In [30]: model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])

In [31]: history = model.fit(X_train, y_train, epochs=100, batch_size=64)

In [32]: y_pred = model.predict(X_test)
         #Converting predictions to label
         pred = list()
         for i in range(len(y_pred)):
             pred.append(np.argmax(y_pred[i]))
         #Converting one hot encoded test label to label
         test = list()
         for i in range(len(y_test)):
             test.append(np.argmax(y_test[i]))

In [33]: from sklearn.metrics import accuracy_score
         a = accuracy_score(pred,test)
         print('Accuracy is:', a*100)

         Accuracy is: 93.15948030569497

In [34]: from sklearn.metrics import roc_curve, auc
         fpr, tpr, thresholds = roc_curve(test, pred)
         roc_auc = auc(fpr, tpr)
         print(roc_auc)

         0.9512418002634057

In [35]: label = 'ANN AUC:' + ' {0:.2f}'.format(roc_auc)
         plt.plot(fpr, tpr, c = 'g', label = label, linewidth = 4)
         plt.xlabel('False Positive Rate', fontsize = 12)
         plt.ylabel('True Positive Rate', fontsize = 12)
         plt.title('Receiver Operating Characteristic', fontsize = 12)
         plt.legend(loc = 'lower right', fontsize = 12)

Out[35]: <matplotlib.legend.Legend at 0x27809a58288>
```

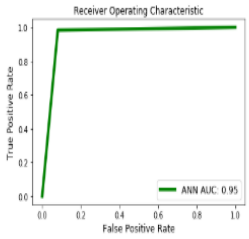

Fig 6: ANN process

V. RESULT AND ANALYSIS

Experimental results based on two metrics: Accuracy score and ROC_AUC curve along with AUC score.

1. Accuracy scores:

It is clear that the accuracy scores obtained from SVM is around 90.833 and the one obtained from ANN which is around 93.159. Hence, ANN outperforms SVM in case of accuracy scores.

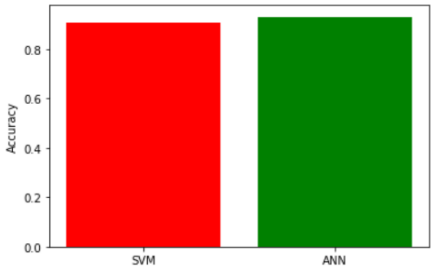

Fig 6: Accuracy scores of SVM and ANN

2. **ROC_AUC curve and AUC scores.**

It is seen that ANN outperforms SVM in AUC score as well. ANN has AUC score around 0.95 while SVM has AUC score around 0.84

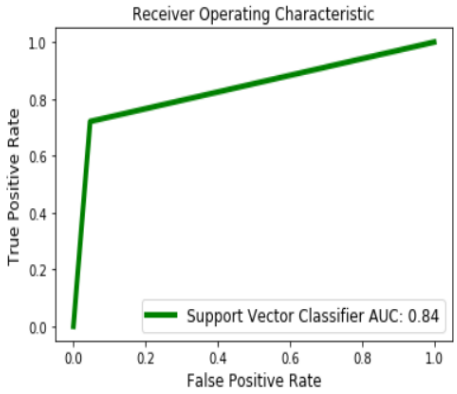

Fig 7: ROC_AUC Curve and AUC scores of SVM & ANN

VI. CONCLUSION

Malware detection is very much needed in current trends. With advancement in network communication, Intrusion Detection System plays a very vital role. There are many approaches and techniques such as Machine learning, Soft Computing and Artificial Intelligence that can be used to detect malicious content and activity in files and network. Among them Machine Learning techniques such as SVM and ANN were used to implement and to compare the accuracies and AUC scores.
It was seen that ANN outperformed SVM in both accuracy and AUC scores and hence ANN could detect and classify malicious data better than SVM. Future work deals with using an hybrid approach i.e. to blend other algorithms with SVM and ANN to give better classification accuracies

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Security Threat Identification and Prevention among Secondary Users in Cognitive Radio Networks

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Summary
The Cognitive radio (CR) is evolving technology for managing the spectrum bandwidth in wireless network. The security plays a vital role in wireless network where the secondary users are trying to access the primary user's bandwidth. During the allocation the any malicious user either he pretends to be primary user or secondary user to access the vital information's such as credentials, hacking the key, network jam, user overlapping etc. This research paper discusses on various types of attack and to prevent the attack in cognitive radio network. In this research, secondary users are identified by the primary user to access the primary network by the secondary users. The secondary users are given authorization to access the primary network. If any secondary user fails to provide the authorization, then that user will be treated as the malicious user. In this paper two approaches are suggested one by applying elliptic curve cryptography and the other method by using priority-based service access.
Key words: *malicious user, security, attacks, threats, cryptography*

1. Introduction

The evolving wireless technologies for different wireless application led to the scarcity of the spectrum bandwidth. The cognitive radio networks has two different types of user i) primary user (PU) who owns the spectrum ii) secondary user (SU) who utilize the primary user's network. The cognitive radio is capable of configuring the devices. The reason for cognitive radio technology is to maximize the utilization of the spectrum due to the scarcity of the spectrum. The resources are shared by both primary and secondary users.

Table1: Different frequencies used for wireless communication

3KHz	Marine Radio Navigation
30KHz	
300KHz	AM Radio
3MHz	Short Radio
30MHz	Television
300MHz	Mobile phones ,wi-fi
3GHz	Satellite communication
30GHz	Astronomy,Satellite Communication
300GHz	

Due to many applications which uses WI-FI technology there is a spectrum scarcity. While sharing the resources, there can be threat to the network. The CR users are also vulnerable to various attacks. The attacks caused by various reason can result into Denial of services, throughput, energy etc. The spectrum can be secured before the attack has attempted. There is a need to identify different security threats and prevention of these threats [6].

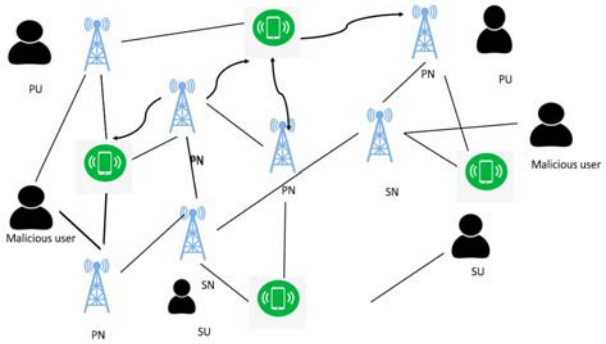

Figure 1: Malicious user pretend to be primary user to access network

The user can pretend either to be primary user or secondary user to access the vital information available in the primary network station. Hence security measures are considered to prevent unauthorized access to the primary network.

1.1 System Architecture for Cognitive Radio Network (CRN)

The wireless network follows IEEE standards 802.11 which comprises three working groups such as: 802.11 wireless LAN, PAN, MAN. The devices must be controlled and optimized for secured communication which can be achieved through software Defined Network (SDN). To access the wireless network access points must be deployed with the corresponding software's which supports IEEE 802.11. The author prescribed ethanol architecture which

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controls access points in wireless networks. To control Aps and other devices ethanol uses south bound interface. To manage home networks north bound interface is used [11]. The below architecture consists of allocation of bandwidth, webQoE, Load balancing, App Aware, Fault Detection and Hand over [12][13][14][15].

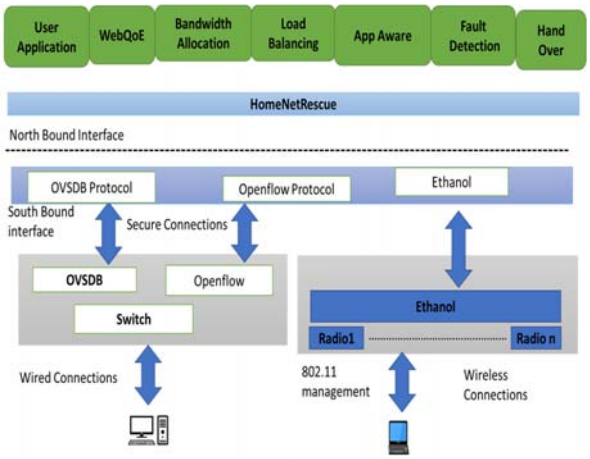

Figure 2: Ethanol implementation [source: Henrique and et.al Ethanol : A Software Defined Architecture for IEEE 802.11]

1.2 Proposed Architecture

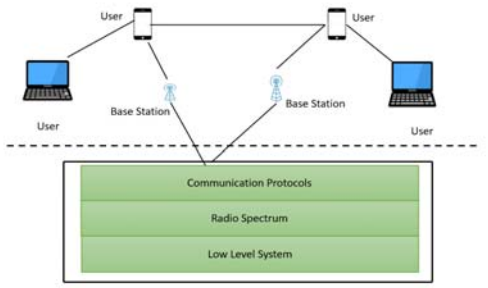

Figure3: Radio communication diagram

The above diagram, indicates the communication between the devise and the underlying communication mechanism. The low-level mechanism consists different hardware devices above which the radio spectrum is available. Through applications the radio communication is possible which are comprised of different protocols to manage various task such as file transfer, online video streaming, sharing audio and video files etc. The system counter to various security threats at different layers of network which is shown in figure 4. The network architecture for cognitive radio network is shown below where in network layers are available for communication in wi-fi technology. The user is trying to have an access to the network layer.

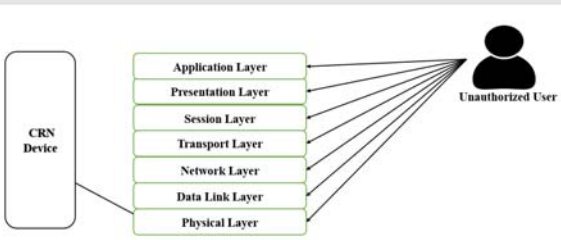

Figure 4: Accessing the network layer

2. Literature Review

The literature review is carried out for identifying security issues at different levels. There is a requirement to address the security at different levels and different layers of network. Sensing and emulation of primary signal (detecting and verifying the signal). Spectrum management (detecting, verifying channel capacity and allocating appropriate channel to cognitive users)
Checking interface level, signal strength and energy detection secure communication.
The below table describes the different types of attacks, in which layered the attack caused.

Table 2: Types of attacks

Attack Type	Network Layers	Reason	Measures to be taken
Primary and secondary User Jamming	Physical	Lack of knowledge About location and unclear access rights to cognitive users	Location consistency checks compare the signal strength and noise level
Primary signal sensing	Physical	Low level primary signal will be missed	Energy based sensing wave-form based sensing cooperative detection of PU
Overlapping secondary user	physical	Location based hard to prevent	Use game models and Nash equilibrium techniques to detect transmission power of Sus
SU unauthorized gain in bandwidth pretending as primary user /False feedback	MAC	Malicious SU tweaks with higher power bandwidth and feedback information to gain signal	Trust management on SU for resources hungry and collaborative management of systems objective functions by controlling radio parameter

Increase interference by malicious mode	Networks	Compromising with malicious node	Appropriate local spectrum sensing controller. Eliminating internal hidden parasite node
Ripple effects	Network	False information about spectrum assignment	Continuous trust management process on Secondary users
Key duplication	Transport	Break the cypher system	Reinvestigate the protocol activity in the context of session. Use secure protocols with robot distribution of key management
Jelly-fish	Transport	Effect on throughput	Trust of node by verifying the packet loss

Based on special characteristics security threats can be determined

i) Security Threats in AI characteristics- it involves reasoning and learning. A reasoning engine is set of logical interference rules. Cognitive radios need some policies for reasoning to deal in different environment. Learning engine in cognitive radios are capable to leave from past experience and current situation and then predict optimal spectrum to select.

ii) Policy Threats: It occurs due to lack of policies present and lack of knowledge base that attacker or malicious user can modify the actual statistics. If an attacker gets unauthorized access of knowledge base then the attacker can modify or delete the existing policy and inject false policies in knowledge base.

iii) Learning Threats: Learning comes from the past experience and the current situation to make the prediction. Learning engine can make wrong decision about the spectrum, if the knowledge base is wrongly updated.

iv) Security threats in dynamic spectrum access: during cooperative sensing, the cognitive user can sense false information in hostile environment or due to presence of malicious users. Sensors can be malfunctioned using some kind of malicious code. False sensing would not detect available spectrum or it can detect busy spectrum.

v) Primary user emulation attack: These attacks prevent the secondary users using the available bandwidth for communication. Intend the malicious user can utilize the spectrum. If there are unoccupied channels then the malicious user pretends to be primary user and attacks all the free channels. PUEA can be classified into two categories a) Malicious PUE Attack- wherein the attacker prevents the secondary user to utilize the available spectrum. b) selfish PUE Attack-It is performed by the selfish secondary user. If a selfish node detects idle spectrum, it prevents other secondary user to detect spectrum so that selfish user could get full access of spectrum. Sometimes the PUE attack is raised by the malicious user imitating as primary user to avail all the resources [9]. The data exchanges between the node are modified by malicious user which in turn leads to denial of services [8].

vi) Objective Function Attack-there are various radio parameters such as modulation, coding, and security. The attack force to enable CR to select sub-optimal value by altering objective function [7].

vii) Lion Attack-it is a kind of attack in CRN performed by an attacker at physical layer to degrade the performance of transmission control protocol (TCP) at transport layer. The secondary user performs spectrum handoff if primary user is active leading to temporal disconnection at physical layer. Data segments sent by TCP can be lost or delayed during handoff process at physical layer by degrading TCP throughput. TCP maintains a time if the receiver doesn't receive acknowledge it assumes that the data is lost. In lion attack the attacker performs PUE attack or Jam channel [2].

Attack Prevention Measures

Physical Layer Authentication: It includes physical layer validation, the physical properties of the flag to separate the essential client initiating assault from the first PU. The properties of physical layer are identified in two categories i) utilizing transmission specific characteristics ii) using channel-specific features.

In physical layer validation strategy incorporates the validity, identification and highlight recognition strategies. In validity recognition strategy hypothesis testing is carried out.

D= {PUEA H<Ht
PU H>Ht}

Ht- Threshold voltage of channel
H stands for channel property
D for the decision
High Layer Authentication Method
This layer uses cryptographic techniques for the authentication. This method uses public key cryptography. In this encryption and decryption can be done using different but related key.

$X= D_{KU} [E_{KR}[X]]$….(1)
$X=D_{KR}[E_{KU}[X]]$….(2)

Here X-Message
D-Decryption
E-Encryption
KU-public key
KR-Private key

In this approach, messages are transmitted using private key and at the receiving end messages are decrypted using public key.

Procedure for transmitting a signal

The client generates a private key and sends along with the signal, since the transmitter only knows the private key the data cannot be signed by any malicious user.

Procedure for the receiving signal

A receiver should recover the public key from the central facility using the public key appropriate transmitter signal can be decrypted and verified [3].
Quad-Type encryption of Data (QED) provides four tier encryption procedure to the main user. If a user needs to join a CR Network, it must start trust arbitration with the channel at closer network. The algorithm works on the basis of three level
Adaptive distance mechanism RSSI
Distributed energy power
User ID in frame format
Description level:
Step 1: The data is encrypted using distance as the key
Step 2: The result is encrypted using energy as it key
Step 3: Again the result is encrypted using user's ID as the key [4]
In delegation user authentication framework, SUs should be serviced by secondary network over the CRN by delegating authentication from PN which achieves the security from selfish nodes and malicious node by providing authentication, unthinkability, anonymity, PU protection, no registration and conditional traceability. The author suggests three phases for the secure authentication framework as a basic security and privacy module for CRN.
Authentication may be either online or offline. In online authentication the process requires that Secondary Network (SN) must connect to primary network (PN) when a new SU demands authentication. In offline the SN obtains the necessary parameters obtained from PN in advance. In setup and registration process PN generates process PN generates the large prime no's and a generator P in the additive group G. later PN chooses two private keys and computes the public key. Each computed value is stored in corresponding Sus smart card.
In online registration, first the SU sends a login request to SN. Later SN generates the ids and random no when SU inserts the smart card. It generates two random number and computes the hash chain. Later it verifies and computes symmetric key. PN decrypts using the secret key and verified by corresponding to SN. SN decrypts and verifies for SU, later it checks for the existence. In offline, the hash key parameters are derived from the online authentication [5].

3. Proposed Methodology for Preventing the Attacks

In this research paper, different methods are suggested for preventing the attack. The secondary user has to be identified where the secondary user can also be a malicious user. To identify the genuine SU, the key exchange algorithm is suggested if there is only one single user at any time t. In case of multiple secondary user's, it's very hard to identify the genuine SU, in that case priority-based algorithm is suggested.

3.1 Method 1:

In this method, Elliptic curve cryptography is applied where the key is shared between the primary users and the secondary user. In this approach it uses two different types of keys i) public key and ii) private key. Both PU and SU picks up a private key and exchange publicly to generate key to encrypt the message and to access the service request and response.

Steps1: Create public keys for both primary user and secondary user. Let p1 be the primary user key and p2 be the secondary user
Step2: primary user selects a private value m and secondary user selects a private value n
Step3: Both the user's computes the public values

$a=p_2\text{^}m \bmod p_1$ ----1
$b=p_2\text{^}n \bmod p_1$ -----2

Step 4: primary user and secondary user exchange the values of a and b
Step5: PU receives b, SU receives a
Step 6: the user creates a symmetric key
$Km = b^m \bmod p_1$
$Kn = a^n \bmod p_1$
Step 7: Km =Kn is the shared key
The above approach is considered for single secondary user and primary user.

3.2 Assessing the service for multiple user

In case of multiple secondary user's, key exchange for multiple user it is a tedious job. The alternative method for identifying the secondary user to mitigate the attack is based on the priority.
For providing secured service to the secondary user, priority-based service access algorithm (PBSAA) is used. In this approach the primary user verifies the secondary user using user token no and the random number generated for the secondary number. In this case time is a constraint where the time is valid only for 10 min of token exchange.

PBSAA procedure steps

Step 1: Secondary user sends a request to the primary user.
Step 2: Primary user sends the channel status either 1 or 0 where 1 denotes the channel is busy and 0 represents the channel is idle.
Step 3: Secondary user confirms. Primary user generates the token number and shares the number with secondary user.
Step 4: Secondary user generates a random number at time t and sends the information along with the token number.
Step 5: Primary user verifies the random number, token number and time
Step 6: If it is valid the services will be provided by the primary network else sends the report as unauthorized users.

3.3 Algorithm

1. Let n be the number of SU
2. Let m be the number of PU
3. For j->0 up to j <m

   Generate Tn for PU
   For i->0 up to i<n
   For j->0 up to j<m
   Sn=Tn
4. For i-0 to n
5. Sui<-Rand (1,10)
6. Check (sn, t, r)
7. For i=0 to n
8. S_{ti}= Generate time of request
9. If(Sn==Tn)
10. If(r>=0 r<10)
11. Allow Service Access
12. Else
13. Deny service for secondary user
14. Else
15. Token not matching

3.4 Flow chart

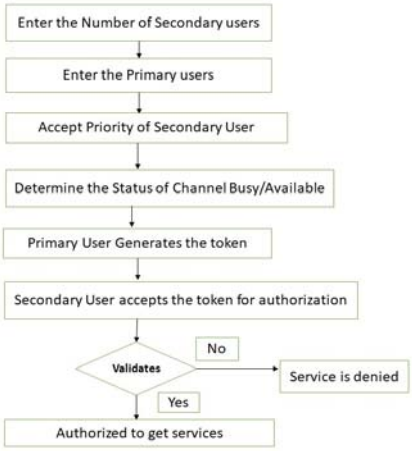

Figure 5: Service Generation

Different types of services

There two main types of services:
- Differentiated services
- Integrated services.

Differentiated services: it ensures that each secondary user gets the bandwidth and the services are provided by the primary users. Later the services can be considered as type-p and type -A.
In type-p service the secondary users are allocated with the bandwidth provided by the primary users. If the spectrum is idle for too long duration, then the maximum usage will be taken by the secondary user.

In type-A the secondary user will raise the demand, the primary user will evaluate the required bandwidth for the secondary user. If there are a greater number of secondary user then there is traffic which in turn reduce the performance of the service.
Integrated services: in this type of service, the secondary user gets the service from the primary user depending on the reservations done by the secondary user. The resource reservation protocol is used for reserving the bandwidth.

During the services, traffic can be generated in the network by the secondary user. The traffic can be managed by applying traffic shaping algorithm.

CCA (Channel Capacity Algorithm) for managing the Secondary users' services. In CRN, there are multiple secondary user who are in waiting state to get the channel allocated and these user's traffic has to be managed in the network to provide the service. The working of algorithm is given below:

Where the secondary users create a traffic in the network since secondary users are more in number than the primary user. The primary user displays the channel state when the channel is idle, during this stage the secondary user will be allotted the channel based on the reservation.

Step-1: Assume the capacity of the spectrum is β.

Step-2: The secondary users are allocated the channel at the rate λ.

Step-3: check the channel capacity. If the channel is already allocated, discard the remaining users.

Step-4: If channel allocated to secondary user has completed with the task at the rate λ else the channel will be idle till next user is allotted.

Flow Chart for Managing Secondary users' traffic

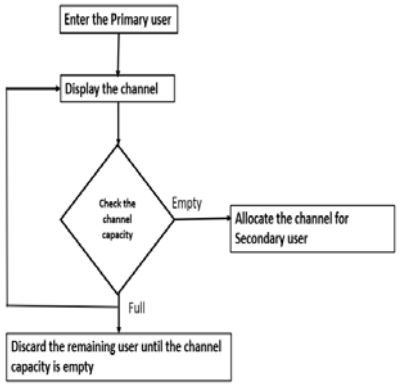

Figure 6: Identifying channel capacity

4. Experimental Results

The experiments were conducted using Scilab tool. The output is considered for both the methods i.e. key exchange algorithm and priority based access service. In Diffie Hellman key exchange two prime numbers are chosen and keys are exchanged publicly. The results are shown below for two different key values and both share a common key.

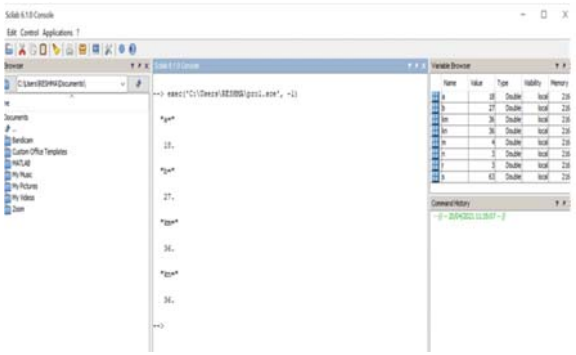

Figure 7: Key Exchange between PU and SU

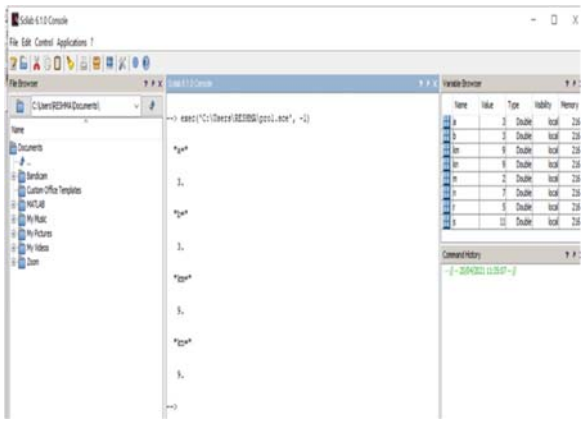

Figure 8: Key Exchange between PU and SU

Figure 9: Availability of spectrum

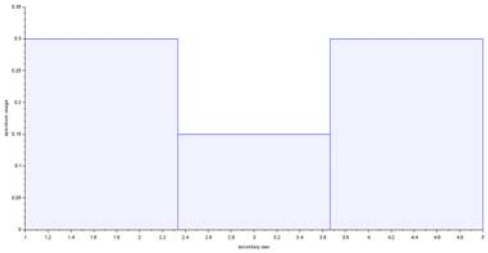

Figure 10: Histogram of priority of secondary user based on usage

5. Conclusion

In this research work, the system demonstrates the accessing of services by secondary users. This paper recognizes the malicious user based on the authorization of secondary user wherein the provision of token is provided by the primary user. The validity of the token is considered from the clock generated by the primary user. The secured spectrum management is vital and attracted several researchers across the world. The future work focuses on improved Block-chain based spectrum management to mitigate the different attacks.

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Naïve Bayes Filter for Communication & Enhancing Semantic in Email

Mariyan Richard A, Prasad Naik, Suhas A, Drakshaveni G

Abstract: ***Due tothe current pandemic of COVID-19, the world has turned into ONLINE modeand an increase in online communication thereby information exchange, sharing useful data through emails and other social Medias.So addressing the security issues places a vital role in computer security and shouldhave thepriorities. We need a security check to enhance the inbox so that the important information or emails should not reach to the spam box. In this paper to improve the filtering techniques, wehave adopted the Naïve Bayes approach in implementation and enhancing the spam filter in the email. Bayes's approach is efficient, accurate, and simple in implementing the proposed algorithm. Bayes algorithm is used to verify correct semantic information of the email and avoidsthe pass to pass approach if the incoming mail is important. The Python language is used to develop the proposed algorithm.***

Keywords: Naïve Bayes, String Sematic, Spam Filtering, Python Language.

I. INTRODUCTION

Spam E-Mail is an unconstrained and unwanted messages sent in bulk. Normally, spam is sent for business and marketing purposes. It might be sent in immense volume by botnets, frameworks of polluted PCs. While a couple of individuals consider it to be corrupt, various associations despite everything use spam. The cost per E-Mail is incredibly low, and associations can pass on mass sums dependably. Spam E-Mail can moreover be a threatening undertaking to get to your PC. Botnets are an arrangement of as of late defiled PCs. Along these lines, the main spammer can be difficult to follow and stop [1].

E-Mail filtering is the process of blocking its contents based on a pre-defined set of rules. It can apply to the intercession of human knowledge, yet regularly alludes to the programmed handling of approaching messages with hostile to spam procedures - to active messages just as those being gotten. E-Mail separating programming may dismiss a thing at the underlying SMTP association stage or pass it through unaltered for conveyance to the client's letterbox - or on the other hand: divert the message for conveyance somewhere else; isolate it for additional checking; alter or 'tag' it here and there. E-mailbox service providers can incorporate dedicated lines in the transmission as a feature of the entirety of the recipients. Against infection, hostile to spam, URL sifting, and validation based dismissals are basic channel types [2-4].

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Corporations frequently use channels to ensure their workers and their data innovation resources. A catch-all channel will "get all" of the messages routed to the area that doesn't exist via the post office server - this can help abstain from losing messages because of incorrect spelling. Users might have the option to introduce separate projects or arrange sifting as a feature of their E-Mail program (E-Mail customer). In E-Mail programs, clients can make individual, "manual" channels that at that point consequently channel e-mail as indicated by the picked measures. E-mail channels can work on inbound and outbound E-Mail traffic. Inbound E-Mail sifting includes checking messages from the Internet routed to clients ensured by the separating framework or for legal interference. Outbound E-Mail sifting includes the opposite - filtering E-Mail messages from nearby clients before any possibly destructive messages can be conveyed to others on the Internet [3,6].

Existing E-Mail Spam Filtering frameworks are subject to List-Based Filter procedures, for example, Blacklist, Real-Time Blackhole List, Whitelist, and Greylist. The boycott is a well-known spam-sifting strategy endeavor to stop undesirable E-Mail by filtering messages from the pre-set rundown of senders that your association's framework overseer makes [4,7,8]. Boycotts are records of E-Mail locations or Internet Protocol (IP) addresses that have been recently used to send spam. At the point when an approaching message shows up, the spam channel verifies whether it's IP or E-Mail address is on the boycott; assuming this is the case, the message is viewed as spam and dismissed. Though boycotts guarantee that realized spammers can't arrive at clients' inboxes, they can likewise misidentify authentic senders as spammers. These alleged bogus positives can result if a spammer happens to send garbage e-mail from an IP address that is additionally utilized by genuine E-Mail clients. Additionally, since numerous shrewd spammers routinely switch IP delivers and E-Mail delivers to cover their tracks, a boycott may not promptly get the most current flare-ups.

II. LITERATURE REVIEW

WuxuPeng : Author in his paper he explained about how important is security concerning the online platform and how is Naïve Bayes algorithm has disadvantages like not properly classifying emails when they contain leetspeak or diacritics. So he explains how his proposed work improves a Novel algorithm for enhancing the accuracy of the Bayes algorithm. He used python as a programming language to implement the work and used concepts of semantic-based, keyword-based, and machine learning algorithms to increase the accuracy[15,16,17].

Deepika Mallampati, Nagaratna P. Hegde: Authors explains about the spam emails were have alias name has non-self, unsolicited commercial emails or fraudulent emails sent to a group of people or for a company. He used Machine learning algorithms. Machine learning classifier to check whether the email received is a valid message or an unwanted message. They used Deep learning as potential tactics that can tackle the challenges of spam emails efficiently [10,11,12].

Jon Kågström: The author explains that Witten Bell is good at Turing with small performance loss comparative to simple Good Turing. He also explained Robinson's estimate based on Bayesian smoother showed excellent results and easy to implement and less computationally expensive than both Witten Bell and Good Turing [13,14].

III. SPAM FILTER

The proposed framework receives Content-Based Filters, which instead of upholding no matter how you look at its strategies for while sending Communication messages from any specific E-Mail or IP address, content-based channels assess words or expressions found in any individual message to decide if communication is spam or not spam [8].The E-mail Spam filter has previously been based on fetching spam signature via supervised learning using communication messages through emails explicitly manually labeled as spam or not spam. In this paper, we study of unsupervised machine learning based spam filter for more effectively identify new spamming. Communication spam filter identifies the unsolicited, unwanted, and virus-infested email as we call them to spam emails and stop it from getting into email inboxes. Internet service providers use spam filters to make sure they aren't distributing spam. The best spam filters currently available in the market are 1)Spam Titan(TitanHQ) it is suitable for all types of businesses2) ZERO SPAM 3) Spambrella 4)MailChannels5) Xeams 6) Topsec Email security 7) Symantec email security 8) MailWasher [18,19,20]

Since a Naïve Bayes channel is continually fabricating its assertion lists dependent on the messages that an individual client gets, it hypothetically turns out to be increasingly powerful the more it's utilized. In any case, since this technique requires a preparation period before it begins functioning admirably, you should practice persistence and will presumably need to physically erase a couple of garbage messages, at any rate from the start.[21,22]

IV. METHODOLOGY

Mathematical Model for SPAM Filter

1. We have to compute the probability that the message is spam, knowing that a given string appears in the message.
2. Then we compute the probability that the message is spam, taking into consideration all of its words
3. Then finally we give with rare string

To minimize false positives and increase the accuracy of Naive Bayes, an addition to the existing Naive Bayes method was created. This addition will be able to convert symbols inside words to possible letters and use a spell check function to ensure the corrected symbol is a word and then run the word through the Naive Bayes spam filter [23,24]

A. Naive Bayes Classifier -

Naïve Bayes algorithm is a Basic, Statistical technique for handling e-mail filtering for Naive Bayes

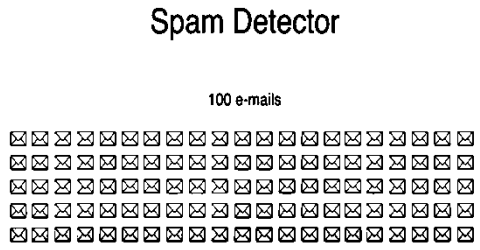
B. Bayesian Classifier – Spam filtering /detection

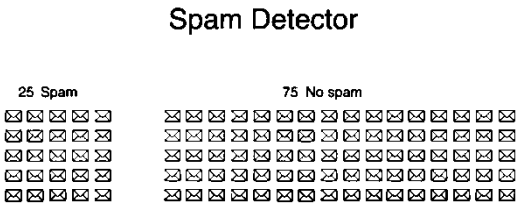
S: Spam
!S: Ham/not Spam

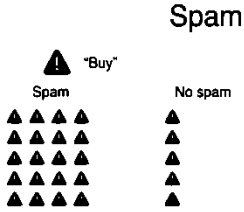
C. Multinomial Naive Bayes – The multinomial Naïve Bayes Classifier is suitable for classification with discrete features like word count in text classification. The multinomial distribution normally requires integer feature count, however, in practice fractional counts such as tf-idf may also work [3]. Theoretically, the best class is determined by multiplying all the probabilities that each word is spam together as shown in the equation to get an overall probability, with probabilities closer to 1 being spam. However, there are instances where the spam word does not occur at all in a message; Laplacian Smoothing may ameliorate this problem.[25]

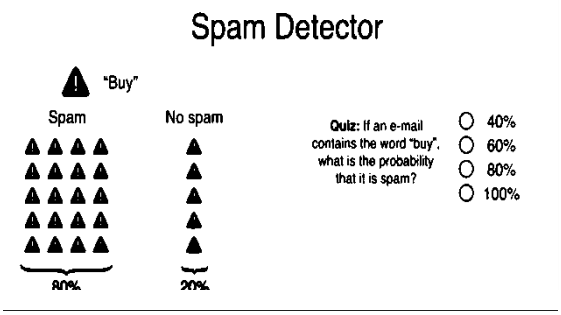
D. Proposed Algorithm – The algorithm is implemented using python language, her in developing the code we used key-based, word-based,semantic-based in unsupervised artificial machine learning [12]

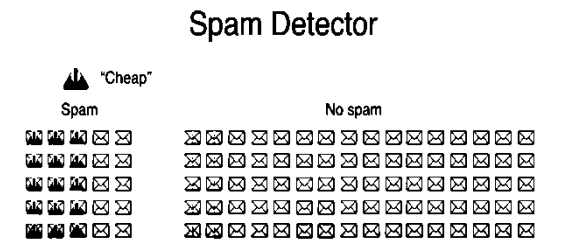
$$P\left(\frac{S}{W}\right) = P\left(\frac{W}{S}\right)P(S)/P\left(\frac{W}{S}\right)P(S) + P\left(\frac{W}{!S}\right)P(!S)$$

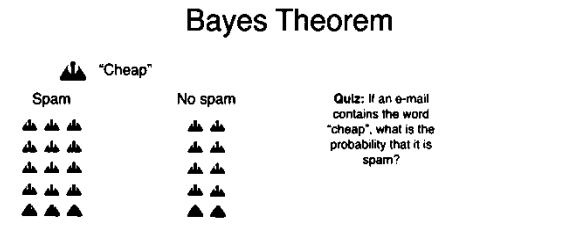


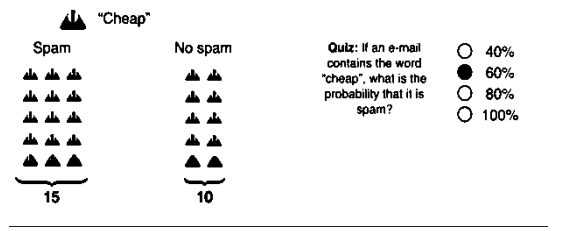


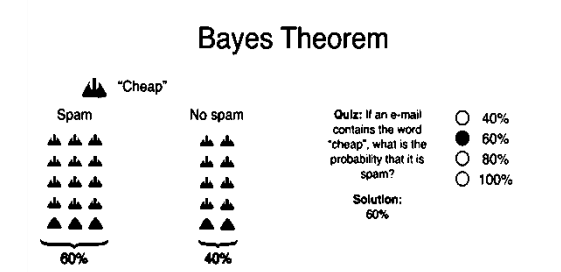


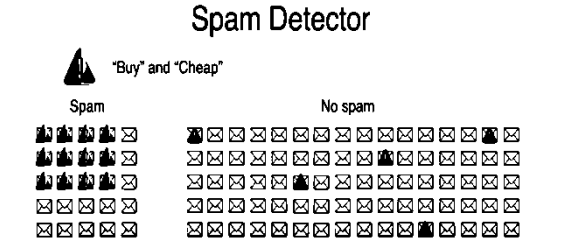


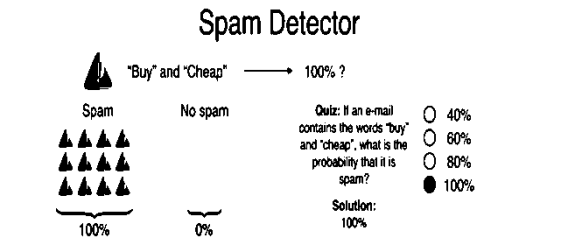


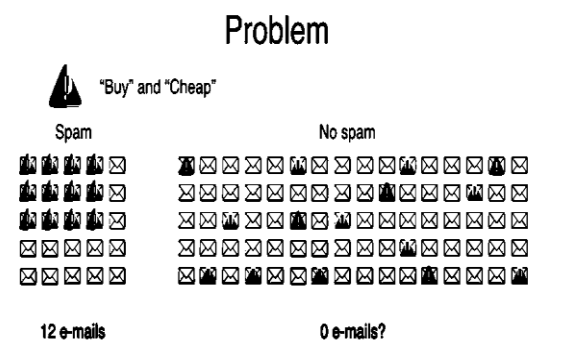












If an emailcontains the word" BUY" what is the probability that it is a SPAM

40%,60%,80%,100%

	Total	BUY	Cheap
Data set 1:	100	5	10
Data set 2:	25	10	15
Data set 3:	75	5	10

$$P\left(\frac{S}{B}\right) = P\left(\frac{B}{S}\right) P(S)/(P\left(\frac{B}{S}\right) + P\left(\frac{B}{H}\right) P(B)$$

$$P(spam\ if\ \text{BUY}) = \frac{20}{25} * \frac{\frac{25}{100}}{\frac{20}{25} * \frac{25}{100} + \frac{5}{75} * 75/100}$$

$$P(spam\ if\ \text{BUY\&"Cheap"}) = \left(\frac{20}{25} * \frac{15}{25} * \frac{25}{100}\right) \square \left(\frac{20}{25} * \frac{15}{25} * \frac{25}{100} + \frac{5}{75} * \frac{10}{75} * \frac{75}{100}\right)$$

$$= 94.737\%$$

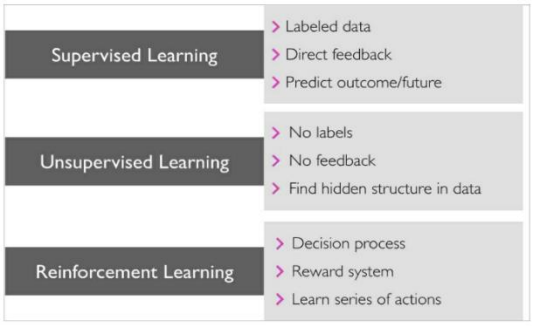


Fig. 1. Making predictions with supervised learning.

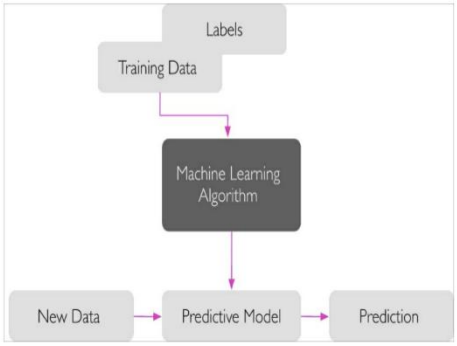


Fig. 2. Proposed algorithm flow.

Consider the data sets

Data sets	String	Filter
1	I Loved the Movie	Ham
2	I hated the Movie	Spam
3	A Great Movie, Good Movie	Ham
4	Poor acting	Spam
5	Great Acting, A Good Movie	Ham

There are 10 unique words in this data set
They are
I, Loved, the, Movie, hated, a ,Great, Poor, Acting , Good

$P(ham) = \frac{3}{5} = 0.6;$

Data set	**I**	**Loved**	**the**	**movie**	**hated**	**a**	**great**	**poor**	**acting**	**good**	**Class**
1	1	1	1	1							Ham
2	1		1	1	1						Spam
3				2		1	1			1	Ham
4								1	1		Spam
5				1		1	1		1	1	Ham

$P\left(\frac{I}{ham}\right) = \frac{1+1}{14+10} = 0.0833$	$P\left(\frac{loved}{ham}\right) = \frac{1+1}{14+10} = 0.0833$
$P\left(\frac{the}{ham}\right) = \frac{1+1}{14+10} = 0.0833$	$P\left(\frac{movie}{ham}\right) = \frac{5+1}{14+10} = 0.2083$
$P\left(\frac{a}{ham}\right) = \frac{2+1}{14+10} = 0.125$	$P\left(\frac{great}{ham}\right) = \frac{2+1}{14+10} = 0.125$
$P\left(\frac{acting}{ham}\right) = \frac{1+1}{14+10} = 0.0833$	$P\left(\frac{good}{ham}\right) = \frac{2+1}{14+10} = 0.125$
$P\left(\frac{hated}{ham}\right) = \frac{0+1}{14+10} = 0.0417$	$P\left(\frac{poor}{ham}\right) = \frac{0+1}{14+10} = 0.0.417$

"I hated the poor acting"

If V_j=ham ;P(ham)P(I/ham)P(hated/ham)P(the/ham)P(poor/ham)P(acting/ham)

$=6.03*10^{-7}$

If V_j=spam ;P(spam)P(I/spam)P(hated/spam)P(the/spam)P(poor/spam)P(acting/spam)

$=1.22*10^{-5}$

$$P\left(\frac{the}{ham}\right) = \frac{1+1}{14+10} = 0.0833$$

$P\left(\frac{I}{spam}\right) = \frac{1+1}{6+10} = 0.125$	$P\left(\frac{the}{spam}\right) = \frac{1+1}{6+10} = 0.125$
$P\left(\frac{movie}{spam}\right) = \frac{1+1}{6+10} = 0.125$	$P\left(\frac{hated}{spam}\right) = \frac{1+1}{6+10} = 0.125$
$P\left(\frac{poor}{spam}\right) = \frac{1+1}{6+10} = 0.125$	$P\left(\frac{acting}{spam}\right) = \frac{1+1}{6+10} = 0.125$
$P\left(\frac{loved}{spam}\right) = \frac{1+1}{6+10} = 0.0625$	$P\left(\frac{a}{spam}\right) = \frac{0+1}{6+10} = 0.0625$
$P\left(\frac{great}{spam}\right) = \frac{0+1}{6+10} = 0.0625$	$P\left(\frac{good}{spam}\right) = \frac{0+1}{6+10} = 0.0625$

$$P(spam) = \frac{2}{5} = 0.4;$$

V. RESULTS

	Spam		Not Spam	
Total	25		75	
BUY	20	4/5	5	1/15
Cheap	15	3/5	10	2/15
Buy & Cheap	12	12/25	2/3	2/225
	$\frac{12}{12+\frac{2}{3}} = \frac{36}{38} = 94.734\%$			

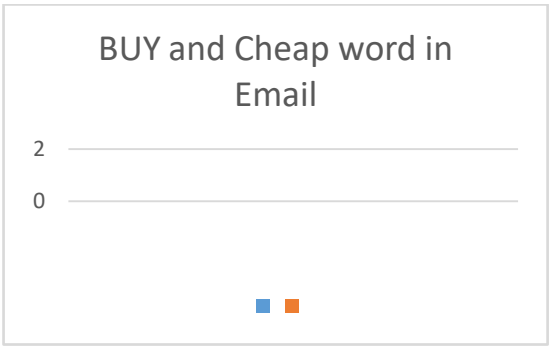


Fig. 3. SPAM Message Detection using the proposed algorithm.

