Collision Detection of Vehicle and Coverage of using GPS and GSM Technology

Prof. Mrs. Mohsina Anjum1, Shubham Shende2, Zeba Khan3, Sofiya Khan4, Sakshi Dongre5
Department of Electronics & Telecommunication Engineering
Anjuman College of Engineering and Technology, Nagpur, Maharashtra, India

Abstract:
Speed is one of the basic reasons for vehicle accidents. Many lives could have been saved if emergency service could get accident information and reach in time. Nowadays, GPS has become an integral part of a vehicle system. Immediately vibration sensor will detect the signal and sends . The GPS will monitor speed of a vehicle and compare with the previous speed in every second through a Microcontroller Unit. Whenever the speed will be below the specified speed, it will assume that an accident has occurred. The system will then send the accident location acquired from the GPS along with the time and the speed by utilizing the GSM network. This will help to reach the rescue service and police control room in time and save the valuable human life.

Keywords: accident monitoring, GPS, accident detection, GPRS, GSM, collision detection.

I. INTRODUCTION

Collision Detection of Vehicle is the technology used to determine the location of a vehicle using different methods like GPS and other radio navigation systems operating through satellites and ground-based stations. By following triangulation or trilateration methods, the tracking system enables to calculate easy and accurate location of the vehicle. Vehicle information like location details, speed, distance traveled etc. can be viewed on a digital mapping with the help of a software via Internet. Even data can be stored and downloaded to a computer from the GPS unit at a base station and that can later be used for analysis. This system is an important tool for tracking each vehicle at a given period of time and now it is becoming increasingly popular for people having expensive cars and hence as a theft prevention and retrieval device.

![Figure 1. Overview of the System](http://ijesc.org/)

Types of GPS Vehicle Tracking: There are three main types of GPS vehicle tracking, tracking based mobile, wireless passive tracking and satellite in real-time GPS tracking. This article discusses the advantages and disadvantages to all three types of GPS vehicle tracking circumference.

1. Mobile phone based tracking

The initial cost for the construction of the system is slightly lower than the other two options. With a mobile phone-based tracking average price is about $500. A cell-based monitoring system sends information about when a vehicle is every five minutes during a rural network. The average monthly cost is about thirty-five dollars for airtime.

2. Wireless Passive Tracking

A big advantage that this type of tracking system is that there is no monthly fee, so that when the system was introduced, there will be other costs associated with it. But setting the scheme is a bit ‘expensive. The average is about $700 for hardware and $800 for software and databases. With this type of system, most say that the disadvantage is that information about where the vehicle is not only can exist when the vehicle is returned to the base business. This is a great disadvantage, particularly for companies that are looking for a monitoring system that tells them where their vehicle will be in case of theft or an accident. However, many systems are now introducing wireless modems into their The system consists of modern hardware and software components enabling one to track their vehicle online or offline. Any vehicle tracking system consists of mainly three parts mobile vehicle unit, fixed based station and database and software system.

- **Vehicle Unit:** It is the hardware component attached to the vehicle having either a GPS/GSM modem. The unit is configured around a primary modem that functions with the tracking software by receiving signals from GPS satellites or radio station points with the help of antenna. The controller modem converts the data and sends the vehicle location data to the server.
- **Fixed Based Station:** Consists of a wireless network to receive and forward the data to the data center. Base stations are equipped with tracking software and geographic map useful for determining the vehicle location. Maps of every city and landmarks are available in the based station that has an in-built Web Server.
- **Database and Software:** The position information or the coordinates of each visiting points are stored in a database, which later can be viewed in a display screen using digital maps. However, the users have to connect themselves to the web server with the respective vehicle ID stored in the
II. LITERATURE SURVEY

