A

PROJECT REPORT

ON

ARDUINO UNO BASED ACCIDENT PREVENTION & DETECTION SYSTEM

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTSFOR THE AWARD OF THE DEGREE
OF

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CHAIBASA ENGINEERING COLLEGE

(ESTD. BY GOVT. OF JHARKHAND AND RUN & MANAGED BY TECHNO INDIA UNDER PPP)

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DECLARATION

We, **RAJA KUMAR** (153408301447), **PIJUS MONDAL** (153408301453) **SHUBHANAKAR CHOUDHARY** (153408301477), **MD SARFRAZ ANSARI** (153408301438), **VIKKY KUMAR DAS** (153408301437), **PANKAJ ORAON** (153408301448) do hereby declare that the project work entitled **"ARDUINO UNO BASED ACCIDENT PREVENTION & DETECTION SYSTEM"** submitted to the **CHAIBASA ENGINEERING COLLEGE** *(ESTD. BY GOVT. OF JHARKHAND AND RUN BY TECHNO INDIA UNDER PPP)*, is a record of an original work done by us under the guidance of **Tamalika Panda** Assistant Professor **(**Department of Electronics & Communication Engineering) for the award of the degree of Bachelor of Technology in Electronics & Communication Engineering. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

In our project **"ARDUINO UNO BASED ACCIDENT PREVENTION & DETECTION SYSTEM"** We are going to use some sensor-based circuits and tried to implement these in our daily life to prevent from accident.

The Objective of this project is to develop a system to keep the vehicle secure and protect it by the occupation of the intruders. The main aim of the project to develop a system of accident avoidance using ultrasonic sensor, GPS Module, GSM Module and Vibration Sensor. The ultrasonic sensor system continuously sends signals and monitors any car or other obstacles are in front of car. The distance up to which ultrasonic sensor can work may be up to 4 meters. When any obstacle or vehicle detected by ultrasonic sensor system, it will send signal to the embedded board. After receiving this signal embedded board sends a signal to give alarm to alert to the driver. Many accidents at High-ways are taking place due to the close running of vehicles. To avoid this kind of accident, the warning system, which contains alarm and display system can arrange at rear side of each and every vehicle.

GPS is one of the technologies that are used in a huge number of applications today. One of the applications is tracking your vehicle and keeps regular monitoring on them. This tracking system can inform you the location and route travelled by vehicle, and that information can be observed from any other remote location. It also includes the web application that provides you exact location of target. This system enables us to track target in any weather conditions. This system uses GPS and GSM technologies.

The paper includes the hardware part which comprises of GPS, GSM, 16x2 LCD and software part is used for interfacing all the required modules and a web application is also developed at the client side. Main objective is to design a system that can be easily installed and to provide platform for further enhancement.

INTRODUCTION

The project on Arduino UNO Based Accident Prevention and Detection System is a project which focuses on preventing the accidents and if any accident has occurred then sending its report to the Emergency Contact Nos. Our project is a prototype of the actual automobile which can make the transportation a safer way to travel. We have made use of Ultrasonic Sensors, Global Positioning System (GPS) Module, Global System for Mobile Communication (GSM) Module, Vibration Sensors and Arduino UNO board to synchronize all the components together.

The Ultrasonic Sensor senses a vehicle approaching from behind the vehicle and gives an alarm to be careful while changing lanes on highways, applying brakes, overtaking vehicles, etc. It has got a transmitter and a receiver which calculates the distance of the approaching vehicle. Unfortunately, if any accident has occurred then the Vibration Sensor will detect the accident and send the report to the Emergency Contact Nos. using the GPS Module and GSM Module along with the location’s latitude and longitude.

The Prototype works on battery and is driven by a Bluetooth Module. The Bluetooth Module is connected with a Arduino UNO. The technique which we have used, can be implemented in the real world and become beneficial to the common public. This system can decrease the no. of casualties caused due these activities.

CHAPTER 1.

ARDUINO UNO BOARD

1.1 INTRODUCTION

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are −

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

1.2 BOARD TYPES

Various kinds of Arduino boards are available depending on different microcontrollers used. However, all Arduino boards have one thing in common: they are programed through the Arduino IDE.

The differences are based on the number of inputs and outputs (the number of sensors, LEDs, and buttons you can use on a single board), speed, operating voltage, form factor etc. Some boards are designed to be embedded and have no programming interface (hardware), which you would need to buy separately. Some can run directly from a 3.7V battery, others need at least 5V.

Here is a list of different Arduino boards available.

