ACCIDENT DETECTION AND REPORTINGSYSTEM USING IoT

Ms. P. Devi[1], Dr. S. Anila[2],
[1]Assistant Professor, Department of ECE, Sri Ramakrishna Institute of Technology, Coimbatore, India.
[2]Associate Professor, Department of ECE, Sri Ramakrishna Institute of Technology, Coimbatore, India.

Abstract

The main concern to be adopted by National Road Safety Council (NRSC) is to involve largely in achieving the reduction of vehicle accidents by helping the injured people and providing on spot rescue operation. The vagueness of accident location and additional information reaching late to the rescue team causes reduced results which are increased death rates. The technologies have increased the communication strategies that aid in the results that guarantee the best outcome. The IoT system solution to accident detection provides instant notification to an authoritative organization that ensures sincere direction to the rescue system with geographic coordinates and some other added information about the passenger, vehicle and road conditions. The accident detection is carried out by the shock sensor followed by the processing of the sensor signal through an algorithm. The system promises to report the accident information in split seconds through specific and detailed data of the vehicles and passengers accessed from databases maintained by the authoritative organization.

Index Terms: Accident, Rescue, Emergency, IoT, Awareness, Reporting, GPS, Shock Sensor, Vehicle Tracking

I. INTRODUCTION

The main objective of this work is to develop a new smart IoT solution which helps the community to reduce the death rate due to vehicle accidents by automatically transmitting the location of the accident and the basic medical information required by the rescue teams to provide emergency services. Many accident victims lose their lives due to late accident reporting, inaccurate geographic location and lack of Victim's medical information; therefore, we have proposed an automated and intelligent system for tackling this problem. The current systems include User interaction after the occurrence of the accident. To request help manually may not be possible if the victim is unconscious or brutally injured. Our proposed system does not require any modes of User interaction as both the detecting and reporting of the accident is fully automated.

This paper is proposes an IoT approach to report the accident occurrence which helps in lowering death rate due to vehicle accidents and to automatically transmit the location of the accident along with the basic medical information required by the rescue teams to provide emergency services.

The growth of technology has made our lives easy. The advent of the technology has also increased in the traffics and the road accidents take place often which causes death because of the improper emergency facilities. This module will give a solution to this drawback. A shock sensor is usually used in the detection of the vibration that the vehicle endures during accidents. If the occurrence of any crash or rollover detection of the vehicle is reported using the signals from a shock sensor, even a small accident can be detected easily. Whenever a vehicle meets with an accident, the sensor senses the signal. The controller sends the alert through the Cellular IoT along with the location to a rescue team. So they can immediately find their location through the GPS and reach the accident spot and take the action immediately. If the person was hit hard, then the alert can be controlled by the driver using a button given to avoid ruining the precious time of the rescue team. As there is a scope for

improvement and as a future implementation we can add a wireless webcam for capturing the images which will help in providing driver's assistance. The widespread usage of the IoT solution enables this system to be maintained as one of the service scheme of the government that could be offered to its people in the long run. The rest of the paper is divided into the related works and proposed works which tell about the existing system and the detailed algorithm for accident detection and reporting system and finally, the paper is concluded.

II. RELATED WORK

Many systems were proposed for detecting accidents. In A traffic accident, recording and reporting model at intersections model extracts the information from the video image, tracks the moving vehicles and extracts features such as the variation rate of the properties of the moving vehicles. This model then makes decisions based on the extracted features. Its drawback is to correct detection rate is only 50% which indicates that equal amount of false predictions were made and recorded.

In Accident Detection and Reporting System using GPS, GPRS, and GSM Technology, a GPS receiver is used to detect the occurrence of the accident by monitoring the speed of the vehicle. Then the reporting is done using a GSM network which reduces the rescue time. Its drawbacks are detecting false accidents as sudden brakes are common.

