Piezo Disk Based Automobile Safety System

[1]Sundar Kharvi, [2]Chirag Patil, [3]Rajesh Khandekar

[1]Asst. Professor, [2,3]UG Student, [1,2,3]SJCEM Palghar, Maharashtra, India.

[1]sundark@sjcet.co.in, [2]patil.chirag656@gmail.com, [3]rajeshkhandekar447@gmail.com

Abstract: An Automobile industry all over the world is rising with a steady growth. It is necessary for an automobile system to provide safety in adverse conditions in order to save lives. Though, different safety measures are employed to make a system more versatile; there is large void in emergency facilities. Many lives can be saved; if the emergency services with crash information and proper help provided in time. Our project provides a new approach to this situation. To track vehicle accident traditional GPS system is used and for reporting GSM Modem is utilized. In this system, we have used multiple piezo disks to sense the collision during accident. The arduino microcontroller read the analog value from the sensor. When threshold value of sensor is exceeded, corresponding GPS coordinates of accident location are sent to the predefined numbers via GSM. If the driver is safe; he needs to turn OFF safety switch manually, before the counter gets expired. The counter is displayed on LCD. This system will be beneficial to manufacture low-cost safety system for automobiles.

Keywords — Piezo disk, Arduino, GSM, GPS, buzzer, safety system.

I. INTRODUCTION

Over the past few decades, there is a large boom in number of accidents, injuries and deaths per million of population of entire world. This is a result of rise in motor vehicle population, heterogeneous nature of traffic, lack of traffic separation.

According to World Heath Organization's (WHO) Global Status Report on Road Safety, India leads the world in road accident deaths. In 2014-2015, 13 million people were victim of road accidents in India. According to the survey the causes for accidents are speeding, drunken driving, less use of helmets and seat belts, child restraints, lack of enforcements, bad roots. The survey also represents the cost need for accident management. 3% of GDP of India was spent on accident management in year 2014-15 [1]. Currently, accidents occur in all the places because of high speeding of vehicles. Moreover, in case of a fatality, the passengers would not be able to get rescued in usual cases. To save someone's life it is necessary to get help within time. All the existing systems though providing better safety they are not capable of providing immediate help. Also the systems are expensive and limited to only particular types of vehicle such as car. It is necessary to overcome these drawbacks.

The major objectives of our project are emergency safety solution, saving time to treat the accident victims and to help rescue team to reach the spot on time. We have proposed this system to provide safety in low cost than already existing systems.

II. SYSTEM BLOCK DIAGRAM

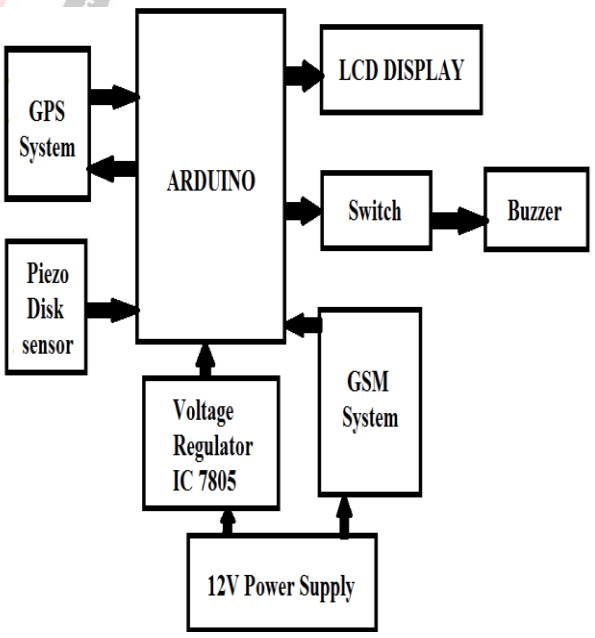

Fig.1 Block Diagram

In this system, we have used Arduino Board as an embedded unit. The arduino uno microcontroller is preprogrammed to

serve as an accident detection system. The system is made to be implemented on vehicle's unit. In this system we have used piezo disk as a sensor. The advantage of using piezo disk as a sensor is that it can be used as both vibration sensor and impact sensor. Whenever, accident happens the vibrations are detected by piezo disk. This disk continuously feeds analog signal to the microcontroller. This signal is converted to digital value. Depending upon this value, threshold is set. When threshold value exceeds buzzer starts ringing.