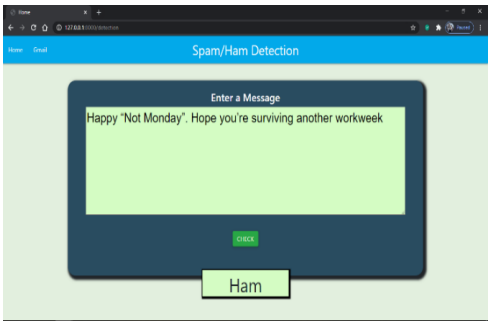


Fig. 4. Ham Message Detection using the proposed algorithm.

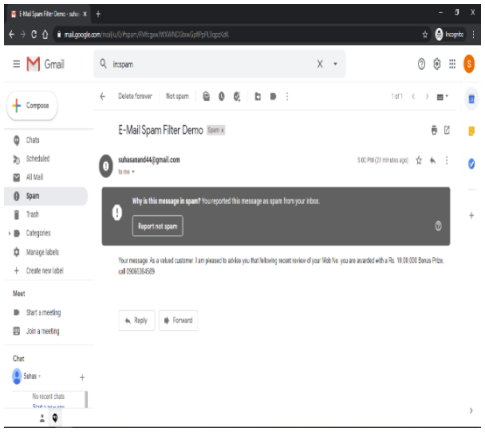


Fig. 5. An E-Mail with SPAM Content being detected by Gmail.

VI. CONCLUSION

Today's generation everyone is using online mode for communication, and started using smart phones, laptops and store/exchange lot of information via emails. We get gigabits of messages every day and partitioning them with spam or not is very difficult talk in hand. So we have come up with new idea of Naïve Bayes spam filter algorithm.

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ULTRASOUND AND THERMAL IMAGE ENHANCEMENT TECHNIQUE USING CONVOLUTION NEURAL NETWORK

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ABSTRACT

Medical imaging is a non-invasive diagnosis technique in the field of medical imaging with non-radioactive nature. However, the efficiency of medical image (thermal and ultrasound) reconstruction affected due to noisy nature, bulk size and time consumption. Therefore, to get high quality reconstructed image we have presented sparsity based image enhancement (SIE) technique using convolution neural network (CNN) namely SIE-CNN for eliminating noise and improving reconstruction quality of thermal and ultrasound image. The proposed image enhancement technique adopted fast CCN architecture (the CNN architecture aid in training larger dataset with improved quality) and sparsity based image enhancement technique is used for building template learning (DL) technique for removing noise. Experiment are conducted to evaluate performance of SIE-CNN over existing model in terms of PSNR and SSIM. The result attained shows the proposed SIE-CNN model achieves better PSNR and SSIM performance than existing image enhancement technique. Thus, SIE-CNN achieves much better reconstruction quality.

Key words: Image enhancement, Convolutional Neural Network, Denoising, Sparse feature, Termal imaging, Ultrasound

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1. INTRODUCTION

In recent years, the human death rate drastically increased globally due to some hazardous medical diseases namely cardiovascular, sinusitis (sinus infection), rheumatoid arthritis, and thyroid etc. [1]. Identifying these diseases at early stages helps in clinical diagnosis and reducing mortality rate to a great extent. In last few years, the detection of cardiovascular, rheumatoid arthritis, sinusitis, and thyroid has been much enhanced due to heavy innovations in imaging techniques namely magnetic resonance imaging, ultrasound, and thermal imaging technique due to its non-radio and non-invasive nature, precise high resolution quality and diagnosis of versatile diseases. Non-invasive imaging technique can be widely utilized in global and local cardiac diagnosis due to its clear deformation detection techniques between myocardium and its surrounding tissues [2]. Further, it can be widely used in many applications namely detection of local myocardial strain and motion, angiography, Arterial Spin Labelling, for diagnosis of heart attack, lung, breast, thyroid and colorectal cancer etc.

However, one should be aware of drawbacks occurs while diagnosis of Non-invasive medical images which degrades its performance such as limited spatial resolution, large encoding, huge image set, large power requirement and high temporal dimensions etc. [3], [4]. Many researchers have shown their interest in limiting these drawbacks and presented many techniques relating to Non-invasive imaging such as compression sensing, dictionary/template learning with block matching, wavelets techniques etc. in last decade. However, recovery of images is not efficient as required due to their low-resolution quality and many existing techniques takes high amount of time in eliminating noise and reconstructing these large set of Non-invasive medical images. Non-invasive imaging speed is limited due to physiological nervy stimulation, amplitude and slew constraints.

There are above mentioned few techniques which tried to reduce these drawbacks in which Compression Sensing is widely adopted by many existing researchers and earned a high praise from various researchers in recent times due to its capability to reduce data acquisition time [5], [6], [7], [8]. In [9], magnetic validation and sensitivity analysis using diffusion weighted approach is used for the diagnosis of non-invasive images. A low rank matrix approximation is used to handle processing dynamic magnetic resonance imaging [10] by FEI XU. A sequential template learning algorithm used for functional non-invasive images from correlated data to get correlation between spatial and temporal smoothness [11]. However, several issues are addressed in above techniques such as high nuclear relaxation time, normalization and optimization problem, realistic electromagnetic issues, large power consumption while medical imaging diagnosis and most importantly, they requires huge processing time which can degrade the performance of the system.

Therefore, to resolve these problems an efficient and speedy algorithm is required which can easily handle large processing of medical images. In recent few years, Convolution Neural Network (CNN) technique becomes the most emerging technique to handle large image datasets due to its robust feed-forward methods and easy training. It can reduce these drawbacks and noises present in thermal and ultrasound images to remove noise and reconstruct image with good quality. It can train large image datasets very precisely in much faster way as it can perform parallel GPU computing using CUDA programing framework. Therefore, this special properties makes CNN architecture much different from other existing state-of-art-techniques [12], [13]. This paper aims at solving speed and high quality reconstruction issues relating to medical images in order to maintain high performance. This is because speed is one of the most important factor in medical imaging due to its bulky image sets and more often they need to transfer at other stations. Therefore, high processing speed is very much essential. While increasing processing speed, there is a chance of

misbehaving reconstruction efficiency. Therefore, generating high quality reconstruction with high speed is very essential process in medical imaging of thermal and ultrasound images.

The contribution of work can be classified as follows:

Therefore, in this paper, we have presented a sparsity based image enhancement technique using CNN for reconstructing high quality medical image. The SIE-CNN model reduce various noises present namely AWG (Additive white Gaussian) noise, ricean and speckle in ultrasound and thermal image. A Template learning algorithm is integrated with sparse representation used to de-noise ultrasound and thermal images which is a subject-based block extraction method. It also increases accuracy (i.e., reduce error) and eliminates computational complexity. Our model sparsity based image enhancement technique based CNN architecture used to eliminate sparse optimization and redundancy problem. Our model subdivide the input image into various blocks and passes it to CNN architecture and then their difference is fed to training phase to generate template. Then this generated templates are used in testing phase to generate high quality image. In this way our model eliminates various noises and outperforms all the existing state-of-art-techniques verified by our experimental results.

This paper is organize in following sections which are as follows. In section 2, we described our proposed ultrasound and thermal image enhancement technique using CNN methodology. In section 3, experimental results and evaluation shown and section 4 concludes our paper.

2. ULTRASOUND AND THERMAL IMAGE ENHANCEMNT TECHNIQUE USING CONVOLUTION NEURAL NETWORK

In this section, we have presented a CNN architecture using sparsity based image enhancement (SIE) technique to eliminate noise and reconstruct high quality thermal and ultrasound image. Our model consists of following phases as template creation phase, combining sparse coding into template stage and parametric reconstruction quality evaluation phase. The step involved of proposed image enhancement technique is shown Algorithm 1.

Algorithm 1: proposed image enhancement technique namely SIE-CNN.

Step 1. Start.

////Training phase.

Step 2. Input image of various type with low resolution quality, image with noise, and image with low contrast level.

Step 3. Segment the image into different blocks in arbitrary manner.

Step 4. Using the input image train the model using Sparse based image enhancement CNN technique for generating weights.

Step 5. Construct template using these weight during training phase.

////Testing phase

Step 6. Input image with different noise such as Gaussian, speckle, and ricean etc. for validating reconstruction quality of proposed image enhancement technique.

Step 7. Use generated templates (i.e., learned weight) during training process for removing noise and reconstruct image.

Step 8. Output enhanced medical image.

Step 9. Stop.

First, in template creation stage an input image is subdivided into various sparse layers. Every image is divided into several different blocks. Then those blocks are fed to our model

SIE-CNN. The output is used in the training stage to construct a template. In next stage, sparsity based image enhancement technique is adopted with template learning methods and constructed template is used in testing to eliminate noise. In this way high quality medical thermal and ultrasound image is generated. In last stage, quality of reconstructed image is evaluated based on PSNR (Peak Signal to Noise Ratio) and SSIM (Structural Similarity Index Metric). Our experimental results demonstrate that the superior quality of reconstructed image.

There are limited amount of thyroid thermal image and abundant amount of huge ultrasound images available in real time which need to transfer and reconstruct at other stations. However, there are few problems present in existing various state-of-art techniques namely high temporal dimensions, large power absorption, huge image dataset, high slew-rate and most essential existing technique are very slow in terms of processing speed. Therefore, in our model, two techniques adopted to evaluate high reconstruction quality and to maintain high processing speed as CNN (Convolution Neural Network) and sparse based image enhancement technique in integration with template learning methods to eliminate noise.

2.1. Convolution Neural Network

Neural Networks works based on the learned image statistics. In recent years, many researchers shown their interest in neural networks, especially in, Convolution Neural Network due to its high quality reconstruction and denoising capability [14]. It can handle large processing and performs various tasks as traffic sign recognition, artificial neural networks and medical image diagnosis etc. easily with the help of its pure feed-forward methods and efficient training [15]. CNN mainly focus on analysis of image data. The structure of CNN architecture is in hierarchical manner and various hidden layers are present, especially in, deep learning CNN techniques.

A special Convolution Neural Network adopted with sparse logistics to get de-noised and high quality thermal and ultrasound images with the help of template learning methods. CNN architecture can de-noise images based on the prior knowledge and efficient training regardless of noise type.

2.2. Architecture of Image Enhancement Technique

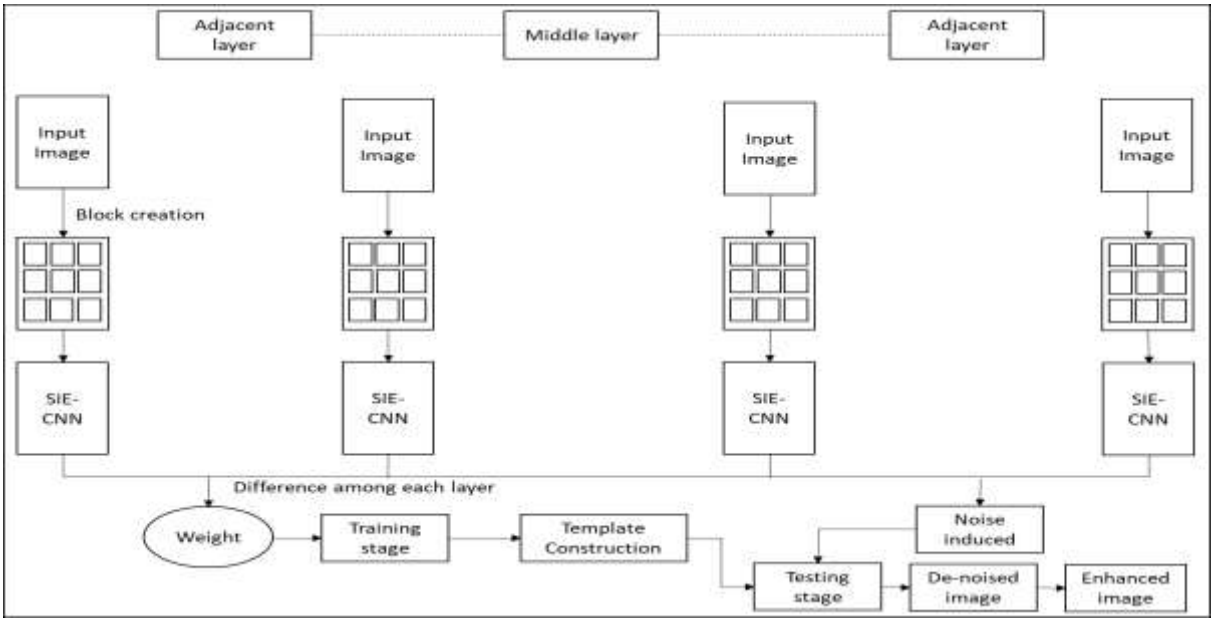


Figure 1 Ultrasound and Thermal Image Enhancement technique Architecture using SIE-CNN.

A medical image noise removal and reconstruction architecture is presented using model SIE-CNN in Figure 1. The input image is subdivided into various blocks and then it passed to SIE-CNN architecture and the result is used in training stage to create template which is further used in testing stage to eliminate noise which added with input image and then a de-noised (i.e., enhanced) reconstructed image is constructed. It consists of two stage such as training stage and testing stage.

2.3. Training Phase

Training is most essential stage for image data analysis. Training dictate the control flow of image data analysis. An efficient training can always ensure high performance of any system. However, it is large and complex process which takes large amount of time to train image data. Therefore, there is a need of an efficient technique which can train image data at incredibly faster rate and takes very less processing time. In training samples are repeatedly drawn and parameter selection is an arbitrary process. However, for effective performance a better architecture is compulsory. Hence, we have presented an efficient sparsity based image enhancement technique based on CNN architecture to get de-noised image.

Here, to train large medical images at much faster rate we have used parallel Graphical Processing Unit (GPU) computing using CUDA programing framework. The estimation of parameters is done based on noise type and blocks. To train high dimensional data more time is needed. Regularization can be achieve using pre-training and small norm vectors are easier to change.

Our model trained on gray scale medical images. Our model can be train on different noisy images and provide a high quality de-noised image. For training in model SIE-CNN we have used the difference between every layer to generate weights and then it is passed to training phase and then template is created which helps in achieving quality denoising for the input image with blocks and also reduces noise completely.

In this way, we can compute an effective training on large datasets and our experimental outcomes verifies our training efficiency by outperforming all state-of-art algorithms image enhancement algorithms in terms of PSNR and SSIM.

2.4. Template Based Methodology

Template learning technique is presented to give support to denoising technique to get de-noised image. Let noise k is merged with input image block signal i,

$$\mathbb{Y} = i + k, \tag{1}$$

Here, block wise denoising is computed. Size of each block taken as $m \times m$ where k more often lies between 8 and 12. All the blocks are individually de-noised and then a reconstructed image is constructed by integrating all together inside a frame; blocks which are overlapped can be controlled by averaging process. Template $\mathbb{D}$ whose size considered as $m^2 \times n$ where $n > m^2$on which our template is based.

2.5. Sparsity based Template Learning Methodology

In a template learning process an atom set can be provided as a basis function. A Sparse linear reconstruction technique is used to de-noise all noisy blocks extracted from an image. The AWG (additive white Gaussian noise) noisy error can be reduced as,

$$\min\|\alpha\|_0 \;\; s.t. \;\; \|\mathbb{D}_\alpha - \mathbb{Y}\|_2 \leq \in, \tag{2}$$

where, a pre-defined factor is provided as $\in$ and l_0 pseudo normalization can be computed using $\|\cdot\|$ and $\mathbb{Y}$ defined as noisy image block. Sparsity solution can be imposed by l_0 pseudo normalization. However, Convex normalization problem cannot be completely sorted out

using l_1 norm. The factor $\in$ can be chosen in such a way that approximation norm error $\|\mathbb{D}_\alpha - \mathbb{Y}\|_2$ can be defined by its variance. The quality denoising can be achieved internally using sliding window concept and the overlapping blocks can be controlled by using averaging scheme as described in following equation

$$\mathbb{D} \leftarrow \eta \, \Delta \frac{\Delta \, \|i - \mathbb{D}_\alpha\|_2}{\Delta \mathbb{D}}, \tag{3}$$

where η belongs to sliding windows. The overlapped blocks are minimized using following equations

$$\min\|i - \mathbb{D}_\alpha\|_2 \quad s.t. \quad -1 \leq \alpha \leq 1, \tag{4}$$

Template learning scheme evaluates the high reconstruction quality image. Therefore, the probable possibilities are: First, use designed template. Second, a template for noiseless image dataset can be learned globally. Third, a template can be learned from a noisy image in adaptive manner. We have demonstrated that from the experiment results our template learning algorithm gives better results. Best results are demonstrated when noisy image adaptively trained. In multi-class templates various distinct sparse features can be incorporated where interclass and incoherence templates uses image blocks.

Template learning schemes can reduce the sparse optimization problem. Template learning performance can be increased using image blocks in both algorithms. Template learning and block classification methods consists lightning speed which utilizes only 10 to 20 percent of the training time while denoising. Template learning does not require any heuristic knowledge and can adaptively learn sparsity based templates. Here, first template is produced using training and then learned template is used to compute high quality reconstructed medical image.

2.6. Testing Phase

In this section, we introduce about our testing performance. Testing efficiency is better than the training efficiency due to efficient denoising performance and block-wise classification. The block difference can be reduced to avoid over-fitting. Similar template is provided in testing which are created in training phase to reduce noise.

$$\hat{\imath} = \bar{i} + \frac{(\mathbb{F}\{(\mathbb{Y} - \mathbb{Y})^2\} - \sigma^2)\left(\mathbb{Y} - \bar{i}\right)}{\mathbb{F}\left\{\left(\mathbb{Y} - \overline{\mathbb{Y}}\right)^2\right\}}, \tag{5}$$

where, equation (5) defines de-noised image expression and σ represents noise level. It involves the computation of $\bar{i}$ and $\mathbb{F}\left\{\left(\mathbb{Y} - \overline{\mathbb{Y}}\right)^2\right\}$. The computation of $\bar{i}$ can be done effectively by filtering noisy image using template learning algorithms on a block size of $m \times k$. The advantage of using templates is their computational efficiency and sparse error minimizing ability. The updated probability distribution function using logarithm for denoising is,

$$i^{(t+1)} = i^{(t)} + \eta \left[\sum_{r=1}^{K} N_r^- * \psi_r\left(N_r * i^{(t)}\right) + \frac{\lambda}{\sigma^2}\left(\mathbb{Y} - i^{(t)}\right)\right], \tag{6}$$

where, N_r^- shows central pixel and convolution is defined by $*$ sign and η used to evaluate step size. To maintain the trade-off between likelihood and priori λ is utilized. The final value of λ rely upon noise level σ. Quality of reconstructed image can be evaluated using PSNR and SSIM.

3. PERFORMANCE EVALUATION

This section describes about the various experiments are conducted to get high performance efficiency on the similar dataset for thermal and ultrasound images used in [18] and [19] in contrast to other state-of-art-techniques. To get de-noised thermal and ultrasound images various multiple experiments are conducted. The proposed denoising technique reduces Gaussian and ricean errors for thermal and ultrasound images. Experimental outcomes verifies high reconstruction quality of various medical images using our proposed model. The experimental outcomes outperforms conventional state-of-art techniques in terms of PSNR, and SSIM. Our outcomes demonstrate efficiency and reconstruction accuracy increases to a large extent. Our model need very less execution time for processing of large datasets. The proposed model implemented on 64-bit windows 10 OS with 16 GB RAM which consists on INTEL (R) core (TM) i5-4460 processor. It consists of 3.20 GHz CPU. We have compared our model with different existing state-of-art techniques [17], [20], [21], and [22].

In modern era, the need of noiseless high quality medical images has provided immense growth for thermal and ultrasound images. Therefore, there is huge demand of an effective technique which can accurately reconstruct high quality medical images in real time after compression. Hence, we have presented a CNN model with sparse representation technique namely SIE-CNN to ensure high quality de-noised medical image for thermal and ultrasound images. The steps involved for carrying out experiment is shown in Figure 2. All the experiments are implemented for thermal and ultrasound images. Further, to evaluate robustness of our model experiment is conducted for MRI and CT images. All the experiments are undertaken on the Matlab library and Python 3.6 framework. All the experiments conducted at very high speed using parallel GPU computing on CUDA computing framework.

Table 1 demonstrated that PSNR and SSIM result comparison with other state-of-art-techniques. The highest PSNR using our model is 35.63 dB which is shown in Figure 3 and highest SSIM is 0.864 which is very high in contrast to other existing state-of-art techniques.

Figure 3 shows enhanced thyroid ultrasound image after eliminating noise using SIE-CNN model. From Figure 3 it can be seen the SIE-CNN model removes noise more efficiently with PSNR value of 37.59db and SSIM value of 0.866. The Figure 3a is the thyroid original ultrasound image without any added noise, Figure 3b is the thyroid ultrasound image with noise, and Figure 3c, the reconstructed thyroid ultrasound image after removing noise using SIE-CNN model. From result attained it can be seen our SIE-CNN model removes noise more efficiently and attain much better reconstruction quality when compared with existing image enhancement technique.

Similarly, Figure 4 shows enhanced thyroid thermal image after eliminating noise using SIE-CNN model. From Figure 4 it can be seen the SIE-CNN model removes noise more efficiently with PSNR value of 37.99db and SSIM value of 0.9557. The Figure 4a is the thyroid thermal original image without any added noise, Figure 4b is the thyroid thermal image with noise, and Figure 4c, the reconstructed thyroid thermal image after removing noise using SIE-CNN model. From result attained it can be seen our SIE-CNN model removes noise more efficiently and attain much better reconstruction quality when compared with existing image enhancement model.

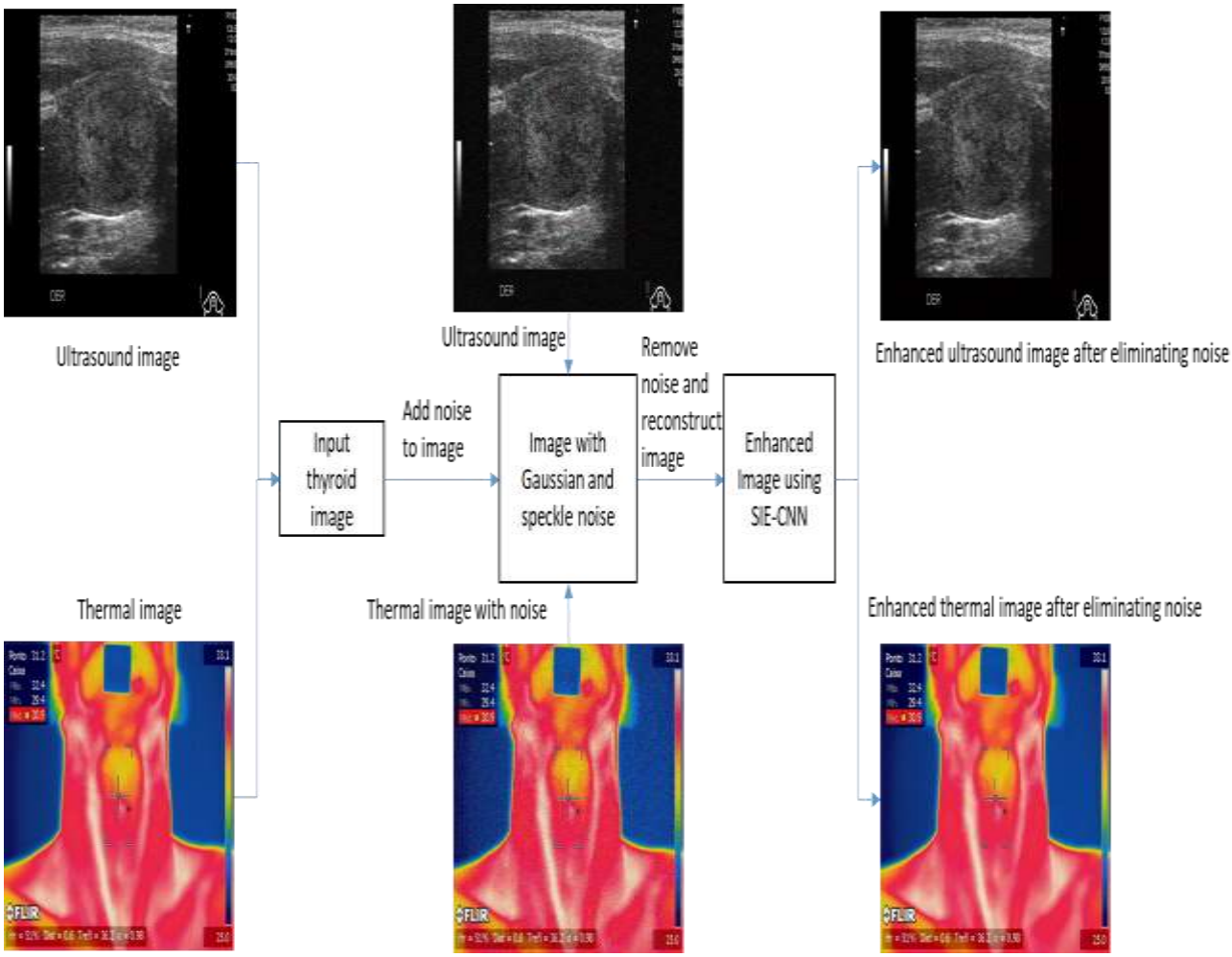
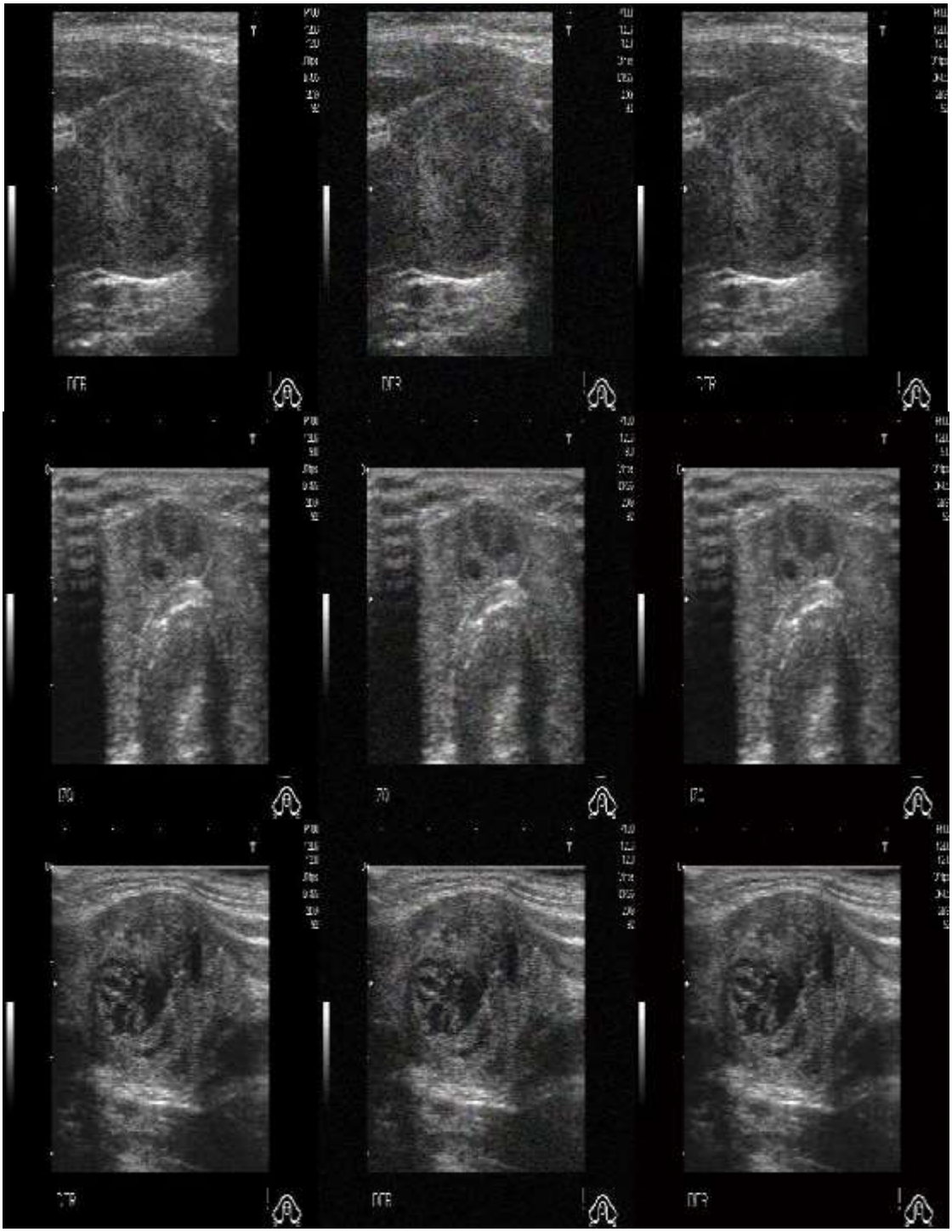


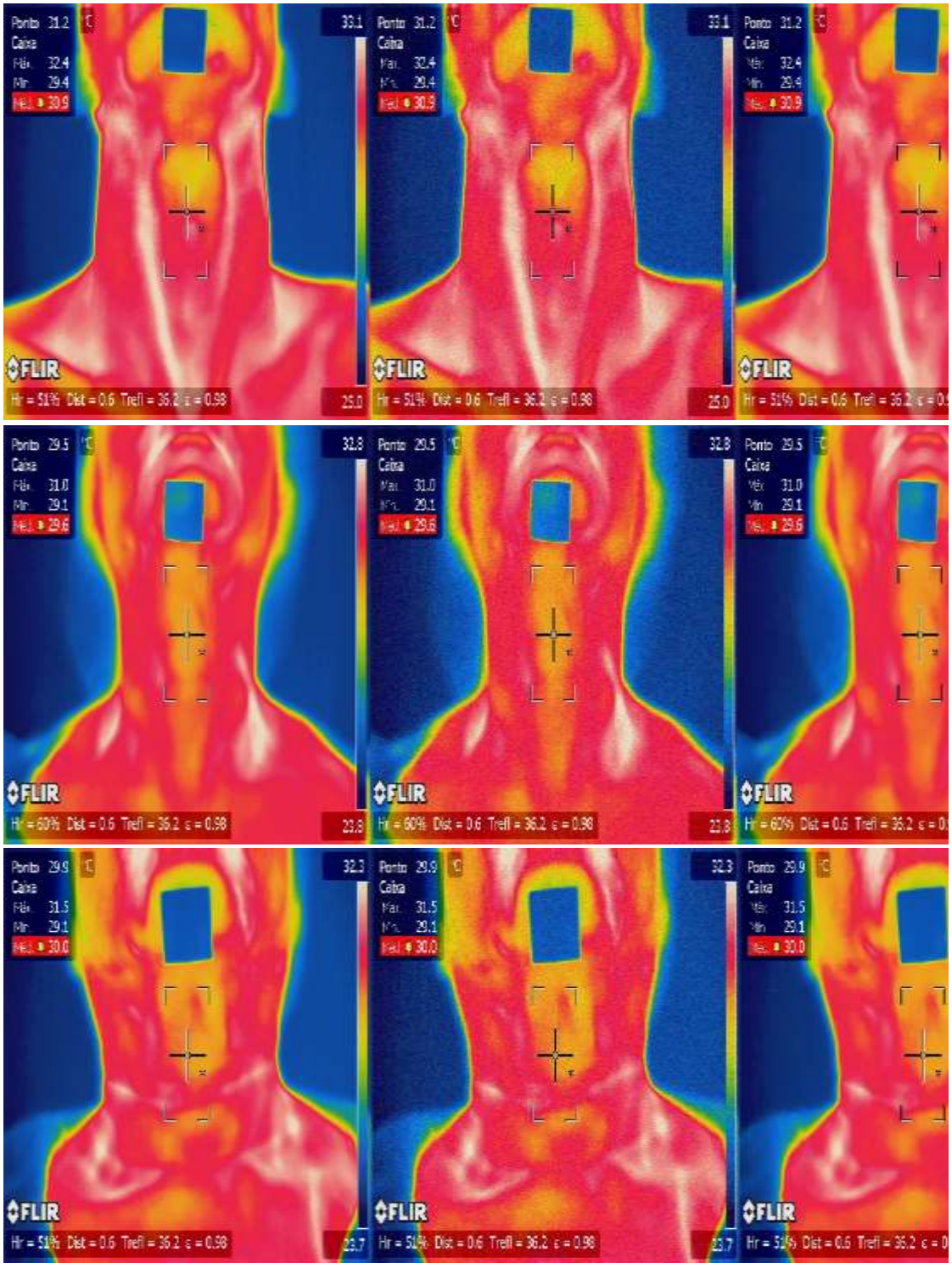
Figure 2 The steps involved for carrying out experiment in removing noise and enhancing medical image.

Lastly, for validating robustness of SIE-CNN model experiment are conducted on CT and ultrasound images. Figure 5 and 6 shows enhanced MRI and CT image after eliminating noise using SIE-CNN model, respectively. From Figure 5 it can be seen the SIE-CNN model removes noise more efficiently with PSNR value of 36.92db and SSIM value of 0.8732 for MRI image. From Figure 6 it can be seen the SIE-CNN model removes noise more efficiently with PSNR value of 37.11 and SSIM value of 0.8921. The Figure 5a and 6a is the MRI and CT image without any added noise, respectively, Figure 5b and 6b is the MRI and CT image with noise, respectively, and Figure 5c and 6c, the reconstructed MRI and CT image after removing noise using SIE-CNN model. From result attained it can be seen our SIE-CNN model removes noise more efficiently and attain much better reconstruction quality when compared with existing image enhancement technique model.



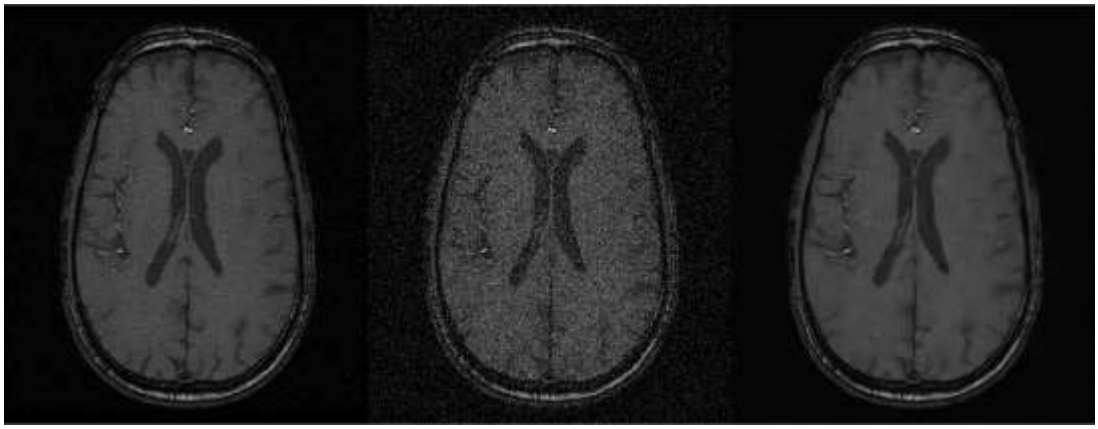
a) Actual Image b) image with noise c) Reconstructed image

Figure 3 Image enhancement outcome of thyroid ultrasound images obtained using SIE-CNN.



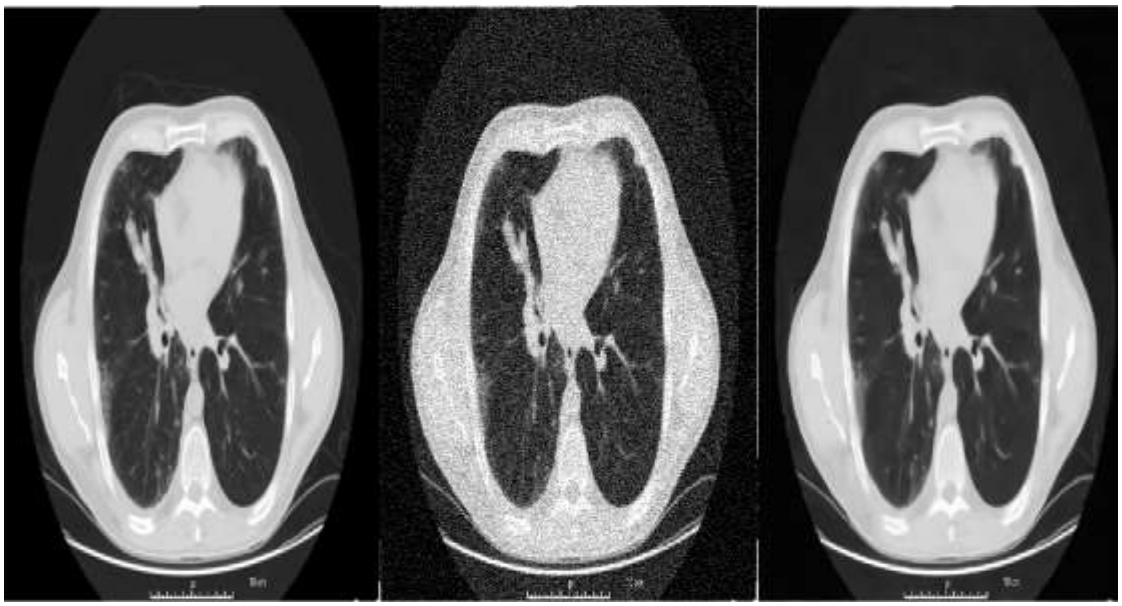
a) Actual Image b) image with noise c) Reconstructed image

Figure 4 Image enhancement outcome of thyroid thermal images obtained using SIE-CNN.



a) Actual Image b) image with noise c) Reconstructed image

Figure 5 Image enhancement outcome of MRI images obtained using SIE-CNN.



a) Actual Image b) image with noise c) Reconstructed image

Figure 5 Image enhancement outcome of CT images obtained using SIE-CNN.

The average PSNR outcome achieved by SIE-CNN over existing image enhancement methodologies are shown in TABLE 1. The PSNR performance outcome comparison are graphically shown in Figure 7. From result achieved it is seen the SIE-CNN improves image quality i.e. PSNR by 54.73%, and 47.434% over CLAHE and QDHE, respectively.

Table 1 PSNR and SSIM comparison with other state-of-art-techniques

Image enhancement methodologies	PSNR [dB]	SSIM
QDHE [17]	19.76384	-
CLAHE [17]	17.01932	-
SIE-CNN	37.598	0.9038

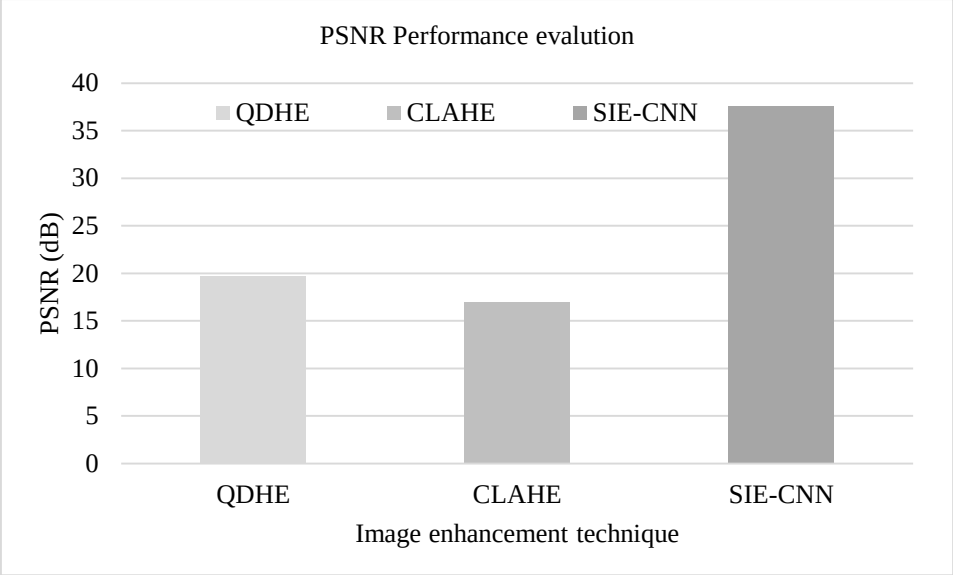


Figure 6 Image enhancement technique PSNR outcome of SIE-CNN and other existing approaches.

4. CONCLUSION

Ultrasound is a widely used non-radio-active detection technique and thermal imaging is also getting increased attention. However, ultrasound and thermal medical image detection is a complex and time consuming procedure as data is not clear because of noisy nature. Therefore, we have implemented sparsity based image enhancement technique using CNN architecture for high quality reconstruction of thermal and ultrasound images with improved time efficiency. In our model SIE-CNN we implemented template learning algorithm by producing a template while training for efficient denoising for various types of noises. We have used various parameters to define high quality of our reconstructed thermal and ultrasound medical image namely PSNR and SSIM. Experimental outcomes shows that our model SIE-CNN outperforms all other state-of-art-algorithms in terms of PSNR, SSIM and time consumption. Our model produces high PSNR results as 37.598 dB which is much higher than any other algorithm. Similarly, SSIM outcomes are 0.9038 using our model SIE-CNN. These results demonstrates superiority of our model SIE-CNN. Future work would consider evaluating performance by introducing different kind of noise such as Gaussian etc. Designing better image enhancement technique will aid detecting and segmenting thyroid more efficiently which in the future will be considered.

