Vehicle Crash Detection System for Two Wheeler

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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ABSTRACT

The Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. Our project will provide an optimum solution to this draw back. An accelerometer can be used in a car alarm application so that dangerous driving can be detected. It can be used as a crash or rollover detector of the vehicle during and after a crash. With signals from an accelerometer, a severe accident can be recognized. According to this project when a vehicle meets with an accident immediately Vibration sensor will detect the signal or if a car rolls over, and Micro electro mechanical system (MEMS) sensor will detects the signal and sends it to ARM controller. Microcontroller sends the alert message through the GSM MODEM including the location to police control room or a rescue team. So the police can immediately trace the location through the GPS MODEM, after receiving the information. Then after conforming the location necessary action will be taken. If the person meets with a small accident or if there is no serious threat to anyone`s life, then the alert message can be terminated by the driver by a switch provided in order to avoid wasting the valuable time of the medical rescue team. This paper is useful in detecting the accident precisely by means of both vibration sensor and Micro electro Mechanical system (MEMS) or accelerometer. As there is a scope for improvement and as a future implementation we can add a wireless webcam for capturing the images which will help in providing driver`s assistance.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Introduction

India has a high population density in the world, as the population grows the demand for vehicles increases significantly, and situations that require concern are road accidents and the number of deaths from accidents. According to the 2019 Traffic Accident Report, a total of 449,002 accidents occurred.

Over a period of 2019, the country was linked to 151,113 deaths and 451,361 injuries. However, the main cause of the increase in mortality is due to delays in emergency services. Automotive is interested in IoT applications to provide advanced products that increase vehicle safety and ultimately maximize profits in response to customer needs. The healthcare industry is concerned about how IoT can improve the speed and accuracy of communications so as both industries required the need for IoT to improve the efficiency of their work this technology is the best solution for that. Other researchers have proposed different technologies at each stage, and each strategy has its strengths and weaknesses.

The process of this system comprises three main steps. These are the hardware devices that detect crashes, the GPS for the location, and the server to establish communication. Intelligent IoT sensors form a vast network for communication capture minute details of their surroundings and pass this important information. The basic idea of the real-time position of the vehicle through GPS is to focus on the vehicle system and to send information through the SMS module through the GSM module through the Internet. This method only recognizes when an object hits the vehicle. The alarm will be generated very instantly once the risk is identified and the location can be identified easily.

1.2 Overview

In urban areas accidents are most common phenomena where many of such accidents can be taken care easily but some accidents occur during night time when the visibility is quite low, during such cases it will be difficult for an ambulance driver to identify the accident spot with the help of phone calls made by the citizens. If the driving force knows the precise spot of the accident the time period between the spot and the hospital is going to be significantly reduced. The main objective of this paper is to help reduce the time factor in case of accidents. There are many cases where an accident occurs during the night and the person met with the accident is unconscious then it would take hours for someone to find out and inform the authorities about it. So, saving such precious time will indeed save lives. In connection with this concept, an experimental setup is constructed that can detect accidents automatically without any human help. After the accident detection, the same setup will send accident coordinates to the ambulance to help to find the location easily. Once the victim is transferred into the ambulance a second setup is connected to the patient which will continuously monitor the vital information of the patient to keep him stable.

Nowadays the cause of death increasing more by accident. If an accident met in a national highway roads no one there to rescue the person to met with an accident this is due to lack of emergency facilities and rescue team to overcome these drawback our paper proposed this method can automatic indicating device for vehicle accident is used in this paper it is used protect the people from the risk as soon as possible after occurrence the accident wasting a time may leads to death. So this system will detect the accident within the less time and convey the information to the police station and to rescue system after a few seconds.

CHAPTER 2
LITERATURE SURVEY

Chunxiao Liao, et. Al [1] proposed a "Shrewd Traffic Accident Detection System Based on Mobile Edge Computing" in the year 2017. This paper proposes a savvy car crash location framework dependent on Mobile Edge Computing with vicinity, low idleness and processing, and vehicle recognizable proof. Our framework uses basic cell phones to get increasing speed and distinguishes pictures indicating mishap scenes primarily at servers if there should arise an occurrence of bogus positives, acknowledging computerization of mishap identification and advising environmental factors and divisions like clinics and branches of transportation progressively.

Sanjana. K.R, et. al [2] proposed "An Approach on Automated Rescue System with Intelligent Traffic Lights for Emergency Service" in the year 2015. They proposed a framework which will naturally identify street mishaps utilizing sensors, advise them to close by crisis administrations and family members through GSM. It is completely computerized, finds the mishap spot utilizing Google guide, and controls the traffic lights, assisting with arriving at the emergency clinic in time. This framework can be viably executed in high populated nations like India.

Bankar Sanket Anil, Kale Aniket Vilas, Prof. S. R. Jagtap [3] proposed an" Intelligent System for Vehicular Accident Detection and Notification" in the year 2014. This paper presents a system which gives an idea about what can be done to provide medical help and other facilities after the accident as soon as possible. A flex sensor and accelerometer can be used to detect an accident, while the

location of the accident will be told to desired persons, such as the nearest hospital, police, and owner of the vehicle through SMS sent using GSM modem containing coordinates obtained from GPS along with the time of the accident and vehicle number. The camera located inside the vehicle will transmit real-time video to see the current situation of passengers inside the vehicle. Thus this paper emphasizes the post-accident system for detecting and informing about it. Simulation result on the hyper terminal is also presented in this paper.

NajiTaaib Said Al Wadhahi, et. Al [4] proposed "Mishaps Detection and Prevention System to decrease Traffic Hazards utilizing IR Sensors" in the year 2018. This paper is utilizing IR sensors and Arduino Uno innovation. The framework has two stages Accident Detection and Accident Prevention. The recognition eliminate is conveyed utilizing IR sensors that could recognize and alarm the individuals by sending SMS utilizing GSM module that contains predefined numbers and mishap area utilizing GPS module. Second Phase, Accident counteraction is done utilizing IR sensors by notice the driver about the neighboring vehicles when the separation between them is past the edge esteem. Reenactment results and Prototype is introduced in this paper.

Nicky Kattukkaran et. Al [5] proposed an “Intelligent Accident Detection and Alert System for Emergency Medical Assistance” in the year 2017. This system aims to alert the nearby centre about the accident to supply immediate medical care. The attached accelerometer within the vehicle senses the lean of the vehicle and therefore the heartbeat sensor on the user’s body senses the abnormality of the heartbeat to know the seriousness of the accident. Thus the systems will make the choice and send the knowledge to the smartphone, connected to the accelerometer and heartbeat sensor, through Bluetooth. The

Android application on the mobile phone will be sent a text message to the nearest medical center and friends. The application also shares the exact location of the accident that can save time.

Arif Shaik et. al [6] proposed "Keen Car: An IoT Based Accident Detection System" in the year 2018. This paper portrays the plausibility of furnishing a vehicle with innovation which will recognize a mishap and promptly ready crisis staff. When there is an auto collision somebody needs to effectively look for help, for example, calling 911 for crisis administrations. There is no programmed warning to the police, emergency vehicle, companions, or family. The Internet of Things (IoT) are frequently wont to deliver a programmed notice and reaction to the scene. A sign from an accelerometer and a GPS sensor is consequently sent to the cloud and from that point, an alarm message will be gotten by whoever is bought in to that vehicle. The sign will show the seriousness of the mishap and the GPS area. The rescue vehicle will utilize the GPS directions to get to the scene rapidly.

CHAPTER 3
THEORY & METHODOLOGY

3.1 Basic Theory and Operation

In urban areas accidents are most common phenomena where many of such accidents can be taken care easily but some accidents occur during night time when the visibility is quite low, during such cases it will be difficult for an ambulance driver to identify the accident spot with the help of phone calls made by the citizens. If the driving force knows the precise spot of the accident the time period between the spot and the hospital is going to be significantly reduced. The main objective of this paper is to help reduce the time factor in case of accidents. There are many cases where an accident occurs during the night and the person met with the accident is unconscious then it would take hours for someone to find out and inform the authorities about it.

So, saving such precious time will indeed save lives. In connection with this concept, an experimental setup is constructed that can detect accidents automatically without any human help. After the accident detection, the same setup will send accident coordinates to the ambulance to help to find the location easily. Once the victim is transferred into the ambulance a second setup is connected to the patient which will continuously monitor the vital information of the patient to keep him stable.

3.2 Methodology

We have divided our whole project work with seven phases of our project. Using the Waterfall model, we have completed our project very readily. The waterfall model is a sequential process to solve any problem to develop any system it should arrange the whole work in the segment so that accuracy can be provided. We used the waterfall model in our system because it is seven stage attributes and feedback opportunity system the characteristics of our workflow is it can return to previous steps. If we want to modify our system at any point according to equipment so we will do it depends on our requirement. In this workflow, each phase must be completed completely before the next steps may begin.