This is done to inform local authorities about accident. Once the value exceeding threshold is obtained, the longitude and latitude values of accident location tracked by GPS; are sent as a message to predefined numbers via GSM Modem. Before sending the message, there is a counter of 30 sec. If driver is safe, he is expected to turn OFF the switch within 30 sec in order to stop messaging system and buzzer.

III. FEASIBILITY STUDY

A task of an embedded system engineer is to design a resource-constrained system which can be modeled with optimum power, optimum processing, and minimum Input/Output devices with less memory usage. Hence we had decided to create a versatile application instead of creating a bulky hardware.

GPS System Feasibility

Collecting information from outdoor can provide a picture of someone's ability to obtain a potential method of remotely monitoring and objectively measuring real time parameters. The study of various GPS modems led us to contradict between their advantages and disadvantages. A GPS device may potentially be less effortful and more reliable than other expensive conventional systems. The feasibility was measured in terms of

1. Wear ability of the device
2. Ease of switching the device ON/OFF
3. Ease of recharging the device
4. Data analysis by testing the device

The validity of the above benefits is checked during our extensive literature survey. The cost of standalone GPS Modem is affordable as compared to the electronic PCB of the same modem. Hence to make the system affordable decision was made to use GPS which will provide TTL output. The GPS which we have selected is S1315RL [2] which are correct according to our feasibility study. This GPS is associated with an antenna which enables the network to the GPS system. The LED on the GPS modem is an indication of network.

Fig.2 GPS System

GSM System Feasibility

The information monitoring and reporting is an essential part of our system. The accident information is the real time data which is to be conveyed within less duration. According to our feasibility study, GSM system is more convenient as it has facility to insert SIM card in it. Subscriber Identity Module (SIM) is associated with the PIN, so it is easy to configure GSM Modem. The power requirement of GSM is optimized to 12V; hence it will be possible to facilitate such power from vehicle's battery. The arduino interfacing of GSM Modem is comparatively simple as compared to its interfacing with other microcontrollers. [3]

Fig.3 GSM SIM 900 Modem

Arduino Feasibility

Arduino system is associated with the small electronic circuit assembly. Hence interfacing of various systems is possible with an arduino board. Serial communication is easy to achieve. However manufacturing arduino board is another scope of project, but to maintain system compatibility and minimize the cost arduino standalone system is used. The use of cutting-edge industry application is the main aim of using

an arduino board. The coding of arduino is comparatively easy and has its resemblance with C, which is termed as an embedded C. The parameters declaration, setting of baud rates, function declaration and reduction in execution time are some of the advantages of the arduino system. [4] Because of all such reasons we preferred to use an arduino board.

Sensor Feasibility

For sensors, we have decided to use the sensor which provides precise analog value for vibration, tilting. Also the thought process was mainly focused to feasibility. During our literature survey, it was found that there were lots of sensors available in the market, but they were quite expensive [5]. As, we had put optimization as our target, we decided to use such a material which is not expensive and can be served as a good sensor. Usually, a piezo-disk is used for vibration detection and is little expensive as a module. But, in this project we have used such disk by breaking a buzzer. We removed piezo-disk from it and connecting wires are drawn from its conducting material. Such an assembly provides analog output with high sensitivity. This analog output is used as an input to the arduino system, and later used to determine threshold of the accident.

IV. WORKING

In this system, we have used piezo-disk as a sensor. This provides analog value of vibration after impact collision during accident. The optimality of using piezo disk as a sensor is that, it is available as a part of buzzer. This cuts down cost overhead of using expensive sensors. The analog value from the sensor is given to arduino microcontroller. These values are converted into digital values by microcontroller itself; hence there is no need of using ADC for the same [6]. As, arduino pins are already configured for specific applications; hence there is no need to declare entire port. Unlike conventional microcontrollers, arduino requires only pin declaration for specific applications.