In Automatic Accident Detection and Reporting framework for two-wheelers includes a microcontroller-based low-cost Accident Detection Unit (ADU) that contains a GPS and a GSM modem to sense and generate accidental events to a centralized server. Its drawback is that this system is valid for only two-wheelers. The sensors used are position sensors but in a car, we also need a shock sensor.

In a smartphone-based pocket fall accident detection, positioning, and rescue system, The fall accident detection and corresponding wide area rescue system based on a smartphone and the third generation (3G) networks. The user's position can be acquired by the global positioning system (GPS) and sent to the rescue center via the 3G communication network so that the user can get medical help immediately. Its drawback is that this is applicable only for 3G technology which will not be useful now since we have moved on to 4G networking.

In Wireless System for Vehicle Accident Detection and Reporting using Accelerometer and GPS, accident detection and reporting is using accelerometer and GPS location of the vehicle. In case of an accident, the system sends an automated message to the preprogrammed number such as family member or emergency medical services via GSM. The drawback is that the time between the accident and getting victim medical attention can often be the difference between life and death. This system provides a better safety than no safety but still needs optimization for giving best results.

In EU eCall system, a vehicle having a collision serious enough for onboard sensors to deploy airbags establishes a voice connection via the 112 number, and also sends a data message – to the nearest PSAP using satellite positioning and mobile telephony caller location. 'eCall Flag 'enables the mobile network operator to determine that an eCall has been received. The operator then tries to make voice contact with the vehicle's occupants to get further information. If there is no reply, or if the occupants are able to confirm the seriousness of the accident, emergency services are dispatched immediately. The disadvantage is that it consumes more time for getting assurance from accident victims. The cost of developing and implementing this system goes well beyond the cost benefits of such a service.

Limitations of the Existing System are Information passed is scarce, less accurate, Delay in message transmission and the Static user registration.

III. PROPOSED METHOD

Our system gives out a widespread usage wherein an emergency service organization (ESO) can serve efficiently to the people. The system consists of various sections that include registration of the vehicle and passengers in the ESO's database, accident detection and further monitoring of accidents through the web interface at the ESO.

Vehicle and Passenger Registration: Here, our IoT device is installed in the vehicle registering the vehicle in the database with a vehicle ID. Therefore on account of the accident, the vehicle ID can be referenced to retrieve the vehicle information that is already stored in the database.

The Passenger registration is done by providing an RFID tag to each passenger. The information of the passengers is contained under the RFID which names a specific passenger. The information includes (a) Name, (b) Mobile number, (c) Email, (d) Blood type,(e) Medical history, (f) Date of birth, (g) Reference phone number. The RFID along with the information is stored in the database, therefore, registering the passenger to the ESO.

The device that is being set in the vehicle consists of the shock sensor that senses the vibration of the vehicle, GPS module that finds the location, RF reader that reads the RFID tag of the passengers, microcontroller unit that stores and process the data of every other module and finally the cellular IoT that transmits the sensed and collected data to the ESO's database after which database tries to map the received data within its storage and therefore the additional information under the ID is retrieved and further implementation of the rescue operation is done immediately.

Accident detection: The detection of the accident is done by the vibration sensor module. A particular threshold level is
fixed in the module according to the impact level a vehicle can hold. Although the predictions are correct most of the times, it is better to be aware of faulty predictions. For this, microcontroller unit is set to wait for an interrupt signal from the passenger (switch press) availing a thirty-second timer check to figure out a faulty prediction. And it is made sure that the reporting continues after this check.

