RESEARCH TITLE

ARDUINIO BASED VEHICLE TRACKING AND ACCIDENT DETECTION SYSTEM

A Report submitted to the Department of Physics

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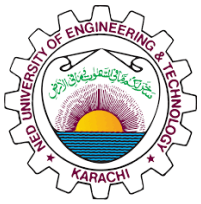

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CERTIFICATE

It is certified that the study presented in this thesis titled as, "**Arduino Based Accident and Vehicle Tracking System**" under the supervision of "**Junaid Kareem Khan**" and has been carried out Aqeela Urooj (AP-14033), Khadija Hussaini (AP-14006), Saba Manzoor (AP-14019), Sana Ejaz (AP-14059) of the Batch 14-15 Applied Physics Ned University in Engineering and Technology. The thesis is submitted for the requirement of Bachelor's degree in applied physics.

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ABSTRACT

As we are living in the highly populated country, where most of the people are losing their lives because of the road accident and improper facilities or first aid provided to the suffered. But these lives could be save if we provide sudden action at the right time. In this technological world, we can implement or construct such devices which may help the people from such road accident. Our project is also a solution of such drawback, when a passenger driving a car meets an accident, a sensor will detect the signal immediately and send it to the Arduino Microcontroller. With the help of GSM modem, an alert message will deliver to the nearest police station and hospitals, and GPS will track the location of the accident. With the help of an application these message are delivered. The proposed system has been practically designed by different hardware components. This system is more secured, reliable and low cost.

CONTENTS

CHAPTER # 01

INTRODUCTION

1.1 Introduction:

The Arduino based Vehicle tracking system and Detecting an Accident by using Global Positioning System (GPS) and Global system for the mobile communication (GSM). In this project, develop a system which will monitor the speed and accident of a vehicle. For tracking, we will use GPS to find the latitude and longitude for the location and the user will be intimated with respective details through SMS by GSM. The user message information and extract the vehicle address by using android application. Any shock will detect by sensor and consider it as an accident, the manually restore button will give in a device to avoid wrong detection of accident. We will take backup of the data using a memory card.

1.2 Background:

As we know, there is an increase in traffic hazards and road accidents.

With the help of vehicle tracking system, vehicle's security is assured and with the help of accident tracking system, people can be rescued easily. Vehicle's security system has quiet improved lately. The one who owns a car can easily track the location of his car and can know the direction in which the car moves.

If a car gets involve in an accident then a system installed in it known as alert system (accident alert) can detect the accident and also finds out the location of occurrence of accident. The car then sends the coordinates of GPS (latitude and longitude) to the designated laptop/monitor or phone.

Global Positioning System (GPS) is used by tracking system of cars to read the location of car accurately. If we want to transfer the car's location to a distant user , we can transfer it through devices such a GSM (Global System for mobile communication) and transmitter for satellite so that all the information or details of the vehicle can be observed by computer's software.

This kind of vehicle tracking project is mostly used in tracking taxi, school/colleges/buses or stolen vehicles (where vehicle can be easily followed by

the police as it emits a signal and in this way the snatched vehicle can be located). This tracking system has applications as fleet operators for routing, dispatch, on-board information and security. Its application also includes monitoring driving behavior.

Vehicle tracking system is also useful in tracking of valuable property of companies that need to track their possessions for the purpose of insurance can simply indicate the location of asset on a map. Productivity has also increased due to this improved system for vehicle tracking. This system also helps to reduce cost of fuel through detecting use of vehicles done personally. The fuel efficiency of vehicles can be improved by decreasing the standard speed.

1.3 Aim:

To develop a system which detect an Accident monitors the system and Tracking a vehicle.

- To design a vehicle accident detection and rescue information system based on the Arduino Microcontroller by using GSM/GPS.
- To implement a service for the vehicle owner and the nearest police station and hospitals or rescue team as well owner's family to receive the notification about the accident occurrence and its location.

1.4 Motivation:

It is not only about the city or country where we live, but all around the world, there are exponent amount of vehicles are growing up day by day .The reason is the non-stop growth of vehicle industries. As the number of vehicles has become superfluous, everyone is suffering from the road accident and there is a huge list for the reason of these road accidents i.e. speed, drunken driving, seat belt etc. According to WHO, there are 1.25 million road accidents occurred in 2010 over worldwide.

From the article published in DAWN Newspaper in May 4th, 2016, Dr. Amir Sheikh shared that five fatal accidents occur every 2 days on roads in Karachi and He said that the most recurring problem is the over speeding. According to the News of 2017, Pakistan is the 1st ranked country of road accidents in Asia and 48th ranked in the worldwide.

1.5 Scope:

Our goal is to provide a Safety mode and safety environment for the vehicle drivers and passengers who may face risk on roads. So, for safety and protection, our project is providing such safeguard that can save someone's life or can reduce the increasing road accidents. Our project implies a system which is a solution of multiple of drawbacks.

Hence with the help of this project we can detect the location of vehicle by mean of sending message using our tracking system to know where the accident has occurred so the immediate help or first aid can be provided with the help of both hospitals and police to the suffered. This project gives high security and self-defense for the drivers and passengers who are using automobiles in their daily routine.

1.6 Benefits of Vehicle Tracking and Accident Detection System:

1.6.1 Vehicle Tracking:

As the stealing rate of Vehicles is increasing on a large scale which causes the increment of crimes. This has a negative effect on social life of every individual in the society. The Vehicle Tracking helps us to trace the thief by tracking the location and the velocity of the vehicle.

1.6.2 Accident Detection:

As we all know that the high rate of traffic accident cause life to mouth of dead or give great injury.

At the place of accident all situation depends up on the people who are around the injured person apart from this at high ways there are no traces of even a single human being to inform or get immediate action to save the life of the injured person. The Accident tracking helps us to reduce the risk of death, increase chances to save a precious life and including all this it also send information to the nearest hospitals or Emergency areas to save the life as quickly as possible.

1.7 Additional Features:

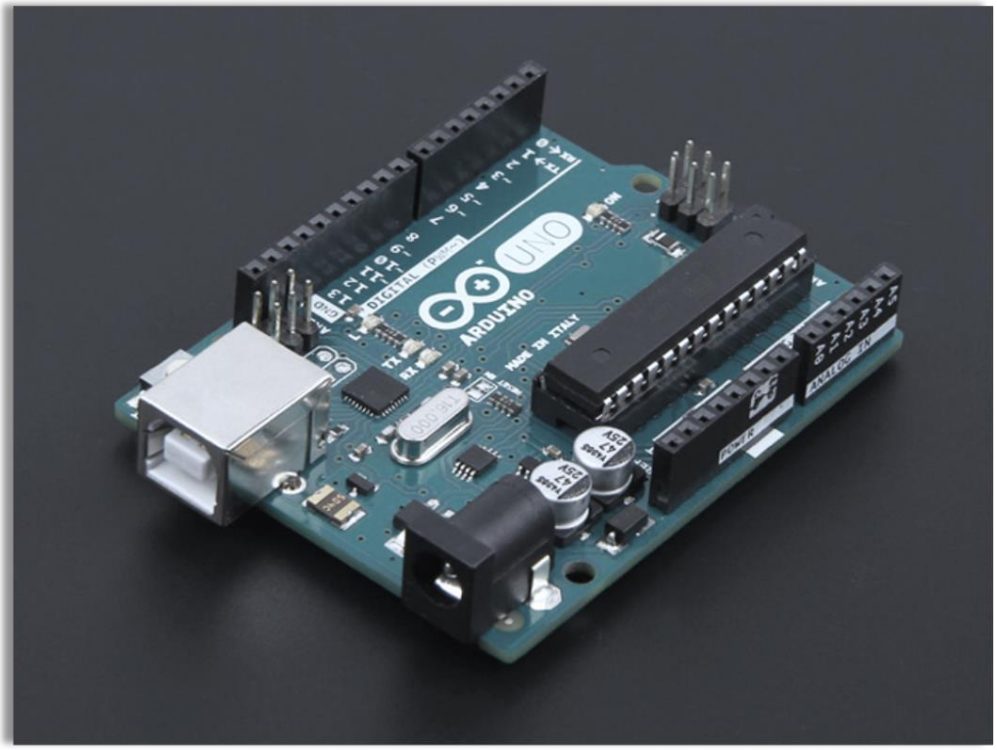
As we have merged two different systems which include vehicle tracking and locating where the accident have been occurred. In order to accomplish this we have designed an android app which will help to find the exact location on Google maps using API's which is very fast for locating the exact location. This will help in taking a sudden action about which route to approach the casualty or which is the nearest hospital and etc. This app will have some limitations and alert signs that will indicate the driver about at which speed to travel is and how much time he had left. The code consists of some rules (which will be displaying on screen) and alert signs to alert driver time to time e.g. no exceed limit from 80m/s.

1.8 Outline:

In this chapter, we explained all about our project that is its introduction, background, Motivation, scope and benefits of our project. Here, we explain GPS (Global Communication System) and GSM (Global System for Mobile Communication), Arduino microcontroller.

CHAPTER 02

ELECTRONIC EQUIPMENT



2. ARDUINO:

In 2011, the newly Arduino UNO was designed, which is the third version of UNO board. It has the best convenient power management and built-in voltage regulated. In this new version of Arduino, we can directly power it up through external power supply or USB. In this version, we have automatic power supply where as in its previous; it doesn't have automatic power supply system.

Arduino is an open-source computer hardware and software physical system. Arduino UNO is a microcontroller having ATmega328 microchip. It includes 14(input/output) digital pins, 6 analogue input pins, reset button, power jack and a USB connection port. In all Arduino USB board, UNO is the latest version and also the reference model for the platform of Arduino.

2.1.1. Components:

- Hardware.
- Software.

2.1.2. Hardware:

The Arduino board consist of many components .The hardware components of Arduino board are:

- Microcontroller.
- Digital I/O pins.
- Analog pins.
- Power and ground pins.
- USB port.
- Reset button.
- Internal programmer.
- External power supply.

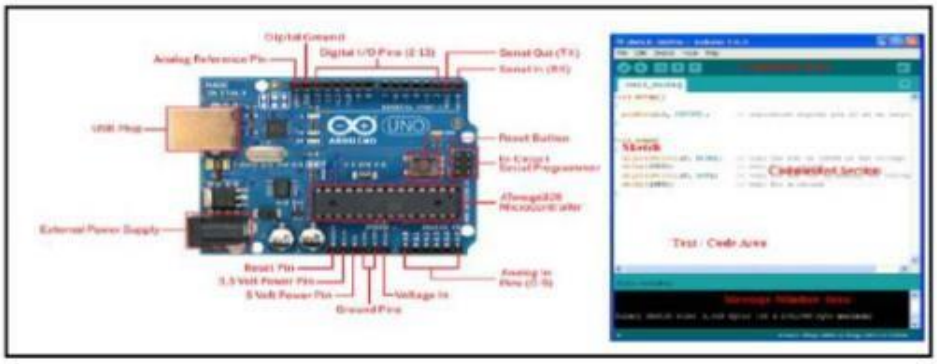


Figure 2.1: Hardware of Arduino.

2.1.3. Software:

Software used for developing such sketch is known as Arduino IDE that includes:

- Text Editor
- Text
- Message area
- Console toolbar

2.1.4. Principle:

Arduino microcontroller is very easy due to simplified version of C++. It has been used in different applications and projects. Arduino boards have different types of built-in modules. Its Bluetooth module is for the wireless communication. Built-in module is also known as Shield. There are different types of shields.

2.1.5. Specification:

- Microcontroller: ATmega328p.
- Start Up Voltage: 5V.
- Input Voltage: 6 to 20V.
- Digital Pins (input/output): 14.
- Analog pins: 6.
- DC current (input/output): 40mA.
- DC current (for 3.3V pin): 1KB.
- Clock Speed: 16MHz.

