

ACCIDENT INTIMATE SYSTEM FOR PUBLIC SAFETY BY USING LORA TECHNIQUE

A Project Report Phase-II

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in Electronics and Communication Engineering

by

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**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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BONA FIDE CERTIFICATE

This is to certify that this Final Year Project Report is the bonafide work of **Immadisetty Jaya Surya (39130167)** and **Inturi Bhanu Prathap Reddy (39130169)** who carried out the project entitled “**Accident Intimate System for Public Safety by using LORA Technique**” under my supervision from Jan 2023 to April 2023.

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ABSTRACT

Vehicle operations had expanded on a larger scale. The growing vehicle activity has also expanded the trade, and traffic deaths occur on a routine basis, culminating in the death or destruction of property due to insufficient emergency equipment. Design title is "Accident intimate system for public safety by using LORA fashion". Due to huge business, exigency vehicles like ambulances are not suitable to reach their destinations in time, performing into the loss of mortal lives. This operation will give an optimum result to this debit. Accident investigation and emergency ambulance transportation by a qualified ambulance service from the scene of the unexpected incident to the closest state hospital where emergency health care can be rendered are covered. These implemented an effective ambulance system for this purpose by combining piezo and vibration detectors with LoRa technology. The Fast-technological development and structure has enriched people's lives. Nevertheless, the technological approach has exacerbated road vulnerability, resulting in numerous traffic accidents that kill many people and destroy much property. Project will give the stylish result to this problem. An accelerometer can be used in a vehicle safety operation to identify dangerous driving. During and after an accident, it generally serves as a rollover or accident finder for the vehicle. An accelerometer's signal can stop a serious accident.

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LIST OF ABBREVIATIONS

FHSS	Frequency-Hopping Spread Spectrum
MCU	Micro Controller Unit
PAN	Personal Area Network
GPS	Global Positioning System
LORA	Long Range Radio
LCD	Liquid Crystal Display
TXD	Transmit Data
RXD	Receiver Data
PCB	Printed Circuit Board
GND	Ground
VCC	Common Collector Voltage
UART	Universal Asynchronous Receiver-Transmitter
USART	Universal Synchronous Asynchronous Receiver and Transmitter
IOT	Internet of Things
GSM	Global System for Mobile Communication

CHAPTER 1

INTRODUCTION

The improvement of a transportation framework has been the generative power for individuals to have the most noteworthy human progress above animals on the earth. Car has an incredible implication in everyday life. People use it to go to work place, stay in contact with loved ones, and convey products. In any case, it can likewise carry calamity to us and even can execute us through mishaps [1]. In 2009, 33,808 individuals kicked the bucket in vehicle car accidents just in USA. Speed is one of the most common and critical driving risk factors It influences the seriousness of an accident, yet additionally expands danger of being engaged with an accident. Regardless of the numerous efforts made by various administrative and non-legislative associations around the globe to address indiscreet driving, however, mishaps occur once in a while.Z

Nevertheless, if the crisis management were able to get the incident information in time, multiple lives could have been saved. An examination demonstrated that majority of sufferers in mishaps could have been counteracted distinctly if the crisis administrations could have reached at the spot of mishap at the correct time. All things considered, effective programmed mishap identification with a programmed warning to the crisis administration with the mishap area is the prime neccesity to spare the valuable human life [2]. The Worldwide Situating Framework (GPS) is a well-known innovation which was fashioned by American Branch of Protection for military use. Later on it was accessible for regular citizen use. It is used for wide scope of uses, for example, area, bearing, speed, timing, looking over, and coordination, traffic the executives, security and so forth.

These days, it has turned into a fundamental piece of a vehicle framework for following and route framework. It can give a precise time, area facilitates, and speeds. Then again, Worldwide Framework for Portable correspondences (GSM) is a computerized adaptable communiqué structure that is generally employed. Over 690 portable systems offer GSM benefits across 213 nations, and GSM speaks to 82.4% of all versatile associations around the world [3]. Other than the voice correspondence it additionally tenders Short Message Administration (SMS) and General parcel radio help (GPRS) to move information.

This paper put forward the use of a GPS recipient's ability to screen a vehicle's speed and identify a mishap based on the checked speed and launch the area and time of the mishap from a microcontroller's GPS information using the GSM system to the Alarm Administration Center [4]. The remainder of the paper is sorted out as pursues. The associated effort examines about the investigates identified with the mishap recognition framework, the Gear and Proposed Strategy segment depicts the necessary supplies and calculation to distinguish the mishap, and the Mishap Identification and Detailing Technique portrays the system to ascertain the speed to recognize mishaps and sending methodology lastly the paper is finished up.

The usage of motor vehicles is growing at a fastest rate as the population increases. Accidents and the death rate are highly increased due to the irregular management of traffic. Mostly, deaths due to accidents are happened due to the time lagging of medical assistance. Majorly it was happened in highways to rectify this problem have proposed a system [5]. The proposed system is used to increase life time of patient. This action is done by sending a reliable data of an accident to the hospital and medical assistance for immediate recovery.

The time efficiency of this system has faster than the before cases. The accident alert and detection system has been designed by android software. In this case, the heartbeat sensor and accelerometer are using to detect the accident and transmitted via Bluetooth module [6]. Automatic alerts system inbuilt a vehicle automatic system has been analyzed accident due to over speed and detected to GPS module and finally transmitted the detail to server by the aid of GSM module. Car accident detection and notify using smart phones. Car accident system detects through an accelerometer sensor and the analyze data are send through a GPS module and GSM module in Smart phones.

The communication is sent through the GSM module and the location of the accident is sensed with the help of the GPS module. The accident can be noticed exactly with the help of vibration sensor. This application offers the optimum solution to poor emergency facilities provided to the roads accidents in the most feasible way. The Internet of Things (IoT) is an organization of consistent computing gadgets, mechanical and digital machines, objects, animals or individuals that are given one kind of an identifiers and the volume to conversation data over a system without requiring human-to-human or human-to-PC communication [7]. IoT is a new idea that has progressed from the convergence of wireless technologies. Wireless

communication is the transmission of data or signal between two or more points that are not connected by an electrical conductor. In IoT devices furnished with Wi-Fi permit the machine-to-machine communication.

The automobile industry plays a very vital role in human life. Life is completely dependent on the automobile industry. In our country more than 1, 50,000 people are killed in accidents in a year. It is very difficult to protect a life of a person when he is met with an accident at the place where he cannot receive any help. In India 1 person dies for every four minutes due to accident [8]. The road safety is a major issue in India. Many lives are lost due to road accidents.

According to one survey conducted by the World Health Organization one lakh people died immediately at the location of the accident in 2013. The road fatality factor of any country can be reduced by contacting the nearest medical centres. The mechanism present in this paper concentrates mainly on the message transmission to the nearest help centres. GPS (Global Positioning System) is a device which is used for the location tracking. This device identifies the location through satellite communication. It takes the inputs at least from 3-4 satellites and identifies the locations [9]. The device uses the triangulation method to identify the locations and then the distance calculation is very easy. Bluetooth module also part of this system. Bluetooth device is used to for short distance communication. Traditional accident system is not concerned about the state of the driver. This proposal is takes the input from the driver. The input from the driver is the base for the further actions. The device uses radio frequency of 2.45 GHz for the communication. The conventional systems use GSM for the message transmission. This paper presents research work on implementation of LORA technology in the detection of accident and ensuring the driver's safety.

The extraordinary demand of automobiles has also enlarged the traffic threats and the road accidents. Life of the people is under high danger. This is for of the absence of best alternative facilities available in our country. An programmed alarm device for vehicle accidents is introduced in this paper. This proposal is a method which can notice coincidences in significantly less time and sends the basic information to first aid center within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had happened. This aware communication is sent to the rescue team in a short time, which will help in saving the valuable lives [11]. A Modification is also provided in order to terminate the sending of

a message in rare case where there is no casualty, this can save the precious time of the medical rescue team. When the accident occurs the focused message is sent automatically to the rescue team and to the police station.

This system uses LORA technology for transmitting the coordinates of the Accident-prone area to the nearest hospitals, so that the immediate help can be sent by that hospital to the area where the accident has taken place. LORA is a device based on an exclusive spread spectrum modulation technique developed by Semtech. Lora Module is an integration of Chirp Spread Spectrum and Forward Error Correction. The operating frequency of Lora Devices is between 137MHz to 1020 MHz. As a result, the devices can operate in both licensed and also in license free bands. Lora follows star topology [12]. The star topology is a topology in which n-number of s are connected to a single server. Based on the server availability it responds to the client. The Lora module proposed in this system is LORASX1278 Ra02 which operates at 433MHz. The main purpose of this paper is to propose a methodology that can solve the present problem. The growth of the human population is becoming a big thing in our world today [12].

About 1.2 billion vehicles are now on the world's roads. Peoples are facing many major issues in daily life. Vehicles accident is one among them. There are many accident prevention systems such as Airbag, Autonomous braking system, anti-lock braking system, etc. Even though accidents are happening and people are dying day by day. When an accident has happened the first one hour is called "Golden Hour" for the rescue operation and treatment purpose, in that small amount of time, This can save someone's life. But many times, the accident victims cannot communicate with the rescue team or ambulance if they injured seriously [14].

In proposed model attempted to develop a vehicle accident detection and alert system which will detect the accidents and inform the nearest hospital, Police station and some assigned contacts along with the location of the accident to rescue the accident victims immediately. This helps the rescue team to find the accident victims immediately. The use GPS (Global Positioning System) module to detect the accident location [16]. GSM (Global System for Mobile communication) helps to make a call or to send messages to the rescue team [15].

Accident alert systems have gained significant attention in recent years due to the increasing number of road accidents worldwide. One of the promising technologies used to develop such systems is the Long Range (LoRa) Module. LoRa technology

provides long-range communication, low power consumption, and low cost. In this literature survey, review the recent research studies that focus on developing accident alert systems using LoRa modules [16].

Long Range (LoRa) Module technology has gained significant attention in recent years due to its low power consumption, long-range communication, and low cost. In this literature survey, review the recent research studies and projects that focus on using LoRa modules in various applications. The LoRa technology has been applied in several areas, such as water management, air quality monitoring, parking, waste management, agriculture, and many others. In this literature survey, review recent research studies and projects that utilize LoRa modules in various applications. The aim of this survey is to highlight the potential of LoRa technology and its impact on improving efficiency and effectiveness in different fields. The reviewed studies and projects demonstrate the versatility of LoRa modules and how they can be used to create innovative solutions to real-world problems [18].

An accident alert system is a critical application that can save lives by alerting emergency services in the event of an accident. Traditional accident alert systems rely on mobile networks or GPS, which can be unreliable in remote or low signal areas. Long Range (LoRa) module technology offers a more reliable solution by providing long-range communication with low power consumption. The LoRa module is ideal for accident alert systems as it can transmit data over long distances, making it suitable for remote and low signal areas. In this literature survey, review recent research studies and projects that utilize LoRa modules for accident alert systems. The aim of this survey is to highlight the potential of LoRa technology in improving the efficiency and effectiveness of accident alert systems. The reviewed studies and projects demonstrate the potential of LoRa modules in creating innovative solutions to real-world problems, such as improving response times and reducing the number of fatalities in accidents [20].

CHAPTER 2

LITERATURE SURVEY

Shanmugasundaram and Faizal Ahmed et.al., [44] done abstraction Accident's being the regular topic in this automobile powered world; road safety remains the major concern. Most of the accidents are not aided as fast as possible, because of passing late information about the accident to the help centers. To address this have developed a system in order to notify each and every helping hand to save an individual's life during accident and in tough situations. So, taking these situations into consideration should have used arduino interfaced along with GSM (SIM 300) and GPS (PMB-648), which passes messages to a helpline and reducing the burden of waiting in line at the toll plaza by developing auto toll pay system. This system also uses a speed sensor which sends a notification, if a vehicle is caught over speeding, may 2014.