1.2.1 Arduino boards based on ATMEGA328 Microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Uno R3	5V	16MHz	14	6	6	1	USB via ATMega16U2
Arduino Uno R3 SMD	5V	16MHz	14	6	6	1	USB via ATMega16U2
Red Board	5V	16MHz	14	6	6	1	USB via FTDI
Arduino Pro 3.3v/8 MHz	3.3V	8MHz	14	6	6	1	FTDI-Compatible Header
Arduino Pro 5V/16MHz	5V	16MHz	14	6	6	1	FTDI-Compatible Header
Arduino mini 05	5V	16MHz	14	8	6	1	FTDI-Compatible Header
Arduino Pro mini 3.3v/8mhz	3.3V	8MHz	14	8	6	1	FTDI-Compatible Header
Arduino Pro mini 5v/16mhz	5V	16MHz	14	8	6	1	FTDI-Compatible Header
Arduino Ethernet	5V	16MHz	14	6	6	1	FTDI-Compatible Header

Table 1.1 ATMEGA328 Microcontrollers

1.2.2 Arduino boards based on ATMEGA32u4 Microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Leonardo	5V	16MHz	20	12	7	1	Native USB
Pro micro 5V/16MHz	5V	16MHz	14	6	6	1	Native USB
Pro micro 3.3V/8MHz	5V	16MHz	14	6	6	1	Native USB
Lily Pad Arduino USB	3.3V	8MHz	14	6	6	1	Native USB

Table 1.2 ATMEGA32u4 Microcontrollers

1.2.3 Arduino boards based on ATMEGA2560 Microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Mega 2560 R3	5V	16MHz	54	16	14	4	USB via ATMega16U2B
Mega Pro 3.3V	3.3V	8MHz	54	16	14	4	FTDI-Compatible Header
Mega Pro 5V	5V	16MHz	54	16	14	4	FTDI-Compatible Header
Mega Pro Mini	3.3V	8MHz	54	16	14	4	FTDI-Compatible

3.3V							Header

Table 1.3 ATMEGA2560 Microcontrollers

1.2.4 Arduino boards based on AT91SAM3X8E Microcontroller

Board Name	Operating Volt	Clock Speed	Digital i/o	Analog Inputs	PWM	UART	Programming Interface
Arduino Mega 2560 R3	3.3V	84MHz	54	12	12	4	USB native

