International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

IOT Based Automatic Accident Detection and Rescue Management System

[1] L.PUSHPA LATHA, [2]S.AKHIL, [3]M.ANURADHA, [4]P.SUBRAHMANYAM, [5]A.AKASH BABU

DEPT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

ABSTRACT

Road accidents are a major cause of injury and death worldwide, and delays in emergency response often lead to increased fatalities. This project proposes an **IoT-based Vehicle Accident Detection and Rescue System** designed to detect vehicular accidents in realtime and promptly alert emergency services, thereby reducing response time and potentially saving lives.

The system integrates sensors such as accelerometers, gyroscopes, and GPS modules to continuously monitor the vehicle's motion and location. Upon detecting an accident, the system automatically sends an alert message to predefined emergency contacts and nearby rescue services. This message includes the exact geographical location of the incident using GPS coordinates, ensuring rapid and accurate response.
Additionally, the system uses a microcontroller (such as Arduino or

Raspberry Pi) for data processing and a GSM module or internet connectivity to transmit the alert. A buzzer and display unit can also be integrated to provide real-time feedback to the vehicle's occupants. The proposed system is cost-effective, scalable, and can be implemented in various types of vehicles to enhance road safety and emergency response efficiency.

I.INTRODUCTION

1.1 Overview:

In recent years, the number of road accidents has significantly increased due to rapid urbanization, growing traffic density, and reckless driving behaviors. According to global statistics, a substantial percentage of fatalities in traffic accidents occur due to delayed emergency response or the inability to report the accident in time. This highlights the urgent need for a system that can automatically detect accidents and notify rescue teams immediately.

The **IoT-Based Vehicle Accident Detection and Rescue System** aims to address this problem by leveraging the power of the Internet of Things (IoT). IoT enables real-time data collection, communication, and processing between devices, making it an ideal solution for accident detection and response automation.

This system integrates multiple sensors such as accelerometers, gyroscopes, and GPS modules to monitor the vehicle's movement and orientation. In the event of a collision or rollover, the system detects the impact and immediately sends an alert message containing the vehicle's location coordinates to preconfigured emergency contacts and rescue services via GSM or internet-based communication.

By providing accurate location data and minimizing human dependency during emergencies, this system helps reduce the response time of medical services, potentially saving lives. The proposed system is costeffective, easy to implement, and can be customized for use in a wide range of vehicles—from private cars to commercial transport fleets.

This project not only contributes to road safety but also serves as a step toward developing smart transportation systems in the era of connected and autonomous vehicles.

1.2 Objective:

To detect the accident automatically without any human assistance.
To get the location of accident occurred to selected contacts.

II. Literature Survey:

Mr. S. Kailasam, Mr. Karthiga, Dr. Kartheeban, R.M. Priyadarshani, K Anithadevi[1] states that due to lack of attention, Drowsiness, and drunk driving are the major causes of road accidents, this paper proposes preparing a system to prevent these circumstances. The proposed system herein aims at preventing and controlling accidents by using a Night Vision Camera. This system monitors the driver's face when the car starts which mainly helps in observing continuously. It uses two functions: One to detect the eye blinking, second is for reading the blinking. Automatic driving and braking systems are also combined with a controlling system using python programming. Speed is automatically reduced until the driver becomes alert and returns to consciousness. The proposed system alerts the driver depending on his state, and makes sure that he is not drowsy. However, if the driver has a medical condition or blinks at an abnormal rate despite not being drowsy, the system will give a false alarm. In the worst case scenario, the driver happens to be in an accident, the system fails to detect the impact and contact the concerned authorities. Lastly the system would constantly consume power and drain the power supply since it monitors the driver continuously. Hence the outcome of not being able to identifying the actual accident scenario made us reject the idea of adding face recognition to our system as it would be costly, power- consuming and inefficient.

