

# Accident Detection System Using Piezo Disk Sensor

Rohit Ganiga, Rohit Maurya , Archana Nanade

**Abstract**— An automobile industry all over the world is rising with a steady growth. The standard of living of people is in full swing. Thus, there are large numbers of personal vehicles adapted by the society. Due to such advent road accident is one of the serious problems of the age. It is necessary to provide safety to automobile systems in adverse conditions. In order to achieve safety certain steps are taken by the government and automobile industry over last two decades. Through, different safety measures are employed to make system even more versatile; there is a large void in post-accident emergency facilities. Many lives can be saved; if the emergency services with proper accident information and help are provided in time. Our project provides a new approach to solve this issue. To track vehicle accident's location GPS system is used and for reporting GSM modem is utilized. In this system, we have used piezo disk to sense the collision during accident. The microcontroller reads along voltage value from sensor and digitizes it. 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/she needs to turn OFF safety switch manually to prevent message sending. This system will be beneficial to manufacture low-cost safety system for automobiles.

**Index Terms**—Piezo-disk, Arduino Uno, GSM, GPS, Buzzer, Safety system .

## I. INTRODUCTION

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

According to World Health 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 survey the causes for accident and speeding, drunken driving, less use of helmets and belts, child restraints, lack of enforcement, bad roads etc. According to road traffic safety experts, the actual number of casualties may be higher than what is documented, as many traffic accidents go unreported. Moreover, victims who die sometime after the accident, a span of time which may vary from a few hours to several days, are not counted as car accident victims. 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 rescue 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 objective of our project is 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

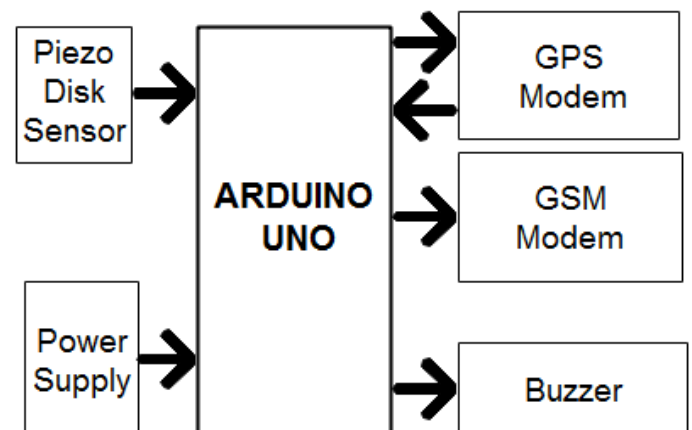


Fig.1 Block Diagram

### GPS Modem

A GPS tracking modem is a device, normally carried by a moving vehicle or person, that uses the Global Positioning System to determine and track its precise location, and hence that of its carrier, at intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location database, or Internet connected computer, using a cellular (GPRS or SMS), radio, or satellite modem embedded in the unit[8].

Global Positioning System (GPS) is a worldwide radio-navigation system formed from the constellation of 24 satellites and their ground stations. The Global Positioning System is mainly funded and controlled by the U.S Department of Defense (DOD). The system was initially

designed for the operation of U. S. military. But today, there are also many civil users of GPS across the whole world. The civil users are allowed to use the Standard Positioning Service without any kind of charge or restrictions[9].

Global Positioning System tracking is a method of working out exactly where something is. A GPS tracking system, for example, may be placed in a vehicle, on a cell phone, or on special GPS devices, which can either be a fixed or portable unit. GPS works by providing information on exact location. It can also track the movement of a vehicle or person. So, for example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck, and by parents to check on the location of their child, or even to monitor high-valued assets in transit[9].

A GPS tracking system uses the Global Navigation Satellite System (GNSS) network. This network incorporates a range of satellites that use microwave signals that are transmitted to GPS devices to give information on location, vehicle speed, time and direction. So, a GPS tracking system can potentially give both real-time and historic navigation data on any kind of journey [9].