Table 1.4 AT91SAM3X8E

1.3 PIN DESCRIPTION

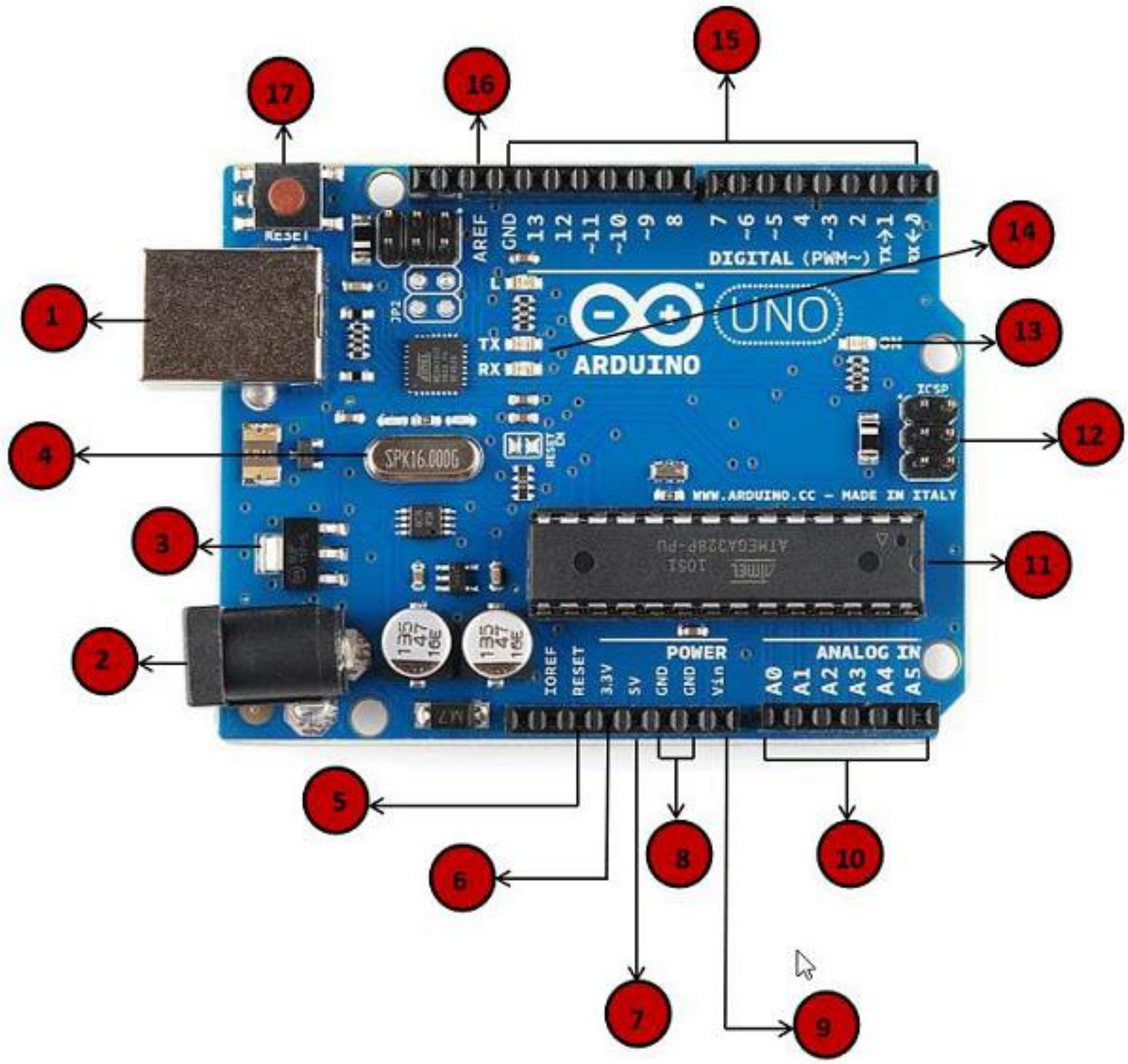

Fig. 1.1 Arduino Pin Layout

1	**Power USB** Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).
2	**Power (Barrel Jack)** Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).

3	**Voltage Regulator** The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.
4	**Crystal Oscillator** The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.
5,17	**Arduino Reset** You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).
6,7 8,9	**Pins (3.3, 5, GND, Vin)** • 3.3V (6) – Supply 3.3 output volts • 5V (7) – Supply 5 output volts • Most of the components used with Arduino board works fine with 3.3 volts and 5 volts. • GND (8) (Ground) – There are several GND pins on the Arduino, any of which can be used to ground your circuit. • Vin (9) – This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
10	**Analog pins** The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.
11	**Main microcontroller** Each Arduino board has its own microcontroller (11). You can assume it as

	the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.
12	**ICSP pin** Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.
13	**Power LED indicator** This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.
14	**TX and RX LEDs** On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.
15	**Digital, I/O** The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled "~" can be used to generate PWM.
16	**AREF** AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog

	input pins.

Table 1.5 Pin Configuration of Arduino UNO

CHAPTER
2.
GEARED DC MOTOR

2.1 INTRODUCTION

A gear motor is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications and are probably used in many devices in your home.

Gear motors are commonly used in devices such as can openers, garage door openers, washing machine time control knobs and even electric alarm clocks. Common commercial applications of a gear motor include hospital beds, commercial jacks, cranes and many other applications that are too many to list.

