International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

Vehicular Accident Detection and Alerting System

Vinitha.D[1], Thamarai Selvi[2], Priyadharsini N.K[3]
[1, 2]IV CSE, Department of CSE, P.A. College of Engineering and Technology
[3]Assistant Professor, Department of CSE, P.A. College of Engineering and Technology
Email address: [3]priyasnk@gmail.com

Abstract**—***Vehicular accidents are one of the leading causes of fatalities across the globe. The major reason for loss of lives is due to time delay between the accident occurred and the response provided by the rescue team. In this paper we attempt to solve this by equipping an IoT kit in the vehicle which helps to detect the accident. This also aims at aiding many injured people as much as possible and providing 24/7 services on spot rescue. Using sensors, the accident will be detected and the information is sent automatically to the nearest emergency service providers and to the emergency contact number (family member). The sent information comprises of user's detail, blood group and the exact geographical location of the crash. During uncertainty conditions Fuzzy logic is implemented to avoid false alarm and the accuracy is maintained.*

Keywords**—** *Emergency service providers, crash, sensors, fuzzy logic, geographical location.*

I. INTRODUCTION

In India, more than 150,000 people are killed each year in traffic accidents. That's about 400 fatalities a day, there is one death every four minutes due to a road accident.

The challenges imposed to local PSOs in saving human lives resulting from vehicles accidents have become a crucial concern due to the huge aforementioned number of departed people. As far as many injured could lose their lives, and since no on-site medical assistance has been provided promptly as a result of: (1) late accident reporting, (2) inaccurate geographic location, and (3) lack of injured medical information, the need for automated and intelligent mobile solution tackling this burden becomes a must.

Using an incident detection program in the United States, a reduction in the response time form 5.2minutes to 3 minutes would have saved 246 lives, a reduction by 11% whereas by reducing the response time to 2minutes, 356 lives would be saved annually.

The 2030 Agenda for Sustainable development was launched which aims at reducing the number of deaths and injuries arising due to road crashed to half its number by the year 2020.The paper attempts to reduce the delay time between the actual incident and the medical response team. The occurrence of accident is intimated to the nearest emergency service providers and to the emergency contact number (family member) along with the location.

The main objective of this paper is to provide solution by (a) Implementing IoT, a smart solution which helps in reducing death rates (b) Ensures no other person intervention required during or after the accident occurred (c) Sending the geographical information of accident occurred (d) Using navigation system, the nearest rescue team could be found.

II. RELATED WORK

Detection of accident automatically and alerting the emergency service providers can be done by several approaches. The key feature of each approach is explored in the remaining part of the section.

Asad Ali and Mohamad Eid proposed a system [2], which detects the accident using the inbuilt sensors of the smartphone. The parameters such as acceleration, rotation and impact are monitored using inbuilt sensors of the smartphone such as accelerometer, gyroscope and force. By analyzing all these parameters, the detection of accident is founded and intimated.

Harit Sharma et al. proposed a system [3], using the inbuilt sensors of the smartphone. The system starts when the user enters into the driving mode. The maximum linear acceleration is calculated using the sensor values. If the accident is detected the collision index is calculated. Indicates the severity of the accident.

Rajesh kannan meghalingam et al. proposed a system [4], which uses the microcontroller in making decision on the traffic accident based on the input from the sensors. The RF transmitter module which is interfaced with the microcontroller will transmit the accident information to the nearby Emergency Service Provider (ESP). This information is received by the RF receiver module at the 'service provider' control room in the locality.

David Khoury et al. proposed a system [5], which uses shock sensor for detecting accidents. It consists of three modules such as 1) Vehicle registration 2) Passenger registration 3) Accident monitoring. The shock sensor readings are continuously monitored and the decision in made in detection of accident.

D. Bindu Tushara et al. proposed a system [6], which uses the Atmel microcontroller AT89S52 which performs all the operations related to controlling the system circuits. It is also used as a collision preventing system. It consists of a keypad for contacting the emergency service providers during the accident.

