Smart Road Accident Detection and Rescue System

Mustafizur Rahman

Department of Electronics & Telecommunication Engineering
Rajshahi University of Engineering & Technology,
Rajshahi, Bangladesh
{mustafiz.ruet.898@gmail.com}

Abstract

The project is based on road accident detection and rescue process. The main purpose of this project is to detect accident using **Vibration Sensor** and then track the location where the accident happened using **GPS** and send the information to a particular person using **GSM** module. Overall, for minimizing the cost of damage via accident is the main objective of this project.

Introduction

The number of fatal road accidents are increasing day by day and has been a great challenge put in front of public health and concerned agencies. Every day in newspapers the main news in the front page is a road accident. The most prominent deaths of today's population are because of road accidents. Over 1,37,000 people were killed in road accidents in 2013 alone. This count is more than the number of soldiers who sacrificed their lives on battlefields. There are many reasons for road accident happenings like improper construction and maintenance of the roads, overcrowding and increasing count of vehicles. Apart from this, the lack of road sense by the drivers and other users of the road have further complicated the matters. Mostly the youngsters are losing their lives on roads because of rash driving, drunken driving and other reasons, which is a great loss for our nation. According to the World Health Organization, road traffic injuries caused an estimated 1.25 million deaths worldwide in the year 2010 i.e. one person is killed every 25 seconds .

Increased number of transportations has given rise to a greater number of road accidents. However, we cannot limit the increasing number of transportation but of course, we can limit the fatal road accident deaths with timely and effective communication of the accidents to hospitals and police. Nowadays technology has become the driving force of our modern world. Hence using micro-controller technology, I developed smart road accident detection and communication system.

Here, the system uses a Vibration Sensor, a Microcontroller, a GPS module and a GSM Module. When the accident is happened the vibration, sensor sense a huge number of collisions and if the measurement of the collision crosses the specified value it send a signal to the microcontroller. The microcontroller then detects the Accident Location using GPS Module and also send a signal to the GSM module. The output of the GPS signal is (as Latitude and Longitude) sent via GSM Module to the rescue team. And thus, the accident loss can be minimized through this system.

