

Vehicle Collision Recognition and Monitoring System Based on AVR Platform

Apurva Mane¹, Prof. Jaideep Rana²

¹Dept. of Electronics, apurvamane91@yahoo.com, JNEC, Aurangabad

²Dept. of Electronics, jaideeprana2003@yahoo.co.in, JNEC, Aurangabad

Abstract— Security in travelling is primary concern for everyone. Demand for automobile has increased traffic and thereby causing more accidents on the road. People lose their lives because of poor emergency facilities. Preemption of the accidents taking place on the roads is not possible but at least after effects can be reduced. Proposed system ensures, making emergency facilities available to accident victims as early as possible by letting people or hospital or rescue team or police station know the accident spot with the help of accelerometer embedded in the vehicle. As vehicle rolls over on the road thereby changing position of the accelerometer, message is sent to the first aid center, rescue team or police station using GSM. With the help of space navigation system GPS locates the position of the vehicle where accident has occurred. So, this paper deals with the GSM-GPS module and accelerometer and ATMEGA 16 microcontroller mounted vehicle, which even meet with the accident, let people know about the accident location and provides situational awareness. This project is about making cars more intelligent, they provide basic information covering geographical co-ordinates to the police station.

Keywords— Vehicle accident, GPS, GSM, accelerometer, vehicle tracking, ATMEGA 16, message.

INTRODUCTION

There are more and more traffic jams as vehicle's demands are getting high day by day. So, transportation needs more improvement as demands are increasing there will be more possibility of vehicle accidents [1]. Vehicle accidents are one of the leading causes of the fatalities. It will be a serious consequence if people can't get help on right time. Poor emergency incident is a major cause of death rate in our country [2]. Even with awareness campaign, this problem is still rising due to riders drunk driving and speed driving. Major automobile manufacturers have developed safety devices such as seat belt to protect riders from accidental injuries [3].

Life saving measure electronic stability control also reduces injuries. Crash analysis studies have shown, traffic accidents could have been prevented with the use of this advanced life saving measure [4]. This design focuses on providing basic information on the accident site to the hospital or police station. As a result of this sudden help, public life may get save [5]. In this work, ADXL accelerometer, a three-axis accelerometer and GPS tracking system works for accidental monitoring. This design detects accidents in less time and sends this information to the hospitals. In this case GSM will send short message to the hospital or police station. This message will read the geographical co-ordinates of accident spot with the help of GPS. And, as now the location has been traced by the GPS, emergency medical service can be given to the accident victims as soon as possible. Using this method, traffic fatalities can be reduced as time between when accident occurs and responders are dispatched to the accident scene, reduces. Accelerometer sensor embedded in a car determines severity of the accident as how much car has rolled [6].

As soon as the accident occurs, an alert message including latitude, longitude position, date and time of accident occurrence and finally link, indicating Google map is sent automatically to the rescue team or to the police station. This message is sent with the help of the GSM module and accident location is detected through GPS module. The accident can be recognized precisely with the help of ADXL accelerometer sensor which also acts as vibration sensor. The angle of the tilt of the car can be shown on LCD. This design provides solution to the road accidents in most feasible way [7].