Mr. S. Kailasam and K. Anitha devi et.al., [45] focused on this era of rapid growth of vehicles, the ratio of road accident increases day by day. Nowadays, Traffic incidents are persistent problems in both developed and developing countries which result in huge loss of life and property. No one in this world is ready to gaze what's happening around them. Nobody cares even when an accident occurs. This paper provides an innovative solution by developing an Accident Alert Message System using an Android Smartphone Application that can be used from the accident zone. The application uses GPS technology for location mapping and sends an alert and notification of an accident. The generated accident alert message is endorsed by the nearby registered users who also witness the accident to ensure the increased reputation of the message. Based on the endorsement of the message, the system will instantly transmit the location of the accident to the nearby emergency services. In this case, users usually lack the enthusiasm to generate or endorse alert messages because they might fear that their privacy will be breached. At the same time, users do not benefit from generating or endorsing alert messages which also makes them lack the enthusiasm or motivation to respond to messages. In order to provide a solution to resolve these issues, this paper presents a novel privacy-preserving Blockchain - Based Incentive Mechanism for Accident Alert Message System, April 2011.

NaziaParveen and Aleem Ali et.al., [14] Presented the concept of detecting car accidents is not fresh and the automobile industries have made tremendous progress in optimizing the technology. This paper is an try and make a contribution in that location of generation. Here peoples are seeking to stumble on accident through the Accelerometer as it facilitates in identifying the vicinity and if the values of x, y and z parameters are extra than the defined values than it's going to set situation to proper and the code written for initiating the intimation and SMS alert gets executed. With this method the accident location can be detected easily and the information of the accident location can be sent via the GPS to the emergency offerings for assistance, June 2009.

G. Suriya Praba Devi and J.C. Miraclin Joyce Pamila et.al., [7] conducted many surveys on Accidents are becoming very common in nowadays. It's causes due to lack of attention of driver while driving. This makes heavy losses and lot of death. These accidents are harm to environment. This paper is describing a module for alert for driver using simple monitoring system. In the analysis, it exposes more than 25% of the accident are caused due to the driver drowsiness. This assures that drowsiness is more harm than drunk and driving. Detection of driver drowsiness is done with simple camera system. This starts the monitoring now of car started and up to end. This monitoring system related to the speed control system which was like automatic speed controller. This paper expresses the techniques to monitor driver safety by evaluating information associated to the visual features of the driver. This will help in the accident alerting. Thus, speed reducing is not complicated and reduced speed will have intimated to the driver. Finally, the accidents happened due to drowsiness of the driver that is reduced by proposed method, Nov 2013.

Hyun Seob OH and Dong Geun Jeong et.al., [25] developed the Open Connectivity Foundation (OCF) is one of the most powerful IoT standard organizations. The OCF has developed not only its own standard but also an open source software framework called IoTivity for efficient implementation of IoT systems. The OCF has made great efforts to develop the bridging techniques for supporting inter-operability with existing non-OCF IoT systems. In this paper, they develop the OCF-to-UWB (O2U) and OCF-to-LoRa (O2L) bridging techniques that can promote the release of diverse services related to UWB-based short-range and LoRaWAN-based long-range communications (e.g., indoor localization, sensor-based metering).

They also suggest a simple and cost-effective bridging technique between different non-OCF IoT systems, which complies with the OCF standard. These O2U and O2L bridging implementation is checked for consistency with the OCF standard using the OCF conformance test tool. Three example use-cases are implemented for demonstrating the usability of the developed O2U and O2L bridges, which are proximity-based Zigbee device control combined with UWB, LoRa-based metering, and LoRaWAN as back of UWB system. work can provide a useful guideline to the development of new bridging techniques for other non-OCF IoT systems, Jan 2014.

David Asianin and Diego Antolin et.al., [17] paper presents a wireless traffic flow detection system, mainly focused on conditions in which the traffic flow is slow or stopped, which increases the risk of highway accidents. To achieve this goal, a Low Power Wide Area Network (LPWAN) based on LoRa called Short LoRa has been developed. This LoRa sub-network complies with the European Telecommunications Standards Institute (ETSI) harmonized standard for its compatibility in Europe countries. In addition, the development of the devices has allowed them to also work on a LoRaWAN network. The introduced development has been compared to a reference system mounted with laser barriers that provided a high accurate comparison. Field tests of the system have been carried out and the data obtained in the measurement has been analysed with two different methods, and both of them were valid for the application. The results can determine vehicle speed with adequate precision at low speeds. The attenuating behaviour of the communication signal is also analysed through the Radio Signal Strength Indicator (RSSI), April 2019.

Mrs. S. Sandhya and Nirmala M5 et.al., [18] have done a fire detection and alert system based on IOT. Here a specific environment is monitored 24x7 and the user is alerted in case of any fatal situation. This can be implemented using a NodeMCU and a number of sensors for detecting different physical parameters that can go high during a fire related accident. NodeMCU is an IOT based controller board with an on board WIFI module called ESP8266. Here two parameters are being monitored continuously temperature and presence of smoke. For sensing temperature LM35 temperature sensor is used. For sensing presence of smoke a gas sensor called MQ6 is used, this sensor can detect and measure any carbon based gas smoke produces CO₂ this makes it possible to detect smoke using MQ6. Also a PIR sensor is used for detecting presence of any human. Both gas and temperature sensor are

analog so cannot be connected to a digital pin but an analog pin that is input to an ADC (analog to digital converter). Also forest area can be monitored through a camera using this camera fire can be detected using image processing. For this they can run a python program from PC and using opencv library fire can be detected. This can be used as a contingency system if the sensors malfunction. If any fire is detected then a water sprinkler will be turned on to prevent fire also an alert is sent to concerned personal for further, March 2016.

Arabboev Mukhriddin and Shubhana.G et.al., [31] conducted a survey on Natural disasters in recent years have shown that people are vulnerable to natural disasters and it is very difficult to protect people from natural disasters. Every year, tens of thousands of people die in various disasters and other similar emergencies. The need for the use of modern technologies and devices in emergencies is growing day by day. A variety of modern devices, techniques, and methods are used in emergencies and post disaster search and rescue operations. Finding a survivor is a very important issue in post-disaster operations. People's vital signs are very important in determining people's lives. Heart rate (HR), blood pressure (BP), respiratory rate (respiratory rate), and body temperature (BT) are four important vital signs that need to be measured regularly. Various technologies are used to transmit data over long distances from sensors that measure human vital signs. One such technology is Long Range (LoRa). Long-distance transmission of human vital signs data based on Long Range (LoRa) allows monitoring a person's location in emergencies as well as their health status. In they develop a health monitoring and emergency alarm device (beeper) based on Long Range (LoRa) that can monitor human vital signs, generate an emergency alarm when human health status is deteriorating and also transmit human vital signs data to web server/ mobile app, Nov 2016.

G. Liang and Yu-Lu et.al., [30] has proposed automatic traffic accident detection using Support Vector Machine (SVM) changed by Ant Colony Algorithm (ACA); as a result, to predict traffic accidents. Here, the Internet of Things (IoT) platform is castoff as an overall framework of Intelligent Transportation. They used RFID Technology and wireless communication. They bearing tests on real-life movement records to guess seven forms of traffic accidents: Vehicle to Vehicle accident, Vehicle to Publics accident, Vehicle – On Blaze, Stream of traffic, Path engaged through crowd, Non-standard Road traffic Setup, and poor path situation.

They saw that SVM reformed by ACA could complete faster-merging speed; also, the Mean Square Error (MSE) is worse as related to the simple SVM. The use of the Ant Colony Algorithm was efficient, May 2017.

V. Ravindra and Jathin.N et.al., [38]. used Image Handling and Machine Learning tackles to sense broken vehicles from the static image received from the observation cameras fixed in streets and roads to detect road accidents automatically. Here three stages are joined into a single frame to see accidents from the static image, which uses five Support Vector Machine (SVM) taught the HOG and GLCM geographics. The first stage includes proposing an innovative method for automatic road accident finding. The second stage consists of an overseen learning technique that senses scratched vehicles as of standing imageries, a period of objects that no observed so far with Machine Vision Methods. The last stage contains two free datasets of broken car DCD-1(Damaged Cars Dataset-1) and DCD-2 (Damaged Cars Dataset-2), which modification built on the distance captured the quality of images. The system's correctness is 82 % for Damaged Cars Dataset-1 caught at about 2 meters using good excellence, and 64% for Damaged Cars Dataset-2, caught next 20 meters through common feature. The finding of broken cars using the Machine Vision Technique was achieved successfully. However, this project's primary limitation is that it doesn't identify damaged cars damaged to an extent, July 2017.

Rohith Vihar. S and Shivangi Sharma et.al., [37] have proposed the IoT-based model to detect car accidents and notify immediately. They used to integrate intelligent sensors with microcontrollers inside the car that can prompt the accident. The other modules are combined with the system to achieve the accidents' site and send them to the recorded number and nearby health center to report them about the accident to receive immediately. It is a wireless mode of communication in which GSM and GPS are cast-off for sending messages, Feb 2013.

Varsha Goud and Varun Singh.V et.al., [19] has proposed a model to detect accidents and sends the alert message to the traffic control room and a rescue squad using an ARM controller and a MEMS (Micro electro-mechanical system), Vibration measuring device, GPS, GSM. They used a Switch for terminating the alert message in a minor calamity or if there is no serious risk to anybody's life. They used GPS Technology to determine the location and GSM Technology for wireless

communication. They say that only accidents detect and send alert messages automatically in another approach, but in this approach, not only accidents are detecting and sending alert messages automatically rather than terminating alert messages by a switch, Oct 2014.

Bhandari Prachi and G. perag et.al., [29] have proposed a model to detect accident spots, control the traffic lights, reach the hospital in time using a Sensor, GPS, GSM as the solution. They used a Sensor to sense the accident. The GPS locates the accident spot location, and GSM sends the accident's information to the central server. They used ADXL-335 (Accelerometer); an Accelerometer warns the motorist by rotating on the buzzer every time the position deviates from the normal for avoiding accidents. They saw good things about this approach that all the modules work after the accident, but in this approach, Accelerometer alerts the driver before the accident to avoid the accidents, Nov 2015.

Ahmar Azam and Kshitij Kumar et.al., [8] Singh have proposed Road Accident Prevention Using Alcohol Detector and Accelerometer Module using an alcohol sensor with Arduino Nano. A Global System for Mobile Communications (GSM) modem is used for Short Message Service (SMS) notification. GPS (Global Positioning System) is used for location along with an LCD (Liquid Crystal Display) display and also a CPU (Central Processing Unit) fan to demonstrate as a vehicle motor. In this approach, an Alcohol reading device is suitable for reading alcohol absorption on mouth smell. It is highly sensitive to alcohol and shows minute behavioural changes towards benzene. The alcohol reading device reads an equivalent resistive output supported alcohol absorption. GSM module is used for communication between the accident detector and alert system and mobile phone. GPS locate and track the accident location and sends microwave signals to the satellites. They saw that in other approaches, the Authors focused mainly on vehicle speed. Still, in this approach, Ahmar Azam and Kshitij Kumar Singh did not focus only on vehicle speed rather than detect drink alcohol by the driver, Dec 2016.

