CHAPTER 46
Analysis of Accident Detection and Alert System Using IOT and Mobile Applications

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ABSTRACT

As the usage of vehicles is increasing drastically, the hazards due to vehicles is also increased. The main cause for accidents is high speed, drunk and drive, diverting minds, over stress and due to electronic gadgets. This paper deals with accident detection system that occurs due to carelessness of the person who is driving the vehicle. This introduces accident alerting system which alerts the person who is driving the vehicle. If the person is not in a position to control the vehicle, then the accident occurs. Once the accident occurs to the vehicle this system will send information to registered mobile number. Initially the GPS continuously takes input data from the satellite and stores the latitude and longitude values in AT89s52microcontroller's buffer. If we have to track the vehicle, we need to send a message to GSM device, by which it gets activated. It also gets activated by detecting accident on the shock sensor connected to vehicle. Parallel deactivates GPS with the help of relay. Once GSM gets activated it takes the last received latitude and longitude positions values from the buffer and sends a message to the particular number or laptop which is predefined in the program. Once message has been sent to the predefined device the GSM gets deactivated and GPS gets activated.

Keywords: *AI based medical Chabot, government hospitals, ultimately results etc.*

INTRODUCTION

The development of a transportation system has been the generative power for human beings to have the highest civilization above creatures in the earth. Automobile has a great importance in our daily life. We utilize it to go to our work place, keep in touch with our friends and family, and deliver our goods. But it can also bring disaster to us and even can kill us through accidents. Speed is one of the most important and basic risk factors in driving. It not only affects the severity of a crash, but also increases risk of being

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involved in a crash. Despite many efforts taken by different governmental and non-governmental organizations all around the world by various programs to aware against careless driving, yet accidents are taking place every now and then. However, many lives could have been saved if the emergency service could get the crash information in time. As such, efficient automatic accident detection with an automatic notification to the emergency service with the accident location is a prime need to save the precious human life. This seminar proposes to utilize the capability of a GPS receiver to monitor the speed of a vehicle and detect an accident basing on the monitored speed and send the location and time of the accident from the GPS data processed by a microcontroller by using the GSM network to the Alert Service Centre.

LITERATURE SURVEY

According to the Global status report on road safety 2015 [1], the total number of deaths caused due to road accidents has leveled out at 1.25 million a year. India faces the highest number of accidents and accidental fatalities in the world. In India, there are many kind of places like hilly area plateaus, and due to improper road facilities accidents are more and death rate due to this accident are more [29]. The maximum number of accidents are reported in the transport sector, that is, on road as well as railways. Some approximations claim that Indian roads alone accounted for approximately 105,000 accidental fatalities in 2010. This is almost 15 percent of the global road fatalities when India has just 1% of the total global vehicles.

The incidents of accidental deaths have shown increasing trend during the year 2000-2015 with an increase of 50 percent in the year 2010 as compared to the year 2000. According to Planning Commission of India, the total annual economic loss is 2.5% of India's GDP due to rising number of road fatalities. According to National Crime Records Bureau, Ministry of Road Transport & Highway, Law commission of India, one serious road accident in the country occurs every minute and 16 die on Indian roads every hour. According to the "WHO Report 2015: Data Tables" [2] the total number of fatalities in India in 2013 is 238,562 and reported number of road traffic deaths is 137,572 with the estimated road traffic death rate per 100,000 populations being 16.6.

The leading cause of death is road traffic injuries especially among young people and it costs countries about 1- 3% of the gross domestic product [3]. One of the major factors that is increasing this number is the delay in reporting of the crashes to emergency centers like near-by police stations and health care centers. According to [1], in 2015 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. In regard to this, authors provide a review on the existing technologies that aim to detect accidents automatically and alert the emergency centers without much delay.

The proposed system in [4] deals with an automatic accident detection system involving vehicles which sends information about the accident including the location, the time and angle of the accident to a rescue team like a first aid center and the police station. This information is sent in the form of an alert message. But in the cases where there are no casualties a switch is provided which can be turned off by the driver to terminate sending the alert message.

A GSM module is used to send the alert message and a GPS module is used to detect the location of the accident. The GPS and GSM module are interfaced to the control unit using serial communication [5]. The accident itself is detected using two sensors- Micro Electro Mechanical System (MEMS) sensor and vibration sensor. MEMS sensor also helps in measuring the angle of roll over of the car. A 32-bit ARM controller is used as the main high speed data-processing unit.

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The vibrations are sent from the vibrating sensor to the controller after passing through an amplifying circuit. Similarly, the roll over angle is sent from the MEMS sensor to the controller. Both the accident and the accident location can be detected as opposed to only one in the other approaches. There is also a method to stop sending the alert message and hence save time of the rescue time. The use of GPS adds to the advantage of the system being cost-effective, portable and detecting the accurate location [6] and the time taken for the entire detection process and sending of the message is greatly reduced as compared to other methods.