Block Diagram

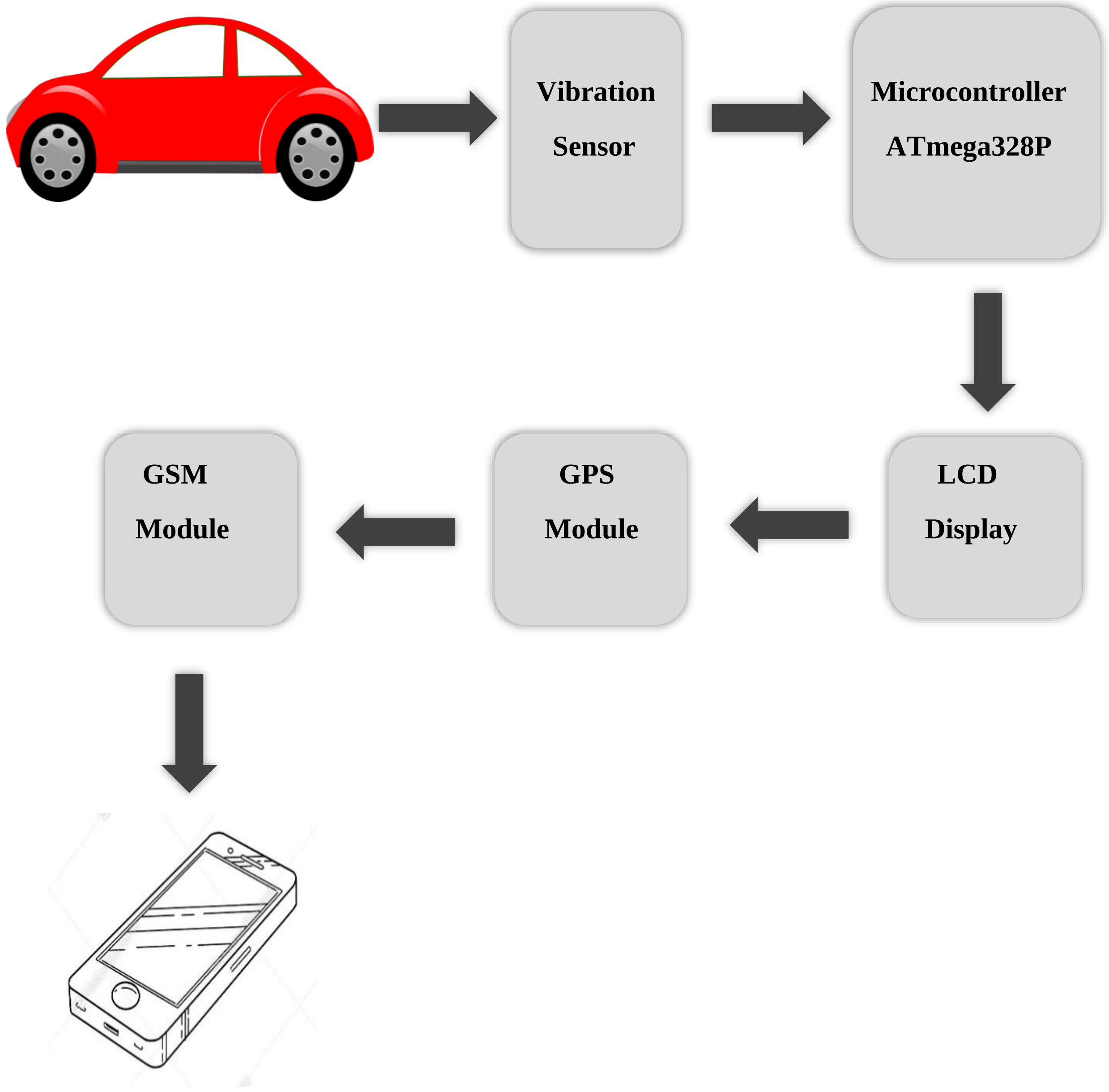


Fig 01: Block diagram

Circuit Diagram

- GSM (SIM 900A), GPS (NEO 6m) and Vibration Sensor Interface with ATMEGA328P

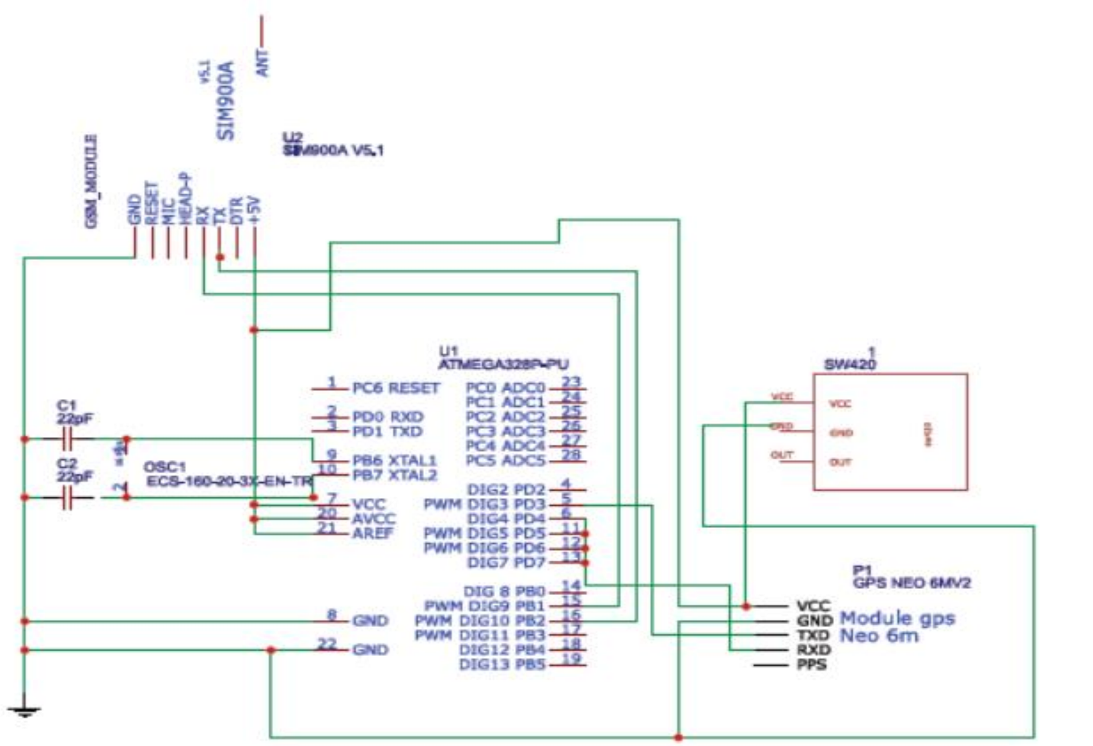


Fig 02: Circuit Diagram for GSM and GPS and Vibration Sensor

- LCD(16×2) Display with ATmega328P

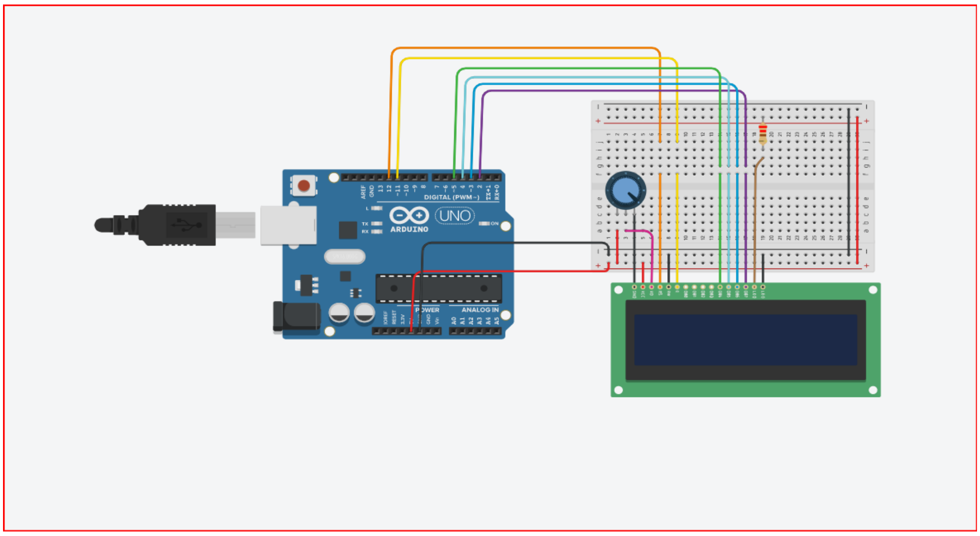
