

DESIGN OF VEHICLE ACCIDENT DETECTION DEVICE

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Abstract

One of the basic reasons for road accidents is speed. Road accidents are rising suddenly today and are one of the key causes of human deaths. Human life is more important than anything else, and timely assistance is more important than lending a helping hand. If emergency service could get accident reports and reach it in time, more lives could have been saved. In saving human lives, the time between the accident and when the ambulance reaches the site of the accident plays an important role. If we reduce the time between when an accident happens and when a medical ambulance is dispatched to the area, we can save human lives by reducing mortality rates. GPS has become an integral part of a vehicle system nowadays. The Vibration Sensor senses a sudden shift in the vehicle's axles. It will be tested by Arduino. The Arduino sends the warning message via the GSM module to the police control room or a rescue team, including the location. So, after receiving the information, the police can automatically track the location via the GPS module. Then, the appropriate action will be taken after verifying the venue.

Keywords: Vehicle accident, Road accidents.

INTRODUCTION

The primary goal of the accident warning system is to save people in crashes. This device helps the owner to observe and find out vehicle activity and its past vehicle movements, the latest such as GPS are highly useful now-a-days. Over the past decade, the use of auto mobiles has improved linearly, which increased the risk of human life. This is because the emergency services are inadequate. We use an alert system in this paper that helps to strengthen the emergency system of the crash system. This device senses the occurrence of the accident and the coordinated accident is reported to the emergency team. Using the Vibration Sensor, an accident is observed. The angle where the car rolled off is shown by a message. This application aims to provide the weak emergency facilities with a suitable alternative. This accident warning system identifies the accident and the location of the accident and sends GPS coordinates to the Smart Phone, device, etc.

HARDWARE REQUIREMENTS

Arduino uno

Arduino Uno is a microcontroller board based on the ATmega328P data. It has 14 digital Input /Output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Arduino consists of both a physical programmable circuit board often referred to microcontroller and a piece of software or IDE(Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.



Fig.1 Arduino Uno

- USB Plug: Arduino board can be powered by using the USB cable from your computer.
- External power supply: Arduino boards can be powered directly from 11 the AC mains power supply by connecting it to the External power supply.
- RESET: The Arduino board can be reset in 2 ways – either the RESET button the board can be pressed or an external reset button can be connected to the board via the RESET pin.
- Crystal Oscillator: The crystal oscillator helps Arduino in dealing with time issues. The frequency is 16,000,000 Hz or 16 MHz.
- ATmega328 microcontroller: This is the main IC and the brain of the board.
- 3.3v pin, 5V pin, Vin pin: These pins are used for providing external power supply to the board.
- Ground pins: These pins can be used to ground the circuit.
- Analog pins: These pins can read the signal from an analog sensor and convert it into a digital value.
- Digital I/O pins: These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled “~” can be used to generate PWM.
- In-circuit serial programmer: This pin is referred to as SPI (Serial Peripheral Interface), which could be considered as an expansion of the output.

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- Serial IN & Serial OUT: The TX and RX LEDs flash when data is sent and received. The speed of the flashing of LED is based on the Baud rate of the process.
- I) Analog reference pin: This pin is used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

GSM Module

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design. This requires additional PCB and circuits for using in application development.

Features:

- SIM900 is designed with a very powerful single-chip processor integrating AMR926EJ-S core
- Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm
- SMT type suit for customer application
- An embedded Powerful TCP/IP protocol stack
- Based upon mature and field-proven platform, backed up by our support service, from definition to design and production



Fig. 2. GSM Module (900A)

GPS Module

The global positioning system is a satellite-based navigation system consisting of a network of 24 orbiting satellites that are eleven thousand nautical miles in Space and in six different orbital paths. The satellites are constantly moving, making two complete orbits around the Earth in just under 24 hours. The orbital paths of these satellites take them between roughly 60 degrees North and 60 degrees south latitudes.

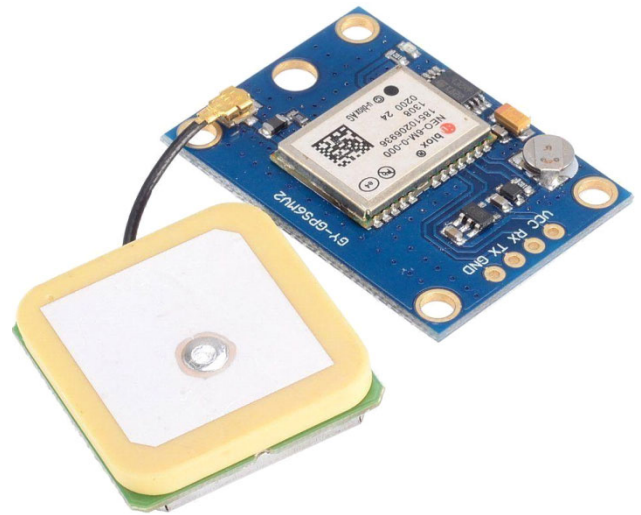


Fig. 3. GPS module (NEO-6M)

Vibration sensor

A vibration sensor is a device that measures the amount and frequency of vibration in a given system, machine, or piece of equipment. Those measurements can be used to detect imbalances or other issues in the asset and predict future breakdowns. The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality. The working principle of vibration sensor is a sensor which operates based on different optical otherwise mechanical principles for detecting observed system vibrations. The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities are also accessible. The sensitivity of the sensor can be selected based on the application. So it is essential to know the levels of vibration amplitude range to which the sensor will be exposed throughout measurements.