Yong-Kul Ki and Dong-Young Lee et.al., [27] have proposed a model. In this model, they illustrated a two-part strategy as a result of road accident recording and reporting. The first part takes the data and detects and tracks vehicles using grey-scale image subtraction. The second section uses feature abstraction to regulate the

tracked cars speeding up, location, field, and Path. The method identifies abnormalities in each of these limitations and, using the mutual result, decides if an accident has happened based on predefined onsets. However, their second part of the method is a reliable way of certifying correct accident findings, Jan 2017.

Fizzah Bhatti and Virajan.K et.al., [10] have proposed an Intelligent Transportation model for Smart City Atmospheres. IoT-enabled ITS (Intelligent Transportation Systems) is achieving necessary attention in academic works and production and is understood to enhance intelligent cities' road safety. It employs information and communication technologies (ICT) to ensure that rescue operations are successful and timely. It uses ICT for well-organized and quick rescue operations. In this model, used car database and hospital database for collecting information. accident detection components are (i) smartphone accelerometer sensor, (ii) GPS technology, (iii) Pressure sensor, and (iv) Smartphone microphone, Feb 2015.

Nicky Kattukkaran and Arun George et.al., [26] have proposed a model for emergency medical assistance. They have an accident warning system and a smartphone in this model. The accident monitoring system will track the bike daily to see whether it is in a normal driving position or dropped. When a bike crash is detected, the driver's body condition and pulse speed are assessed. If an abnormality is discovered, the Android application connected to the accident detection device will notify the nearest emergency center via Bluetooth. In other approaches, they saw the system send alert messages only to the nearest hospital, March 2016.

Nejdet Dogru and Abdul Hamil et.al., [13] Subasi have proposed a model using Machine Learning Methods. In this model, they used Vehicular Ad Hoc Networks (VANETs) for communicating V2V (vehicle -to-vehicle) or V2R (vehicle-toRoadside) manner. It's used as a cellular network for identify the vehicle's location and SUMO traffic trainer to enable mobility of cars, April 2012.

Elie Nasr, Elie Kfoury, and David Khoury et.al., [35] have proposed a public safety agency model using IoT and GPS. The public safety agency, crash, rescue, IoT, sensor, and geographical coordinates are all used in this method. This paper aims to locate the accident and alert the appropriate public safety agency. It detects the collision using a shock sensor or airbag deployment. The downside of this strategy is

that it only alerts drivers of vehicles equipped with airbags and shock sensors in an accident. Because of the high false-positive rate, May 2013.

Hector Jalil and David Scoresese et.al., [2] have proposed an approach. They concentrated on the interaction of an onboard device in a vehicular network in this approach. For both fog and cloud computing, they have proposed an SOS (a series of systems where each system acts as a component) network. In cloud and fog computing, the researchers focused on interoperability, availability, time, and interoperability. This method's limitations, the authors have suggested a network and compared it to some current networks in this approach, June 2019.

Nimish Agarwal and Mohan.K et.al., [1] have proposed a Deep Learning model. Since GPS devices take time to represent the impacts of a collision on the road, this model relied on cameras for instant detection. Two methods were used in this model. On the traffic dataset, they first applied the learning approach to finetune retransferred state-of-the-art deep learning models. Second, it used the Bing image search API (web-crawling) to build a custom dataset to improve the system's usability. For image classification, different datasets are needed. Accident, Crash, Concentrated Traffic, and Sparse Traffic are the other datasets, July 2020.

Md. Azizur Rahman and Aamir.Z et.al., [40] have proposed this study proposes a smart accident detection and alert system that utilizes the LoRa module. The proposed system is designed to detect vehicle accidents using sensors placed inside the vehicle. The sensors detect the acceleration of the vehicle and send the data to the LoRa module. The LoRa module then transmits the data to a remote server using a LoRa gateway. The server then sends an alert message to the emergency services and the driver's family members, Aug 2020.

Harsha Vardhini and Bhanuesh.ch et.al., [37] have proposed this study presents an intelligent accident detection and reporting system that uses the LoRa module. The proposed system consists of an accelerometer, a LoRa module, and a microcontroller. The accelerometer is used to detect the acceleration of the vehicle, and the microcontroller processes the data and sends it to the LoRa module. The LoRa module transmits the data to a remote server, which sends an alert message to the emergency services, Sep 2021.

D.I. Daramola and K.N.S. Sunil et.al., [22] have proposed this study proposes an intelligent vehicle accident detection and reporting system that uses the LoRa module. The proposed system is designed to detect vehicle accidents using a combination of sensors, including an accelerometer and a GPS module. The data from the sensors is processed by a microcontroller, which sends the data to the LoRa module. The LoRa module then transmits the data to a remote server using a LoRa gateway. The server sends an alert message to the emergency services and the driver's family members, Sep 2020.

Prashanth and Srinivas D et.al., [34] have proposed this study presents a smart water management system that utilizes the LoRa module. The proposed system is designed to monitor and control the water level in tanks and wells. The LoRa module is used to transmit the data from the water level sensors to a remote server. The server processes the data and sends control signals to the motor to turn on and off based on the water level in the tanks, Oct 2019.

Li and Xu-Yu et.al., [16] have proposed this study proposes a real-time air quality monitoring system that uses the LoRa module. The proposed system consists of multiple air quality sensors, a LoRa module, and a microcontroller. The sensors measure the concentration of air pollutants, and the microcontroller processes the data and sends it to the LoRa module. The LoRa module transmits the data to a remote server, which displays the real-time air quality data on a website, Nov 2018

Xu and Raneil.D et.al., [23] have proposed this study presents a smart parking system that utilizes the LoRa module. The proposed system is designed to monitor the occupancy status of parking spaces in a parking lot. The LoRa module is used to transmit the data from the parking sensors to a remote server. The server processes the data and displays the real-time parking occupancy status on a mobile application.

Kumar and Pavan.V et.al., [41] have introduced this study proposes a smart waste management system that uses the LoRa module. The proposed system consists of multiple waste bins equipped with sensors that detect the level of waste in the bins. The LoRa module is used to transmit the data from the waste bin sensors to a remote server. The server processes the data and sends alerts to the waste management staff when the bins need to be emptied, July 2017.

Ayyanar and Kathiresan et.al., [33] have this study presents a real-time accident alert system that utilizes the LoRa module. The proposed system consists of an accelerometer, a LoRa module, and a microcontroller. The accelerometer measures the sudden changes in acceleration, which are indicative of an accident. The microcontroller processes the data and sends an alert message to the LoRa module. The LoRa module transmits the alert message to a remote server, which sends notifications to emergency services, Jan 2017.

Mandal and Karet et.al., [25] have this study propose a smart helmet for an accident alert system that uses the LoRa module, the smart helmet is equipped with sensors that detect the sudden changes in acceleration, indicating an accident. The LoRa module is used to transmit the alert message from the helmet to a remote server. The server processes the data and sends notifications to emergency service, Apr 2021.

Ravi and Srikar.R et.al., [7] have this study presents a smart vehicle accident alert system that utilizes the LoRa module. The proposed system consists of an accelerometer, a GPS module, and a LoRa module. The accelerometer measures the sudden changes in acceleration, indicating an accident. The GPS module provides the location information of the accident. The LoRa module is used to transmit the alert message to a remote server, which sends notifications to emergency service, Aug 2015.

Kshirsagar and Garge et.al., [19] have this study proposes a low-cost accident alert system for two-wheeler vehicles that uses the LoRa module. The proposed system consists of an accelerometer, a microcontroller, and a LoRa module. The accelerometer measures the sudden changes in acceleration, indicating an accident. The microcontroller processes the data and sends the alert message to the LoRa module. The LoRa module transmits the alert message to a remote server, which sends notifications to emergency services, Feb 2018.

Ghosh and Vimal.p et.al., [8] have this study presents a smart pedestrian accident alert system that utilizes the LoRa module. The proposed system consists of an accelerometer, a LoRa module, and a microcontroller. The accelerometer measures the sudden changes in acceleration, indicating an accident. The microcontroller processes the data and sends the alert message to the LoRa module.

The LoRa module transmits the alert message to a remote server, which sends notifications to emergency services, Nov 2021.

2.1 Inferences from Literature Survey

The LORA Accident alert system is a relatively new technology designed to improve the safety of road users by detecting accidents and alerting emergency services. A literature survey of this system may include a range of inferences based on the available research.

The effectiveness of LORA: A literature survey may infer the effectiveness of the LORA system based on previous research. For instance, studies may have evaluated the accuracy of the system in detecting accidents and alerting emergency services. Inferences can be drawn based on the results of these studies to determine the reliability and efficiency of the system.

The potential impact of LORA: Another inference that can be drawn from a literature survey of the LORA system is its potential impact on road safety. Research may have investigated the number of accidents that could be prevented through the implementation of the LORA system, which could provide insights into the benefits of the technology.

The limitations of LORA: A literature survey may also highlight the limitations of the LORA system. For example, studies may have identified certain scenarios or conditions where the system may not function optimally or may not be suitable. Inferences based on such research can provide valuable insights into the practical applications of the LORA system.

Future directions for LORA research: Based on a literature survey of the LORA system, it may be possible to identify gaps in current research and potential future directions for investigation. For example, studies may have focused on the technical aspects of the system, and there may be a need for research into the social and economic factors that could impact the implementation of the LORA system.

Overall, a literature survey of the LORA Accident alert system can provide valuable insights into the technology's effectiveness, potential impact, limitations, and future directions for research

2.2 Open Problems in Existing System

There are several open problems in existing accident alert systems that can be improved upon:

1. The existing accident alert systems may not be entirely reliable in some situations. For instance, they may not always be able to send alerts to emergency responders due to weak signal strength or other communication issues.
2. The accuracy of the system in detecting accidents is another issue that needs improvement. False alarms can create panic and increase emergency response time, whereas failing to detect an actual accident could have serious consequences.
3. The existing accident alert systems may not be integrated with other emergency response systems. For example, they may not be able to communicate with 911 dispatch centre's or other emergency response teams.
4. Accident alert systems rely on battery power, and their battery life may be limited. This could be problematic if an accident occurs in a remote location, and the battery runs out before an alert is sent.
5. As with any IoT device, the accident alert system is vulnerable to cyber threats, and ensuring data privacy and security is critical.
6. The existing accident alert systems may not be scalable, making it difficult to deploy them in large-scale operations.
7. Accident alert systems may be costly to implement, and the cost could be a barrier to adoption, especially in developing countries.

These are some of the open problems in the existing accident alert systems that require further research and development.

CHAPTER 3

AIM AND SCOPE OF PRESENT INVESTIGATION

3.1 Aim of the Existing Methodology

The main aim of this project is to prevent casualties which happen due to lack of medical assistance in time. Certainly, if the accident happens due to other cases, the used electronic devices will be able to provide the spontaneous message and exact location to police and ambulance in order to recover victims. Avoiding casualties caused by road accidents is the main goal of this paper, with the help of Accelerometer and GPS present in the mobile phones. Based on the data collected from these sensors, which are present in most mobile phones, the location of the accident is sent at the same time of the accident to the friends and relatives which the user allowed and stored, and also to the rescue and emergency services

3.2 Existing Methodology System

The principle of detection and tracking of accident. The system is on and initialization. If vehicle is normal, no information sends to rescue team. Whenever accident occurred, the vehicle changes its direction randomly and vibrates with high frequency. The MEMS sensor detects the happening with vehicle. The controller gets the input from sensor and send the accident alert information to rescue team and loved one and placement of the accident place through WIFI and GPS. It can facilitate connectivity to the closest hospital and supply medical assistance through IOT technology. Whenever accident is occurred then this device sends messages to given mobile number, nearby Police station and Hospital. It will obtain the exact location of the vehicle live.

Drawbacks of the Existing System

The live system can't work if any of the following occur at the time of the crash:

1. Automatic or phone is disconnected or damaged.
2. No GPS signal at the time of the crash.
3. Insufficient cellular signal to upload crash details.