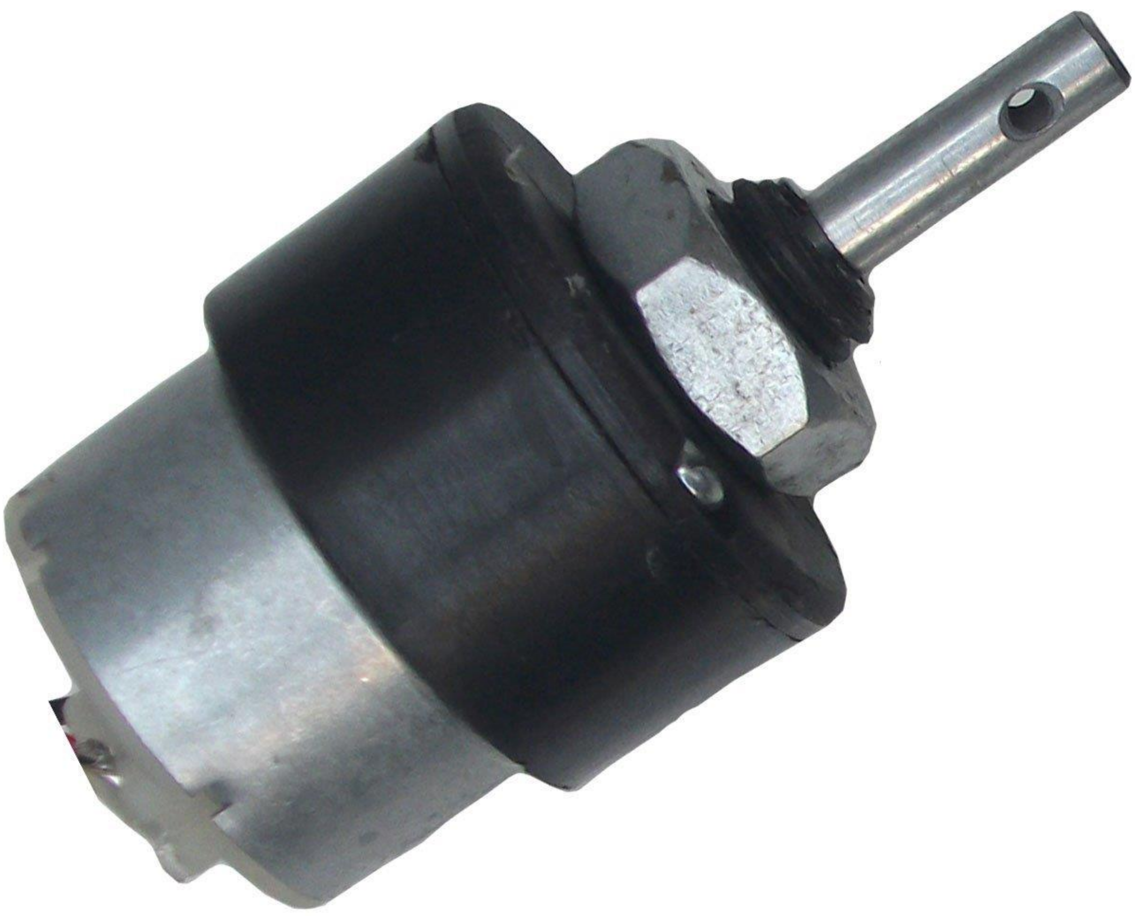

Fig. 2.1 Dc Gear Motor

2.2 FEATURES

•Long-life: Intermittent operation over 1 million cycles with optimized brush design.
• Continuous operating life of 3000 hours.
• High output: High heat dissipation and heat resistance achieves higher Output.
• High strength: High radial load capacity due to robust construction large diameter output
shaft and ball bearings
• Low noise and increased insulation due to new resin brush holders.
• Large selection of gear heads and reduction ratios are available to meet all needs.
• Also available with magnetic revolution sensor and noise filter.

2.3 SPECIFICATIONS

• RPM: 300 at 12V
• Voltage: 4V to 12V
• Stall torque: 23Kg-cm at stall current of 8.4A@12V
• Shaft diameter: 8mm
• Shaft length: 17.5mm
• Gear assembly: Spur
• Brush type: Carbon Motor weight: 280gms.

2.4 L293D MOTOR DRIVER

2.4.1 INTRODUCTION

It is a motor driver ICthat can drive two motors simultaneously. L293D IC is a dual H-bridge motor driver IC. One H-bridge is capable to drive a dc motor in bidirectional. L293D IC is a current enhancing IC as the output from the sensor is not able to drive motors itself so L293D is used for this purpose. L293D is a 16 pin IC having two enables pins which should always be remain high to enable both the H-bridges. L239B is also a motor driver which can be used for driving the motors.

Fig. 2.2 L293D Motor Driver IC

2.4.2 WORKING OF L293D MOTOR DRIVER

There are 4 input pins for l293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right-hand side. The motors are rotated based on the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

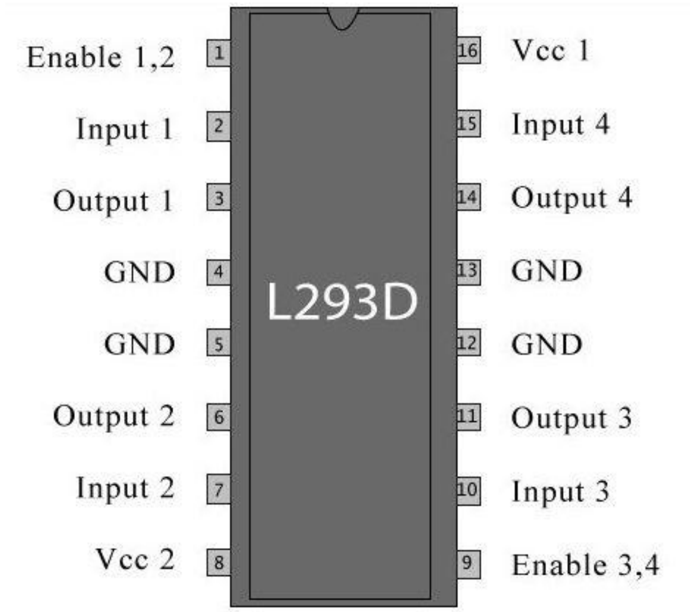

Fig. 2.3 L293D PIN Diagram

2.4.3 PIN DESCRIPTION

- 1 - Enable 1-2, when this is HIGH the left part of the IC will work and when it is low the left part won't work.
- 2 - INPUT 1, when this pin is HIGH the current will flow though output 1
- 3 - OUTPUT 1, this pin should be connected to one of the terminals of motor
- 4,5 - GND, ground pins
- 6 - OUTPUT 2, this pin should be connected to one of the terminals of motor
- 7 - INPUT 2, when this pin is HIGH the current will flow though output 2
- 8 - VCC2, this is the voltage which will be supplied to the motor.
- 16 - VCC1, this is the power source to the IC. So, this pin should be supplied with 5 V
- 15 - INPUT 4, when this pin is HIGH the current will flow though output 4
- 14 - OUTPUT 4, this pin should be connected to one of the terminals of motor
- 13,12 - GND, ground pins
- 11 - OUTPUT 3, this pin should be connected to one of the terminals of motor
- 10 - INPUT 3, when this pin is HIGH the current will flow though output 3

- 9 - Enable 3-4, when this is HIGH the right part of the IC will work and when it is low the right part won't work.