3.3Waterfall Model of Methodology

This project has been completed by following strategy, which is given below:

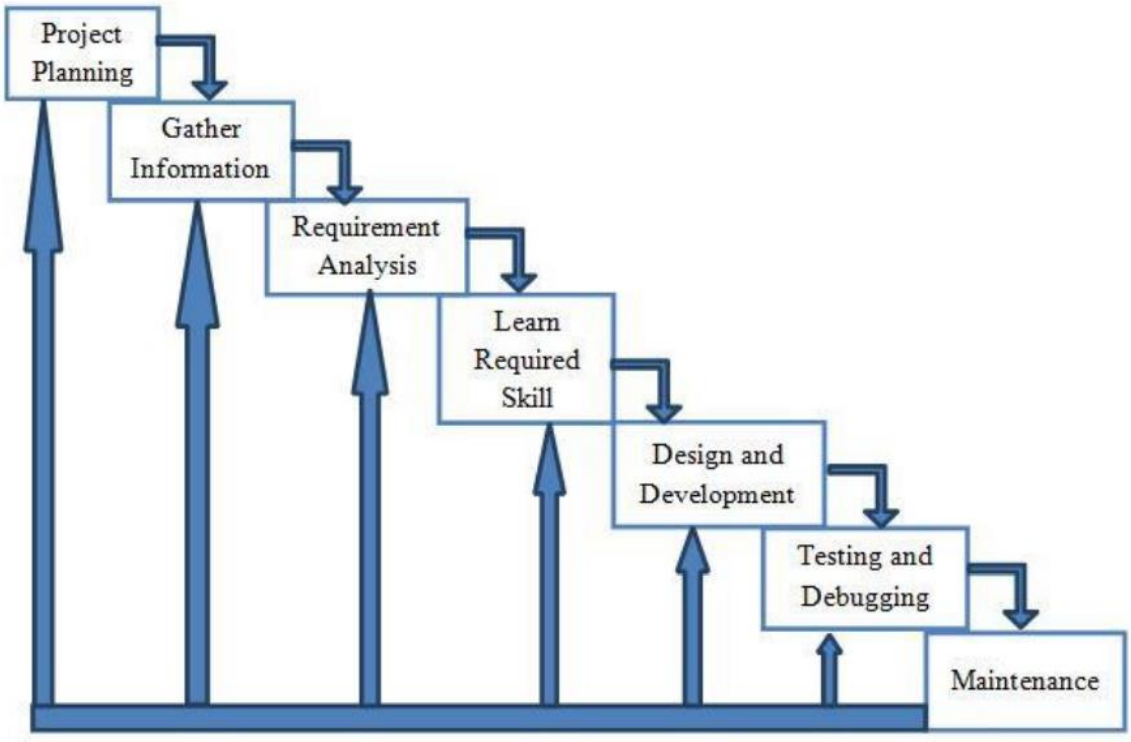

Figure 3.1: Waterfall model of the project

3.4 Description of Methodology

Full work has been divided into seven parts. The work is done part by part.

• **Project Planning:** We seek for some problems in our real life. Then we found this problem and planned to solve the problem.

• **Gather Information:** We read some research papers related to accident detection problem. We search on the internet to find solutions.

• **Requirement Analysis:** We use Arduino Uno, GPS, GSM, Accelerometer, Vibration sensor, Breadboard, Jumper wires Etc.,

• **Learn Required Skill:** To complete the project, we learned C++ language, Arduino Uno language, hardware connection.

• **Design and Development:** We developed a device which the system communicates with the web server through GPS communication via a GSM. It will send the vehicle location's latitude and longitude data to the web server upon user request or after detection of the accident.

• **Testing and Debugging:** Final module testing aims to demonstrate correctness, whereas testing during debugging is primarily aimed at locating errors.

• **Maintenance:** Hardware project maintenance presents the full scope and understanding how to function should operate and be managed in an implementation area. Actions necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life. It includes corrective maintenance and preventive maintenance.

CHAPTER 4
PROPOSED SYSTEM

4.1 Introduction to Vehicle Accident Detection System

The advent of technology has also increased the traffic hazards and the road accidents. Due to the lack of best emergency facilities available in our country the lives of the people are under high risk. An automatic alarm device for vehicles is introduced in this paper which sends the basic information to the medical rescue team within a few seconds of an accident. This device can detect accidents and sends an alert message to rescue teams in significantly less time which will help in saving the lives of the people. The alert message contains the geographical coordinates, time and angle in which the accident has occurred. In cases where there is no casualty the message can be terminated with the help of a switch in order to avoid wasting the valuable time of the rescue team.

4.2 Accident Prevention System

In this project work, we have studied and implemented a complete working model using a Microcontroller. The programming and interfacing of microcontroller has been mastered during the implementation. This work includes the study of GSM and GPS modems using sensors. The biggest advantage of using this project is, whenever the sensor is activated we will be getting the acknowledgement from GSM modem to our mobile numbers which are stored in EEPROM and GSM network operators have roaming facilities, and finding the location and sending information to user so that they can often continue to use their mobile phones when they travel to other countries etc.

4.3 Related Work

In the paper have developed vehicle accident detection and notification system that has combined smart phones with vehicles through the second generation of On - Board Unit (OBD-II) interface to achieve smart vehicle modelling. The authors have developed an Android application that sent SMS to a pre-specified format with relevant data if an accident has encountered and could make an emergency call automatically. The OBD-II standard is mandatory since 2001 in the U.S and there is also a European version of this standard. So, this solution is applicable to all vehicles in the U.S and European countries but not available in all vehicles in other countries. Besides, the maintenance or upgrading process of this system is an expensive operation.

In the E-call system has explored the possibility of implementing an automatic crash detection and notification service for portable devices Smartphone. This system has used the cellular network to communicate between the portable device and the Server Center. The main limitation of the system is the E-call system has used Smartphone built-in accelerometer sensor as a crash sensor and the E-call system subjects to high rates of false positives emerging while the user is outside the vehicle. Have developed a system which made use of the accelerometer, GPS and vibration to detect accidents. Upon detection of an accident sends an emergency notification to an SMS to the emergency contacts, emergency responders have to access to find out an accident. Their system made use of the same sensors and hardware that the algorithm presented in this research work except for a few features. There is no system for individual responder that responded to the emergency to track victim's location and also the system lacked the functionality to send emergency notification to the nearest emergency center in case there is more than one emergency center in the area. If an incident has occurred, the application contacts nearby emergency services and provides GPS-coordinates of the accident location.

GPS technology can achieve an extremely high degree of precision and it is widely applied to many military and civilian. It's developed Review of Automatic Speed Control of Vehicle using RFID Technology to reduce the rate of road accident they are propose a system which controls the speed of vehicle automatically in any critical zone, without major inconvenience to driver. Here, there is review a model based on RFID technology.

One RFID reader inside the vehicle reads the RFID tag placed either at speed limit signboard or at traffic light. A controlling module in the vehicle then takes the decision and control the speed accordingly. This paper proposes to detect an accident from the map matched position of a vehicle by utilizing the GPS speed data and map matching algorithm and send accident location to an Alert Service Center. The GPS provides speed and position in every 0.1 second. The position data will be used in the map matching algorithm to locate the vehicle on the road. The present speed will be compared with the previous speed in every 0.1 second through a Microcontroller Unit. Whenever the speed will be falling below the safe calculated threshold speed, the system will generate an accident situation. It will check the vehicle location from map matching module and generate an accident situation if the vehicle is found outside the road network. This will reduce the false accident detection drastically. The map matched accident location is then sent by utilizing the GSM network. The proposed system will save many accident victims with timely rescue.

CHAPTER 5

HARDWARE DETAILS

Requirement:

- Arduino UNO Board
- Accelerometer Module
- GSM Module (SIM 800L)
- GPS Module
- Vibration Sensor
- Breadboard
- Jumper Wires

5.1 Arduino UNO Board

Arduino is an opensource computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project

provides an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

5.1.1 Features of the Arduino UNO

- Microcontroller: ATmega328 Operating
- Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