Many researchers carried out their studies on accident detection system. Traditional traffic accident prediction uses long-term traffic data such as annual average daily traffic and hourly volume. In contrast to traditional traffic accident prediction, real-time traffic accident prediction relates accident occurrences to real-time traffic data obtained from various detectors such as induction loops, infrared detector, camera etc. Real-time traffic accident prediction focuses on the change of traffic conditions before an accident occurrence, while traffic incident detection studies are concerned with the change of traffic conditions after an incident occurrence [3]. However, the performance of these detection and prediction system is greatly restricted by the number of monitoring sensor, available fund, algorithms used to confirm an accident, weather, traffic flow etc. Besides the automatic detection system, manual incident detection methods detects the accident from the motorist report, transportation department or public crews report, aerial surveillance or close circuit camera surveillance. The drawback of this type of detection system is that someone has to witness the incident. Moreover, there are delays and inaccuracies due to the expression problem of the witness. Compared to these detection method, driver initiated incident detection system has more advantages which includes the quick reaction, more incident information etc. However, with the severity of the accident, driver may not be able to report at all. Conventional built-in automatic accident detection system utilizes impact sensor or the car airbag sensor to detect an accident and GPS to locate the accident place. L. Chuan-zhi et al. proposed a freeway incident detection system by utilizing the car air bag sensor and accelerometer, GPS to locate the accident place and GSM to send the accident location [4]. However, the system did not utilize the GPS to detect the accident. A smart phone based accident detection system is proposed by C. Thompson et al. [5]. However, smart phones are very expensive and due to false alarm filter, it may not detect all accidents. An acoustic accident detection method is proposed by D. A. Whitney and J. J. Pisano [6]. There are possibilities of false alarm in the system and also does not guarantee the occurrence of an accident. Accident detection by utilizing an impact sensor and reporting system by wireless module is proposed by R.K. Megalingam et al. [7]. However, a wireless reporting infrastructure is very expensive and difficult to implement as installation of repeated receivers on the road at a very short interval are required. The proposed method aims to overcome the above mentioned limitations and utilizes only the GPS data to detect the accident and GSM network to send the location and activate a voice channel with the Alert Service Cent or police control room.

III. PROPOSED METHODOLOGY

A. GPS Receiver

The sensor for the accident detection is the GPS receiver. Nowadays, GPS technology has become more accurate, smaller, reliable, and economical. A very sensitive and accurate GPS signal acquiring device is required for the system. HI-2041III Ultra High Sensitive GPS receiver of Haicom Electronics Corporation is proposed for this project. The receiver continuously tracks all satellites in view and provides accurate satellite positioning data. Its 20 parallel channels and 4000 search bins provide fast satellite signal acquisition and short startup time which is <8 second in hot start and <40 second in cold start. Tracking sensitivity of -159dBm offers good navigation performance even in urban canyons having limited sky view. It provides output in NMEA standards in every second which allows monitor the speed continuously.

B. GSM/GPRS Modem

The GSM/GPRS modem utilizes the GSM network to send the location of the accident. The modem can be controlled by microcontroller through AT Command set. The Wavecom Q2403 is proposed for this system. It supports dual frequency (GSM/GPRS 900/1800MHz) with voice function and RS-232 interface. This modem supports all the AT Commands.

C. Microcontroller Unit

The microcontroller unit (MCU) is the heart of the system. It receives data from the GPS, processes all data and detects the accident from the processed data. The location of the accidents also sent by the microcontroller. 80520 is proposed forth system. The Large amounts of RAM for buffering, Enhanced Flash program memory and low power consumption make it ideal for the proposed system.

D. Accident Detection Algorithm

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 involved in a crash. People need some processing time to decide whether or not to react and then to execute an action. At high speeds the distance between starting to brake and a complete stand still is longer. The braking distance is proportional to the square of speed [8]. Therefore; the possibility to avoid a collision becomes smaller as speed increases. A moving body contains kinetic energy according to (1). When an accident occurs, kinetic energy is transformed into destructive forces [9] cause injury to occupants as well as to the vehicle.

\[
\text{KineticEnergy} = \frac{1}{2}mv^2
\]

where \( m \) = mass of object and \( v \) = speed of the vehicle.

When brake is applied, two forces work on the vehicle to decelerate the speed. One is the gravitational force \( (g) \) and the other one is the friction force \( (f) \). Considering the friction coefficient 0.8 for a plain road surface and standard gravitational force (9.8 metres per square second), from the Equation 2, we can get the final speed of a vehicle \( (u) \) after one second once the brake is applied. This is the maximum speed after considering the deceleration factors. Table 1 shows the maximum speed starting from the initial speed of 160 kph after one second once the brake is applied. As such, if the speed is less than these maximum speed, than it would be assumed that some other deceleration force worked on the vehicle to reduce the speed and an accident has occurred.