GPS provides special satellite signals, which are processed by a receiver. These GPS receivers not only track the exact location but can also compute velocity and time. The positions can even be computed in three-dimensional views with the help of four GPS satellite signals. The Space Segment of the Global Positioning System consists of 27 Earth-orbiting GPS satellites. There are 24 operational and 3 extra (in case one fails) satellites that move round the Earth each 12 hours and send radio signals from space that are received by the GPS receiver [9].

The control of the Positioning System consists of different tracking stations that are located across the globe. These monitoring stations help in tracking signals from the GPS satellites that are continuously orbiting the earth. Space vehicles transmit microwave carrier signals. The users of Global Positioning Systems have GPS receivers that convert these satellite signals so that one can estimate the actual position, velocity and time [9].

A GPS tracking system can work in various ways. From a commercial perspective, GPS devices are generally used to record the position of vehicles as they make their journeys. Some systems will store the data within the GPS tracking system itself (known as passive tracking) and some send the information to a centralized database or system via a modem within the GPS system unit on a regular basis (known as active tracking) or 2-Way GPS [9].

A passive GPS tracking system will monitor location and will store its data on journeys based on certain types of events. So, for example, this kind of GPS system may log data such as where the device has traveled in the past 12 hours. The data stored on this kind of GPS tracking system is usually stored in internal memory or on a memory card, which can then be downloaded to a computer at a later date for analysis. In some cases the data can be sent automatically for wireless download at predetermined points/times or can be requested at specific points during the journey [9].

An active GPS tracking system is also known as a real-time system as this method automatically sends the information on the GPS system to a central tracking portal or system in real-time as it happens. This kind of system is

usually a better option for commercial purposes such as fleet tracking or monitoring of people, such as children or elderly, as it allows a caregiver to know exactly where loved ones are, whether they are on time and whether they are where they are supposed to be during a journey. This is also a useful way of monitoring the behavior of employees as they carry out their work and of streamlining internal processes and procedures for delivery fleets [9].



Fig:2 Sim 808

## GSM Modem

A GSM Modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. A GSM modem exposes an interface that allows applications to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an “extended AT command set” for sending/receiving SMS messages[1].

## Arduino UNO Board

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P, It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few rupees and start over again.

In our proposed system Arduino/Genuino Uno microcontroller is acting as a motherboard through which data will be passed to the GSM modem and GPS modem. Input voltage ranges from 5v to 12v, but 5v is recommended.

We are using Arduino IDE 1.7.10 to develop systems program. For coding purpose developer requires knowledge of c++ language. Importing libraries are similar to c++.

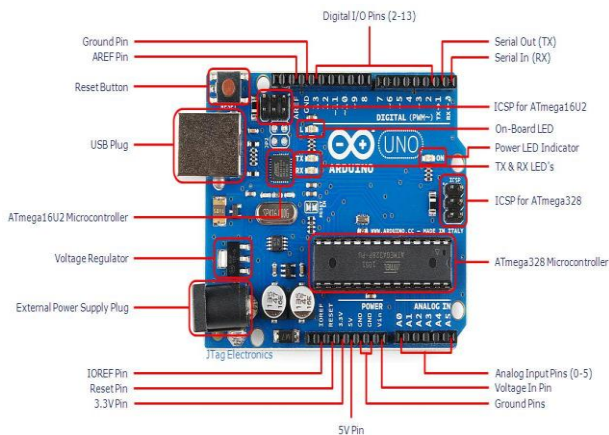


Fig:3 Arduino UNO R3

### Piezo Disk Sensor

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 the feasibility. During our literature survey, it was found that there were lots of sensors available in the market, but they were quite expensive. As, we had put optimization as our target, we decided to use such a material which is not expensive and can be served as an 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 a piezo-disk from it and connecting wires are drawn from its insulating material. Such an assembly provides analog output with high sensitivity. This analog output is used as an input to the Arduino system, and later to determine threshold of the accident.



Fig:4 Piezo disk sensor

### III. WORKING

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 vibrator sensor and impact sensor. Whenever, accident happens the vibrations are detected by using piezo disk. This disk continuously feeds analog signal to the micro controller. This signal is converted to digital value. Depending on 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 20 sec in order to stop messaging system and buzzer.