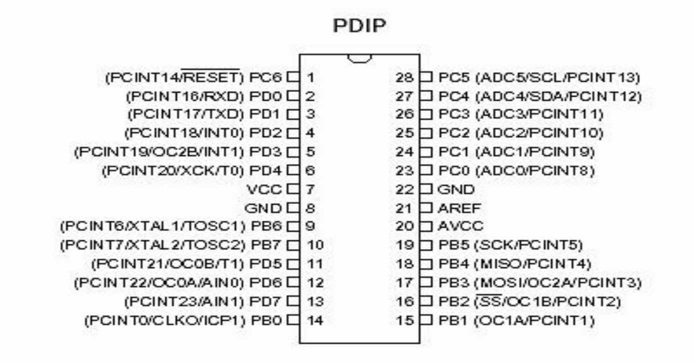


Fig 03: LCD connection with ATmega328p

System Apparatus

1. ATmega328p microcontroller

The ATmega328P 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 ATmega328P achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.



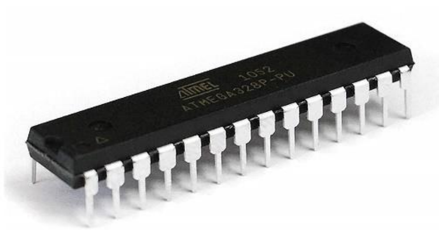


Fig 04: Pin Diagram of ATmega328p

Specification:

• High Performance, Low Power AVR® 8-Bit Microcontroller
• Advanced RISC Architecture
– 131 Powerful Instructions – Most Single Clock Cycle Execution
– 32 x 8 General Purpose Working Registers
– Fully Static Operation
– Up to 20 MIPS Throughput at 20 MHz
– On-chip 2-cycle Multiplier
• High Endurance Non-volatile Memory Segments
–32K Bytes of In-System Self-Programmable Flash program memory
–1K Bytes EEPROM
–2K Bytes Internal SRAM
– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
– Data retention: 20 years at 85°C/100 years at 25°C (1)
– Optional Boot Code Section with Independent Lock Bits
In-System Programming by On-chip Boot Program
• Peripheral Features
– Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
– One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
– Real Time Counter with Separate Oscillator
– Six PWM Channels
– 8-channel 10-bit ADC in TQFP and QFN/MLF package
Temperature Measurement
– 6-channel 10-bit ADC in PDIP Package
Temperature Measurement

– Programmable Serial USART
– Master/Slave SPI Serial Interface
– Byte-oriented 2-wire Serial Interface (Philips I2C compatible)
– Programmable Watchdog Timer with Separate On-chip Oscillator
– On-chip Analog Comparator
– Interrupt and Wake-up on Pin Change
• Special Microcontroller Features
– Power-on Reset and Programmable Brown-out Detection
– Internal Calibrated Oscillator
– External and Internal Interrupt Sources
– Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
• I/O and Packages
– 23 Programmable I/O Lines
– 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF
• Operating Voltage:
– 1.8 - 5.5V for ATmega328P
• Temperature Range:
– -40°C to 85°C
• Speed Grade:
– ATmega328P: 0 - 4 MHz @ 1.8 - 5.5V, 0 - 10 MHz @ 2.7 - 5.5V, 0 - 20 MHz @ 4.5 - 5.5V

2. Neo 6m GPS Module

Fig 05: Neo 6m GPS Module

GPS module GY neo-6m uses the popular Ublox Neo 6M GPS chip.
The detachable high gain antenna supports fast satellite acquisition, keeping the gps accuracy within 5m. There's dedicated EEPROM and a backup battery onboard that stores the satellite ephemeris data when powered off and thus helps faster location estimation as soon as the module powers on.

Features:

- u-blox NEO-6M onboard,
- with high-gain active antenna

- Chargeable backup battery,
- keeps the ephemeris data when power down, supports hot starts
- Onboard EEPROM for storing config information
- Compatible with Arduino and Raspberry Pi

Caution**:**
Put 3.3V to the VCC pin, not 5V. The Tx and Rx pin can work with both 5V or 3.3V logic level.

3. SIM 900A GSM Module

Fig 06: SIM 900A GSM Module

The onboard two set power supply interface VCC5 5V power supply, VCC4 interface, 3.5--4.5V power supply, optional power on self-starting (default) and control start. The onboard SMA (default) and IPXmini antenna interface, SIM900A interface reserved reset. The computer can give early computer debugging USB module power supply, a very large amount of data under the condition of the recommended current more than 1A. Standby dozens of MA data can be set to provide dormancy, dormancy of 10MA low power. Support 2, mobile phone 3,4G card.
The serial port circuit: support for 3.3V single chip microcomputer. TTL serial port support 3.3 and 5V single chip microcomputer. The SIM card circuit to increase the SMF05C ESD chip.
Antenna circuit: Guarantee short and straight, so as to ensure the signal strength.
PCB display screen printing mark: each interface, convenient development two times, the SIM900/A hardware is completely following the design when the design manual.
Two power supply interfaces: VCC5, 5V DC above 1A. Computer 5V power supply can be early computer USB. DC long data circuit over larger recommended 5V1A. VCC4, 3.5--4.5V power supply, ibid., suitable for lithium battery.
A TTL level, compatible with 3.3V and 5V.
The two-antenna interface, the default SMA straight head, connector for IPXmini antenna.
One way of speech interface, the way Mike interface.
The control interface of each pin description:
GND - GND
SIMR SIM900A RXD, TTL level, can not be directly connected to the 232 level
SIMT SIM900A TXD, TTL level, can not be directly connected to the 232 level
VCC_MCU when the SIM900A module and 5V TTL level communication, this pin is connected to DC 5V; when the level of communication of SIM900A and 3.3V TTL, this pin is connected to DC 3.3V.