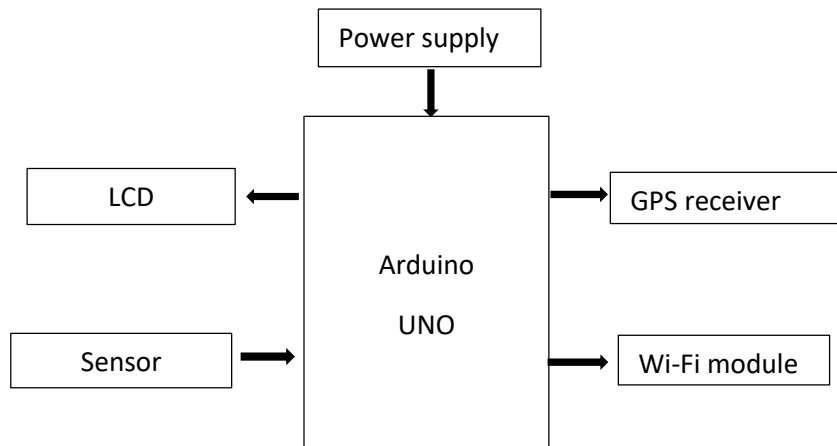


Fig.3.1: Block Diagram of Accident Alert System by Using Wifi Module

The above figure 3.1 describes about a accident alert system using a WiFi module can be designed to detect and report accidents using the WiFi network. The system consists of an accelerometer and a WiFi module, which is used to send accident information to a designated phone number or email address. When an accident occurs, the accelerometer detects the impact and triggers the WiFi module to send a signal to the designated recipient. The WiFi module can be connected to a smartphone or a computer using a WiFi network to send the alert. The accident alert system using a WiFi module can also be designed to include GPS capabilities, allowing the location of the accident to be determined and included in the alert. This feature can be particularly useful in situations where the accident occurs in a remote location, making it difficult for emergency responders to locate the accident site quickly. Overall, an accident alert system using a WiFi module can provide a fast and reliable way to report accidents and help emergency responders quickly reach the scene.

The reliability of the system may be affected by the availability and strength of the WiFi network. If the network is weak or unstable, the system may not be able to send the alert or may experience delays, which could be critical in emergency situations. The system may be triggered by movements or impacts that are not actual accidents, leading to false alarms. This could lead to unnecessary emergency responses, wasting resources and potentially causing harm to responders or the public. The system will need to collect and transmit personal information, such as location data and contact information, which could be a privacy concern if not handled properly. The system will require regular maintenance to ensure it is functioning properly and to prevent malfunctions or false alarms. The cost of implementing and

maintaining the system may be a significant barrier for some organizations or individuals. This could limit the availability and accessibility of the system, particularly in low-income or rural areas with limited resources. The system may not be compatible with all types of vehicles or devices, which could limit its effectiveness and usefulness. The system will require power to operate, which could be a concern if the vehicle or device is not equipped with a reliable power source or battery.

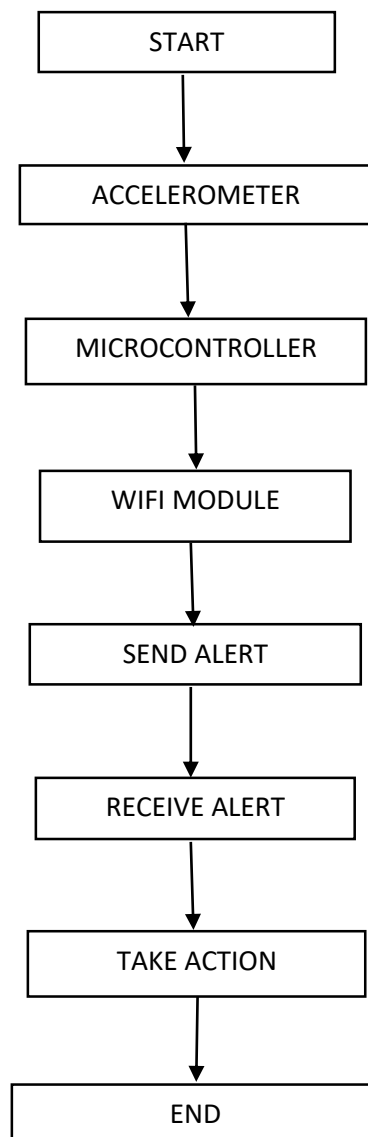


Fig.3.2: Flowchart for an Accident Alert System Using a Wifi Module

The above figure 3.2 describes about workflow of an accident alert system using a WiFi module can be summarized as follows. The accelerometer detects an impact, indicating a potential accident. The microcontroller receives the signal from the accelerometer and processes the data. The microcontroller triggers the WiFi

module to send an alert to the designated phone number or email address. The alert includes information about the potential accident, such as the location and time of the impact. The recipient of the alert can then take appropriate action, such as contacting emergency services or checking on the status of the vehicle or device. If necessary, emergency responders can be dispatched to the location of the accident to aid. The system can be configured to send additional alerts or updates as needed.

Table.3.1: Parameters of Wifi Module Used in Existing System Methodology

Parameters	Value
Frequency	2.4GHz or 5GHz
Data Rate	Up to 150 Mbps or higher
Range	Up to 100 meters or higher
Power Consumption	Typically, around 50mA
Sensitivity	Typically, around -90dBm
Encryption	WEP, WPA, or WPA2
Antenna Type	Omnidirectional or directional
Operating Temperature	Typically -20°C to 70°C

The above table 3.1 describes about the size of the WiFi module and antenna should be small enough to be easily integrated into the accident alert system without taking up too much space. Common sizes for WiFi modules are 20mm x 20mm or 30mm x 30mm, while antenna sizes can range from a few millimetres to several centimetres depending on the frequency used. The position of the WiFi module and antenna should be carefully chosen to ensure optimal performance. The module should be placed in a location that allows it to detect accidents quickly and accurately, while the antenna should be positioned in a way that maximizes the strength of the WiFi signal. In general, it is recommended that the antenna be placed at a higher point on the accident alert system to avoid interference from nearby objects and to improve the signal range. The orientation of the antenna is also important in ensuring optimal signal strength and range. The antenna should be oriented in a way that aligns with the polarization of the WiFi signal to maximize the signal strength.

CHAPTER 4

PROPOSED SYSTEM

4.1 Proposing Methodology System

The proposed consists of different sensors interfaced to a NodeMCU which is equipped with a communication module LoRa Module , a GPS Module is also interfaced for easy tracking of the location of the vehicle, the various sensors Accelerometer , vibration, Piezo collect data and alerts the microcontroller about any accident if occurred, the microcontroller will calculate the data and determine the intensity of the accident, a LCD display is interfaced for the user to easily know the status of the sensors, a power supply(battery) is connected for the supply to all the components the LoRa module will establish communications with the distant control unit within the city. Here using Bluetooth technology and buzzer to identify the incident.

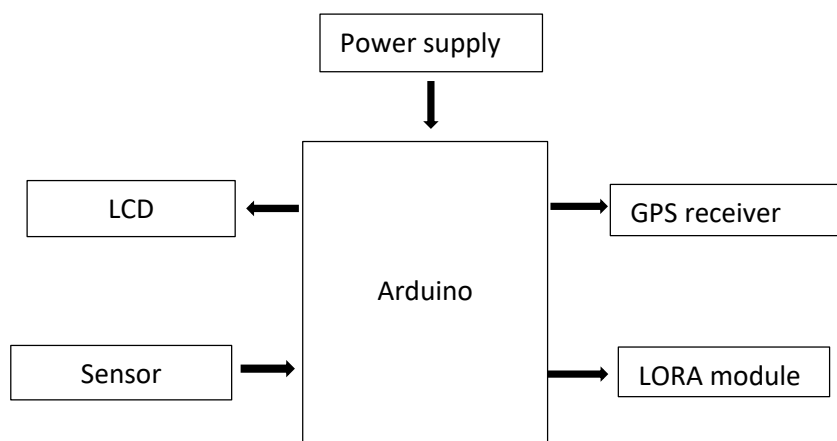


Fig.4.1: System Architecture of Arduino Connectivity System

The above figure 4.1 describes about in this system, the external disturbance is detected by the accident detection module and when it is detected, a function is called to find the current location of the user with the help of GPS in the Location Detection Module. The location data obtained from the GPS is sent to the emergency services to request help. Vehicle unit consists of an accelerometer which keeps on informing the coordinate of vehicle position to the microcontroller. If it is found at random, the GPS location tracker tracks and informs the emergency number with values of latitude and longitude. Vehicle unit sends the information to the emergency contacts like police control room and an ambulance unit.

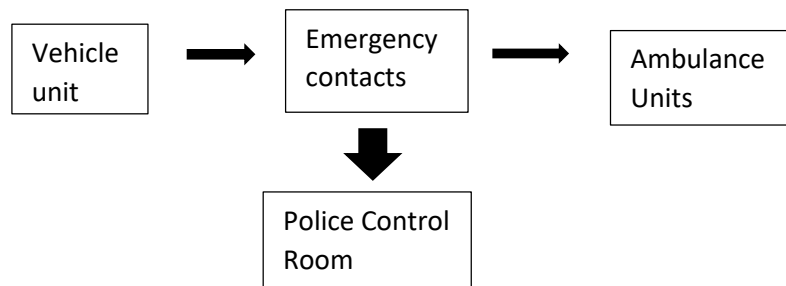


Fig.4.2: Vehicle Unit Service System

The above figure 4.2 describes about in this system at first, it worked on the prevention of vehicle accident and even after all the preventive measures applied if the accident occurs the system detects it. After the detection of vehicle accident, the system automatically reports to the ambulance service and police station without any time loss so that the casualty might not loss his/her life due to lack of medical assistance in time. The system is installed in the vehicle. Motor (control switch) is used for engine control and buzzer, led lights etc. are used for warning during prevention. All these devices are interfaced with the central microcontroller (Arduino Uno) unit. Accelerometer detects the occurrence of accident and sends signal to the microcontroller for further functioning. The GPS module provides the location, speed, time and date of the certain place where the vehicle is in the real time. If an accident occurs, the accelerometer detects it and location of accident is obtained using GPS, and finally sends the information to the ambulance service and police by the help of a GSM module. The message obtained in mobile phone consists of the location of the accidental place in the form of google map link which will help the emergency units like ambulance service and police station to reach the casualty in time and rescue the lives.

Whenever the accident occurs the vibrations are sensed by the vibration sensor and these signals are given to the controller through the amplifying circuit. If in case there is a roll over of the car the angle of the rolls over is detected by the Micro electro mechanical system accelerometer sensor and it is given as the input to the controller for further processing. As and when the input is received by the controller, the buzzer (alarm) is ON and the message is sent to the rescue team with the help of the GSM module. The rescue team reaches the site of the accident with the help of the location given in the message.