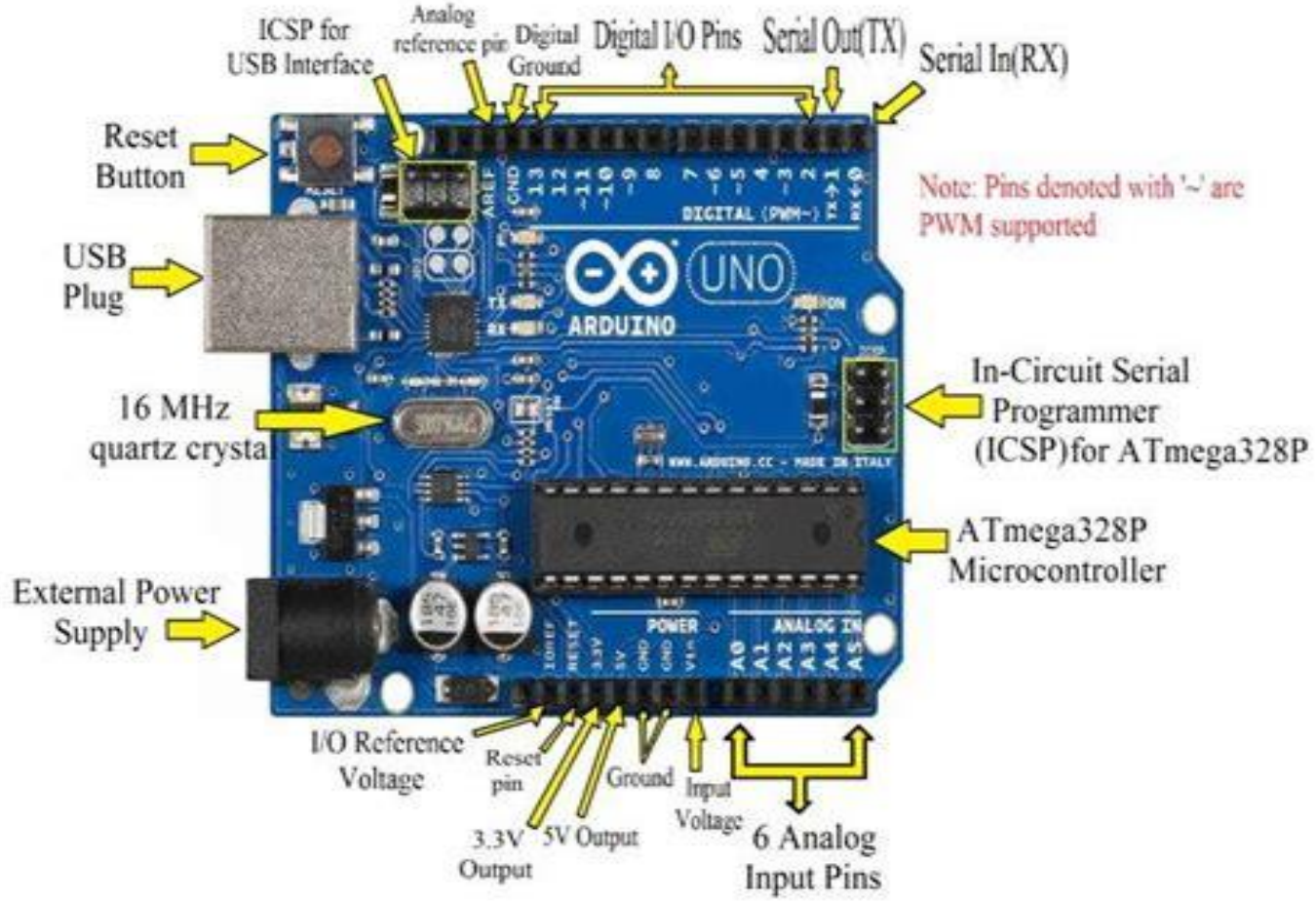

Figure 5.1: Arduino UNO

5.1.2 ARDUINO HARDWARE PART

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially

released have avoided the project name by using various names ending in -duino. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. Arduino microcontrollers are pre- programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS232 logic levels and transistor–transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to- serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

5.1.3 ARDUINO SOFTWARE PART

IDE The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

A program written with the Arduino IDE is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde.

A minimal Arduino C/C++ program consist of only two functions:

- setup (): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.
- loop(): After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

5.2 Accelerometer Module

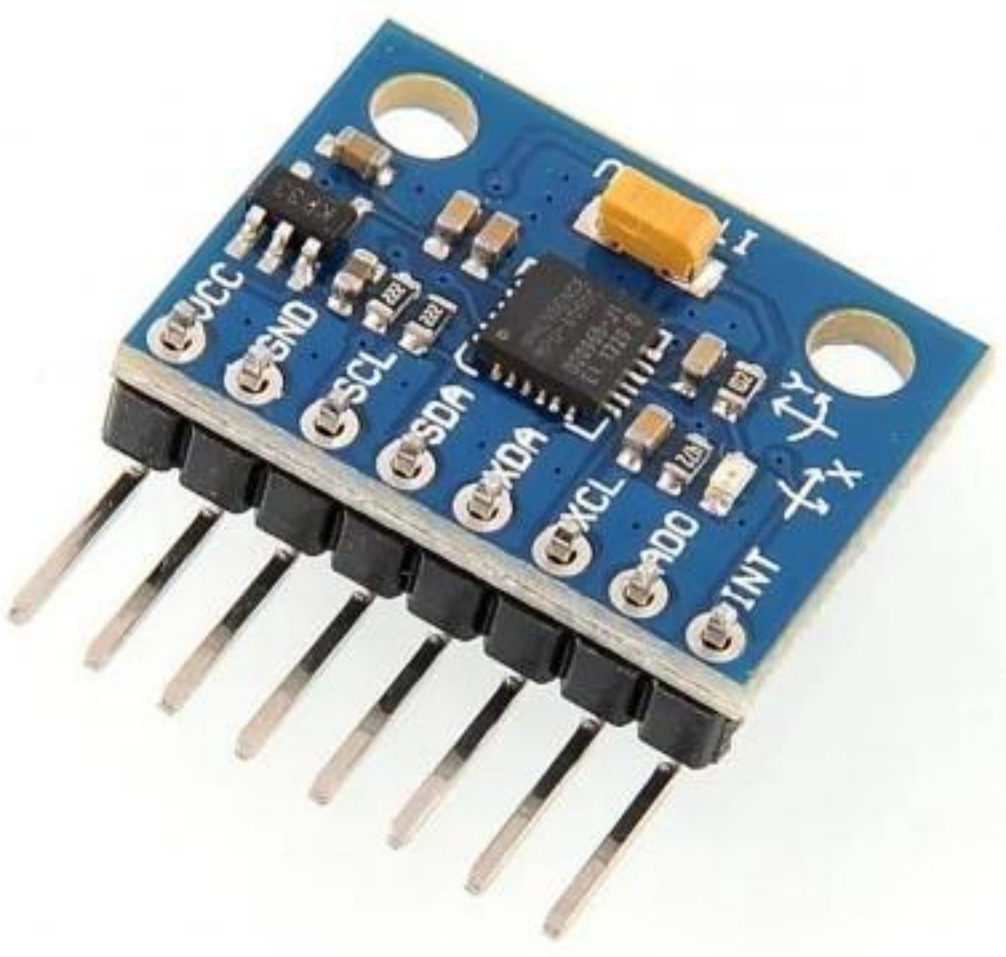

Figure 5.2: MPU6050 2-Axis Accelerometer Module

5.2.1 MPU 6050

MPU 6050 2-Axis Accelerometer is a sensor board based on MPU 6050 accelerometer integrated circuit. The MPU 6050 is a small, thin, ultralow power, 2-axis accelerometer with high resolution (13-bit) measurement at up to ±16 g. Digital output data is formatted as 16-bit twos complement and is accessible through either a SPI (3- or 4-wire) or I2C digital interface. The MPU 6050 is well suited for mobile device applications. It measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock. Its high resolution (3.9 mg/LSB) enables measurement of inclination changes less than 1.0°. Several special sensing functions are provided. Activity and inactivity sensing detect the presence or lack of motion by comparing the acceleration on any axis with user-set thresholds. Tap sensing detects single and double taps in any direction. Freefall sensing detects if the device is falling. These functions can be mapped individually to either of two interrupt output pins.

PIN	Descriptions
VCC	+3V to +5V
GND	Ground
SCL	Serial Clock
SDA	Serial Data
XDA	Auxiliary Serial Data
XCL	Auxiliary Serial Clock
ADO	I2C Address Select
INT	Interrupt

Table 5.1: MPU 6050 Pin Details

5.2.2 MPU 6050 2-Axis Accelerometer - General Specifications

- Single tap/double tap detection
- Free-fall detection
- SPI (3- and 4-wire) and I2C digital interfaces
- Activity/inactivity monitoring
- 10,000 g shock survival
- Flexible interrupt modes mappable to either interrupt pin
- Measurement ranges selectable via serial command
- Bandwidth selectable via serial command

5.2.3 MPU 6050 2-Axis Accelerometer - Technical Specifications

- Operating Voltage: 4V to 6V
- I/O Voltage Range: 1.7V to 3.6V
- Communication: SPI and I2C
- Operating Temperature: -40C to 85C
- Size: 3 mm × 5 mm × 1 mm

5.2.4 MPU 6050 2-Axis Accelerometer

The MPU 6050 is a 2-axis accelerometer with high resolution (13-bit) measurement at up to ±16 g. Digital output data is formatted as 16-bit twos complement and is accessible through either a SPI (3- or 4-wire) or I2C digital interface. The MPU 6050 is well suited for mobile device applications. It measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock. Its high resolution (3.9 mg/LSB) enables measurement of inclination changes less than 1.0°. Several special sensing functions are provided. Activity and inactivity sensing detect the

presence or lack of motion by comparing the acceleration on any axis with user-set thresholds. Tap sensing detects single and double taps in any direction. Freefall sensing detects if the device is falling, can be mapped individually to either of two interrupt output pins. An integrated, patent pending memory management system with a 32-level first in, first out (FIFO) buffer can be used to store data to minimize host processor activity and lower overall system power consumption. Low power modes enable intelligent motion-based power management with threshold sensing and active acceleration measurement at extremely low power dissipation.