All the approaches of the existing system are considered. This paper aims at proposing a new system which detects the accident in a smart way by overcoming the weakness of the existing systems.

III. METHODOLOGY

In this section, we explain our proposed system at high level of scope. The proposed system comprises of the following modules: (1) Registration module (2) Data

Vinitha.D, Thamarai Selvi, and Priyadharsini N.K, "Vehicular accident detection and alerting system," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 1, Issue 9, pp. 6-9, 2019.

collection module (3) Decision making module (4) Location detection module (5) Response module.

Registration Module

This module acts as interface between user and the application. The web application collects the details from the user and later it is used for rescuing. It comprises of the User name, Vehicle model and its number, User personal and emergency contact and also the blood group. All the data are maintained at Firebase.

Data Collection Module

The data are collected from the two sensors namely Vibration and Crash sensors. The readings are taken from the continuously monitoring sensors. When it exceeds the threshold value, the further step is carried out by the decision making module.

Location Detection Module

When the occurrence of the accident is confirmed, the accurate location is detected. It is then intimated to the Emergency Service Providers with latitude and longitude using GPS Neo- 6M (Global Positioning System). And also to the Emergency contact (family member) which the user registered during the registration module.

Response Module

The nearest emergency service provider is founded by the Haversine algorithm. Whenever the emergency service providers receive the information, they provide immediate rescue to the passengers (injured).

Decision Making Module

According to the data received from the previous module, the decision is taken. The data are compared with the pre-defined test cases. Uncertainty situations are handled by the fuzzy logic. False alarm generation is avoided by using the fuzzy logic concept.

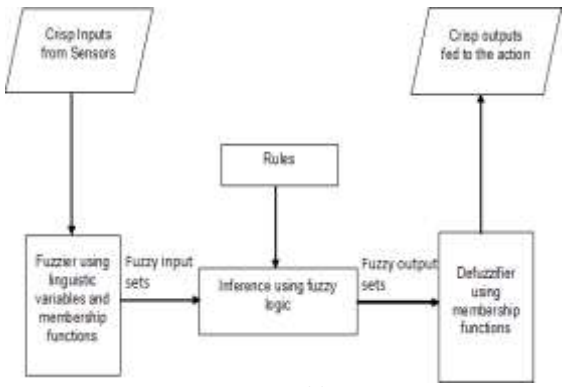

Fig. 1. Working of fuzzy logic.

Haversine formula:

$$hav\left(\frac{d}{r}\right) = hav\ (\varphi_2 - \varphi_1) + \cos(\varphi_1)\cos(\varphi_2)hav(\lambda_2 - \lambda_1)$$

Where
hav is the haversine function:

$$hav(\theta) = \sin^2\left(\frac{\theta}{2}\right) = \frac{1-\cos(\theta)}{2}$$

d is the distance between the two points (along the great circle of the sphere),
r is the radius of the sphere,
φ_1, φ_2:Latitude of point 1 and latitude of point 2 in radians,
λ_1,λ_2: Longitude of point 1 and longitude of point 2 in radians.

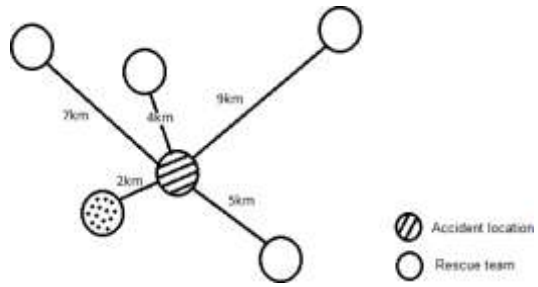

Fig. 2. Points distribution example scenario.

IV. Design and Architecture

The Architecture of the proposed system provides a clear view of the system design.