2.1.6. Application:

Arduino hardware and software is very easy to use. Some applications of Arduino are as follow:

- Bluetooth.
- Wi-Fi.
- Robotics.
- GSM and GPS based project.

And many others.

2.2. GSM:

2.2.1. Principle:

The GSM module is like mobile for receiving /sending calls and messages. It also used mobile GPRS for internet based programming. The full abbreviation of GSM module is Global positioning system. The SIM (Subscriber's identity module) is installed on this modem to operate all of the above mentioned processes. This Module comprises of four basic systems.

- Switching System.
- Base System.
- Mobile Station.

2.2.2. Features of GSM900:

- Mobile to BTS (uplink): 890-915MHz.
- BTS to Mobile (downlink): 935-960MHz.
- Bandwidth 2*25MHz.

2.2.3. GSM Module Specification:

Duplex Frequency Spacing	45MHz
Carrier Separation	200KHz
Frequency Channels	124
Time Slots/Frame (Full Rate)	8
Voice Coder Bit Rate	13 Kbps
Modulation	GMSK
Air transmission rate	270.833333
Access method	FDMA/TDMA
Speech Coder	RPE-LTP-LPC

1. **Switching System:**
   It has databases by which call processing function and other related function process
   Authentication Centre
   Mobile switching system

   Three types of registers

   - Home location.
   - Visitor location.
   - Equipment identity.

2. **Base Station System:**
   Base station system has two types.
   - Base transceiver System (BTS).
   - Base Service Centre (BSC).

   Base transceiver system has radio transceiver station. The main purpose of Base Station system is to manage the radio station resources from different Center.

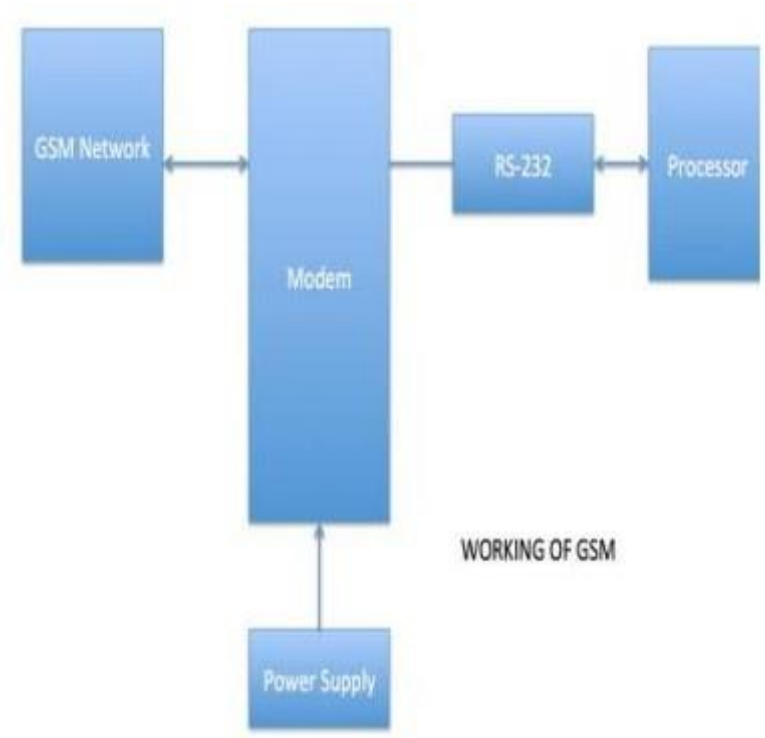


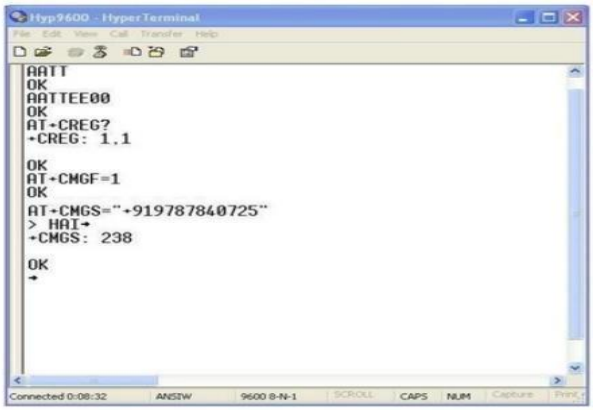
Figure 2.2: Working of GSM.

3. Mobile Station:

Mobile station has SIM and mobile equipment .it use IMEI for sending and receiving message.

2.2.4. AT Command:

For sending and receiving message and making call we use AT commands.



- AT use for checking connections.
- AT+CMGF it is for changing modes there is two modes
  For text mode 1
  For PDU mode 0
- AT+CMGS for sending message.
- AT+CMGR for receiving message.

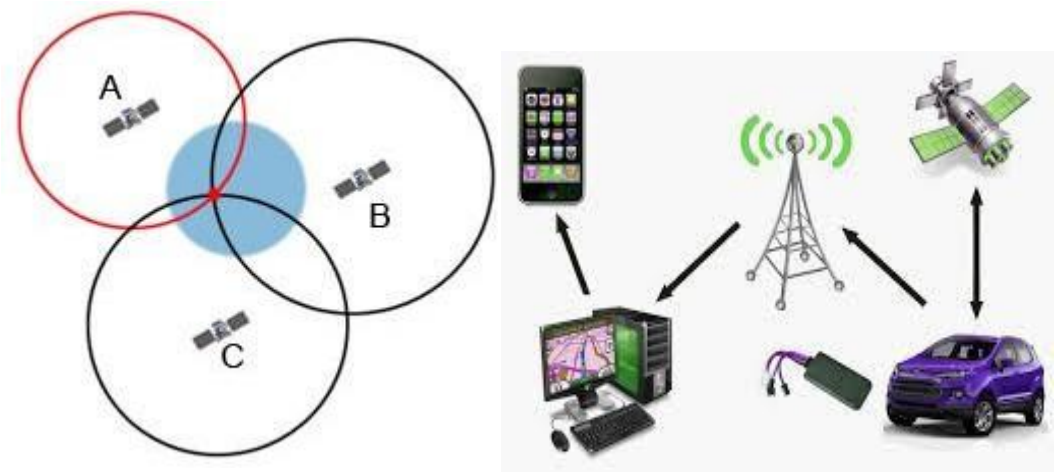
2.2.5. Application:

- Make connection with internet over wide range of GPRS.
- Sending and receiving SMS.
- Provide remote control to electronic device by SMS.
- Help to receive sensor data.

2.3. GPS:

2.3.1. Principle:

The Global positioning system (GPS) is based on the principle of 'trilateration'. The position can be determined from the measurement of distances to satellites. For example, a person is standing on Earth and there are three satellites in the sky above him. If the person knows how far he is standing from satellite A, then his location must be somewhere on the red circle. If the person standing on Earth considers satellites B and C, he can find out the location by seeing where the three circles are intersecting. This is how the GPS receiver works. The information is sent from the satellite to the GPS receiver by using the method of triangulation to determine a user's exact location.
Your location on earth can be determined more accurately by GPS unit if there is large number of satellites in the sky..



2.3.2. Function:

A GPS receiver is also called a GPS navigation system that receives details from satellites and then finds out the geographical position of vehicle. A GPS receiver is a device that shows the location of a car on a map by using particular computer software and also directs the vehicle to move in a suitable direction. GPS uses a network of about 30 satellites.

GPS receivers use the signals broadcasted by satellites and gives the latitude, longitude, and altitude along with the time.

There is a GPS receiver in the system which provides real time location of vehicle which is then stored in the database. The GSM module is connected to the microcontroller (Arduino) that sends and receive the SMS and then send the data to the database. This data is taken by GSM module that sends it to the user of phone who wants to know the position of vehicle. The data has coordinates of GPS and a link to see the location by using map. If the vehicle is stolen, the person who owns the car can follow it, after he knows the location of the car, and gives information of location to the police so that the recovery of the stolen car can be done quickly. In our project, we have used Arduino UNO R3 as a microcontroller for connecting to different devices of hardware. This design scans the movement of your vehicle and announces its status as required. To achieve this, we connect or interface the Arduino with a device known as GSM Modem and GPS. GPS receiver gives data in latitude and longitude form so that the location of device or car can be detected.

Message formats (data of GPS) of different types can be displayed over a serial port (serially).Mostly all GPS receivers' output data in NMEA format. The NMEA standard format consists of sentences in the form of lines of data and data bits are arranged in a format where a data is parted by commas. Most of the GPS modules use this format of data. GPS module consists of a Ground (GRD) pin that is

connected to the ground of Arduino and supply voltage (VCC) of GPS is connected to 5 (Volts) on the Arduino.

NMEA data is displayed in the form of sentences and it is then sent out of the GPS modules serial transmit pin (TX). The NMEA data in the form of sentences contain all of the useful data such as position, time, etc. Once we have powered a GPS module , NMEA data transports out of (TX) at a suitable rate (bit rate) or update rate of about 57600 (bps) ,i.e., the update rate of GPS module calculates and reports its position. To have your Arduino read the NMEA data, we need to attach the GPS transmitting pin (TX) with the receiving pin (RX) of Arduino.

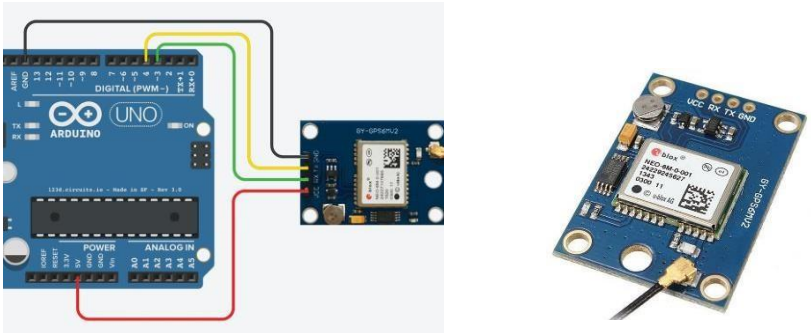


Figure 2.3: GPS connection with a Arduino.

2.3.3. Purpose:

Accident prevention system helps us to identify the accident of vehicle and when accident occurs at the same time, the vehicle tracking system will locate the place to inform the people to reach the location where the accident took place. In this project, a system based on Arduino has been developed by using the technology of GSM and GPS. When accident occurs, the GPS will show the location of that particular place, and will send an SMS immediately using the GSM. The main purpose of a GPS tracker in your car is to inform you about the location of your car at all times. For example, if someone stole your car, so you can inform the police about it with the help of GPS tracking device installed in your car. Another purpose of GPS is parents can track the location of their kid's car or see the record of the places they have visited or whenever they tried to break the limit of car's speed, all can be done by using GPS tracking device.

2.3.4. Application:

GPS systems are used in :

1. **Tracking Locations:** Most important use of GPS is tracking the locations. For example, you have visisted a different city, and you are not aware of the paths or roads in that city so you can use GPS tracker which helps you to take you to your destinationn on time.
2. **Access to emergency support:** if your car had an accident and you need immediate help, so you can make a call to emergency numbers that were already pre-progammed in your phone, and in this way hospital's emergency crew will trace the current location.
3. **To Prevent from car theft:** GPS tracker is an excellent anti-theft device. If your car is stolen and you want to locate your car, so it can be done easily by installing GPS tracker in the vehcile.
4. **Mining:** Miners can track several minerals in the earth's surface by using GPS tracking system.
5. **Flying planes:** to find the route in space, mostly aircrafts use this device. By using GPS, the track of movements of plane's route are kept by commanding station. By installing a GPS tracker on plane's black box so that it can be easily found when being missed.
6. **Fleet tracking:** different companies use GPS tracking devices on the fleets to find the location of route of their vehicles and that leads to increase in company's efficiency.

2.4 ACCELEROMETER:

2.4.1. Principle:

An accelerometer is a small device that can be used to measure some forces known as acceleration forces, i.e., static force, gravity's constant force etc. In case of devices such as phones, an effective force measures motion and vibrations or shaking of vehicles.