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A FRAMEWORK FOR PERFORMANCE EVALUATION OF MACHINE LEARNING TECHNIQUES TO PREDICT THE DECISION TO CHOOSE PALLIATIVE CARE IN ADVANCED STAGES OF ALZHEIMER'S DISEASE

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Abstract - Alzheimer's is one of the chronic diseases that stand as a challenge in the geriatrics domain. The symptoms, diagnosis and treatment varying from person to person makes it more complex to understand the inherent nature of this disease. The lifestyle factors and behavioural traits play major role in the onset and progression of Alzheimer's disease compared to genetic factors. Studying and analysing such behavioural traits would help the healthcare practitioners to understand its effect on the progression of the disease and its manageability in the advanced stages. This would culminate in enhancing the provision of customized palliative care to alleviate the trauma faced by patients and their caregivers. Making the machines learn from and build models on such data would make the task of healthcare professionals, much easier and quicker. It assists the healthcare stakeholders in studying large amounts of patient data and get equipped to work with patient specific symptoms, to strategize their treatment and improve terminal care facilities. The social media data, available in the form of discussions on patient support groups hosted by Facebook, is manually curated and used for training various machine learning models. Gaussian Naïve Bayes followed by Support Vector Machine were found to be the best performing models based on various context specific evaluation metrics.

Keywords: Social media; Alzheimer's; behavioural traits; machine learning; evaluation metrics; feature selection.

1. Introduction

Alzheimer's is an irreversible and a progressive brain disorder that gradually hampers the memory and thinking skills which culminates into cognitive impairment [1]. This disease is more prevalent in western countries compared to other parts of the world. Despite being ranked as one of the successful and happiest countries in the world, Finland and United States stand at the top among the most affected countries, by Alzheimer's. Canada, Iceland, and Sweden follow in numbers raising debatable questions on the factors that lead to this disease. Alzheimer's has been the 6th leading cause of death in the United States though the mortality rates have significantly improved in the last 20 years [2]. Magnetic Resonance Imaging (MRI) features that depict the brain tissue shrinkage is the only means, so far, to predict the rate at which the cognitive health declines from mild impairment to dementia. But, researchers believe that the interplay of lifestyle, environmental and behavioural factors constitute the major cause for onset and progression of Alzheimer's, which eventually affect the brain, though less than 1% of the time, it is caused by gene specific factors [3]. Studying and using the lifestyle related factors, personality & behavioural traits, and their effect on the important aspects of Alzheimer's disease will be of great help to the medical practitioners (specifically neurologists and neuropsychologists) to customize their treatment and counselling methods that alleviate the trauma this disease causes to the patients as well as caregivers. This kind of data would even help them to understand various trends related to the disease and its progression.

Patient networks/communities on social media are a rich source of data in the form of discussions about how patients and their caregivers deal with the disease, its progression and repercussions, diagnosis and treatment methods, and many such relevant issues. Analysing this data would help the stakeholders in this domain to make an in depth study about this disease and strategize their treatment methods as the onset, symptoms, and progression of Alzheimer's varies from patient to patient and is highly dependent on their lifestyle, relationship with the caregiver, and other factors. In this setting, our current work focuses on analysing the behavioural traits in association with some demographic factors of the Alzheimer's patients that are collected from the discussions of their caregivers on social media patient networks. This work is a step towards finding the best performing machine learning model to predict whether the caregivers opt to take care of their loved ones at home i.e., whether the disease is manageable in the advanced stages or the caregivers resort to palliative care/hospice based on the patient behaviour and other relevant factors. This would provide an informative outlook about the disease to the healthcare stakeholders as to how various attributes play significant role in the manageability of the patients in their last stages.

1.1 *Relevant work*

Vast amount of work was being carried out in applying machine learning techniques in the healthcare domain to predict various diseases. The authors in [4] have made an extensive literature review on the studies made to compare performances of various supervised machine learning algorithms that are used in disease prediction. Nearly 336 unique articles were published in indexed journals that discussed about the application of machine learning in prediction of diseases like breast cancer, heart disease, Parkinson's etc. The work in [5] presented a systematic review of the tools for data analysis in the healthcare domain by providing examples of various machine learning algorithms. The authors of [6] reviewed briefly, the important literature on how deep learning can benefit the researchers to diagnose the Alzheimer's disease at early stages. As the diagnosis of Alzheimer's disease mostly uses brain images that visualize the pharmacology, functionality, and structure of the brain, which are generated by using imaging techniques like functional and structural imaging [7], all the Alzheimer's related research rely on this kind of data only.

A mathematical tool called path signature for the selection of features for machine learning to predict a diagnosis for the Alzheimer's disease was discussed in [8]. Ubiquitous technologies generate time-ordered data through patient monitoring methods from which predictive features can be selected by using the path signature method. This research work used whole brain, hippocampus, and ventricles related measurements as variables and further feature selection. Though some research towards using deep learning techniques in the diagnostic classification and detection of Alzheimer's is being carried out recently, it is very limited and moreover, they mostly rely on neuroimaging data and fluid biomarkers for their analysis [9]. The research study presented in [10] applied a binary classification benchmarking algorithm to predict the risk of late-onset of Alzheimer's disease by using data related to genetic variation. It also carried out systematic comparisons of machine learning algorithms' performance in classification which would help to harness the predictive capabilities of the models discussed in their work. The work by the authors in [11] presented the development of a machine learning model which is used to predict dementia in general patient population from different institutions of healthcare by making use of routine care data that is available as electronic health records. Structured and unstructured data from diagnosis, medical notes, and prescriptions was used to train their model proposed and predict one and three years prior to the onset of the disease. Easily understandable ML techniques were selected by the authors to make it adaptable by the healthcare professionals.

The data related to Alzheimer's disease diagnosis, classification, and prediction that is being analysed so far, is in the form of neuro-images and biomarkers. But, Alzheimer's patients also exhibit some behavioural disturbances and psychological symptoms as prominent features observed in approximately 90% of the patients suffering from it. The symptoms like anxiety, aggression, excessive sleep, and other abnormalities in behaviour can be noticed commonly. The process of neuro-degeneration is affected by dysfunctionalities in neurotransmission along with personality traits and psychological factors playing an equally progressive role [12]. A study indicated only moderate differences between the types of mental or behavioural traits noticed at different phases of illness caused by Alzheimer's that leads to different types of dementia. In [13], large community of elderly people were investigated to find that Alzheimer's patients are more likely to have illusions, deviant motor behaviour, and aggression as common symptoms and less likely to suffer from depression. The behavioural deviations from normal are generally described as "agitation" which include wandering, aggression etc. [14]. Analysing such behaviour related data of the Alzheimer's patients by applying machine learning models is not taken as a research problem up to date.

1.2 *Our contribution*

Analysing data shared on social media related to behavioural traits of Alzheimer's patients has a huge potential of making the stakeholders of healthcare domain stay well-equipped to make important/informed decisions related to diagnosis, strategize treatments and provide more effective palliative care for the victims. The details about the behavioural traits of Alzheimer's patients along with other demographic and related factors would serve as a rich source of data, and when analysed, would unveil some interesting trends in understanding the problem at depth. Our current work focuses on designing a framework to make the machine learn from such data gathered from online patient communities' discussions (caregivers as members), evaluate its performance with various models and their goodness of fit to the data at hand. This would enable the deployment of applications developed based on this framework across institutions for its extensive usage. The data in the form of discussions on social media patient support groups is self-reported by the caregivers who directly deal with the patients and is at par with any proctored survey data in which, actually, the scope of data collection has many limitations. Forthcoming parts of this paper present the proposed conceptual framework in Section 2, data source, collection and experimental setting in Section 3, feature engineering and selection in Section 4, elaboration on the machine learning techniques used in Section 5, results and discussion in Section 6 followed by conclusion and future work.

2. Proposed Conceptual Framework

The steps followed to conduct the experiment and find the best performing model for the given problem and data collected is depicted in Fig. 1. The upcoming sections will further elaborate on each of these steps.

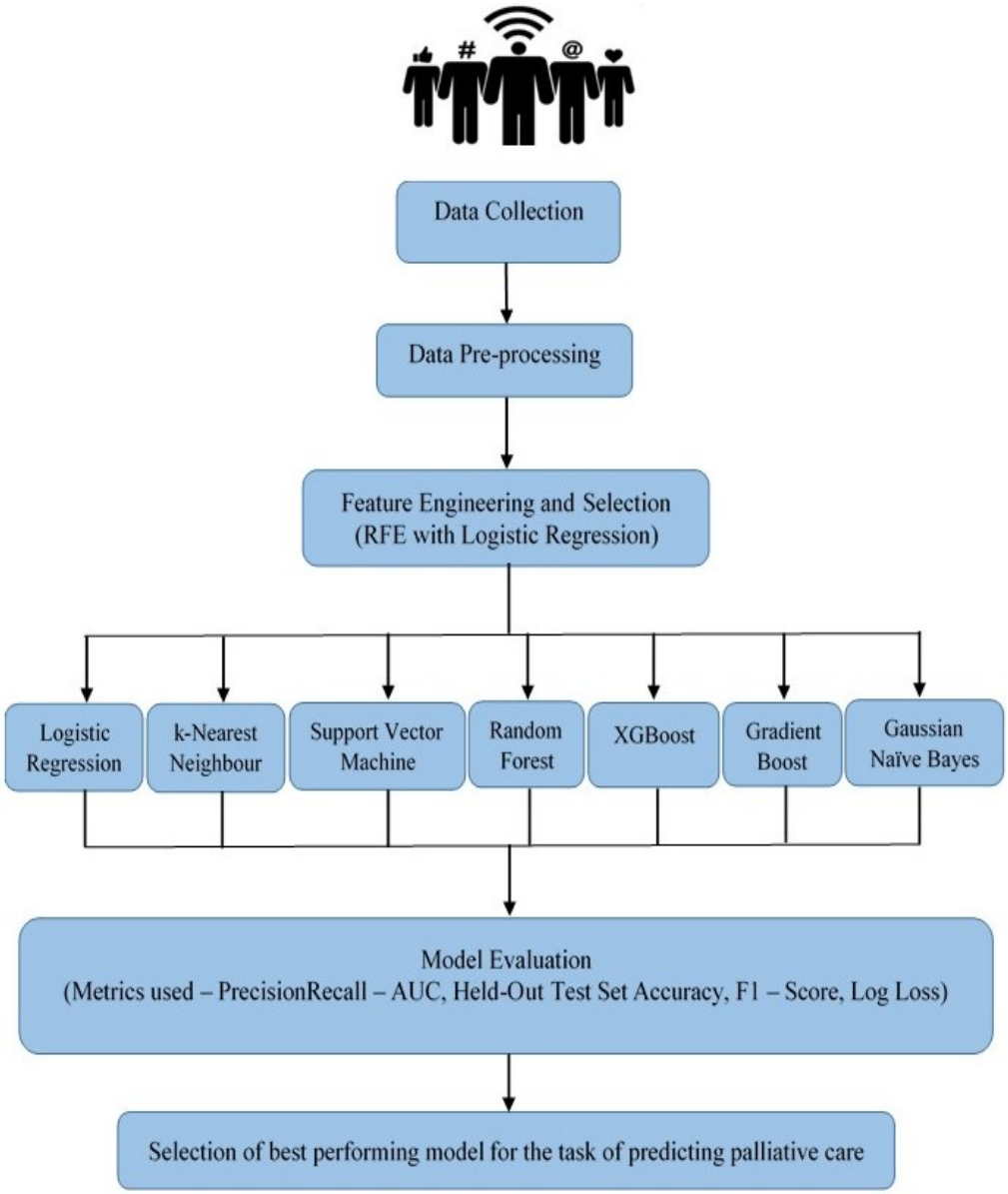

Fig. 1. Framework for the study

3. Data Collection and Experimental Setting

The patient related data and behavioural traits required to train the machine learning models, that can predict the decision of caregivers to opt for a hospice, is collected from the discussions between caregivers on social media patient support networks/communities hosted by Facebook. These communities provide valuable source of such information strengthening the recent news that therapists are proposing online support groups to the patients, for them to obtain emotional support and overcome geographical isolation. Though our general emphasis is on predicting the chronic disease trends by using social media data, the specific focus is directed towards making the machines learn and predict trends in Alzheimer's disease using online caregiver discussions (as patients can't directly participate due to cognitive impairment) because this area didn't receive much attention from the research community. Data like gender of the patient, age at which they are diagnosed with Alzheimer's, country to which he/she belongs to, behaviour of the patient as reported by the caregiver in his/her discussion, in what kind of activity they are engaged in, throughout the day, patient and caregiver biological relation with each other and the frequency of the messages by the caregiver on the patient network in terms of seeking advice or venting out, was collected. The data of 243 patients, manually collected by observing their posts on the timeline, is retained after pre-processing the data to remove missing values and outliers. The patient identification data is anonymised to protect the privacy of the patients as per the data privacy law.

4. Feature Engineering and Selection

The process of data preparation for modelling is coined as "Feature Engineering". Feature engineering is an essential step to achieve good performance for predictive modelling problems and is dependent on how the data is prepared for modelling [15]. The steps include right from exploratory analysis and visualization of the data, handling missing or redundant data, dealing with outliers, encoding categorical features, engineering numeric features, and selecting features that majorly contribute in predicting the outcome/target variable.

The data that is collected is in numerical as well as categorical format. Most of the machine learning models do not work well with categorical data. The Python library "sklearn" used for the machine learning algorithms requires the features to be in numerical format. So, they have to be converted into numerical values with proper encoding techniques suitable to the characteristics of the features. The numerical values are min-max-scaled to bring them into a fixed range, normally 0 to 1. This is done to bring down the standard deviations and suppress the outlier effect. The categorical values are target encoded as obtaining dummies will increase the dimensionality of the dataset with increase in the categories for each feature. Ordinal encoder is another option if there is specific ordering in the categories of the features. The dependent or the predicted variable, that is the decision of choosing a hospice was originally tabulated as Yes or No which is further label encoded to convert it into 1 and 0, respectively. These steps bring all the values of the features into a common range and ready for fitting the machine learning models.

Recursive Feature Elimination (RFE) is one of the feature selection methods that fits a model while removing the less contributing features iteratively until specified number of features is reached [16]. The collinearity and dependencies in the model, if any, will be eliminated by recursively eliminating small number of features in every iteration. Thus features will be ranked by the model. Though the number of features to be retained is not known in advance, 5-fold stratified cross-validation is used along with recursive feature elimination in order to find the optimal number of features. This process scores different subsets of features and selects the best scoring subset of features.

We attempted to use logistic regression (linear model) and random forest (non-linear model), further elaborated in the next section, as estimators for the RFE feature selection algorithm to choose relevant features. In order to automatically get the number of features selected by RFE, cross-validation evaluation of different sets of features is performed and the optimal number of features with the best mean score is selected. The following Fig. 2 shows the optimal number of features with random forest and logistic regression as estimators.

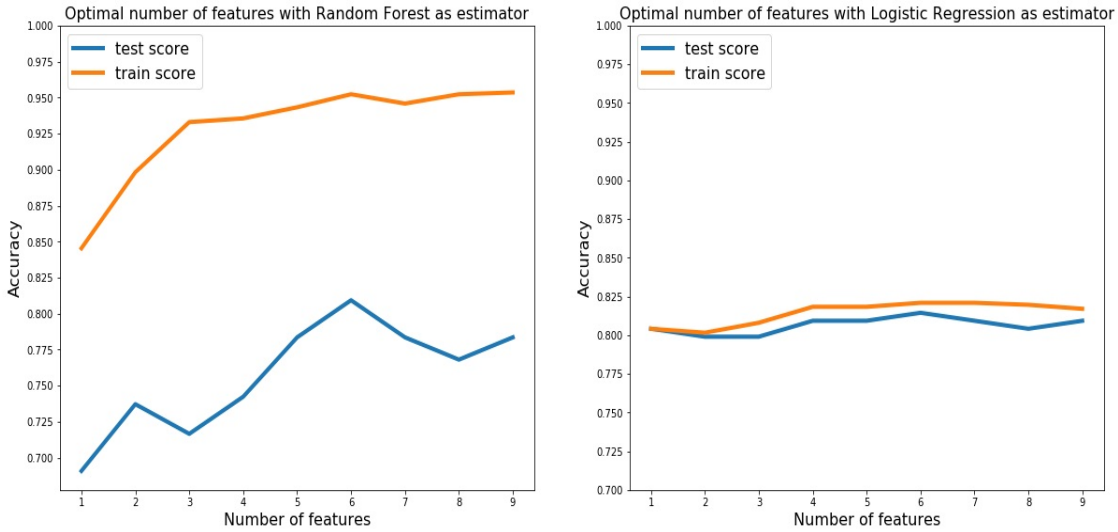

Fig. 2. Optimal number of features using RFE with non-linear and linear estimator

The illustration in Fig. 2 shows that random forest estimator seems to over fit with training score maximizing around 0.95 and test score at 0.81 for 6 features selected after which there is no considerable improvement in the training and test scores. On the other hand, logistic regression's training score is maximum at 0.82 and test score at 0.81 for 6 features, again, with no further improvement. This leads to a decision of selecting logistic regression as estimator for RFE to perform automatic feature selection before choosing various models to fit on the selected features and compare their performance.

Having known that selection of 6 features gives the best 5-fold cross-validated training and test scores, it is now intriguing to know which features are those. The feature ranks as assigned by RFE are presented in Table 1.

Table 1. Ranks assigned by RFE to features (1 – most contributing feature)

Feature description	Rank
Female	1
Male	2
Age Diagnosed	4
Frequency of Messages	1
Behavior	1
Activity Engaged in	1
Care Giver	1
Location	1
Relation	3

5. Machine Learning Techniques used

The selection of machine learning techniques depends on the data source and also the application domain [17]. Models namely Logistic Regression, k-Nearest Neighbour, Support Vector Machine, Random Forest, XG Boost classifier, Gradient Boost classifier, and Gaussian Naïve Bayes were used in the present work in order to find the best performing model by careful fine-tuning of the hyper-parameters. As the data collected is a combination of numerical, categorical as well as binary, it is compelling to understand how each of the above mentioned, proved to be efficient models (in various scenarios) perform with the data concerned.

5.1 *Logistic regression*

Logistic regression is a machine learning algorithm which is used for the classification problems based on the concept of probability to perform predictive analysis and especially when the target variable is of categorical type. It uses a complex cost function defined as 'Sigmoid function' or simply a 'logistic function' to bring predicted values down into the range of 0 and 1 [18]. Sigmoid function is used to map the predicted values to probabilities so that the assignment of data points to the appropriate classes is performed by the algorithm with some amount of likelihood. The equation for Sigmoid function is provided below as Eq. (1).

$$y = 1/(1 + e^{-x}) \quad (1)$$

The Sigmoid function graph is depicted in Fig. 3.

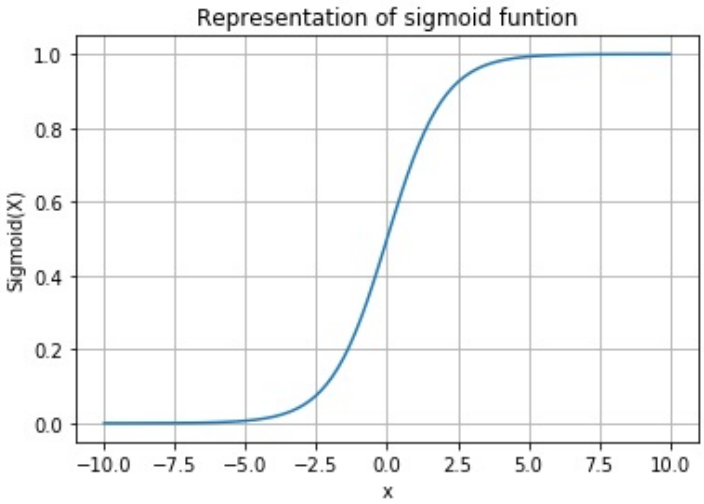

Fig. 3. Illustration of a Sigmoid function

The variable *e* represents the exponential constant with an approximate value of 2.71828. While using the logistic regression, usually a threshold is specified and all values above the set threshold will be assigned to one class and all values below it will be assigned to the other class. There are several solver options available but only 'lbfgs' was selected for the model fitting in this work as it avoids drawbacks like saddle points and is fast compared to other solvers. The maximum number of iterations were chosen as 100 to reach the convergence of the model. Logistic regression can also be used for multiclass classification problems by following the notion of 'one Vs. all'.

5.2 *k-Nearest Neighbour (kNN)*

KNN is a simple supervised machine learning algorithm which can be used to solve both regression and classification problems. This algorithm depends on labelled training data to learn a function which predicts an appropriate output when posed with an unseen/unlabelled data. Depending on the type of problem being solved, a choice among various distance measures like Euclidean, Minkowski etc. can be made to compute the distance between the data points [19]. The hyper parameter *k* has to be carefully tuned to avoid overfitting (model learning too much) or under fitting (model learning too less) of the model and increase its generalization capability.

5.3 *Support Vector Machine (SVM)*

The SVM finds a hyperplane that clearly classifies the sample points in an n-dimensional feature space. Among the many possible hyperplanes that can be chosen, to separate the two classes, a plane that has the maximum margin between the classes will be chosen as the optimal hyperplane. This provides reinforcement to the model so that the unseen data points can be more confidently classified.

The SVM's approach can be seen in Fig. 4. This is good enough for linearly separable classes but to perform complex classification with real data, kernalised SVMs can be used.

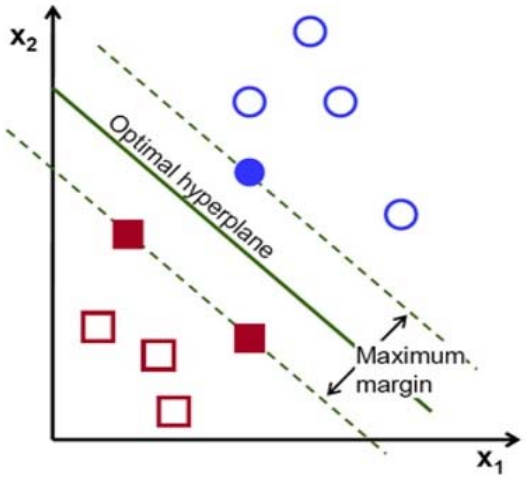

Fig. 4. Approach of Support Vector Machine [20]

Kernalised SVMs take the original input data space and transforms it to a different higher dimensional feature space after which it becomes easier to linearly classify the transformed data. Though there are many transformations available, Radial Basis Function (RBF) kernel proved to be the best performing option and thus selected for the experiment under discussion. The RBF kernel can be represented by the following Eq. (2).

$$K(x, x') = \exp[-\gamma . ||x - x'||^2] \quad (2)$$

A kernel can be defined as similarity measure (dot product) between the data points. The hyper-parameters γ and C have to be tuned properly. Smaller values for γ represent larger similarity radius resulting in decision boundaries that are smooth and larger values of γ require data points to be more closer to be considered as similar. On the other hand, C is a regularization parameter that interacts with the γ parameter. If γ is large, C will not have much influence. If γ is small, the model is heavily constrained and C affects the classifier as it does with a linear classifier. For the present experiment, both γ and C values were set to 1 as it is observed that the classifier gives best performance at these hyper-parameter values.

5.4 *Random forest*

The random forest classifier uses an ensemble of individual decision trees. The individual class predictions by each tree are counted to find the class with maximum votes which will be the model's prediction [21]. The underlying notion can be attributed to 'wisdom of crowds'. The key feature is low correlation between the models in ensemble, as uncorrelated models would produce better ensemble predictions than any of the individual predictions. But, increasing the complexity of the random forest classifier in terms of increasing its number of estimators and maximum depth may result in overfitting of the model that performs too good on the training data and badly on the test set. Careful tuning would help to overcome this problem and reap the benefits of this ensemble method. The number of estimators is set to 5 and maximum depth to 2 to obtain best possible performance from this model.

5.5 *eXtreme Gradient Boost (XGBoost) classifier*

XGBoost is an implementation of gradient boosted decision trees which is available as an open source library. Though basically it is an ensemble technique, this classifier takes an iterative approach. Each new model is trained to predict and correct the mistakes (called residuals) made by the previous models. This process is repeated until it converges i.e., no further improvements in performance can be made. The main objective of this iterative process is to avoid individual models ending up making same kind of mistakes. XGBoost works to optimize the objective function which encourages the predictive models and optimize regularization to achieve lesser variance that makes predictions stable. The objective function can be represented as Eq. (3).

$$L(\emptyset) = \sum_i l(\hat{y_i}, y_i) + \sum_j \eta(f_j) \quad (3)$$

The first term of the equation is the loss function which is the summation of the prediction errors and the second term is the regularization to reduce the variance in the model [22]. The learning rate is one of the hyper-parameters of XGBoost that needs to be set optimally and should be set as low as possible to reach the best optimum but, this makes the computation slow. A trade-off between these two have to be maintained ensuring better performance at the same time. The learning rate η for the model used is set to 0.1, the regularization parameter γ to 1 and maximum depth to 2. The sub sample ratio of the training instances is set to 0.2.

5.6 *Gradient Boosting Classifier (GBC)*

Gradient boosting method is a more general implementation of XGBoost. This model also follows the step-wise additive model which generates learners during the process. Using the gradient descent optimisation, individual weak learner contributes to the ensemble [23]. It uses the loss function of the basic decision tree model as a means to minimize the prediction error of the overall model whereas XGBoost uses 2nd order derivative for approximation and advanced L1 and L2 regularization. Compared to XGBoost, Gradient Boost usually takes more time for getting trained.

5.7 *Gaussian Naïve Bayes Classifier*

Gaussian Naïve Bayes is an extension of the Naïve Bayes classifier to real-valued attributes by assuming that they have Gaussian distribution. The likelihood of the features of the data is assumed as in the Eq. (4).

$$P(x_i|y) = \frac{1}{\sqrt{2\pi\sigma_y^2}} \exp\left(-\frac{(x_i-\bar{y})^2}{2\sigma_y^2}\right) \quad (4)$$

The model can be fit by finding mean and the standard deviation of the data points within each target label. At every sample point, the z-score distance between that sample point and each class mean is measured, which is the distance from class mean divided by the class's standard deviation [24]. This classifier doesn't require more training data and can handle both discrete and continuous data. The model is fast and its scalability with number of data points and predictors is very impressive. The hyper-parameter namely variance smoothing is tuned to *1e-01*. The variance smoothing value indicates the portion of largest variance of all the features which is added to variances for stability in calculation.

6. Results and Discussion

The dataset is imported into Jupyter notebook. The machine learning models namely Logistic Regression, k Nearest Neighbour, Support Vector Machine, Random Forest, eXtreme Gradient Boosting, Gradient Boosting, and Gaussian Naïve Bayes are used and evaluated using various metrics. Stratified cross-validation with 5 folds is performed in order to obtain the accuracy measure on the training and validation sets. Compared to k-fold cross-validation, stratified k-fold cross-validation will ensure that each of the folds get the same proportion of training examples with a given categorical value. This procedure makes each of the data points to pass through the training as well as validation phase. The held-out test set is completely hidden from the model and serves to check the generalization capability of the model. The scores of accuracy on the training set, validation set and the held-out test set obtained with each of the machine learning models used, is presented in Table 2.

Table 2. Accuracy scores for training, validation and held-out test sets for different models

ML Model	Training set	Validation set	Held-out test set
Logistic Regression	0.82	0.81	0.82
K-Nearest Neighbor	0.83	0.80	0.82
Support Vector Machine	0.84	0.80	0.88
Random Forest	0.83	0.78	0.82
XG Boost	0.88	0.78	0.80
Gradient Boost	0.81	0.78	0.84
Gaussian Naïve Bayes	0.81	0.81	0.90

Note: The hyper-parameter values were tuned to obtain maximum performance (discussed in Section 5).

Among the selected models, it is observed that Gaussian Naïve Bayes (GNB) followed by Support Vector Machine (SVM) models are showing significant performance on the held-out set. Logistic regression is also having good training set and validation set accuracy but not generalizing as good as SVM and GNB, on the held-out set. Moreover, checking merely the accuracy metric is not sufficient to evaluate a model and justify its generalizability. So, we have taken the following metrics into consideration to further gain confidence in evaluating the performance of the models used.

6.1 *Precision –Recall Curve – AUC*

Precision – Recall curve combines precision (Positive Predictive Value - confidence in the prediction of a positive class) and recall (True Positive Rate – fraction of all positive instances that the classifier correctly predicts as positive) in a single illustration. The larger is the area under the curve (AUC), the better is the model performance. PR curve is preferred to ROC curve as there is class-imbalance in the dataset being used, which can be better covered by a PR curve. Fig. 5 shows the P-R AUC for all the machine learning models considered except Gaussian Naïve Bayes. It can be noticed that AUC is more for SVM and logistic regression models whereas least in random forest classifier. In Fig. 6, the P-R curve for Gaussian Naïve Bayes model is shown and found to have the same measure as SVM and logistic regression. This makes it difficult to select between the models which further drives us to consider F1 score and log loss metrics to select the suitable model.

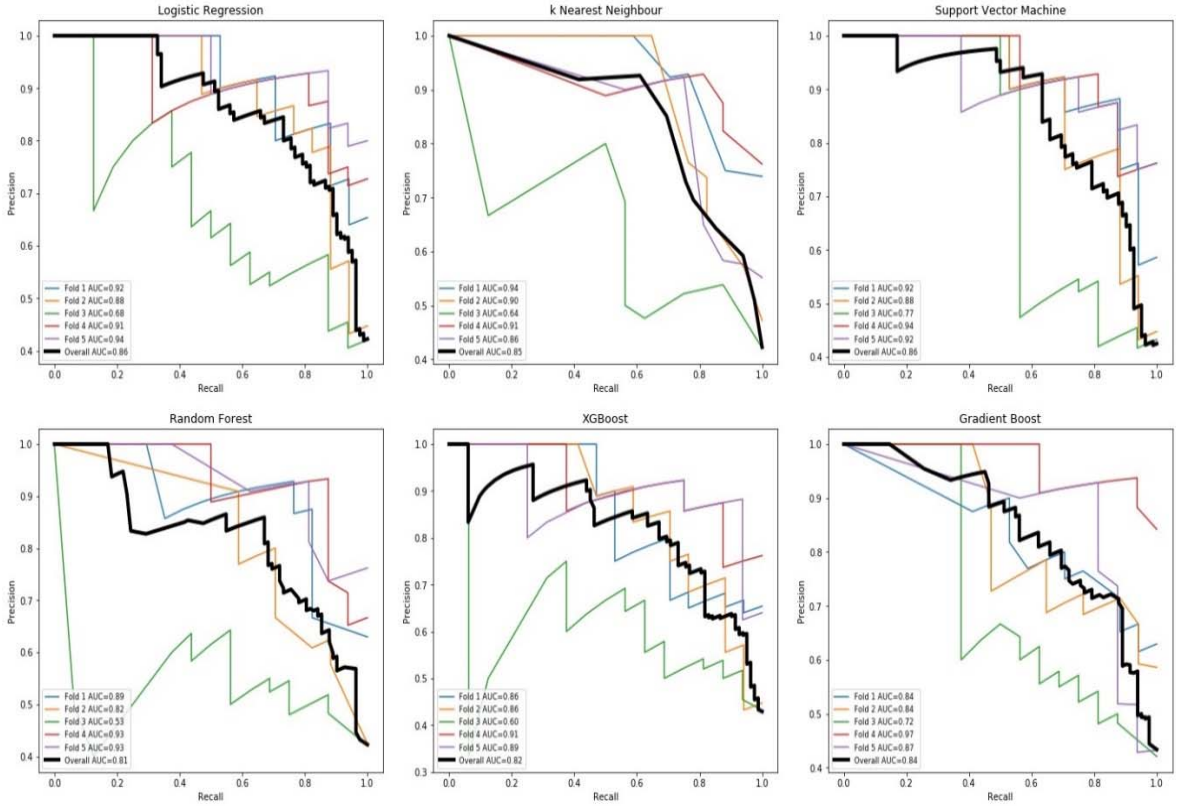

Fig. 5. P-R Curve AUC for the 6 models other than Gaussian Naïve Bayes

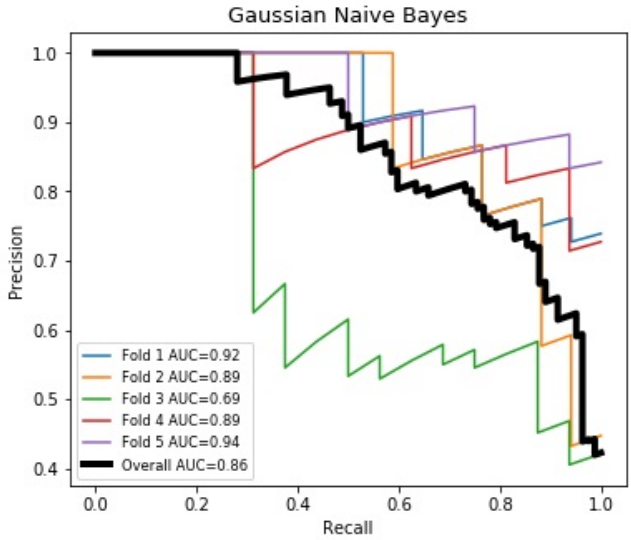

Fig. 6. P-R Curve AUC for Gaussian Naïve Bayes

6.2 *F1-Score*

Also called as F Measure or the F Score, F1 score explains the balance between the precision and recall. F1 score is more useful than accuracy score in the cases where class distribution is uneven. The F1 score is calculated using the formula in Eq. (5). The F1 score value lies between 0 and 1. The value towards 1 indicates a better score and thus better model.

$$F1 = 2 * \left(\frac{precision * recall}{precision + recall}\right) \quad (5)$$

The F1 scores of the machine learning models are represented in the form of a bar graph for better visualization in Fig. 7.

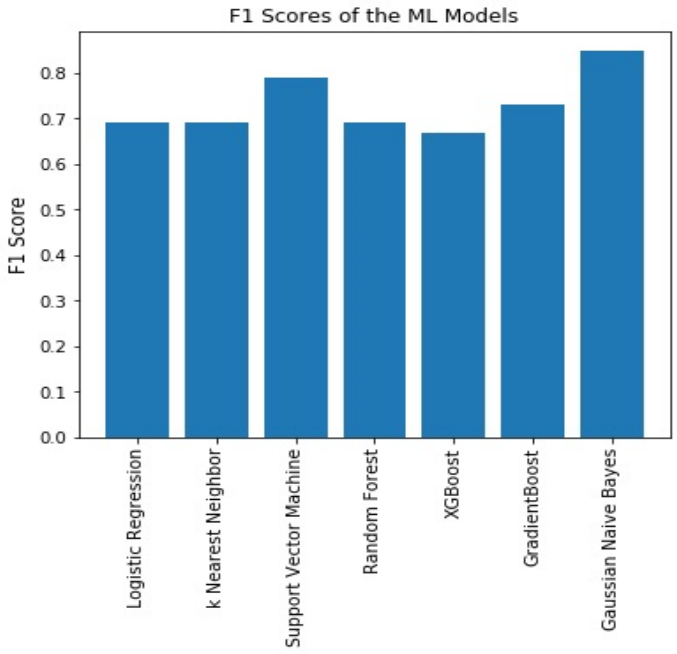

Fig. 7. F1 Scores of the machine learning models used

The F1 scores of Gaussian Naïve Bayes and SVM models are 0.85 and 0.79, respectively, having better scores compared to other models. Logistic regression's F1 score is 0.69 showing the uncertainty in its predictive capability.

6.3 *Log Loss (LL)*

Logarithmic Loss or Cross-Entropy Loss or simply Log Loss is a loss function and is the most important metric used in classification. It is a probability value that lies between 0 and 1. It quantifies the performance of a classifier model by penalising the false classifications. The representation of a log loss is given in Eq. (6).

$$LL_p(q) = -\frac{1}{N}\sum_{i=1}^{N} t_i \,.\, \log\big(p(t_i)\big) + (1 - t_i) \,.\, \log(1 - p(t_i)) \qquad (6)$$

In the above equation, *t* is the target label and *p(t)* is the predicted probability of the data point's label being Yes/positive class. It will favour the models that can more strongly distinguish the classes. This measure increases as the probability that is predicted, deviates from the actual target label. If the model predicts 0.009 when the observation label is actually 1, would result in high loss measurement. Fig. 8 shows the log loss of the machine learning models considered for the experiment and helps to take a decision on the selection of best performing model.

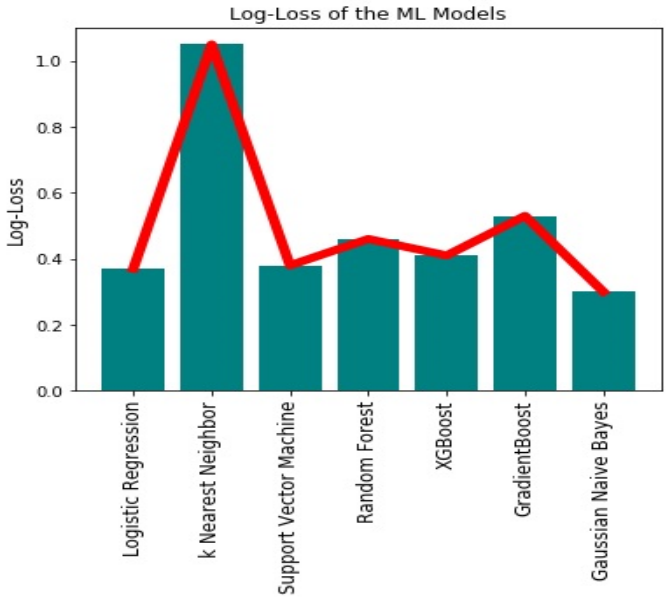

Fig. 8. Log Loss values of the machine learning models used

The log loss value for the Gaussian Naïve Bayes model at 0.30, is the least when compared to other models asserting its suitability to the problem at hand. The log loss values for SVM and logistic regression are almost the same at around 0.38.

The above results presented can help to infer the best performing machine learning model. Good amount of effort has been put into tuning the hyper-parameters of these models to achieve each model's maximum performance. Though most of the models perform well with respect to training data, they fail to retain the same performance with validation and held-out datasets. This also indicates that the model is overfitting with the training data and it would reduce the generalization capacity of the model. Held-out set accuracy scores enable us to understand how good a model is performing the prediction task on unseen data. Still, relying on these scores alone will make the evaluation task incomplete. Choosing a P-R curve AUC will help us to decide on a better model. As the classes are imbalanced, P-R curve would help us take better decision compared to ROC curve. F1 score is selected as another metric for evaluation as we care more about the positive class, that is, choosing palliative care in advanced stages of the Alzheimer's disease. Log loss will guide us to further evaluate goodness of the model based on the notion that, lesser the uncertainty in predictions, better is the model in its performance at the task. Taking all these metrics into consideration, we can conclude that Gaussian Naïve Bayes followed by SVM are the best performing models with better held-out set score, P-R curve AUC, F1 score and least log loss values. Most of the Alzheimer's disease related data will be in categorical format when it comes to analysing the behavioural traits, lifestyle, demographic and family relations. The inherent nature of Gaussian Naïve Bayes is to work well with categorical data that makes it suitable for the problem and standing out as the best performing model.

7. Conclusion and Future Work

The framework we have designed helps us to apply machine learning techniques in order to predict the decision to choose palliative care in the advanced stages of Alzheimer's disease. The data about the behavioural traits along with other relevant patient data was collected from the social media patient networks which provides a rich source of caregiver discussions. Rather than proctored surveys taken from the researcher or healthcare professional perspective, social media discussions contain dynamic data reported by caregivers. The caregivers directly deal with the patient and discuss about patient specific scenario, in the patient support groups, from their perspective. This helps the healthcare stakeholders to analyse the data and understand the trends in disease progression. Applying machine learning models to such data captured will assist them to take some informed decisions about treatment and hospice assistance required by the victims. The current experiment conducted finds Gaussian Naïve Bayes model, followed by SVM, as the best performing models in predicting the decision to choose palliative care in advanced stage of Alzheimer's disease. Future work is planned in the direction of studying the trends in patients' cognitive deterioration, rated with respect to different activities on various scales, using machine learning techniques.

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RESEARCH ARTICLE

Cyber World

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ABSTRACT

This paper presents a Web Based attacks which is a part of Cyber World. It is all about how attackers can misuse the website or web application and how attacks can be prevented from attackers[1]. It consists of various attacks like SQL Injection Attack, File Inclusion Attack, Cross-Site Scripting, DoS, Brute Force, Dictionary attack, Session Hijacking, Man in the Middle (MIM) Attack, Phishing, Spear Phishing, Whaling.

Keywords: This paper presents a Web Based attacks which is a part of Cyber World. It is all about how attackers can misuse the website or web application and how attacks can be prevented from attackers [1]. It consists of various attacks like SQL Injection Attack, File Inclusion Attack, Cross-Site Scripting, DoS, Brute Force, Dictionary attack, Session Hijacking, Man in the Middle(MIM) Attack, Phishing, Spear Phishing, Whaling.

INTRODUCTION

Cyber security can be defined as to protect data, computers, networks, programs from attackers or from unauthorized content, so attackers will gain the targeted information. We need cyber-security, because everything is going on the web and the main computers will be connected to the internet.
Cyber security is classified into two types:
*Web based attacks
*System based attacks
Web based attacks can be performed on website or web application.
System based attacks can be performed on computer or computer network[2].
This paper describes about web based attacks and how it can be prevented.

They are:

- Injection attack.
- File Inclusion attack.
- Cross-Site Scripting
- DoS
- Man-In-The-Middle(MITM) attack.
- Brute Force
- Dictionary Attack
- Session Hijacking
- Phishing, Spear Phishing
- Whaling.

Literature Survey

Web Security plays major role in application deployment and has a lot of challenges and complexity. The web developers may not be to implement or fulfill the security practices. Web based attacks use malicious code to manipulate the web application or website where attackers gain the information which is needed [3]. Security is the most important for web application or website, so that we can protect data against theft or malware.

Working of the Project

We have chosen different types of web based attacks like:

Injection Attack means where the data is inserted to website or web application, so that it will manipulate whole web applications. There are different types Injection attacks like: SQL Injection, XML Injection, Code Injection, Log Injection etc [4].

- The most frequently used attack is SQL Injection(SQLi).
- SQLi can be corrected by validating the data for input and output.