4. **LCD display**

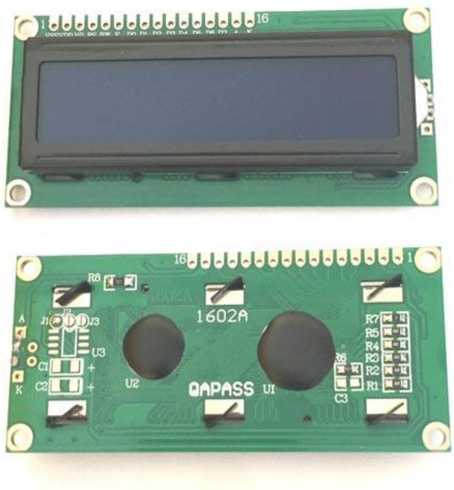


Fig 07: LCD Display

16x2 LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability, programmer friendly and available educational resources.

5. **SW-420 Vibration sensor**

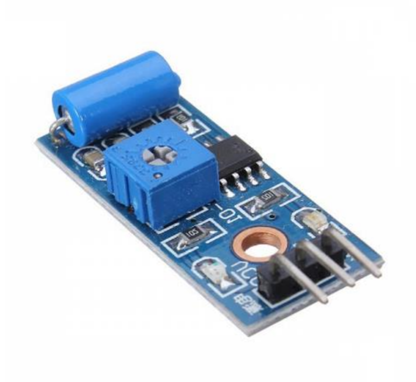


Fig 08: SW-420 Vibration sensor

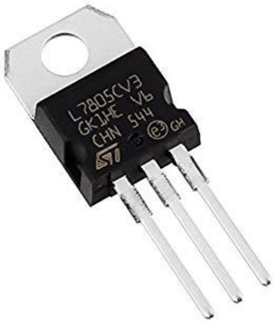
Vibration Sensor Module. The Vibration module based on the vibration sensor SW-420 and Comparator LM393 to detect if there is any vibration that beyond the threshold. ... When this no vibration, this module output logic LOW the signal indicate LED light, aqnd vice versa.

Features:

- Using SW-420 normally closed type vibration sensor.
- The comparator output signal is clean, good waveform, driving ability, more than 15mA
- The working voltage of 3.3V-5V
- The output format: digital switching outputs (0 and 1)
- A fixed bolt holes for easy installation

- ➢ Amall PCB board size: 3.2cm x 1.4cm
- ➢ Using a wide voltage LM393 comparator

6. L7805 Voltage Regulator



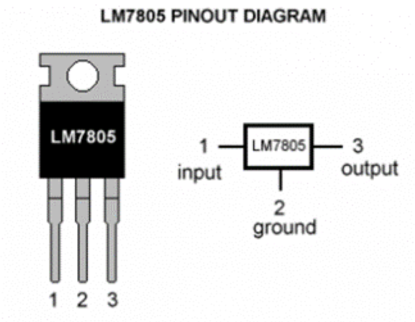


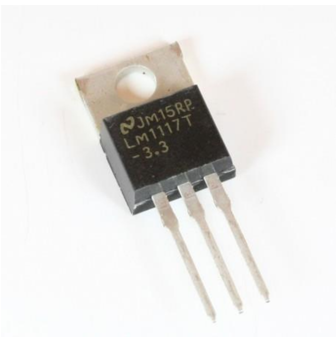
Fig 09: L7805 Voltage Regulator

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value.

Features:

- ➢ Typical Output Voltage:5V
- ➢ Typical Short Circuit Current:230mA

7. LM1117T Voltage Regulator



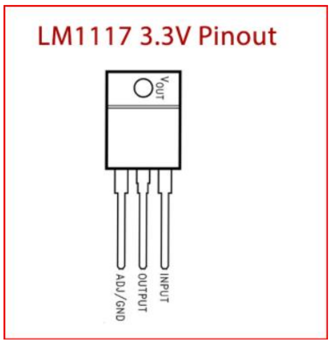


Fig 10: LM1117T Voltage Regulator

LM71117T is a voltage regulator integrated circuit. It gives 3.3v output voltage.

Features:

- ➢ Space Saving SOT-223 Package

- ➢ Current Limiting and Thermal Protection
- ➢ Output Current 800mA
- ➢ Temperature Range 0˚C to 125˚C
- ➢ Line Regulation 0.2% (Max)
- ➢ Load Regulation 0.4% (Max)

8. Capacitor

Fig 11: Capacitor

A capacitor is a passive electronic component that stores energy in the form of an electrostatic field. In its simplest form, a capacitor consists of two conducting plates separated by an insulating material called the dielectric.