Figure 2. Block diagram of system
\[ t = \frac{V - u}{a} \]

where \( v \) = initial speed, \( u \) = final speed, \( a\) = acceleration or deceleration

Applications

Commercial fleet operators are by far the largest users of vehicle tracking systems. These systems are used for operational functions such as routing, security, dispatch and collecting on-board information. These systems are also used in consumer vehicles as devices for preventing theft and retrieving stolen/lost vehicles. The signal sent out by the installed device help the police to track the vehicle. These tracking systems can be used as an alternative for traditional car alarms or in combination with it. Installing tracking systems can thus bring down the insurance costs for your vehicle by reducing the risk factor. Vehicle tracking systems often have several alternatives, like sending automatic alerts to a phone or email if the vehicle is moved without due authorization. They can also work as one layer of several combined security measures. Apart from security concerns, the tracking systems can also help users such as taxi services to improve their customer service. The systems enable the operators to identify the empty taxis and direct the nearest one to pick up the customer. Vehicle tracking systems can also be applied for monitoring driving behavior for both commercial and individual situations. Parents for instance can use tracking devices to keep an eye on their teenage son’s driving. The applications for this project are in military, navigation, automobiles, aircrafts, fleet management, remote monitoring, remote control, security systems, teleservices, etc.

Main advantages of implementing this system are as follows:

- Fleet monitoring
- Vehicle scheduling
- Route monitoring
- Driver monitoring
- Accident analysis
- Geo-fencing geo-coding

IV. CONCLUSION

Vehicle collision tracking system makes better fleet management and which in turn brings large profits. Better scheduling or route planning can enable you handle larger 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. Finally the aim of the assignment i.e. to trace the vehicle is successfully achieved. In Future we will improvise

- We can use the EEPROM to store the previous Navigating positions up to 256 locations and we can navigate up to N number of locations by increasing its memory.

- We can reduce the size of the kit by using GPS+GSM on the same module.
- We can increase the accuracy up to 3m by increasing the cost of the GPS receivers.
- We can use our kit for detection of bomb by connecting to the bomb detector.
- With the help of high sensitivity vibration sensors we can detect the accident.
- Whenever vehicle unexpectedly had an accident on the road with help of vibration sensor we can detect the accident and we can send the location to the owner, hospital and police.
- We can use our kit to assist the traffic. By keeping the kits in the entire vehicles and by knowing the locations of all the vehicles.
- If anybody steals our car we can easily find our car around the globe. By keeping vehicle positioning vehicle on the vehicle.

Limitations

- This program is highly sensitive to the camera position and the environment, so a considerable amount of tuning has to be done each time a new video is taken or camera position is changed and even more so if the video is of an entirely new environment.
- The other limitation is the traffic problem, the program will not able to detect which vehicle to track if it finds some vehicle in the &-step_y and &+step_y of the current guess. If the nearby vehicle is same as the one in the model. As in our data images if we bring maruti-800 near the car than the probability of error increases manifold.
- If there is noise in the edge detected image, we can't really track the vehicle. What is meant by noise is that if some humans are coming near to the car then the edge detected image will have the edges of that human or animal or tree, then the program will try to match those edges with the car model. The program might treat this match as a success but really it will be off the track.
- We could not model the curves in the maruti-800, like in some images the driver and the steering can be seen, but we could not find a solution for that. Also the body of the Maruti can be best modeled as combination of curves and the lines.
- Also if distance between the vehicle positions in the two consecutive frames is too much then this tracking program can’t detect the vehicle in the second frame and will try to track it in the subsequent frame.
- The main limitation of the software is the real time implementation, this can’t be implemented with this much time efficiency in any of the real time applications. This limitation is mainly due to the processing time.

V. REFERENCES


[5]. R.SGAONKAR Microprocessor architecture programming and Application” WILEY EASTERN LTD, NEWDELHI

[6]. KRISHNA KANT “Microprocessor and microcontroller” EASTERN COMPANY EDITION NEW DELHI 2007

[7]. KRISHNA KANT “Microprocessor and microcontroller” EASTERN COMPANY EDITION NEW DELHI 2007

[8]. DANIEL, W.LEWIS “Fundamental of embedded software prentice Hall of India, 2004

[9]. WILLIAM STALLING “Wireless communication and Networks”, 2nd edition, 2005 prentice hall of India

[10]. www.8051projects.com


[12]. www.atmel.com

[13]. www.tatateleservices.com

[14]. www.roseindia.net

[15]. www.electronicsforyou.com