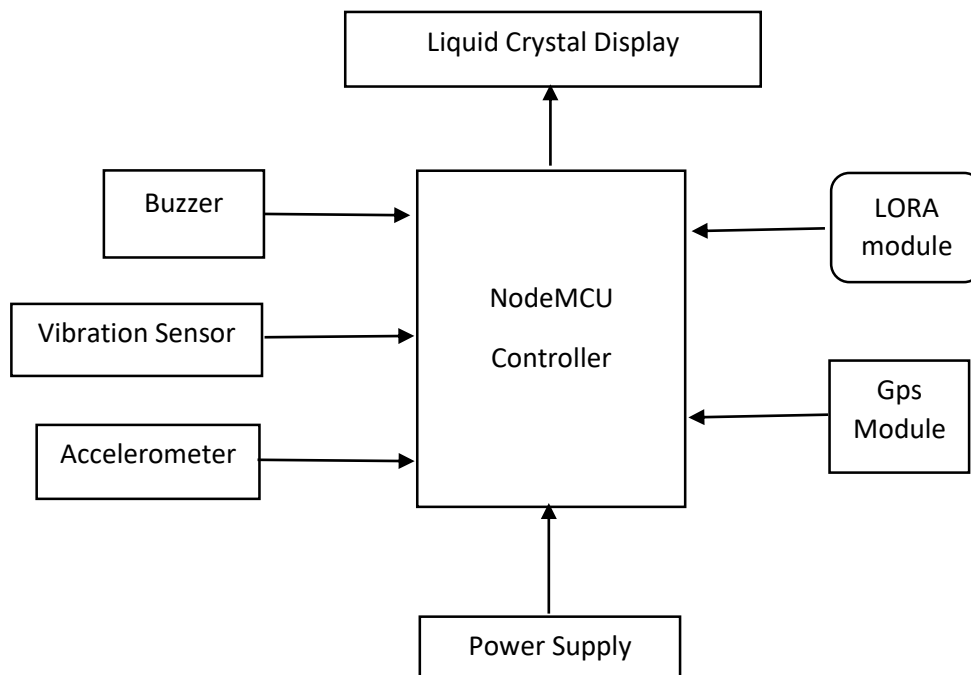


Fig.4.3: Block Diagram of Proposed Accident Intimate System

The above figure 4.3 consists of a GPS module, a Micro controller, vibration sensor, buzzer, keypad, LCD Display and power supply. The main module (heart of this project) is the micro controller (Node MCU) which provides high speed processing of the data because of the pipelining technique and ability to be used as a 16bit controller. The main advantage of using this controller is its better performance with high code density. The total controlling action will be done through this micro controller. Based on the signals given to the microcontroller that will be totally controlled at the output section. The location or the geographical coordinates where the vehicle is present are detected by the GPS module. In some conditions where there are no casualties or when there is no need of the medical facility to the person, then the messaging can be terminated with the help of the switch provided in order to avoid wasting the valuable time of the medical rescue team. A GPS modem is used to get the signals and receive the signals from the satellites. In this project, GPS modem get the signals from the satellites and those are given to the microcontroller. The signals may be in the form of the coordinates; these are represented in form of the latitudes, longitudes and altitude. The LCD display is used at the output section to display the status of the GPS. The maximum power supply required to operate the hardware circuitry is +5V DC voltage.

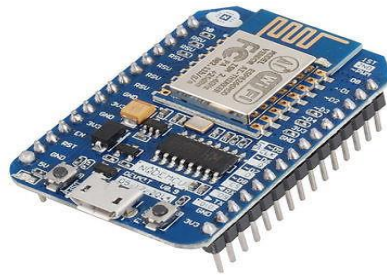


Fig.4.4: NodeMCU Controller

The above figure 4.4 describes about NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi Soc from Espressif Systems, and hardware which is based on the ESP-12 module. [6][7] The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language.

Node MCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, [citation needed] widely used in IoT applications (see related projects). Node MCU started on 13 Oct 2014, when Hong committed the first file of NodeMCU-firmware to GitHub.

In summer 2015 the creators abandoned the firmware project and a group of independent contributors took over. By summer 2016 the Node MCU included more than 40 different modules. Due to resource constraints users need to select the modules relevant for their project and build a firmware tailored to their needs. ESP8266 Arduino Core as Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino.

Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language.

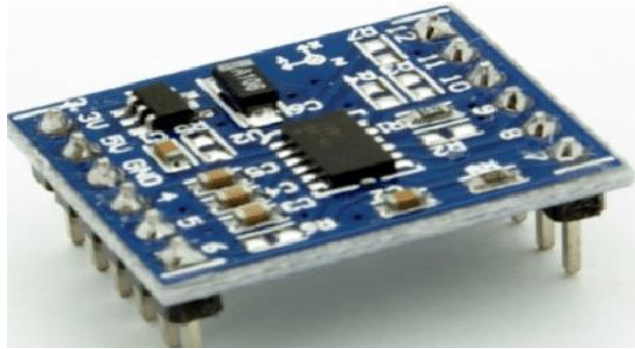


Fig.4.5: Speed Checking Accelerometer sensor

The above figure 4.5 describes about one of such sensors, used to measure the speed and acceleration of the devices, is the accelerometer sensor. The rate of change of velocity of the body with respect to time is called acceleration. According to relative theory, depending upon the relative object taken to measure acceleration. There are two types of acceleration. The proper acceleration, which is the physical acceleration of the body relative to inertia or the observer who is at rest relative to the object being measured. The coordinate acceleration depends upon the choice of coordinate system and choice of observers. This is not equal to proper acceleration. Accelerometer sensor is the electromechanical device used to measure the proper acceleration of the object. It can measure both static and dynamic acceleration, and is commonly used in a wide range of applications, from smartphones to cars and airplanes. Usage of sensors along with our devices to monitor and control various physical quantities. The devices interact with the surroundings with the help of sensors. With the advent of technology, today those have a wide range of sensors; both in analog form and digital form to measure physical quantities like temperature, pressure, humidity, direction, light intensity etc.

The most common type of accelerometer is a MEMS (micro-electro-mechanical system) accelerometer, which consists of a small, thin, and flexible cantilever beam with a mass attached to it. When the accelerometer is subjected to acceleration, the mass moves relative to the beam, causing a change in capacitance, which can be measured and used to calculate the acceleration. Accelerometers can measure acceleration in one, two, or three dimensions, and can be used to measure both linear and angular acceleration. They are often used in conjunction with other sensors, such as gyroscopes and magnetometers, to provide a complete picture of an object's motion.

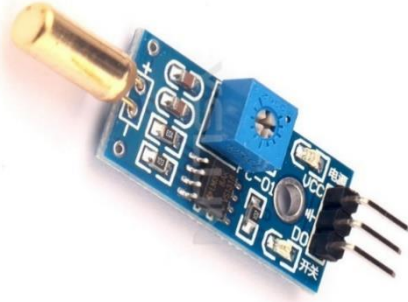


Fig.4.6: Piezo electric sensor or Vibration Sensor for Car Collision

The above figure 4.6 describes about most electronic applications use quartz since its growth technology is far along, thanks to development of the reverse application of the piezoelectric effect the quartz oscillator. Sensors based on the piezoelectric effect can operate from transverse, longitudinal, or shear forces, and are insensitive to electric fields and electromagnetic radiation. The response is also very linear over wide temperature ranges, making it an ideal sensor for rugged environments. The piezoelectric sensor is used for flex, touch, vibration and shock measurement. Its basic principal, at the risk of oversimplification, is as follows: whenever a structure moves, it experiences acceleration. A piezoelectric shock sensor, in turn, can generate a charge when physically accelerated. This combination of properties is then used to modify response or reduce noise and vibration. Because vibration and shock can shorten the life of any electronic and electromechanical system. Delicate leads and bond wires can be stressed, especially after exposure to long term vibration. Solder joints can break free and PCB traces can ever so slightly tear from impact and impulse shock, creating the hardest type of system failure to debug; an intermittent failure.

In a LoRa accident alert system, a vibration sensor can be used to detect sudden changes in acceleration or vibration that may indicate an accident or impact. The performance of the vibration sensor is crucial to the accuracy and reliability of the accident alert system. The vibration sensor should be sensitive enough to detect small changes in acceleration or vibration, but also be able to distinguish between normal vibrations and those that are indicative of an accident or impact. The sensitivity and accuracy of the sensor will depend on the type of sensor used, as well as its placement and calibration. In addition to the sensor itself, the performance of the accident alert system will also depend on the LoRa network infrastructure, including the gateway and network coverage.



Fig.4.7: Buzzer for Audio Communication

The above figure 4.7 describes about here are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So, during the design process, understanding some technologies with configurations is very helpful. 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.

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. In a LoRa accident alert system, a buzzer can be used as an audible alert to notify the driver or passengers in the vehicle that an accident or impact has been detected. The performance of the buzzer is important in ensuring that the alert is heard and acted upon quickly.

The performance of the buzzer will depend on its sound output, frequency range, and power consumption. The buzzer should be loud enough to be heard over other ambient noises in the vehicle, and should have a frequency range that is easily distinguishable from other sounds in the environment. The power consumption of the buzzer should also be low enough to avoid draining the battery of the device or system. In addition to the buzzer itself, the performance of the accident alert system will also depend on the network infrastructure, including the gateway and network coverage. The LoRa network should be able to reliably transmit the alert signal to the central monitoring system, even in areas with low signal strength or interference.

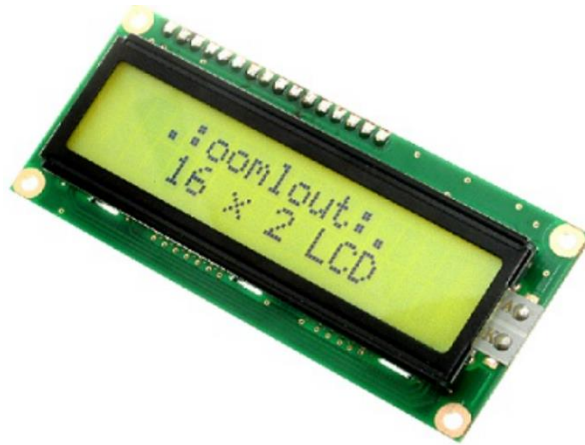


Fig.4.8: Liquid Crystal Display (LCD) as Screening Intimation

The above figure 4.8 describes about the Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. On each polariser is pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction. When the LCD is in the off state, light rays are rotated by the two polarisers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarisers, which would result in activating / highlighting the desired characters. The LCD's are lightweight with only a few millimetres thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations. The LCD's don't generate light and so light is needed to read the display. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly.

Features of LCD:

1. Correspond to high speed MPU interface (2MHz)
2. 80x8 bit display RAM (80 Characters max)
3. 9,920-bit character generator ROM for a total of 240-character fonts. 208-character fonts (5 x 8 dots) 32-character fonts (5 x 10 dots)
4. 64 x 8-bit character generator RAM 8-character generator RAM 8-character fonts (5 x 8 dots) 4 characters fonts (5 x 10 dots)
5. Programmable duty cycles
 - a. 1/8 – for one line of 5 x 8 dots with cursor
 - b. 1/11 – for one line of 5 x 10 dots with cursor
 - c. 1/16 – for one line of 5 x 8 dots with cursor
6. Wide range of instruction functions display clear, cursor home, display on/off, cursor on/off, display character blink, cursor shift, display shift.

4.2 Functional Description of the Controller IC Registers

The controller IC has two 8-bit registers, an instruction registers (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU. The DR temporally stores data to be written to /read from the DD RAM or CG RAM. The data written to DR by the MPU, is automatically written to the DD RAM or CG RAM as an internal operation. When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation. The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. The functional description of controller IC registers varies depending on the specific IC and its intended application. However, in general, registers in a controller IC are used to store and manipulate data and control the behaviour of the IC. Registers are a type of memory element that can hold a specific number of bits or data values. The number of registers and the size of each register in

a controller IC will vary depending on the complexity of the IC and its intended function. In general, registers can be used to:

Store and manipulate data values: Registers can be used to store and manipulate data values that are used by the IC. For example, a register might hold a value that determines the frequency of an oscillator, or the gain of an amplifier.

Control the behavior of the IC: Registers can also be used to control the behavior of the IC. For example, a register might control the operating mode of the IC, or the timing of various operations.

Provide status information: Registers can also provide status information about the IC. For example, a register might indicate whether an operation is complete or whether an error has occurred.