Rajvardhan Rish, Sofiya Yede, Keshav Kunal, Nutan V Bansode [2] proposed a system which states that the leading cause of deaths in road accidents is due to delay in medical help. This can be prevented by messaging the authorities and emergency contacts too on time. The system consists of GPS, GSM, accelerometer and Arduino. It alerts nearest hospital, police headquarters, family and friends during the time of mishap mainly by detecting changes in accelerometer. The system sends a google map link using GPS module and Arduino. The vehicle sets the flag bit of the Arduino UNO as an accident is identified until it detects abrupt deviation from the threshold values with the help of the measuring system detector. Throughout the accident, the device sets the effective sensitive value for measuring instrument detectors, unless a crash is observed. Once the accident or set bit is detected by the measuring instrument detector, Arduino activates the GSM module, which has a manually saved signal of the accident victim's emergency contact, and sends a pre-stored SMS to that contact. Though this system works fine, it lacks the detection of rare minor accidents with no casualties. So, it will eventually result in waste of resources and time in the case of minor accidents.

Furthermore, it uses Arduino UNO which is less powerful than the recent microcontrollers available in the market. Hence, we decided to only take the system architecture components which would be beneficial to our project in accuracy which are the following: GSM, GPS module, accelerometer.

Aarya D.S, Athulya C.K, Anas.P, Basil Kuriakose, Jerin Susan Joy, Leena Thomas [3] proposed a system that states the vehicle accidents are one of the most leading causes of fatality. The period between the occurrence of an accident and the dispatch of emergency medical services to the accident site is a critical factor in accident survival rates.

Accident detection and messaging system will be stationed in vehicle itself which will be helpful during the time of accident as hospital, police and emergency contact can be informed immediately.

The system is executed using GPS and GSM technology. A vibration sensor detects a collision using piezoelectric effect; which is the ability of certain materials to generate an electric charge when they are under mechanical stress. As soon as the collision is detected the GPS module locates the accident (latitude and longitude) and sends a message to the hospital

and the emergency contact using the GSM module. The ambulance arrives to the location which is tracked by the GPS module and hence the victim is treated as soon as possible reducing the help time. In case if there is a minor accident, the victim can press a switch (button) to prevent the emergency contacts from being alerted. This system comprises of Arduino, GPS, GSM and vibration sensor, which detects the accident and alerts the authorities immediately, it also combats false alarms by using a switch provided for the driver. However, the system does not provide the medical data and history of the victim and hence there could be a delay in the victim's treatment. We shall improvise our system in this scope.

Prashant Kapri, Shubham Patane, Arul Shalom [4] proposed a system which states that an accident might occur at an isolated area where humans are absent to report any mishap. Inbuilt hardware modules in luxury vehicles have recently been developed to detect and report accidents. Unfortunately, such devices are both costly and immobile. They proposed a system in which the accidents are detected with the help of in-built sensors in the smartphone and physical context information. The system comprises of the a server and the software.

IV.HARDWARE DESCRIPTION

4.1 ESP32 :

The ESP32 is a powerful and versatile microcontroller developed by Espressif Systems, combining robust processing power with built-in wireless connectivity. It is widely used in IoT, robotics, and embedded systems due to its extensive feature set, low power consumption, and affordability.

Typically, the ESP32 is embedded on device-specific printed circuit boards or offered as part of development kits that include a variety of GPIO pins and connectors, with configurations varying by model and manufacturer. The ESP32 was designed by Espressif Systems and is manufactured by TSMC using their 40 nm process.[2] It is a successor to the ESP8266 microcontroller.

Key Features:

1.Processor:Dual-core or single-core Tensilica Xtensa LX6 microprocessor.Clock speed: up to 240 MHz.

2.Wireless Connectivity: Wi-Fi (802.11 b/g/n) with support for station, access point, and Wi-Fi Direct modes.Bluetooth 4.2 and Bluetooth Low Energy (BLE).

