Automatic Vehicle Accident Detection And Messaging System Using GPS and GSM Modems

Sri Krishna Chaitanya Varma, Poornesh, Tarun Varma, Harsha

Abstract —The aim of our work is to find the vehicle accident location by means of sending a message using a system which is placed inside of vehicle system. The main purpose is to provide security to the vehicle in very reasonable cost. So in this work we are using the basic microcontroller AT89C52 for cost effective and also for easy understanding. Here we used assembly programming for better accuracy and GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to our remote devices (mobile phones) using GSM modem.

Index Terms— GPS (Global Positioning System); GSM (Global Service for Mobile Applications); Microcontroller.

1 INTRODUCTION

Road accidents constitute the major part of the accident deaths all over the world. According to the Insurance Institute for Highway Safety (IIHS), new cars and its high-tech safety features have helped to lessen auto related deaths over the past 12 years. Though it credits technology for lessening auto accidents, yet the IIHS cannot help accusing bad driving behaviours like drunken driving, speeding and not using seatbelts for still causing major traffic deaths. Automatic vehicle accident detection and messaging system is an embedded intelligence implanted into the automobile.

The purpose of the project is to find the vehicle where it is and locate the vehicle by means of sending a message using a system which is placed inside of vehicle system Most of the times we may not be able to find accident location because we don't know where accident will happen. In order to give treatment for injured people, first we need to know where the accident happened through location tracking and sending a message to your related one or to the emergency services. So in this work we are using the basic microcontroller AT89C52 for cost effective and also for easy understanding. Here we used assembly programming for better accuracy and GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to our remote devices (mobile phones) using GSM modem

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2 WORKING PRINCIPLE

Our paper describes about the AUTOMATIC VEHICLE ACCIDENT DETECTION AND MESSAGING SYSTEM using GPS and GSM technologies. We are using AT89C52 microcontroller in our project. When the system is switched on, LED will be ON indicating that power is supplied to the circuit. When the IR sensors that we are using in our project sense any obstacle, they send interrupt to microcontroller. The GPS receives the location of the vehicle that met with an accident and gives the information back. This information will be sent to a mobile number through a message. This message will be received using GSM modem present in the circuit. The message will give the information of longitude and latitude values. Using these values the position of the vehicle can be estimated.

Modem performs modulation during transmission and performs demodulation during reception. GSM modem is similar to mobile phone without any display, keypad, and speakers. It can send and receive messages and calls. The data will be sent to MAX232 IC through RS232 cable.MAX232 synchronizes the baud rates of modem and microcontroller. It also converts RS 232 voltage levels to TTL voltage levels and vice versa. In RS 232 , Logic 0 is represented in between +3 volts to +25 volts, Logic 1 is represented in between -3 to -25 volts. In TTL logic 0 is represented as zero volts logic 1 is represented as +5 volts. Microcontroller supports TTL voltage levels rather than RS 232 voltage levels. The received data is given to the microcontroller. Correspondingly it gives an acknowledgement in the form of an SMS to the mobile phone. LCD used in the circuit displays the reception of messages.

The microcontroller is interfaced to GPS and GSM module via a multiplexer, where these devices are activated using select lines internally built in the multiplexer. Multiplexer is interfaced to microcontroller via transmit and receive pin.

LCD is interfaced to any ports of micro controller, it is used to display the current status of the GPS and GSM modules, whether data is been reading from GPS or writing to GSM

Most digital logic circuits and processors need a 5 volt power supply. To use these parts we need to build a regulated 5 volt source. Usually you start with an unregulated power To make a 5 volt power supply, we use a LM7805 voltage regulator IC (Integrated Circuit)

3 GLOBAL POSITIONING SYSTEM

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

Distance = Velocity * Time here Velocity of the GPS signal is the speed of light, approximately 300,000 Km/s.

GPS transmissions occur on a frequency of 1575.42 and 1227.60 MHz. Both of these frequencies are within the L Band.

3.1 Function Of GPS

The Global Positioning System satellites transmit signals to equipment on the ground. GPS receivers passively receive satellite signals; they do not transmit. GPS receivers require an unobstructed view of the sky, so they are used only outdoors and they often do not perform well within forested areas or near tall buildings. GPS operations depend on a very accurate time reference, which is provided by atomic clocks on board.

Each GPS satellite transmits data that indicates its location and the current time. All GPS satellites synchronize operations so that these repeating signals are transmitted at the same instant. The signals, moving at the speed of light, arrive at a GPS receiver at slightly different times because some satellites are further away than others. The distance to the GPS satellites can be determined by estimating the amount of time it takes for their signals to reach the receiver. When the receiver estimates the distance to at least four GPS satellites, it can calculate its position in three dimensions.