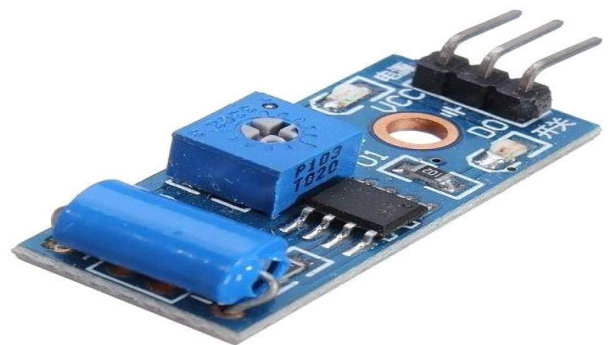


Fig.4. Vibration sensor

Jumper wires

A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

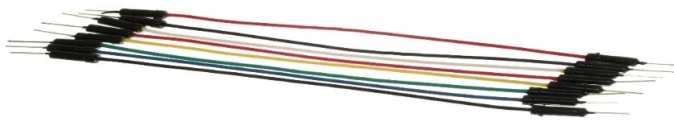


Fig. 5. Jumper wires

DESIGN AND IMPLEMENTATION

Methodology

The Prototype of this Accident Detection and information passing technique uses the following steps:

- The Complete Setup is depicted in the form of block diagram.
- Vibration sensor detects the first occurrence of the accident and it is intimated to the MCU.
- The Latitude and Longitude are detected using GPS and it is sent as message to the rescue team through GSM.
- The GSM sends the message to the number given in the program.

Circuit diagram

Circuit connections of this Vehicle Accident Detection System here is,

- The Tx and Rx pins of GSM are directly connected to Rx and Tx pins of Arduino UNO. And the gnd is connected to gnd of Arduino UNO.
- The Vcc, Dout, gnd of Vibration sensor are connected to the 5V, 2nd and gnd pins of Arduino UNO.
- The Vcc, gnd, Rx, Tx pins of the GPS are connected to the 3.9V, gnd, 9th and 10th pins of the Arduino UNO.