As we know that change in velocity divided by time is known as acceleration. When a car speeds up at a spend of about 60 miles per hour in tome duration of about 6 seconds then the car has acceleration of 10 miles per hour/seconds.

Another example is that gravitational pull can be measured by a dynamic accelerometer to determine the angle w.r.t the Earth at which vehicle leaned slightly. By sensing the acceleration, we can determine the car's movement.

By using accelerometer, you can determine speed of vehicle when it is moving uphill, or when the vehicle leans in a direction or falls or if the car moves in horizontal direction and moves downward.

2.4.2. Function:

Accelerometers can be used to sense rotations and they can sense 180˚ movement due to the another movement of 180˚rotation (mirror image of the previous one). As the sensor moves around x- axis, there is no change in values of sensor and we can use combined values of y-axis and z-axis to determine x-axis by using a function Atan2 (ADXL335) which is a trigonometric function and gives values in radians (from -180˚to +180˚rotation).
When an accelerometer stands still, it reports proper data. When an accelerometer is in motion (free fall motion) then its values doesn't completely depend on gravity. When we combine a gyro and accelerometer, they form an Inertial Measurement Unit (IMU). To measure rotation we use gyro and accelerometer is used to determine orientation.
In this Project, We have connected a particular type of accelerometer that is ADXL335 with Arduino. This type of accelerometer consists of 5 pins where Pin no. 0(analog 0) is for self-test of accelerometer; Pin no. 1(analog 1) is the z-axis attached to Arduino's input pin no (2). The analog Pin no (2) of accelerometer is the Y-axis connected to Pin no.2 on Arduino, the Pin no. 3(analog 3) is the x-axis connected analog input pin no. 0 on Arduino, and Pin no. 4(analog 4) of accelerometer is for ground(GND) attached to the GND of Arduino. In simple word, the connectors x, y and z are connected to input pins 0, 1, 2. This accelerometer (ADXL335) gives output as an analog voltage which depends on the sensed value. Accelerometer has Pin no. 5(analog 5) of VCC/ power supply of 3.3 volts.

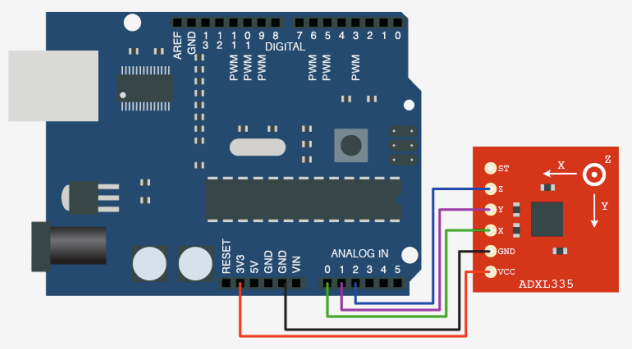


Figure 2.4: pin configuration of ADXL335 with Arduino.

2.4.3. Purpose:

An accelerometer is a sort of sensor which measures the tilt and orientation of a vehicle. In simple words, an accelerometer measures acceleration of the vehicle or how fast a vehicle speeds up and speeds down. In this project we have used 3-axes Accelerometer (ADXL335) that can measure in three orthogonal axes namely X, Y and Z. Accelerometers can be used to sense both static acceleration (gravity) and dynamic acceleration (sudden starts/stops). One of the more purposes for accelerometers is sensing of tilt motion of car. They are affected by the acceleration due to gravity, an accelerometer tells us how much a vehicle is oriented with respect to the surface of Earth.

2.5. RELAY:

Relay is an electromagnetic device which is used as a switch such as on and off. There are two circuit in relay, one is control circuit and the other one is load circuit. In figure 2.5. when the switch is on the current flow through the circuit and the operation would be turn on that is called normal open (NO). When the switch is of current does not flow through the circuit that is called normal closed relay (NC).

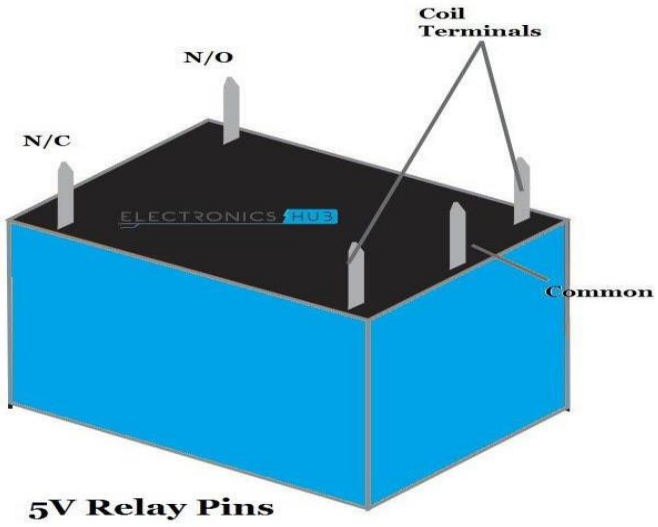


Figure 2.5: pin configuration of Relay.

There are four basic parts of relay.

- Electromagnetic part
- Switch point connection part
- Movable armature part
- And the spring part.

The relay is powered by ac and dc current when the voltage and cuurent which would apply exceed a threshold value. When current flows from the relay the armature would open the circuit.

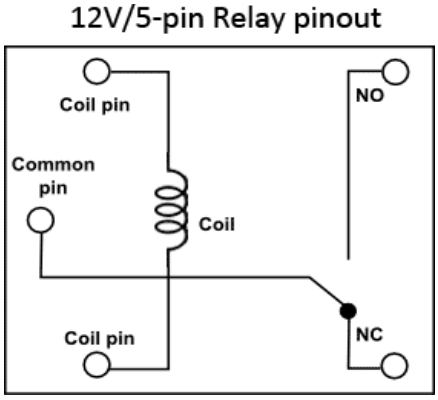


Figure 2.6: bottom view of the relay.

In figure 2.6 shows that the inner part of the relay, the electromagnetic devices have iron coil which surrounded on it. The relay as well have iron wounded coil. When the power is connect to the circuit the switch would be on and the control switch connected with the load. After the connection current flows and electromagnetic starts energizing a generates electromagnetic fields. Then armature is connected to the switch contact. The contact arm starts attracting bottom arm and due to short circuit its closes the connection

2.5.1. Classification of Relay:

There are two types of relay;

- Mechanical relay.
- And semiconductor relay.

In Mechanical relay is a contact open and shut mechanically as shown in figure2.3. And in Semiconductor relay, it does not open and shut mechanically because the contact material is semiconductor which would be made conductor and insulator by changing voltage.

2.5.2. Application:

There is a various application of relay that is,

- Automobile devices.
- Industrial devices.
- Medical devices.
- Security devices.

2.6. VIBRATION SENSOR KY-002:

Vibration sensor are sensor which are measuring, displacement, analysing velocity and acceleration. When human sense cannot detect or unnoticed the signal then vibration sensor indicates the signal. Vibration sensors are also used as a switches when high sensitivity occurs and also detect the ambient vibration strength. We get high Digital output (DO) when module did not reach at the threshold in shock and get low digital output (DO) when vibration sensor exceed the threshold.

2.6.1. Principle:

The logic states will be produced by the sensor module which depend on the vibration and external applied force. We get low output logic states when there is no vibration in the sensor module. And if there is any vibration we get high output logic state. When we get low output logic states then module indicates the LED light. The voltage of this circuit is between 3.3v to 5V DC.

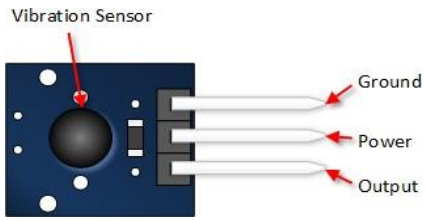


Figure 2.7: pin configuration of vibration sensor KY-002.

Vibration sensor KY-002 has three connection as shown in the figure 2.7. It consists a ground, power (input) and an output.

2.6.2. Feature of the Vibration sensor module KY-002:

- Voltage 3.3V-5V Input voltage.
- Output voltage 0 to1 digital output.
- Small PCB board 3.2cm-1.4cm.

2.6.3. Purpose:

Vibration sensor KY-002 will connect with Arduino as shown in figure 2.5. The ground pin of the Arduino connect with the ground pin of sensor. The middle pin which has +5V connected with Arduino pin +5V and signal pin S connect with pin 10 of the Arduino. We can connect Arduino directly when digital output is low level, thereby to detect the ambient vibration.

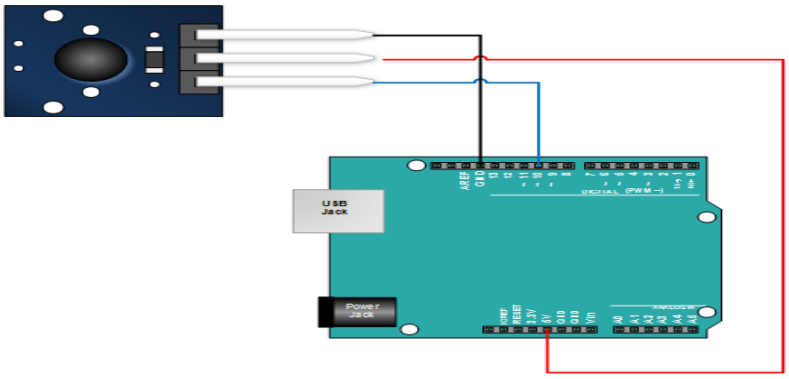


Figure 2.8: Arduino connection with vibration sensor module KY-002.

2.6.4 Application:

- Vibration detecting.
- Smart car.
- Object movement detecting.
- Earthquake alarms.

2.7. LCD (light Crystal Display):

LCD abbreviates as LIGHT CRYSTAL DISPLAY, which is used to display in smaller computers. LED can be made with two matrixes that is:

- ACTIVE MATRIX.
- PASSIVE MATRIX.

The passive matrix has a conducting grid with the pixels in every intersection. Some passive matrix have dual characteristic of screening, that in a same time of current they can scan the grid twice.

In active matrix, to control pixel luminance, we require less current, therefore current can be switch ON or OFF most of the time. The active matrix is a superior technology.

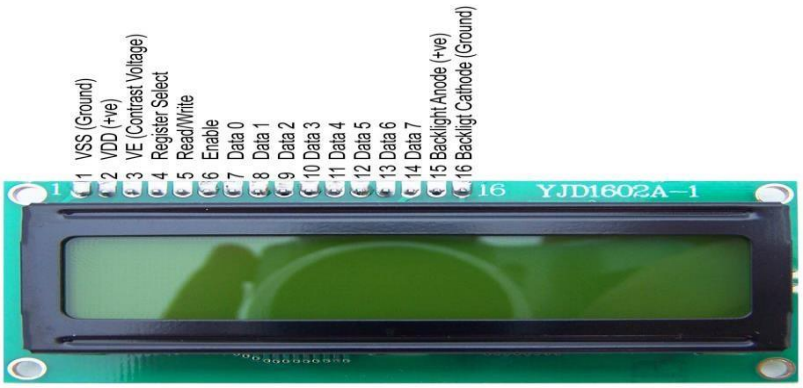
2.7.1. Function:

LCD is very common and has taken a giant leap in the industry of screen by using a cathode ray tube. As compare to cathode ray tube, LCD has less power. It is the state combination of solid and liquid, in which solid can maintain the state whereas, liquid change its orientation. LCD consumes less power as compare to LED. LCD has a power of some microwatts whereas LED has power of some milliwatts.

2.7.2. Principle:

In LCD, when an electric current is applied, it tends untwisted, therefore the angle of light passing through the LCD is changed.