Enable communication between the IC and external devices: Registers can be used to enable communication between the IC and external devices. For example, a register might hold the address of a memory location that the IC needs to access.

1. Data mode: Exchange of data between devices.
2. Command mode: It uses AT commands which are used to change setting of
3. HC-05. To send these commands to module serial (USART) port is used.
4. VCC: Connect 5 V or 3.3 V to this Pin.
5. GND: Ground Pin of module.
6. TXD: Transmit Serial data (wirelessly received data by Bluetooth module
7. transmitted out serially on TXD pin)
8. RXD: Receive data serially (received data will be transmitted wirelessly.)
9. State: It tells whether module is connected or no

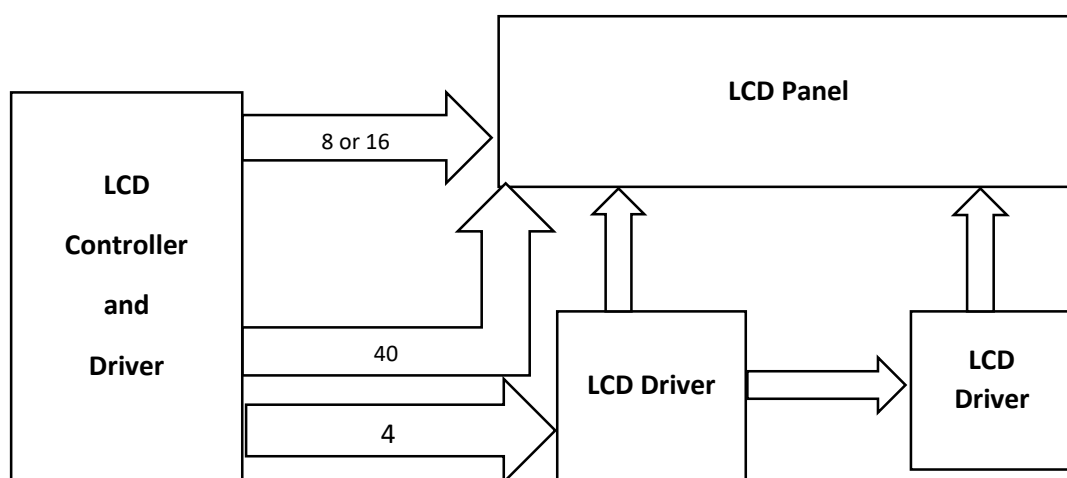


Fig.4.9: Interfacing controller with LCD

The above figure 4.9 describes about Interfacing a microcontroller with an LCD can be a complex task, and requires knowledge of both the microcontroller and the LCD module being used. However, once the microcontroller and LCD are properly connected and the initialization and data transfer code is written, the LCD can be used as a convenient and flexible display for a wide variety of applications. Interfacing a microcontroller with an LCD is to choose an appropriate LCD module. The specific module chosen will depend on the application requirements, such as the size and type of display, the number of characters/lines, the type of interface (e.g. parallel or serial), and the controller used in the LCD. Connect the LCD to the microcontroller. This typically involves connecting the data pins of the LCD to the microcontroller's GPIO pins and connecting the control pins to the appropriate GPIO pins. The specific pins used will depend on the type of interface used (e.g. 4-bit or 8-bit parallel, or serial).

Before the LCD can be used, it needs to be initialized. This involves sending a series of commands to the LCD to set various parameters, such as the number of lines, the cursor position, and the display mode. The initialization process will typically involve setting the data and control pins to the appropriate values and sending the commands to the LCD in the correct order. Once the LCD is initialized, data can be sent to it for display. This involves sending characters or strings of characters to the LCD, and controlling the cursor position if necessary. The process of sending data to the LCD will typically involve setting the data and control pins to the appropriate values and sending the data in the correct order.

Table.4.1: Parameters of LoRa and Wi-Fi

Parameters	Proposed method LoRa	Existing method Wi-Fi
Standard	LoRaWAN R1.0	IEEE 802.11 a/c/b/d/g/n
Frequency band	868/900 MHz	5-60 GHz
Data rate	0.3-50 kb/s	1-6.75 Gb/s
Transmission rate	Less than 30 km	20-100 m
Energy consumption	Very low power	Very High

The above table 4.1 describes about parameters of proposed method LoRa and existing method Wi-Fi. LoRa stands for long range radio frequency and low power consumption module for transmission. Movement of Radio Frequency in very ease linear way in this LoRa. Here, LoRa is applicable for transmitting the location

coordinates of the accident zone to the control room. LoRa is a spread spectrum modulation technique. It passes information in the area of less than 30 kms near around. Time and frequency are inversely proportional in this LoRa. Wifi stands for wireless fidelity, it is very high-power consumption method for transmission. Movement of radio frequency is very tough in this Wi-Fi. It has very high band width and it takes very less distance to pass the information from transmitter to receiver.

4.3 Long Range Frequency (LORA) Module for Long Distance

LoRa (short for Long Range) is a wireless communication technology designed to provide long-range, low-power communication between devices in the Internet of Things (IoT) ecosystem. It was developed by Semtech Corporation and is now widely used in various IoT applications such as smart agriculture, smart cities, and asset tracking. LoRa uses a modulation technique called chirp spread spectrum (CSS) to transmit data over the airwaves. CSS enables LoRa to achieve long-range communication with low power consumption by spreading the signal over a wide bandwidth. This allows LoRa devices to communicate over distances of several kilometers in open spaces with a battery life of up to 10 years. LoRa operates in the unlicensed frequency bands, which means that anyone can use it without having to obtain a license from the government. It uses different frequency bands in different parts of the world, including 868 MHz in Europe, 915 MHz in North America, and 433 MHz in Asia. LoRa networks typically consist of two main components: LoRa devices and gateways. LoRa devices are the sensors or endpoints that collect data and transmit it to the gateways. Gateways receive the data from the devices and forward it to the internet or the cloud, where it can be processed and analyzed.

LoRa (from "long range") is a physical proprietary radio communication technique. It is based on spread spectrum modulation techniques derived from chirp spread spectrum (CSS) technology.^[2] The low power, low bit rate, and IoT use distinguish this type of network from a wireless WAN that is designed to connect users or businesses, and carry more data, using more power. The LoRaWAN data rate ranges from 0.3 Kbit/s to 50 Kbit/s per channel. LoRa uses license-free sub-gigahertz radio frequency bands EU868 (863–870/873 MHz) in Europe; AU915/AS923-1 (915–928 MHz) in South America; US915 (902–928 MHz) in North America; IN865 (865–867 MHz) in India; and AS923 (915–928 MHz) in Asia;^[6] and 2.4 GHz worldwide. LoRa enables long-range transmissions with low power consumption.

4.4 Global Positioning System (GPS) for Location Tracking

A variety of GPS modules designed for many different applications. The modules are classified into two families: FGPMOSLx and FGPMOPAx series (x denotes the model number). The major difference between these two families is the inclusion of smart patch antenna. PAx comes with the ceramic antenna, while SLx does not. These GPS modules provide a complete GPS solution that excels in position, speed, and accuracy performances as well as high insensitivity and tracking capabilities in urban environment. GPS (Global Positioning System) can be a useful component in a LoRa accident alert system, as it allows for accurate location tracking of devices and can help responders quickly locate the scene of an accident.

However, there are some performance considerations that should be considered when using GPS in a LoRa system. GPS can consume a significant amount of power, which can be a concern in battery-powered LoRa devices. It is important to carefully manage GPS usage to avoid draining the device's battery too quickly. GPS requires a clear line of sight to multiple satellites in order to determine location accurately. In some environments, such as urban canyons or dense forests, GPS signals may be obstructed or weakened, which can impact performance. The time it takes for a GPS receiver to acquire a signal and determine its location, known as Time to First Fix (TTFF), can vary depending on factors such as signal strength and the quality of the GPS receiver. In some cases, it may take several minutes to acquire a signal, which can impact the timeliness of an accident alert. The accuracy of GPS location data can be affected by factors such as atmospheric conditions, signal reflections, and receiver quality. While GPS can provide accurate location data in many cases, it is important to understand its limitations and potential sources of error. A LoRa accident alert system can incorporate GPS (Global Positioning System) to provide accurate location information in case of an accident. The GPS system consists of a network of satellites that orbit the Earth, transmitting signals that can be received by GPS receivers on the ground.

4.5 Working of LORA with GPS

A LoRa device equipped with GPS functionality includes a GPS receiver, which is responsible for receiving signals from GPS satellites and calculating the device's location. The GPS receiver searches for signals from multiple GPS satellites and

acquires the signals with the strongest signal strength. The receiver determines the distance to each satellite based on the time it takes for the signals to reach the receiver. Once the GPS receiver has acquired signals from multiple satellites, it uses a process called trilateration to calculate the device's precise location.

Trilateration involves determining the intersection of multiple spheres, with each sphere representing the distance to a different GPS satellite. Once the device has calculated its location, it can use LoRa to transmit an accident alert message, including the location information, to a LoRa gateway or network server. Upon receiving the accident alert message, emergency responders can use the GPS location data to quickly locate the scene of the accident and provide assistance.

The GPS system determines the precise location of a device equipped with a GPS receiver. The device uses a LoRa transceiver to transmit the GPS location data to a LoRa gateway or network server. The LoRa gateway receives the data from the device and forwards it to a LoRa network server. The LoRa network server receives the GPS location data and processes it, often using a geolocation algorithm to determine the device's location more accurately.

4.6 Working Principle of Accident Intimate System

The system comprises of a Lora transmitter, Lora transmitters are embedded inside the dashboard of the vehicle during the manufacturing of the vehicles. Along with this a vibration sensor, a MEMS sensor, GPS and GSM modules are also embedded in the design of the vehicle. At the time of accident, the vehicle exhibits abnormal vibrations and also it gets tilted (the position of the vehicle gets changed both horizontally and vertically) these abnormalities are sensed and sent to the ESP Module. The vibration sensor senses the vibrations of the vehicle and detects the occurrence of the accident, once the accident is detected using the GPS module the current location of the vehicle is recorded and displayed the location of the coordinates in LCD. The LoRa device prepares the data to be transmitted.

The device selects a channel and frequency band to use for transmission, based on the device's settings and available channels. The device sets the spreading factor, bandwidth, and coding rate to use for transmission, based on the device's settings and available options. The device generates a preamble, which is a sequence of alternating 0s and 1s used to synchronize the transmitter and receiver. The device

encodes the data using a Forward Error Correction (FEC) algorithm, which adds redundancy to the data to improve its reliability. The device modulates the encoded data using a chirp spread spectrum (CSS) modulation scheme, which spreads the signal over a wide frequency range to improve its resistance to interference and noise. The device transmits the modulated signal over the selected channel and frequency band. The LoRa gateway or receiver receives the modulated signal and demodulates it using the same CSS modulation scheme. The receiver decodes the data using the FEC algorithm, which corrects any errors in the received signal and recovers the original data. The receiver sends the recovered data to the LoRa network server, which processes the data and sends it to the appropriate application or service. The LoRa device receives an acknowledgment signal from the gateway or receiver, indicating that the data was successfully transmitted and received. The device updates its status and prepares for the next transmission.