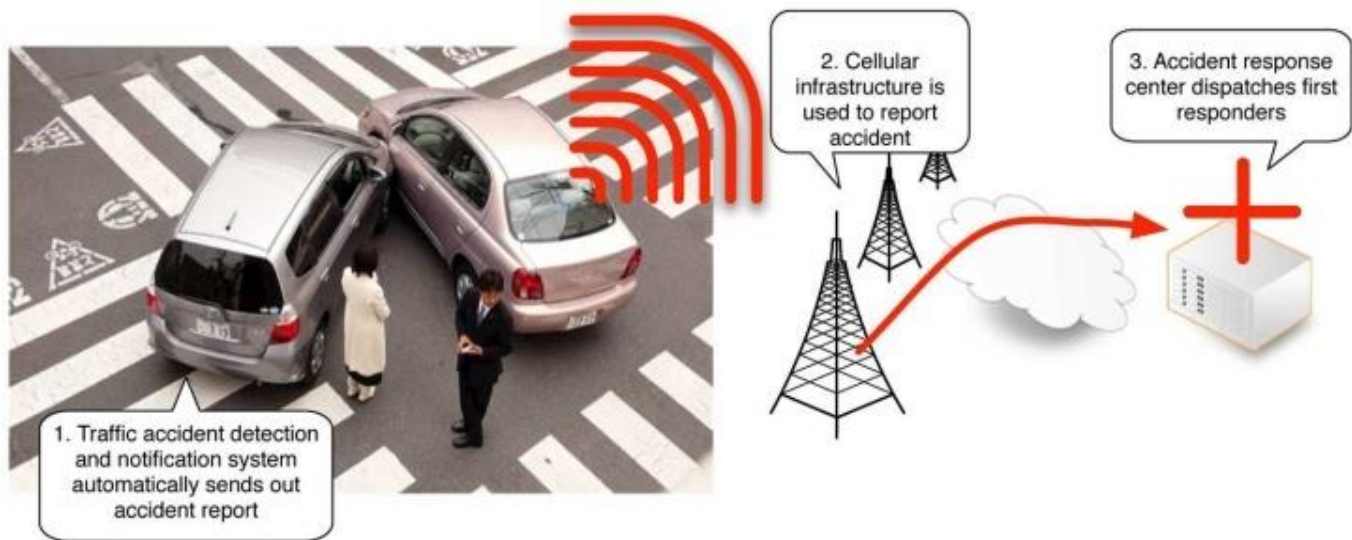


Fig.1 Vehicle accident recognition and monitoring system

Key features of this design include:

1. Vehicle real time monitoring by sending its information regarding position (longitude & latitude), time, link to the Google maps, to the people or hospital or police station, whomsoever phone no. is provided that should help them to get medical help if accident occurs.
2. After getting message from the vehicle which has had accident, user has access to get real-time position of the vehicle.

LITERATURE SURVEY

There are many efforts, applications; approaches have been proposed to provide security and safety in case of accidents. A novel approach to increase the safety of road travel using the concepts of wireless sensor networks and the Bluetooth protocol has been proposed. It discussed, how vehicles can form mobile ad-hoc networks and exchange data sensed by the on-board sensors [8]. The platform of the android operating system (OS) and software development environment proved optimum solution for the public safety in case of road accidents [9]. A good survey of using personal mobile phone, microcontroller, Bluetooth and Java technology has been provided in [10]. It developed integrated system to manage, control and monitor all the accessories inside the vehicle in order to achieve the idea of an intelligence car with ability to uses personal mobile hand phone as a remote interface. Smart phone-based accident detection can reduce overall traffic congestion and awareness of emergency responders. This approach also has been proposed [11]. A new design was developed containing vehicle tracking and control system to control the vehicle through an android based Smartphone [12]. Again, one application provided a solution with the use of a mobile phone for monitoring an SMS-based GPS tracker especially in locations where GPRS may not be available [13]. The general mechanism is to provide the real time position of a vehicle using GPS receiver and send this information to GSM center through the software, this is all done by the monitoring center which is working as a control unit that is connected not only by optical cable but also connected wirelessly through TCP/IP protocols. The monitoring center distributes the data to the client in the understandable format and it also stores the travelling records and displays the information about vehicle on electronic map through GIS system [14]. Another approach is that, vehicle terminal includes a GPS receiver which extracts information about position through GPS satellites and sends it through GSM network and to the control center which reads the information and saves it in the data base system and on user demand displays it on electronic map [15]. Different application of localizing the vehicle system by receiving the real time position of the vehicle through GPS and send this information through GSM module via SMS service with an added feature of GPRS transmission to the monitoring center through usage of internet [16]. This project has been designed using microcontroller AT89S52, too. It used EEPROM to store the phone numbers. People also designed a mobile technology using smart phones to find the leading vehicle, allowing the possibility to make collision warning systems more affordable and portable. A smart approach consisting efficient driving assistant that uses the features of the Smartphone to accurately figure out the driver's driving style from point of view of energy consumption and generate eco-driving tips to correct the bad driver's driving habits.