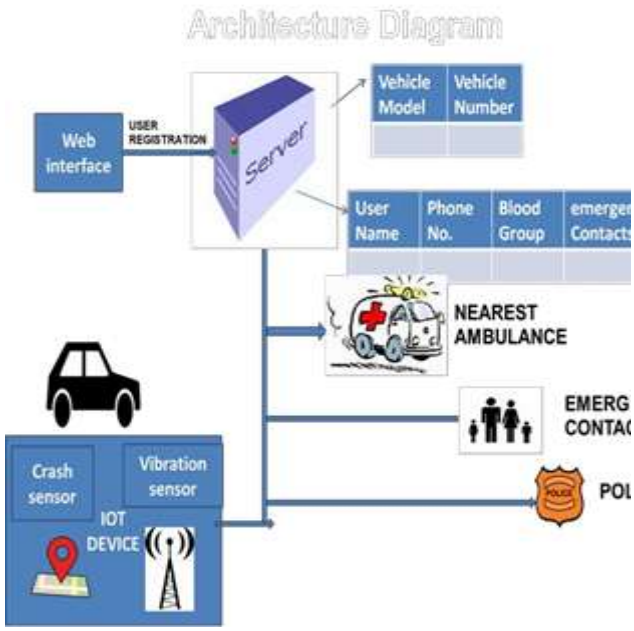

Fig. 3. Architecture.

Using the web interface user first registers his information such as Username, Phone number, Blood group, Vehicle model, Vehicle number and the emergency contact number. The IoT kit which is placed in the vehicle detects the accident occurrence. If the accident is detected the location of the accident is sent to the nearest emergency service providers, emergency contact number and to the police.

The overall flowchart of the system:

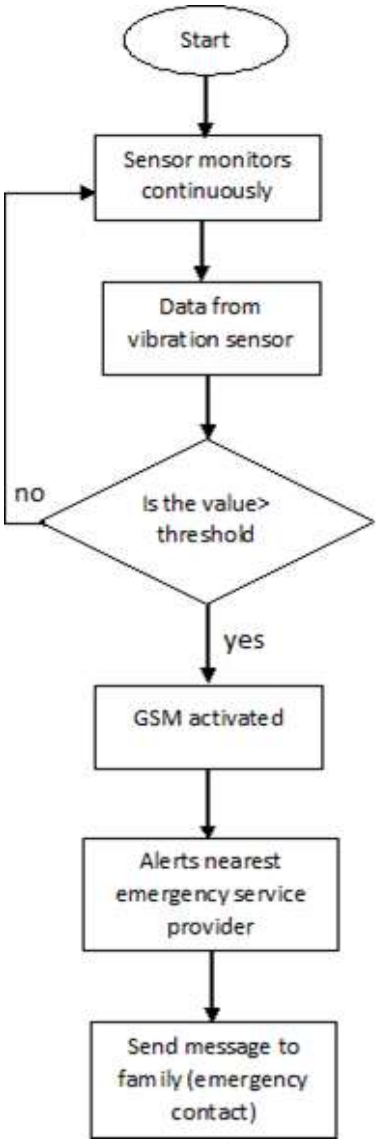

Fig. 4. System flowchart.

V. IMPLEMENTATION

Hardware Components

In our implementation we have used an IoT device containing different components and modules as well as communications capability. The main components of this device are:

1. *Arduino*

Arduino microcontroller plays the vital role of integrating the sensors with the web application. The Arduino microcontroller collects the value from sensors and is sent to the web application for further processing. Arduino controls the working of sensors.

2. *Vibration sensor*

Vibration sensor monitors the displacement, velocity and acceleration of the vehicle. It monitors the parameters with the help of threshold value.

3. *Crash sensor*

Crash sensor is another important component in detection of accident. Crash sensor has a threshold value and anything that exceeds that value is detected. The parameters that are monitored by crash sensor are speed and brake pressure.

4. *GPS NEO-6M*

This is a complete GPS module that is based on the Ublox Neo-6M. This unit uses the latest technology from Ublox to give the best possible positioning information and includes a larger built in active GPS antenna with UART TTL socket. A battery is also included so that we can obtain a GPS location faster.