9. Resistor

Fig 12: Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

10. LED

Fig 13: LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

11. Crystal Oscillator

Fig 14: Crystal Oscillator

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency.

12. 9V Battery

Fig 15: 9V Battery

13. 5V 2A Adapter

Fig 16: **5V 2A Adapter**

Fabrication Process

PCB Design :

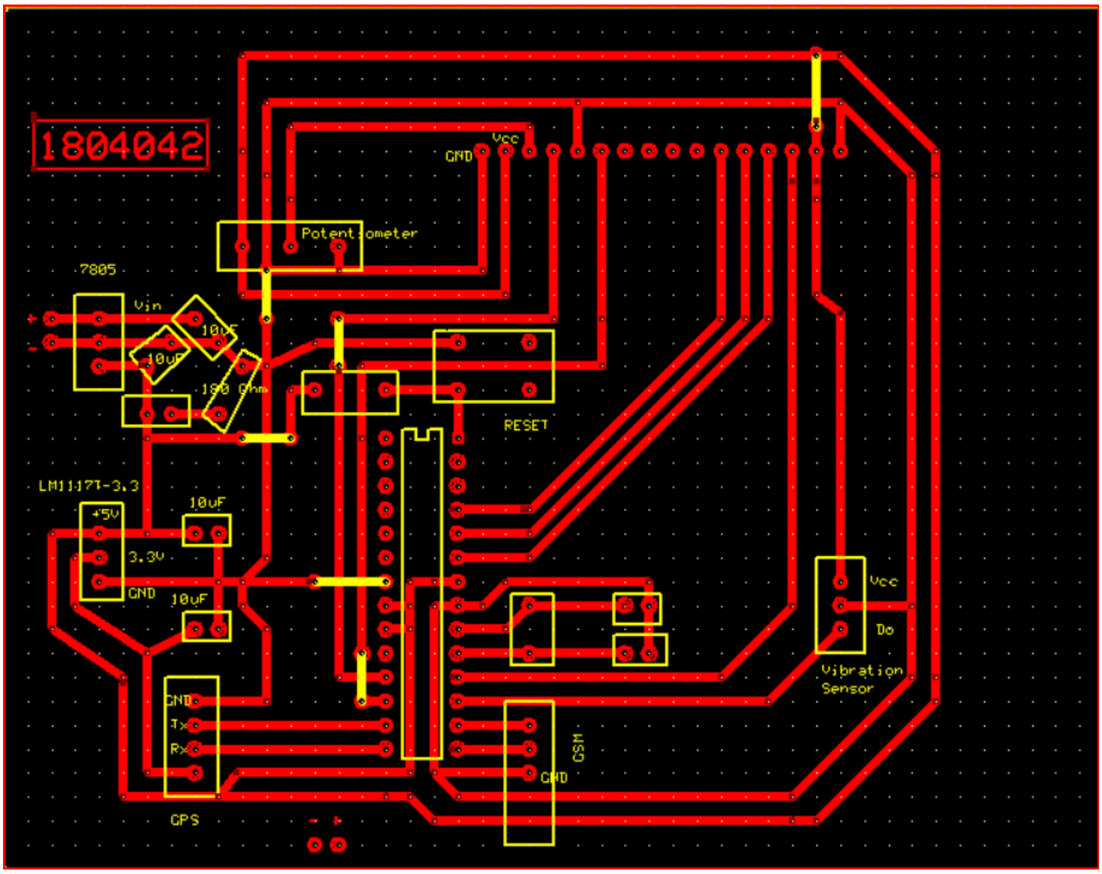
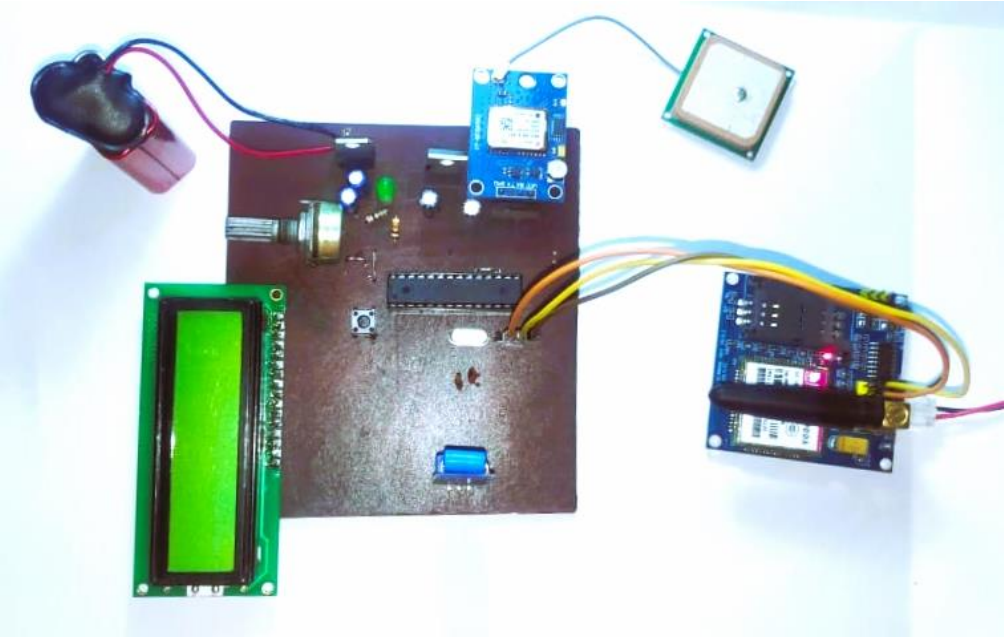