5.2.5 Features

- Power consumption scales automatically with bandwidth.
- User-selectable resolution .
- Full resolution, where resolution increases with g range, up to 13-bit resolution at ±16 g (maintaining 4 mg/LSB scale factor in all g ranges).
- SPI (3- and 4-wire) and I2C digital interfaces.
- Flexible interrupt modes mappable to either interrupt pin.

5.2.6 Specifications

- Current: Ultralow as low as 23 μA in measurement mode and 0.1 μA in standby mode at VS = 2.5 V (typical).
- Patent pending, embedded memory management system with FIFO technology minimizes host processor load.

5.3 GSM Module (SIM 800L)

Figure 5.3: GSM sim800l

5.3.1 GSM

The use of GSM technology in monitoring and controlling transformer load is a highly efficient and cost-effective means of communication. With its deterministic character, GSM enables the remote control of DC motors, stepper motors, temperature sensors, and solid-state relays through a simple message sent via a GSM modem. This eliminates the need for manual operation and transportation, making it an ideal solution for industrial controls, automobiles, and appliances. The SIM900A modem, equipped with a SIM800L GSM chip and RS232 interface, allows for easy connection to a computer or microcontroller using USB to Serial or RS232 to TTL converters. By opening a serial connection and sending AT commands, the modem can be easily configured to perform various functions. With its reliability and ease of use, GSM technology is the preferred choice for remote control and monitoring applications.

Pin Name	Pin No.	Description
VCC	1	Module Supply Power Pin(5V)
GND	2	Ground Pin
5V TXD	3	Transmit Data Pin 5V
5V RXD	4	Receive Data 5V
3.3V TXD	5	Transmit Data Pin 3.3V
3.3V RXD	6	Receive Data 3.3V

Table 5.2: GSM Module Pin Details

5.3.2 Specifications

- Single supply voltage: 3.4V – 4.5V.
- Power saving mode: Typical power consumption in SLEEP mode is 1.5mA
- Frequency bands: SIM900A Dual-band: EGSM900, DCS1800. The SIM900A can search the two frequency bands automatically. The frequency bands also can be set by AT command.
- Transmitting power: Class 4 (2W) at EGSM 900, Class 1 (1W) at DCS 1800.
- Operating Temperature: -30ºC to +80ºC.
- DATA GPRS: download transfer max is 85.6KBps, Upload transfer max 42.8KBps.
- Supports CSD, USSD, SMS, FAX, MIC and Audio.
- Communication by using AT commands.
- Firmware upgrade by debug port.

5.3.3 Features

- Typical power consumption in SLEEP mode is 1.5mA (BS-PA-MFRMS=5).
- SIM900A Dual-band: EGSM900, DCS1800. The SIM900A can search the 2 frequency bands automatically. The frequency bands also can be set by AT command.
- Class 4 (2W) at EGSM 900, Class 1 (1W) at DCS 1800.
- GPRS multi-slot class 10 (default).
- GPRS multi-slot class 8 (option).
- GPRS mobile station class B.

5.4 GPS Module

A GPS module is an electronic device that communicates with GPS satellites to provide geographical location data. GPS modules operate based on a system of satellites orbiting the Earth. These satellites transmit precise microwave signals. The GPS module receives these signals and uses the data to calculate the user's exact location through a process known as trilateration. Trilateration involves determining the distances to at least three satellites and using these measurements, pinpoints the device's position on the globe.

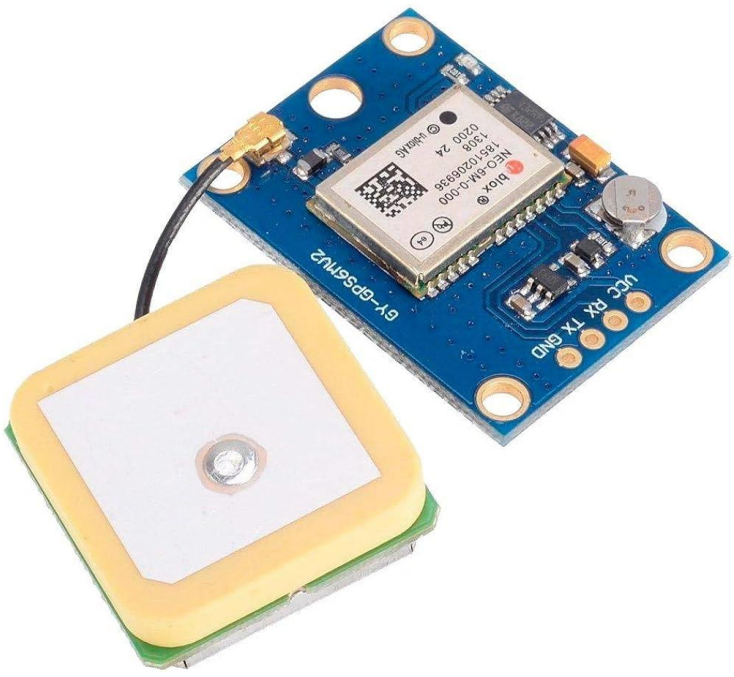

Figure 5.4: GPS Module

5.4.1 Components of a GPS Module

Antenna: Receives GPS signals from satellites. The quality of the antenna significantly influences the module's performance.

RF Amplifier: Strengthens the GPS signal for better processing.

GPS Receiver: Decodes the satellite signals into a format that the device can interpret.

Microcontroller: Acts as the 'brain' of the GPS module, handling calculations and data processing.

Accuracy and Precision: Standard GPS modules provide an accuracy level within 10 to 15 meters. Advanced systems with Differential GPS (DGPS) or Real-Time Kinematic (RTK) methods can achieve sub-meter or even centimeter-level accuracy.

5.4.2 NEO-6M GPS Module

The NEO-6MV2 is a GPS (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position. It is from a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature (16 x 12.2 x 2.4 mm) package. The compact architecture, power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. Its Innovative design gives NEO-6MV2 excellent navigation performance even in the most challenging environments.

Pin Name	Description
VCC	+5V Power Pin
RX	UART Receiver Pin
TX	UART Transmit Pin
GND	Ground

Table 5.3: GPS Module Pin Details

5.4.3 Features and Electrical Characteristics

- Standalone GPS receiver.
- Anti-jamming technology.
- UART Interface at the output pins (Can use SPI ,I2C and USB by soldering pins to the chip core).
- Under 1 second time-to-first-fix for hot and aided starts.
- Receiver type: 50 Channels - GPS L1 frequency - SBAS (WAAS, EGNOS, MSAS, GAGAN).
- Time-To-First-fix: For Cold Start 32s, For Warm Start 23s, For Hot Start <1s.
- Maximum navigation update rate: 5Hz.
- Default baud rate: 9600bps.
- EEPROM with battery backup.
- Sensitivity: -160dBm,Supply voltage: 3.6V.
- Maximum DC current at any output: 10mA.
- Operation limits: Gravity-4g, Altitude-50000m, Velocity-500m/s.
- Operating temperature range: -40ºC TO 85°C.

5.5 Vibration Sensor

The Normally Open Vibration Sensor Module is a versatile device designed to activate a variety of functions, including theft alarms, smart cars, and electronic building blocks. It is important to note that this module is designed to detect small vibrations and has a short trigger time, which may not be sufficient to drive a relay. However, it can be directly connected to some information displays or relay modules, although its effectiveness may vary.

When the product is not vibrating, the vibration switch remains in the off state, and the output is high, causing the green light to remain off. When the product is vibrating, the vibration switch enters momentary conduction mode, causing the output end to go low and the green indicator light to turn on. The output can be easily connected to a microcontroller to detect high and low levels and determine if there is any vibration in the environment, thereby playing an essential role in alerting users of potential danger.

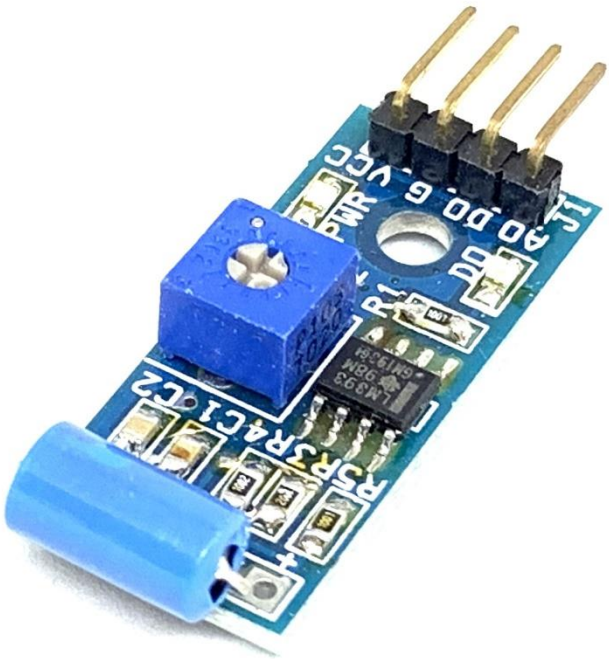

Figure 5.5: Vibration Sensor

5.5.1 How do vibration sensors work

Vibration sensors are devices that detect vibration, shock, and sound. They can be used in machinery to detect problems before they happen. Vibration sensors work by detecting the motion of a material or object by sensing its frequency. The faster the movement, the higher the frequency detected on a vibration sensor.