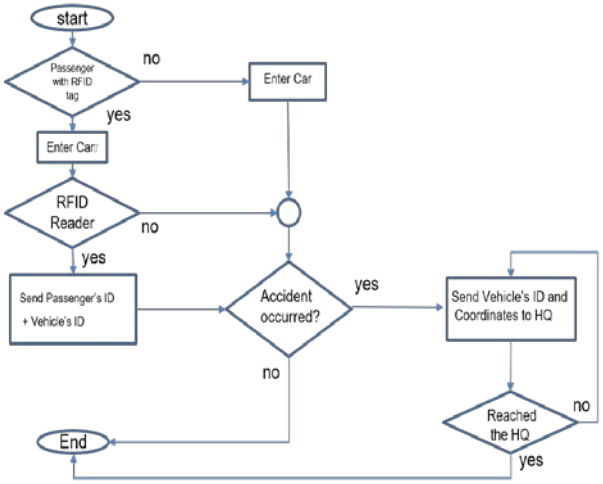


Fig.1-**Flow Chart of the Proposed System**

Monitoring accidents: The RFID tag of the passenger is read by the RF reader that is set in the IoT device when the passenger enters the car. In case of an accident, the vibration sensor senses the impact based on the threshold value that the sensor is set in its module. The microcontroller unit processes the signal from the sensor. Along with the processed signal, location of the vehicle and the RFID is sent via the cellular IoT to the ESO' database. In case of unavailability of RFID with the passengers, the processed signal, and location of the vehicle indicating the coordinates of the latitude and longitude are sent to the database

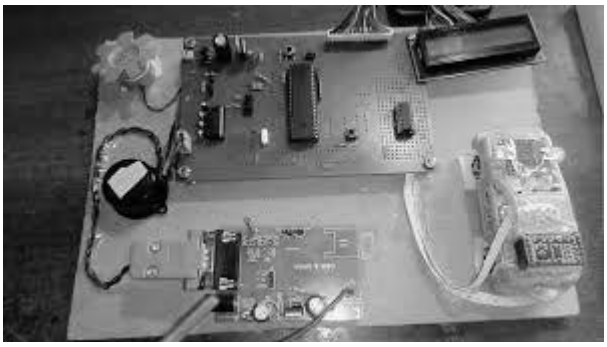


Fig.2- Accident Detection unit

IV. DESIGN AND ARCHITECTURE

The below system architecture is the theoretical model that defines the idea, specifies the structure, behavior, and also some views of our proposed system.

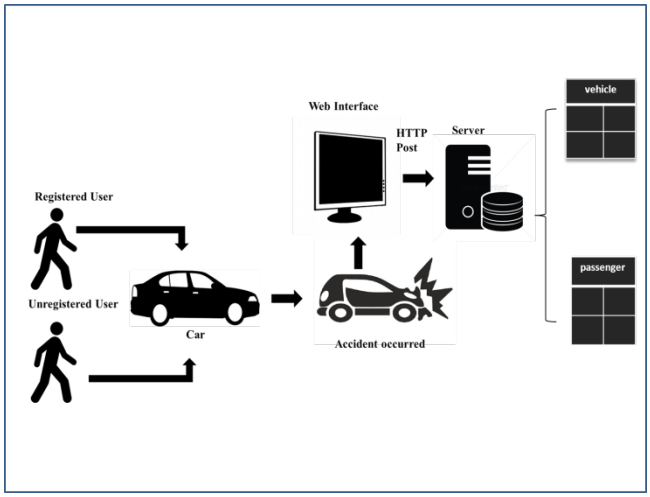


Fig.3–Registration Phase Architectural Diagram

The registration phase explained before is represented in detail in Fig 3. The operator registers the vehicle using its vehicle ID through a web interface connected to the database server. As a result, the Vehicle table in the database now

contains the records pertaining to all registered vehicles. Furthermore, the passenger registers himself/herself on the server through the corresponding mobile interface.

This allows the passenger to get into any device implemented vehicle and get any help from the rescue team.