GSM Modem and GPS Modem are connected to the arduino microcontroller. Once the system is ON, latitude and longitude coordinates of vehicle's location are continuously tracked.[7] For this purpose, an antenna is associated with GPS Module. Also, the piezo disk is continuously sensing vehicle vibrations. When vehicle meets an accident the analog value sensed by the piezo disk exceeds its threshold. This control signal is sent by sensor to the microcontroller. Upon receiving the signal, microcontroller makes the pin high to which buzzer is connected. Due to this buzzer starts blowing. The intention of buzzer is to notify nearby locality about accident. As soon as the buzzer is high, the down counter of 30 seconds starts displaying on LCD for user. If user is safe, he is expected to turn OFF the switch within the expiry time of counter. If switch is turned OFF the buzzer stops and also the message will not be sent to the predefined numbers.

In other case, when the value of sensor exceeding its threshold, then it is detected by the microcontroller. At that instant, the latitude and longitude provided by GPS Modem are fetched by microcontroller. At that time the message, "Accident is occurred. Please help me. My location is: Latitude, Longitude" will be sending to the list of contacts which are predefined or already present in user's database.

Usually, entire system works on the power supply of 12V Dc. In practical implications such power can be easily made available from vehicle's battery. The arduino system and its circuitry require power supply of 5V. This is achieved by onboard voltage regulator IC 7805. This regulator has three pins. The 12V power supply is down converted to 5V for arduino system. However, for GSM Modem direct 12V power supply is provided. The power requirement of GPS System and sensor caters by arduino microcontroller.

For GSM and GPS system to work properly, the satellite network is needed. [8] The indication of network is given by LEDs connected to both the modem. For GPS System second led is blinking continuously upon receiving the network. Whereas, for GSM Modem after inserting SIM card, the second led blinks after every 3 seconds ensures the proper network.