4.2 MPU6050:

The MPU6050 is a popular 6-axis motion tracking device developed by InvenSense. It integrates a 3axis gyroscope and a 3-axis accelerometer on a single chip, making it highly useful for motion sensing and control applications. Additionally, the MPU6050 includes a Digital Motion Processor (DMP), which offloads complex motion processing tasks from the host microcontroller.

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers.

It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc.

If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output.

Key Features:

- **Gyroscope Range**: ±250, ±500, ±1000, ±2000 degrees per second (dps)
- **Accelerometer Range**: ±2g, ±4g, ±8g, ±16g
- **Communication**: I2C and SPI (depending on the variant)
- **Supply Voltage**: 3.3V or 5V

4.3 NEO-8M GPS Sensor :

The NEO-8M GPS module, developed by u-blox, is a high-performance, low-power Global Navigation Satellite System (GNSS) receiver. It is widely used in applications requiring precise location tracking, navigation, and time synchronization. It supports multiple GNSS systems, providing high accuracy and reliable positioning data.

The GY-NEO-8M module is an advanced GPS module based on uBlox m8N that **supports UART communication** protocol with active antenna. You can interface this module easily with a microcontroller. This module has a rechargeable battery and can also be connected directly to a computer using a USB to TTL converter.

NEO-8M can receive information and then calculate the geographical position with very high accuracy and fast speed. In addition to supporting BeiDou, Galileo, GLONASS, GPS / QZSS, the module has an internal memory to save settings. NEO-8M is **compatible with Arduino** and can be used in any project

4.4 SIM800C

The SIM800C is a quad-band GSM/GPRS module developed by SIMCom. It is widely used for cellular communication in IoT, embedded systems, and other wireless applications. The module is compact, lowpower, and versatile, supporting both data transmission and voice communication**.**