In manufacturing, for example, when a machine is vibrating abnormally, it may experience problems with its bearings. The bearings allow flexible movement while also providing stability and support for critical components like gears and motors. If something causes abnormal vibrations in these parts, they can break down over time due to wear and tear.

5.5.2 Pin Configuration

Pin Name	Description
VCC	Positive Power Supply
GND	Ground
DO	Digital Signal Output
AO	With this shock sensor this function is invalid

Table 5.4: Vibration Sensor Pin details

5.6 Breadboard

A Breadboard is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits. More complex circuits and high frequency circuits are less suited to breadboarding. Breadboard circuits are also not ideal for long term use like circuits built on perfboard (protoboard) or PCB (printed circuit board), but they also don't have the soldering (protoboard), or design and manufacturing costs (PCBs).

The breadboard is the bread-and-butter of DIY electronics. Breadboards allow beginners to get acquainted with circuits without the need for soldering, and even seasoned tinkerers use breadboards as starting points for large-scale projects.

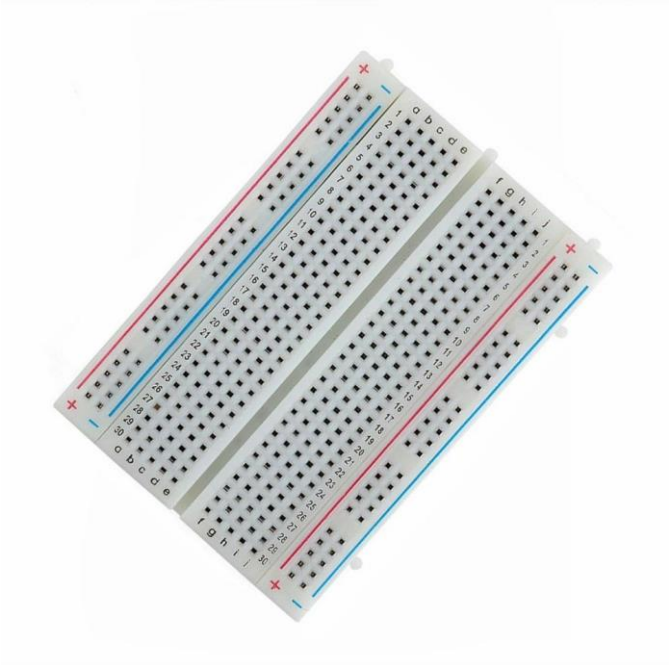

Figure 5.6: Bread Board

5.7 Jumper Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

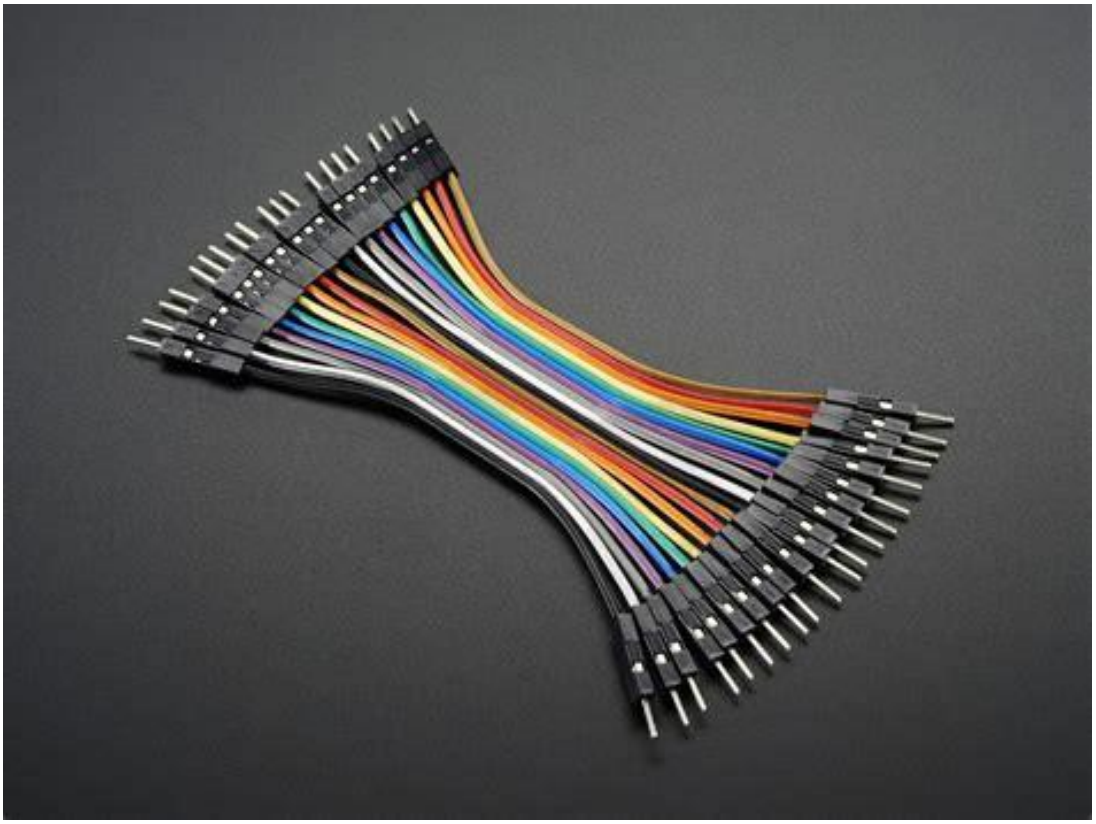

Figure 5.7: Jumper Wires

CHAPTER 6
SYSTEM DESIGN AND FABRICATION

6.1 Introduction

In this chapter fully discuss about the project design and fabrication. A general block diagram has been developed and implement according diagram. Here we described overall project description, implementation procedure and working principle. Total project flow chart is also available in this chapter.