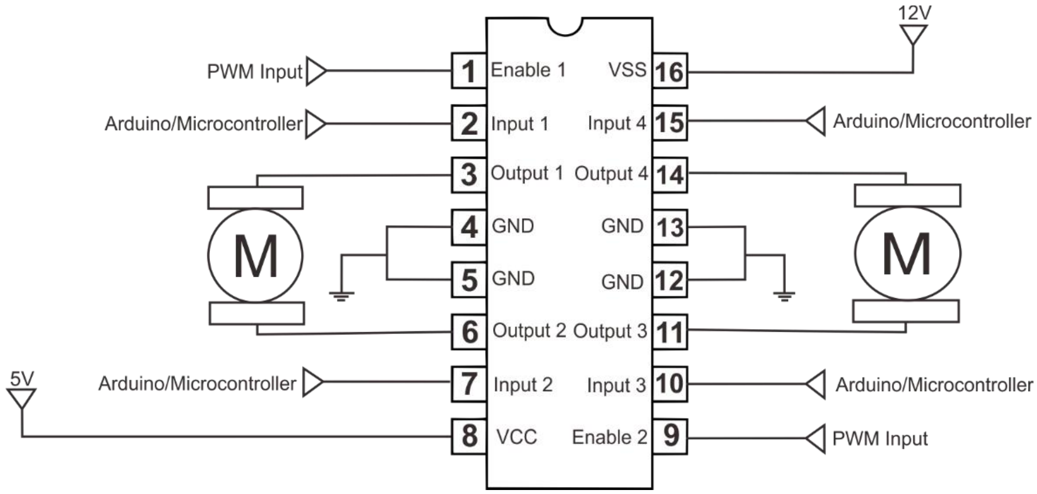

Fig. 2.4 Circuit Diagram of L293D Motor Driver

2.4.4 TECHNICAL SPECIFICATION

- Supply Voltage Range 4.5V to 36V.
- 600-mA Output current capability per driver.
- Separate Input-logic supply.
- It can drive small DC-geared motors, bipolar stepper motor.
- Pulsed Current 1.2-A Per Driver.
- Thermal Shutdown.
- Internal ESD Protection.
- High-Noise-Immunity Inputs.