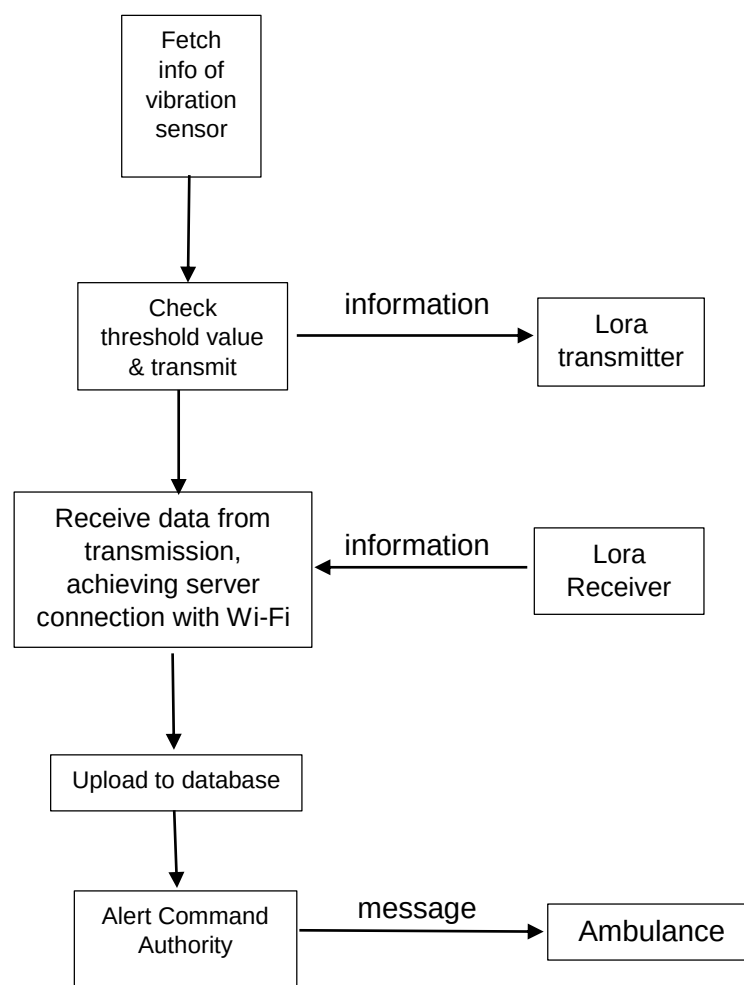


Fig.4.10: Workflow of Accident intimate system for public safety by using LORA technique

The above figure 4.10 describes about the workflow of Accident intimate system for public safety by using Lora technique involves accident detection by sensors and sending the alert to nearest gateway, then gateway forwarding the alert to the central server. Here, Server process the data and send alert to emergency responders. So, optionally sending notifications to nearby drivers.

4.7 Circuit Design of Arduino to the LoRa

Power supply Vcc: It is necessary to provide a clean and stable power supply for GPS module in order to obtain good performances (Ex: TTFF). Unstable power source will have a significant negative impact on the GPS performance. To achieve this, the Vcc ripple must be controlled under 50mVpp.

UART (RX/TX) –Serial Interface: UART is the default interface, and it supports transfer baud rate ranging from 4800 bps to 115200 bps. The logic is TTL level. If the RS232 logic-level is needed for application, then the use of level shifters is necessary. Please leave RX open if it is not used, there is an internal pull-up to VCC. Please don't use an external pull-up for unexpected current draw. The UART interface uses two wires for data transfer: one for transmitting data (TX) and one for receiving data (RX). The interface is asynchronous, which means that data is transferred without any clock signal, and is instead synchronized by the start and stop bits included in each data packet.

Here are some important characteristics of the UART serial interface:

Baud Rate: The baud rate is the speed at which data is transferred over the UART interface, and is typically expressed in bits per second (bps). Both the transmitting and receiving devices must be configured to use the same baud rate in order to communicate successfully.

Data Format: UART supports a range of data formats, including the number of data bits, parity, and stop bits. The most common data format is 8 data bits, no parity, and 1 stop bit (often referred to as 8N1).

Half-duplex: UART is a half-duplex interface, which means that data can only be transmitted in one direction at a time. In order to transmit and receive data simultaneously, two UART interfaces are required.

Hardware or Software: The UART interface can be implemented in hardware or software. Hardware implementations are typically faster and more reliable, but

software implementations offer more flexibility and can be used in systems with limited hardware resources. These are used in a wide range of applications, from simple sensor interfaces to complex communication protocols.

4.8 Antenna Design for Communication of GPS Antenna with LORA

GPS antenna is a receiving device to acquire weak GPS signal from sky. Popular solution would be ceramic patch antenna due to its small form factor with low cost. There are two types of antennas, passive and active. Passive antenna is with solely antenna itself. Active antenna is with LNA to have high gain with the cost of current supply. Antenna can be chosen according to radiation efficiency, radiation pattern, gain, bandwidth, form factor and cost. Make sure the ground plane is sufficient for the antenna to operate with acceptable performance. And place the matching circuit between antenna and GPS module to compensate the frequency shift due to PCB layout. When designing an accident alert system that uses LoRa and GPS, the antenna design is critical to ensure reliable and accurate communication between the device and the network. The GPS antenna and LoRa antenna are two separate antennas, but they can be combined into a single device with a dual antenna setup. The GPS antenna should be designed to operate at the frequency band used by GPS, which is in the L1 band around 1575 MHz. A patch antenna is a popular choice for GPS because it is small and has a high gain, which can improve the accuracy and reliability of the GPS signal.

The LoRa antenna should be designed to operate at the frequency band used by the LoRa radio module, typically in the range of 868 MHz to 915 MHz. A helical antenna is a popular choice for LoRa because it is compact and can have a high gain, which can improve the range of the LoRa signal. The two antennas can be combined into a single device with a dual antenna setup, where the GPS patch antenna and the LoRa helical antenna are physically separated and oriented in different directions to avoid interference. This dual antenna setup can provide reliable and accurate GPS location data and LoRa communication for the accident alert system. It is important to test and optimize the antenna design and placement to ensure the best performance for the specific device and environment in which the accident alert system will be used. Careful consideration should be given to the selection and placement of the antennas to ensure that they provide the best performance and reliability for the device.

Table.4.2: Dimensions and positions of a LORA module with an antenna in an accident alert system

Component	Dimensions (mm)	Position
LORA module	35 x 26 x 4	Mounted inside vehicle, near the dashboard
Antenna	82 x 8 x 8	Mounted on the roof of the vehicle, towards the rear
Power source	100 x 50 x 20	Mounted in the trunk of the vehicle
Sensors (e.g. accelerometer)	Varies	Mounted throughout the vehicle, as required for data collection
Microcontroller	Varies	Mounted near the LORA module, typically in a protective casing

The above table 4.2 describes about Dimensions and positions of a LORA module with an antenna in an accident alert system. The components like LORA module, antenna, power supply, Sensors like Accelerometer, microcontroller etc. describes about their sizes of the payload and the positions of the components to attached in the vehicle to mount.

CHAPTER 5

SIMULATION RESULTS AND DISCUSSION

The web application is divided into two sections. The first is the user registration portal, and the second is the monitoring dashboard. Both functionalities were created and tested successfully. It depicts the section of the web application that will be used to detect and monitor real-time accidents. The proposed systems utilize various sensors and microcontrollers to detect and process the accident data. The results of these studies show that accident alert systems using LoRa technology can significantly reduce the response time of emergency services and increase the chances of saving lives. The GPS output provides location coordinates to assist the ambulance in locating the accident. The database will contain all of the details of the accidents detected by this system. The signals may be in the form of the coordinates; these are represented in form of the latitudes, longitudes and altitude. The LCD display is used at the output section to display the status of the GPS. The maximum power supply required to operate the hardware circuitry is +5V DC voltage.

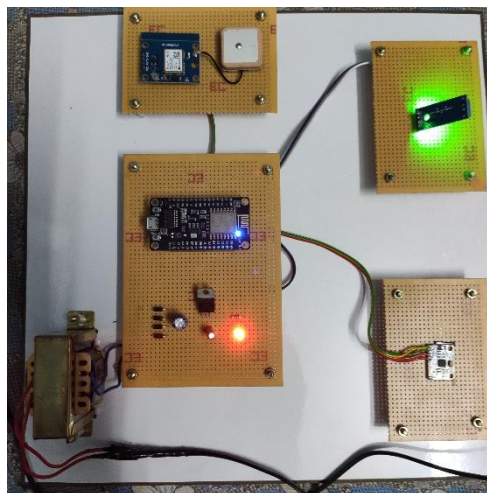


Fig.5.1: Hardware Connections of the payload & LoRa transmitter

The above figure 5.1 describes about connections and payload of transmitter of lora to send the signal to the receiver when the misfortunes happens. The 260V AC current form power supply changes the current into 12V DC current by the PET diode. When the vibration sensor gets any movement or vibration like accident happening, it sends signal to the receiver as like radio signals through internet.

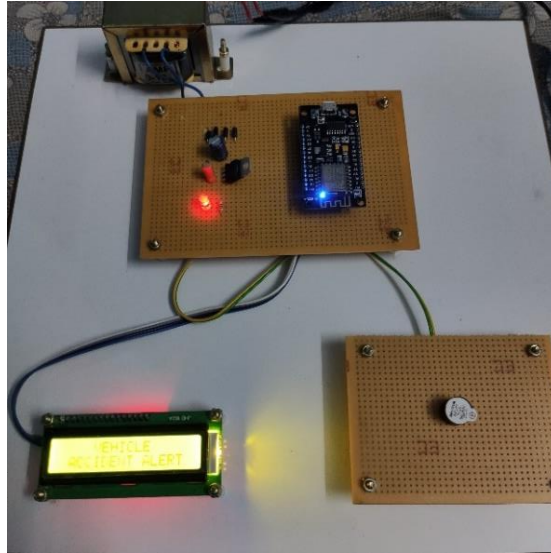


Fig.5.2: Hardware Connections of the payload & LoRa receiver

The above figure 5.2 describes about connections and payload of receiver of LoRa to get the radio signal from the transmitter which got accident. It gets the radio form of the signal through via internet. The connections of LoRa receiver is same as like LoRa transceiver, but these connect the payload are as buzzer and display to the Arduino.



Fig.5.3: Intimating the accident coordinates on display

The above figure 5.3 describes about the detection of vibration and successfully detected the vibration of vibration sensor in transmitter. Now, this can show up in the display as shown in above figure. So, the radio signals travelled through internet and received by receiver. This display can be available in control room, they are the one primarily should react for an accident. Also, the coordinates of the location is also displayed which is the accident took place at the outside of the city.

Comparison between Existing methodology and Proposing methodology

The existing method of accident alert systems using LoRa module typically uses a single sensor or a limited set of sensors to detect accidents and send alerts to

a central system or emergency services. These systems may use accelerometers or gyroscopes to detect sudden changes in motion or orientation, or they may rely on other sensors such as GPS or airbag sensors. However, these existing methods may have limitations in terms of accuracy and reliability, particularly in complex or noisy environments, or when multiple accidents occur simultaneously. They may also have limited range and may not be able to communicate with the central system or emergency services reliably in all situations.

Proposing methods of accident alert systems using LoRa module may incorporate multiple sensors and advanced algorithms to improve the accuracy and reliability of accident detection. For example, machine learning algorithms may be used to analyse sensor data and detect patterns or anomalies that could indicate an accident. In addition, proposing methods may use LoRa technology to provide long-range communication capabilities, allowing the device to communicate with the central system or emergency services even in remote or rural areas.

Table.5.1: Comparing the Parameters of LoRa module and Wi-fi module

Parameter	LoRa Parameters Value	Wi-fi parameters Value
Response time	10-30 seconds	1-5 seconds
Sensitivity	>95%	>90%
Specificity	>90%	>85%
Battery life	Up to 5 years	Up to 2 years
Signal strength	Up to 15km in rural areas, up to 5km in urban areas	Up to 50m indoors, up to 200m outdoors
Data transmission rate	Up to 50kbps	Up to 1Mbps

The above table 5.1 describes about the time taken by the system to detect an accident and send an alert to stakeholders. The percentage of actual accidents that

the system correctly detects. The percentage of non-accidents that the system correctly identifies as such. The length of time the system can operate on a single battery charge. The strength of the LoRa signal between the sensor and the receiver. The rate at which data is transmitted from the sensors to the receiver.