A reflecting mirror is used at the back to make an LCD screen. An electrode plate at the top and a glass is placed at the bottom side. The entire LCD is covered by a common electrode. A piece of glass is placed in a rectangular shape at the bottom. Light passes through the front of LCD, when no current is applied and it will be reflect by the mirror and bounced back. As the light is blocked to pass. So that particular rectangular area appears blank.



2.7.3. Application:

LCDs are used in a wide range of applications includes:

- Monitors.
- Aircrafts.
- Panels Display screen in calculators.
- Image used in digital camera.
- Video player.

There is a huge uncountable list for the applications of LCD.

2.8. BUZZER:

Buzzer is audio generating device. We used buzzer to alert driver not to exceed it speed limit. As well it is also used to confirm by driver the false detection (in extreme cases).

2.8.1. Types of buzzer:

- Mechanical.
- Electromechanical.
- Piezo electrical.

Mechanical buzzer:
The type of ordinary buzzer which was driven by driver.
Electromechanical Buzzer:
In this buzzer relay are used instead of metal gong .The relay connect for causing buzz.
Piezo Electrical buzzer: This type of buzzer driven by oscillating electronic device, it driven with a piezo electrical audio amplifier. It also caused by acoustic cavity /Helmholtz resonance for buzzing .We used piezoelectric buzzer.

Figure 2.9a: Piezo Buzzer

Figure 2.9b: E.M Buzzer

Figure 2.9c: Mechanical Buzzer

Insight of Piezo Electric Buzzer:
It has wide application it is used in vehicles, computer etc. Piezo buzzer is based on the principle of piezo electricity.

Piezo electricity:
When we applied a mechanical pressure to the certain substance the electricity produced, this also valid for vice versa process. This certain materials also called piezo electric material.

Piezo Ceramic:
In buzzer piezo ceramic material is used which is made by human this material is heart of buzzer or it is used in disc also.
When we apply AC electric field this material compresses according to the frequency of the signal then produce sound.

2.8.3. Structure and Working of Piezo Buzzer:

In clamped edge mounting, the whole surface of the flexing can vibrate in phase. Nodal support mounting cause them vibrate, greater interaction between the sound-producing element and the top house which reduces the amplitude of the vibrations. In flexible edge mounting, the flexing element is restrained by a material, such as a rubber.

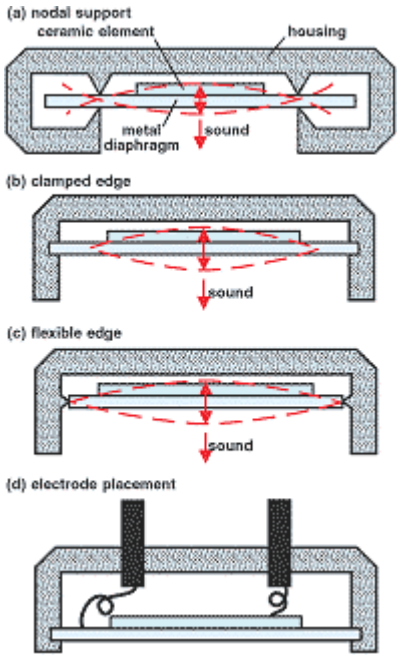


Figure 2.8: Audible sound transducers.

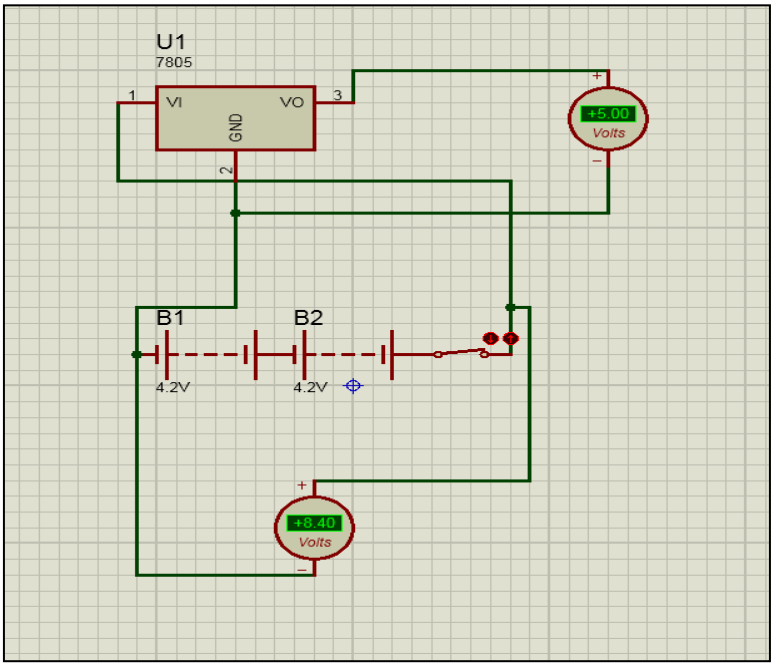
2.9. USE OF POWER BANK:

GSM and Arduino board required 5V and 8V respectively, so we powered up these two boards by using external battery .The Arduino board also provide 5V but it give 1 ampere current but GSM require 2 ampere current. To full fill this requirement we made a power bank.

2.9.1. Components Requirement:

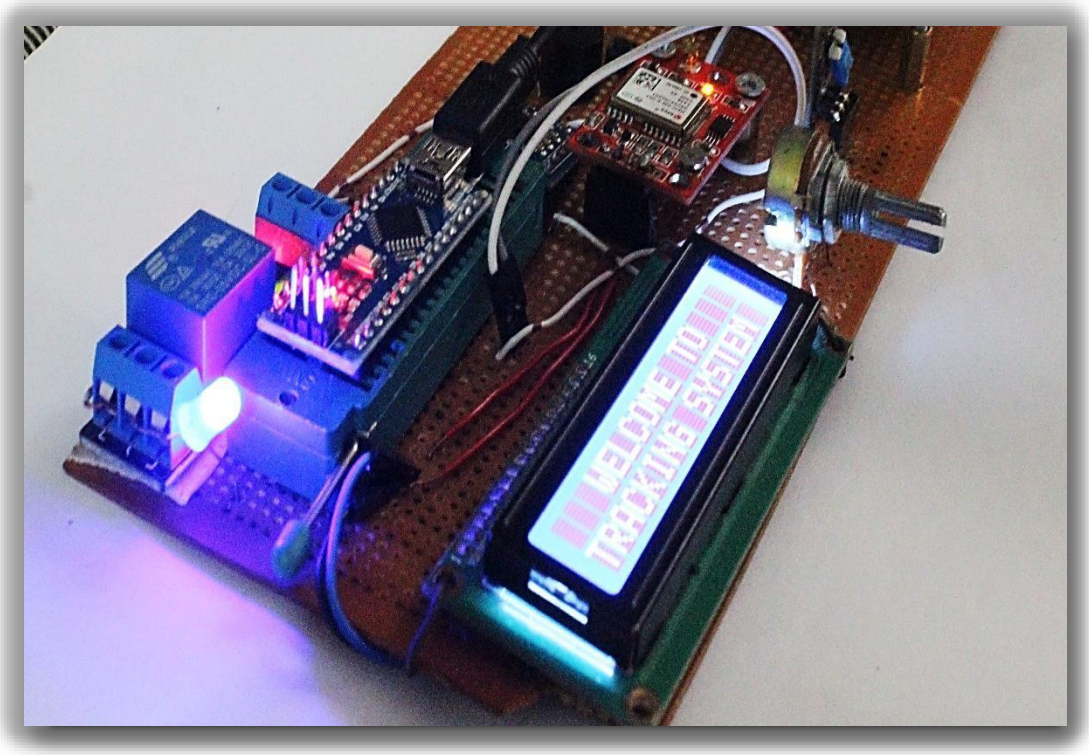
- Two battery of 4V (1.2 amp current).
- IC(LM7805),to divide the sum up voltage 8.1V to 5V.
- Switch (ON & OFF).
- Wire for recharge as well as to power us the Arduino board.
- Wire to Connect GSM.

2.9.2. Simulation in Proteus:



CHAPTER # 03

HARDWARE



3.1 DESIGN SPECIFICATION:

This project is designed with different components to make a detection system and tracking system. The hardware components we used in our project are listed below:

- ARDUINO (ATMEGA328).
- LCD DISPLAY (16*2).
- GPS (NEO-6M-0-001).
- GSM (SIM900).
- POWER SUPPLY.
- RELAY (12V-10A).
- ACCELEROMETER (Adxl335).
- VIBRATION SENSOR (KY-002).
- BUZZER.

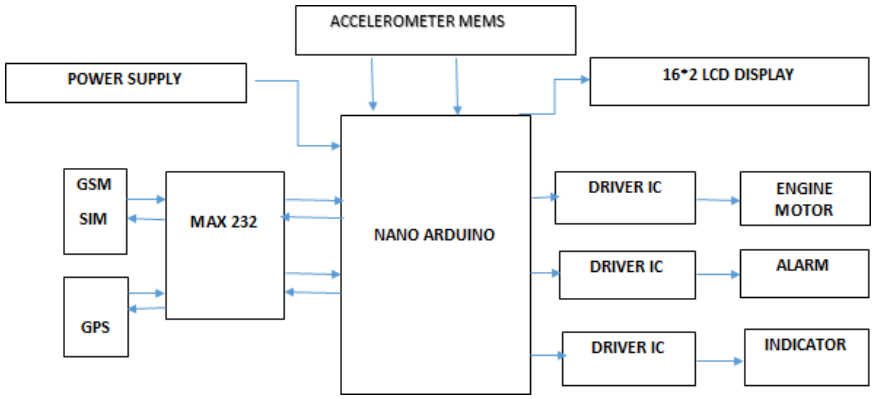


Figure 3.1: Block Diagram of Hardware Components.

In the above mentioned block diagram, we have components used for the project and the pattern of connections through which the system will operate and perform work on it.

The Arduino board is the main source of this system by which the components are connected. The Arduino board is controlling the performance of the system and all connection of others components that are linked with the system. This model of vehicle accident detection system and tracking system we implemented consist or

two parts. The first part is accident detection system; the two main components that are especially work for accident detection system are accelerometer and vibration sensor. Whereas the second part is tracking system, for this purpose the major component is GPS and the purpose of these both parts will be done with the help of an application which is to be made for the model.

3.2 HARDWARE CONNECTIONS AND ANDROID APPLICATION:

A hardware connection is implemented in the project. To fulfil the application, the system is installed in the automobile and the user can monitor their vehicle through application if any accident occurred.

3.2.1 Hardware Connections:

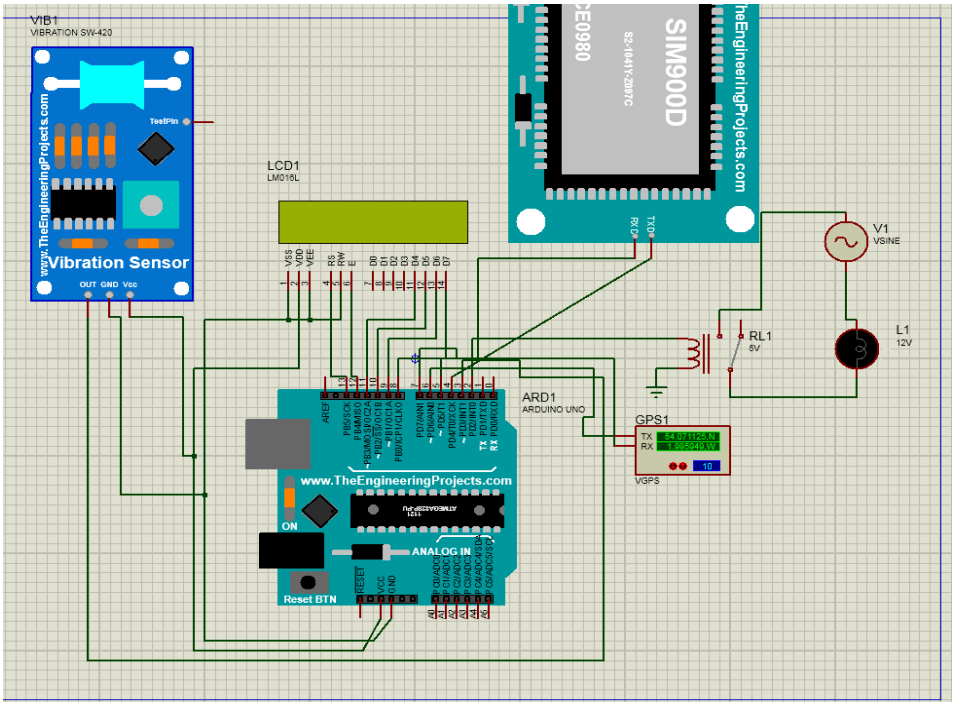


Figure 3.2: Hardware Connections

3.2.2 Android Application:

For the purpose of working of the system, we develop an android application that will receive all upcoming data through the system fitted in the vehicles. The working of this application is, it will send an alert message notification whenever the vehicle feels any accident shock. The GPS help to send the location of accident also the longitude, latitude, car speed and direction will be scanned with the help of the hardware system. The details will be sent to the nearest hospitals, police station and other numbers that uploaded with the help of using Arduino programming by using the Android Application.