SYSTEM ARCHITECTURE

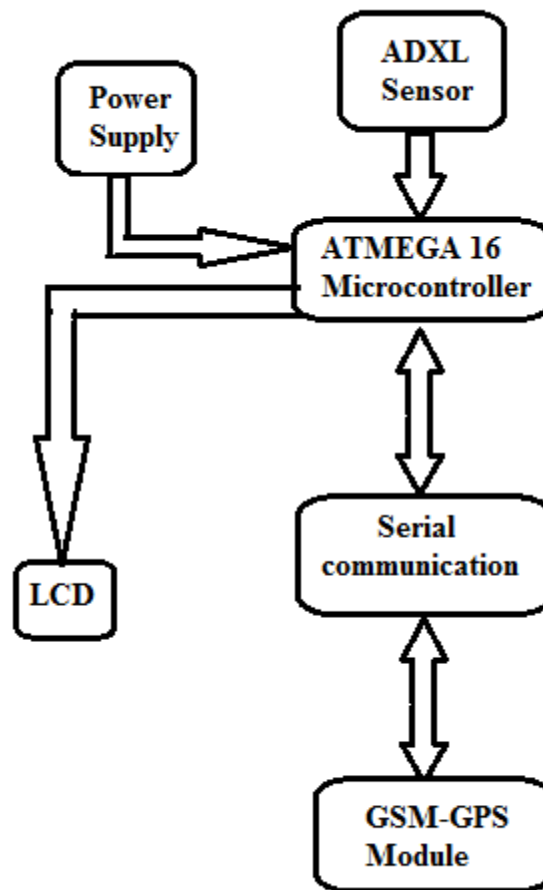


Fig.2 Block diagram of Vehicle Collision Recognition & Monitoring System Based on AVR Platform

This design includes hardware that consists of ADXL accelerometer, ATMEGA 16 microcontroller, GSM and GPS Module and LCD. The whole system works on a 5V or 9V dc regulated power supply. The GPS receiver module is interfaced with USART of ATMEGA 16. It gives speed and location information. Whenever accident occurs, the vibrations are sensed by the accelerometer sensor and these signals are given to the controller. If incase there is a rolls over of car, the angle of the rolls over is detected by this ADXL sensor and it is given as the input to the controller for further processing. When the input is received by the controller, the message is sent to the rescue team with the help of the GSM module. The rescue team reaches the accident spot with the help of the location given in the message. An LCD display is provided to get the display of the tasks carried out; it also shows the accelerometer readings. The GSM - GPS module is interfaced to the AVR controller using serial communication. All the components are interfaced precisely so that the accident detection and message sending are fully automated, so that the warning time is reduced significantly.

COMPONENT DESCRIPTION

1. **GSM-GPS MODULE:** The GPS Tracker GPS303-B is the new tracker in the market, it can locate accurately and be used for Vehicle's accident detection, set multiple functions of security, positioning, monitoring surveillance, emergency alarms and tracking. It is based on existing GSM/GPRS (850/900/1800/1900MHz) GSM network and GPS satellites, locate and monitor any remote targets by SMS or Computer or PDA.

GSM Module- Global System for Mobile communications (GSM) is the popular wireless standard for mobile phones in the world. GSM module allows transmission of Short message service (SMS) in text mode.

GPS Module- The Global Positioning System (GPS) is a space-based radio navigation system that provides positioning, navigation, and timing services to users on a continuous worldwide basis. For anyone with a GPS receiver, the system will provide location and time. GPS provides accurate location and time information for number of people in all weather, day and night, anywhere in the world. A GPS navigation device is a device that accurately calculates geographical location by receiving information from GPS satellites. The GPS concept is based on time. The satellites carry atomic clocks which are synchronized and very stable; any drift from true time maintained on the ground is corrected daily. Likewise, the satellite locations are monitored precisely. GPS satellites transmit data continuously which contains their current time and position.