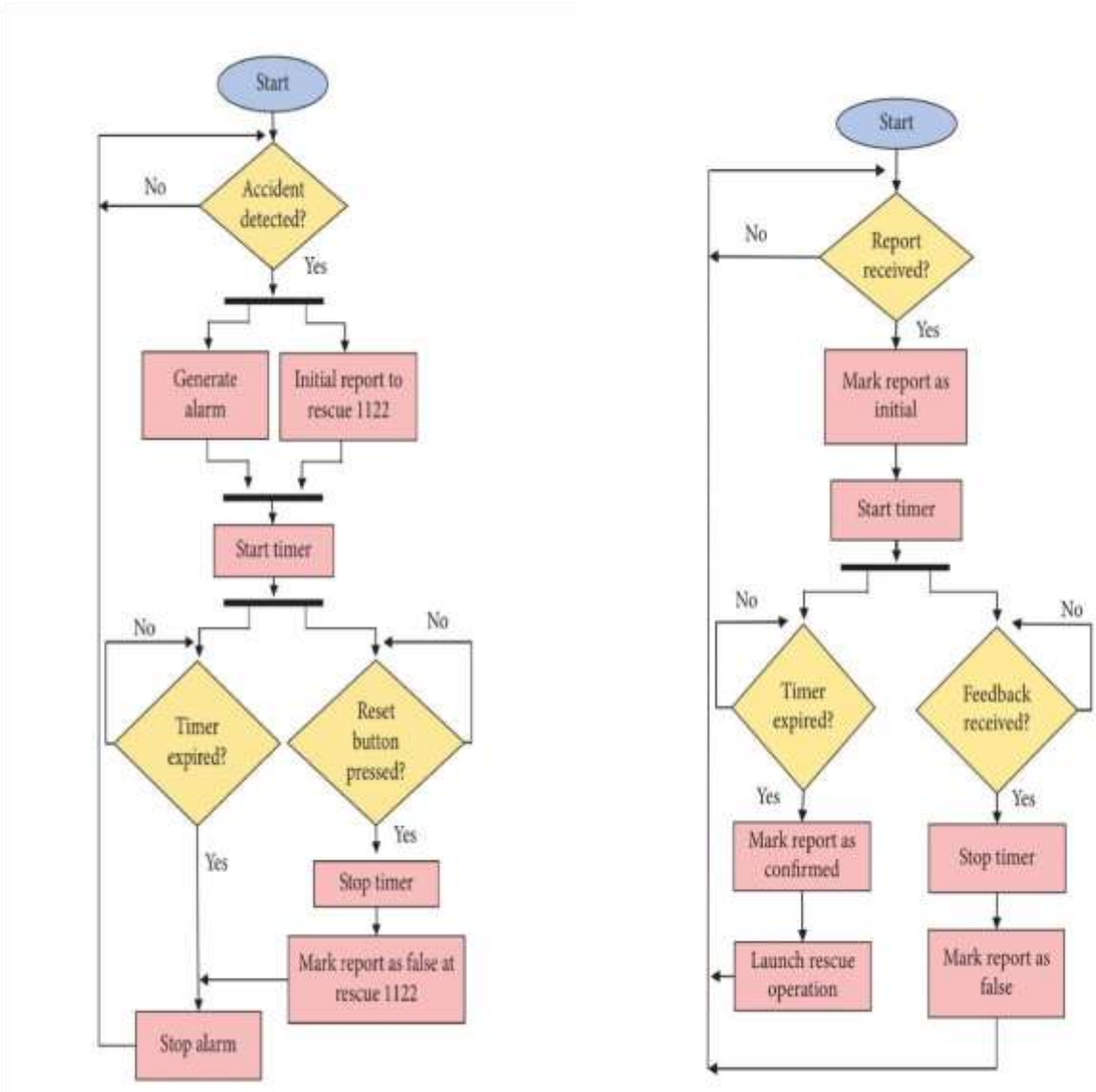
BUZZER

An audio signaling device like a beeper or buzzer may be electromechanical or
piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren. The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal

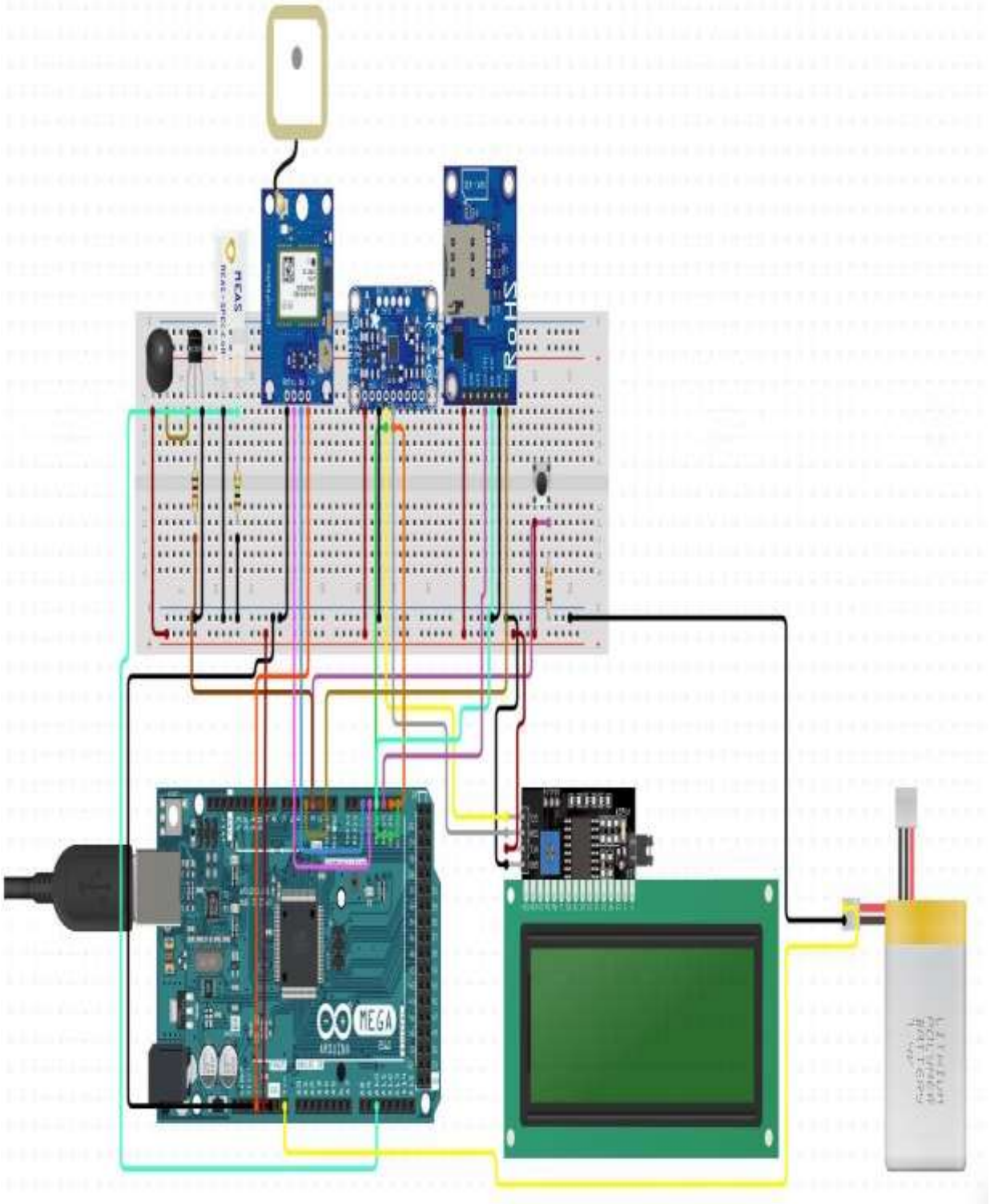
4.5 FLEX SENSOR

A **flex sensor** is a low-cost, easy-to-use variable resistor that is designed to measure the amount of deflection it experiences when bent. The sensor's resistance is lowest when it's flat on the surface, increases when we bend it slowly and reaches its maximum when it's at a 90-degree angle.
Flex sensors are popular because they are used in many different applications like game controllers, data gloves, motion trackers, and even in biomedical devices to register static and dynamic postures. So in today's project, we will learn all about flex sensors, how it works, and how you can interface them with an Arduino.

V. PROPOSED SYSTEM AND FLOWCHART



5.3 **Schematic diagram**



VII.CONCLUSION:

The development of an IoT-based vehicle accident detection and rescue system represents a significant advancement in intelligent transportation and road safety. By leveraging real-time data from sensors, GPS, and communication modules, the system can detect accidents instantly and alert emergency services without human intervention. This drastically reduces the response time, which is critical in saving lives and minimizing the impact of road accidents.

Such systems not only enhance personal vehicle safety but also contribute to broader public safety infrastructure by enabling faster emergency responses and more accurate data collection for traffic management. While the current implementations show great potential, future improvements involving AI integration, better connectivity (5G), and enhanced security will further increase system reliability and adoption.

In conclusion, IoT-based accident detection systems offer a practical, scalable, and life-saving solution to a global problem, making them an essential part of future smart city and intelligent transportation systems.

Future scope:

The future of IoT-based vehicle accident detection and rescue systems is promising, with vast potential for technological advancement and real-world application. One of the key areas of development lies in the integration of artificial intelligence and machine learning, which can enhance the system's ability to accurately detect and classify accidents while minimizing false alarms.

The adoption of edge computing will further improve response time by enabling local data processing, especially in areas with limited internet connectivity. With the emergence of 5G and other advanced network technologies, real-time communication between vehicles, infrastructure, and emergency services will become faster and more reliable.

Additionally, the implementation of blockchain can ensure secure and tamper-proof data transmission, which is crucial for accident verification and insurance claims. These systems can also be integrated with hospitals, ambulances, and local authorities to automate emergency responses.