5. *GSM*

This is a compatible quad-band cell phone, which works in the frequency of 850/900/1800/1900 MHZ and which can be used not only to access the internet, but also for oral communication and for SMS.

Software Components

1. *HTML*

Hypertext Markup Language (HTML) is the standard markup language for Creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web. HTML can embed programs written in a scripting language such as JavaScript, which affects the behavior and content of web pages.

2. *Java script*

Java script is a high level dynamic and interpreted programming language. Alongside HTML and CSS, JavaScript is one of the three core technologies of the World Wide Web. JavaScript enables interactive web pages and thus is an essential part of web applications.

3. *Firebase*

Firebase is a mobile and web application development platform. It provides a real-time database and backend as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored in firebase's cloud

VI. RESULTS

This section shows a simulation of some important features implemented in this project.

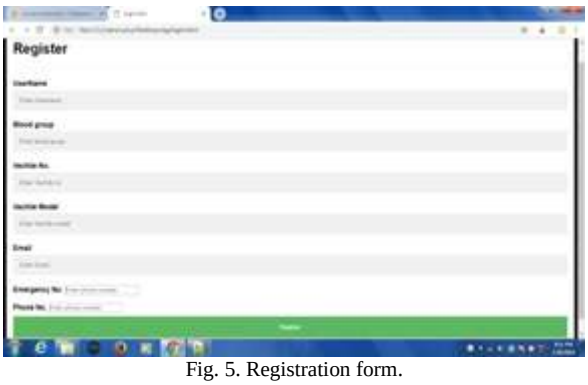

Fig. 5. Registration form.

Fig. 5 shows the registration form where the user registers their details and the details which gets stored in the firebase is shown in fig. 6.

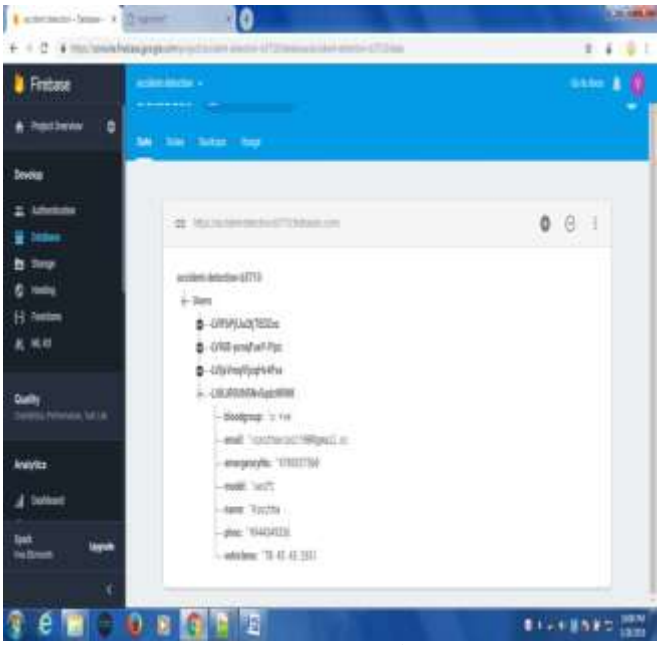

Fig. 6. Details stored in firebase.

Fig. 7 depicts the hardware setup of detection the location of the accident and the output is shown in fig. 8.

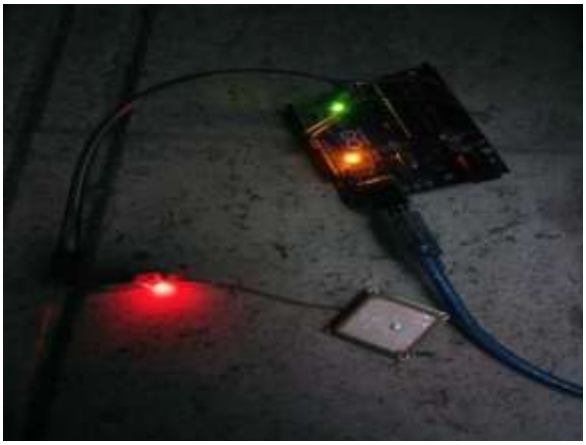

Fig. 7. Location detection hardware.