2. ADXL ACCLEROMETER: The ADXL335 is 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ± 3 g. It can measure the static acceleration of gravity in tilt sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. An accelerometer measures acceleration. Acceleration is a measure of how quickly speed changes. Accelerometer sensor is used to measure static (earth Gravity) or dynamic acceleration in all three axes, forward/backward, left/right and up/down. Accelerometer is used in this design for the collision detection. Accelerometers operate on the piezoelectric principal: a crystal generates a low voltage or charge when stressed as for example during compression. (The Greek root word “piezein” means “to squeeze”.) Motion in the axial direction stresses the crystal due to the inertial force of the mass and produces a signal proportional to acceleration of that mass. This accelerometer also acts as vibration sensor to measure vibrations whenever vehicle collides with another vehicle. Accelerometer is interfaced to the ADC 1 and ADC 2 of the microcontroller.
3. ATMEGA 16: The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. Microcontroller unit receives information from accelerometer, GPS module and send it to rescue system and police station by using GSM.

WORKING OF THE SYSTEM



Fig. 3 Working of the system

Whenever accident occurs, accelerometer sensor detects and sends the signals to microcontroller, by using GPS we will get particular locations where accident has occurred, then GSM sends message to the person whose phone number is given.

SYSTEM SOFTWARE DESIGN

The software used for the development of system is Proteus 7.8 with the C program language been used. The Flow Chart of the system is shown in the figure 4. It shows the system is initialized on power ON. When the system is detected to be abnormal, it can be concluded that the accident has occurred. The vibration/acceleration of the vehicle is detected to confirm the cause of the accident. As soon as the accident is detected, the message is sent automatically to the rescue team after the location is detected by the GPS.

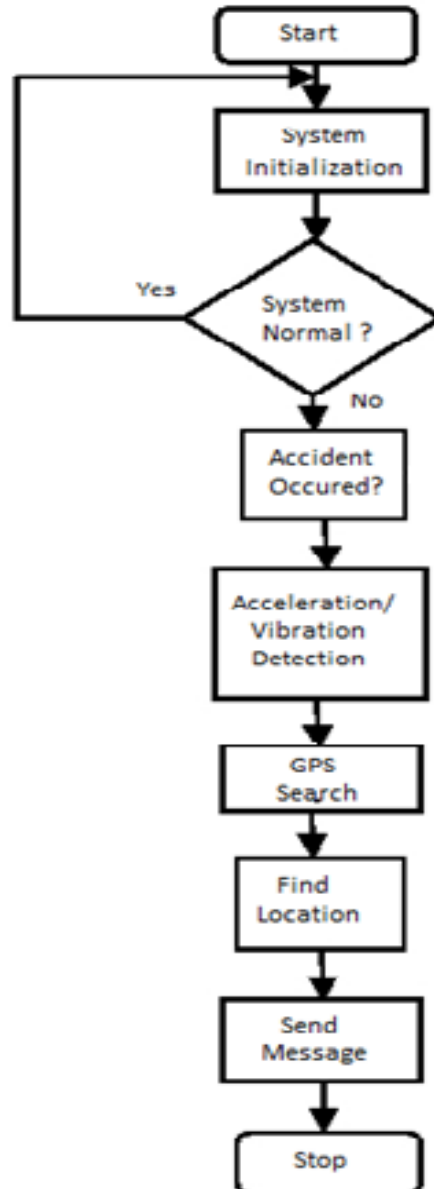


Fig.4 Flow chart of Vehicle Collision Recognition & Monitoring System Based on AVR Platform

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CONCLUSION

This paper provides the design which has the advantages of low cost, portability, small size. The platform of the system is AVR along with accelerometer sensor; GPS and GSM, interfacing which reduces the alarm time to a large extent and locate the site of accident accurately. This system can overcome the problems of lack of automated system for accident location detection. Consequently, the time for searching the location is reduced and the person can be treated as soon as possible which will save many lives. This system will have broad application prospects as it integrates the positioning systems and the network of medical based services.

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