Fig 17: **PCB Design for ATMega328P, GPS, GSM, Vibration Sensor, LCD and Power Supply.**

Experimental Setup :



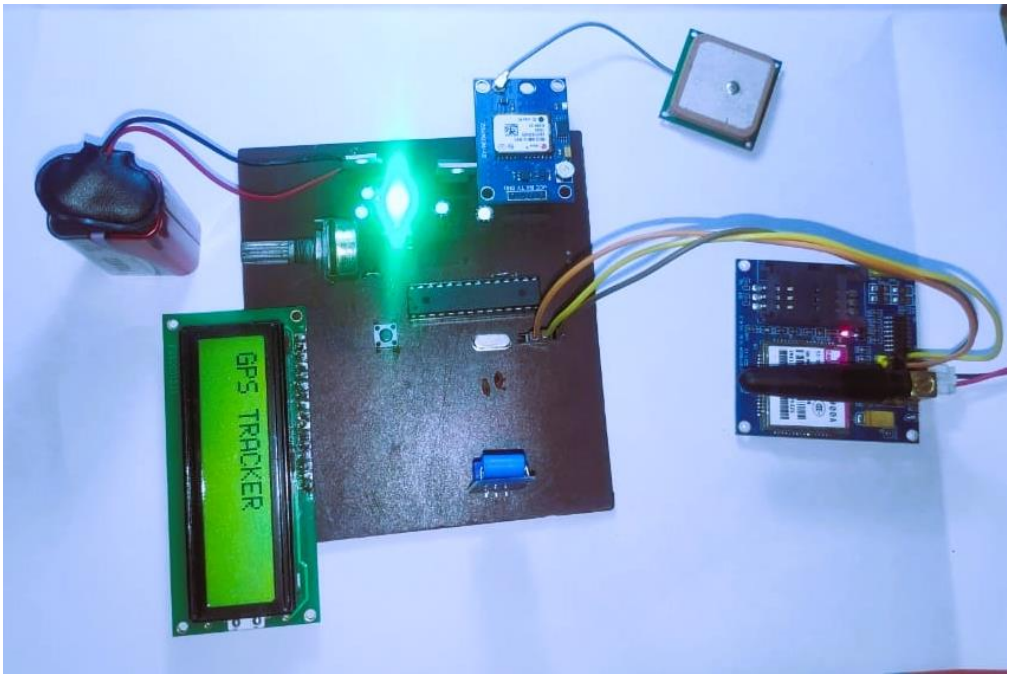


Fig 18: **Experimental final set up.**

Advantage and Disadvantage

The main advantage of this project is to detect the accident location as soon as possible and notify the rescue team so that the rescue team can reach the location in a possible short time. By doing so the damage or the losses of the accident can be minimized easily.