Overall the system is portable, has a small size, and is of low cost and expandable. In [7], traffic accidents have been detected successfully using an Internet of Things (Iota) and cloud computing framework. Traffic accidents have been detected using Support Vector Machine (SVM) that has been improved with the Ant Colony Algorithm (ACA). ACA is used for the parameter selection of SVM which plays an important role in the accuracy that can be achieved by SVM. The Iota sensors used here for monitoring the vehicles are the highly sensitive magneto resistive sensors. In fact, multiple sensor modules are employed to detect the presence of vehicles including sensors that detect the changes in the magnetic field on the road, the sound signals from brakes and collisions and two different sensors that help detect the direction of the vehicles. SVM is trained with historical traffic information and tested on future traffic data.

The algorithm tries to find a decision plane that separates the class of 'traffic accident' from the class of "no traffic accident'. This is improved by using ACA which is an optimization algorithm [8]. The metrics that have been used to detect the efficiency of detection include: (1) False Alarm Rate (FAR): ratio of error alerts to all detected events, (2) Detection Rate (DR): ratio of detected events to the real world accidents and (3) Average Time to Detect (ATD): time average between detected and happened.

The vehicle unit: This unit consists of a microcontroller, sensors, GPS, GSM module and an accelerometer. The sensors detect the accident, the GPS gets the location and the GSM module conveys this information to the main server unit.

The accelerometer can help avoid accidents by notifying the driver when the position of the vehicle is deviated from the normal. The entire vehicle unit must be installed in the vehicle. The control unit: This unit contains the database of hospitals and is responsible for communicating messages between all the units. The ambulance unit: This unit has a patient monitoring system to constantly measure and convey the patient's temperature and pulse rate to the hospital.

The traffic junction unit: This unit turns the signal to green when the ambulance is about 10 meters away so that the path is clear for it to move quickly. This is achieved through RF communication. Thus, this system has overcome many drawbacks of the existing accident detection systems with respect to time.

The proposed system in [12] is in the form of an Android application which detects an accident using an accelerometer which is built in the smartphone. The phone must be docked inside the vehicle and not held by any person. The working of this application is as follows:

When the device is tilted above a certain threshold and is detected by the accelerometer, the application waits for 15 seconds. Here, three kinds of input can be received. (1) If the user is active, he can press "cancel" if the device was tilted by mistake. (2) If the user is active, he can press "send" if an accident has occurred. (3) If the user is inactive and no button is pressed after 15 seconds, an accident is assumed have occurred.

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In case of (2) and (3), the current to location is fetched by GPS and a pre-recorded voice message along with the location is sent to the 108 ambulance emergency response service. A study on GPS services provided by Android has been thoroughly conducted [13] [14]. Thus, through the use of just a Smartphone without any extra hardware components, efficient accident detection and notification has been achieved.

The proposed system in [15] also uses an Android application where the Smartphone must be placed in a holder attached to the vehicle.

The Accident Detection Algorithm detects an accident based on three kinds of events: (1) A collision is detected if the accelerometer shows a reading above the threshold which is 4g (g=9.8m/s2) and the approximate severity of the accident is determined by a metric called Acceleration Severity Index (ASI). (2) Rollovers are detected using a gyroscope and a magnetometer. If a rotation greater than 45 degrees occurs and if the instantaneous speed is found to be less than 5km/h, it is considered as a rollover. (3) And airbag deployed signal indicates an accident as well.

This system controls false positives by sending accident notifications only if a countdown sequence is not interrupted by any of the passengers. The proposed system in [16] consist of several components with different functions. First, the vehicles should have embedded in it an On- Board Unit (OBU) responsible for detecting accidents and communicating information about dangerous situations.

The notification of the detected accidents is made through a combination of both Vehicle-to-Vehicle (V2V) communications and Vehicle and the Roadside Infrastructure (V2I) communications, while the destination of the information is the Control Unit (CU) which will handle the alert notification, estimating the severity of the accident and communicating the incident to the appropriate emergency services which is done through the internet service.

The different technologies used include GPS, accelerometers and Kalan filters. The major need for this algorithm are more accuracy in GPS systems as they suffer from the line of sight and poor update rate and as such, the acceleration data derived from the GPS lacks in instantaneous acceleration which is very important in determining a sudden deceleration due to accident. High and instantaneous data can be acquired from the IMU (Inertial Measurement Unit) as opposed to GPS.