CHAPTER
3.
LCD MODULE
16X2

3.1 INTRODUCTION

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

3.2 PIN DIAGRAM

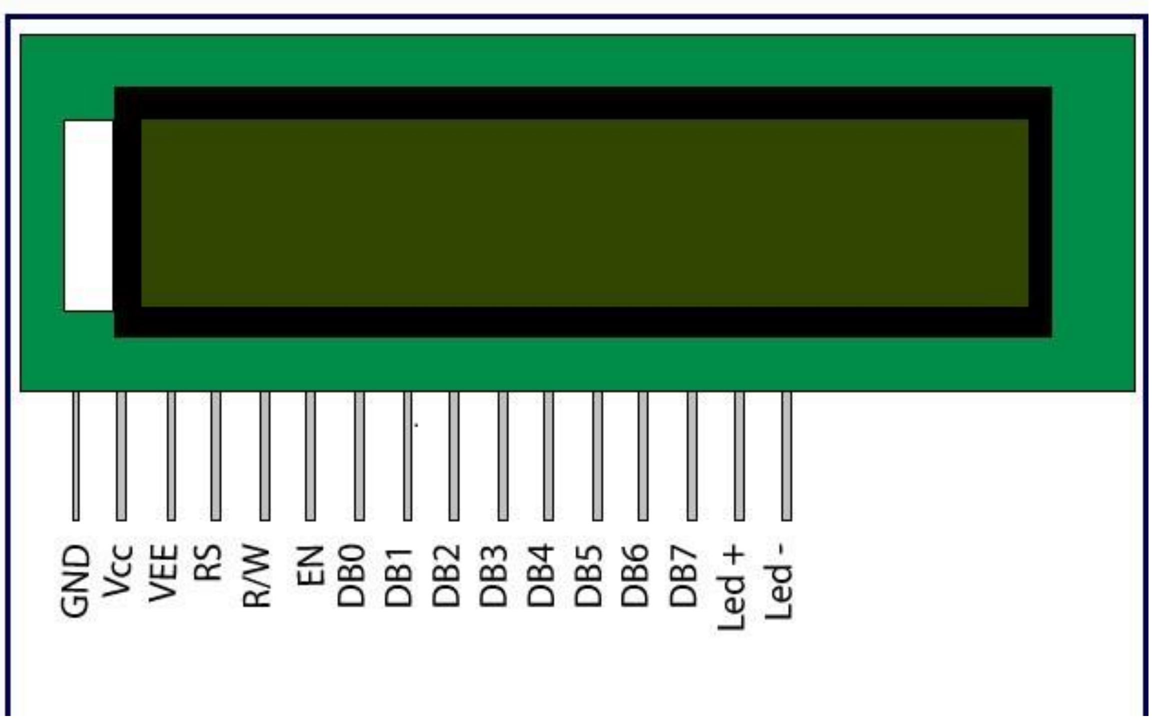

Fig. 3.1 16x2 LCD Display

3.3 PIN DESCRIPTION

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table 3.1 Pin Configuration

3.4 FEATURES

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

3.5 MECHANICAL DATA

ITEM	STANDARD VALUE	UNIT
Module Dimension	80.0 x 36.0	mm
Viewing Area	66.0 x 16.0	mm
Dot Size	0.56 x 0.66	mm
Character Size	2.56 x 5.56	mm

Table 3.2 Mechanical Data

3.6 ELECTRICAL DATA

<table>
<tr><th rowspan="2">ITEM</th><th rowspan="2">SYMBOL</th><th rowspan="2" colspan="2">CONDITION</th><th colspan="3">STANDARD VALUE</th><th rowspan="2">UNIT</th></tr>
<tr><th>MIN.</th><th>TYP.</th><th>MAX.</th></tr>
<tr><td rowspan="2">Input voltage</td><td rowspan="2">VDD</td><td colspan="2">VDD= +5V</td><td>4.7</td><td>5.0</td><td>5.3</td><td>V</td></tr>
<tr><td colspan="2">VDD= +3V</td><td>2.7</td><td>3.0</td><td>5.3</td><td>V</td></tr>
<tr><td>Supply Current</td><td>IDD</td><td colspan="2">VDD= 5V</td><td>-</td><td>1.2</td><td>3.0</td><td>mA</td></tr>
<tr><td rowspan="5">Recommended LC Driving Voltage for Normal Temp. Version Module</td><td rowspan="5">VDD-V0</td><td colspan="2">-20˚C</td><td>-</td><td>-</td><td>-</td><td rowspan="5">V</td></tr>
<tr><td colspan="2">0˚C</td><td>4.2</td><td>4.8</td><td>5.1</td></tr>
<tr><td colspan="2">25˚C</td><td>3.8</td><td>4.2</td><td>4.6</td></tr>
<tr><td colspan="2">50˚C</td><td>3.6</td><td>4.0</td><td>4.4</td></tr>
<tr><td colspan="2">70˚C</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Led Forward Voltage</td><td>VF</td><td colspan="2">25˚C</td><td>-</td><td>4.2</td><td>4.6</td><td>V</td></tr>
<tr><td rowspan="2">Led Forward Current</td><td rowspan="2">IF</td><td rowspan="2">25˚C</td><td>Array</td><td>-</td><td>130</td><td>260</td><td rowspan="2">mA</td></tr>
<tr><td>Edge</td><td>-</td><td>20</td><td>40</td></tr>
<tr><td>EL Power SupplyCurrent</td><td>IEL</td><td colspan="2">Vel.=110VAC:400Hz</td><td>-</td><td>-</td><td>5.0</td><td>mA</td></tr>
</table>

Table 3.3 Electrical Data

CHAPTER 4.
BUZZER

4.1 INTRODUCTION

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play."

Fig. 4.1 Buzzer

4.2 SPECIFICATION

- On-board passive buzzer
- On-board 8550 triode drive
- Can control with single-chip microcontroller IO directly
- Working voltage: 5V
- Board size: 22 (mm) x12 (mm)