3.3 CIRCUIT CONNECTIONS:

A proper pattern is formed to connect every component of this system with the Arduino. The connections of the components are listed one by one:

3.3.1 Arduino and LCD:

The connection between Arduino and LCD are:

LCD	**ARDUINO**
D_4	D_4
D_5	D_5
D_6	D_6
D_7	D_7
E	D_3
R_S	D_2
V_{CC}	+5V

Whereas, in LCD the “D” label indicates the data pin and in Arduino the “D” label indicates digital pins.

3.3.2 Arduino and GPS:

GPS	ARDUINO
V_{CC}	+5V
G_{ND}	G_{ND}
R_X	D_8
T_X	D_9

In both columns, the label R_X and T_X indicates the receiving pin and transmitting pin. In case when we don't have multiple pins and the connection requires more than one pin in it so we do make these pins in multiple orders by using connection wire or jumper wire.

3.3.3 Arduino and Accelerometer:

ACCELEROMETER	ARDUINO
V_{CC}	5V
X(out)	A_1
Y(out)	A_2
Z(outs)	A_0
G_{ND}	G_{ND}

In these two columns, we have X, Y and Z pins in Accelerometer which indicates the three dimensions of the directions used in accelerometer to indicate the direction. Whereas in Arduino, the "A" named pin indicates the Analog pins of Arduino board.

3.3.4 Arduino and GSM:

GSM	ARDUINO
R_X	D_{11}
T_X	D_{12}

3.3.5 Arduino and Vibration Sensor:

VIBRATION SENSOR	ARDUINO
S	D_{10}
V_{CC}	5V
G_{ND}	G_{ND}

3.3.6 Arduino and Buzzer:

BUZZER	ARDUINO
A_3	A_3

The A_3 pin of Arduino board is connected with the wire of buzzer for the working of alarm.

3.3.7 Arduino and Button:

BUTTON	ARDUINO
A_4	A_4

The A_4 pin of Arduino board is connected with the button. The button will perform the working of switch on and off when needed.

3.3.8 Arduino and Relay:

RELAY	ARDUINO
D_{13}	D_{13}
V_{IN}	5V
G_{ND}	G_{ND}

In the circuit, the relay is connected to the D_{13} pin of Arduino board. Whereas, its V_{IN} is connected to the 5V of Arduino and ground of relay is connected with the ground of Arduino board.

3.4 CIRCUIT DIAGRAM:

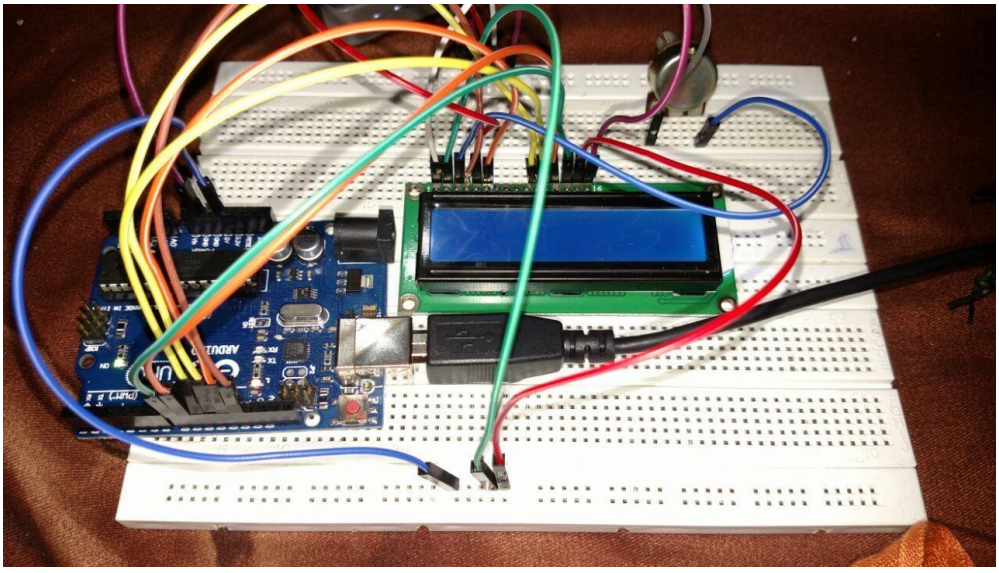


Figure 3.4: Circuit Connections

CHAPTER # 04

SOFTWARE

4.1 SOFTWARE:

The software used for the coding is called “ARDUINO SOFTWARE”. To develop different sketches of programming we use this software. The structure of Arduino software is shown below:

Figure 4.1: Arduino Software.

At the left top of fig 4.1, there are five different option used for different manners of the software. The first symbol is (√) which is “verify” key. Second key is (→) which is “upload” key. Third is (▒) which is for the “new page”. The fourth is (⇧) which is used for open any previous saved file. The fifth symbol (↓) means the programming /coding or files to be saved in the Arduino software files. .At the right top of the figure, the symbol “Ϙ” is the serial monitor key which only gives response if the Arduino hardware board is connected to the laptop. At the bottom of Figure, the small black sheet is the message area, when any component’s programming is done, this area responses either any correction message or coding confirmation message is received over there. If any error is found, the message area highlights the coding and the line where the error is founded. Therefore this sheet is called message area.

4.2 CODING:

The vehicle tracking and accident detection system requires a coding to operate it. Every component has its own coding to run the program, with its specific libraries and connection coding. The coding we made for our components are as follow:

4.2.1 LCD:

For LCD, our coding structure is picturized below:

4.2.2 GPS:

The system we used for our tracking purpose in GPS. The programming or coding we used with specific pattern for GPS is given below:

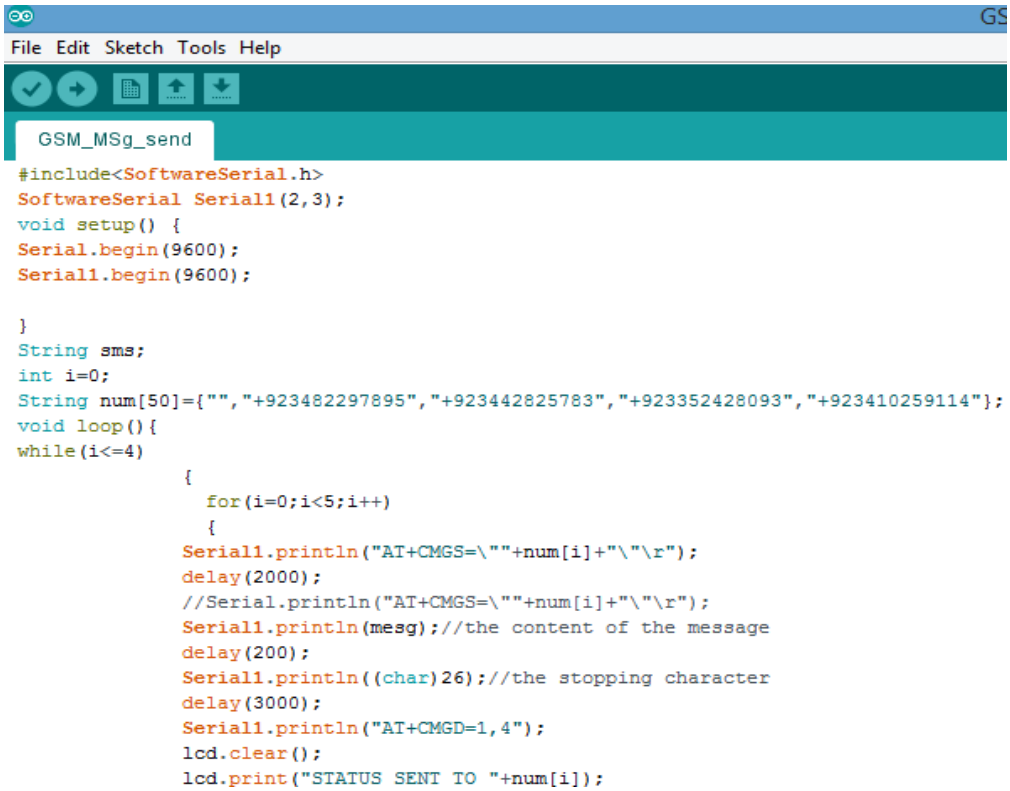
```
a="CURRENT LOCATION\n""LATITUDE:"+(String)new1+"\n"+"LONGITUDE:"+(String)

  lcd.setCursor(0,0);
  Serial.print("LAT: ");
  Serial.print(lat,6);
  lcd.print("LAT: ");
  lcd.print(lat,6);
  lcd.setCursor(0,1);
  Serial.print("LONG:");
  Serial.print(lon,6);
  lcd.print("LONG:");
  lcd.print(lon,6);
  delay(5000);
  lcd.clear();

} }}
```

4.2.3. GSM:

The GSM modem requires sending as well as receiving format of programming/coding.

a) Sending:

The coding used for sending message is given as follow:

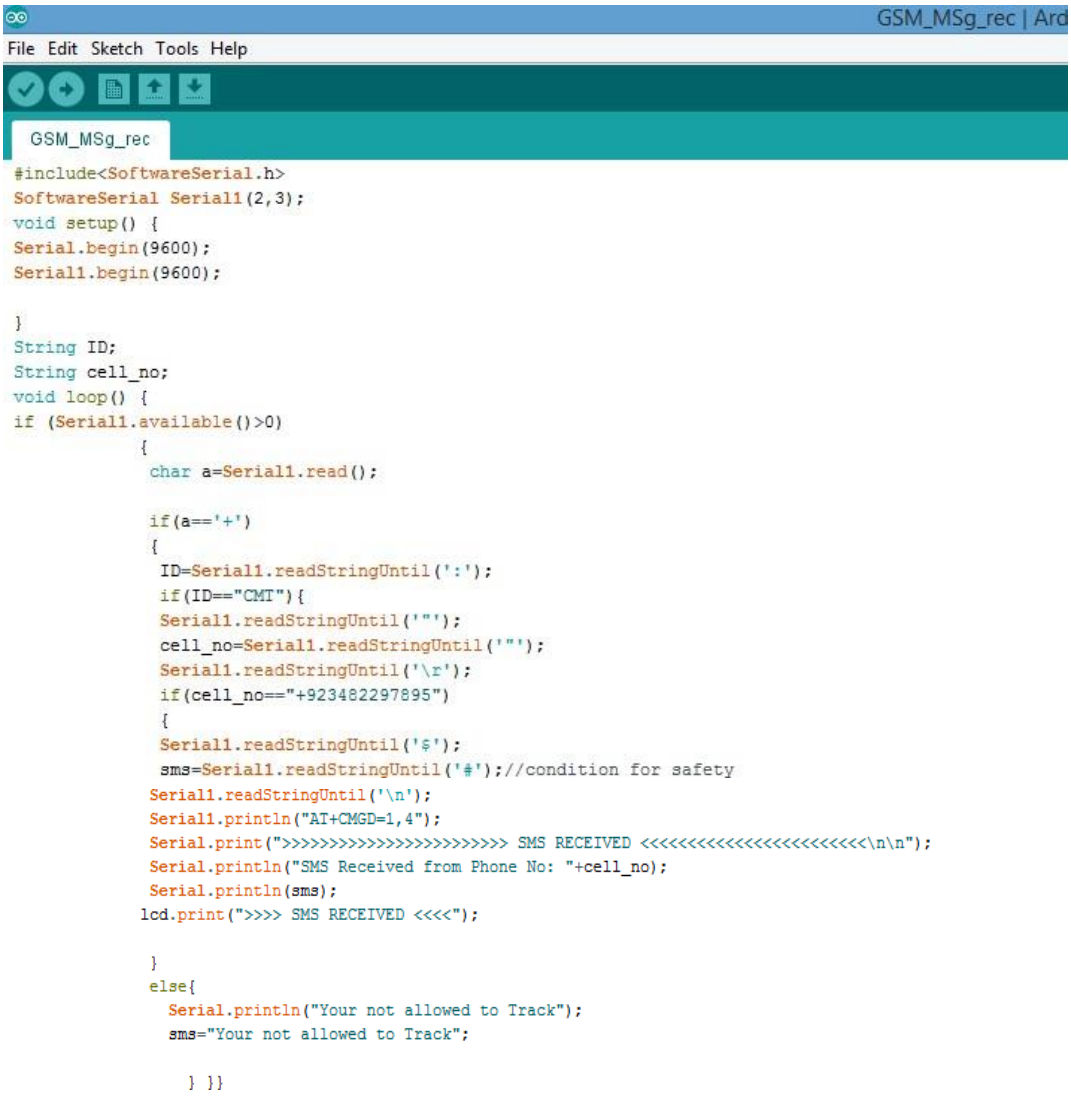



```
#include<SoftwareSerial.h>
SoftwareSerial Serial1(2,3);
void setup() {
Serial.begin(9600);
Serial1.begin(9600);

}
String sms;
int i=0;
String num[50]={"","+923482297895","+923442825783","+923352428093","+923410259114"};
void loop(){
while(i<=4)
              {
                for(i=0;i<5;i++)
                {
              Serial1.println("AT+CMGS=\""+num[i]+"\"\r");
              delay(2000);
              //Serial.println("AT+CMGS=\""+num[i]+"\"\r");
              Serial1.println(mesg);//the content of the message
              delay(200);
              Serial1.println((char)26);//the stopping character
              delay(3000);
              Serial1.println("AT+CMGD=1,4");
              lcd.clear();
              lcd.print("STATUS SENT TO "+num[i]);
```

```
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Message sent....");
Serial.println("Message sent....");
Serial.println("Sent msg to "+num[i]);
delay(3000);
lcd.clear();
}}

    } }}
```

(b) Receiving:

The coding we made for receiving the message through GSM is given below:




```
#include<SoftwareSerial.h>
SoftwareSerial Serial1(2,3);
void setup() {
Serial.begin(9600);
Serial1.begin(9600);

}
String ID;
String cell_no;
void loop() {
if (Serial1.available()>0)
            {
             char a=Serial1.read();

             if(a=='+')
             {
              ID=Serial1.readStringUntil(':');
              if(ID=="CMT"){
              Serial1.readStringUntil('"');
              cell_no=Serial1.readStringUntil('"');
              Serial1.readStringUntil('\r');
              if(cell_no=="+923482297895")
              {
              Serial1.readStringUntil('$');
              sms=Serial1.readStringUntil('#');//condition for safety
             Serial1.readStringUntil('\n');
             Serial1.println("AT+CMGD=1,4");
             Serial.print(">>>>>>>>>>>>>>>>>>>>>>>> SMS RECEIVED <<<<<<<<<<<<<<<<<<<<<<<<\n\n");
             Serial.println("SMS Received from Phone No: "+cell_no);
             Serial.println(sms);
            lcd.print(">>>> SMS RECEIVED <<<<");

             }
             else{
               Serial.println("Your not allowed to Track");
               sms="Your not allowed to Track";

                 } }}
```

4.2.4. Accelerometer:

In the system, we use accelerometer to check the tilt position of our automobile (car). For this purpose, the coding is formatted as:

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(2,3,4,5,6,7);
const int Xpin=A2;
const int Ypin=A1;
const int Zpin=A0;
int e,f,g,s;
String a,sms;
void setup() {
  Serial.begin(9600);
}

void loop() {
  //analogReference(EXTERNAL);

e=analogRead(Xpin)-435;
  Serial.print(e);
  Serial.print("\t");
f=analogRead(Ypin)-435;
Serial.print(f);
  Serial.print("\t");
g=analogRead(Zpin)-1023;
  Serial.print(g);
  Serial.print("\t");
```

```
Serial.print("\t");
Serial.print("\n");
delay(2000);
if (e<5 && f<5 && g<5)
{
  s=0;
}
if(e>5 || f>5 || g>5){
  delay(10);
  if( s=0)
  {
//   digitalWrite(Buzzer_pin,HIGH);

  a="CURRENT LOCATION\nLATITUDE:24.61718\nLONGITUDE:67.89933\n";//FOR TESTING
            //a="lat:24.61718,lon:67.89933";
           // GPS();
            Serial.println(a);
//            Send_sms(a);
          Serial.println ("SEND SMS");
          lcd.clear();
          lcd.setCursor(0,0);
          lcd.print("SMS SEND");
          lcd.clear();
```

```
            lcd.clear();
            lcd.setCursor(0,0);
            lcd.print("SMS SEND");
            lcd.clear();

//            digitalWrite(Buzzer_pin,LOW);
s=1;
}
```

4.2.5 Vibration Sensor:

We used two sensors in our system, one is accelerometer and other is vibration sensor. The vibration sensor is used to detect the ambient vibration strength.

The programming for vibration sensor is given as:

```
#include<LiquidCrystal.h>
#include <TinyGPS.h>
#include<SoftwareSerial.h>
#define Relay 13
#define vib_pin 10
#define button A4
#define Buzzer_pin A3
//SoftwareSerial Serial1(11,12);//when we made RX-TX-GSM
SoftwareSerial Serial1(11,12);//when we made RX-TX-GPS
LiquidCrystal lcd (2,3,4,5,6,7);//VDD-power,VSS-VEE-RW-GROUND
TinyGPS gps;
unsigned long chars;
unsigned short sentences, failed_checksum;
char new1[15];
char new2[15];
String a;
float lati,lon;
void setup()
{
pinMode(vib_pin,INPUT);
pinMode(button,INPUT);
pinMode(Buzzer_pin,OUTPUT);
Serial.begin(9600);
```

```
void vibration()
{

long b=pulseIn (vib_pin,HIGH);
  //Serial.println (b);
  delay(10);
  if (b > 10000) {

    x = 1;
    c=millis();
  digitalWrite(Buzzer_pin,HIGH);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Confirmation delay");
  lcd.setCursor(0,1);
  lcd.print("Press Button...");
  lcd.clear();
    }
  if(x==1){

    d=millis();
    t=d-c;
    s=digitalRead(button);



 if(s>0 && t<10000){
   digitalWrite(Buzzer_pin,LOW);
   lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("False Alarm");
   lcd.setCursor(0,1);
   lcd.print("Acknowledged");
   //lcd.clear();*/
   //Serial.println("False Alarm");
   x=0;
   }
 if(t>=10000){