There are at least 24 operational GPS satellites at all times plus a number of spares. The satellites, operated by the U.S. Department of Defence, orbit with a period of 12 hours (two orbits per day) at a height of about 11,500 miles travelling at near 2,000mph. Ground stations are used to precisely track each satellite's orbit.

3.2 Accuracy Of G.P.S

The accuracy of a position determined with GPS depends on the type of receiver. Most hand-held GPS units have about 10-20 meter accuracy. Other types of receivers use a method called Differential GPS (DGPS) to obtain much higher accuracy. DGPS requires an additional receiver fixed at a known location nearby. Observations made by the stationary receiver are used to correct positions recorded by the roving units, producing an accuracy greater than 1 meter. When the system was created, timing errors were inserted into GPS transmissions to limit the accuracy of non-military GPS receivers to about 100 meters. This part of GPS operations, called Selective Availability, was eliminated in May 2000.

4 GLOBAL SYSTEM FOR MOBILE COMMUNICATION

GSM is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band.

GSM is the de facto wireless telephone standard in Europe. GSM has over one billion users worldwide and is available in 190 countries. Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries.

4.1 History Of GSM

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas (including Canada and the United States) use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated.

The rarer 400 and 450 MHz frequency bands are assigned in some countries, notably Scandinavia, where these frequencies were previously used for first-generation systems.

In the 900 MHz band the uplink frequency band is 890–915 MHz, and the downlink frequency band is 935–960 MHz This 25 MHz bandwidth is subdivided into 124 carrier frequency channels, each spaced 200 kHz apart. Time division multiplexing is used to allow eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio timeslots (giving eight burst periods) grouped into what is called a TDMA frame. Half rate channels use alternate frames in the same timeslot. The channel data rate is 270.833 Kbit/s, and the frame duration is 4.615 ms.

The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

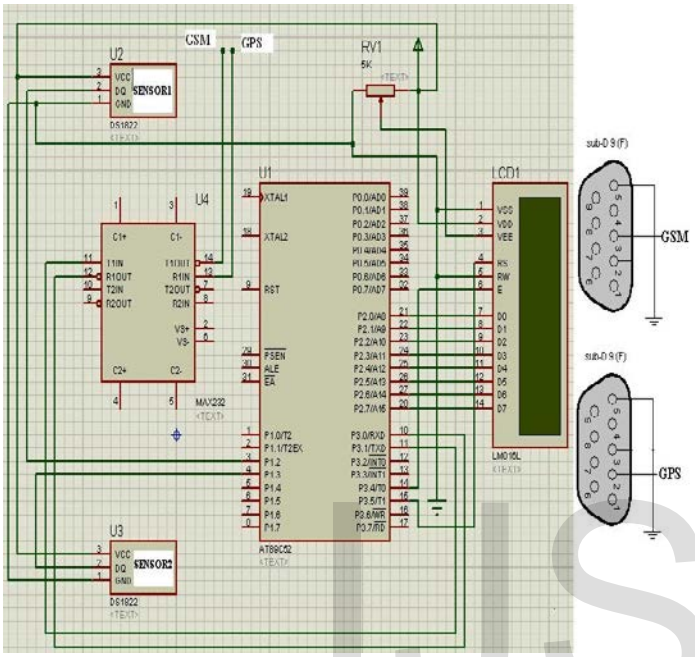
GSM has used a variety of voice codec's to squeeze 3.1 kHz audio into between 5.6 and 13 Kbit/s. Originally, two codec's, named after the types of data channel they were allocated, were used, called Half Rate (5.6 Kbit/s) and Full Rate (13 Kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficient with bitrates, these codec's also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal.

4.2 GSM Features

- Mobile Frequency Range Rx : 925-960;
- Tx: 880-915
- Multiple Access Method : TDMA/FDM
- Duplex Method : FDD
- Number of Channels :24 (8 users per

channel)
- Channel Spacing :200 kHz
- Modulation :GMSK (0.3 Gaussian Filter)
- Channel Bit Rate :270.833Kb

5 OPERATIONAL CIRCUIT



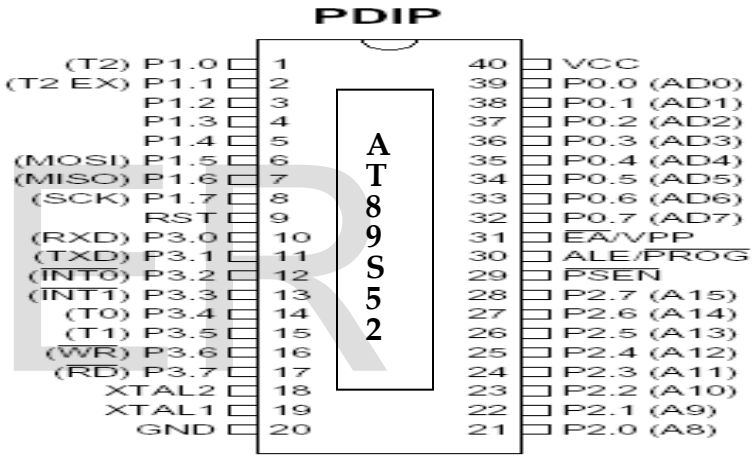
5.1 AT89S52 Microcontroller

The AT89S52 is a low power, high-performance CMOS 8-bit microcontroller with 8K bytes of in system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry- standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features.