4.3 PIN CONFIGURATION

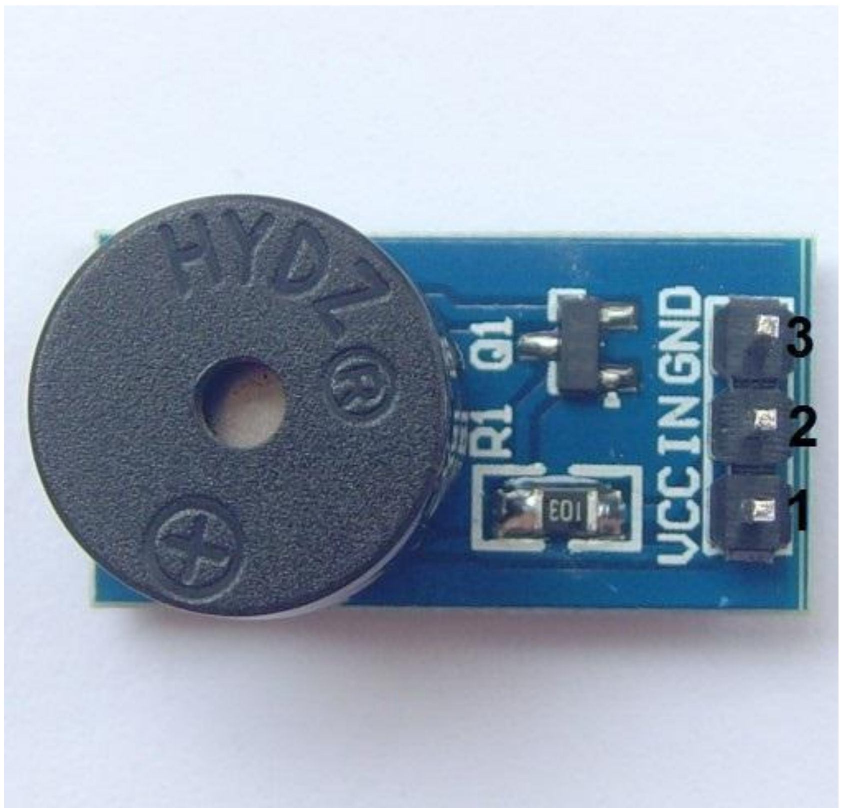

Fig. 4.2 Buzzer with PINs.

1. VCC
2. Input
3. Ground

4.4 TYPES OF BUZZER

4.4.1 ELECTROMECHANICAL

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

4.4.2 MECHANICAL

A joy buzzer is an example of a purely mechanical buzzer and they require drivers. Other examples of them are doorbells.

4.4.3 PIEZOELECTRIC

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

A piezoelectric buzzer/beeper also depends on acoustic cavity resonance or Helmholtz resonance to produce an audible beep.

4.5 APPLICATIONS

While technological advancements have caused buzzers to be impractical and undesirable, there are still instances in which buzzers and similar circuits may be used. Present day applications include:

- Novelty uses
- Judging panels
- Educational purposes
- Annunciator panels.
- Electronic metronomes.
- Game show lock-out device.
- Microwave ovens and other household appliances.
- Sporting events such as basketball games.
- Electrical alarms.

- Joy buzzer (mechanical buzzer used for pranks).

CHAPTER 5.
BLUETOOTH MODULE

5.1 INTRODUCTION

HC-05 module is an easy to use **Bluetooth SPP (Serial Port Protocol) module**, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified **Bluetooth V2.0+EDR (Enhanced Data Rate)**3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses **CSR Blue core 04**-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default, the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc. Just go through the datasheet for more detail.

Fig. 5.1 Blurtooth Module

5.2 HARDWARE FEATURES

- Typical -80dBm sensitivity.
- Up to +4dBm RF transmit power.
- 3.3 to 5 V I/O.

5.3 SOFTWARE FEATURES

- Slave default Baud rate: 9600, Data bits:8, Stop bit:1, Parity: No parity.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:”1234” as default.

5.4 PIN DESCRIPTION

The HC-05 Bluetooth Module has 6pins. They are as follows:

ENABLE:

When enable is pulled **LOW**, the module is disabled which means the module will **not turn on** and it **fails to communicate**. When enable is **left open or connected to 3.3V**, the module is enabled i.e the module **remains on** and **communication also takes place**.

Vcc: Supply Voltage 3.3V to 5V

GND: Ground pin

TXD & RXD: These two pins acts as an UART interface for communication

STATE:

It acts as a status indicator. When the module is **not connected to / paired** with any other Bluetooth device, signal goes **Low**. At this **low state**, the **led flashes continuously** which denotes that the module is **not paired** with another device. When this module is **connected to/paired** with any other Bluetooth device, the signal goes **High**. At this **high state**, the **led blinks with a constant delay** say for example 2s delay which indicates that the module is **paired**.

5.5 BUTTON SWITCH:

This is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands, the user can change the parameters of this module but only when the module is not paired with any other BT device. If the module is connected to any other Bluetooth device, it starts to communicate with that device and fails to work in AT command mode.

5.6 HARDWARE CONNECTIONS

As we know that Vcc and Gnd of the module goes to Vcc and Gnd of Arduino. The TXD pin goes to RXD pin of Arduino and RXD pin goes to TXD pin of Arduino i.e. (digital pin 0 and 1).The user can use the on board Led. But here, LED is connected to digital pin 12 externally for betterment of the process.