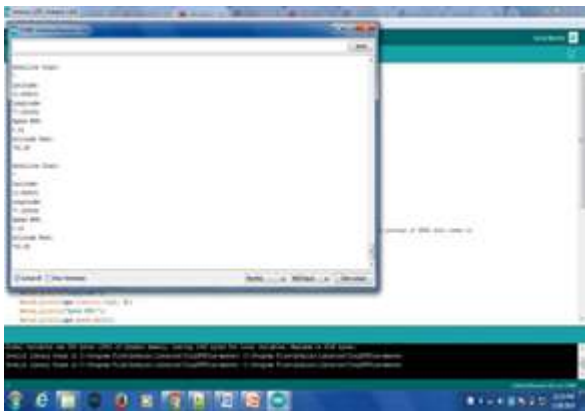

Fig. 8. Output with latitude and longitude.

Fig. 9. Alert message.

VII. Conclusion

In this paper we proposed and implemented an IOT system which helps in decreasing the fatalities resulting from vehicle accidents. Results showed that this solution reduce the response time when compared to traditional systems. It minimizes injured passenger interaction, providing basic medical information to emergency service providers recognizing exact and accurate accident location.

References

[1] A. Alkandari, I. F. Al- Shaikhli, A. Naaja, and M. Alijandal, "Accident detection and action system using fuzzy logic theory," in *International Conference on Fuzzy Theory And its Applications*, 2013.

[2] A. Ali and M. Eid, "An automated system for accident detection," in *IEEE Instrumentation and Measurement Society*, 2015.

[3] H. Sharma, R. Reddy, and A. Karthik, "S-Car crash: Real time crash detection analysis and emergency alert using smartphone," in *IEEE International Conference on Connected Vehicles*, 2016.

[4] R. K. Meghalingam, R. N. Nair, and S. M. Prakya, "Wireless vehicular accident detection and reporting system," in *International Conference on Mechanical and Electrical technology*, 2010.

[5] E. Nasr, E. K. Foury, and D. Khoury, "An IOT approach to vehicle accident detection, reporting and navigation," in *IEEE International Multidisciplinary Conference on Engineering technology*, 2016.

[6] D. B. Tushara and P. A. H. Vardhini, "Wireless vehicle alert and colliosion prevention system design using atmel microcontroller," in *International Conference on Electrical, Electronics and Optimization Techniques*, 2016.

[7] N. Watthanawisuth, T. Lomas and A. Tuantranont, "Wireless black box using MEMS accelerometer and GPS tracking for accidental monitoring of vehicles," in *IEEE International Conference on Biomedical And Health Informatics*, 2012.

[8] S. Amin, J. Jalil, and M. B. I Reaz, "Accident detection and reporting system using GPS, GPRS and GSM technology," in *IEEE International Conference onInformatics, Electronics & Vision*, 2014.

[9] V. K. Kota, N. K. Mangali, T. K. Kanakurthi, A. R. Kumar, and T. Velayutham, "Automated accident detection and rescue system," *International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)*, 2017.

[10] B. S. Anil, K. A. Vilas and S. R. Jagtap, "Intelligent system for vehicular accident detection and notification," in *International Conference on Communication and Signal Processing*, 2014.

[11] Y.-C. Wei and Y.-M. Chen, "Adaptive decision making for improving trust establishment in VANET," *The 16th Asia-Pacific Network Operations and Management Symposium*, 2014.

[12] W. C. Veness, "Calculate distance and bearing between two Latitude/Longitude points using haversine formula in JavaScript," Movable-type.co.uk, 2016[Online].
Available: http://www.movabletype.co.uk/scripts/lat long.html