6.2 Block Diagram

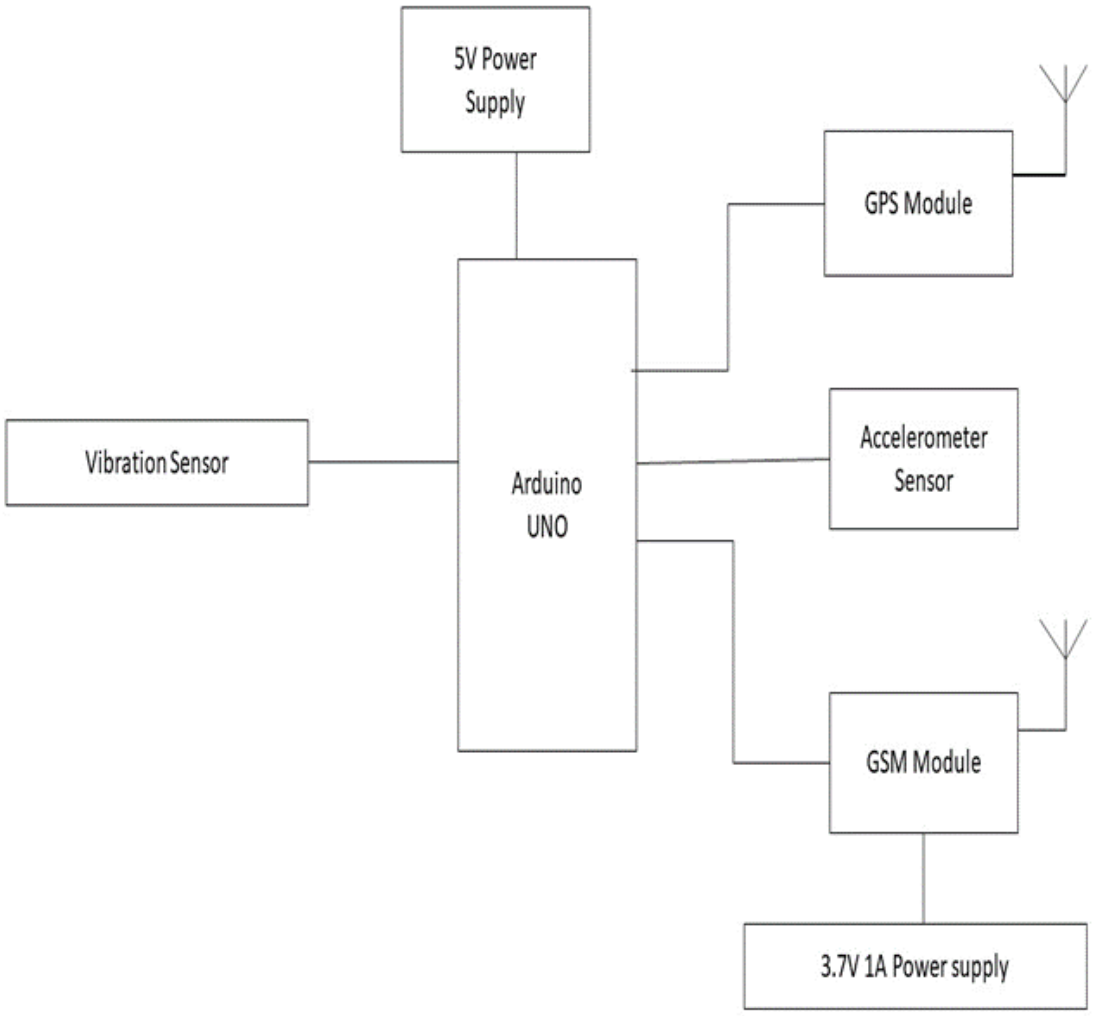

Figure 6.1: Block Diagram

6.3 Circuit Diagram

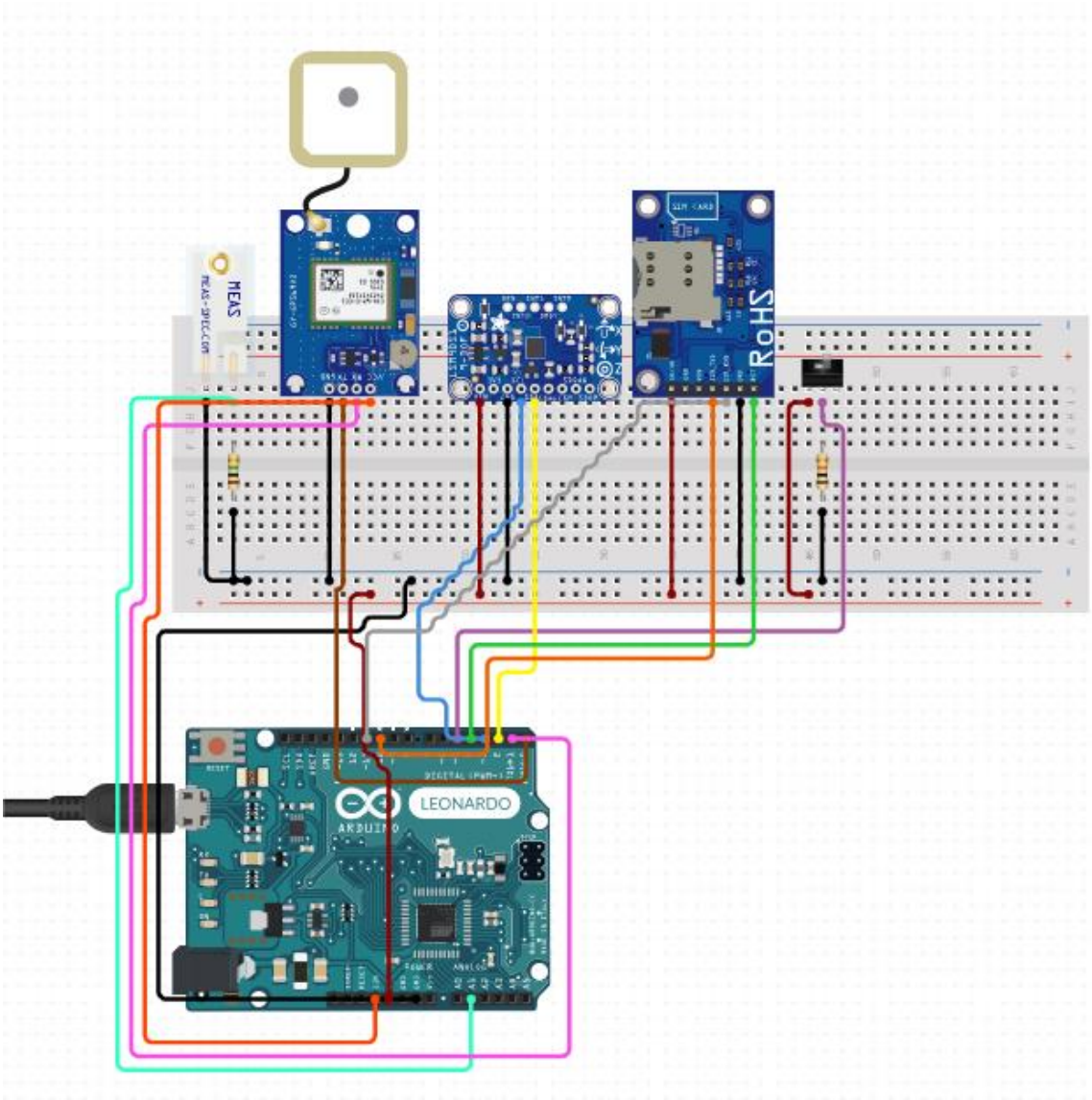

Figure 6.2: Circuit Diagram of vehicle accident detection

6.3.1 Working Principle

Circuit connection for our Accident Alert System device is not so complex. Here Tx pin of GPS module is directly connected to RX pin (RX0) of Arduino Uno. By using Software Serial Library here, we have allowed serial communication on pin RX0 and TX0, and made them Rx and Tx respectively and left the Rx pin of the GPS Module open. By default, pin 0 and 1 of Arduino are used for serial communication but by using the Software Serial library, we can allow serial communication on other digital pins of the Arduino. 5 Volt supply is used to power the GPS Module. GSM module's Tx and Rx pins of are directly connected to pin D8 and D7 of Arduino. For GSM interfacing, here we have also used software serial library. GSM module is also powered by 5v supply. An optional LCD's data pins D4, D5, D6, and D7 are connected to pin number 12, 11, 6, and 5 of Arduino. Command pin RS and EN of LCD are connected with pin number 4 and 3 of Arduino and RW pin is directly connected with ground. A Potentiometer is also used for setting contrast or brightness of LCD. An Accelerometer is added in this system for detecting an accident and its x,y, and z-axis ADC output pins are directly connected to Arduino ADC pin A0, A1, and A2.

6.4 System Description

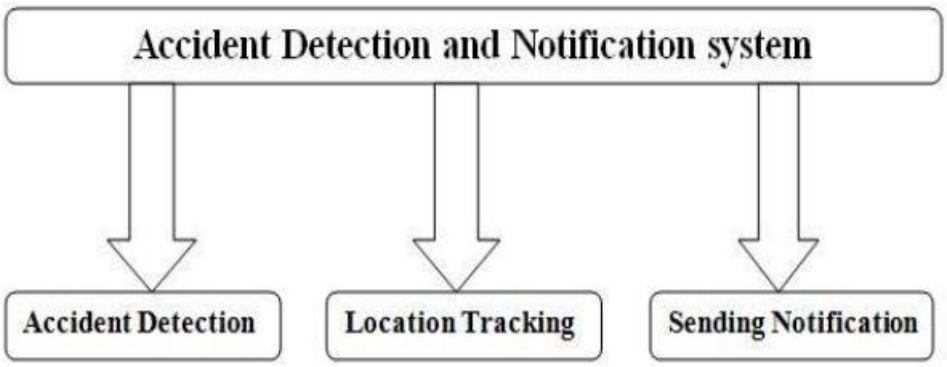

Figure 6.3: System Description Models

The project is divided into three phases. They are.

Accident Detection:

An accelerometer sensor senses the accident when the vehicles are fallen down detection x, y, z. initially the angle of the vehicle is zero degree and it could be increase 360 degrees towards any axis. If the angle of the vehicle rises in any direction exceeds our threshold value, the accelerometer considers the situation as an accident. The threshold value in X and Y axis are 320 and 320, respectively. The sensor has sent the signal to the microcontroller. We have used to vibration sensor in front or back of the vehicle. vibration sensor is always turn on when any accident will be occur sensor sense the vibration and indicate the micro controller.

Location Tracking:

The GPS sensor can detect the current location of the vehicle. In our proposed system we use the GPS device to find the exact accident location. When microcontroller receives any signal of accident it requests for current location of accident spot to the GPS. The GPS sends the location of accident spot to the microcontroller.

Sending Notification:

With accident location link GSM sends text message to the hospital and police control room. The hospital and police control room will get a message along with the map link which will contain the exact latitude and longitude details of the location. In the same time, nearest police station receives an accident occurs message with link Google map. With the help of these details, the ambulance can take the shortest route to the accident location and reduce the time to save the victim.