On a larger scale, cloud-based platforms can collect and analyze accident data to identify high-risk areas and inform better traffic and infrastructure planning. Furthermore, extending these systems to two-wheelers through smart helmet integration and improving power efficiency using renewable energy sources like solar panels will increase their reach and sustainability. With growing governmental interest in road safety and smart city initiatives, such systems have the potential to become a standard safety feature in vehicles worldwide.

REFERENCES:

[1] DR.C.K.Gomathy , V.Geetha , S.Madhumitha , S.Sangeetha , R.Vishnupriya Article: A Secure With Efficient Data Transaction In Cloud Service, Published by International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5 Issue 4, March 2016, ISSN: 2278 – 1323.

[2] Dr.C.K.Gomathy,C K Hemalatha, Article: A Study On Employee Safety And Health Management International Research Journal Of Engineering And Technology (Irjet)- Volume: 08 Issue: 04 | Apr 2021.

[3] Dr.C K Gomathy, Article: A Study on the Effect of Digital Literacy and information Management, IAETSD Journal For Advanced Research In Applied Sciences, Volume 7 Issue 3, P.No-51-57, ISSN NO: 2279-543X,Mar/2018.

[4] Dr.C K Gomathy, Article: An Effective Innovation Technology In Enhancing Teaching And Learning Of Knowledge Using Ict Methods, International Journal Of Contemporary Research In Computer Science And Technology (Ijcrcst) EIssn: 2395-5325 Volume3, Issue 4,P.No-10-13, April '2017.

[5] Dr.C K Gomathy, Article: Supply chain-Impact of importance and Technology in

Software Release Management, International Journal of Scientific Research in Computer Science Engineering and Information Technology (IJSRCSEIT) Volume 3 | Issue 6 | ISSN : 24563307, P.No:1-4, July-2018.

[6] C K Gomathy and V Geetha. Article: A Real Time Analysis of Service based using Mobile Phone Controlled Vehicle using DTMF for Accident Prevention. International Journal of Computer Applications 138(2):11-13, March 2016. Published by Foundation of Computer Science (FCS), NY, USA,ISSN No: 0975-8887.

[7] C K Gomathy and V Geetha. Article: Evaluation on Ethernet based Passive Optical Network Service Enhancement through Splitting of Architecture. International Journal of Computer Applications 138(2):14-17, March 2016. Published by Foundation of Computer Science (FCS), NY, USA, ISSN No: 0975-8887.

[8] C.K.Gomathy and Dr.S.Rajalakshmi.(2014), "A Software Design Pattern for Bank Service Oriented Architecture", International Journal of Advanced Research in Computer Engineering and Technology(IJARCET), Volume 3,Issue IV, April 2014,P.No:1302-1306, ,ISSN:2278-1323.

[9] C. K. Gomathy and S. Rajalakshmi, "A software quality metric performance of professional management in service oriented architecture," Second International Conference on Current Trends in Engineering and Technology - ICCTET 2014, 2014, pp.

[10] Dr.C K Gomathy, V Geetha ,T N V Siddartha, M Sandeep , B Srinivasa Srujay Article: Web Service Composition In A Digitalized Health Care Environment For Effective Communications, Published by International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5 Issue 4, April 2016, ISSN: 2278 – 1323.

[11] Dr.C K Gomathy, V Geetha , T.Jayanthi, M.Bhargavi, P.Sai Haritha Article: A Medical Information Security Using Cryptosystem For Wireless Sensor Networks, International Journal Of Contemporary Research In Computer Science And Technology (Ijcrcst) E-Issn: 2395-5325 Volume3, Issue 4, P.No-1-5,April ’2017.

[12] V Geetha , Dr.C K Gomathy T.Jayanthi, R. Jayashree,, S. Indhumathi, E. Avinash,, Article: An Efficient Prediction Of Medical Diseases Using Pattern Mining In Data Exploration, International Journal Of Contemporary Research In Computer Science And Technology (Ijcrcst) E-Issn: 2395-5325 Volume3, Issue 4,P.No-1821,April ’2017.