   x=0;
   digitalWrite(Buzzer_pin,LOW);
         //GPS();
        Send_sms(a);
        //Serial.println("No Alarm");
        //Serial.println ("SEND SMS");
        lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("SMS SEND");
        lcd.clear();
```

4.2.6 Buzzer:

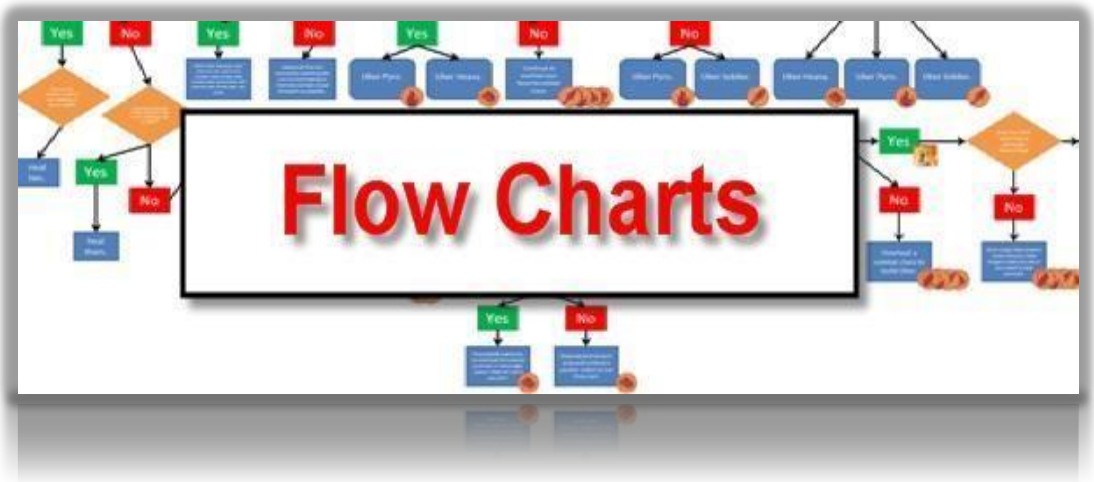
The purpose of our project is to track the location, to detect the accident, and to save our automobile. When any shock is detected by the car, the buzzer will automatically starts to work, that it generates a beep sound.

4.2.7 Button:

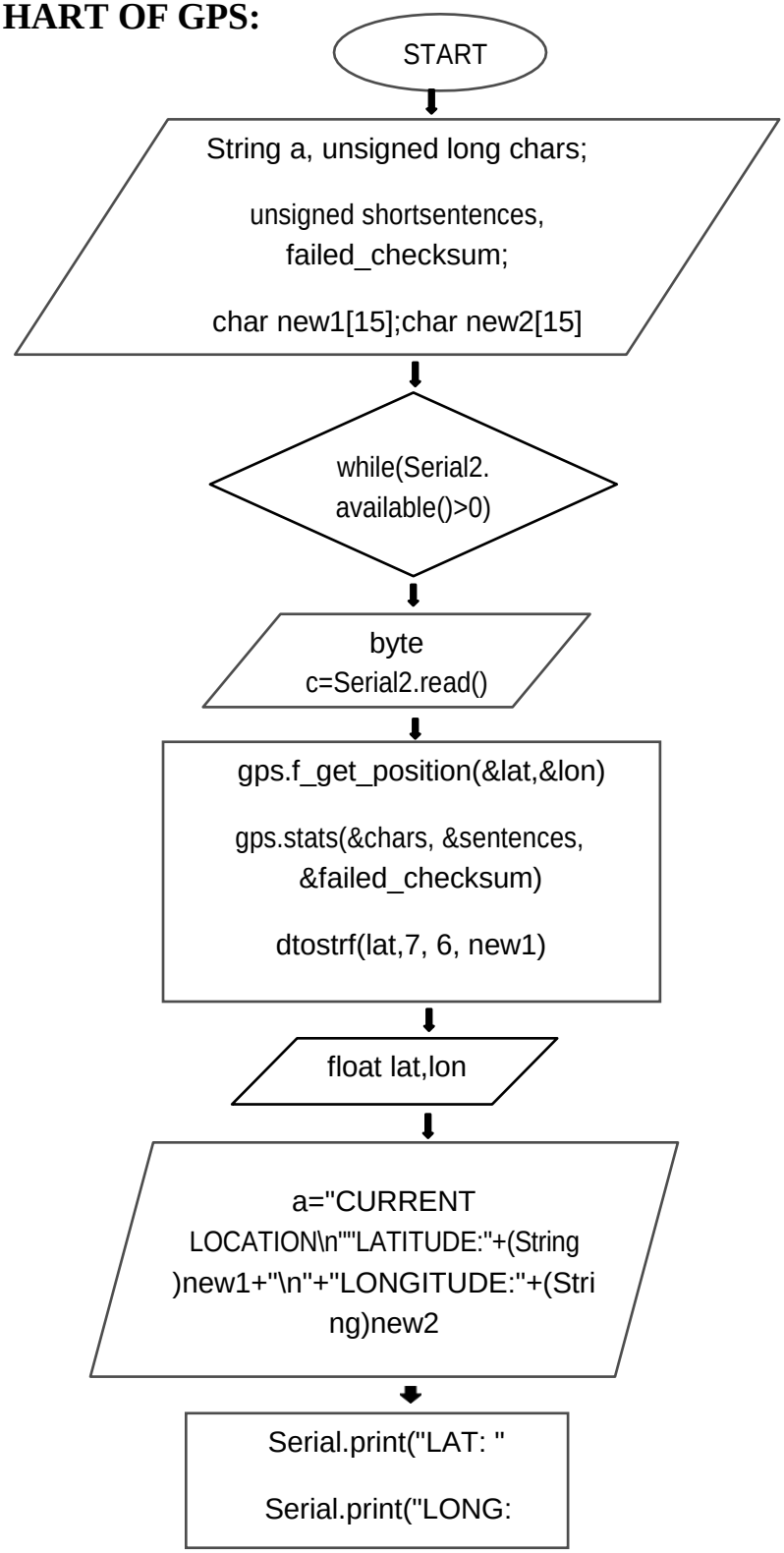
The purpose of button is to switch on or off. When the shock is generated by the car, the buzzer will start work and after 10 seconds of the sound the message will deliver (to nearest hospitals, police station, and others to provide first aid). But if the button is pressed before 10 seconds by the person, the system will not deliver the message.

CHAPTER # 05

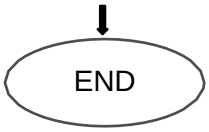
FLOWCHART



5.1. FLOWCHART OF GPS:



``



5.1.1. ALOGRITHM FOR GPS:

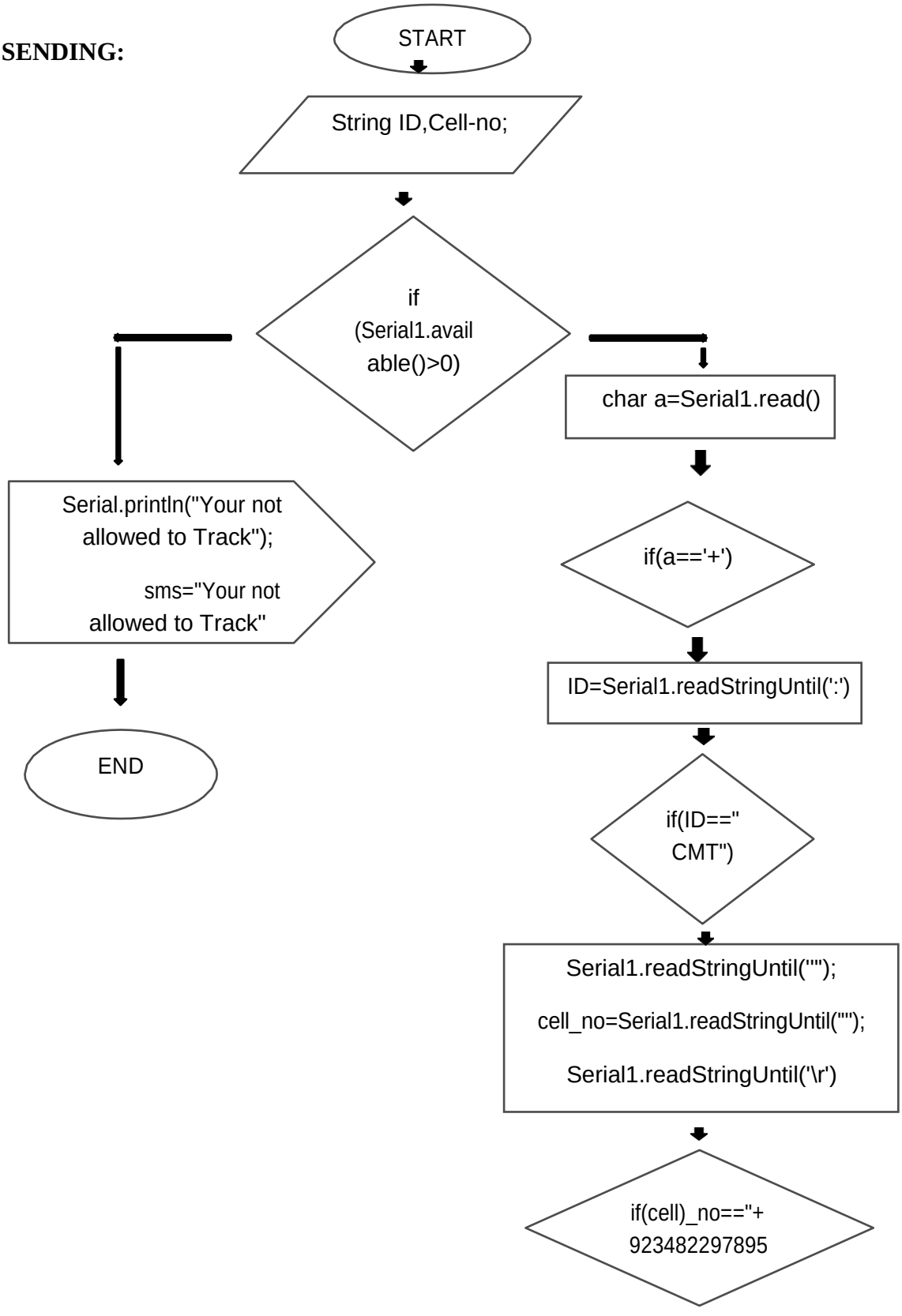
1. Start.
2. Input
   String a, unsigned long chars;
   Unsigned shortsentences
   failed_checksum;
   Char new1 [15]
   Char new2 [15]

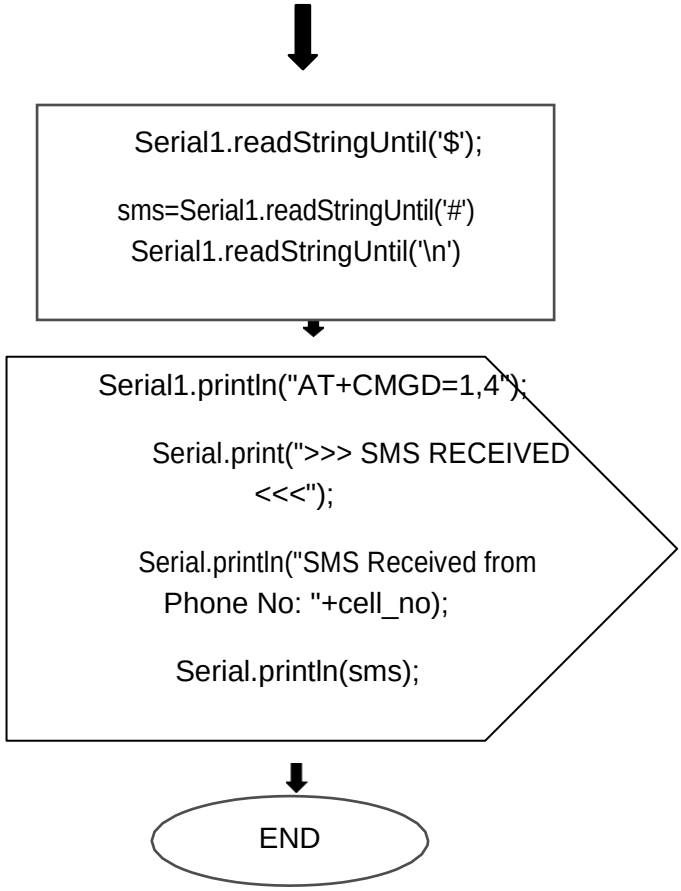
3. Condition
   While (Serial2.available()>0)
4. Input
   Byte c=Serial2.read()
5. Function
   gps.f_get_position (&lat,&lon)
   gps.stats(&chars, &sentences, &failed_checksum)
   dtostrf (lat,7, 6, new1)
   Float latitude and longitude
   a="CURRENTLOCATION\n""LATITUDE
   :"+(String)new1+"\n"+"LONGITUDE:"+(String)new2

6. Print.
7. Serial.print("LAT: ")
8. Serial.print("LONG:")
9. END

5.2. FLOWCHART OF GSM:

I. SENDING:





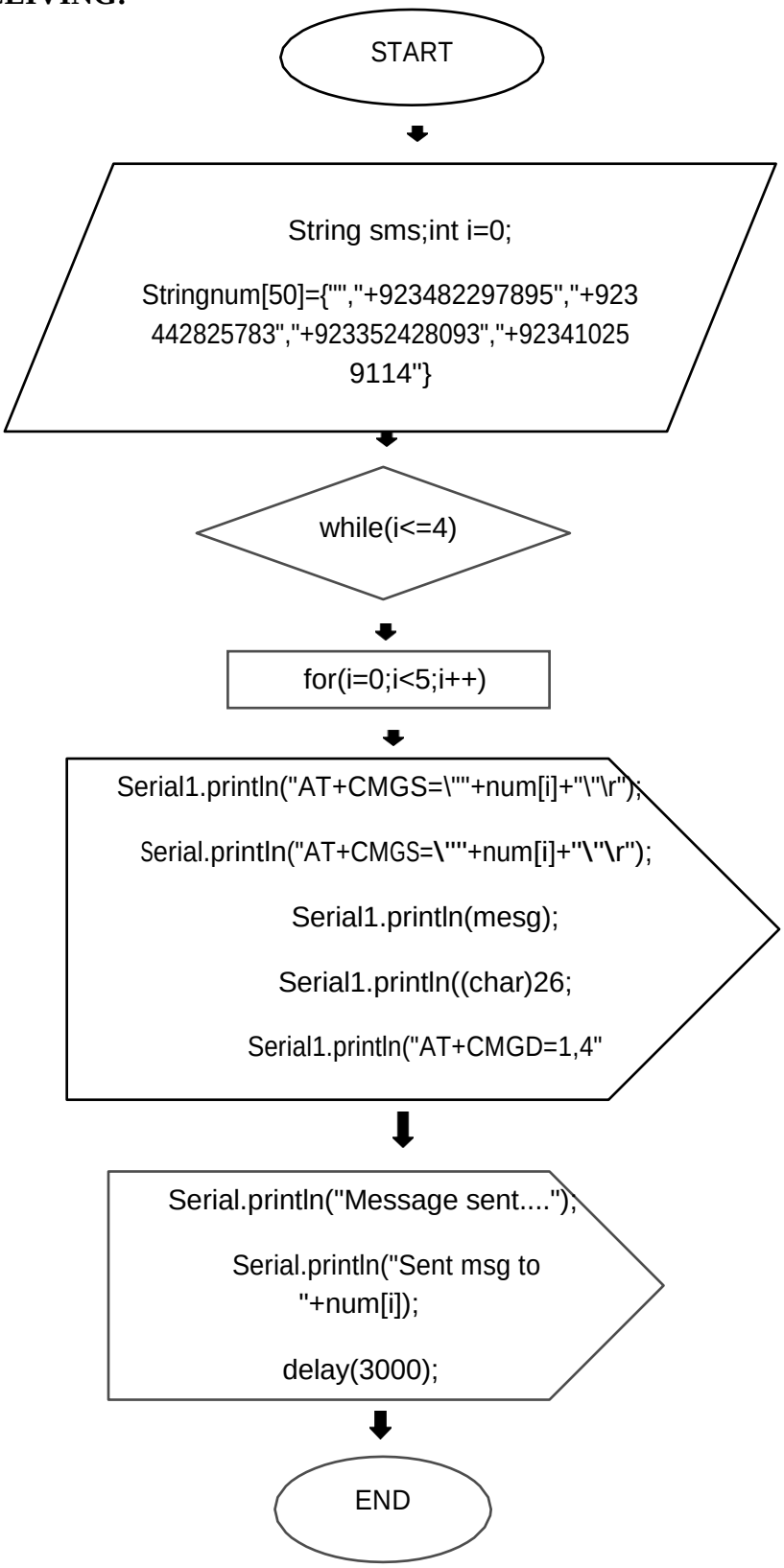
5.2.1. ALOGRITHIM FOR GSM SENDING MESSAGE:

1. Start.
2. Put Input.
   String ID, Cell-no.
3. Condition.
   if (Serial1.available()>0)
4. char a=Serial1.read()
5. if(a=='+')
6. Serial1.readStringUntil("")
   cell_no=Serial1.readStringUntil("")
   Serial1.readStringUntil('\r')
7. if(ID=="CMT") if(cell)_no=="+923482297895, Serial1.readStringUntil('$'),
   sms=Serial1.readStringUntil('#') Serial1.readStringUntil('\n')
   Serial1.println("AT+CMGD=1,4")
   Serial.print(">>> SMS RECEIVED <<<")

Serial.println("SMS Received from Phone No: "+cell_no); Serial.println(sms)

8. End.

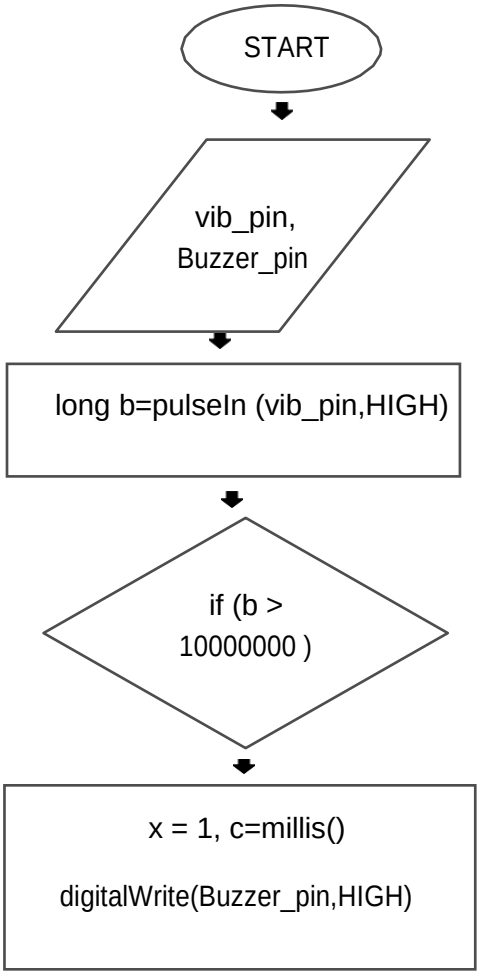
II. RECEIVING:

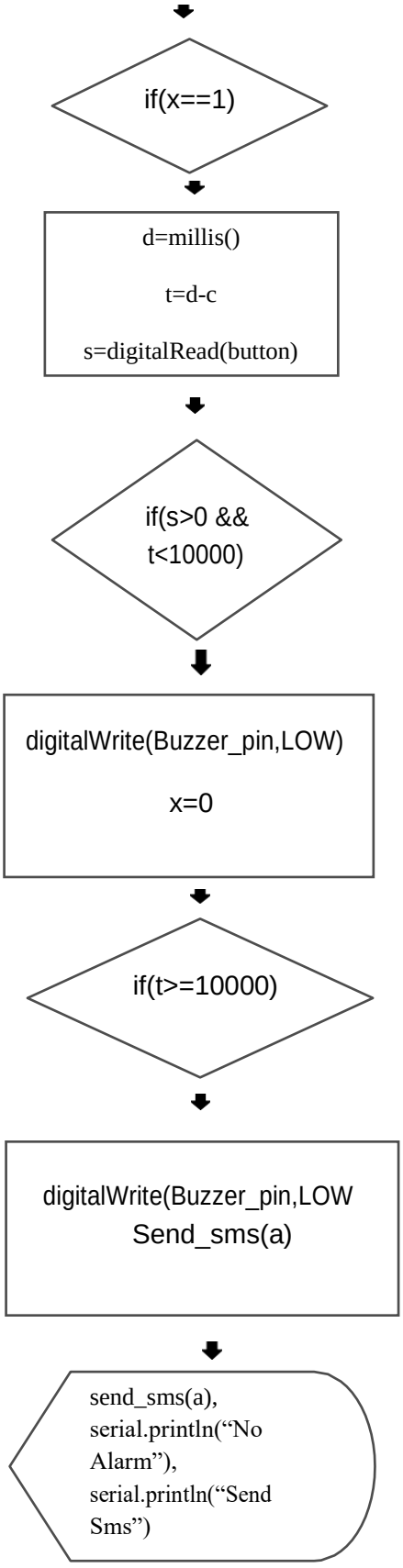


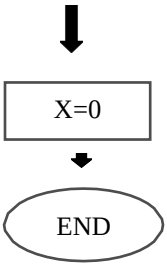
5.2.3. ALGORITHM FOR GSM RECEIVING MESSAGE:

1. START
2. while(i<=4)
3. String sms;int i=0
4. Stringnum[50]={"","+923482297895","+923442825783","+923352428093","+923410259114
5. Serial.println("Message sent....")
6. Serial.println("Sent msg to "+num[i])
7. delay(3000)
8. Serial1.println("AT+CMGS=\""+num[i]+"\"\r")
9. Serial.println("AT+CMGS=\""+num[i]+"\"\r")
10. Serial1.println(mesg)
11. Serial1.println((char)26
12. Serial1.println("AT+CMGD=1,4"
13. End.

5.3. VIBRATION SENSOR:




if(x==1)
d=millis()
t=d-c
s=digitalRead(button)
if(s>0 &&
t<10000)
digitalWrite(Buzzer_pin,LOW)
x=0
if(t>=10000)
digitalWrite(Buzzer_pin,LOW
Send_sms(a)
send_sms(a),
serial.println("No
Alarm"),
serial.println("Send
Sms")



5.3.1. ALOGORITHIM FOR VIBRATION SENSOR:

1. Start