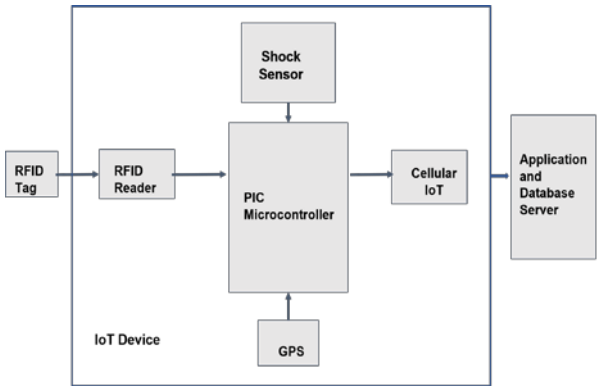


Fig.4- Block diagram of the Proposed system

The integral concept of the proposed system is explained in section III as represented in Fig 4. When the user with an RFID tag enters the registered car, an HTTP request which contains the vehicle's ID and the passenger's ID, is sent via the IoT cellular network to the database servers. If a passenger decides to leave the car, the system automatically removes the ID details from the database. In the Server, a table which contains the current trip is maintained. Each trip consists of its passengers and the vehicle's ID. If an accident occurs, another HTTP request which contains the vehicle's ID and the GPS location coordinates (longitude and latitude) is sent to the server where all record attributes such as name, blood group, contact information of the passenger and the vehicle registration ID are stored in the database as an XML file immediately.

V. IMPLEMENTATION

For the implementation of the proposed system, the following components and modules are used.

A. Radio Frequency Identification (RFID)

RFID is used for automatically identifying and capturing data using radio waves. RFID system typically consists of RFID tag, RF reader and Antenna. The RFID tag is used to exchange data to the RF reader.

RFID reader is used for the purpose of identifying each passenger via their RFID tag. Then the ID is matched with the corresponding database entry.

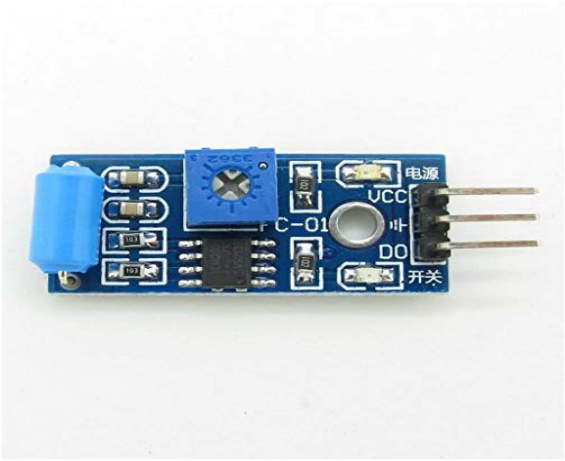
B. Global positioning system (GPS)

A GPS Navigation system is used to calculate the geographical position of the device by using the GPS satellites. Using appropriate software, the coordinates can be displayed on a map.

Here, After the occurrence of an accident, the precise location of the vehicle is captured as coordinates by the GPS module which is distributed via the IoT module.

C. Vibration Sensor

The vibration sensor module SW-420 is used which depends on the vibration sensor and comparator LM393 to ascertain the occurrence of an accident if the vibration is beyond the threshold. The in-built potentiometer is used to adjust the threshold value.

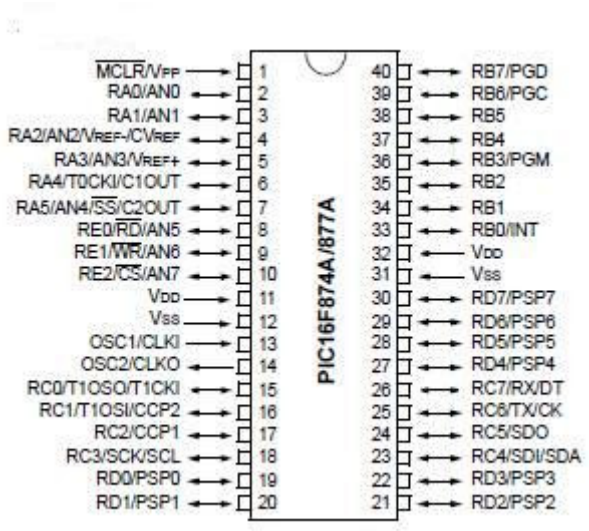


D. PIC Microcontroller

The PIC Microcontroller PIC16f877a is used. It has a FLASH memory and can be written and erased as many times as needed. It has a total of 40 pins and 33 input/output pins. Microcontroller is used to control each component and the overall operations of the system.