- SQLi can be prevented by using:

***Parameterized Query**

Snippet code for Parameterized Query

```
Protected void btnGetEmpbyName_click(object sender, EventArgs e)
{
 String cs = ConfigurationManager.ConnectionStrings["DBCS"].ConnectionString;
SqlConnection con = new SqlConnection(cs);
SqlCommandcmd = new SqlCommand("SELECT * FROM [Sample].[dbo].[tblEmployee] where Name=@Name", con);
cmd.Parameters.Add(new SqlParameter("@Name", txtid.Text));
con.Open();
GridView1.DataSource=cmd.ExecuteReader();
GridView1.DataBind();
con.Close();
}
```

***Stored Procedure**

Snippet code for Stored Procedure

```
protected void btnGetEmpbyName_click(object sender, EventArgs e
{
 String cs = ConfigurationManager.ConnectionStrings["DBCS"].ConnectionString;
SqlConnection con = new SqlConnection(cs);
```

```
SqlCommandcmd = new SqlCommand("sp_GetEmployeeByName", con);
cmd.CommandType = CommandType.StoredProcedure;
cmd.Parameters.Add(new SqlParameter("@Name", txtid.Text));
con.Open();
GridView1.DataSource = cmd.ExecuteReader();
GridView1.DataBind();
con.Close();
 }
```

File Inclusion Attack

- File Inclusion Attack means, where attacker will be able to access data which is sensitive or unauthorized which is obtainable on web server and it uses include functionality.[5]
- File Inclusion Attack can be categorized into:
  - Local File Inclusion: means where files can be obtained locally on server.
  - Remote File Inclusion -> means where it includes & executes the unauthorized code on remotely hosted file.

File Inclusion attack can be prevented by:

- The database can contain the file path and those file path can be assigned to ID. So, users can see their ID but they can't change or view path.
- The higher authority can restrict specific files.
- Instead of storing all the data which is related to files on web server it can be stored in database.

Cross-Site Scripting

- Cross-Site Scripting is executed in the client browser by editing JavaScript in web applications.[6]
- Cross-site scripting is classified as:
  - **Reflected XSS Attack**: where the current HTTP request will contain malicious script.
  - **Stored XSS Attack**: where the website database contains a malicious script.
  - **DOM Based XSS Attack**: where the malicious script present in client-side scripting.

Cross-Site Scripting can be prevented by:

- The data can be validated at the arrival of input.[7]
- The output of data should be encoded.
- Proper response headers should be used.
- Content Security Policy should be followed.

DNS Spoofing

- Computer hacking attack is known as DNS spoofing attack.
- The resolver DNS cache was introduced to the data which caused the name server to return an invalid IP address.
- DNS Spoofing can be avoided by:
  - Forged Responses
  - Weak passwords
  - Spam emails[8]

DoS (Denial of Service)

- DoS attack means where the network resource or server won't be available to the users.
- Generally, a lot of communication requests will be filled in the server.
- A denial of service will contain one system and one Internet connection where it can attack the server.
- Distributed Denial of Service (DDoS) will contain multiple systems and Internet connections for many requests will be present in the server and difficult to handle.[9]

Man-In-The-Middle Attack

- Man-In-The-Middle Attack refers to attacker seize the connection between client and server and accomplishes a bridge between them.
- An Attacker may perform operations like reading, insert and modify at the time of intercepted communication.
- Denial of Service and Man-In-The-Middle Attack can be prevented by:
  - **Security Extensions**: to deal with security threats against DNS the net Engineering Task Force(IETF) developed DNS Security Extensions(DNSSEC).
  - **DNS Updates**: The updated version of DNS will be having cryptographically secure transaction Identification and port randomization to save data against attackers.
  - **Password policies**: Avoid employing a weak countersign and implement countersign protection policies is of utmost importance.
  - We must avoid the WIFI which does not contain any password.
  - We should log out after using a secure application if we are not currently using it.
  - We should avoid using public networks while conducting a sensitive transaction.

Brute Force Attack

- Brute Force attack is a experimental & error method where it will be having a large number of data and it receives actual data. Actual data means password in general.

Dictionary Attack

- Dictionary Attack will be containing the most used passwords and verify to get the actual password.
- Prevention of Brute Force Attack and Dictionary Attack
  - We can limit the login when it is failed.
  - The root user can be made inaccessible through SSH by modifying asshd_config file.
  - We can use Captcha.
  - Two factor authentications can be used.
  - We can use distinctive URLs for login.

Session Hijacking

- Web-based applications or website, store state &it collects particulars of user sessions and uses cookies.
- If an attacker gets the cookies he will be able to access all the user data.
- Session Hijacking can be prevented by:
  - We can set an idle time for the application, so after a while, the account should be deactivated.
  - The session key should be regenerated after initial authentication. The session key will be changed immediately after authentication where it nullifies session fixation attacks.

Phishing

- Phishing is an attempt to acquire sensitive information.
- The main aim of phishing is to gain or steal sensitive information like login or credit card credentials.
- Phishing is classified into:
  - **Spear Phishing:** It is a form of phishing, where confidential data is collected from the targeted organization.
  - **Whaling:** It targets executives or others in powerful positions or job titles and high-ranking bankers.

Phishing can be prevented by:

- To recognize the phishing attacks, the organization or high authority must train employees that not to click the malicious link.
- The browsers can enable browser add-ons and extensions which prevents clicking on a malicious link.
- To prevent hackers who have compromised the user credentials from gaining access, two-factor authentication can be implemented.

CONCLUSION

Web-based Attacks have both advantages and disadvantages. Protects the data and information regarding any organization. Prevents from computer hackers and identity theft. Users have to ensure they have enabled pop-up blockers to overcome phishing, spam email, or malicious links. Users must maintain backup and protect it from strong passwords and use secure connection. People should know about laws against cybercrime or cyber law and actions which they can fight against crime.

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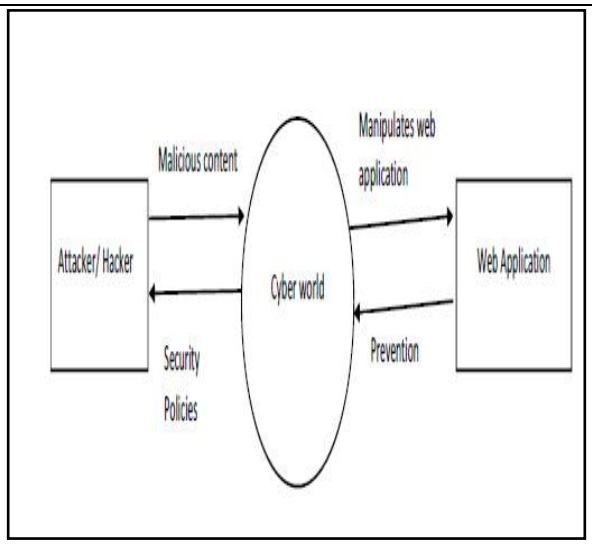

Fig.1 :Data Flow Diagram

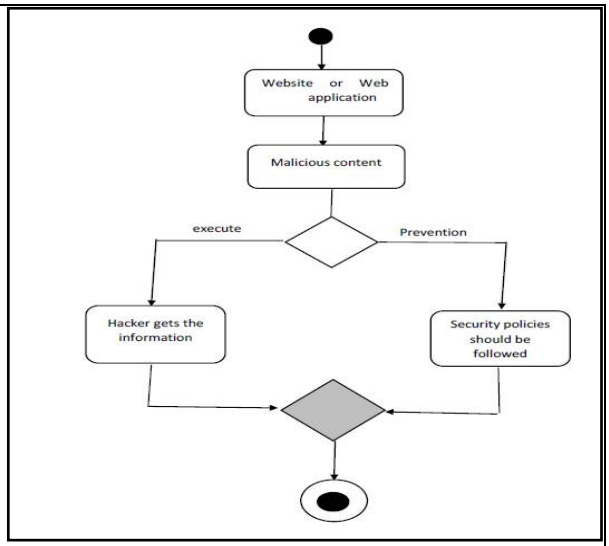

Fig.2 : Activity Diagram

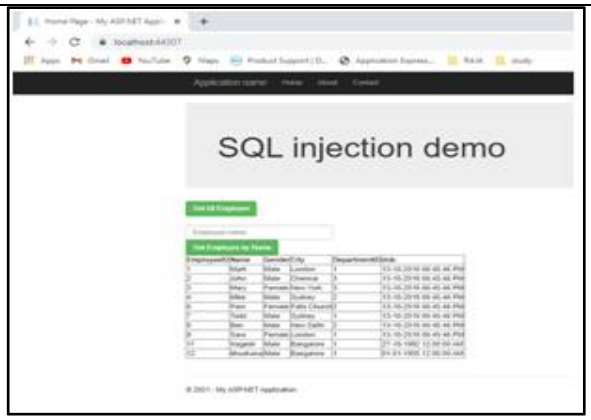

Fig.3 : Get All Employee Details

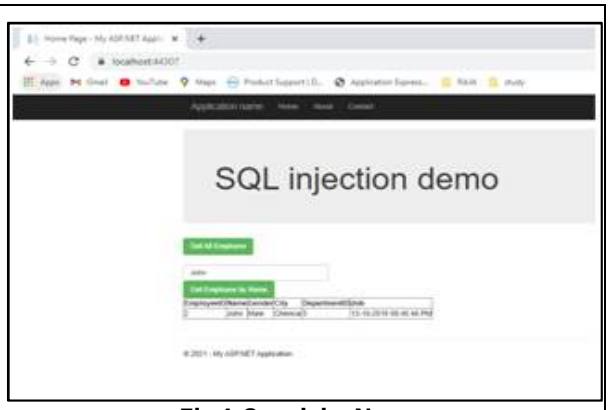

Fig.4: Search by Name

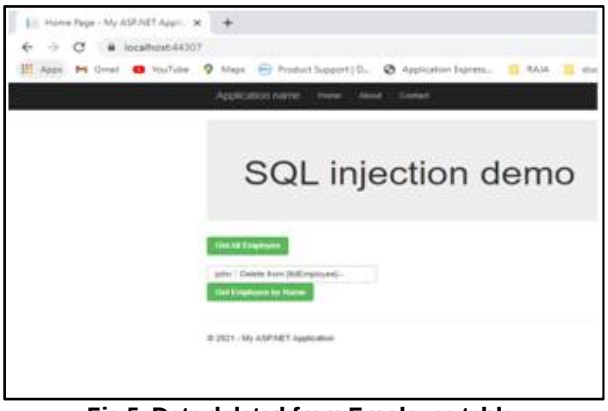

Fig.5: Data deleted from Employee table

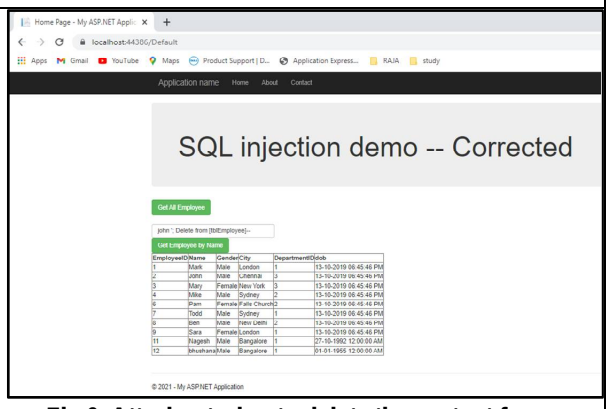

Fig.6: Attacker trying to delete the content from Employee table

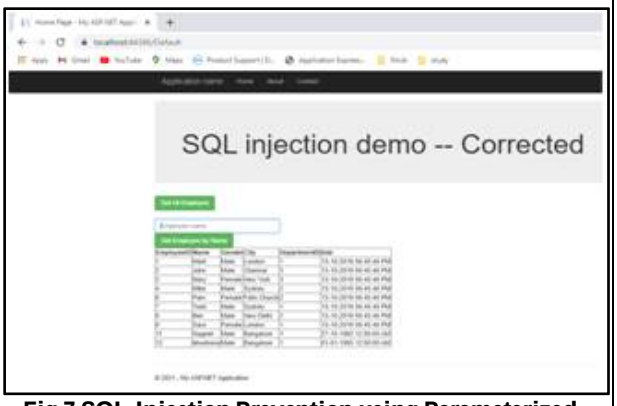

Fig.7:SQL Injection Prevention using Parameterized query and Stored Procedure

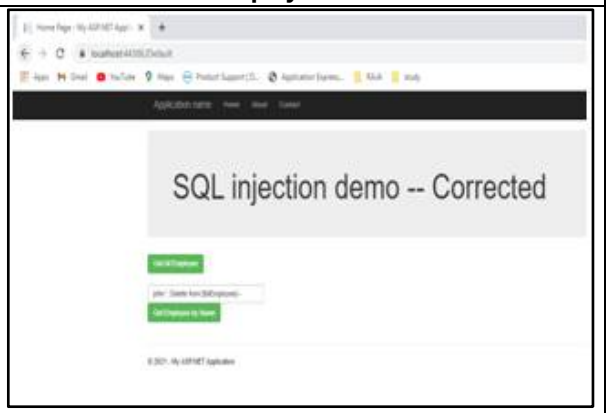

Fig.8: After prevention, hacker is trying to delete the details from table employee

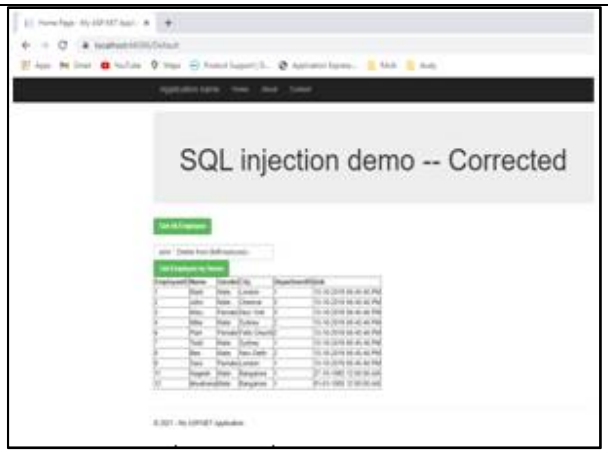

Fig. 9 : The details will be safe and secure after sql injection prevention using Stored Procedure and Parameterized query.

Mobile App for Accident Detection to Provide Medical Aid

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Abstract

This application is used to provide immediate medical aid. The street mishaps rates are extremely high these days, particularly bikes. Convenient clinical guide can help in sparing lives. This framework means to make the close by clinical focus about the mishap aware of give quick clinical guide. The accelerometer in the android versatile faculties the tilt of the vehicle and in the event that it discovered it is a mishap, it brings the longitude and scope of vehicle utilizing Global Positioning Sensor (GPS) and forward the subtleties to web server utilizing web. Web server has framework that distinguish the closest emergency clinic and police headquarters utilizing the Euclidean separation computation, once the closest medical clinic and police headquarters is shortlisted, web server sends a mishap subtleties to the worry clinic and police headquarters. The Android application in the cell phone will sent instant message with respect to the mishap area to the guardian of the person in question. This framework spares the life of the mishap casualty by shares the specific area of the mishap. In this system we are using accident detect-system that provides an alert message to the authorized people with the help of accelerometer sensor through the help of using android application to get required needs.

Keywords

Accident detection Alert system Accelerometer Android application

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Google Scholar (http://scholar.google.com/scholar_lookup?title=Cloud-assisted%20mobile%20crowd%20sensing%20for%20traffic%20congestion%20control&author=H.%20Yan&author=Q.%20Hua&author=D.%20Zhang&journal=Mobile%20Networks%20and%20Applications&volume=22&pages=1212-1218&publication_year=2017&doi=10.1007%2Fs11036-017-0873-2)

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Google Scholar (http://scholar.google.com/scholar_lookup?title=Framework%20for%20enhancing%20mobile%20availability%20of%20RESTful%20services&author=S.%20Ma&author=W.%20Lee&author=P.%20Chen&journal=Mobile%20Networks%20and%20Applications&volume=21&pages=337-351&publication_year=2016&doi=10.1007%2Fs11036-015-0655-7)

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"MOBILE APP FOR ACCIDENT DETECTION TO PROVIDE MEDICAL AID"

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Abstract

This application is used to provide immediate medical aid. The street mishaps rates are extremely high these days, particularly bikes. Convenient clinical guide can help in sparing lives. This framework means to make the close by clinical focus about the mishap aware of give quick clinical guide[4]. The accelerometer in the android versatile faculties the tilt of the vehicle and in the event that it discovered it is a mishap, it brings the longitude and scope of vehicle utilizing Global Positioning Sensor (GPS) and forward the subtleties to web server utilizing web[2]. Web server has framework that distinguish the closest emergency clinic and police headquarters utilizing the Euclidean separation computation, once the closest medical clinic and police headquarters is shortlisted, web server sends a mishap subtleties to the worry clinic and police headquarters. The Android application in the cell phone will sent instant message with respect to the mishap area to the guardian of the person in question. This framework spares the life of the mishap casualty by shares the specific area of the mishap[1]. In this system we are using accident detect-system that provides an alert message to the authorized people with the help of accelerometer sensor through the help of using android application to get required needs.

Keywords: Accident Detection, Alert System, Accelerometer, Android Application.

1. Introduction

In this era the engine vehicle populace is expanding more than the social and financial development. Because of mishap (accident) and demise (death), the street mishap, particularly bicycles are additionally expanding in high rate. Because of the absence of quick clinical help, the greater part of the mishap passing's that occur on the streets like thruways. We can give quick clinical help to the mishap recognize that assists with diminishing the mishap all the more proficiently. On account of this got a plan to build up a ready framework that could detects the

earnestness of the mishap and alarms the close by emergency clinic by giving rescue vehicle to spare the person in question. Regardless of whether a mishap has happened will be checked by a created framework and it recognizes injury of driver. In the event that the mishap has happened, the framework will searches for the close by clinical focus and alarmed by utilizing the notice about the incident. The salvage group (rescue team) could hurry to the incident spot promptly without postponing as the present area of the user is shared by his versatile. It likewise sends message to the family, companions and family members to tell them about the incident. The data about the family, companions and family members are put away as of now in the database which has been given by the versatile users one who previously utilizing this application. Entire info would keep in directory and that subtleties will be given to approve individual if mishap happens. This framework causes us to know the present area of the mishap casualty and sends ready messages to close by police headquarters, emergency clinic and fire motor too with the goal that salvage group will hurry to the present area of the mishap casualty right away.

2. Existing and Proposed System

Existing System

Android Application is attached with Internet of things kit, so it is quite difficult to use. In the existing system the mobile accelerometer sensor is not considered, here only considered hospital near by ambulance assistance alert system and less usage of technologies.

Drawbacks:

- Here not possible to send emergency message which containing location to registered contacts.
- In this existing system there is no voice reorganization system.

Proposed System

The **"Help"** button is used and it will gets activate when pressed, that will provides assistance to the vehicle driver who has been already met with an accident. User when they screams by telling "help" or "help me" or "please help me" or "help me please" the GPS System will trace the nearby police station. The GPS tracks the longitude and latitude that makes out the exact location of the user and forwards the pre-entered emergency alert message which has been given by the user to the nearby police station using GSM and the mobile numbers which has been registered as well. So that alert notification will be forwarded to the cops, hospital, family, friend and relatives about the incident.

Expected outcome:

The proposed system gives the information about the user by giving alarm (alert) message to police station and hospital if drivers are not safe by using location GPS tracking system in Android Mobile App.

3. Tools & technology Used

Android Introduction

It is a completed association of programming for cellular mob, for instance, pill PC's, word pads, mobile telephones, eBook peruses, set-pinnacle containers. It carries a Linux-based OS, middleware and key transportable packages. It has a tendency to be idea of as a flexible working framework. However, it isn't constrained to transportable as it had been. It is now as of utilized in one of a kind gadgets, for instance, mobiles, capsules, TVs and so forth.

Android Emulator

Fig: 2.3.1 Emulator of android

Highlights:

1) Unfold-supply.
2) Everybody could tweak the droid Policy.
3) Greater deal of transportable programs thus may be taken by way of the consumer.
4) Provides charming highlights like weather subtleties, beginning display, stay RSS channels.

4.1 AndroidManifest.xml file in android

Document incorporates statistics of your bundle, inclusive of elements of the utility, as an instance, sporting activities, administrations, talk creditors, content material providers.
It performs specific undertakings:

- Successful to comfy the petition to receive to ensured elements via providing the authorizations.
- This moreover pronounces the android lay out network that the application goes to uses.

- That facts the instrumentations instruction. The instrumentation elegance gives profile, exceptional information's. These facts are expelled not lengthy earlier than the software is shipped and so forth.

3.2 Dalvik Virtual Machine

The DVM is a droid digital device upgraded for cellular telephones. Improve the digital machine for reminiscence, power-bank lifestyles and execution. Dalvik is a call of a metropolis in Iceland and was composed with the aid of Dan Bornstein. The Dex compiler modifications over the magnificence statistics into .dex document that surprising spike in call for for the Dalvik VM. Different magnificence facts are changed over into one dex record.

3.3 HTML

Hypertext MarkUp Language, licenses customers to precede Web pages to join substance, delineations and pointer to another Web page.

Positive conditions

- Pretty much nothing and along these lines easy for providing through net.
- It excludes masterminded information.
- Stage self-sufficient.
- Case-unstable.

Benefits:

- Record is anything but difficult to send over the net since it is little.
- It does excluding arranged data so it's little.
- Stage autonomous.
- Doesn't case-touchy.

4.4 Java Script

Substance based program language. At first called Live Script and recalled as JavaScript to exhibit its relation with Java. This supports the improvement of customer and server fragments. Customer side, inside webpage, programs get executes. On server side, it might be utilized to make webserver program that could technique info introduced by a web-program and thereafter update the program's exhibit in like way.

4.5 Java Server Pages

Innovations allow you keep scraps of servlet code legitimately to a book based archive. A JSP is a book related report that has two kinds of content: static layout information would be communicated in many content based configurations, for example, HTML, WML, and XML, and JSP components, decide how page builds dynamic substance.

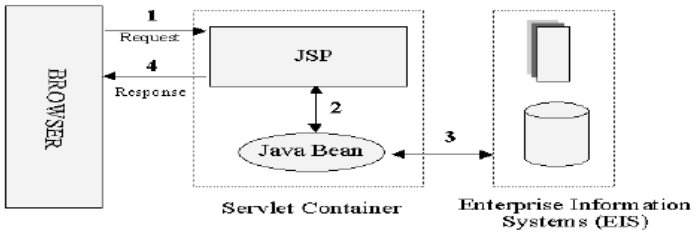

Fig: 4.5 JSP

4.6 J2EE Platform Overview

This stage is proposed to give server side and client side assistance for making appropriated, staggered applications. Such apps are conventionally masterminded as a client level to give UI, in any event one focus level module that give user organizations and business basis for an application and behind try information-systems giving data to administrators.

Benefits

- Disentangled plan and improvement
- Opportunity of selecting servers, instruments, portions
- Incorporation with existing informational structures
- Adaptability - fulfil need assortments

4.7 MySql:

Introduction

It is Social database of board structure, which orchestrates data as tables. MySQL is different databases -servers reliant on RDBMS model, take care of data that will go to 3 express things- data structures, data uprightness and data control. MySQL uses systems resources, on gear configurations, to pass on not matching execution and versatility.

Features:

Portable:

The MySQL is used on wide extent of stage running by computers to supercomputer & many user load module, comparable application not having changes.

Good:

MySQL RDBMS is a predominant weakness liberal DBMS, particularly expected for online trade planning and for deals with huge database applications.

Multithreaded Server Architecture:

MySQL versatile multithreaded server engineering conveys adaptable superior for extremely enormous rate of clients of equipment design**.**

Highlights:

- Data freedom.
- Managing information simultaneousness.
- Parallel getting support for accelerate information section and online exchange handling utilized for applications.
- DB methodology, capacities and bundles.

4.8 SQLYOG

It is modified and made in C++. No restriction on runtimes. It takes a local database to preserve internal data such as network positions. Thusly these surrounds will determined across gatherings on a for each table reason.

- To save period creating inquiries with language shape checking
- To spare time arranging ostensibly difficult requests.

4.9 SERVLET

It is a small program that runs within the web-server & it receives and responds to request from the client usually across http.

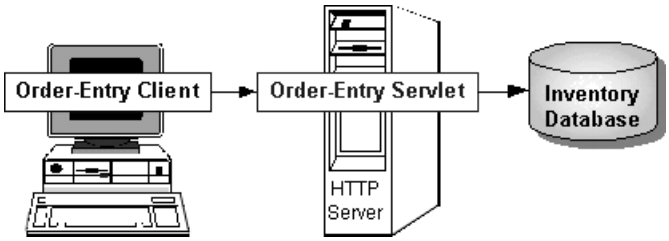

Fig: 4.9 Client/Servlet Database

4. Results

8.1 Web-Application:

In the local host we suppose to click on our project little that leads to login page of an admin. The admin must enter his/her user-name & password correctly then it redirects to actual web application.

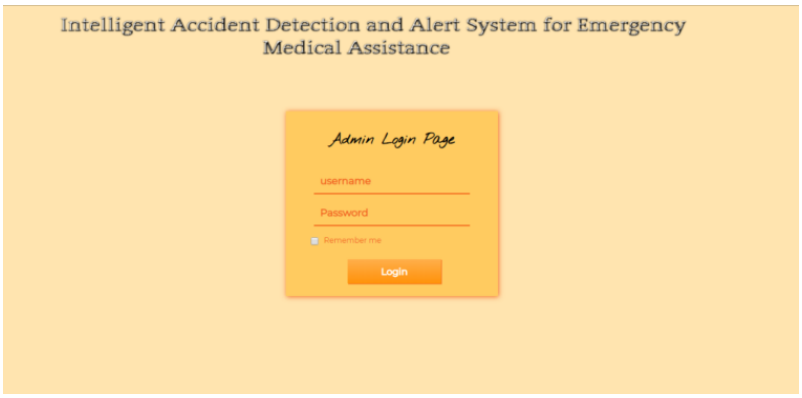

Fig: 8.1.1 Admin Login

The add hospital will consits of details such as name of the hospital, address containing area, city, state and pin code. It also have Email id where we should provide Existing email-id and should provide Phone no. Mainly we suppose to provide location longitute and latitude of the hospital.

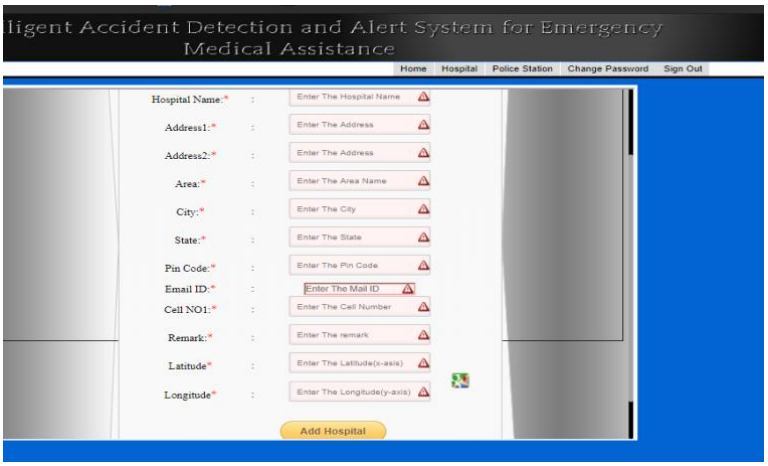

Fig: 8.1.2 Add Hospital

The above added details of the hospital information will be displayed here. In this list, it may contain plenty of records and also we can delete the records by selecting it.

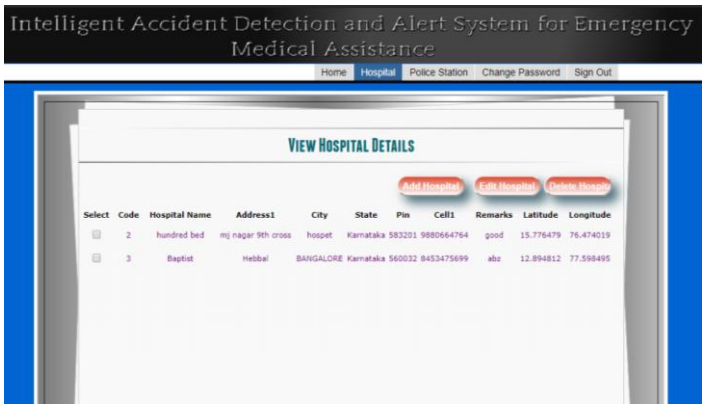

Fig: 8.1.3 View Hospital Info

The add police-station will consits of details such as name of the station, address that contains Area, City, State and PIN-code. It also have Email-id where we must give an existing email-address and should provide cell-phone No. Particularlly we have to give the location that has longitute and latitude of the Police-Station.

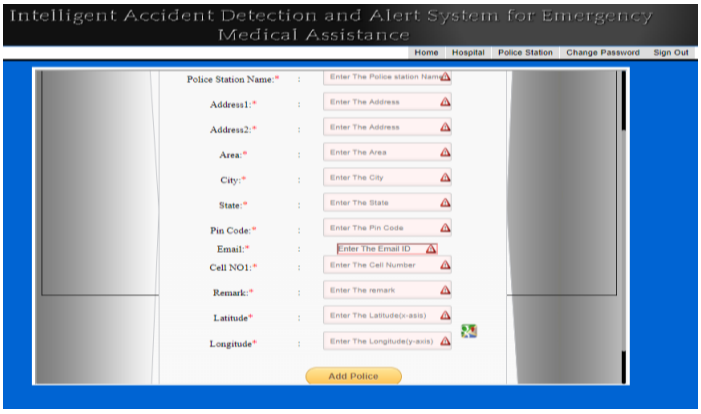

Fig: 8.1.4 Add, Edit & Delete Police Station Details

The above add details of the police station would be display here. The list-of records, it may have more records & also we could remove the record by sleeting it.

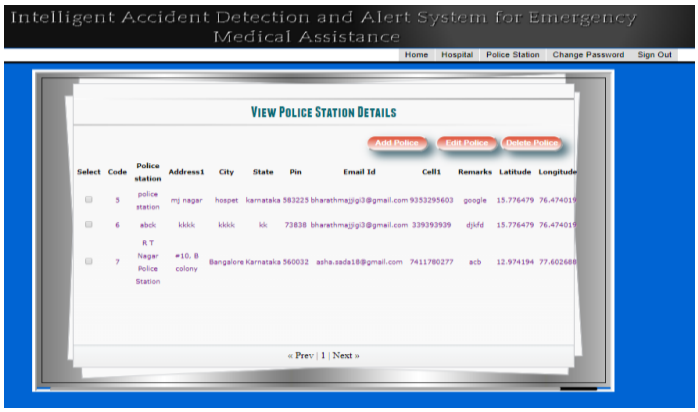

Fig: 8.1.5 View Police Station Details

It allows us to update new password.

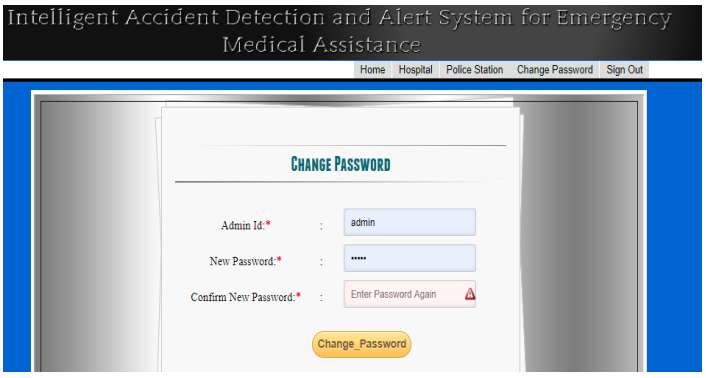

Fig: 8.1.6 Change Password Page

8.2 Android-Application

We should provide IP address here which has been given by the system. Version should to be typed then pressed ok to go to registration page.

Fig: 8.2.1 IP Address

To get registration we should provide user-name, email-id, PH No and PWD. Then click on Register Button. Once it's done we can go to login page.

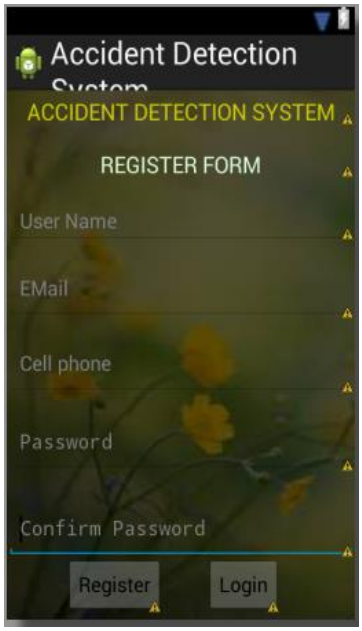

Fig: 8.2.2 Register Form

In the login should give the same user-name which we used in the register form and then we should type the password then click on sign-in button.

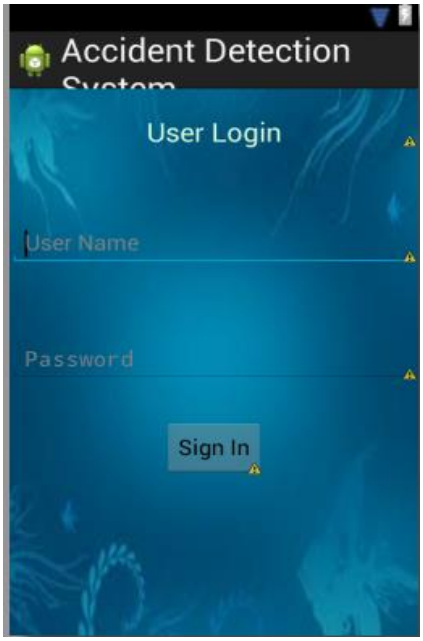

Fig: 8.2.3 Client Login

Once we log-in it will redirects to home page. Here we can see add authorize, panic, call police-station, call fire-engine, change password and log-out options. In authorize we can add details such as name, phone no and relationship. Panic button helps us to send voice message and we can call nearby police station and fire-engine. Even we can change our password then click on log-out.

Fig: 8.2.4 Home Page

In this page it displays the user-id, name, phone number and relationship of the user with authorized person. We can view the details which have been entered previously.

Fig: 8.2.5 Change Password

The update password will allow to provide current PWD and should enter new Password by reentering it then click on Update button.

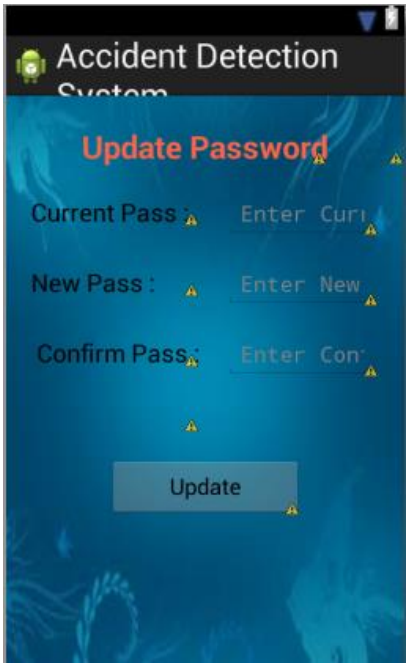

Fig: 8.2.6 Change Password

5. Conclusion

The proposed system deals with the mishaps (accident) that cautions (alerts) the system by sending message. Accelerometer is the main part of the system which supports to move the message to various gadgets in the system. The Accelerometer sensor will turn on when the

accident take place and the details will transmit to the mobile number via GSM module. Utilizing GPS the exact position can be address to nearby police station, hospital and fire engine. And also it sends message to family, friends and relatives as well. The accident could be recognizing by an accelerometer sensor that has been used as primary module in the system.

6. Future Enhancements

The specific system deals with the alarming (alerting) of the accidents. By activating automatic driving mode the alert system can able to identify about the incident to overcome the accidents. Starting at now this specific system was produced for just android telephones in future it very well may be created for IOS, Windows and different stages too.

APENDIX A

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Using Video Conference Applications to conduct Interviews during Covid-19 Pandemic

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Abstract: This year 2020, the entire world has experienced near emergency situation created by covid-19 virus. At the same time, millions of people across the globe have lost their jobs. Freshers and the ones who lost their jobs are striving hard to earn their bread and butter. The main focus of this paper is to throw a light on how to safely conduct online interviews by referring to some of cases. Also we are discussing about the impact of online interviews on interview candidates and hiring organizations. Video conferencing is a technology that allows users in different locations to hold face-to-face meetings without having to travel together to one location. This technology is especially convenient for business users in different cities or even in different countries as it saves the time, expense and hassle of business travel. Uses of videoconferencing include conducting routine meetings, negotiating business deals, and interviewing candidates.

Keywords: *Online interview, video conferencing, Remote communication Pros and Cons, Comparison.*

I.INTRODUCTION

From early 2020 China, the most populated and technologically sound country started facing the covid-19 related health issues and lately severe death issues. In the beginning, apart from China, entire world was almost ignorant of corona virus. The time when it started to propagate the virus outside the Wuhan city of china, people started demanding their governments to block the international flights and tourism. But the World Health Organization did not announce Covid-19 as pandemic. Then slowly covid-19 started spreading to many countries as the flights and cargo services were still functioning normally. Eventually many people started losing their jobs, manufacturing plants were severely affected and started closing one by one. WHO started giving guidelines to fight against corona and to take precautionary measures. Many offices, more than 90% were almost closed by end of April 2020 across many countries. Companies forced their employees to work from home. As it was not possible both logically and technically to work from home for certain professionals. These professionals were facing problems with respect to infrastructure setup and good internet facilities and the distractions from their family members. As a result of this

effect and due to loss of business, companies gave mandatory leaves without pay, especially airlines, tourism and hospitality firms. With this, people had no option other than searching for temporary as well as alternative jobs. This triggered the problem further, who will give job?, how do the companies conduct interviews? By then, few companies had slowly started hiring for immediate positions by conducting Online interviews by using various digital platforms like: Microsoft Teams, Zoom, Google Meet, Zoho and other popular applications. Similar trends of using digital platforms for video conferencing and online teaching were greatly promoted by academic institutions across the globe. In the subsequent sections of this paper, we have analysed the approach of conducting online interviews and technology impact on employer and interview candidates is discussed. By the end of July 2020, the world has registered 17,338,023 cases and in India alone 1,69,184 Covid-19 cases are registered. Video conferencing services generally offer more than face-to-face interactions. Best-in-class video conferencing services allow users to share screens, remotely access each other's desktops, text chat, exchange files, communicate via digital whiteboards, and even broadcast lectures to large groups of passive viewers. Some are part of Voice over IP (VoIP) business plans, which dynamically change voice calls to video calls and shared meetings with the push of a button without establishing new connections.

These are all fantastic communication tools for work-at-home scenarios, especially when viewed through a long-term lens. But video conferencing also has other functions besides keeping distributed employees connected. For one thing, it's an effective way to take on tasks like answering live customer support questions, engaging with customers in real-time webinars or other marketing events, and even contacting partners. These capabilities have taken a step back from the start of the coronavirus pandemic, leading to further growth in video conferencing, primarily in its consumer-centric brands.

In this paper we are highlighting two major things: i) How to conduct online interviews?, ii) Pros and cons of online interviews.. Also we have discussed on how technology platforms have evolved to cater the needs of the society.

II.LITERATURE REVIEW

Current video meetings are progressively moving to the WebRTC innovation, which works in a program. Practically all cutting edge video conferencing frameworks give usefulness to upkeep, transcoding, and recording of a few video transfers. The proposed stage gives the occasion to encourage understudies utilizing video meetings and coordinates into Moodle.[1]

Separation learning is one of the approaches to accomplish equivalent quality schooling in a nation like Indonesia. To help the separation instruction measure, great innovation is additionally required so the learning cycle works out in a good way. In this exploration, we offer another video gathering innovation arrangement utilizing webRTC innovation as a substitute for applications that actually utilize streak innovation. This innovation permits clients to direct video gathering exercises. What's more, the format of this framework is made as intently as conceivable with the past application, causing the client to feel acquainted with this application.[2]

The thorough hunt performed by the HEVC encoder makes the encoding cycle exceptionally moderate. Video conferencing is exceptionally utilized these days and this sort of recordings requires extremely quick encoding for constant transmission. [3]

The viability in correspondence and the incredible streamlining as expected and cost make the video gathering framework become a significant application today. In the event that the video meeting framework can be built on Internet, its practicability and application worth will be improved enormously. Notwithstanding, with conventional site page strategies, it is hard to develop a video meeting framework that has numerous intricate capacities. The framework additionally gives text visit work and certain manager function.[4]

With the quick improvement of reproduction innovation and video gathering, the exploration of the video meeting in appropriated intelligent recreation climate is significant. The exchange of floor is profoundly talked about; the structure of planning framework and two markers (Loss Rate and Average of Tardiness) which measure the productivity of booking calculation are presented in this paper. A calculation of the floor move is progressed; this calculation accomplished the normal objectives in the investigation. In light of the calculation, the absolute plan of video meeting dependent on RTI is presented, and the technique for video and sound information transmission, which is actualized by HLA intelligent class and RTI services.[5] A strategy to give four-way video conferencing of 640times480 designs goal in the home worker coordinating the elements of fast correspondence, advanced telecom gathering, and home mechanization applications. The home worker has been intended to have the usefulness of IP, earthbound and link STB imbedded with the goal that it has a sight and sound unraveling module as a PCI (fringe part interconnect) slave gadget to interpret the sound and the video information packed in different arrangements. Also, we add an exceptional video gathering module having sound/video codec, screen divider, and sound blender. A meeting director of use program starts and controls the added substance meetings vital over the span of member option from two-way, three-approach to four-way. The meeting control depends on SIP convention situated in the handling module of the home worker. The sound/video transfers from each gathering are decoded in the video meeting module. The decoded video transfers are shown on the screen partitioned spatially. The spatially partitioned video is encoded in the MPEG encoder of the video meeting module and shipped off objections. The sound streams from each gathering are blended so four distinctive blended streams from the blender return to every objective with the spatially separated video. [6]

As we are observing since March 2020, the concept of conducting webinars is rapidly gaining the momentum, as it can connect people from remote places using a common platform to achieve communication, which is supported by high quality Live audio and video facilities, and other add-on facilities like- computer screen sharing, presentation, use of graphs/charts, drawing and other facilities. These facilities are very much appreciated by industry and academia. Sheba Agarwal- Jans in her article written about proceedings of webinar on “Corona, HIV and the impact on the LGBTQI community”. Like this, many o have effectively conducted webinars to disseminate knowledge and to interview people about various things. Author said that conducting virtual interviews for surgical training

programme. Author said that, with all necessary technical and infrastructure related preparations, we can easily conduct virtual interviews with good contingency plans at place. The advantage of this approach is we can stay safe from covid-19 and to further promote this approach as a good option to conduct online interviews. Author shared their views about the preparedness required to face the virtual interviews. This throws light on technological aspects of conducting the interviews and the nuances of online video conferencing.[7] XinPei Jin et. al. in his paper discussed about how virtual reality helps in conducting interviews to make it more lively, as it creates an illusion that the interaction is happening face to face in our place. I. Stanica et. Al. in their paper suggested the use of Virtual Reality simulator to understand nature and working of VR technology. This approach is better to get used to the VR Technology. Interview candidates can use this as tool to practice.[8] . The body language, behavior needed to face online interviews. This is very much helpful from the preparedness perspective. Without this preparedness, it is difficult to face online interviews confidently. [9]

The progressing pandemic has unquestionably constrained undertakings to reconsider the manner in which they work. They changed the manner in which they remain associated and went to computerized stages like Zoom. Video conferencing is the nearest option in contrast to an up close and personal gathering permitting to rapidly trade messages and address worries on the spot. We should discuss the advantages of web conferencing.