The proposed system in [25] monitors the deceleration data from the GPS and IMU accelerometer sensors. These two types of data are integrated by the Kalan filter [26]. Whenever the deceleration from the GPS is available, IMU deceleration is updated by this filter. The deceleration data from the IMU is considered only in the GPS outage scenario. The Razor INS can fill the gaps in case of GPS outage and the IMU data are updated through the integration of valid GPS data. The IMU provides accelerometer, gyroscope and magnetometer reading in all three axes.

The orientation of the vehicle relative to gravity can be predicted by integrating gyroscope with the accelerometer and the direction of the vehicle can be determined from the magnetometer. By integrating these sensors in three axes, the Attitude Heading Reference System (AHRS) [27] is built. The Direction Cosine Matrix (DCM) is used as a basis to integrate the accelerometer, gyroscope and magnetometer.

This matrix is a form to represent a rotation through a 3X3 R matrix. The DCM matrix described in [28] has been used as a model for the IMU sensors to build the AHRS. The ARHS data gets corrupted, which is fused with GPS data using the Kalan filter.

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Vehicle decelerates when the brake is applied. Any deceleration more than 5Gs as obtained is considered as an accident situation by the proposed algorithm. In this situation, the system would raise an alarm for the location detection module. The results from the paper are based on the threshold maintained which is 5Gs, which when the deceleration is below it, an alert is sent.

METHODOLOGY

To protect the vehicle and tracking so many advanced technologies are available in now a day. In olden days the information of accident can be transferred, but the place of accident spot cannot be identified. In any vehicle airbags are designed, air bags are used for security and safety travels [2]. The air bag system was introduced in the year of 1968.

BLOCK DIAGRAM

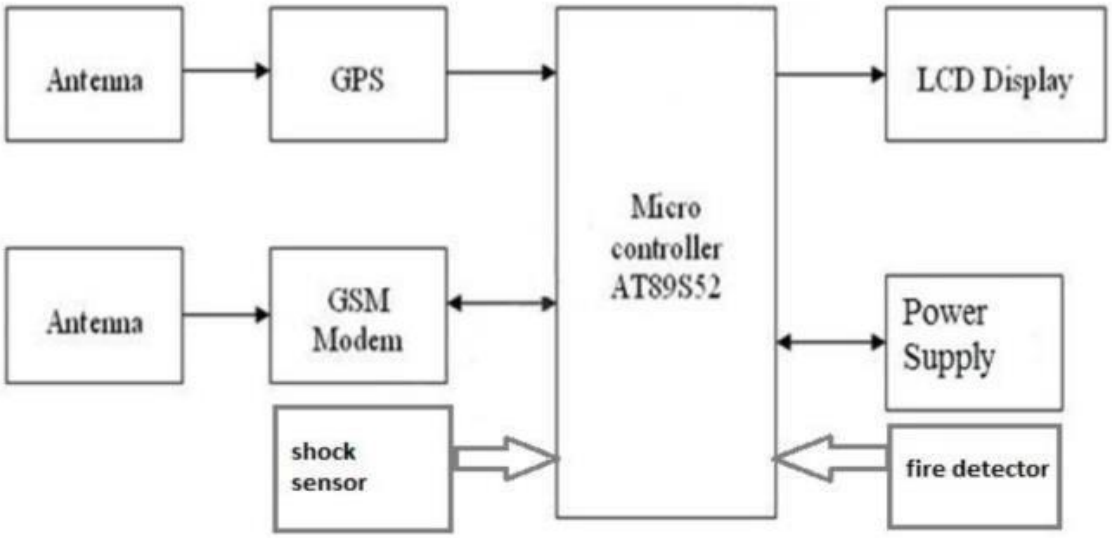

Figure 3.1, Block Diagram

The Arduino UNO is a widely used open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. The Arduino is the major control unit to detect or alert when an accident occurs. It collects the data from vibration sensor, GPRS and GSM modules and reflects the output either in display system or through a message.