There is no disadvantage of this project. The project is all about saving life and goods from road accidents.

Conclusion

Road accidents rates are very high nowadays, especially two wheelers. Timely medical aid can help in saving lives. This system aims to alert the nearby rescue team about the accident to provide immediate medical aid. The attached vibration sensor in the vehicle senses the tilt of the vehicle of the accident. Thus, the systems will make the decision and sends the information as text message to the smartphone, connected to the GPS module, through GSM module. Application shares the exact location of the accident that can save the time. There are some drawback of this system. The GPS module sometimes take a little time to lock the location as it uses 3 satellite data to get the location. Again, sometimes the power consumption of the GPS creates problem to start the module. On the other hand, there are some little problem in vibration sensor IC. In main project the vibration sensor must be more sensitive and accurate

Code for System

```
int vibr_sensr = 13;

#include<SoftwareSerial.h>

#include <LiquidCrystal.h>

#include <TinyGPS++.h>


LiquidCrystal lcd(12, 11, 2, 3, 4, 5);

SoftwareSerial gpsSerial(10,9); //RX=pin 10, TX=pin 11


TinyGPSPlus gps;                    //This is the GPS object that will pretty much do all the grunt
work with the NMEA data

SoftwareSerial mySerial(7,8 );


void setup()
```

```
{ Serial.begin(9600);
pinMode(vibr_sensr, INPUT); //set vibr_Pin input for measurment

  gpsSerial.begin(9600);

  lcd.begin(16, 2);// set up the LCD's number of columns and rows

  delay(1000);
  mySerial.begin(9600);   // Setting the baud rate of GSM Module

}

void loop()
{
  long measurement = Vibration();
  delay(100);

 Serial.println(measurement);  // Serial.print("measurment = ");

  if( measurement > 1500){


    lcd.setCursor(4,0);
    lcd.print("DANGER!!");
    delay(5000);
    lcd.clear();



 while(1)
```

```
{
  while(gpsSerial.available() > 0)
   {gps.encode(gpsSerial.read());}

      gps.location.isUpdated();

      Serial.print("LAT=");  Serial.println(gps.location.lat(),6);
      Serial.print("LONG="); Serial.println(gps.location.lng(),6);
      break;
     }

   Serial.print("LATTITUDE="); Serial.println(gps.location.lat(),6);
  Serial.print("LONGITUDE="); Serial.println(gps.location.lng(),6);
 delay(3000);



     lcd.println("Accident Happenen");
     lcd.setCursor(0,1);
     lcd.println ("ed at location :");
     delay(5000);
     lcd.clear();



     lcd.print("LAT:");lcd.println (gps.location.lat(),6);
     lcd.setCursor(0,1);
     lcd.print("LON:");lcd.println (gps.location.lng(),6);

     delay(2000);
```

```
    Serial.println("GSM SIM900A BEGIN");
    delay(100);
    char ch='s';
    switch(ch)
    {
      case 's':
      SendMessage();
      break;
    }
     if (mySerial.available()>0){
      Serial.write(mySerial.read());


  }

 }




}

void SendMessage()
{
  float a,b;
  mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(500);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\"+8801703193698\"\r"); // Replace x with mobile number
  delay(200);
  mySerial.println("Accident Happened to Your Car at Location:\n");
```

```
  delay(1000);
  mySerial.println("Latitude:");
  mySerial.println(gps.location.lat(), 6);
  delay(100);
  mySerial.println("Longitude:");
  mySerial.println(gps.location.lng(), 6);
  delay(100);
  mySerial.println("http://www.google.com/maps/place/gps.location.lat(),gps.location.lng()");
  delay(100);
  mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
}
long Vibration(){
  long measurement=pulseIn (vibr_sensr, HIGH);  //wait for the pin to get HIGH and returns measurement
  return measurement;



}
```

References

[1] S. Gopalkrishnan, "A Public Health Perspective of Road Traffic Accidents", Journal of family medicine and primary care, vol.1, issue.2, dec2012, pp.144-150.

[2] Road accident statistics in India, available at http://sites.ndtv.com/roadsafety/important-feature-to-you-inyour-car-5 / viewed on 10 Jan 2018.

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