6.5 Flow Chart of the System

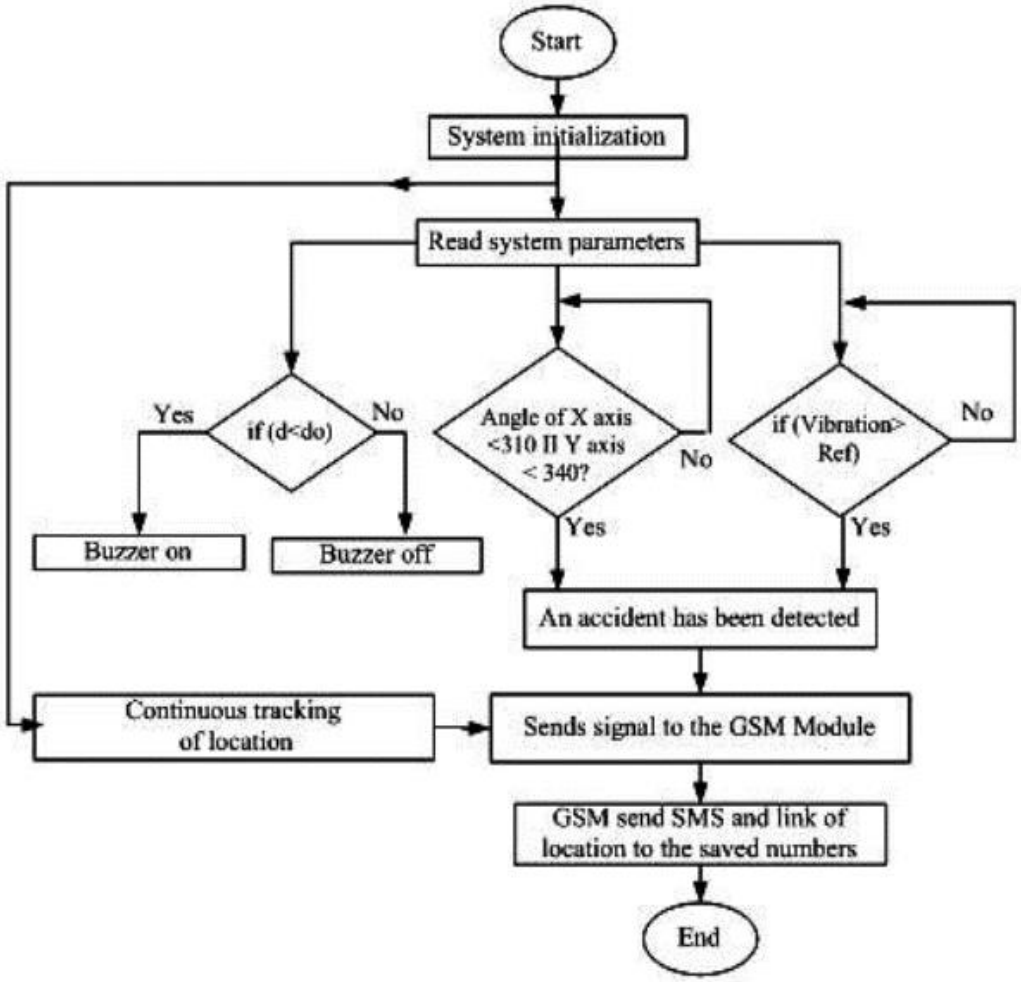

Figure 6.4 Flow Chart of the accident detection of the system

6.5.1 Description of Flow Chart

First thing first, our system being started after that all of the mechanism will be initialized that means all the functionality is being started. After the initialization of the system , all of the sensor data will be collected. Here we used three different types of sensor, those are perform different task. First of all, the ultrasonic sensor get the object distance that come forward to the vehicle and buzzer will be on otherwise it will go back to the system. After that, our system will check that the vehicle is Shaked or not and it will measure by the accelerometer sensor. If the vehicle shake much then the system make sure that the accident is detected. After accident detection, our system will pass signal through the GSM module and GSM send SMS and the location where the accident occur to the saved numbers. If not shake the system will follow normally. The vibration sensor response by any kind of stroke. If vehicle get stroke strongly, the vibration sensor make sure that the accident occurred. Similarly, our system will generate signal and will pass through the GSM module and GSM send SMS and the location where the accident occur to the saved number.

6.6 Arduino UNO Programming Code for accident detection

```
#include <SPI.h>

#include <GSM.h>

// Define the GSM module's baud rate

#define GSM_BAUD 9600

// Define the GPS module's baud rate

#define GPS_BAUD 4800

// Define the accelerometer's sensitivity

#define ACCELEROMETER_SENSITIVITY 1024

// Define the minimum acceleration required to trigger an alarm

#define ACCELEROMETER_TRIGGER 100

// Define the GSM module's phone number

#define GSM_PHONE_NUMBER "+15555555555"

// Define the GPS module's coordinates

#define GPS_LATITUDE 37.7833

#define GPS_LONGITUDE -122.4167

// Define the buzzer's pin

#define BUZZER_PIN 13

// Define the LED's pin

#define LED_PIN 12

// Create a GSM object

GSM gsm;
```

```
// Create a GPS object
GPS gps;
// Create an accelerometer object
Accelerometer accelerometer;
// Create a buzzer object
Buzzer buzzer;
// Create an LED object
LED led;
void setup() {
  // Initialize the serial port
  Serial.begin(9600);
  // Initialize the GSM module
  gsm.begin(GSM_BAUD);
  // Initialize the GPS module
  gps.begin(GPS_BAUD);
  // Initialize the accelerometer
  accelerometer.begin();
  // Initialize the buzzer
  buzzer.begin();
  // Initialize the LED
  led.begin();
}
```

```
void loop() {
  // Get the accelerometer's reading
  int accelerometerValue = accelerometer.read();  // If the accelerometer's reading is greater than the trigger, then an accident has occurred
  if (accelerometerValue > ACCELEROMETER_TRIGGER) {
    // Turn on the buzzer
    buzzer.on();
  // Turn on the LED
    led.on();
    // Get the GPS coordinates
    String gpsCoordinates = gps.getCoordinates();
    // Send an SMS message to the predefined phone number with the GPS coordinates
    gsm.sendSMS(GSM_PHONE_NUMBER, gpsCoordinates);
    // Wait for 10 seconds
    delay(10000);
    // Turn off the buzzer
    buzzer.off();
    // Turn off the LED
    led.off();
  }
}
```

CHAPTER 7

EXPERIMENTAL RESULTS

7.1 Introduction

This chapter contains the results obtained and discussion about the full project. We have also covered discussions about advantages, limitation, application of the vehicle accident detection.

7.2 Results and Discussions

The results include the successful operation of an automatic accident detection and notification systems. This system can detect the accident and then alert the nearest police station and medical assist center to provide emergency medical aid to accident victim.

Actually which types of sensor have been used in this project discuss it given bellow:

7.3 Limitations of the System

- It does not work without network

7.4 Angle of Rotation Vibration Sensor

Now let's find a complete angle of rotation (0° to 360°) around X, Y, Z axis, which we can also call as,

- Roll - Angle of rotation along the X axis
- Pitch - Angle of rotation along the Y axis
- Yaw - Angle of rotation along the Z axis

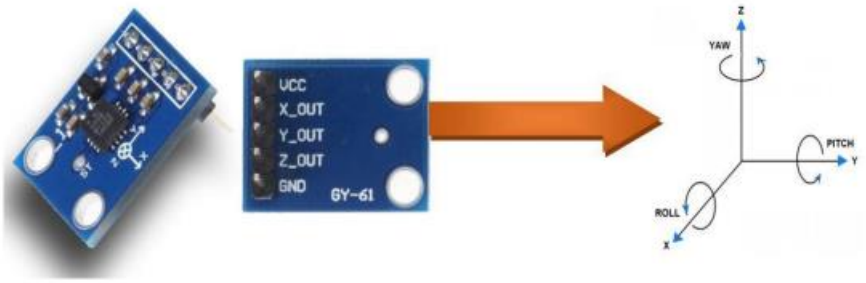

Figure 7.1 Angle of Rotation Vibration Sensor

7.4.1 Angles Calculation of Vibration Sensor

- Angle of inclination means by how much angle the device is tilted from its plane of surface.
- Angle of inclination is shown in below figure.
- To calculate angle of inclination of X, Y, Z axis from its reference, we need to use below formulas.