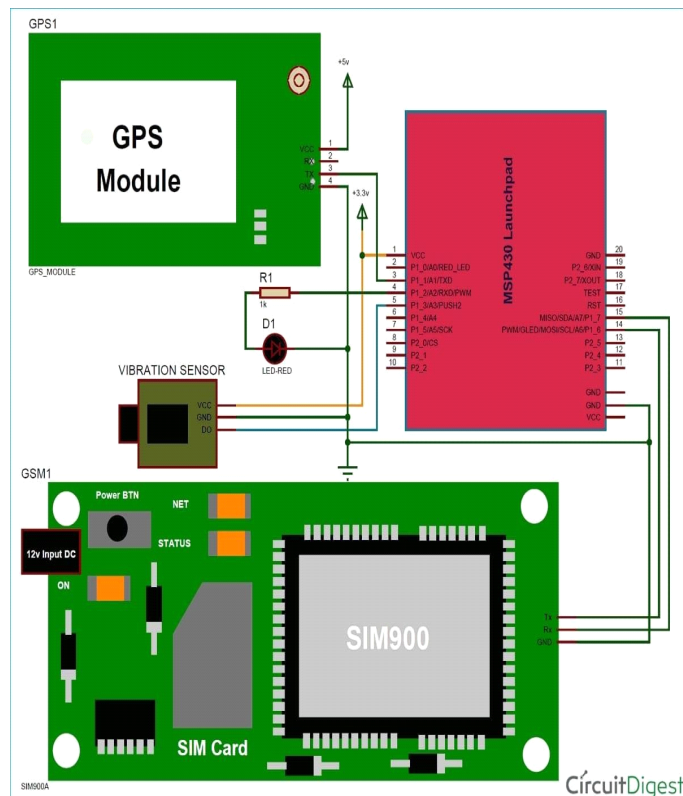


Fig.6. Circuit diagram

Source code

```
int led=3;int vib=2;

void setup()
{
  Serial.begin(9600); Serial.println("AT"); delay(1000);
  Serial.println("ATE0"); delay(1000);
  Serial.println("AT+CMGF=1");pinMode(vib, INPUT);
  pinMode(led, OUTPUT);
}

void loop()
{
  int val; val=digitalRead(vib);
  if(val == 1)
  {
    digitalWrite(led, HIGH);Send(); digitalWrite(led, LOW);
    delay(2000);
  }
  else {}
}

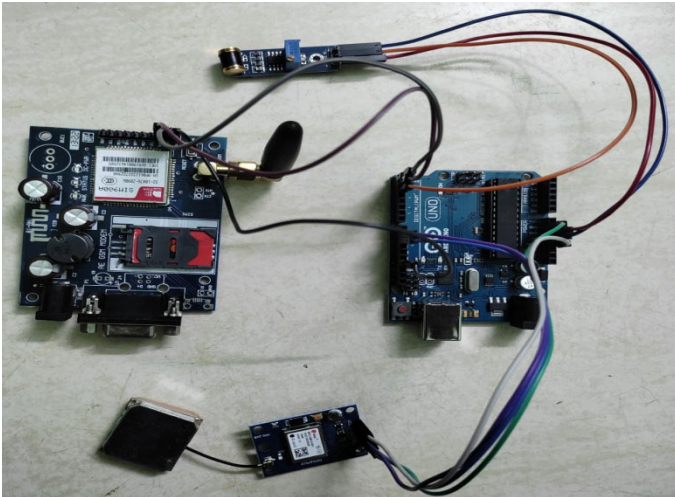
void Send()
{
  Serial.print("AT+CMGS=");Serial.print("");
  Serial.print("+916374763404"); // enter your Mobile number
  Serial.println("");
  delay(500);
  // GSM.println("Latitude:");
  // GSM.println(latitude); Serial.println("Accident Happened");

  delay(500);
  // GSM.println(" longitude:");
  // GSM.println(longitude);
  Serial.println("Click On link to see Location");
  Serial.print("https://maps.app.goo.gl/uMG5KCG5vq9gyh9m8");
  ;Serial.write(26);
  delay(4000);
}
}
```

Working principle

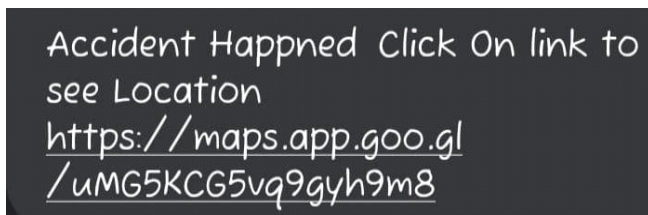
The Arduino controller used in this project is the controller that is used to control all the circuit modules. Two of the key sections of the circuit. The two key components other than the controller are the GPS module used as a receiver and GSM is another module. The GPS module is used to receive the coordinates of the vehicle and GSM will send the received coordinates to the user via SMS. If a person driving the vehicle has an accident, the sudden change of information about the Vibration sensor axis sends to the Arduino and the location of the vehicle is sent to the GSM module and the vehicle coordinates are sent to the GSM module.

Working model



Results

The system detects accident from vehicle and send message through GSM module. The message is received by the device or smart phone, etc. The GPS Module shows the exact location of accident and it's details.



Scope and future work

A wireless webcam can be added in this for capturing the images which will help in providing driver's assistance. This can also be bettered by locking all the brakes automatically in case of accident. Mostly in accidents, it becomes serious as the drivers lose control and fail to stop the vehicle. In such cases, the vibration sensor will be triggered because of the vibrations received and also processed by the processor. The processor has to be linked to the devices which can lock the brakes when triggered. With this improvement, we can stop the vehicle and can weaken the impact of the accident. This system can also be utilized in fleet management, food services, traffic violation cases, rental vehicle services etc.

Advantages

- This method is a system of urgent assistance.
- Monitors all risks and hazards.
- The warning message about the accident is sent automatically.

- It is possible to use this scheme for a social cause.
- Isolates both GSM & GPM
- Alerts police and medical units about accidents.
- Simple design and can be interfaced with other systems.
- Easy to operate by the user.
- Monitors hazards and threats.
- Sophisticated security.
- Simple and Reliable Design.

Applications

- It can be used to shield passengers in cars/motor vehicles.
- It may be used by the health department to survey the wider scale of incidents that have occurred.
- We can also use this framework in traffic estimation with some modifications.

Conclusion

Our idea is used to detect accident and automate emergency assistance services. As a result, system is sending SMS to the nearest Emergency assistance service provider from accident location. The high demand of automobiles has also increased the traffic hazards and the road accidents. Life of the people is under high risk. This is because of the lack of best emergency facilities available in our country. An automatic alarm device for vehicle accidents. This design is a system which can detect accidents in significantly less time and sends the basic information. This alert message is sent to the rescue team in a short time, which will help in saving the valuable lives. A Switch is also provided in order to terminate the sending of a message in rare case where there is no casualty, this can save the precious time of the medical rescue team. When the accident occurs the alert message is sent automatically to the rescue team and to the police station and the message is sent through the GSM module.

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