2. Input vibratory pin 10 and buzzer pin A3
3. Longb=pulseIn(vib_pin,high)
4. If (b>10000)then,

   X=1

   C=millis()

   digitalWrite(Buzzer_pin,high)

5. If (x==1)then,

   d=millis()

   t=d-c

   s=digitalRead(Button)

6. If(s>0 && t>10000)then,

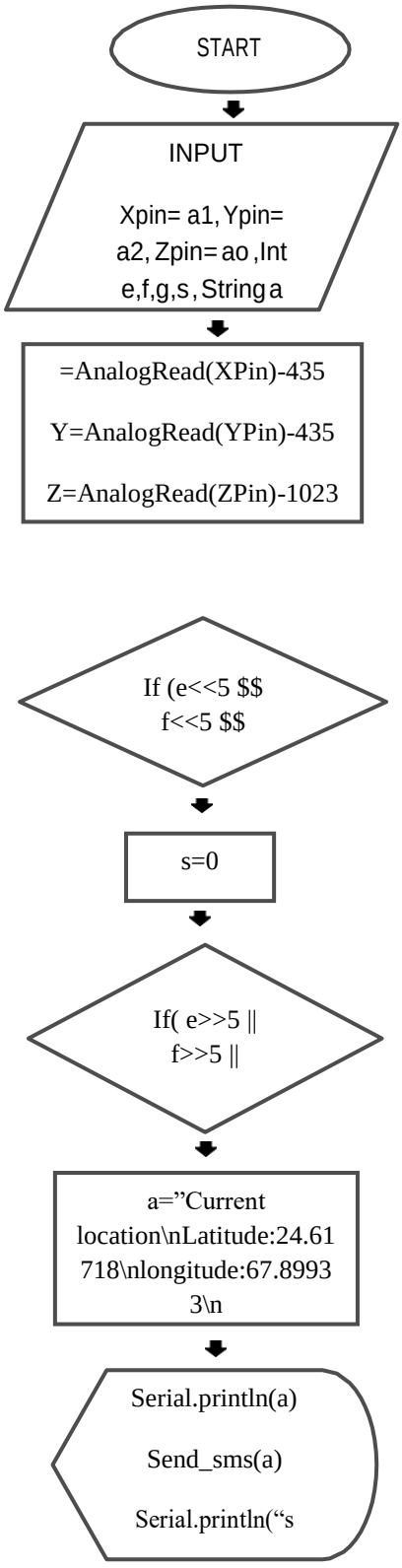
   digitalWrite(buzzer_pin,low)

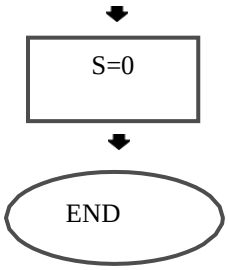
   x=0

7. If (t>10000)then,
   digitalWrite(buzzer_pin,low)
8. Print a (a=”Current location\nLatitude:24.61718\nlongitude:67.89933\n;)

9. End

5.4. ACCLEROMETER:





5.4.1. ALGORITHM OF ACCELEROMETER:

1. Start
2. XPIN=a1, YPIN=a2, ZPIN=a0, int e,f,g,s, String a sms
3. X=AnalogRead(XPin)-435, Y=AnalogRead(YPin)-435, Z=AnalogRead(ZPin)
4. If (e<<5 $$ f<<5 $$ g<<5) then,

S=0

5. If(e>>5 || f>>5 || g>>5) then,
   a=”Current location\nLatitude:24.61718\nlongitude:67.89933\n;
6. Print or display a.
7. S=0.
8. Stop.

CHAPTER # 06

PROBLEM EVALUTION

6.1. PROBLEMS OCCURING DURING PROJECT:

- When we use two virtual serial communications so they did not work simultaneously. To prevent it, we used built-in and a virtual serial communication.
- Timing issues of accepting message and getting latitude and longitude.
- We should use vibration sensor very carefully because it is more sensitive.
- We change three vibration sensors due to spring breakage.
- When we used Nano ATMEGA168, it causes storage problem to upload entire code. This problem is resolved by using ATMEGA328, having large storage.

6.2.RESTRICTIONS:

- For the working of GPS, GPS should not be indoor it must be outdoor. If the GPS is placed at the indoor side satellite problems may occur.
- All time message packages should be available on SMS to send messages.
- Signal tower should be available at the nearby place to deliver and generate the signals.
- Battery should be charged all the time.
- For the working of accelerometer, the device should be stable in the car.

6.3. MODIFICATION:

- In this setup, we used GPS and GSM separately. But it can be used as a combine device so that there will be less chances of problems and we also do not need any kind of difficult coding for this purpose.
- What if the thief removed device from the car? We can use piezo electric device for this purpose by which we can generate the voltage. Piezo electric device generate the voltage without the need of any battery.
- We can also modify the setup by using the motion sensor, we use such coding that when the device is getting removed from the car, this motion sensor sense that the device is removing from the car. And for the time when the device is removing from the car, in few of seconds the motion sensor complete its work and deliver the address or location via message. Because the piezo electric device generates the voltages, so with the help of GSM and GPS the location sent through the message.
- We can also design our setup on PCB which is more accurate and fixed coding.

- For more accuracy, we can also use MEGA Arduino
- We can also use ULTRASONIC SENDER to measure the distance between our car and the front car to, make the limitation for the distance of both cars. If the limitation is crossed, an automatic break will pressed from the car. This is also applicable for further modifications.