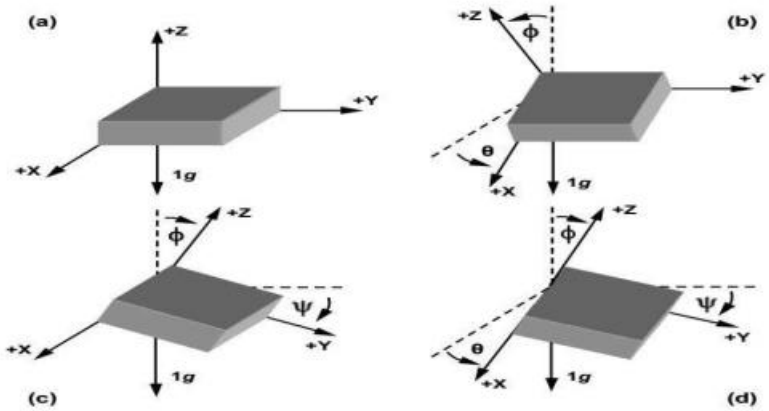

Figure 7.2 Angles calculation of Vibration Sensor

7.5 Setup & Output Image

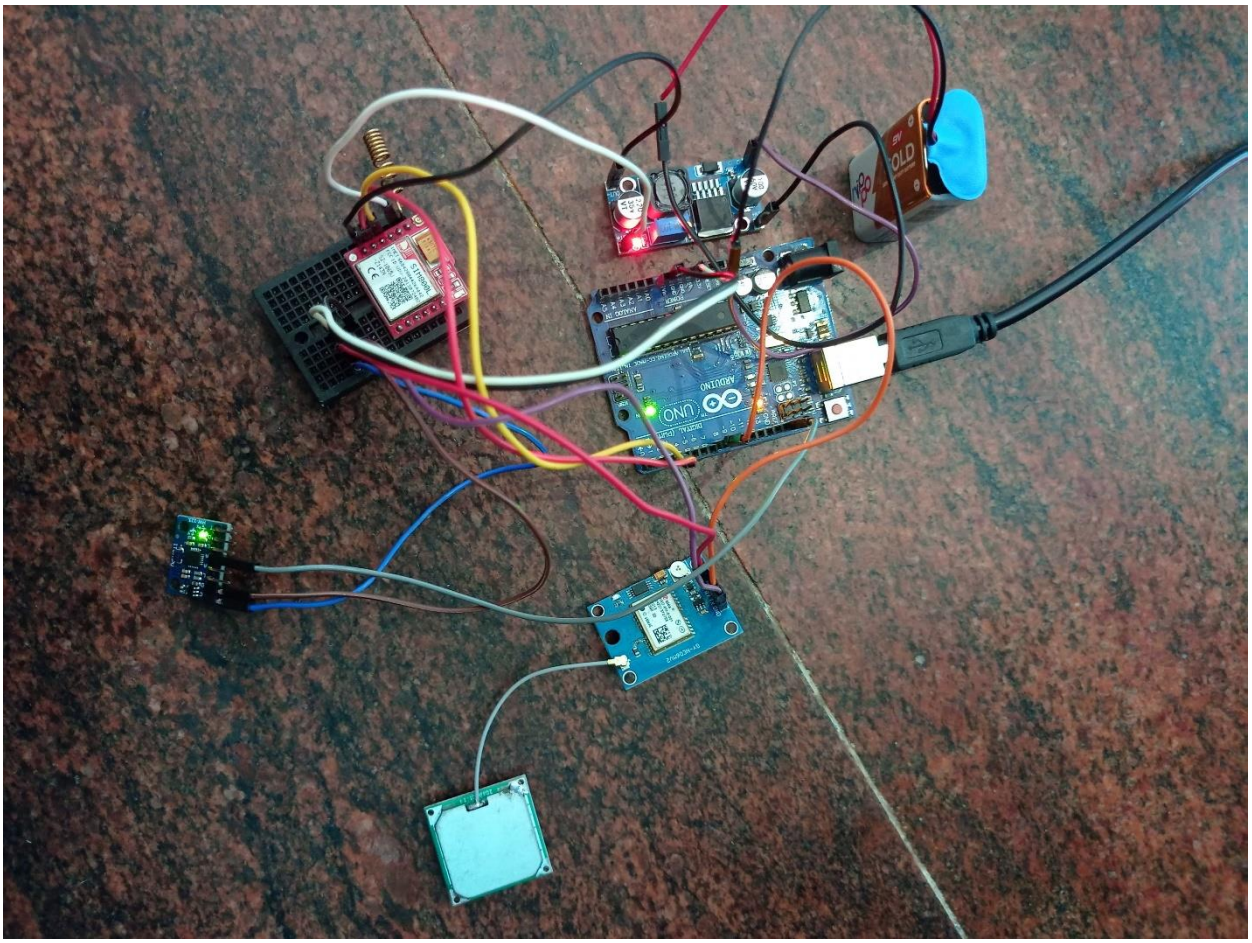

Figure 7.3 Setup Image

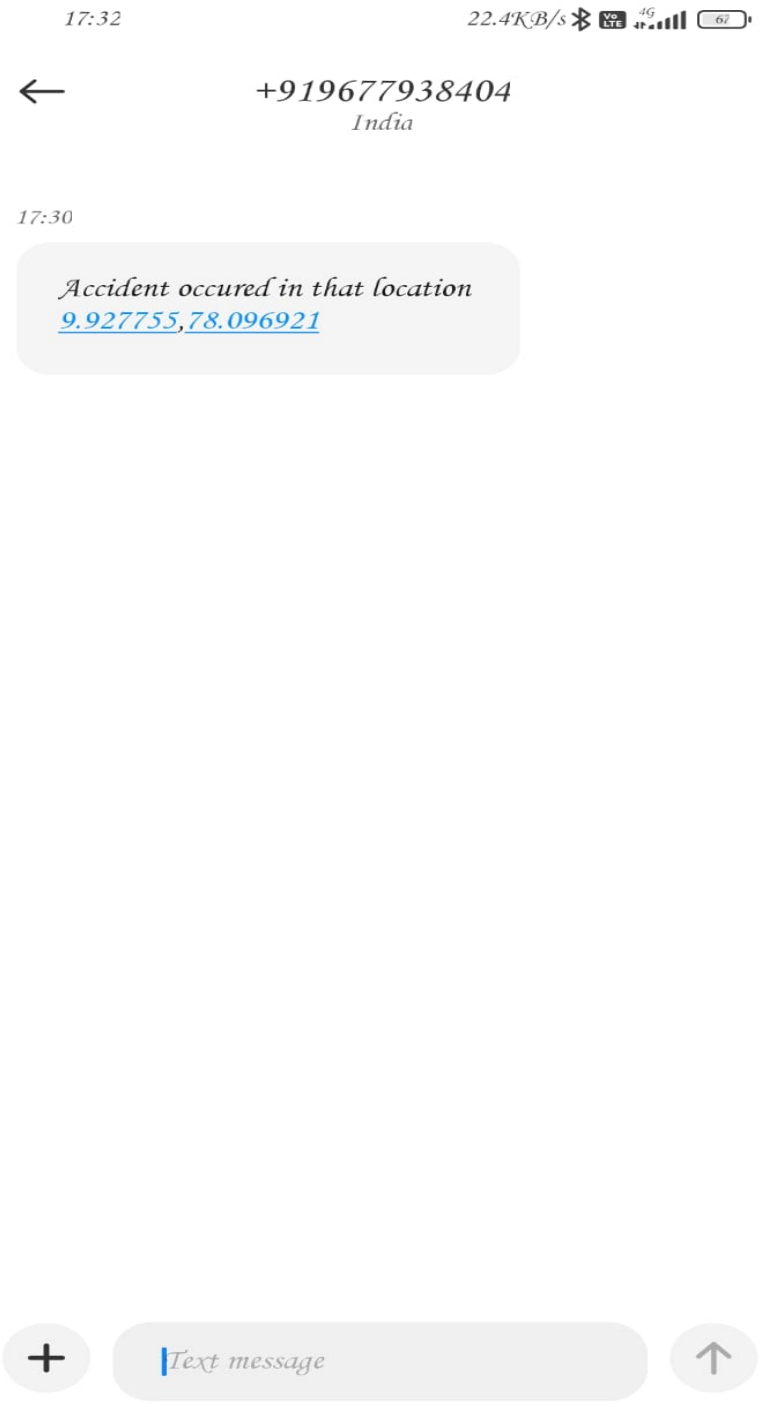

Figure 7.4 SMS with Location Coordination (latitude, longitude)

7.6 Advantages of the System

- Portable and easy to use.
- It is easy to design and manufacture as all the components are easily available.
- It is portable and hence can be placed anywhere. Due to wireless communication data rate is faster.
- No need for lengthy wires.
- Easy to control
- Easy to maintain and repair
- Efficient and low-cost design
- Low power consumption
- Can be modified easily.

7.7 Applications of the System

- It can be widely used in all types of vehicle for automatic accident detection and sending notification to the nearest police station and medical assist center.
- It can be used to track the stolen vehicle.

CHAPTER 8
CONCLUSION & FUTURE WORK

8.1 Conclusion

This project presents vehicle accident detection and alert system with SMS to the user defined mobile numbers. The GPS tracking and GSM alert based algorithm is designed and implemented. The proposed vehicle accident detection system can track geographical information automatically and sends an alert SMS regarding accident. The system is successfully implemented and tested. After the detailed experiment, it is observed that this system is efficient and reliable.

8.2 Future Works

This system could be more reliable and useable if we develop or add some other features and systems. They are as follows:

- The Accident Alert System is a versatile system which can be modified to work with many other embedded circuits in vehicles to provide a number of applications.
- The Accident Alert System can be interfaced with the Air Bag system, which provides security to the driver in case of an accident.
- The circuit can be used for parking assistance in vehicles with slight modifications.
- A Proximity sensor can be added to the circuit, which would alert the driver by beeping a buzzer if the driver is about to collide with the vehicle in front.
- The presence of GSM modem makes it possible to track the vehicle in case of theft.
- The GPS modem makes it possible to make route navigation possible.

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