Comfort - on account of video conferencing you presently don't have to head out to see associates or customers. It tends to be used to rapidly associate during time-delicate or squeezing circumstances. Clients can consistently converse with people in various time regions outside of standard work hours from the solace of their homes.

Cash and time reserve funds - voyaging can devour large pieces of time and spending plan. Albeit a few gatherings should be held face to face, the vast majority of them can be effortlessly held during a video meeting.

More close to home online gatherings - whenever contrasted with email or sound calls, video meetings takes it to the following level. You can utilize outward appearance prompts and construct a more close to home relationship.

Recording instruments - most of video conferencing stages permit gatherings to be recorded. This guarantees that significant focuses structure the gathering are not missed and can be imparted to the individuals who were inaccessible at the hour of the gathering. Also, stages like Verbit can create live records of video calls, for instance, to help produce rundowns of gatherings.

Representative Onboarding - video conferencing can be utilized in the schooling of new workers. HR divisions regularly use it during onboarding and offboarding. Far off preparing has demonstrated to be the best and connecting with when utilizing video apparatuses.

Availability - because of instruments like live inscriptions or record video conferencing gives all workers equivalent occasions to connect with and partake. Those devices ensure that distant representatives or those with incapacities like hearing misfortune can viably take an interest in gatherings.

Advanced labor force - video gatherings help to keep up human associations and accelerate the dynamic cycle through worldwide joint effort.

Video conferencing can be exceptionally valuable for organizations, however just when utilized effectively. A portion of the stages may appear simple to deal with, yet instructional courses are an absolute necessity to guarantee representatives know about the highlights accessible and how to best utilize them.

Lighting and sound quality assume a huge part in viable correspondence. Legitimate arrangement can require some serious energy, so it is essential to address the potential issues already. Also, business pioneers ought to outfit their workers with a solid Internet association. Probably the best act of video conferencing is setting a reasonable plan and correspondence focuses before the gathering to guarantee all watchers remain on target.

There are a few focuses you should know about.

Longer conveyance time - it will take more time to construct an answer without any preparation and test it appropriately prior to delivering

Operational unpredictability - you should send and deal with a whole foundation

Cross-administration security - when working without any preparation, you have to guarantee that the arrangement meets every essential guideline and consistence prerequisites.

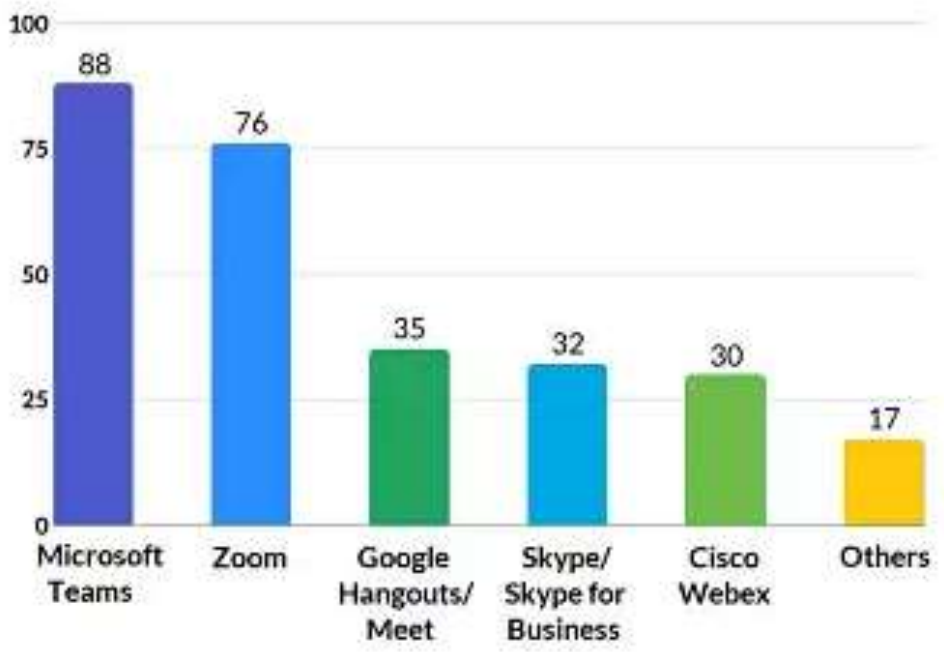

Figure1: Video Conferencing Applications (Taken responses 278)

In the above figure 1 represents the Video Conferencing Applications taken responses 278. A few associations have an inside inclination to utilize a specific application; in any case, their clients and different accomplices in the environment may have an inclination for another application.Video conferencing, correspondence, and group cooperation are emphatically connected. With regards to Office suites; Microsoft Office 365 takes a greater part lead, with near 53 percent of respondents settling on it; yet its Google partner, G-Suite is in close rivalry, with near 47 percent.

Group joint effort is one of the critical segments of empowering WFH and Slack appears to be a champ, the overview states. WhatsApp has come out as a mainstream and fascinating decision among clients, it being very inescapable and its usability go in support of its. Likewise a few respondents referenced about utilizing Project Management and Online Collaborative Whiteboard applications for better coordination among the particular groups.

III.APPROACH

The proposed approach believes in conducting online interviews by implementing certain standard procedures. We are dividing these procedures into three types: i)Technical procedures, ii)Behavioral procedures and iii)Infrastructure related procedures.

A. Technical Procedures:

Step1: One should learn about computer and Internet usage.

Step2: Learn how to use online live meeting/video conferencing platforms such as- Microsoft Teams, Zoom, GoogleMeet, Zoho and so on. Anyone of these is good enough to conduct online interviews.

Step3: Make sure that your Mic, camera etc. are working fine and are of high quality. Practice before you take up live interviews.

B. Behavioral Procedures:

Step1: Learn the basic etiquette of communication.

Step2: Setup the place that is disturbance free, especially no interference from family members, TV and radio.

Step3: Understand the context of interview, and show confidence about your skills and commitment. Be professional. Don't run any parallel applications as it can create disturbance.

Step4: Don't hesitate to ask questions to achieve more clarity.

Infrastructure related Procedures:

Step1: Make sure that you have a very good Laptop or Desktop computer equipped with Microphone, speaker and camera of high quality.

Step2: Check your internet connectivity. It is desirable to have alternate internet connection if something goes wrong.

Step3: Run a demo test before you face actual online interview.

	Price	Length	Participants	Live stream	Record	Grid view	Breakout rooms	Join without account
zoom	Free basic plan	40 min (No limit with edu account)	100	✗ Paid only	To computer	49 people	✓	✓
Teams	Free basic plan	No limit	300	✗ Paid only	✗ Paid only	49 people	✓	✓
Meet	Free basic plan	60 min (No limit with paid account)	100	✗ Paid only	✗ Paid only	49 people	✓ (Paid accounts currently)	✗ (Sign in with Google account on free plan)
Webex	Free basic plan	50 min (No limit with paid account)	100	✗ Paid only	To computer	25 people	✓	✓

Figure 2: Comparison of Video conferencing for Colleges/schools/Universities

The above figure 2 represents the Video conferencing for Colleges/schools/Universities. This analysis done by October 2020 during pandemic. As per the analysis, Colleges/schools/Universities moving towards Google meet application because of more feasible solution and navigation.

C. Pros of Online Interviews:

- Useful in maintaining social distancing in situations like Covid-19 pandemic.
- Saves lot of time required for traveling.
- Organizations can conduct interviews for immediate positions. Thus helps in business continuity.
- There are several online platforms which are free to use. Saves lot of money especially for organizations.
- Interviews can be recorded and can be shown as proof.

D. Cons of Online Interviews:

- Internet connectivity in remote villages is a very big issue in developing countries.
- Sometimes we can see lot of interference/disturbance from family members, Television while attending online interviews.
- It is not possible to hire certain professional by conducting online interviews due to various reasons, especially where the candidate cannot demonstrate certain skills online.
- It is tough to hire computer Illiterates by conducting online interviews.
- It will be a totally new thing for certain interview candidates.

- If the voice or video clarity is not good, then it becomes difficult to continue with the interview.

IV.CONCLUSION

During this covid-19 pandemic many employees have become jobless and they are trying their best to fetch a new job. In this situation, online interviews are the best choice to take up interviews. We are seeing a spike in number of companies conducting online interviews, thus helping in business continuity. This trend may continue now onwards and many people are day by day becoming computer literates, which is a positive sign for companies. Not only the companies, even academics are greatly promoting video conferencing applications to conduct online classes. Hence online interview is one of the best solution to conduct interviews during pandemic situations.

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Learning of Advanced Telecommunication Computing Architecture (ATCA)-Based Femto Gateway Framework

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Abstract

A case study of designing advanced telecommunicatıon computing architecture (ATCA) framework using femtocells. A small cell is smaller than the expected base station, explicitly intended to broaden the information capacity, speed, and proficiency of a cell arrange. These low force radio access hubs can be sent inside or outside, and utilize authorized, shared, or unlicensed range. The femtocell gateway architecture is designed for a small range such as 10 m to a few kilometers. Small cells can be utilized to give in-building and open-air remote help. Mobile operators use them to expand their service coverage and additionally increment network limits. Small cells are downsized, low force, lightweight remote access base stations that are found regularly inside homes, workplaces, and shopping centers.

The small cell solution is comprised of a clusters of small cells, the access points intended for in-building home or undertaking use, and a little arrangement of core system components for interconnection between the small cells cluster and the inheritance core system. The small cells cluster relies on an IP level architecture that organizes into a system several elements of the conventional UMTS. It gives both the NodeB and RNC functionalities. The small cell arrangement is comprised of one or a few cluster of small cells, in addition to this arrangement of components shared between the groups. A

"cluster" is characterized as the group of small cells (up to 64,000) associated with a "small cell gateway" furnishing the interworking with the mobile packet core. ATCA depicts a high data transfer capacity, high network, and chassis-based architecture designed principally to appeal to the telecommunication industry. AdvancedTCA or ATCA is an open standard from the PCI industrial computer manufacturers group (PICMG) that characterizes particulars for high-performance communication framework.

Keywords

Small cell Universal mobile telecommunication system (UMTS) Cluster
Sun Netra X4250 Advanced telecommunication computing architecture (ATCA)

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Personalised recommendations

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Abstract

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The small cell solution is comprised of a clusters of small cells, the access points intended for in-building home or undertaking use, and a little arrangement of core system components for interconnection between the small cells cluster and the inheritance core system. The small cells cluster relies on an IP level architecture that organizes into a system several elements of the conventional UMTS. It gives both the NodeB and RNC functionalities. The small cell arrangement is comprised of one or a few cluster of small cells, in addition to this arrangement of components shared between the groups. A “cluster” is characterized as the group of small cells (up to 64,000) associated with a “small cell gateway” furnishing the interworking with the mobile packet core. ATCA depicts a high data transfer capacity, high network, and chassis-based architecture designed principally to appeal to the telecommunication industry. AdvancedTCA or ATCA is an open standard from the PCI industrial computer manufacturers group (PICMG) that characterizes particulars for high-performance communication framework.

Keywords

Small cell
Universal mobile telecommunication system (UMTS)
Cluster
Sun Netra X4250
Advanced telecommunication computing architecture (ATCA)

1. Introduction

In telecommunications, a femtocell is small, the most well-known type of small cells is femtocells. Small cells are downsized, low force, and lightweight remote access base stations that are found normally inside homes, workplaces, and shopping centers. Small cells can be utilized to give in-building and open-air remote. Portable administrators use them to expand their administration inclusion as well as increment arrange limit. Small cells are remote transmitters and beneficiaries intended to give organize inclusion to smaller regions. The utilization of femtocells permits to arrange inclusion in places where the sign to the fundamental system cells may be excessively powerless. They can be integrated into a home residential gateway or in a standalone format. These small units are installed by consumers. The small cell solution is made up of a cluster of small

cells, and the access points designed for in-building home or enterprise use, and a small set of core network elements for interconnection between the small cell cluster and the legacy core network [1]. The small cells cluster is based on a flat IP architecture that collapses many functions of the traditional UMTS network into a device. It provides both the NodeB and RNC functionalities. The multi-standard small cell access points (home cell and enterprise cell) and metro cell outdoor use 3GPP interfaces to connect to neighboring eNodeBs, and other small cell access points and existing core network (CN) elements [2]. Home NodeB underpins radio administration while the portal keeps up the center systems usefulness. Femtocell adds the security functionalities, and design can be improved by including the capacities like authentication, authorization, and accounting works in femto gateway. On the Sun Netra X4250 and advanced telecommunication computation architecture (ATCA) hardware platforms, the small cell gateway is deployed. ATCA is a small cell gateway hardware platform. For both 3G and 4G support, the ATCAv2 hardware platform is available. It is high bandwidth, high availability, and efficient and versatile, built for cost-effectiveness [3].

2. Literature Survey

LTE femtocells support for improving the performance of 3GPP specifications. It is designed with different modulation techniques such as OFDMA and SC-FDMA modulation used in downlink as well as uplink communication. Even both FDD and TDD topologies for designing a TD-LTE femtocell and FD-LTE femtocell architecture. Current networks, such as 2G and 3G, are used by central devices and their base stations are operated by RNCs. Within a single macrocell coverage area, there are thousands of femtocells. Thus, a single RNC needs to control on the order of hundreds to thousands or tens of thousands of femtocells. It is not possible to handle or control so many FAPs using the current network control entities. In order to boost the performance of the overall device, FAP connectivity should also be different from that of current 3GPP network connectivity for femtocell deployment. The different femtocell architecture such as 3G(UMTS) femtocell architecture, lu-h interface, LTE femtocell architecture, and WiMAX femtocell architecture are used in current generation networks [6].

3. Methodology

Femtocells are smaller and low-controlled base stations (small base stations). Femtocells are a financially savvy answer for filling any holes in inclusion and rapidly expanding limits in high-thickness, high-traffic regions. Femtocells cover a

span of 50–100 m (for example, a huge house). The small cell is built around, a large number of access points (metro indoor and outdoor, home enterprise). The small cells access points are home cell supports 4 users and with an approximate cell radius of 30–60 m, enterprise cell supports up to 32 users, with an approximate cell radius of 100–150 m, metro cell indoor supports up to 32 users with an approximate cell radius of 100–150 m (based on the construction of building in which it is located), metro cell outdoor supports up to 32 users with the extended cell range feature (cell radius up to 2 km. Femto arrangement objects focused on a limit that essentially improves execution, producing about upgraded quality of experience (**QoE**) for end clients by empowering quicker, progressively dependable information associations, and higher information throughput on both W-CDMA and LTE systems. Femto solutions can be deployed almost everywhere with enhanced visual integration compared to traditional towers [4]. They can be mounted easily on walls, lamp posts, poles, or even on the side of a building, extending coverage, and capacity to indoor locations. Femtocell base station uses a broadband Internet Protocol connection as “backhaul”, namely for connection to CN. Here, the operator should perform authentication using the unique Id between the femto gateway and the femto access point for security. And to provide quality of service to the user, the operator must provide a guarantee that no packet loss and delay should happen. And femtocell reduces traffic and load on the network by using IP as a backhaul and also it helps the operator by high maintenance cost and also from the tower deployment burden. By providing these benefits the operator can get better service at a lower rate.

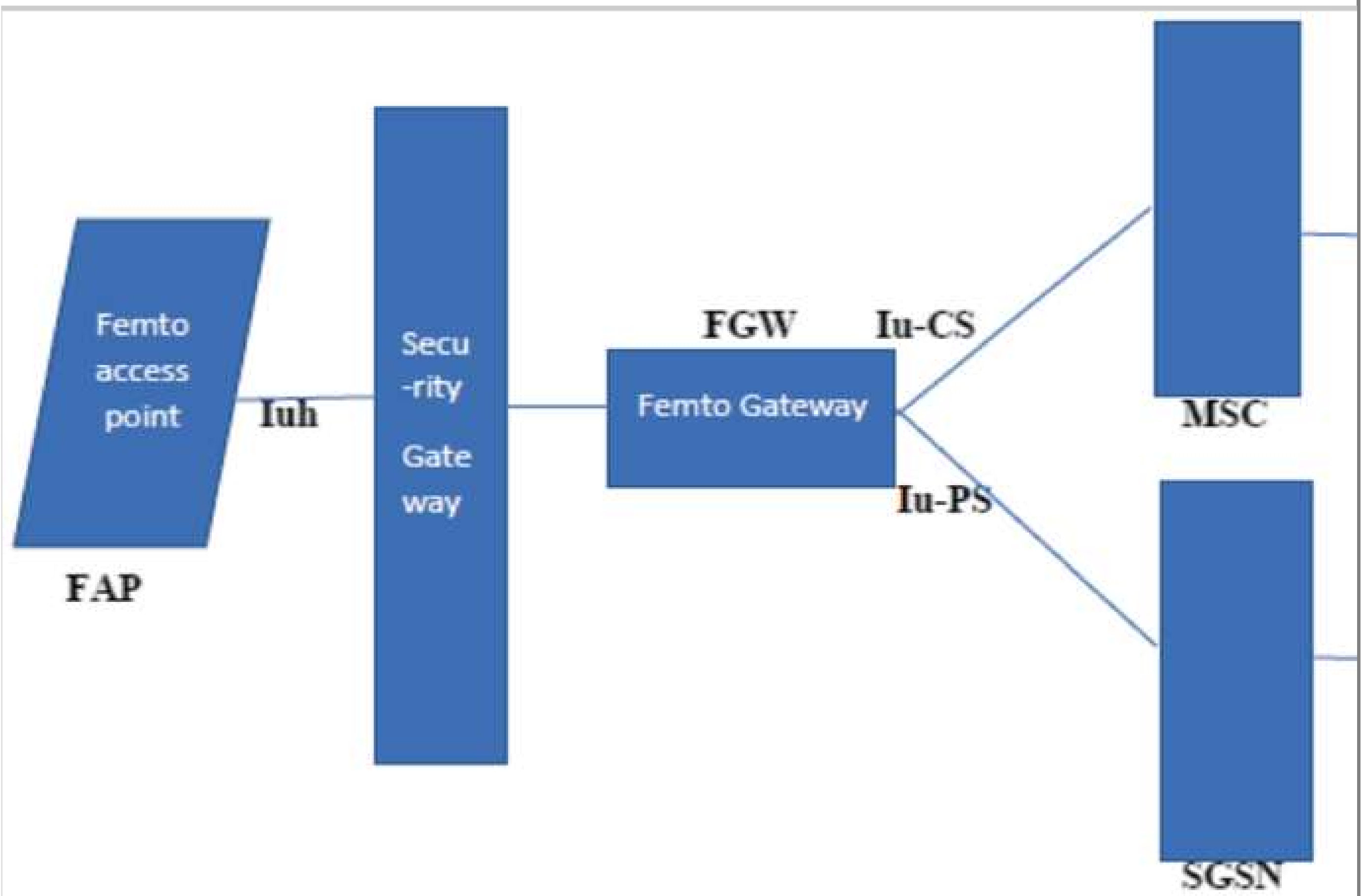
One kind of broadband Web convention associations is a digital subscriber line (DSL). The DSL associates a DSL transmitter-recipient (“handset”) of the femtocell base station profoundly organizes. Since the LTE network has a flat architecture, it is extended to the femtocell network. The multi-standard femtocell access points use 3GPP interfaces to connect to neighboring eNodeBs and other femto solution access points and existing mobile core network (CN) elements while offering a 3GPP complaint air interface. The architecture integrates seamlessly into the operator's existing LTE and UMTS network, including interfaces with other elements as well as existing management systems, thereby incorporating standard interfaces with existing applications, portals, and services. Femto solution access points interconnect with the core network elements with the addition of a SeGW, a femtocell gateway between the femto solution access points and the W-CDMA/LTE core network elements [5]. Core network (CN) elements for connection to a standard core network through the PS/CS interfaces (applicable for 3G support) and S1-MME interfaces.

3.1. 3G Femtocell Network Architecture

Figure 1 explains how 3G femtocell network architecture works [6] from the mobile or user equipment connection to home NodeB happens over the Uu interface. This interface is the standard W-CDMA radio interface between the UE and HNB. A femtocell is a mini-base station that can be installed on the customer premise, whether residential or enterprise, as a standalone entity. The primary use behind the femtocell is to give better cellular coverage within the building. The primary reason for the femtocell is to give the better transmission, which is a test within buildings without femtocells. A femtocell network system consists of a femto access point (FAP) as part of a universal terrestrial radio access network (UTRAN) and a femtocell gateway to support and control the user plane access to the femto user equipment. To provide the communication between femtocells with the main core network, the mobile backhaul system uses the user's Ethernet broadband connection, whether digital subscriber line (DSL), cable, fiber, or another such link to provide a cost-effective and available connection for the femtocell that can be used as a standard for all applications. Iuh interface consists of RANAP, HNBAP, SCTP on the control plane, and UP [7]. This provides the interface toward the FGW. This is the interface that provides the link between the femto and the femto gateway. And also, this interface consists of an HNB application protocol, for the HNBAP deployment, it provides a high level of scalability.

Fig. 1.

3G femtocell network architecture



The functionalities of the control plane and the user plane are provided by the interface, i.e., Iuh interface. And for the user plane, radio access bearer management, security, and mobility management are the functionalities of the user plane. The HNB gateway connects the large number of HNBs with the Iu interface that is divided into two interfaces, the IuPS, this interface toward SGSNs, this is handled by IuPS signaling gateway, and for the IuPS user plane is handled by packet gateway. And the IuCS interface toward 3G MSCs, to handle the IuCS radio network control plane and user plane is handled by the voice gateway. The core network part is further divided into two domains, i.e., circuit-switched (CS) domain and the packet-switched (PS) domain. Circuit-switched networks are connection-oriented networks. To transfer the message from the source to the destination, a path will be established to transfer the entire message from the source to the destination. The message sent by the source it is received in order, the message will be sent in order. Circuit-switched networks are implemented at the physical layer. It is more reliable, at the source only data is processed and transmitted.

Packet switching networks are connectionless networks. To route the data from source to destination, it divides the message and it is grouped into several units these are called packets. These packets will route individually from the source to

the destination. In the circuit-switched, a path is established and here there need not establish a path from source to destination. Separately each packet is routed. It is flexible and the packets follow a different path for the different data. It is designed for data transfer and the packet switching is implemented at the network layer. Not at the source only data is processed and transmitted, but at each switching station, it is processed and transmitted. The message of each packet is received out of order.

The operator’s core network part is used for the exchange of information between the LAN’s and also it provides a path and it interconnects the network. The elements that are present in the core network part are MSC, VLR, and media gateway. In the packet switching part, the elements are gateway GPRS support node (GGSN) [8], serving GPRS support node (SGSN). The main functionality of MSC is to handle the signaling messages, manages, and tear down the phone calls, and it is used to route the voice calls and SMS, conference calls, and also releases the end-to-end connection. During the call, it handles to manage mobility and hand over purpose. The main functionality of VLR is, it contains the information of the mobile subscriber and also the location, like the location of the subscriber present in the service area and it is a database of mobile stations (MSs). The information is either received from home location register (HLR) or it is collected from MSC. For the subscriber who wants to connect, the authorization will be done for each subscriber to use CN, and the main purpose is to handle the incoming calls. It contains the subscriber identity number and subscribers phone number. It also informs the HLR that a subscriber has arrived in a particular area and tracks in which area the subscriber is located.

The functionality of the media gateway is to redirect telephone calls from one part of the network to another. The radio network controller (RNC) delivers CS traffic, that is voice and SMS to the core network that is MSC over the IuCs interface. Here, the purpose of RNC is, the main responsible is, it controls all the NodeBs which are connected to it. At the radio resource management, the RNC will be carried. It will perform the role of mobility management and encryption from the mobile and to the mobile before the data is sent. A security gateway is a compact solution that provides encryption for untrusted portions of communications networks. Providing complete network protection through encryption. The functionality of the security gateway is, it protects user privacy and also protects network security [9]. It is installed in the operators network and it establishes IPsec tunnels with HNBs, IPsec tunnels, and the functionality is for delivering all voice, messaging, and packet data services between HNB and CN and it forwards the traffic to gateway. The main feature it provides is high availability, and also if there

is a fault with the switching it can complete in seconds, and also it supports plug and represents components and in-service platform upgrades. When the user wants to communicate the call goes from the femto access point to the security gateway and the femto gateway, through the femto gateway to the core network.

3.2. Small Cell Gateway on ATCA Platform

The small cell gateway system uses carrier-grade ATCA architecture. Redundancy is used in the design. Advanced telecommunication computing architecture (ATCA) hardware is a chassis type system based on the standards specified by PCI industrial computer manufacturers group (PICMG). This hardware platform for the small cell gateway product. The ATCAV2 platform is now available for both 3G and 4G support. The ATCAv2 platform is mainly composed of a rackable 11U height shelf equipped with: For internal communication, one pair of switching boards will be provided and for external physical connectivity support using the RTM. ATCAv2 supports up to 6 clusters, and each single one is managed independently from others.

3.3. ATCAv2

Figure 2 is the ATCAv2 shelf, the shelf is fully PICMG 3.0 (ATCA) standard compliant. NEBS certified and ETSI compliant. A total of 14 slots ATCA housing used slots for up to 12 single boards computer (e.g., Bono or Tome) supporting HeNBGW [10] application.

Fig. 2

ATCAv2 shelf diagram

One pair of switching boards providing internal communication and external physical connectivity support using the RTM. These are called small cell gateway switching (BGS) boards. One or several (up to six) application board pairs, supporting the small cell gateway application. These are called small cell gateway application (BGA) [12] boards. Slots for two switching boards (e.g., Malban10 or MalbanX) supporting I/O Dual star 1G and Dual start 10G fabric backplane implementation. Two shelf management boards working in active/standby mode, management based on standard IPMI and radial IPMB bus implementation for high availability, integrated alarm collecting blade. Top and bottom fan trays for

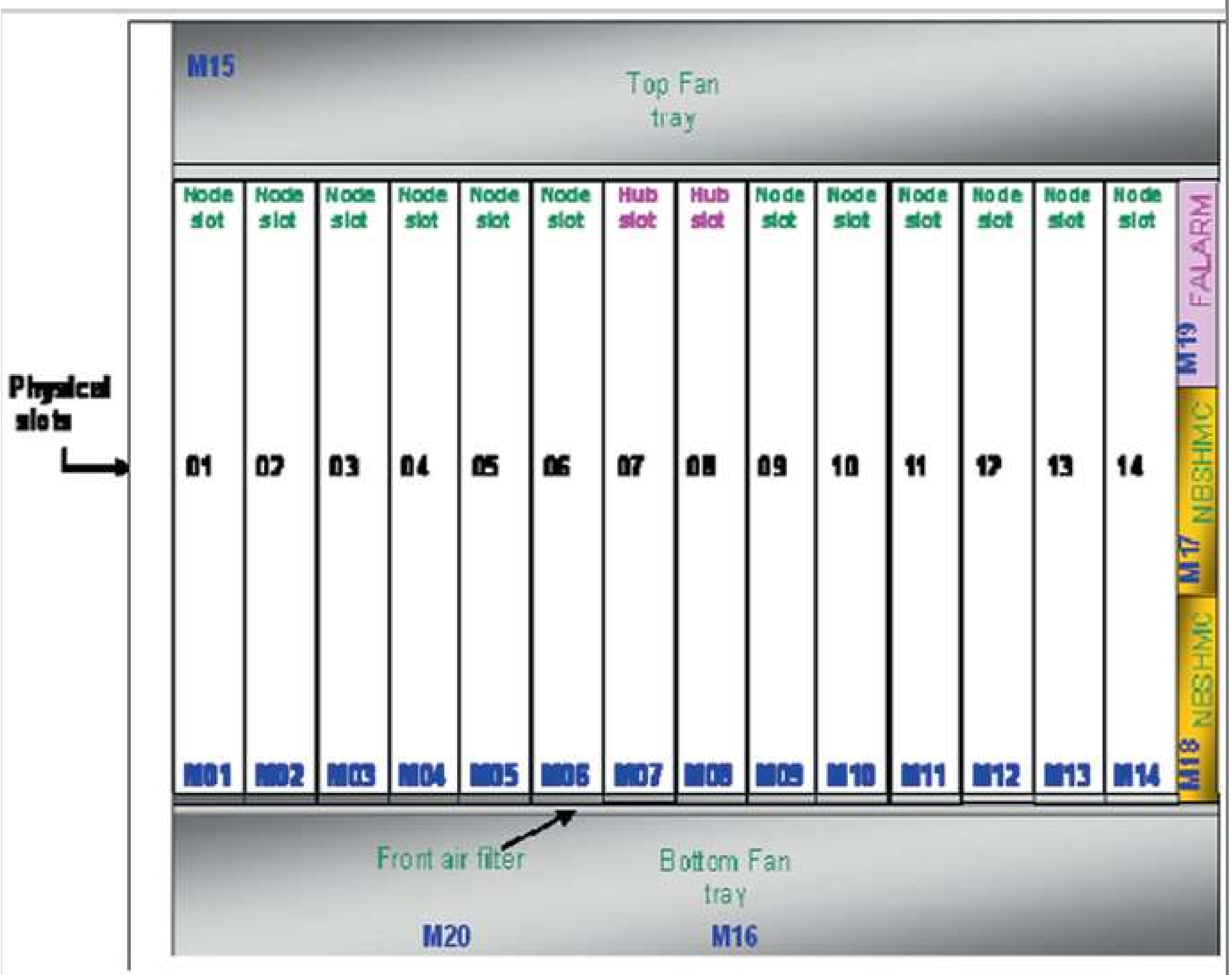
push/pull cooling management consist of 330 W/slot capacity and up to 70-80CFM per slot.

3.4. ATCAv2 Shelf (Front)

Figure 3 is the front view of ATCAv2 shelf [12] and also it has 14 slots, i.e., each cluster consists of 2 Bono's (active and standby state).

Fig. 3

ATCAv2 (front) shelf diagram



M01 to M06: Application boards.

M07 to M08: Switching boards.

M09 to M14: Application boards.

M15: Fan tray top.

M16: Fan tray bottom.

M17: Shelf manager top board.

M18: Shelf manager bottom board.

M19: Alarm board.

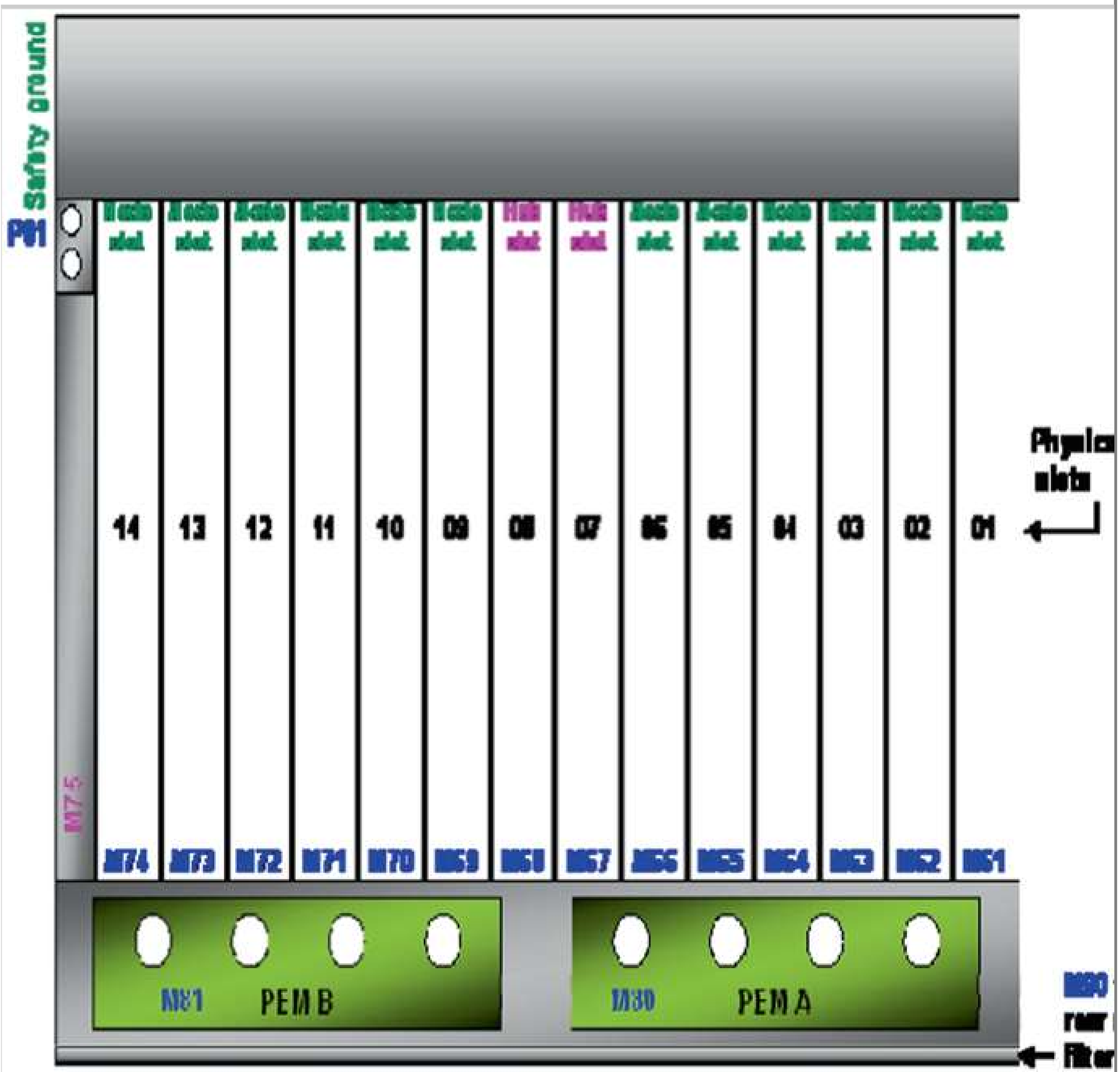
M20: Front air filter.

3.5. ATCAv2 Shelf (Rear)

Figure 4 is the rear view of ATCAv2 shelf:

Fig. 4

ATCAv2 (rear) shelf diagram



M61 to M66: unused.

M67 to M68: RTM of BGS boards for external connectivity.

M69 to M74: unused.

M75: Alarm access.

M80 to M81: Power entry module (capacitor).

P01: rear safety ground.

M90: rear air filter.

Backplanes dual star topology.

3.6. Fabric and Base Dual Star Topology

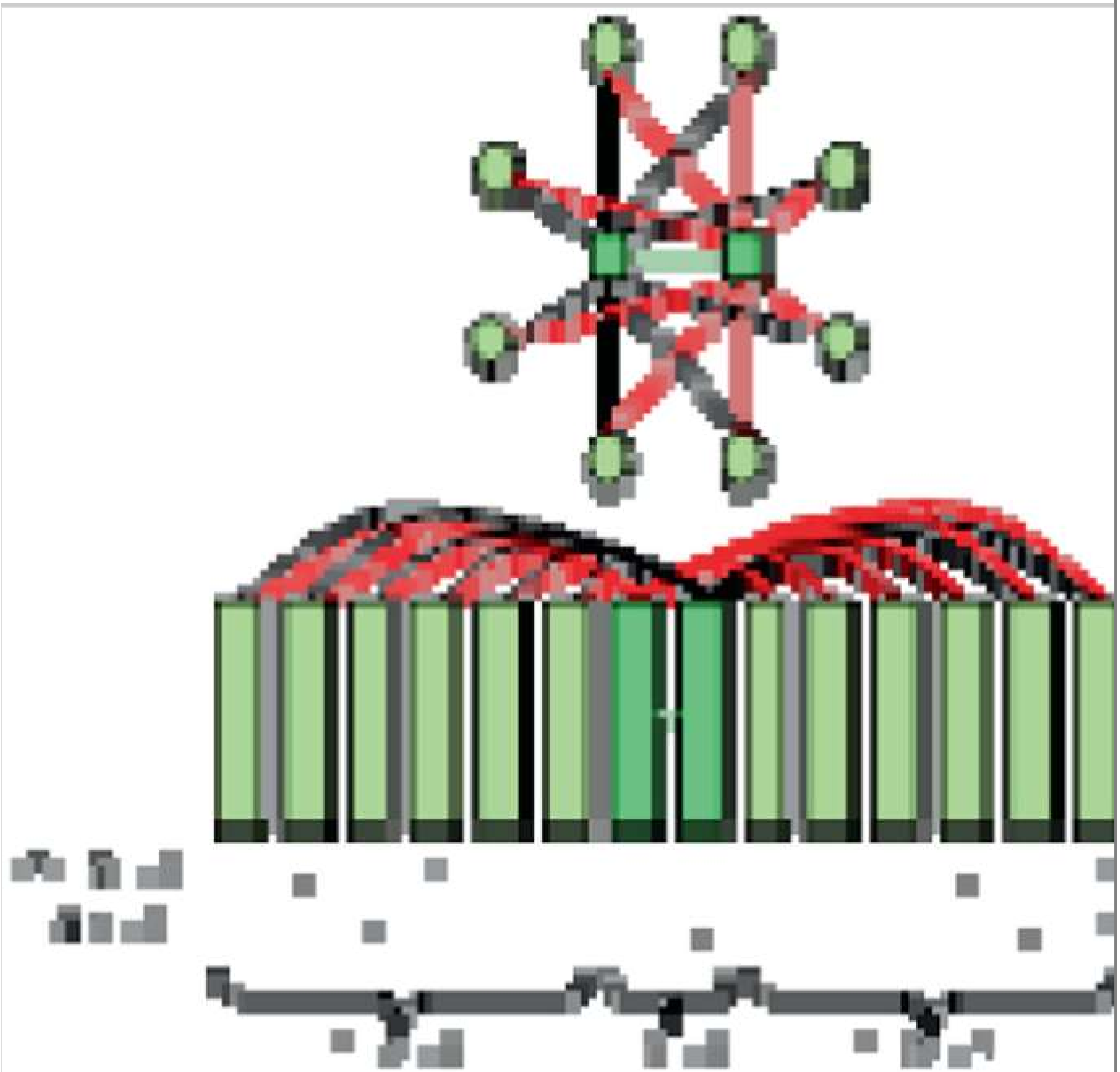
The fabric backplane is10Gbps and it handles telecom traffic. 1Gbps is the base interface and manages O&M traffic. Hardware management through the shelf management board is an IPMI bus. ATCA offers very good capabilities for shelf management. When the event occurs like overvoltage, over-current, or when the temperature increased then the shelf manager will receive events from field replaceable units (FRUs), when an event occurs the shelf manager reacts to an event by increasing fan speed or shutting down the board.

3.7. Dual Star Topology

Figure 5 is the dual star topology means, for a channel connection to all node boards and the other hub board, each hub board supports. Each node board supports two channels (one toward each hub board) [11].

Fig. 5

Dual star topology diagram

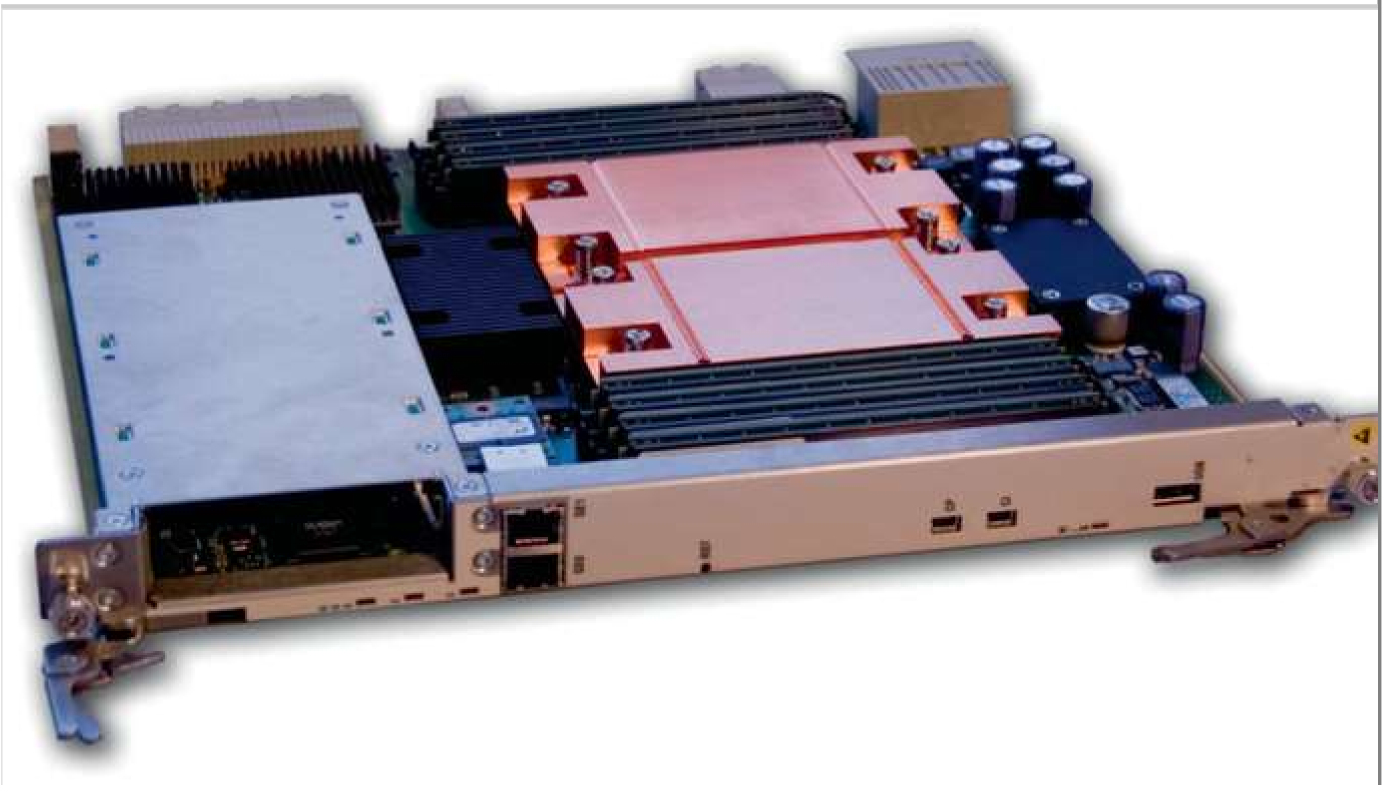


3.8. Bono Blades (Application Blades)

Figure 6 is a Bono blade on an ATCA hardware platform, the following are the features of the Bono blade, Dual 6 Core × 86–64 single board computer. Dual CPU is from Intel Westmere @ 2 GHz, 32 GB of volatile memory DDR3 ECC 1066 GHz RDIMM, Performances- ~ 200 SpecInt Rate base 2006 (with turbo and multithreading), OS Linux Redhat6, 300 GB Hard drive (AMC format daughterboard), Ethernet I/O Backplane, Fabric (1GEth or 10GEth per plane) and base (1GEth per plane). Each cluster consists of two Bono blades, one is in an active state and another one is in standby state [12].