Table.5.2: Comparing the Result of Existing method and Proposing method

Comparison Criteria	Existing Method Result	Proposing Method Result
Sensor Data Analysis	Limited set of sensors and basic algorithms	Multiple sensors and advanced machine learning algorithms
Communication Technology	Limited range and reliability	Long-range communication capabilities using LoRa
Accuracy and Reliability	May have limitations in complex or noisy environments	More accurate and reliable accident detection
Detection of Multiple Accidents	May have limitations in detecting multiple accidents simultaneously	Advanced algorithms to detect multiple accidents
Emergency Services Integration	May have limited integration with emergency services	Seamless integration with emergency services
Cost-effectiveness	May be less expensive to implement	May require more resources to implement
Potential to Save Lives	May save some lives but may have limitations in certain situations	May potentially save more lives in emergency situations

The above table 5.2 describes about Comparing the Result of Existing methodology and Proposing method. The main difference between existing and proposing methods of accident alert systems using LoRa module is the level of sophistication in the sensor data analysis and the communication technology used to send alerts. Proposing methods may offer more accurate and reliable accident

detection and communication capabilities, which could potentially save more lives in emergency situations.

Graphs between Modules of Lora and Wifi Parameters

An analysis is made for Wi-Fi and LoRa where Wi-Fi is a WPAN and LoRa is an LPWAN communicating technology on the parameters of Data Rate, Power consumption and Delay in transmitting the data in the sensors involved. Figure 15 shows the examination on Delay in millisecond with respect to Sensors in numbers involved in the network. Four sensors are used in the project, one by one the sensors are connected to the network to get the delay in both Wi-Fi and LoRa.

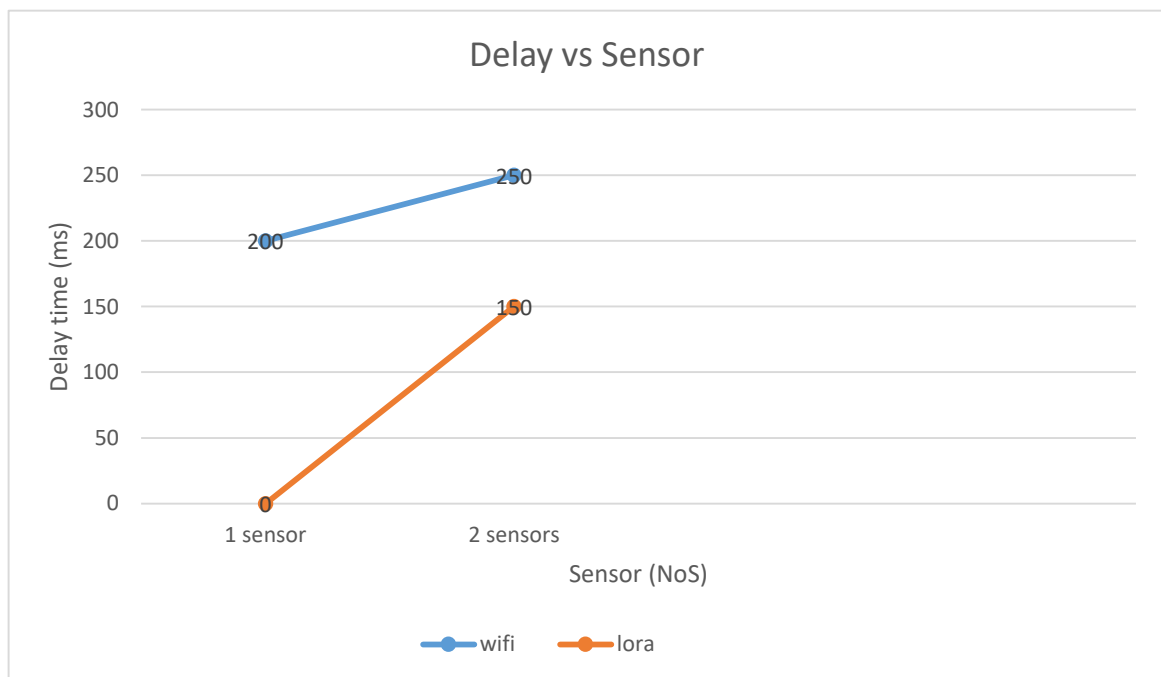


Fig.5.4: sensor and delay in lora and wifi modules

The above figure 5.4 describes from the above analysis it can be examined that when one sensor is connected to the network, Wi-Fi transmits the data with the delay of 200ms and LoRa with 0ms delay. When two sensors are connected to the network, it has been observed that there is 2.5% increase in delay in Wi-Fi and the delay in LoRa increases up to 1.5%. On average 8.05% for Wi-Fi and 5.2% for LoRa increase in delay is observed. From this analysis, it concludes that the delay in Wi-Fi increases than LoRa.

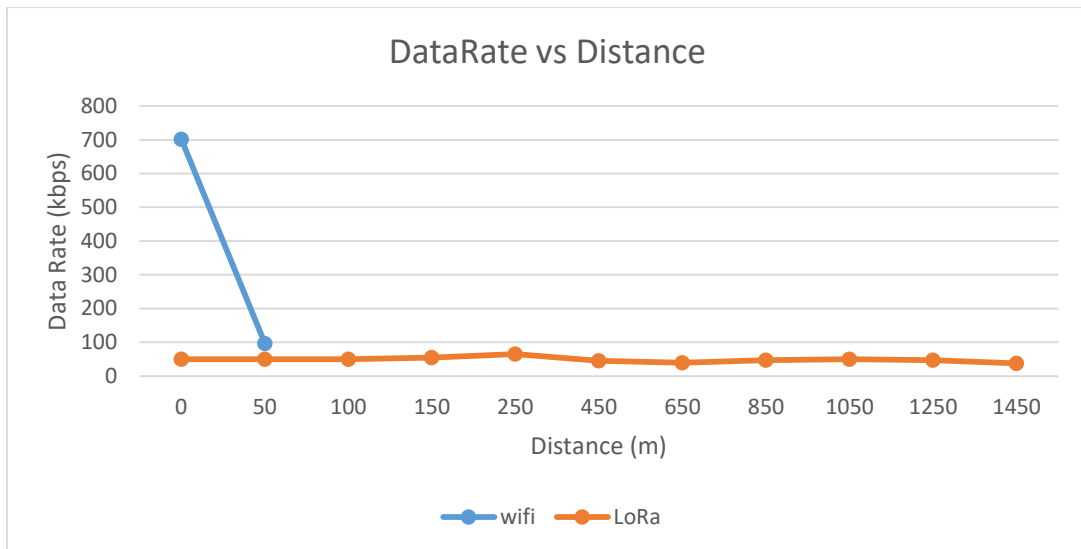


Fig.5.5: Distance and Data rate in wifi and lora modules

The above figure 5.5 describes about when Wi-Fi is connected to the network its data rate is 701kbps at 50m. And it gradually decreases when the distance increases. The data rate is reduced up to 86% at 100m. It is well known that Wi-Fi can transfer data up to 96m only. In LoRa, the data rate is less than Wi-Fi but it reduced up to only 6% at 100m distance which is much less when compared to Wi-Fi. Though the distance increases LoRa maintains its data rate and continuously transfers the data. The above data is taken up to 1.5km and this shows that performance of LoRa is better when compared with Wi-Fi. On average LoRa transmits the data rate with 23% decrease in kbps as the distance increases. Wi-Fi operates on radio frequency of 2.4GHz. It covers up to 96m unobstructed. In this system the sender and the receiver is kept at two different areas where there are obstacles between them. And this becomes the negative side of Wi-Fi where its data rate is low with respect to its distance. LoRa uses the maximum frequency of 915 MHz Frequency of LoRa depends on country basis. The transmission rate of LoRa doesn't vary even obstacles present in the area. This analysis came to end by concluding that smaller the frequency larger the range.

CHAPTER 6

CONCLUSION

Speed is one of a mishap's most notable reasons. The GPS can also screen the speed and distinguish a mishap, other than using it for different purposes. GPS collector has now become a required tool. It is capable of sending the fault area to the Warning administration centre by using a modest and standard GSM modem. The last speed before the mishap can also be submitted to determine the scope of the mishap and start a voice call. Close to the programmed location framework, the vehicle inhabitant will have the option to physically send the mishap circumstance by squeezing the Manual Discovery Switch. In good time, rescue steps at the right location can save a significant number of lives. In this way, the proposed framework can be of great benefit to humanity, as human life is important. The proposed system deals with the detection of the accidents. But this can be extended by providing medication to the victims at the accident spot. These can detect the vehicle's position and condition by increasing the technology and sensors such as Gyroscope. These can also prevent accidents through the use of alerts systems that can detect the vehicle's over speed.

6.1 FUTURE WORK

The LoRa accident alert system will be collecting sensitive data, such as location information, and it is important to ensure that this data is secure and protected from unauthorized access. The success of the LoRa accident alert system will depend on user acceptance, and it is important to conduct research to understand user needs and preferences to ensure that the system is designed to meet their needs. LoRa accident alert system needs to be standardized to ensure interoperability with other systems, and to enable seamless integration into existing infrastructure.

STANDARDS AND CONSTRAINTS

STANDARDS

The LoRaWAN open specification is a low power, wide area networking (LPWAN) standard managed by the LoRa Alliance®, a non-profit technology alliance. Designed to wirelessly connect battery operated things to the internet in regional, national or global networks, the LoRaWAN standard meets key Internet of Things (IoT) requirements such as bidirectional communication, end-to-end security, mobility, and geolocation services. LoRaWAN leverages the unlicensed radio spectrum in the Industrial, Scientific and Medical (ISM) band. The specification defines the device-to-infrastructure of LoRa® physical layer parameters and the LoRaWAN standard, and provides seamless interoperability between manufacturers. The LoRaWAN standard is recognized by the International Telecommunication Union (ITU), the United Nations specialized agency for information and communication technologies (ICTs), as a standard for LPWANs. While Semtech provides LoRa chipsets, the LoRa Alliance drives the standardization and global harmonization of the LoRaWAN standard for the vast ecosystem.

- IEEE 1451.0 - Smart Sensor/Smart Transducer
- IEEE 802.11 ah - Non-Proprietary Low-Power Long-Range standard
- IEEE 802.11.b – Wireless Communications
- IEEE 802.11p - Physical and MAC layers
- IEEE 802.15.2 - Bluetooth and Wi-Fi co-existing mechanism
- IEEE 802.15.4 - Wireless Sensor

CONSTRAINTS

Many people only know the standards of the long transmission distance of the LoRa module, but do not understand why it can transmit so far. In fact, it sacrifices the data transmission rate in the air to achieve ultra-long transmission distance. In the field of wireless communication, the higher the transmission rate of the module, the closer the transmission distance. Because the higher the rate, the easier the signal is weakened; the lower the transmission rate, the opposite is true. If this project has high requirements for transmission rate, choosing LoRa module is an unwise choice. Among the many types of wireless modules in Nice RF, the price of the LoRa module is relatively more expensive than the RF modules of the GFSK and FSK series. So, company will recommend the LoRa module. Its performance of various parameters is indeed second to none in all kinds of wireless modules. the continuous development of LoRa, LoRa equipment, and network deployment continue to increase, and certain spectrum interference will occur between each other. During the LoRa deployment process, users need to build their own network. The payload of LoRa transmission data is relatively small and has a byte limit

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