V. FLOW DIAGRAM

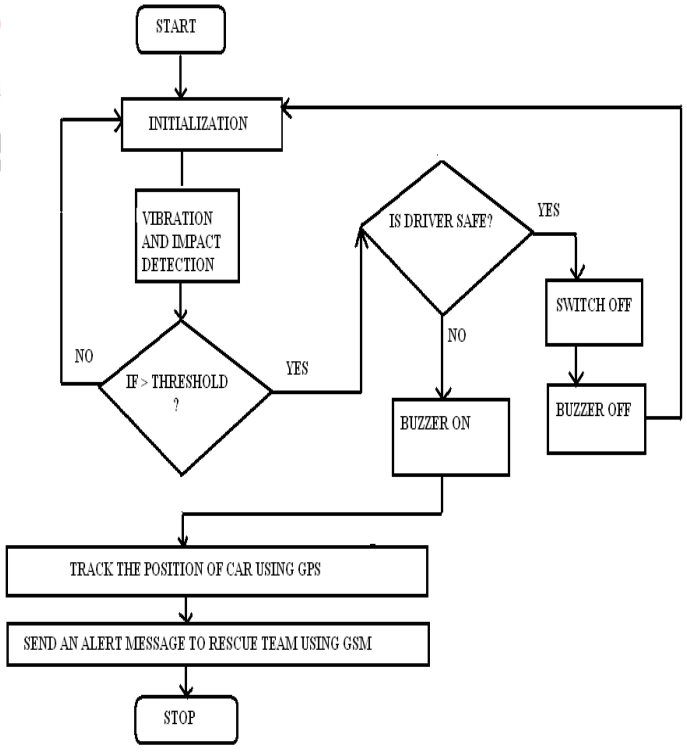

Fig.4 Flowchart

VI. SIMULATION OUTPUT

GPS System Simulation

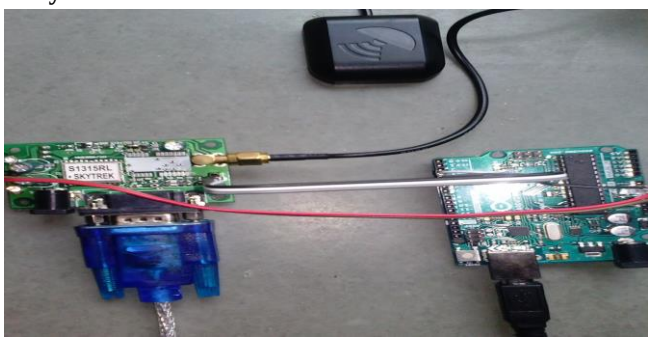

Fig.5 GPS Arduino Interfacing

Circuit Simulations

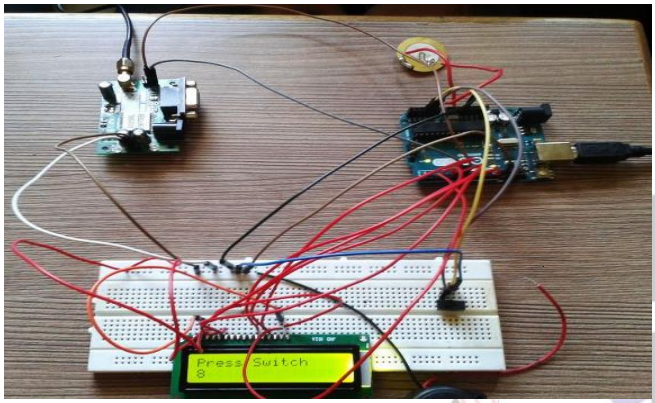

Fig.6 Breadboard Testing

GSM System Output

Fig.8 Message Output

VII. CONCLUSION

Our system provides an optimum solution for safety in automobile industry. This forms baseline for developing advanced safety systems. In order to make safety system more versatile we have used piezo disk sensor. The sensor disk we have used is also available in small scale devices such as buzzer, thus cost of system is reduced. Our system is power efficient system as it requires less power supply than conventional systems. We have successfully reduced action time and exact location of an accident is obtained with GPS Modem and also the information regarding accident can be sent to particular contact numbers. Ultimately, the system is capable of provide safety in less expenses.

VIII. FUTURE SCOPE

The system can be integrated by using multiple low-cost sensors. Also the concept of node creation will step this system in long run, in which database of various rescue teams and hospitals is maintained. Depending upon geographical position of accident; nearest rescue team is informed about the accident location. This will help to reduce the time required to treat the victims.

ACKNOWLEDGEMENT

We take this opportunity to express sincere gratitude to Assistant Professor Mr.Sundar Kharvi for his valuable guidance, immense support, suggestion, encouragement and interest in our project work. We are fully obliged and conveying our thanks to the teaching and as well as non-teaching staff of the department. We would like to thank all direct and indirect identities of the college with whom we took the strides for this project.

REFERENCES

[1] Lokesh Hebbani, “Road Safety Scenario Problems & Solutions”, in 5th Foundation Day Lecture, CiSTUP, IISC, January 10, 2014

[2] “GPS Receiver with antenna-S1315RL-TTL+ Serial”, Internet: www.fizzible.com

[3]Akshay Keshwatkar, Vishwa, John William, P.S.Smitha “Sensor based Automated Accident Tracking System” International Journal of Advanced Research in Computer Science Engineering and Information Technology Vol-2, Issue 1, February2014

[4] Kajal Nandaniya,Viraj Choksi, Ashish Patel,M.B Potdar “Automatic Accident Alert and Safety System using Embedded GSM interface” International Journal of Computer Applications Vol-85, January 2014

[5] Darshil Shah, Rahul Nair,Vaibhav Parikh, Viraj Shah “Accident Alarm System using GSM, GPS and Accelerometer”, International Journal of Innovative Research in Computer and Communication Engineering,Vol 3,Issue 4,April 2015.