Fig. 6

Bono blades



3.9. Malban Blades (Switching Blades)

Figure 7 is a Malban blade in the ATCA platform, the following are the features of the Malban blade [12]:

Fig. 7

Malban blades

Core features are 1Intel Merom Core 2 Duo processor (19 SpecInt Rate 2006), 2RDIMM slots, max 8 GB DDR2-400 ECC, Redhat RHEL6 Linux OS, hardware diagnostic, Ethernet switch, base switch (O&M), it handles O&M traffic and13 ports GEth 1000Base-T to Base back plan and one 10GEth uplink to RTM (RTM supporting 1 × 1GEth for O&M I/O). Fabric switch handles telecom traffic/200Gbps switching and 10GEth × 12 ports to fabric backplane. Here, two 10Geth uplinks to RTM supporting 12 × 1GEth for telecom I/O (RTM) [12].

3.9.1. Femto Gateway Test Framework

This demonstrates the end-to-end system communication occurs between the simulators and femto gateway. Femto gateway test framework consists of femtocell (mini-base station) or femto access point, femto gateway, and CN elements. Femtocell access point combines all functions of UMTS, i.e., NodeB and RNC into a single physical network element. It connects to the Internet via the gateway. The IP network is connected with the core network via gateway. The femto gateway acts as an intermediate between the simulators femto access point and the core network [13].

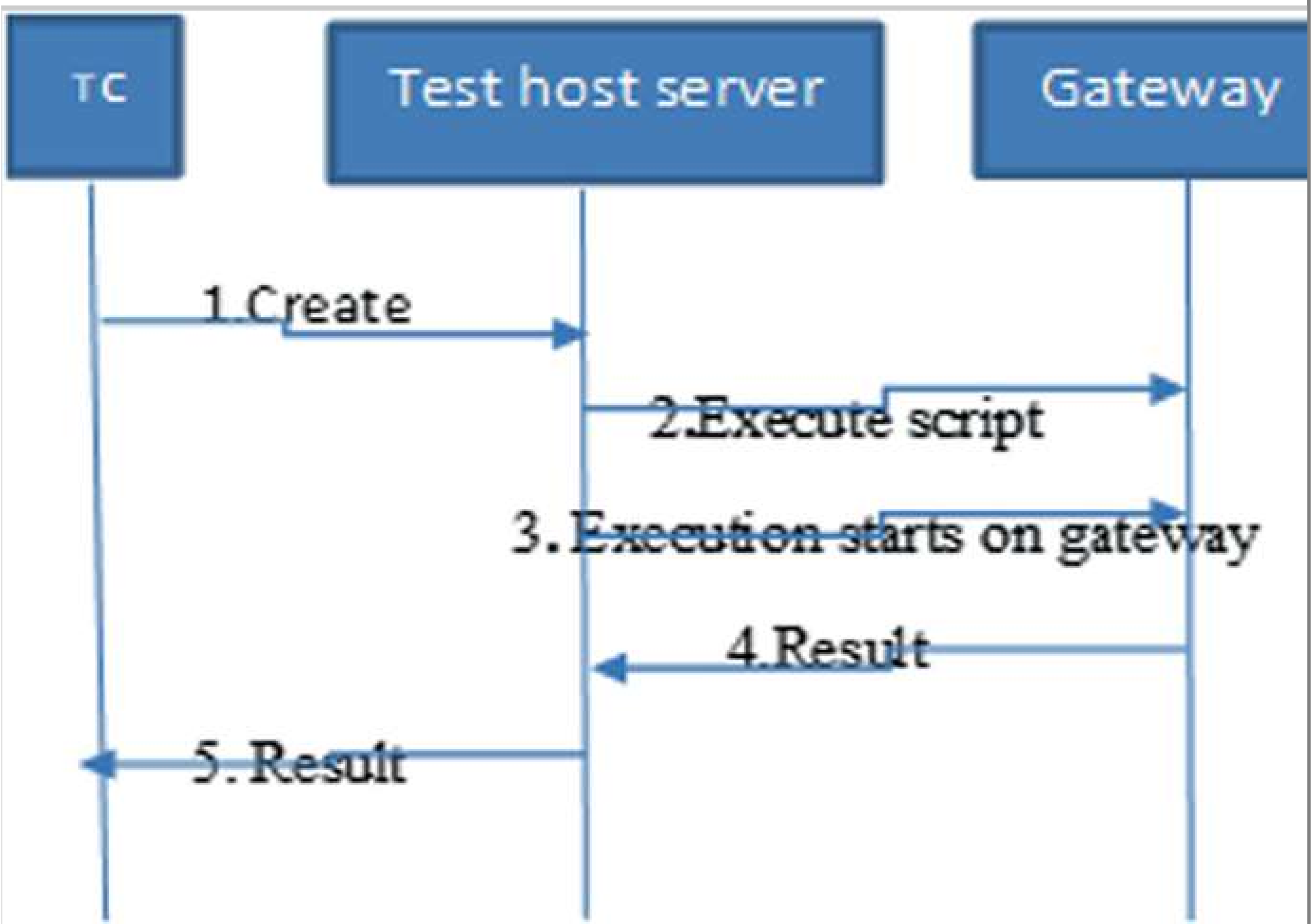
FGW will be integrated on the ATCA hardware platform. Also, it provides 3G femtocell and 4G femtocell functionalities. The HeNBGW is implemented using the

addition of SeGW. The HeNBGW can be used with the integrated security gateway (SeGW) to secure the communication. Using the IPsec tunnels, its secure communication between HeNB and femto gateway. The communication happens between the simulators and the FGW through the IP network and the femto gateway. The installation on the gateway can be done manually or automatically by executing the installation scripts. After the build is successfully installed on the gateway, then call verification will be done by executing call flow scripts on the gateway for both 3G and 4G.

Figure 8 is an example of the basic script execution process, how the test co-ordinator performs the operation on gateway, and lists the operations to be done on gateway from the test host server. From the test host server, the test co-ordinator logon to the gateway to perform the testing operations on the femto gateway. The test co-ordinator from the test host server performs the 3G/4G operations on cluster, there will be seven clusters, and each cluster consists of two bono blades such as active and standby state. From the server, the test co-ordinator login to bono, using the Ssh command logins to the gateway. By copying the builds from the server to the test host server and from the test host server copy the files on the gateway occurs often. The process of installation on the gateway can be done manually or using scripts, like 3G installation and 4G installation scripts. After the successful execution of installation scripts on the gateway, need to test the basic call script on the gateway, if the installation script got fail then need to debug the error and fix it.

Fig. 8

Basic script execution diagram



The following are the steps to perform the installation on gateway.

Build installation process on gateway is used for the test co-ordinator to perform the installation on both the blades bono1 and bono2 (active and standby) and to ensure that the installation is performed by the superuser or a user with superuser privileges.

The procedure for the build installation:

1. Copy the build file < build > . tar. gz from the server to both the bonos (bono1 and bono2)

2. Enter the command tar -zmxvf FGW- < version > . tar. gz in the downloaded location to extract the files. After the extraction of the package, all files will be extracted in their respective folders with default files.

3. Enter the following command stopbsg, if any existing build or process are running.

4. After the extraction of the package, enter the following commands in the directory

   Cd DELIVERY/FGW/FGW-<version>

   ./BSGInstall

   The ./BSGInstall script performs the following actions: Creates the required directories for installation and various directories, which is used for post-installation.

5. Configure the attributes in OAM_PreConfig.xml using the FGW_Config tool provided as follows. Populate “FGWConfig_All.ini” file with correct values by entering the values manually or copy existing ones from backup or read the values from testbed configuration file (read the values from this file) using scripts. FGWConfig_All.ini is available in /opt/conf and FGWConfig.exe is available in /opt/bin.

   Here, the testbed configuration file contains all the interface IP addresses, switch, bonos, malban, SeGW IP addresses that are configured will read the values of this testbed file using the scripts.

6. Execute the steps below to clean up the OAM_PersistentDB.xml file

   cd /opt/confmv OAM_persistentDB.xml OAM_PersistentDB.xml_bckp

7. Run the config tool. (./FGWConfig.exe)

   Execute the following command ./FGWConfig.exe

   This command will load the configuration present in FGWConfig_All.ini and generates OAM_PreConfig.xml.

8. After that execute the command startbsg

9. Check the status and processes on bono1 and bono2 by giving the commands status and showproc. Status command shows the version, IP’s configuration, state (active/standby). Showproc command shows the running on the bonos.

   Patch installation process on the gateway:

- Copy the build from the server to the test host server

- Now SCP the file from the test host to both the Bonos (Bono1 and Bono2)
- Copy the install_patch.sh into /opt/scripts directory
- Change the permissions

  $chmod 755 /opt/scripts/install_patch.sh

  $dos2Unix /opt/scripts/install_patch.sh

  Now, the following command to be executed to install the patch

  $/opt/scripts/install_patch.sh /home/admin/FGW-version.tar.gz

10. After the successful patch installation executes the basic call test.

    After the successful build installation and patch installation and basic call execution, sanity testing will be done. If there is an issue with the patch install, build install, and basic call to run sanity testing.

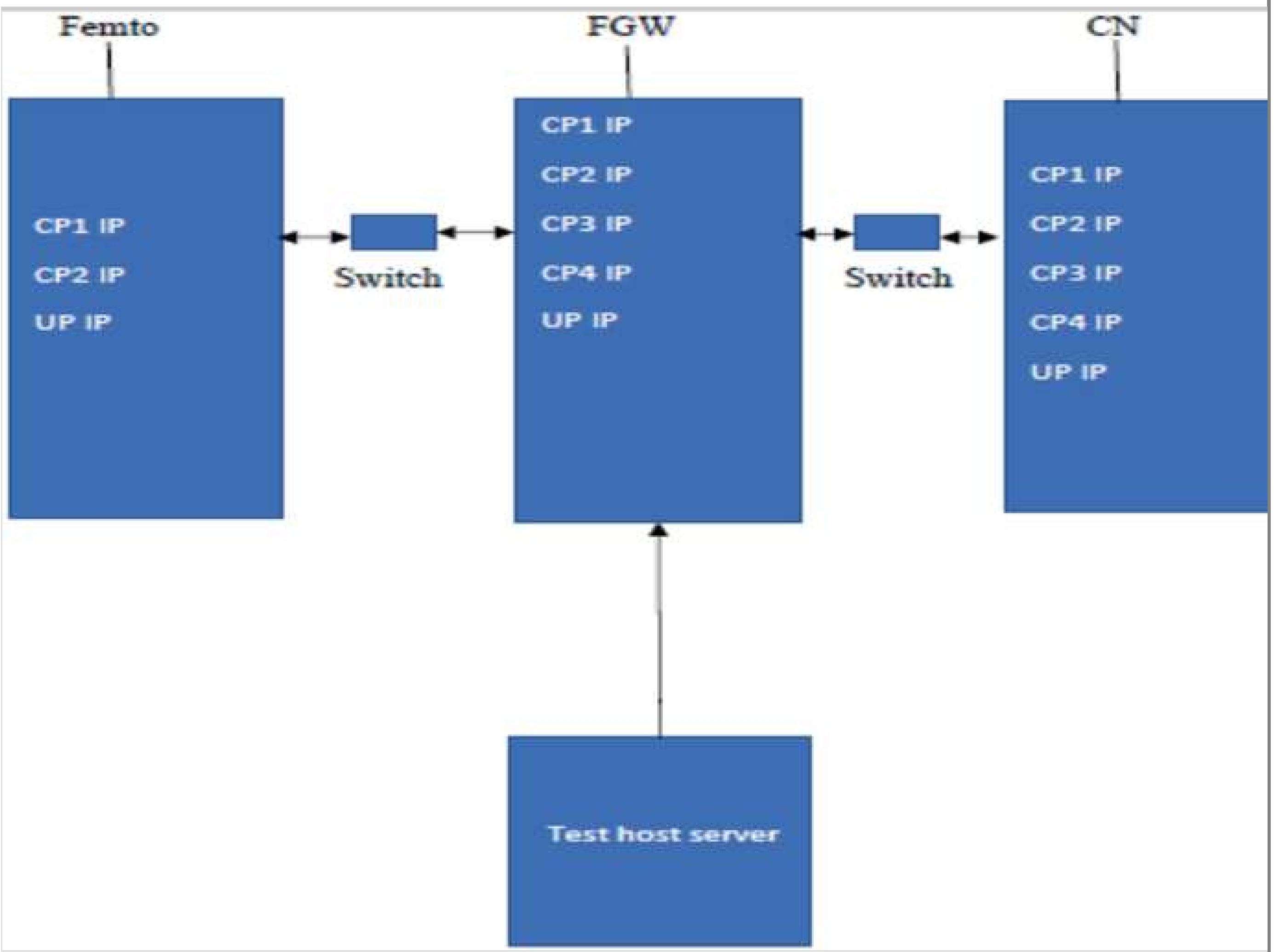
3.9.2. Femtocell Interfaces IP Connections

Figure 9 explains the femtocell end-to-end system connection, with the core network elements and the femto IP network is connected through the femto gateway. The gateway uses carrier-grade ATCA architecture. Redundancy is used in the design. FGW between the femto and the core network, end-to-end communication happen through the gateway and the switch. On switch, IP addresses are configured for the communication and to send and receive the information from the femto to femto gateway and femto gateway to the core network. CP and UP both are the interfaces for communication, to send and receive the data [14]. Control plane (CP) is used for signaling or control messages between the network and the UE. And it is also used for the radio access bearer control and for the connection between the UE and network. Control plane aggregation, the gateway provides a set of control plane aggregation capacities. User plane (UP) is used for traffic or user path. For transferring the user data, the UP is responsible, such as voice or application data. GW offers a user plane focus function alongside the control plane capacity. There are two domains such as circuit-switched and packet-switched. To route the data from source to destination, it divides the message and it is grouped into a number of units these are called packets. These packets will route individually from the source to the destination. In the circuit-

switched, a path is established and here there need not establish a path from source to destination.

Fig. 9

Femto gateway interfaces IP network connection diagram



4. 4G Gateway

The ATCAv2-based small cell gateway supports the following functions for 4G support [15]:

4G GW software architecture.

MST—MME SCTP Terminator call processing.

HeNBGrp—HeNBGrp Instance process monitor.

HST—HeNB SCTP Terminator.

DS—Directory Services.

STATSD—PM collector.

Explains the working of the LTE 4G gateway, it consists of the following functionalities.

MMESCTP Terminator: MMESCTP terminator is primarily responsible for establishing and monitoring the SCTP association with one specific MME.

SCTP messages received from the MME are classified into one of two groups:

UE associated signaling messages—forwarded to the relevant HeNB group process.

Non-UE associated signaling, including S1AP Handover Request messages—forwarded to the Directory Services process.

The functionality of HeNBSCTP terminator is primarily responsible for accepting the SCTP associations from HeNBs and more importantly to load balance the HeNBs among the HeNB group process instances. This process is primarily responsible for terminating the SCTP associations with HeNBs. The process is responsible for load balancing across HeNB group instances. All messages toward the HeNB goes through this process.

The functionality of is HeNB group, this process is responsible for managing a set of HeNBs and all the UEs connected via these HeNBs. This is the call processing-related process within the 4G small cell gateway acts as virtual eNB to the MME and as virtual MME to the HeNB. Storage of HeNB configuration data, HeNB management, UE signaling context management and S1 interface handling, allocation, and maintenance of virtual UE identifiers (virtual eNB UE S1AP IDs and virtual MME UE S1AP IDs), maintenance of MME context, GUMMEI List, and MME relative capacity, virtual eNB S1 AP IDs storage, handling OAM configuration and management[18] (Table 1).

Table 1

HeNB group information table

HENBGRPI > show supported commands	Description

HENBGRPI > show supported commands	Description
Show mme	Display mme data in detail
Show mme henbgrp	Display mme data in henbgrp
Show mmer	Display mme region
Show henb	Display base HeNB context
Show henb henbgrp	Display HeNBGRP HeNB context
Show gwdata	Display HeNBGW data

AQ1

4.1. Directory Services

This process is primarily responsible for handling MME associations and non-UE associated signaling. The directory services process is responsible for maintaining the mapping of HeNBs to HeNB group process instances [10].

The ENB UE S1AP Id range of each HeNB group instance in the HeNB gateway is configured in the directory services process. As the directory services holds the HeNB group instances [16] for each HeNB and knows the mapping of ENB UE S1AP Ids to HeNB group instances it is responsible for handling all non-UE associated signaling (e.g., paging and reset). Responsible for routing handover requests to the appropriate HeNB group. Directory services are responsible to establish and maintain the S1 connection to all MMEs[18] ~~[17]~~ (Table 2).

Table 2

Directory service ınformation table

DS > ds show supported command	Description
Alarm	Display alarm status
mme conf	Display MME configured data in detail
Mme	Display MME summary data
mme det	Display MME learn data in detail
Mmer	Display MME region
gwdata	Display HeNBGW data

5. Conclusion

This article concludes that femtocell network end-to-end system connectivity and testing. Femtocell network implemented using femto, security gateway, femto gateway, and core network. Femtocells can provide at a very low cost for high-quality network access to indoor users. Gateway is a high-performance solution, offering dedicated security processors along with high throughput performance. It is available in a variety of standards-based ATCA chassis and the function or the main use of FGW is to provide better mobility and operation administration and maintenance (OAM) work for UEs. A run of the mill ATCA-based framework utilizes redundancy which means the chassis contains numerous switching and packet processing blades that give reinforcement in case of a component failure.

The FGW is integrated on the ATCA platform, and the FGW is intermediate between the simulator UE and simulator core network. The process is to build installation and patch installation to be done on femto gateway manually or by executing scripts. The debugging process happens if the script has failed or aborted. The call flow occurs between UE, femto gateway, and core network components, and whatever test cases are to be conducted to verify that the call is successful or not, is to be tested after the successful installation phase by running the call flow scripts on the gateway. For the study of advanced telecommunications computıng architecture (ATCA) in LTE communication, the latest frameworks establish various aspects of HetNet communication. Moreover, this framework supports different LTE communication using femtocells in future cellular networks. These frameworks can be revised with different mobility conditions of the network in future.

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Advanced Wireless techniques to avoid accidents on roads through wearing Smart helmet

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Abstract. ***Accidents will mainly occur when the individual or group of people get distracted from driving. Distraction together with carelessness of the rider is considered as one of the major causes for accidents. In spite of having strict laws that mandates motorcycle riders to wear helmets and not consume alcohol before driving, where riders do not follow it. In order to overcome this problem, this research work proposes an intelligent system called the "Smart helmet". The presence of the helmet and alcohol detection data has been analyzed on smart phone by making it a smart device. The proposed system is designed in such a way that, only when the conditions are satisfied, the bike will get started. This will safeguard the rider in wearing the helmet strictly and also it will refrain from driving, when the rider has consumed alcohol. During the bike ride, if any accident occurs then the GSM system detects and intimates the relatives and/or friends by sending the geographical location of rider via SMS.***

Keywords: Accident detection, alert system, alcohol detection, biker's safety, geo-location, smart helmet, sensors.

I. INTRODUCTION

Since many decades, it has been witnessed that, various technological developments are changing how things are being done actually. More and more innovations have come up to solve the today's challenges that are frequently faced by humans, since the evolution. Automobile industry is one among these sectors, which has been swiftly adapting the technological innovations to reduce death and casualty during accidents. The solution to accidents is mostly awareness and appropriate for technical inventions [7]. A famous quote explains, "If you close your eyes to the fact, you will learn through accidents!" There are many cases of such accidents, which occur and learn every single day in our life. Every accident may be in the personal life or may be in the road; has its root causes somewhere either in you or somewhere linked to you nearby. Like the crisis which one suffer in life, any kind of road accident is also a devastator which can make you know how important life is, and how crucial it is for one to keep safety precaution along with while moving out on a ride [8]. On this basis, new 21st century auto-technologies have reduced road accidents drastically by adapting safety precautions. Coming to the motorcycle accidents in which riders suffer on roads, may be due to speeding, consuming alcohol or some other reason that lies within; or the accidental causes that are not due to personal carelessness but because of mistakes caused by some other source like any other vehicle colliding, bad weather etc., where the biker suffers from a crisis; there are a lot of things to discuss. This article will put a limelight on the motorcycle accidents keeping in mind on what are all the real causes that leads to motorcycle accidents, how are these accidents need to be prevented and what all help one can have from the motor cycle accident attorney. "Accidents are most common in people who love to enjoy the journey of life without keeping safety!" It is fair to enjoy your rides, enjoy the riding; but it is always better to keep safe concerns with you while riding on roads. As the say goes "Accident hurts! Safety doesn't!" [8].

One such safety device to prevent motorcycle accident is the helmet. Helmet is a hard or padded protective hat [9]. Hence, the constitutions from all over the countries have made a law on motor-powered riders to attire a helmet compulsorily and not to consume alcohol while riding. But, we see still people are violating this rules. To overcome this situation, an easy and a cost effective smart system is been proposed, the 'INSOLENT HELMET', which by design authorisations

whether the helmet is wore by the rider and non-alcoholic breath before riding. This smart system consisting of a transmitter located in the helmet and a receiver in the motorbike. This smart system is capable of providing security and safety of the bikers in case of a road accident.

This smart system comprises of MQ 135 an alcohol sensor which detect whether the rider has consumed alcohol, a switch which sense helmet and detects the rider had worn a helmet or not and finally received output is fed to the Micro Controller Unit (MCU). Since the sensors and switch are place in the helmet, if any case the rider violates the condition the ignition of the engine will not take place.

The functions of other blocks in this smart system are controlled by micro control unit. MCU generates the digital data from the input data received by sensors. In case of accident, GSM system will globally locate the biker and immediately sends the information about the location of accident as a SMS to registered mobile number. On detecting the rash driving with the help of sensor, appropriate messages will be sent to registered mobile number.

II. LITERARY SURVEY

The literature survey was performed to envisage the accidental data by both bicycle and motor cycle due to non-precautionary measurements. Base on survey, the children's between the age 5-14 years ride bicycles. In US 70% of children use bicycles (Sacks et.al., 1996). Injuries with Bicycle riding has ranked secondly, whereas the first being with motor vehicles (Wilson et. al., 1991). From the survey of National Highway Traffic Safety Administration (2008) around 698 bicyclists lost their life and 44,000 were injured in 2007. Among them 15% of those who lost their life and 29% of those injured were under the oldness of 16. From these data it confirm that around 10 to 15-years of oldness group had the highest fatality rate of 46% and injury rates of 162% which is further than the average rate for all bicyclists.

Three forth of bike related deaths and more than 65% of bicycle related hospitalization are due to head injuries (Brewer et al., 1995; Rivera et al., 1998). It was also documented that head injuries have been reduced to 85% and head injuries by 88% using Bicycle helmets (Thompson, Rivera, & Thompson, 1996). A careful study on crashes in children's found 63% reduction in the risk of head injury (Thomas et. al., 1994). The study also predicts that, serious head damages were occurred even due to collisions with motor vehicle. From the survey by Rivera et al. 1999, children and youth who did not wear suitably fitted helmets were more likely to be injured than those who wore properly fitted helmets. Helmet misuse between Six to Fifteen oldness groups was more than double the level observed in the Sixteen to Thirty oldness group was deep-rooted by Foss and Beirness (2000). These data specifies that countermeasures that targets use of helmet in this age group must also target appropriate helmet use.

Due to low cost, two wheelers are widely used form of transportation. Generally, it is observed that most of the riders refuse to wear helmet which leads to the resulting in serious accidents. The two major factors of the road accidents are driving under the influence of alcohol and driving under drowsy conditions. Statistics reveals that 35% of the accidents were caused by two- wheelers, in that 60% of the accidents are instigated due to want of consciousness, driving under the influence of alcohol and driving without wearing helmet.

Various walks of people exist in life like the postman or delivery boy, who extensively use two wheelers to perform their tasks. They are the ones who perform the last mile operations. It is important to give them a sense of assurance in case of emergencies like road accidents. This was one of the main factors for proposing this paper.

This paper aims in minimizing accidents by developing a smart system which can detect helmet. The unit is fixed in the helmet, such that, the unit will sync with the other unit that is fixed on bike. This will confirm that the rider has worn the helmet.

In India, as year goes on the traffic accidents has been increased widely. As per the Motor Vehicles Act 1988, section 129, it is very much required that for every single two-wheeler rider to attire protective headgear following to ethics of the BIS (Bureau of Indian Standards). Also, according to the Motor Vehicle act 1939, riding the vehicle by consuming alcohol is a criminal offence, rider will be penalized strictly in case he is found guilty. In most cases we have seen bikers hoodwinking the system. There are three main issues which we are addressing to minimize accidents. The first issue is to detect the rider has worn helmet or not. If any case helmet is worn then only the ignition will begin that can be attain using FSR sensor. Secondly, alcohol detection sensor (MQ-3) is used as breath analyser. If it goes beyond certain acceptable range, then ignition in the bike will not be permitted. When these two settings are fulfilled then ignition will start. The 3rd issue is most importantly in getting timely medical help. As per the survey every second persons decease due to late medical help or the accidents that take place in deserted areas where human activity is zero. The accident can be detected using the reading of the accelerometer that is placed in the bike unit. We have used two different microcontrollers unit in this system. Arduino Lily pad was used for bike unit and ARM7 lpc2148 was used for helmet. Radio frequency is used for transmitting signal between the helmet component and bike element.

It is well known that, human behavior related to risk of accident was reflected by head gestures and brain activity while riding and this can be analyzed using camera. But, this work presents a Smart Helmet in order to track the head gestures and the brain activity of the rider to recognize anomalous behavior without using any camera. Data extracted from sensor placed in the helmet is used for computing risk of an accident (a safety level). This makes Smart Helmet system an inexpensive, non-intrusive, non-invasive and non-vision-based system.

III. EXISTING WORK

The existing smart system finds uses of MQ3 alcohol sensor from which the presence of alcohol concentration in the driver's breath can be detected and also it gives an analog resistive output based on the alcohol concentration. Output of the alcohol sensor and a switch is fed to the MCU in order to control all the functions of other blocks in this system.

The design is developed in such a way that, MCU receives data from these sensors converts into digital data analogous to the output of sensors to the encoder only if the two conditions are satisfied. Alcohol sensing element: MQ-3 alcohol sensing element was used which is controlled through a NPN power electronic transistor TIP122 by the MCU. [10]

Other existing system uses speed controller. Sensors and all other components that read the speed of the bike can be attached to the biker's helmet, which instructs the rider to manage the speed based on the obstacles in front of the bike. In consort with the sensors that limit speed, the helmet also checks if the rider is under the influence of alcohol and is currently driving. If the rider is under the influence of alcohol then the ignition of the bike does not occur eliminating the risk of the rider proceeding with the ride. Also, this mechanism is useful in determining the true owner or his/her friend using voice encrypted password mechanism and check the presence of helmet using an ultrasonic sensor for detection. [11]

Another smart system to start the bike, when the rider should wear helmet and he should not be under any influence of alcohol was also synchronized with the system. Here, RF transmitter was fixed in the helmet and a receiver was fixed on the bike. When the rider wear helmet, the sensor will detect and direct the signal to the receiver that in turn starts the relay and the ignition starts [12].

Limitations

- It does not give any information regarding the location of accident but just sends a message to the emergency number.
- The helmet is easily breakable and might fail during severe accidents.
- Poor performance.
- Relays leads to consume more power.

IV. PROPOSED SYSTEM

The idea of this work is to give information about the rider wearing the helmet or not, whether the rider drunken or not and also, when he meets with an accident it gives an information about location where he is met with an accident through GSM module to mobile numbers of registered family members, so GSM technology is chosen to give the information by sending SMS, using GSM module which has SIM card slot to place the SIM and send SMS. Sending SMS alone can't help the driver, if we send an SMS saying that accident had occurred where the ambulance will come without knowing the location of the accident. So to trace out the location where exactly accident has occurred we use GPS module which gives signal to microcontroller which in turns sends an SMS which contains the latitude and longitude of a area to registered mobile numbers.

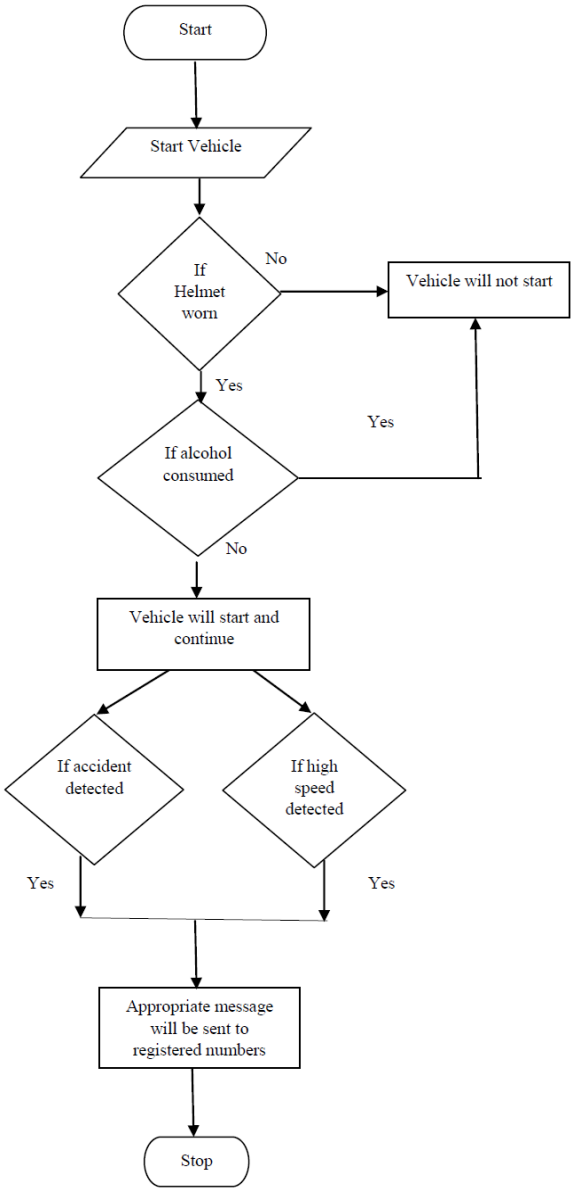

Figure 1: Flow chart of the proposed model

This system was organized in such a way that it has two units which is the Transmitter Unit(helmet) and Receiver Unit(vehicle). Vehicle can be organized using signals from the helmet unit which has a sensor that detects whether the rider has worn helmet or not, in case helmet is not worn the vehicle will not start.

In addition to this alcohol detection sensor is used to detect whether the rider is under the influence of alcohol or not. If the detected value exceeds the set value the vehicle will not start. Also, accelerometer sensor is used to detect rash driving. If rash driving/accident is detected then SMS will be sent to the registered number.

V. SYSTEM DESIGN

The process of defining the components, modules, architecture, interfaces and data for a system to fulfil the specified requirements that can be expressed as system design. In system design, the system theories are applied to product development. It is a schematic process, wherein all the related variables are taken into account and decisions are made on how the data should travel through the system. The hardware and software forms the important components of system design.

The systemhas two units

A. Transmitter Unit (Helmet)

Transmitter unit has alcohol, touch and accelerometer sensor mounted in it, one of these sensors sense and sends the signal to the receiver unit through the antenna

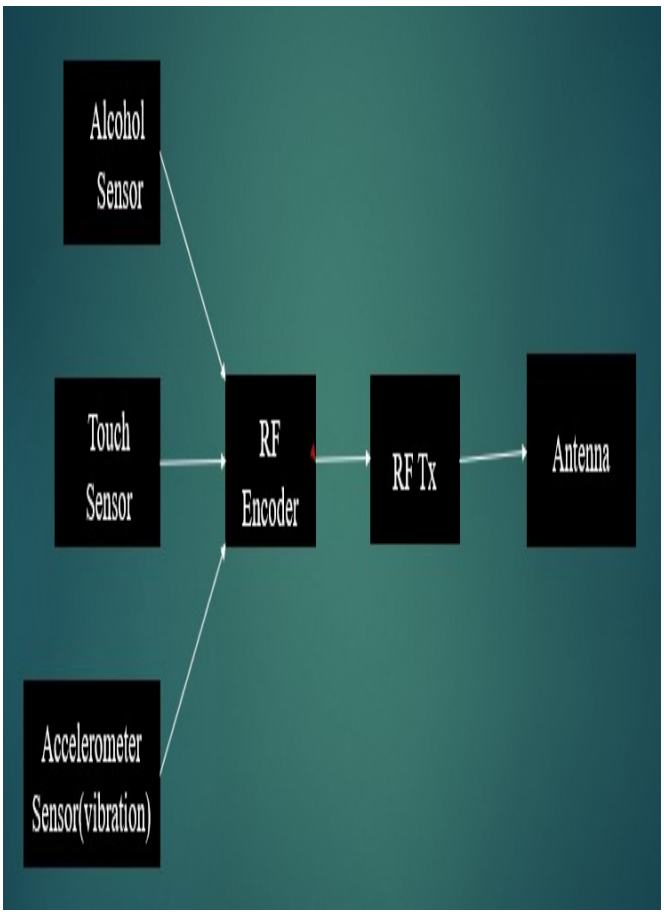

Figure 2. Transmitter Unit

B. Receiver Unit(vehicle)

Based on the signal received, the vehicle (i.e.) receiver unit takes the necessary action such as not allowing the vehicle to start, locking the ignition etc

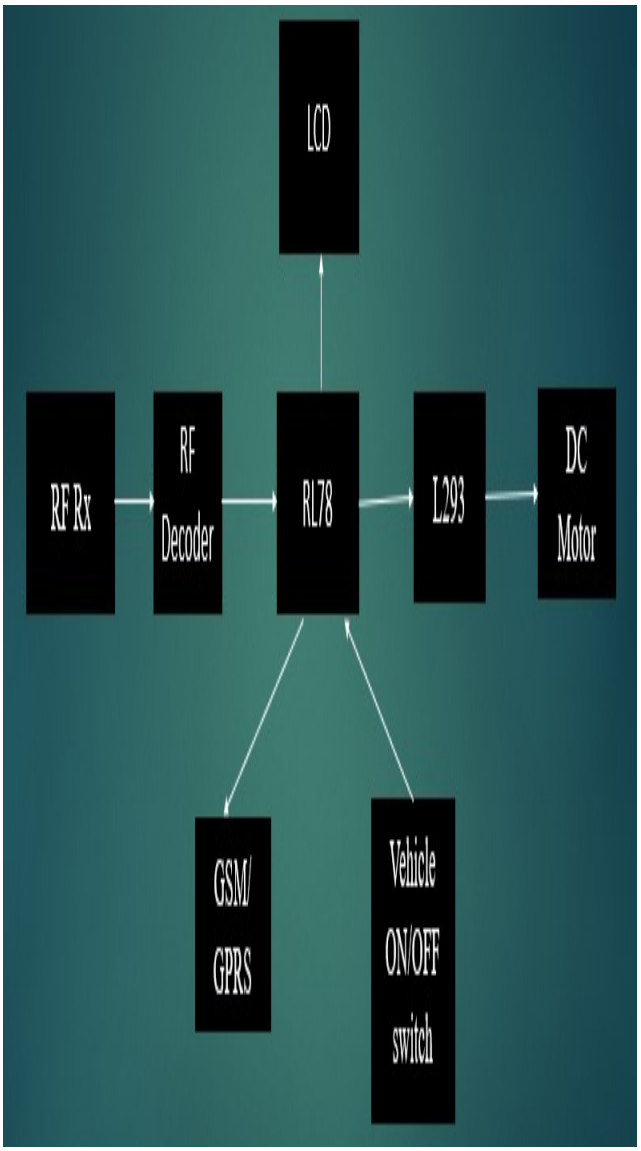

Figure 3. Receiver Unit

VI. TECHNICAL STUDIES

A. Renesas Microcontroller

RL78 Family, 16-bit microcontrollers have extraordinarily high CPU performance of 78K0R which use functions of R8C and 78K. It offers line-up of 10-128 pin and 1KB to 512 KB products for 8/16-bit market. It has an efficiency of working at low power consumption of about 46 µA/MHz all through for normal operation and 0.57 µA/MHz during clock operation. One can expect significantly enhanced power efficiency using RL78 microcontrollers. Incorporated features like temperature sensor, background operation data flash capable of 1 million rewrites, high-precision (±1%) high-speed on-chip oscillator and interface ports for multiple power supplies makes it possible for the effective application [13].

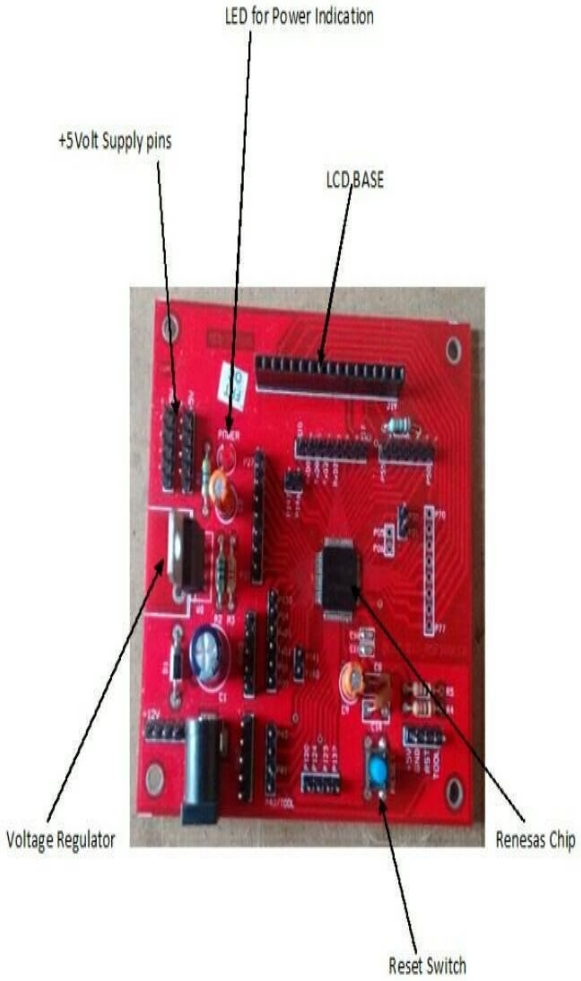

Fig 4. Renesas microcontroller

B. MQ-135 Alcohol Sensor

MQ-135 gas sensor was used to detect the concentration of alcohol content in human's breath. It consists of tin dioxide (SnO2) layer inside the aluminium oxide micro tubes (measuring electrodes) with a heating element inside a tubular casing. Sensor front side is enclosed with a stainless steel mesh and the backside of the sensor holds the connection terminals. If any ethyl alcohol present in human's breath is then oxidized to acetic acid when it passes through the heating element. With the reduced number of oxygen atoms close to the tin dioxide sensing layer, the resistance decreases. The resistance variation is converted into a suitable voltage variation, by using the external load resistance. The circuit diagram in Figure 5 and the connection arrangement of the MQ- 135 alcohol is shown below [8].

C. Tilt Sensor (Accident detection)

A tilt sensor is an instrument used to measure tilt of an object in multiple axes of a reference plane and also tilting position keeping gravity as a reference which enable easy detection of inclination or orientation. In some places, they are also called the tilt switches or rolling ball switches. Since many years sensor have become thrust instruments/system being reformed in increasing numbers of high-end applications. In aviation, the tilt sensors have been used widely to provide the data with regards to both horizontal and vertical inclination of an airplane. The data was used by the pilots to tackle the situation during flying. Stunt pilots use data given by the tilt sensors to understand the orientation of the plane. It is the tilt sensor data which helps pilots create spectacular acrobatic performances. In the current system, we use the tilt sensor by placing it on the helmet of the rider. The data obtained from the tilt sensor is analysed to detect whether an accident has occurred or not.

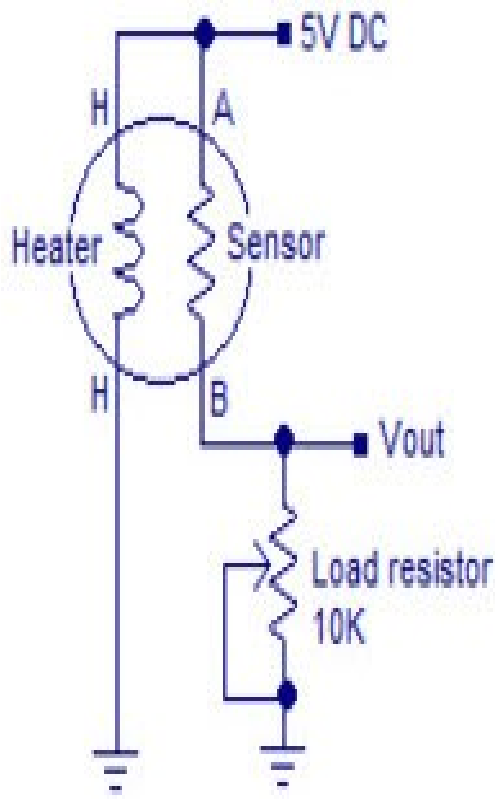

Figure 5. MQ-135 Circuit Diagram

D. MMA7361 Accelerometer

MMA7361 sensor can quantify the dynamic or static (earth's gravity) acceleration in three axes. This accelerometer measures the level of acceleration/deceleration of an object and also the tilt of the platform to the earth's axis.