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 [5]. 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 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 [6]. 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 locality about accident. As soon as the buzzer is high, the down counter of 30 seconds starts displaying on the 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 predefined numbers.

In other case, when the value of the sensor exceeding the 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 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 implementations such power can be easily made available from vehicle's battery. The Arduino system and its circuitry requires power supply of 5V. This is achieved by onboard voltage regulator IC7805. 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 requirements of GPS system and sensor caters by Arduino microcontroller.

For GSM and GPS system to work properly, the satellite network is needed [7]. 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.



Fig:5 Working

#### IV. EXPERIMENTAL RESULT



Fig:6 Experimental result

Latitude and Longitude are the units that represent the coordinates at geographic coordinate system. Just like every actual house has its address (which includes the number, the name of the street, city, etc), every single point on the surface of earth can be specified by the latitude and longitude coordinates. Therefore, by using latitude and longitude we can specify virtually any point on earth.

The latitude has the symbol of phi, and it shows the angle between the straight line in the certain point and the equatorial plane. The latitude is specified by degrees, starting from 0° and ending up with 90° to both sides of the equator, making latitude Northern and Southern. The equator is the line with 0° latitude. The longitude has the symbol of lambda and is another angular coordinate defining the position of a point on a surface of earth. The longitude is defined as an angle pointing west or east from the Greenwich Meridian, which is taken as the Prime Meridian. The longitude can be defined maximum as 180° east from the Prime Meridian and 180° west from the Prime Meridian[10].

Both latitude and longitude are measured in degrees, which are in turn divided into minutes and seconds. For example, the geographical coordinates of the Kandivali in Mumbai has the geographic coordinates of 19.1998°N, 72.8426°E[10].

#### V. CONCLUSION

The proposed project is versatile as an application and has a vast scope for advancements. This system is a fully functional device which provides accident detection, tracking and messaging services. The accident location is tracked by GPS modem and altitude and latitude value is send to rescue team using GSM modem.

To track vehicle accident's location GPS system is used and for reporting GSM modem is utilized. In this system, we have used piezo disk to sense the collision during accident. The microcontroller reads along voltage value from sensor and digitizes it. 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/she needs to turn OFF safety switch manually to prevent message sending. This system will be beneficial to manufacture low-cost safety system for automobiles.

Multiple piezo sensors can be used to detect accident more efficiently. At the receiving end, the system can be merged with a database for real time tracking and monitoring.

#### REFERENCES

- [1] www.potentiallabs.com Fig:2
- [2] www.jtagelectronics.com Fig:3
- [3] www.ebay.com Fig:4
- [4] P.Kaliuga Lakshmi, C.Thangamani "An Efficient Vehicle Accident Detection Using Sensor Technology" International Journal Of Advanced Research in Computer Engineering & Techonology Volume 5Issue 3, March 2016.
- [5] Rashida Nazir, Ayesha Tariq, Sadia Murawwat, Sajjid Rabbani "Accident Prevention and Reporting System using GSM and GPS" International Journal Of Communications, Network and System Sciences, July 2014
- [6] S.Sonalika, S.Sathiyasekar, S.Jaishree "Intelligent Accident Identification System using GPS and GSM Modem" International Journal of Advanced Research in Computer and Communication Engineering Vol-3, Issue 2, Febuary 2015.

[7] Akshay Keshwantkar, 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, Issue1, February 2014

[8] [www.Wikipedia.com](http://www.Wikipedia.com)

[9] Article title: How does a GPS tracking system work? Web site title: EETimes. URL:[http://www.eetimes.com/document.asp?doc\\_id=1278363](http://www.eetimes.com/document.asp?doc_id=1278363)

[10] <http://www.latlong.net/>

**Authors Details:**

**Rohit Ganiga** B.E in Information and Technology (Pursuing). Theem College of Engineering, Mumbai University .

**Rohit Maurya** B.E in Information and Technology (Pursuing). Theem College of Engineering, Mumbai University.

**Archana Nanade** Assistant professor at Theem College of Engineering, Mumbai University. Master of Engineering in Information and Technology.