The PIC microcontroller is programmed using Embedded C Language in an IDE (Integrated Development Environment). A compiler is used to convert the program into HEX file and an IPE (Integrated Programming Environment)is used to

dump the hex file into the Microcontroller.



E. IoT Module

An IoT Module is a device that connects to wireless networks. It can be used to send and receive data. An IoT module is always on connectivity and offers extended coverage. It works in real time without the interference of physical contact. This IoT Module distributes information and communicates with the server database. Our system uses the cellular 3G module to establish all kinds of wireless communications from and to the server.

VI. CONCLUSION AND FUTURE WORK

Over 50% of deaths per year are occurring due to accidents. Many accident victims lose their lives due to insufficient information regarding the accident such as its location and the other medical issues of the victims. The overall death rate can be reduced immensely if the victims can be rescued on time and the required information is communicated accurately. Therefore, we have proposed and implemented an IoT system which may help the community decrease the death rates resulting from vehicles accidents. Our system automatically transmits the location of the accident and the basic medical information required by the rescue teams to provide emergency services. The system is robust and reliable as the IoT device is always connected to the internet and keeps sending continuous notification of accident occurrence until the message is reached successfully to the server Database. The data collected from this system can help Traffic police offices, Road engineers, Statistical authorities, The general public etc. to easily get and share timely information among each other.

VII. REFERENCES

[1] Devi P, Bhargavi Venu, Devipriya Ravichandran, Fousiya Dasthakeer and Menaka Manoharan. "Traffic Congestion Control with Automatic Signal Clearance." International Journal for Innovative Research in Science & Technology, March 2017 : 61-68

[2] Lih-Jen Kau and Chih-Sheng Chen,"A Smart Phone- Based Pocket Fall Accident Detection, Positioning and Rescue System", IEEE Journal Of Biomedical and Health Informatics, Vol. 19, no. 1, January 2015.

[3] AmitMeena', SrikrishnaIyer, Monika Nimje, SaketJogJekar, SachinJagtap, MujeebRahman, "Automatic Accident Detection and Reporting framework for two wheelers", IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT) ,2014.

[4] Yong-Kul Ki and Dong-Young Lee," A traffic accident recording and reporting model at intersections", IEEE Transactions On Intelligent Transportation Systems, Vol. 8, no. 2, June 2007.

[5] Md. Syedul Amin, JubayerJalil, M. B. I. Reaz ," Accident Detection and Reporting System using GPS, GPRS and GSM Technology", IEEE/OSA/IAPR International Conference on Informatics, Electronics & Vision, ICIEV 2012.

[6] ShaileshBhavthankar 1 , Prof. H.G.Sayyed 2, "Wireless System for Vehicle Accident Detection and Reporting using Accelerometer and GPS", International Journal of Scientific & Engineering Research, Volume 6, Issue 8, August-2015.

[7] Liling Li, SharadShrestha, Gongzhu Hu, " Analysis of Road Traffic Fatal Accidents Using Data Mining Techniques",

[8] M. Grewal, L. Weill and A. Andrews, Global positioning systems, inertial navigation, and integration. New York: John Wiley, 2001.

[9] M. Hendry, Near field communications technology and applications.

[10] "Cellular networks for massive IoT," Ericsson White Paper, Jan 2016

[11] w. Chris Veness, "Calculate distance and bearing between two Latitude/Longitude points using haversine formula in JavaScript", 2016.