Further, this sensor provides zero gravity output which identifies linear free-fall. MMA7361LC consumes less power because it supports "Sleep Mode" which is the main feature for battery power devices. It has low profile capacitive micro machined accelerometer featuring signal conditioning, a self-test, a temperature compensation, single pole low pass filter and zero gravity detect which detects linear free-fall and a g-Select. The g-Select permits us to select between two sensitivities. This unit can be directly powered with 5V DC supply or from a 3.3V 'Clean' DC supply [9].

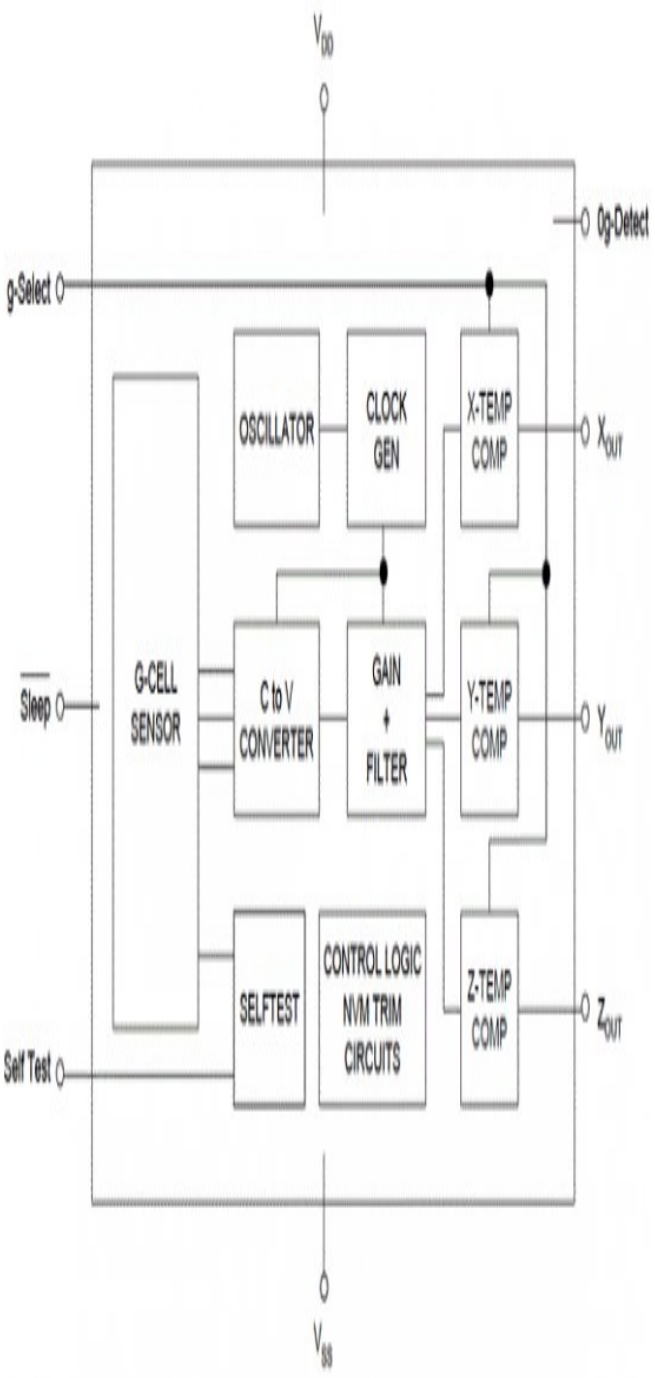

Figure 6. Simplified Accelerometer Functional Block Diagram

E. APPLICATION:

- It can be used to detect accident location and provide necessary update to near and dear ones.
- It can be used to avoid accident by discouraging driving when the rider is under the influence of alcohol.
- This technology can be modified and implemented to cars where-in seat belts can be used as a point of trigger.

VII. CONCLUSION AND FUTURE ENHANCEMENT

The government has to initiate by making compulsory Helmet and no Drink and Drive. According to analysis only 10 % of the bike riders follow these rules and many a times these rules are violated. The previously developed helmets detect only the presence of helmet and not the alcohol in driver's breath. The proposed system provides a "Smart Helmet" which detects the alcohol consumed by the rider and whether the rider has worn the helmet or not.

We have introduced an advanced sensors, techniques and radio frequency wireless communications to make this system a noble one. This valuable smart system pays attention for the efficient checking of wearing the helmet and driving under the influence of alcohol. By implementing this smart system, we can safeguard the life of a rider by wearing helmet and eliminate the possibility of driver driving under the influence of alcohol which makes the journey very safe. This system consists of both hardware and the software part. The results obtained from the sensors i.e. IR Sensor for Helmet detection and MQ303A for alcohol detection will be analysed on the smart phone. Hopefully the proposed system will provide the rider's safety and restrict driving under the influence of alcohol.

In future, this intelligent system can be further miniaturized and the scope can be extended to stop no entry and no parking violations. Government should implement laws to install such violation detection and avoidance system in each 2-wheeler. By way of instigating such system in two wheelers, the deaths which are attributed due to careless driving and other alternative road fatalities can be bought to zero percent. In case of any accident, messages can be periodically sent to friends continuously about the location of the accident until the first aid reaches the rider. A small camera can be installed for the recording the driver's activity.

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Fault Tolerant Cluster Head Selection Using Game Theory Approach in Wireless Sensor Network

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Abstract. The present cluster head selection is fixed as a static node, so the cluster head becomes malicious the entire cluster communication is discarded in wireless sensor network (WSNs). As per our new approach, the cluster heads are using fault tolerance schemes supports for selection cluster head through the game theory. This process may take additional energy to detect malicious cluster heads and to recover the network communication in the cluster. This article proposes fault-tolerant Backup Cluster Head (BCH) selection influenced by game theory in wireless sensor networks WSNs by utilizing less energy. In WSNs the malicious cluster heads can be exhibited efficiently using game theory through the different network conditions such as scalability, mobility, and energy utilization. Due to scalable WSNs, the cluster node is increasing in the cluster head becomes malicious thus network lifetime is reduced. So the fault-tolerant BCH technique is incorporated to increase the lifetime of WSNs. So the efficiency of the sensor network is reduced due to the cooperation of malicious and normal nodes. The malicious cluster heads being detected based on node parameters and the clustered network operations are carried out through fault-tolerant backup cluster head in WSNs. The simulation results have obtained for the proposed scheme compared with the network parameters such as dead nodes, alive nodes, and average energy of active nodes in the network.

Keywords: Wireless sensor network, Game theory, Fault tolerant network, Cluster head selection, Backup Cluster Head..

1 Introduction

In the current generation networks the Wireless Sensor Networks (WSNs) more popular and growing on a very large scale from the last few decades in major application areas such as defense, industrial environment monitoring, Internet of Things, health care monitoring, object tracking, and few more. The sensors are deployed in wide areas since very difficult to maintain WSNs and also replace the fault senor very frequently makes unhealthy environment. So the maintenance cost

of the network environment can be reduced through the deployment of fault-tolerant infrastructure, which leads to maximizing the lifetime of the network [1]. The lifetime sensor node is defined in terms of a time to live in a network until any or all set of sensor nodes dies in the network. WSNs are deployed with fixed a basic station (sink), which is communicated through cluster heads to the sensor nodes wirelessly. Then, the gathered information is processed in the base station with specific parameters to extract the required estimated values more accurately. The clustering approach increases the lifetime of sensor nodes as well as reduces energy usage in the clustering network. In WSNs, the set of sensor nodes are grouped into cluster groups, thus the group is called a cluster. Every cluster would have identified with a leader having high energy, which is referred to as cluster head (CH). In most of WSNs case studies, some sensor nodes are deployed with high energy to manage the network situations. These sensor nodes are distinct from another sensor node to act as gateway nodes defined as CH. The CHs are more responsible for gathering a piece of node information from cluster nodes and accountable for transferring the data to the base station, which also coordinates the sensors under the respective cluster group. Every cluster node belongs to a specific cluster and communicates to the respective CH. The benefits of a clustering approach in WSNs to increase the lifetime of the network by reducing energy consumption with network situations such as scalability and mobility sensor nodes in the network.

Especially in WSNs, a fault-tolerant clustering algorithm is proposed using the game-theoretic approach in a wireless sensor network. The backup cluster head (BCH) and cluster head (CH) selection based on Bayesian game decision strategies, with imperfect information and multiple player strategies. In this game, each player's decision depends on the set of player's action strategies. The selected action is based on using a possibility value calculated at each step [2]. The proposed algorithm for selecting cluster head (CH), backup cluster head (BCH) based gaming model has simulated in MATLAB simulative environment. The utility of CH, BCH, and CN activities observed and simulated.

2 Related Work

In this[3], there are different clustering for data analysis using machine learning for different industrial uses. Traditional clustering algorithms were also discussed for performance and accuracy as datasets with varying dimensions. A new clustering algorithm called the Fast Density-Grid clustering algorithm has been proposed. In [4] this article, the various characteristics of clustering used in vehicular communication between different zone routing protocols (ZRP) were analyzed. A different selection of cluster headers from members of other clusters has also been introduced.

The cluster head selection has been proposed in Linked Cluster Algorithm (LCA) [5] through the exceptional clustering key factors of any sensor node. There are multiple sets of clustering protocols designed based on neighborhood nodes information. Highest Connectivity Cluster Algorithm (HCCA) [5], is designed

with the degree of a neighbor node with a 1-hop distance to cluster head and frequent information update requirements.

Moreover, the WSNs clustering-based probabilistic methods rely on different probabilistic conditions of the wireless sensors. Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol in [6] offers an energy balanced cluster heads selection with random rotation to maintain meanwhile constant load balancing in multi-hop and single-hop distance sensor networks.

LEACH-C [7], BCDCP [8], DMSTRP [9], and LEACH-F [10] protocols are implemented towards centralizing clustering algorithms. LEACH-C algorithm has been proposed based on energy levels and location awareness between every sensor and base station with predefined energy threshold levels various cluster heads. Even the cluster heads selection in Base Station Controlled Dynamic Clustering Protocol (BCDCP) aims for selecting cluster heads through the base station from the different set of sensor nodes by applying determined energy threshold and residual energy of sensor nodes. The cluster heads are capable to operate either in cluster mode or sensing mode. LEACH-C moreover the same as LEACH-F towards the selection of cluster head. But, in LEACH-F clusters are formed statistically. Every cluster nodes have a choice of switching the roles among the sensor nodes.

In this paper [11], the basic clustering schemes are designed using game theory for reducing energy consumption in WSNs. Also, the energy-efficient clustering schemes for selecting cluster heads through the game theory approach are proposed in Subgame Perfect NE (SPNE) [12]. The SPNE decision is more helpful in selecting cluster heads in WSNs.

The responsibility of selecting a cluster head from a set of sensor nodes in CoPA to reduce energy consumption through a weighted metric in the combination of both residual and transmit the energy of every sensor node. The proposed anti-coordination clustering game formation with a minimum of two players to N players using the present sensor node information and linear optimization in the clustering game introduced for correlated equilibrium (CE) for solving games. Thus the convergence of the probability distribution to the CE is achieved through the adaptive regret matching (no-regret) algorithm. Evermore, the pure and mixed strategy Nash Equilibria (MSNE) solutions compared with the optimality of CE solution in a two-player clustering strategy game, in terms of fairness and the efficiency of sensor nodes [13].

In this paper [14], both the routing algorithms and energy-efficient clustering for WSNs are designed for fault-tolerant communication. The algorithms contribute towards the identification failure cluster head and recovery of cluster head to resume communication services. The new proposed cluster-aware routing algorithms as Distributed Fault-tolerant Clustering and Routing (DFCR) address the list of issues in the energy efficiency matric in WSNs. During the clustering phase, the cluster head has selected based on its cost matric function, which consists of the residual energy of the cluster head. Also node parameters such as

distance between cluster head to sensor node as well as the distance from the base station to the cluster head. In order to achieve fault-tolerant CHs, the method does not adopt either re-clustering or a redundant deployment of CHs approaches. In the data routing phase, CHs select their next-hop neighbor CH in such a way that their energy consumption is minimized and balanced.

3 Proposed System

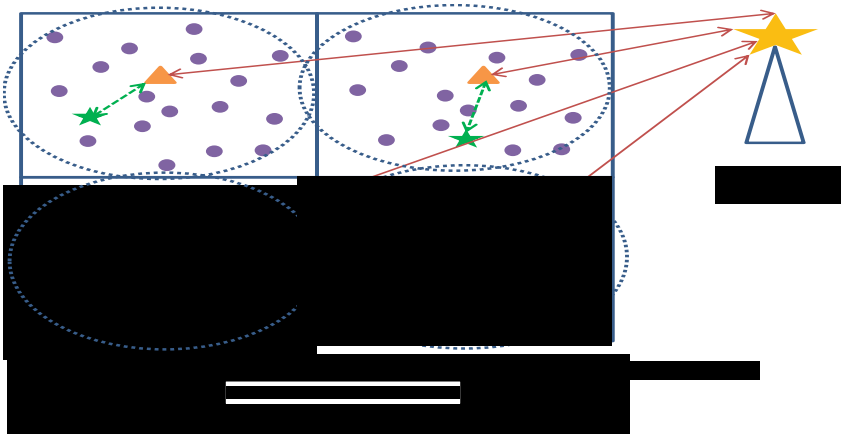
The proposed system Fault-Tolerant Cluster Head using Game Theory (FTCHG) aims at selecting cluster head, backup cluster head by optimizing the energy consumption in the cluster with a set of sensor nodes in which transmits the data between cluster head and sensor nodes. The cluster head activities are stored in the backup cluster head to resume the regular process when the cluster head fails or malicious in the wireless sensor networks. The network becomes scalable due to large numbers of sensor node deployment the energy consumption also increases by transmitting more data packets. So the cluster head becomes malicious by consuming more energy, thus the cluster network can resume with regular services as usual by utilizing back cluster head in the cluster group in which is implemented fault-tolerant backup cluster head selection using game-theoretic solutions. Based on this game strategy, the fault-tolerant backup cluster head is selected from the set of cluster of nodes then this backup cluster head communicates with the cluster nodes within the cluster group by collecting the information from all other cluster nodes. The fault-tolerant cluster communication with the help of an energy-efficient cluster head or backup cluster head communicates the data to the base station. This will improve the lifetime of the network with effective data communication in wireless sensor networks.

In order to avoid energy consumption, some nodes which are malicious are restricted to perform cluster head selection, to identify malicious cluster head and backup cluster head using game theory has been implemented. It helps to find out different strategies of nodes.

4. Cluster Formation

The cluster formation referred to the grid-based hybrid network deployment (GHND) [15] framework with variable grid size. The nodes are randomly deployed and distributed within a specific area. The different phases of cluster formation as follows:

Deployment Phase: The given set nodes (N) are deployed randomly within a square area field with specified field height (FH) and field width (FW). As per the paper [15] the node parameter such as node instance, cluster coordinates, node ID, and residual energy level. After the node deployment, the node parameters and their configuration were shared to the base station. Grid cluster Formation: During this phase, the cluster zone formation has done by collecting the information from all of the nodes.



4.1 Cost of Cluster head

The cost of being a cluster head C_{CH} is calculated the summation of receiving energy from all of the cluster nodes and transmitting energy required to transmit the packets between the base station and proposed cluster head to be subtracted from the available residual energy as follows.

$$C_{CH} = RS_E(CH) - k \times T_E(CH, BD) - \sum_{i=1}^{k} R_E(CN_i) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where the terms are represented as cost of cluster head (C_{CH}), Residual Energy (RS_E), Transmitting energy (T_E), Receiving Energy (R_E), and a number of packets(k).

4.2 Cost of Backup Cluster head

The cost of being a backup cluster head CB_{CH} is calculated the summation of receiving energy from all of the cluster nodes and transmitting energy required to transmit the packets between the base station to backup cluster head to be subtracted from the available residual energy as follows.

$$C_{BCH} = RS_E(BCH) - k \times T_E(BCH, BS) - \sum_{i=1}^{k} R_E(CN_i) \ldots\ldots\ldots\ldots (2)$$

Where the terms are represented as cost of Backup cluster head (C_{BCH}), Residual Energy (RS_E), Transmitting energy(T_E), Receiving Energy (R_E), and a number of packets(k).

4.3 Cost of Cluster Node with cluster head

$$C_{CN}(CH) = RS_E(CN) - T_E(CN, CH) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

4.4 Cost of Cluster Node with Backup cluster head

$$C_{CN}(BCH) = RS_E(CN) - T_E(CN, BCH) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Based on the above-mentioned equations (2), (3), (4), and (5) considering that the base station is located away from all of the clusters regions, the cost CH, BCH and CN is estimated based on the distance, and their transmitting powers of every cluster [16], i.e., $C_{CH}>C_{BCH}>C_{CN}$

$$T_E(CH, BS) = \varepsilon_{elec} + \varepsilon_{amp} \times d_{CH}^4 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$T_E(BCH, BS) = \varepsilon_{elec} + \varepsilon_{amp} \times d_{BCH}^4 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$T_E(CN, CH) = \varepsilon_{elec} + \varepsilon_{amp} \times d_{CN}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$T_E(CN, BCH) = \varepsilon_{elec} + \varepsilon_{amp} \times d_{BCN}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$R_E(CH) = \varepsilon_{elec} \ldots\ldots\ldots\ldots (9) \qquad R_E(BCH) = \varepsilon_{elec} \ldots\ldots\ldots\ldots (10)$$

ε_{elec} and ε_{amp} [14] are basic energy consumption constants in circuits of sensors for transmitting and receiving data among transmitters and receivers. Also, d is the distance between transmitter and receivers.

5 Game theory

In a formal game-theoretic approach a game contains set players with possible strategic options set si represented as S. The main aim of the game is optimizing the utility of the player. The notations of the gaming set as represented as follows[17]:

1. Players (P) = p_i, which i=1,2,3,……,n set of players;
2. Actions (A) =a_j, which j=1,2,3,……,m set of actions;
3. Strategy(S) =$s_{k,}$ which k=1,2,3,……,q set of strategies;
4. Pay-off Utilization (U) calculates the pay-off of each player.
5. Player Decision act as a decision agent which makes an optimized decision during a game.

Game: The formal description of a different strategic condition in the environment. Rationality: If they play such that their pay-off is maximized, and this is termed as fair player. The rationality of all the players is also believed to be common knowledge.

Strategy: One of the most possible actions in the given set the actions is a strategy.

Pay-off : A pay-off is an amount that is often referred to as a utility. For a player, it positions the desirability of a result. Pay-offs are weighted with odds, given that the result is random. The predicted pay-off is closely linked to the intent of the player to take risks.

An N-player is exressed with anti-coordination and 3-symmetric strategy game. Let the game is defined as G = {N, S, U}. N is the number of players who participated in the game; every player has a similar gaming strategy denoted by S for action/strategy, and U gives the utility of respective strategies. Therefore, S =

{Cluster Head, Backup Cluster Head, Cluster Node}= {CH, BCH, CN} is the strategy package. S is the strategy that refers to the method the cluster node may declare as a CH or not being a CH in N player strategy game. In the gaming environment, the cost of CH and the cost of BCH is defined in terms of distance and available energy of the cluster nodes. Also, the utility payoff of every player can choose to serve as the cluster head to have the further tasks for its cluster nodes, or decline to be a cluster head. If more than one player opts to become a cluster head or backup cluster head in nearby physical proximity, when the smaller clusters occur If none of the nodes want to be a cluster head or a backup cluster head, however, all the cluster nodes are suffering to gain the payoff of 0, then nodes will not be send any information to the base station. The utility functions to a specific strategy of cluster nodes denoted by $U(S_i)$ and defined by:

$$U(S_i) = \begin{cases} C_{CH} & for \quad S_j = CH \ \ and \ C_{CH} > T_E \\ C_{BCH} & for\, S_j = BCH \ \ and \ C_{CH} \geq C_{BCH} > T_E \\ C_{CN} & for\, S_j = CN \ and \ T_E > C_{CN} > 0 \\ 0 & for \ S_j = CN \ \forall \ N \ C_{CN} \cong 0 \end{cases} \quad \ldots\ldots\ldots (11)$$

The proposed method deals with the game strategy of nodes becoming a cluster head, backup cluster head, or cluster member for energy consumption in wireless sensor networks (WSNs). Every node has to play for three strategies in which can act among any one of the strategies such as cluster head (CH), backup cluster head (BCH), and cluster node (CN). The cluster node may have a strategy to choose either cluster head or not. Sometimes the nodes act as cluster heads, but they do not send any information to the base station and are unable to obtain any utility payoff. The best way for every CN to act as a selfish node when the node itself has not been chosen for cluster head, but the highest residual energy nodes are announced as cluster head in every cluster. Each node gains utility through a backup cluster head or cluster head by representing their cost are revealed as CCH and CBCH respectively. In this case, a minimum three-node network is well-defined.

In which every node has extended its utility payoff as per the choice of CH or BCH in the cluster. Assumes that CH, BCH, and CN stands for selecting itself as cluster head, backup Cluster head, and cluster nodes respectively, then Table 1 shows the interaction between the two players with possible strategist options.

Table 1: Payoff matrix of two players with different strategy game

Players	Player (P_j)			
Player (P_i)	Strategies	CH	BCH	CN
	CH	($CH_{i,1}$,$CH_{j,1}$)	($CH_{i,2}$,$BCH_{j,1}$)	($CH_{i,3}$,$CN_{j,1}$)
	BCH	($BCH_{i,1}$,$CH_{j,2}$)	($BCH_{i,2}$,$BCH_{j,2}$)	($BCH_{i,3}$,$CN_{j,2}$)
	CN	($CN_{i,1}$,$CH_{i,3}$)	($CN_{i,2}$,$BCH_{i,3}$)	($CN_{i,3}$,$CN_{i,3}$)

The Payoffs of plays listed as (row, column). Where $C_{CH}>C_{BCH}>C_{CN}$

5.1 Nash Equilibrium

In the Nash gaming environment [18], the new concepts of solutions formed of Pure and Mixed strategies for 2-players. But as per our proposed method does support only mixed equilibrium due to the presence of three strategies with a 2-player environment.

5.2 Players Utility Payoff

Let us assume that i^{th} player (P_i) chooses CH with probability α_1, BCH with probability α_2, and CN with probability $1-\alpha_1-\alpha_2$. And similar way j^{th} player (P_j) chooses CH with probability β_1, BCH with probability β_2, and CN with probability $1-\beta_1-\beta_2$. The utility playoff of players have calculated as follows:

$$U_i(CH)= \alpha_1 CH_{i,1}+ \alpha_2 CH_{i,2}+(1- \alpha_1- \alpha_2)CH_{i,3} \quad \ldots\ldots(12)$$

$$U_i(BCH)= \alpha_1 BCH_{i,1}+ \alpha_2 BCH_{i,2}+(1- \alpha_1- \alpha_2)BCH_{i,3} \quad \ldots\ldots(13)$$

$$U_i(CN) = \alpha_1 CN_{i,1}+ \alpha_2 CN_{i,2}+(1- \alpha_1- \alpha_2)CN_{i,3} \quad \ldots\ldots(14)$$

$$U_j(CH)=\beta_1 CH_{j,1}+ \beta_2 CH_{j,2}+(1- \beta_1- \beta_2)CH_{j,3} \quad \ldots\ldots(15)$$

$$U_j(BCH) = \beta_1 BCH_{j,1}+ \beta_2 BCH_{j,2}+(1- \beta_1- \beta_2)BCH_{j,3} \quad \ldots\ldots(16)$$

$$U_j(CN) = \beta_1 CN_{j,1}+ \beta_2 CN_{j,2}+(1- \beta_1- \beta_2)CN_{j,3} \quad \ldots\ldots(17)$$

Based on Nash Equilibrium from the equations (12), (13), and (14) the equation written as

$$U_i(CH)= U_i(BCH)= U_i(CN) \quad \ldots\ldots(18)$$

Based on Nash Equilibrium from the equations (15), (16), and (17) the equation written as

$$U_j(CH)= U_j(BCH)= U_j(CN) \quad \ldots\ldots(19)$$

In addition to the above linear equations have four $\alpha 1, \alpha_2, \beta_1, \beta_2$ then the equations are split up into another two equations

$$\alpha_1 CH_{i,1}+ \alpha_2 CH_{i,2}+(1- \alpha_1- \alpha_2)CH_{i,3} = \alpha_1 BCH_{i,1}+ \alpha_2 BCH_{i,2}+(1- \alpha_1- \alpha_2)BCH_{i,3} \text{ -------} \quad (20)$$

$$\alpha_1 CH_{i,1}+ \alpha_2 CH_{i,2}+(1- \alpha_1- \alpha_2)CH_{i,3} = \alpha_1 CN_{i,1}+ \alpha_2 CN_{i,2}+(1- \alpha_1- \alpha_2)CN_{i,3} \text{ ----------} \quad (21)$$

$$\beta_1 CH_{j,1}+ \beta_2 CH_{j,2}+(1- \beta_1- \beta_2)CH_{j,3} = \beta_1 BCH_{j,1}+ \beta_2 BCH_{j,2}+(1- \beta_1- \beta_2)BCH_{j,3} \text{ --------} \quad (22)$$

$$\beta_1 CH_{j,1}+ \beta_2 CH_{j,2}+(1- \beta_1- \beta_2)CH_{j,3} = \beta_1 CN_{j,1}+ \beta_2 CN_{j,2}+(1- \beta_1- \beta_2)CN_{j,3} \text{ ----------} \quad (23)$$

If player P_i or P_j chooses to play with only two strategies between CH and BCH then the probabilities of β and $1-\beta$ then have three variables and three equations (4), (8) and (9)

$$\beta\, CHj_{,1}+(1- \beta)CH_{j,2} = \beta\, BCH_{j,1}+(1- \beta)BCH_{j,2} \text{ ----------} \quad (24)$$

$$\beta\, CHj_{,1}+(1- \beta)CH_{j,2} = \beta\, CN_{j,1}+(1- \beta)CN_{j,2} \text{ ----------} \quad (25)$$

If any one player mixing the strategies to play with other players in a Nash equilibrium, the payoff coefficients of above given the matrix is identical in terms of a row or a column. The mixing player might choose any mix strategies involved to get Nash equilibrium.The Cluster head is selected in which the cluster head have maximum cluster head utility payoff among all the cluster nodes.

$U(CH)=max\{U_1(CH), U_2(CH),\ldots\ldots\ldots U_n(CH)\}$ ……(26)

Similar to the cluster head the backup cluster head is selected in which the backup cluster head has maximum cluster head utility payoff among all the cluster nodes.

$U(BCH)=max\{U_1(BCH), U_2(BCH),\ldots\ldots\ldots U_n(BCH)\}$ ……(27)

5.3 Player Utility payoff Algorithm

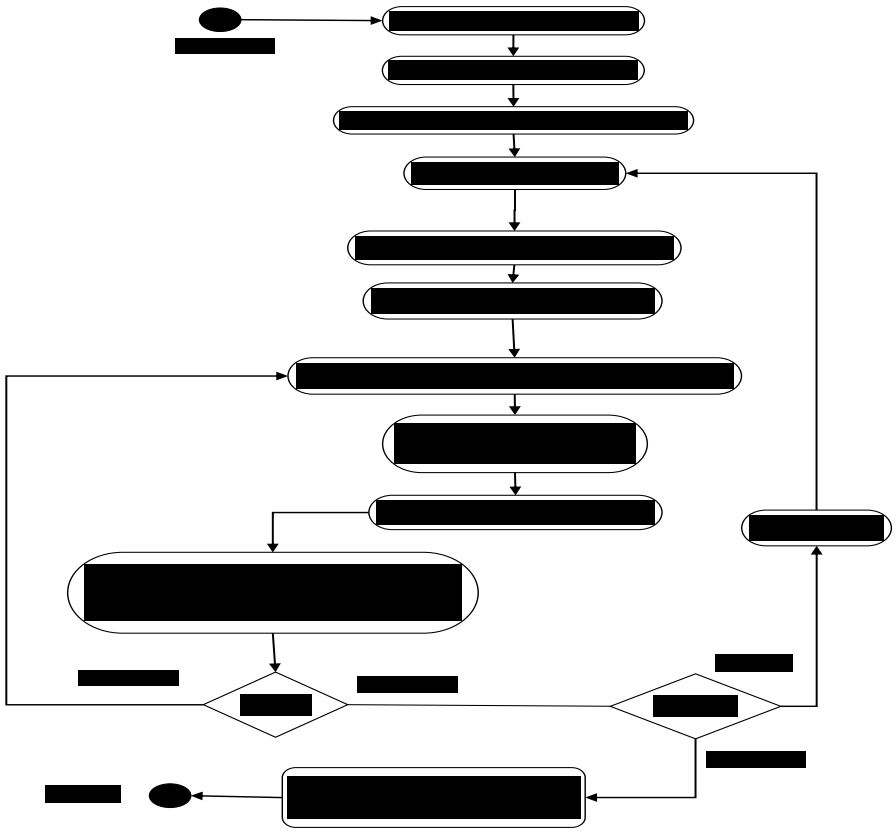


Fig 2: Proposed Nash Equilibrium algorithm

a. Start
b. Deploy the Wireless Sensor Node with initial energy
c. Formulate cluster with neighbor node information

d. Design a gaming environment and initialize N players
e. Initialize the threshold Energy T_E and i=1
f. Evaluate the node energy R_E and initialize j=i+1
g. Select the players P_i and P_j
h. Design game strategies for players P_i and P_j
i. Calculate strategy payoff for players P_i and P_j
j. Apply the mixed Nash Equilibrium and calculate the utility payoff of each player P_i and P_j
k. If the utility payoff is greater then update player utility payoff
l. Repeat the steps step 7 to step 12 until j<N
m. Repeat the steps step 6 to step 13 until i<N
n. Select Cluster head (CH) and Backup cluster Head (BCH) based on maximum utility payoff
o. Stop

6 Simulation and Results

6.1 Simulation parameters

Every round network simulation represents the lifetime of the sensor node. Few of the simulation parameters used for the implementation and shown below. These parameters are set in the same way as a reference [19], used in many WSN research papers.

Parameter &Values
Area 500x500 meters
Sensor nodes: 300
Initial None energy of Cluster nodes: 0.6 J
Energy Required per bit transfer: $5x10^{-8}$J/bit
Energy Required per bit receive : $5x10^{-8}$J/bit
Simulation rounds : till all the nodes become dead or 5000
Packet size CH to BS: 6400 bytes
Packet size Nodes to CH: 200bytes
Node communication range: 100 m
Cluster head communication range: 500 m
MAC Interface: Mac/802.11Ext
Antenna Type: Antenna/OmniAntenna
Routing protocol: Fault-TolerantClustering using Game theory

6.2 Result Analysis

The simulation results were set for both GCEEC[20] and FTCHG protocols with a probability of 0.3. So that is 3% percentage of cluster nodes become CH and 2% cluster nodes become BCH in the total simulation environment.

The experimental results had compared in terms of the number of dead nodes in every round in the proposed FTCHG as well as GCEEC. The list of dead nodes includes CHs and sensor nodes becomes dead due to the reduction energy or the failure of the device was observed in reliability function. In which FTCHG gives better results than the GCEEC during the simulation environment for the analysis of network lifetime. In the proposed method has dynamic CH selection using BCH, which has elected as CH using a game theory with a high payload utility of BCH. The CN is communicated to CH than the packets transmitted to BS. The CH requires more energy because all packets are delivered to BS through CH. The proposed game theory algorithms will identity better CH from BCH when the existing CH becomes a failure.

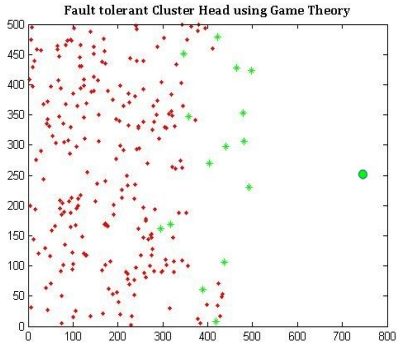


Fig 3: FTCHG simulation setup for 300 nodes with Sink

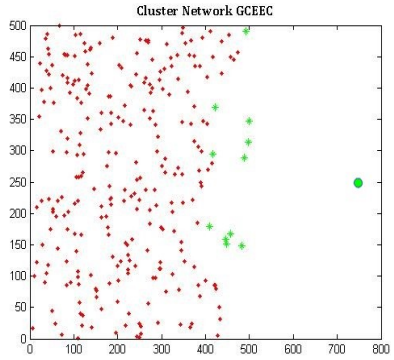


Fig 4: GCEEC simulation setup for 300 nodes with Sink

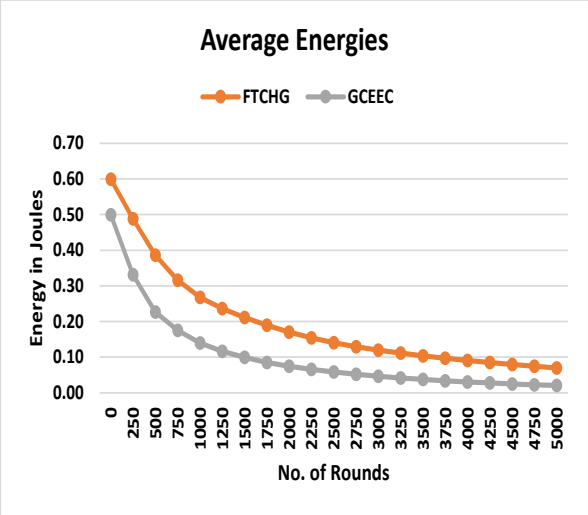


Fig 6. Average Energy Comparison

Rounds	FTCHG	GCEEC
0	0.60	0.50
250	0.49	0.33
500	0.39	0.23
750	0.32	0.18
1000	0.27	0.14
1250	0.24	0.12
1500	0.21	0.10
1750	0.19	0.09
2000	0.17	0.07
2250	0.15	0.07
2500	0.14	0.06
2750	0.13	0.05
3000	0.12	0.05
3250	0.11	0.04
3500	0.10	0.04
3750	0.10	0.03
4000	0.09	0.03
4250	0.08	0.03
4500	0.08	0.02
4750	0.07	0.02
5000	0.07	0.02

Figure 6 represents the consumption average energy per in FTCHG has lower than the GCEEC algorithm. The average energy consumption of sensor nodes in every round better than the existing algorithm.

Based on figure 7 shows the comparison of alive and dead nodes in every round and simulated for 5000 rounds or till all nodes become dead. As per the graph, the dead nodes are increasing the alive nodes will decrease in every round.

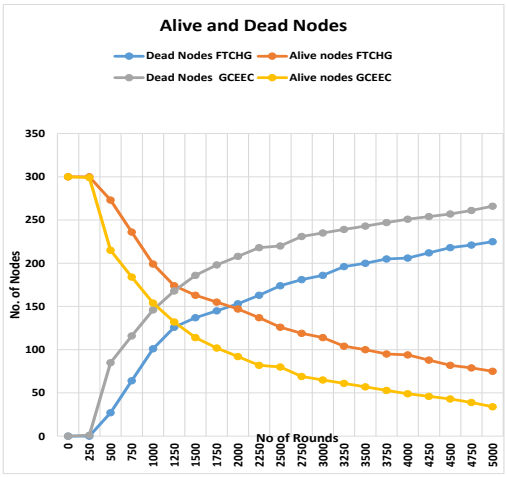


Fig 7: Alive and Dead nodes Comparison

Rounds	Dead Nodes FTCHG	Alive nodes FTCHG	Dead Nodes GCEEC	Alive nodes GCEEC
0	0	300	0	300
250	0	300	1	299
500	27	273	85	215
750	64	236	116	184
1000	101	199	146	154
1250	126	174	168	132
1500	137	163	186	114
1750	145	155	198	102
2000	153	147	208	92
2250	163	137	218	82
2500	174	126	220	80
2750	181	119	231	69
3000	186	114	235	65
3250	196	104	239	61
3500	200	100	243	57
3750	205	95	247	53
4000	206	94	251	49
4250	212	88	254	46
4500	218	82	257	43
4750	221	79	261	39
5000	225	75	266	34

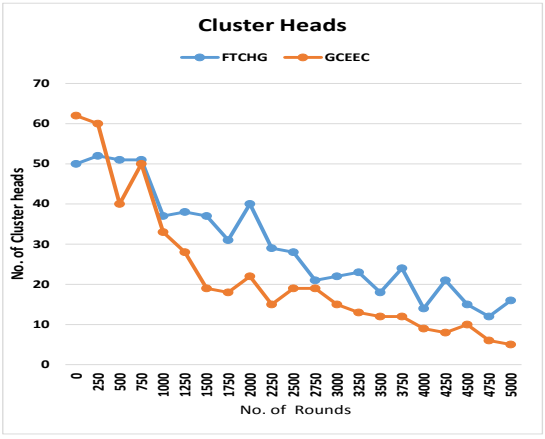
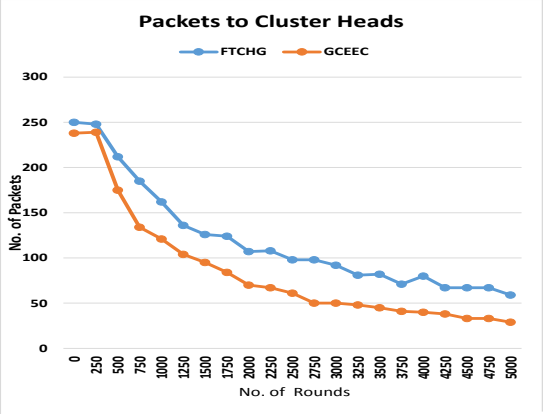


Fig 8: Cluster Heads Comparison

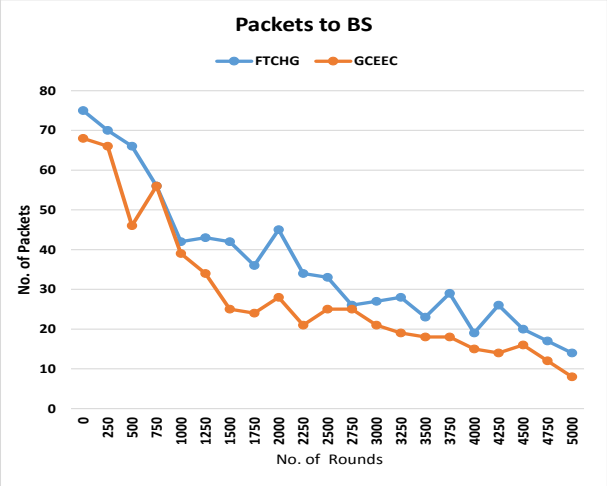
Rounds	FTCHG	GCEEC
0	50	62
250	52	60
500	51	40
750	51	50
1000	37	33
1250	38	28
1500	37	19
1750	31	18
2000	40	22
2250	29	15
2500	28	19
2750	21	19
3000	22	15
3250	23	13
3500	18	12
3750	24	12
4000	14	9
4250	21	8
4500	15	10
4750	12	6
5000	16	5

In which our FTCHG has better results than the existing GCEEC algorithm. In figure 8 shows a number of cluster heads in every round.This also proves the better throughput at both cluster head and base station. Figures 9 and 10 represent the transmission of the packet between the cluster heads and base stations.



Rounds	FTCHG	GCEEC
0	250	238
250	248	239
500	212	175
750	185	134
1000	162	121
1250	136	104
1500	126	95
1750	124	84
2000	107	70
2250	108	67
2500	98	61
2750	98	50
3000	92	50
3250	81	48
3500	82	45
3750	71	41
4000	80	40
4250	67	38
4500	67	33
4750	67	33
5000	59	29

Fig 9: Packets to Cluster Heads Comparison



Rounds	FTCHG	GCEEC
0	75	68
250	70	66
500	66	46
750	56	56
1000	42	39
1250	43	34
1500	42	25
1750	36	24
2000	45	28
2250	34	21
2500	33	25
2750	26	25
3000	27	21
3250	28	19
3500	23	18
3750	29	18
4000	19	15
4250	26	14
4500	20	16
4750	17	12
5000	14	8

Fig 10: Packets to Base Station

7 Conclusion and Future Enhancement

In the current generation, networks have wider wireless communication and many applications. The main challenging task in wireless sensor networks towards increasing network lifetime by utilizing sensor node batteries. The WSN's are managed by implementing suitable energy consumption algorithms to improve the lifetime of the network. The proposed game theory-based fault-tolerant cluster head selection supports a better network lifetime compared to the existing GCEEC algorithm. In this game-theoretic algorithm has been implemented with Backup Cluster heads (BCH) and cluster heads (CH) which will resume the services of CH

through BCH when the CH becomes failure or death. The complete explanation of FTCHG and GCEEC protocols was implemented and presented in this paper. Based on the comparison of the simulation results the FTCHG algorithms perform better than GCEEC. The simulation results clarify the number of alive and dead nodes based on FTCHG and GCEEC algorithms including its non-cooperative game theory approach of the WSNs.The future work may be an attempt to design game-theoretic wireless sensor routing algorithms in various scenarios such as energy variation and mobility conditions.

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Resilience Test case Automation for LTE Femtocell Networks

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***Abstract*—The automated test case generation includes the manual test cases, which are converted to automated test cases through executable test scripts. It is more essential to bring out an effective resilience testing for network gateways. The automation testing plays a major role in performing time constrained and skillful work. Moreover, the network gateways will not take part in one-time investment, even when the technology or environment evolves, the test scripts are continuously patched based on the market demands. Thus, the automation testing is remaining as a challenging task to define and test automatically in a cost-effective mode. The developed device is called as femtocell, which helps to effectively densify the network and deliver a great customer experience in small indoor environments. It is checked to meet the real world scenarios under resilience test cases. It is performed by various manual test cases. Moreover, this project automates the manual test cases.**

Keywords*— *Long Term Evolution, Femtocell, Gateway, SAM Client, Wireless Provisioning System.