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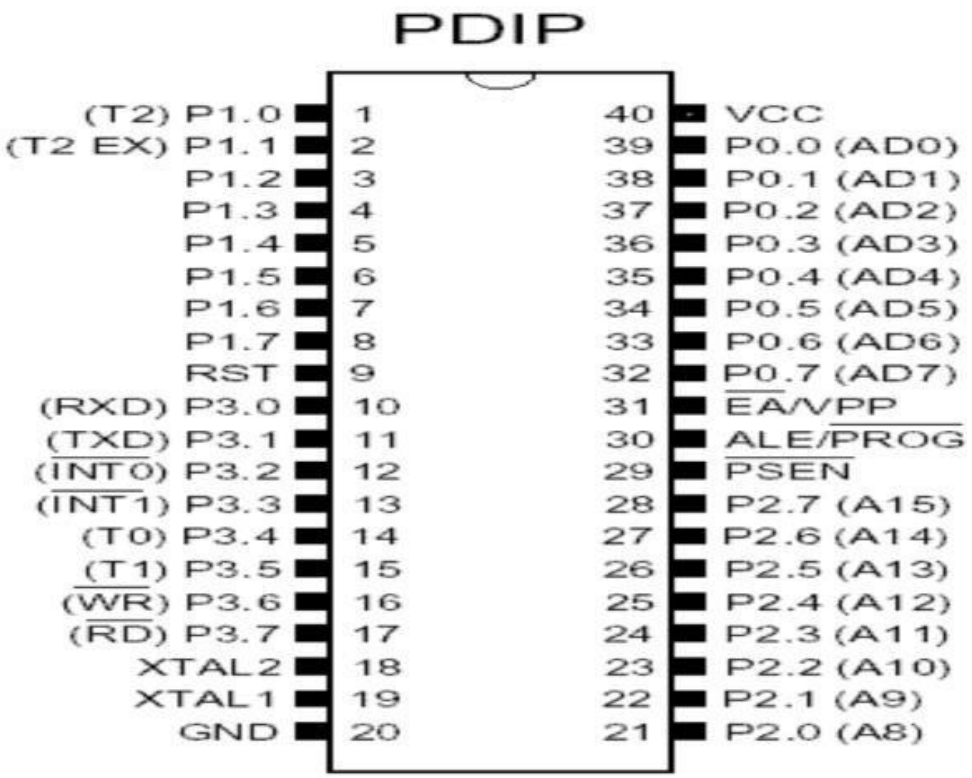

Figure 3.2, Micro Controller

Here vibration sensor plays a major role. This vibration sensor will receive the vibrations of the vehicle which in turn acts as an accident detection module. Arduino gathers the information from all other modules and sends the message to the receiver though GSM module.

For providing communication between the GPS, GSM and the allocated mobile number GSM SIM900 module is preferred. The name SIM900 says that, it is a tri band work ranging a frequency of 900MHz to 1900 MHz such as EGSM900 MHz, PCS 1900 MHz and DSC 100 MHz Receiving pin of GSM module and transmitting pin of GPS module are used for communication between the modules and the mobile phone.

To find the location on the earth the whole is divided into some coordinates where the location can be easily captured by a module called GPS module. Here the GPS used is SIM28ML. This GPS module will find the location of the vehicle and the information fetched by the GPS receiver is received through the coordinates and the received data is first send to Arduino and the information is transmitted to the saved contact through GSM module. The frequency is operated in the range of 1575.42 MHz and the output of GPS module is in NMEA format which includes data like location in real time.

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Figure 3.3, GPS

The controller used in this project is Arduino which is used for controlling all the modules in the circuit. The two major parts other than controller is GPS module which is used as a receiver and other module is GSM. To receive the coordinates of the vehicle GPS module is used and GSM will send the received coordinates to the user through SMS. There is an additional LCD which is used for displaying status message or coordinates.

When a person is driving the vehicle met with an accident then the vibrations of the vehicle is received by the vibration sensor and the sensor acts as an accident detection module which further send the information to the micro controller and the location of the vehicle is received through GPS module and the coordinates of the vehicle is send to the GSM module. The received information is send to Arduino Uno. The received coordinate's information is collected and is send to the respected person through SMS.

CONCEPT AND OVERVIEW

This vehicle tracking system takes input from GPS and send it through the GSM module to desired mobile/laptop using mobile communication. Vehicle Tracking System is one of the biggest technological advancements to track the activities of the vehicle. The security system uses Global Positioning System GPS, to find the location of the monitored or tracked vehicle and then uses satellite or radio systems to send to send the coordinates and the location data to the monitoring center.

At monitoring center various software's are used to plot the Vehicle on a map. In this way the Vehicle owners are able to track their vehicle on a real-time basis. Due to real-time tracking facility, vehicle tracking systems are becoming increasingly popular among owners of expensive vehicles.

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RESULT AND ANALYSIS

Whenever accident of the vehicle is occurred then the device sends message to given mobile device. Message for accident: “Accident alert latitude:2400.0090, Nlongitude:12100.0000, Etime:12:00” This system will show the location of vehicle on the led connected to it also just to make sure the working condition of the microcontroller.

CONCLUSION

Vehicle tracking system makes better fleet management and which in turn brings large profits. Better scheduling or route planning can enable you handle larger jobs loads within a particular time. Vehicle tracking both in case of personal as well as business purpose improves safety and security, communication medium, performance monitoring and increases productivity. So in the coming year, it is going to Play a major role in our day-to-day living. Main motto of the accident alert system project is to decrease the chances of losing life in such accident which we can’t stop from occurring. Whenever accident is alerted the paramedics are reached to the particular location to increase the chances of life. This device invention is much more useful for the accidents occurred in deserted places and midnights. This vehicle tracking and accident alert feature plays much more important role in day to day life in future.

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