- Compatible with MCS-51® Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)

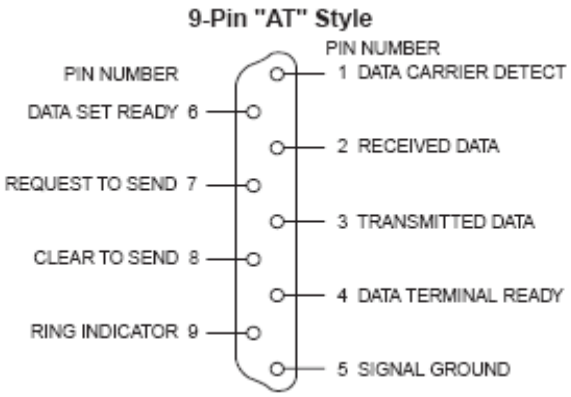
In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

5.2 AT89S52 Pin Diagram



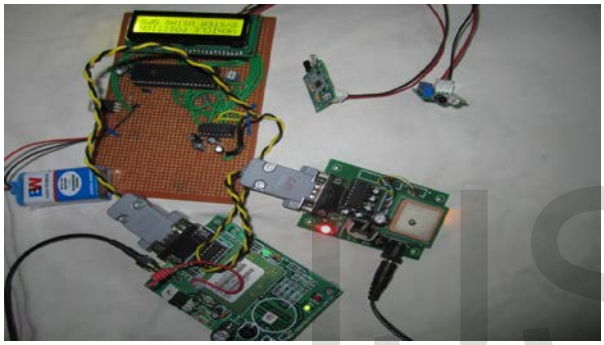
6 RS-232

Information being transferred between data processing equipment and peripherals is in the form of digital data which is transmitted in either a serial or parallel mode. Parallel communications are used mainly for connections between test instruments or computers and printers, while serial is often used between computers and other peripherals. Serial transmission involves the sending of data one bit at a time, over a single communications line. In contrast, parallel communications require at least as many lines as there are bits in a word being transmitted (for an 8-bit word, a minimum of 8 lines are needed).Serial transmission is beneficial for long distance communications, whereas parallel is designed for short distances or when very high transmission rates are required.

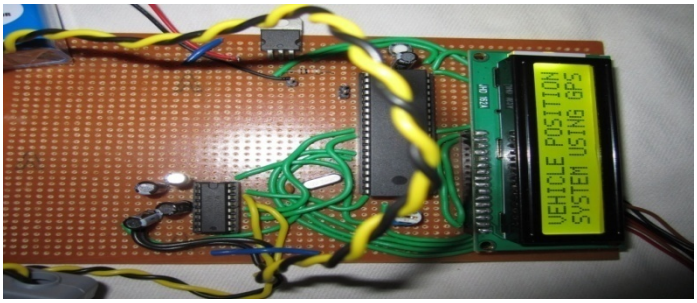


7 RESULT

7.1 Research Experiment Picture



7.2 Picture Of Interface LCD With Microcontroller



8 APPLICATIONS

- Used in automotives and transport vehicles- from lighter vehicles like cars, to heavier automotives like ships and aeroplanes.
- Security and remote monitoring of vehicles especially during military operations.
- This system is also can be interfaced with Vehicle airbag system such that when the sensors detect the accident, the air bags get opened.

9 CONCLUSION

A working model of **Automatic vehicle accident detection and messaging** system using a GPS and GSM modems has been implemented successfully.

The biggest advantage of our research is, whenever the sensor is activated we will be immediately getting the acknowledgement from GSM modem to our mobile numbers which are stored in EEPROM, without any delay. This system locates the accident spot accurately, realizing the automation of accident detection and messaging system. Consequently, it will save the precious time required to save the accident victims. Further this system can be implemented using the vibration sensors as well as the sound sensors, in order to make it more accurate and efficient to detect an accident.

ACKNOWLEDGMENT

The authors wish to thank P.U.K.Prabha professor, ece dept.,M.V.G.R COLLEGE OF ENGINEERING , ANDHRA PRADESH , INDIA . This work was supported in part by a grant from E.C.E department , M.V.G.R COLLEGE OF ENGINEERING.

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