I. INTRODUCTION

The energy for achieving higher information rates in remote systems is persistent and has set off the game plan and improvement in new information protested cell rules. Wi-Fi work orchestrates likewise for being made to give transient high rate information benefits in a verifiably appropriate manner. Notwithstanding the way that the Wi-Fi systems will never have the choice to help a relative degree of transportability and consolidation as like the telephone rules, to be totally serious for home and office use, cell information structures should generally offer assistance in every practical sense, which remain unclear from that offered by Wi-Fi structures [1].

Femtocell offers a substitute technique to these issues. Right when mobile phones come in femtocells grow, consequently calls will be changed to the relating cell. The voice and information calls are blended when managing through the femtocells. This develops the security of the client information. At a time three to four calls from a relative supervisor can be managed by a solitary cell through the normal mobile phones. Femtocell gives fixed helpful intermixing (FMC), interminable relationship among remote and fixed telecom structures. Most of the FMC models need twofold mode handset (telephone that utilizes different methods for transmitting and getting information and voice). This works inside the unlicensed extent of private or undertaking remote ways anyway femtocell-based system utilizes any handset at any rate needs new ways establishment which utilize endorsed run. Femtocell gets related with the ace network's structure through broadband alliance like association or DSL. The position affiliation must pre-plan the contraption before client could begin utilizing the cell, yet no game plan of adaptable is required. For the adaptable chiefs, femtocell's enormous highlights improve both thought and limit in the in-portals while upgrading the noteworthiness use and make base station (BS) affiliation financially shrewd. Adaptable endorsers are offered better clue quality and longer battery life utilizing femtocells. In NOKIA, testing of Femtocell Gateway begins with the distinguishing proof of test situations from necessities and use cases. These situations are meant manual experiments. A manual experiment is an arrangement of test steps written in common language each test step is basically a guidance for the analyzer to play out an activity on the server [2].

Manual experiments are planned for execution by people. Yet, in circumstances where huge manual test suites should be run more than once in time-obliged relapse cycles, manual execution is unreasonable. The target of our Resilience test robotization to have number of manual tests, which are strength

test cases. Along these lines, for effective test execution, and driven by the logical prerequisites of strength testing, manual tests are changed over to test contents (or projects) that play out the test steps precisely; this action is known as test computerization.

Although test robotization is attractive and frequently vital, it is costly. Traditional test-computerization procedures are tedious; additionally, they can deliver delicate contents that break as often as possible and have a common support cost. For example, record-replay in which an analyzer plays out the test steps by means of a testing instrument, the device records the analyzer's activities, and makes a content to replay the activities consequently—is adroitly basic and bolstered by numerous business and open-source testing apparatuses. In any case, it produces contents that are difficult to keep up. The contents are solid projects with no modularization, contain hard-coded information, and are amazingly weak. An elective robotization approach, one that is very mainstream and addresses a portion of the impediments of record-replay, is catchphrase driven computerization. Be that as it may, building up a robotization system is a costly movement, requiring noteworthy time and skill in addition, the delivered contents can break without any problem [3].

A Femtocell is really the very small in which are called as small cell that can be used to increase cellular communication link inside a particular geographical area (typically a small, single location). Femtocells, in relation to it being the thinnest in the family of small cell advanced technology, should use least level of power; as a result, they do not even have too much of an impact when it comes to expanding communication link.

II. LITERATURE SURVEY

The solutions built in this environment based on resiliency test cases to find problems related to particular solution in the designed environment. For every solution pre-defined set of resource identified for the respective problem to manage the resources in resiliency test case environment. The solutions of test cases were built based on operational mode and non-functional requirements.

The Test Automation Framework (TAP) enables the creation of testing process. TAP project requirements are composed of multiple of testing process that describe the set of conditions that are executed on multiple TAP components (the logical entities that control the physical equipment on the platform) or regulate the control flow of the testing process (for example, repeating specified actions or conducting multiple behaviours varies depending on the testing process) [4].

In the operational model the resiliency test cases are enabled to describe the several components present in their interactions. The flow sequences in this model describes the flow both request and response in the end-to-end communication [5].

The design of a system is built based on failure mode analysis earlier designs. In this design helps to identify the list of active components, which are connected to internal and external interfaces for identifying possible failures at that point. If the failure points are identified, the test automation to build again for validating data resiliency in every point of failure. Those type of automation for data in every application before hosting the application. The automation is configured based on infrastructure, load balancing and traffic management solutions and ensure to deploy in single region for of latency issues. The well-defined automated rollback mechanism is for identifying failures and roll back to previous point [6].

The Robot Framework is really a Maven plugin that enables users to use it. The main objective of all this plugin is to enable people to be using Robot Framework in a Maven libraries without installing additional plugins such as Robot Framework, python, etc.. In a nutshell, it's a non-intrusive way of actually incorporating testing process investigation proposes to clients current sites.

LTE is a wireless technologies created by 3GPP which really offers excellent data to cellular telephones and mobile network. 3GPP Release 8 and 9 quality standards define the specification.
In this case, the strategy covers incorporating Layer 2 and Layer 3 firmware with high speed physical layer on the high speed device.

Pynguin is an automated test scripts generation framework written in and for the Python language. The approach is accessible on GitHub as open-source software licensed under the Gnu General Public License.

III. METHODOLOGY

A. LTE Femtocell Architecture

Well Lets Dig in to LTE based Femtocell Architecture, Here the two major architecture such as HeNBs and HeNB-GW are inter-connected, and they will be connected to different mobile providers through backbone network by establishing network connectivity. So, if you want to communicate its possible only from the core network. We also have some cases where does not have any macro cell (We call it Dead Zones), in these cases the users equipment will be in a state of outage. We cannot communicate between user equipment’s when they are outside the coverage area. There is a catch here, when we are in dead zones, calls will be dropped when the user devices enters to this coverage region. This situation is same for other femtocell architectures as well in this network architecture.

In Fig.1 Image clearly states the architecture proposed. The LTE femtocell architecture extends based on infrastructure as well as its features. When we observe the above architecture, we also introduced a road gateway (RGW) infrastructure with the extension of suitable installation work on streets when we choose this architecture. The HeNBs which will be there in

our residence and industries are very near to the RGW architecture, then they need to connect to the RGW with extended features. The integration of RGW and HeNB as like a similar interface present in HeNB and possible user requirements. Each and every RGW have a suitable interfaces and communication take part of another RGW with nearby location. The RGW that are searching the nearby HeNB-GW and communicate to other HeNB-GW through their interface protocols. Commonly every HeNB-GWs are connected to the backbone of existing network. If HeNB-GW are exits within the coverage region to HeNB, then the HeNB can get connected automatically to the nearest HeNB-GW nodes instead of connecting to other RGW [7].

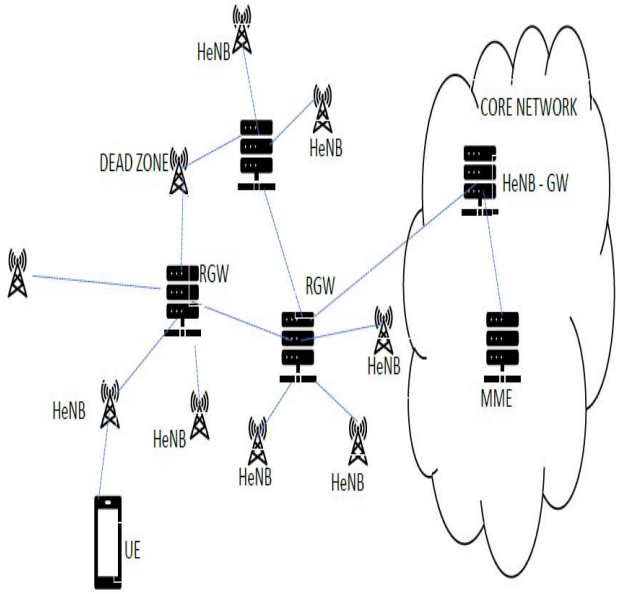

Fig. 1: Architecture of LTE Femtocell

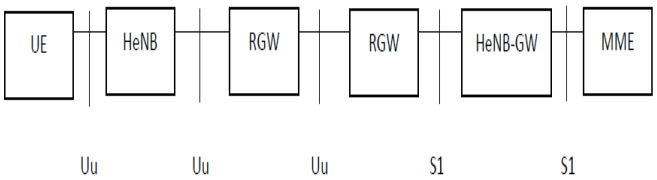

Fig. 2: LTE femtocell architecture Interfaces

In Fig.2 exhibits the list interfaces used in this architecture as well as the list of communication devices for the architecture in detail. The user devices and HeNB are equipped with the suitable communication interface such as Uu to their functionalities. The Uu interface supports for HeNB and RGW communication as well as the communication between different RGWs. The S1 interface also supports for connection between RGW and HeNB-GW. Even S1 interface supports for connection between HeNB-GW and MME. The S1 interface contains two major interfaces mainly S1-MME and S1-U. The S1-MME interface manages control plane and S1-U manages user plane. The user plane interface consists of well-defined set protocol stack for the communication between HeNB and RGW for transferring user data. The control plane also have protocol stack with various set functions and procedures to continue the communication between interfaces [8].

Fig. 3 shows how correspondence happens in the proposed engineering. The way of correspondence is demonstrated utilizing intense lines. Think about a client gear (UE) which is in a no man's land and endeavors to make an interface through a another client hardware. The client hardware starts the communication the HeNB and its associated devices. The HeNB get connected to the associated devices through a nearby RGW which also communicated to another RGW till a HeNB entry is reached. At this point the HeNB Portal and its associates are managed by central communication system. Subsequently, regardless of whether there is no availability from a HeNB to a HeNB-GW, the RGWs can be utilized by advanced procedure calls.

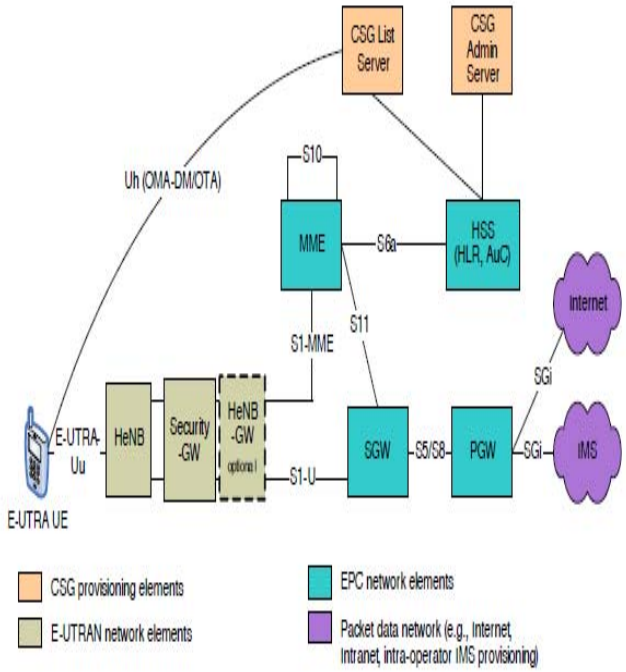

Fig. 3: Communication in the LTE femtocell architecture

Meanwhile HeNB and the RGW are separated each other, though less force is required for the correspondence between the RGW and HeNB. Comparative is the situation for the communication between any two RGWs supports to avoid call drop at whatever point a client gear enters a no man's land. Rather, the client gear associates with a close by HeNB and the correspondence proceeds with no interference. Additionally, the association between the HeNB and RGW is remote. Along these lines, broadband association isn't required for setting up an association with the center system. This design is plausible due to the accompanying reasons: The expense of executing the femtocells will be little when contrasted with the usage of the macro cells in bumpy district

and thick timberland zones. Land procurement isn't required for this design which makes it simple to execute. Likewise, no specialized information is required for the establishment of femtocells. In this architecture does not required any broadband network for communication for utilizing this design, but it continued with the current convention stack [9].

B. Components of Femto Cell Network:

SAM: It provides OAM functions for Femto Cell units, Femtocell Gateway. It also supports fault management for the Femtocell Gateway, Small Cell auto-configuration, Northbound Interface, performance measurement collection, and storage (option with Gold SLA). The 7750 SR is managed by the 5620 SAM across both network and service management domains [10].

HDM: This is responsible for management of the Femtocell Access Points in conjunction with the 5620 SAM; the HDM manages dynamic aspects of the Femtocell Access Points (notifications, operator intervention, etc.) whereas the 5620 SAM manages static and semi static aspects (configuration) and periodic upload of Femtocell Access Point information (FM logs, PM files)[11].
WPS: This offline tool assists with configuration management by SAM-FC.

C. Test Automation

Test automation simply means creating automated tests. When we're testing software, test automation means developing software that support testing. a standard misunderstanding is that test automation is understood as automated testing. In product development, testing is mainly analysis and problem solving, an inspired activity requiring human brains. Testing is as impossible to automate as product development. Automated testing means unattended testing where no humans are involved. this suggests programmatically selecting the test scope, test target, test sets, expected results and actual test execution, test analysis and test reporting. Iterative development with frequent release cycle requires continuous integration, which is enabled by automated testing. Also, short time-boxed iterations require to write down automated acceptance tests before the implementation Automated tests enable customers and us to implement changes way more often, quicker and safer than with manual tests. We can run the suite of automated tests after every change, again and again during the day and night, because the test execution doesn't require human involvement. Automated tests enable continuous integration that improves the communication and quality of the developed product. the quantity of faults found in release testing has decreased in comparison with a project without automated testing.

D. Robot Framework

Robot Framework is an Agile test automation system that produces it easy for a software project to: Collaboratively define and maintain automated tests, run those tests and see their results. Robot may be a framework within which the test automation will be organized and developed. On top of the core framework, it contains a collection of utilities, libraries and documentation that describe and facilitate development, documentation and use of tests cases. Robot is also platform and not dependent on any applications. While the core is written in Python, Robot will be extended with Java, C++, Python or Jython test libraries. Through test libraries it's also possible to integrate new or existing test tools, implemented with any language, with Robot. Robot makes it possible to form and maintain automated test without programming skills. Robot also isolate test engineers from the complexities of the test framework. Robot supports Acceptance Test Driven Development (ATTD) [12] i.e. enables describing requirements as executable test.

E. Centralized Logging Configuration

Centralized Logging configurations are a part of Security Hardening Feature. This enables configuring a Central Log Server where the Security Logs from the Bono is transferred to regularly.
Centralized Logging needs the following configurations:

1. A Central Log Server that supports ssh / sftp with the latest updates.
2. A SFTP User configured on the Central Log Server that can be used by the Bono.
3. SSH Key sharing to be done between the Bono and the Central Log Server to enable password less file transfer between the Bono and the Central Log Server.

The SSH Key sharing must be done between the admin user on the Gateway and the SFTP User on the Central Log Server.

F. Link interrupt scenarios

1) Interface Bring UP

Startbsg script creates the FGWMon process. FGWMon spawns the OAMServer which in turn parses the OAM_Preconfig xml file and shares the following with FGWMon configured operation mode (either simplex or redundant) interface details [13].

In case of simplex
FGWMon configure interfaces with floating IP.

In case of redundant
FGWMon negotiates state with peer. If peer is unreachable then it becomes active.

In case of redundant active state

- FGWMon configures interfaces with floating IP.

In case of redundant standby state

- FGWMon configures interfaces with dumpy IP and starts ping based interface monitoring of the node.

FGWMon notifies the current state to OAM [14]. In case of FGWMon state SIMPLEX or REDUNDANTACTIVE OAM [11] initiates relevant process start request (Ex BSG.exe, gsnmpProxy.exe etc.). After successful process start-up active node is ready for handling BSR requests.

2) Route Configuration

All persistent route needs to be added only on the Active node using BSGCLI or SAM [15]. So, FGW processes must be running for any persistent routes' configuration or modifications. All persistent routes are dynamically applied to relevant interfaces by FGWMon on both the Nodes. The routes added to interface LMT will persist even if FGW processes are not running. Routes added using BSGCLI or SAM are updated in the DB. So, it will be reflected on both Active and Standby as the routes data will be synced during the DB sync between the two.

3) Test case activity

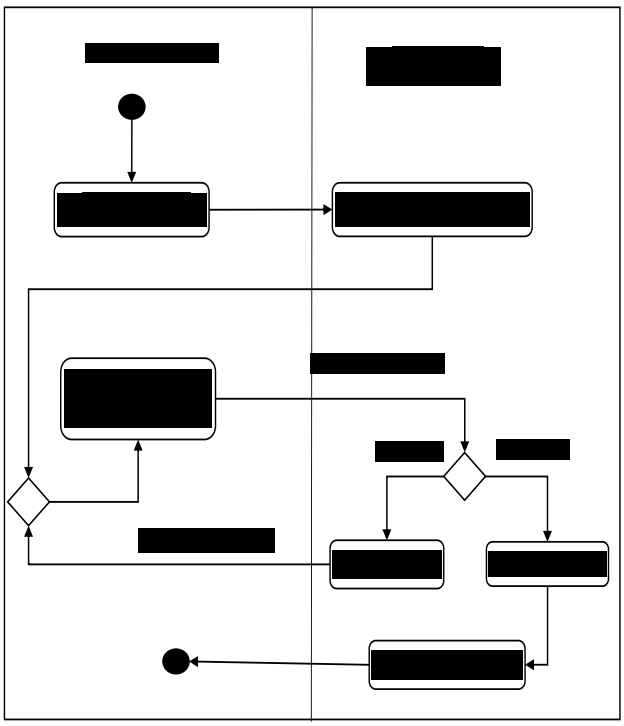

Fig 4: Automation test case activity

Activity is started by the tester actor who needs to execute the script. Tester login to the server by use of IP address and password which access the gateway after the login the sequence indicates the test case which fail or pass according to the given scenario in next phase the executed process is displayed and the activity is ended, if in case there is a fail in result the tester can rerun to check or end with the given result. The test case scenarios invokes list of available connections to all of the other systems in the network. As the test case identify the list of availed HeNB-Gateways and its sequence of gates to be connected. Then finally the automated test cases were built and displayed in the test case Report.

4) Execution summary

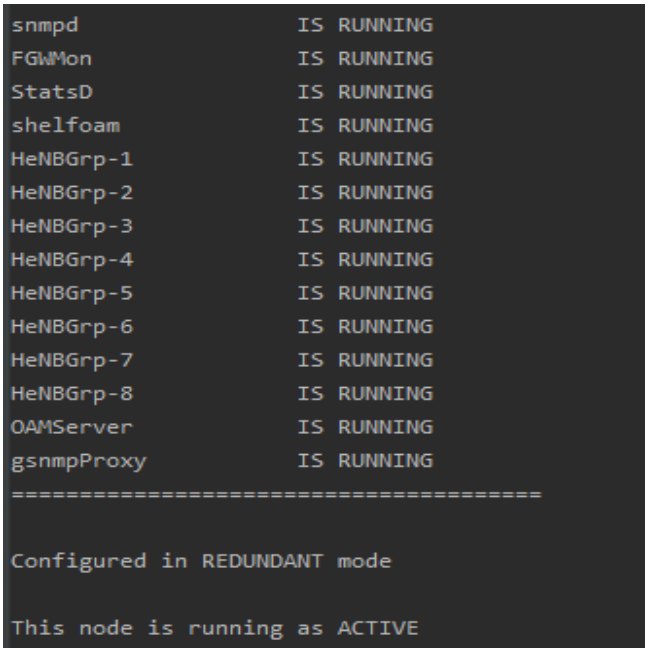

Fig 5 : Login to Gateway

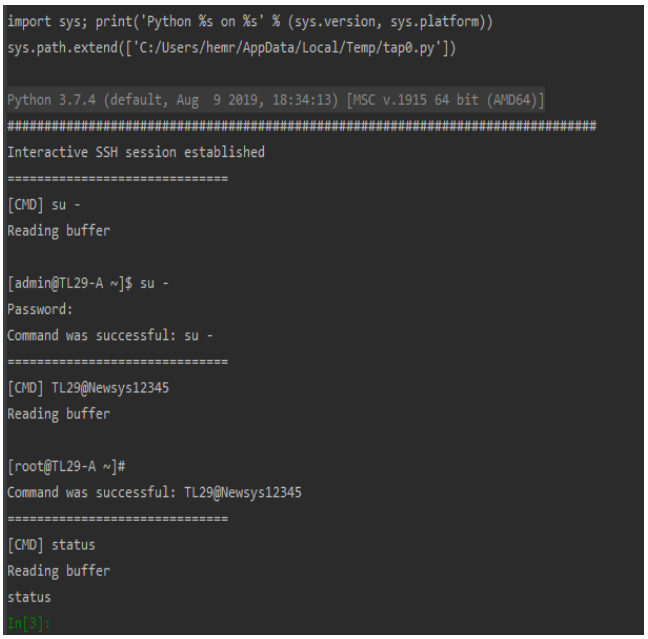

Fig 6: Checking the active gateway nodes

```
[admin@TL29-B ~]$
Command was successful: status
============================
[CMD] ifconfig
Reading buffer
ifconfig
10Geth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether 00:11:3f:f3:e6:17  txqueuelen 1000  (Ethernet)
        RX packets 8613100  bytes 5277429523 (4.9 GiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 7373048  bytes 3601003483 (3.3 GiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

10Geth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether 00:11:3f:f3:e6:1c  txqueuelen 1000  (Ethernet)
        RX packets 2434767  bytes 235680612 (224.7 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 2314330  bytes 228256156 (217.6 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

10Geth0.79: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.79.12  netmask 255.255.255.0  broadcast 192.168.79.255
        inet6 fe80::211:3fff:fef3:e617  prefixlen 64  scopeid 0x20<link>
        ether 00:11:3f:f3:e6:17  txqueuelen 1000  (Ethernet)
        RX packets 10734  bytes 123026917 (117.3 MiB)
In[9]:
```

Fig 7: Display of network Interface

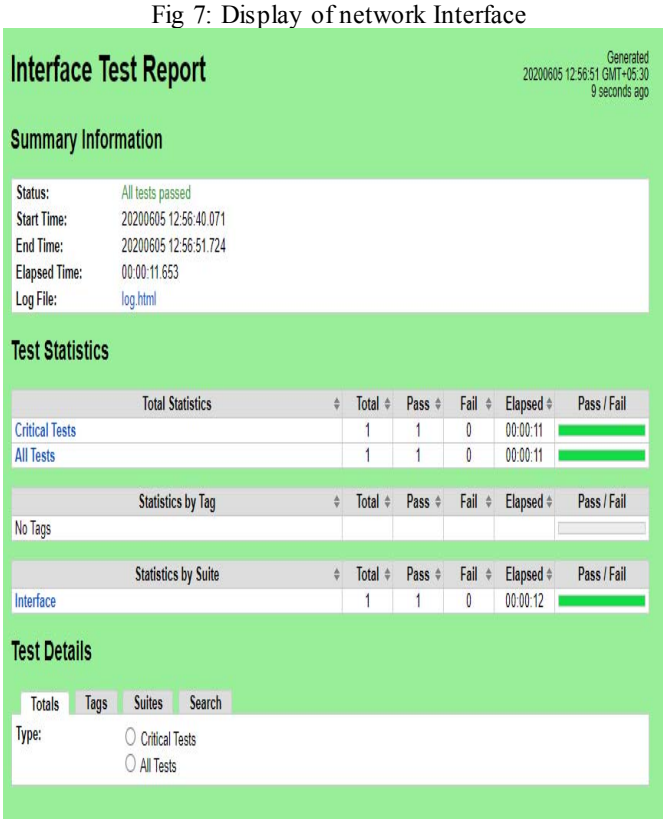

Fig 8. Interface Test Report

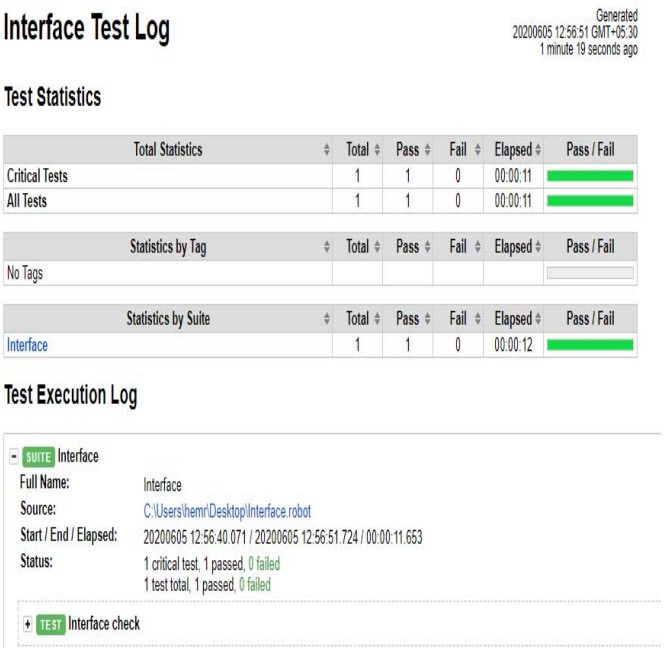

Fig 9 : Interface Log Report

All the list of test case are stored in the log file. I can be view in a web interface. It is GUI interface show the list of teste case were tested and the number of test case passed in Robot testing. Before starting test automation all the network connections are verified to build a test case [16].

5) IuFlex – Commands to create PsRegionnriToCnNodePS

PsRegionnriToCnNodePS is a sub-class of PsRegion. This class links the core network node SGSN to region using the NRI value specified in the attribute 'nriToCnNodePSNri' and the SGSN node specified in attribute 'nriToCnNodePSCnNode'. The NRI value received from BSR during call origination is compared with the value of 'nriToCnNodePSNri' to connect to the corresponding SGSN node available in the region. The 'nriToCnNodePSWeight' attribute is used to select the available interface in the region during load sharing process. During call origination when NRI value received from BSR is not matched with any of the network nodes available in the region, the current interface available in load sharing list is selected if the value of the corresponding interface's 'nriToCnNodePSWeight' is not zero. IuPS interface should be created ahead to include its reference in this class.

IV. CONCLUSION

This paper conclude that Femtocells are viewed as the answer for meet the future requirements for high information rates and limit in the remote cell systems. Be that as it may, for femtocells to turn out to be generally satisfactory there are various difficulties. Right now femtocells are being given by administrators, however because of the still low sending numbers, the difficulties are not yet clear by and by. Femtocells would confront numerous issues when the sending is for a huge scope and their thickness increments. This can

reduce both capital use and working expense. Offering a better support than end-clients thusly lessens agitate. There may likewise be open door for new administrations. Customers exploit from upgraded inclusion and perhaps better voice quality and similarly better battery life. Every normal need can be severed by testing the item with real-time scenarios', so the test case are shaped and executed to defeat manual execution the computerization of a few test case has been finished. This will assist the item with gaining quality in business and great improvement in innovation. Henceforth the strength test cases are robotized to spare time and cost.

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(22) Date of filing of Application :25/08/2020

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(54) Title of the invention : COVID -19 THERMAL SCREENING USING SMART HELMET

(51) International classification	:A42B0003040000, G06F0001160000, A62B0018040000, A42B0003100000, A42B0003280000
(31) Priority Document No	:NA
(32) Priority Date	:NA
(33) Name of priority country	:NA
(86) International Application No Filing Date	:NA :NA
(87) International Publication No	: NA
(61) Patent of Addition to Application Number Filing Date	:NA :NA
(62) Divisional to Application Number Filing Date	:NA :NA

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(57) Abstract :
The invention divulges a lightweight portable helmet capable of thermal scanning and reducing the transmission of Covid19. The system providing protection for entire head viz hair, face, eyes, nose, mouth, ears, & upper body including neck and shoulders against COVID19 which is easily mountable on the head and is light weight helmet. The front cover of the helmet is fitted with air filtration opening protected by an air filtration medium and it comprises of three-layered cloth and is replaceable. The helmet is enabled with infrared thermal sensors which are capable of recoding data and communicating the same to the doctors/physicians to provide a real time data using IOT technology.

No. of Pages : 7 No. of Claims : 1

(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :12/11/2020

(21) Application No.202041049454 A
(43) Publication Date : 20/11/2020

(54) Title of the invention : CATASTROPHE DETECTION AND SMART RESCUE SYSTEM UTILIZING ANDROID SMARTPHONE WITH REAL-TIME LOCATION TRACKING

(51) International classification	:G08B25/14
(31) Priority Document No	:NA
(32) Priority Date	:NA
(33) Name of priority country	:NA
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(57) Abstract :
Abstract: Emergency never comes with prior intimation. In real world scenarios detecting such emergencies and reporting them is a real challenge. The proposed invention to overcome common problem of having manual intervention while reporting emergency. A large number of deaths are caused by Traffic accidents worldwide. The global crisis of road safety can be seen by observing the significant number of deaths and injuries that are caused by road traffic accidents. In many situations the family members or emergency services are not informed in time. This results in delayed emergency service response time, which can lead to an individualâ€™s death or cause severe injury. The proposed invention purpose is to reduce the response time of emergency services in situations like traffic accidents or other emergencies such as fire, theft/robberies and medical emergencies. By utilizing onboard sensors of a smartphone to detect vehicular accidents and report it to the nearest emergency responder available and provide real time location tracking for responders and emergency victims, will drastically increase the chances of survival for emergency victims, and also help save emergency services time and resources. Smart phone will upload that emergency along with other information like current location tracked by GPS on phone, mobile number (personâ€™s identity) and incident time over internet (long range protocol) to concern cloud platform to popup notification in website and smart phone applications.

No. of Pages : 15 No. of Claims : 4

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(43) Publication Date : 16/07/2021

(54) Title of the invention : AI AND IOT BASED SMART DAIRY FARM WITH HIGH-QUALITY MILK PRODUCTIVITY

(51) International classification	:G06Q0050020000, A47J0031440000, H04L0029080000, A23C0009152000, A23C0009142000
(31) Priority Document No	:NA
(32) Priority Date	:NA
(33) Name of priority country	:NA
(86) International Application No Filing Date	:NA :NA
(87) International Publication No	: NA
(61) Patent of Addition to Application Number Filing Date	:NA :NA
(62) Divisional to Application Number Filing Date	:NA :NA

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(57) Abstract :
The Internet of Things (IoT) and data-driven strategies are expanding the possibilities for smart dairying. Milk consumption is expanding inexorably due to the world's growing population. Dairy products employ more people in industrialized nations than in underdeveloped nations. Better technical solutions for increasing milk supply are necessary to meet this rising demand for milk products. It is conceivable that IoT and other AI approaches may assist a farmer in overcoming several traditional agricultural obstacles and increasing high-quality milk output.

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(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :04/09/2020

(21) Application No.202021038154 A
(43) Publication Date : 18/09/2020

(54) Title of the invention : PREVENT THE SENSITIVE DATA LEAKAGE IN REST.

(51) International classification	:G06F0021620000, H04L0029060000, G06F0021550000, G06F0021880000, G06F0021790000
(31) Priority Document No	:NA
(32) Priority Date	:NA
(33) Name of priority country	:NA
(86) International Application No Filing Date	:NA :NA
(87) International Publication No	: NA
(61) Patent of Addition to Application Number Filing Date	:NA :NA
(62) Divisional to Application Number Filing Date	:NA :NA

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(57) Abstract :
1. ABSTRACT: Gossiping is the one of the threat caused by insider employee to an organization, Technology is strong enough, but human is the weak. Today every organization needs internal monitoring wing to keep track of the employees behavior and interactions among the people both internal and external world. Since, today most of the industrial organization adapted digital technology in their operations. The long running organizations had plenty of data stored in their legacy storage devices. This data in full or partially might consists of the sensitive raw information. It is threat to organization since, the organizations still they are using the obsolete systems to do their operations, and the data might store in magnetic tapes, floppy disks, and even backup hard drives. This paper gives insights of threats, challenges and opportunities and also discusses various methods, algorithms, and techniques followed to prevent the sensitive data leakage. This paper also gives the machine learning method to judge and take self-decision to prevent sensitive data leakage when data is at rest. The security awareness metrics that help tailor education to individuals operating within different business units and the appropriate monitoring and recording of high risk activities to identify why, when or where an employee's behavior has increased the likelihood of a data breach. The covert channels were used to leak the data from the sensors, network routers, Computer devices and smartphones by analyzing the timing and storage noises of the systems.

No. of Pages : 5 No. of Claims : 1

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GEOGRAPHICAL INDICATIONS

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APPLICATION NUMBER	202141019370
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APPLICANT NAME	1 . Dr N P G Bhavani,Saveetha School of Engineering 2 . Mr. T CH Anil Kumar,VFSTR (Deemed To Be University) 3 . Mr. Haqqani Arshad,Yanbu Industrial College 4 . Dr. Prathik Jain S,Dayananda Sagar college of Engineering 5 . Prof. Prerana Chaithra,Visveswaraya Technological University 6 . Dr. Shantharam Nayak,Visveswaraya Technological University 7 . Drakshaveni G,BMSITM 8 . Vasanthamma H,Proudhadevaraya Institute of Technology 9 . Shahida begum,PDIT 10 . Manjula S Devargaon,Proudhadevaraya Institute of Technology 11 . Dr. Kirankumar Y Bendigeri,Basaveshwar Engineering College (Autonomous) 12 . Dr. Santosh B. Kumbalavati,Basaveshwar Engineering College (Autonomous)
TITLE OF INVENTION	SMART WIRELESS CHARGING SYSTEM FOR IOT DEVICES IN HOME AUTOMATION
FIELD OF INVENTION	ELECTRICAL
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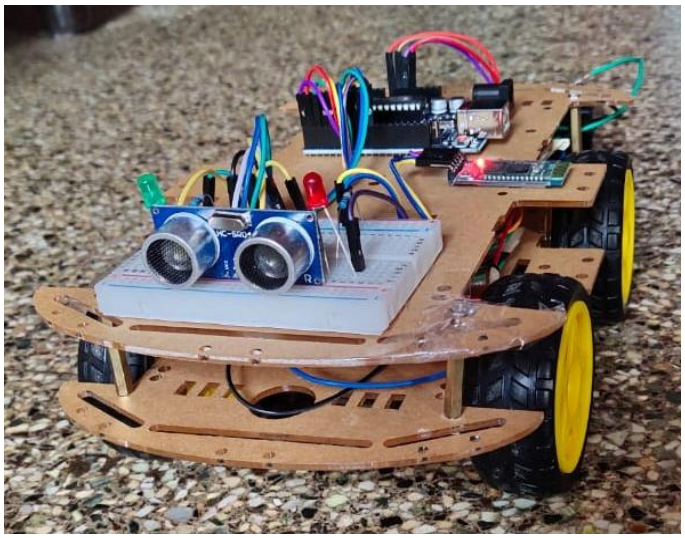
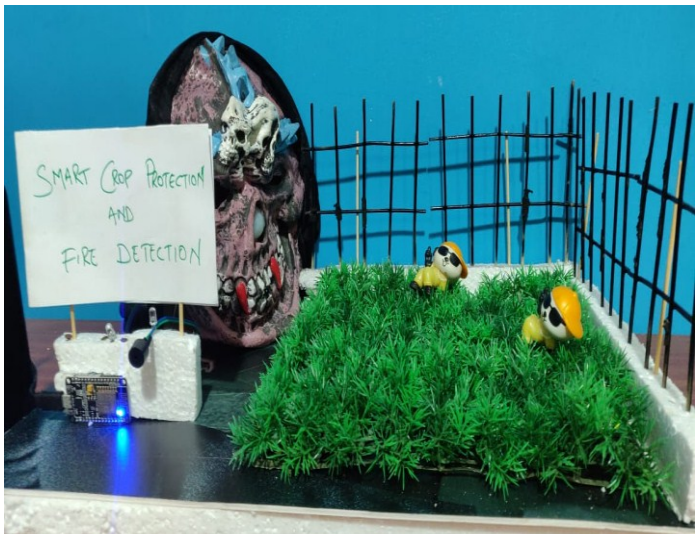
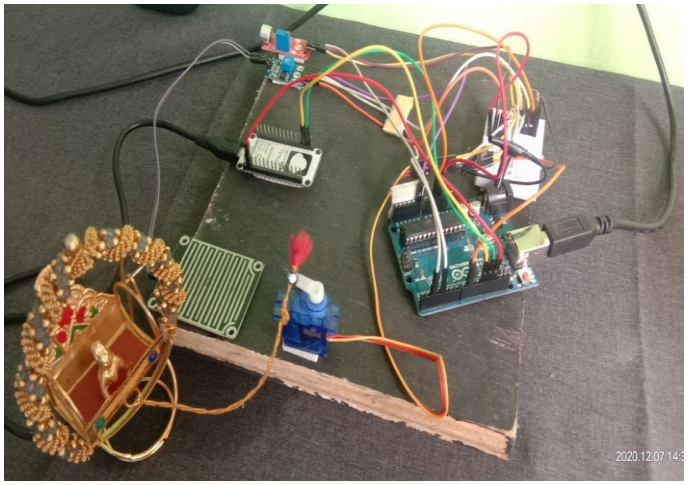


Smart Control Rover

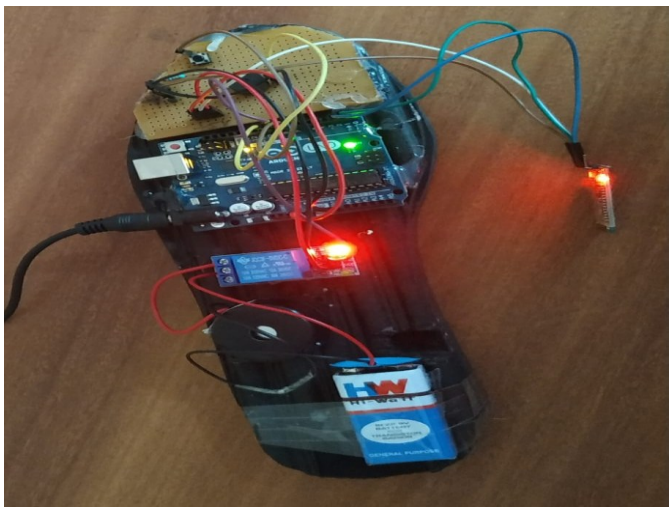


Smart Crop Protection

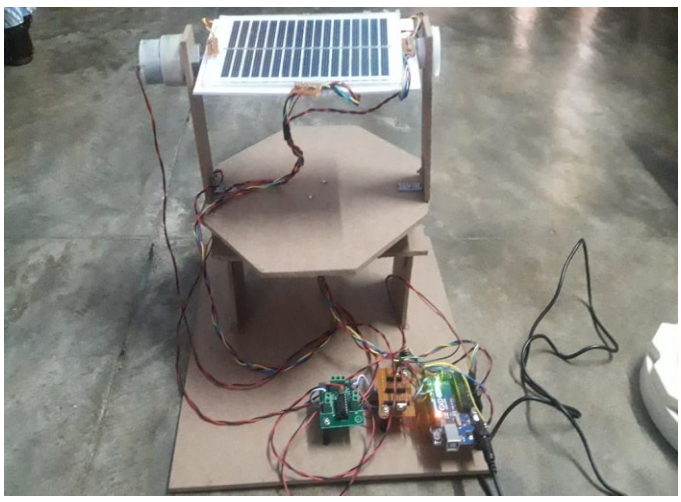
Smart Dustbin



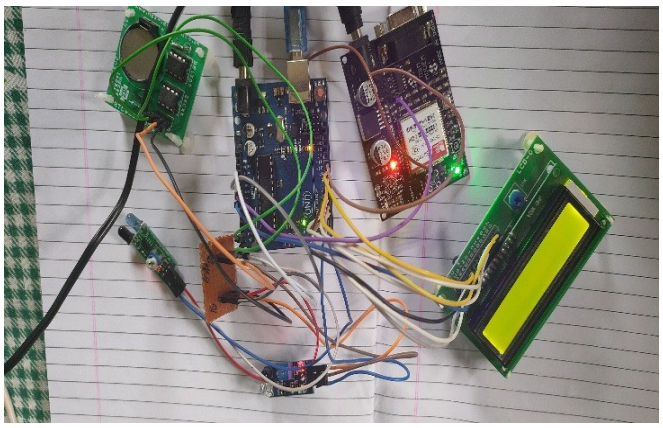
Smart Candle



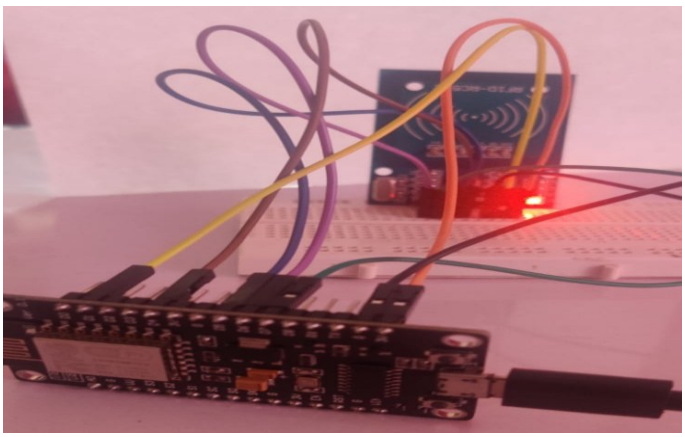
Smart Women Footwear



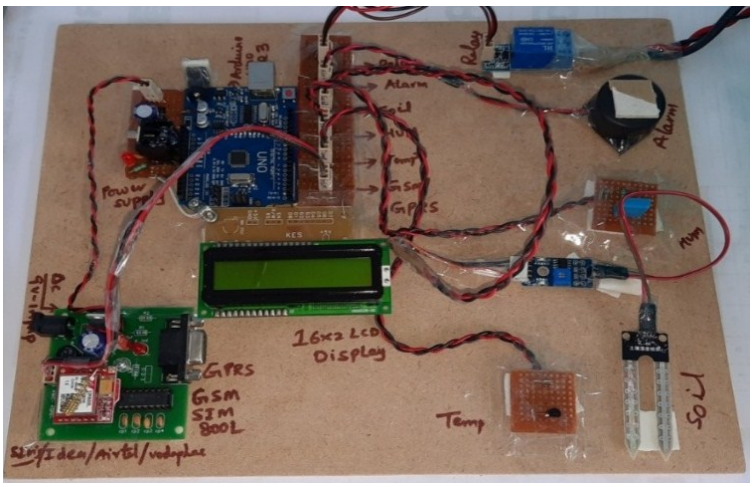
Solar Tracker Panel



Smart Refrigerator



Prediction of Temperature, Humidity and Moisture of an Agricultural Field Using IoT And Machine Learning



Hygienic Restroom

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