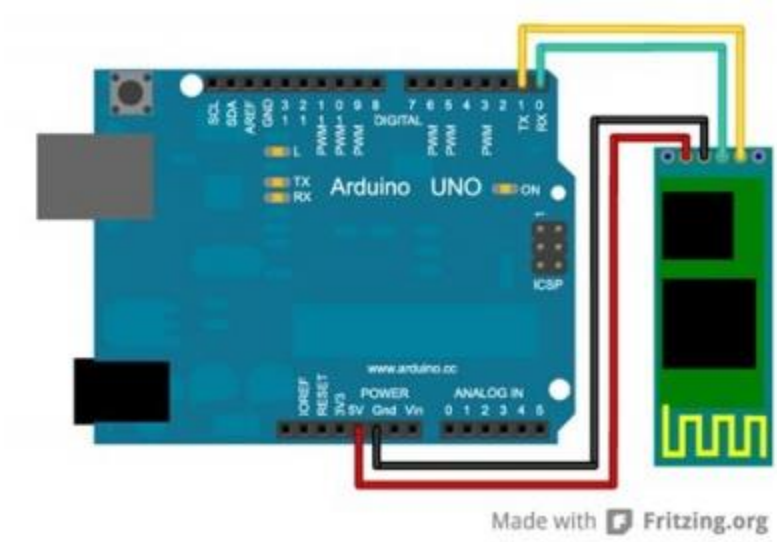

Fig. 5.2 Hardware Connection with Arduino

CHAPTER 6.

VIBRATION SENSOR

6.1 INTRODUCTION

The Vibration module based on the vibration sensor SW-420 and Comparator LM393 to detect if there is any vibration that beyond the threshold. The threshold can be adjusted by the on-board potentiometer. When this no vibration, this module output logic LOW the signal indicates LED light, And vice versa. Uses: For a variety of shocks triggering, theft alarm, smart car, an earthquake alarm, motorcycle alarm. This module when compared with normally open pneumatic shock sensor module, shock triggered much longer can drive relay module features: the use of the company's production of SW-420 normally closed type vibration sensors. compactor output signal clean wave well, driving ability, 15mA rated voltage and 3.3V-5V output: digital switching output (0 and 1) a bolt-hole for easy installation small Board PCB dimensions: 3.2cm x 1.4cm using wide LM393 voltage compactor Module description: the product when it is not shock, vibrate switch is closed on-State, output low level, the green indicator light is on; When vibration, vibration switches disconnected moments, output line, the Green led is not lit; the output can be directly connected to the micro controller, by single-chip computer to detect high or low level, to detect whether there is vibration, alarm function

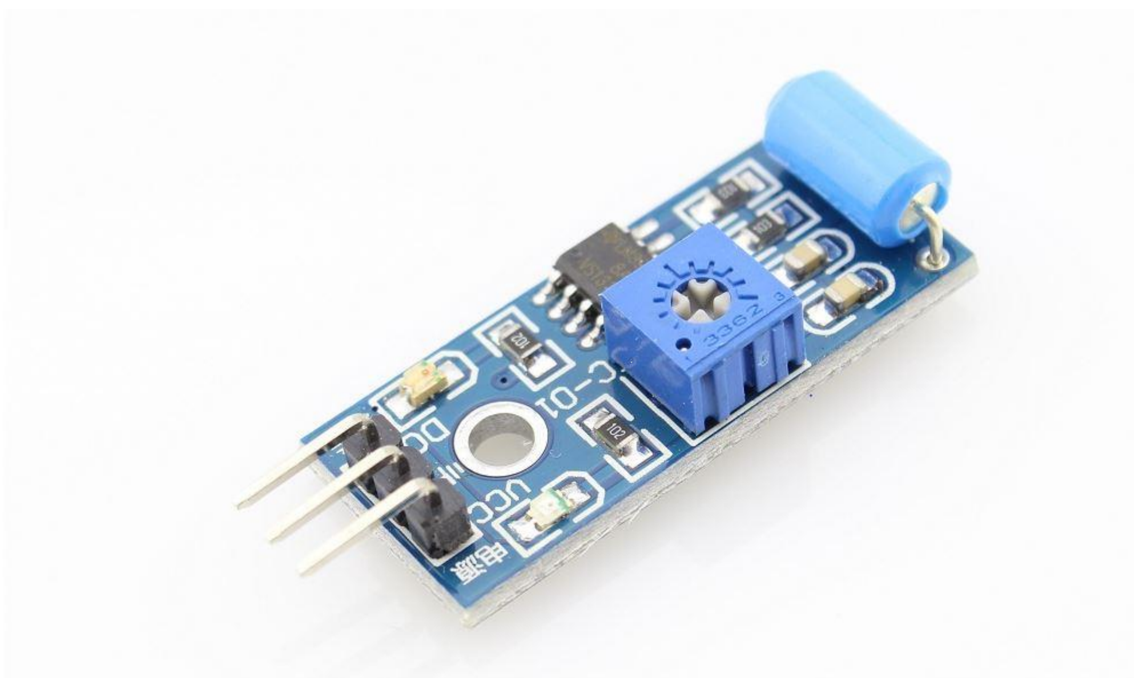

Fig. 6.1 Vibration Sensor

6.2 **FEATURES**

- This is Open-Type Vibration sensor Module
- The working voltage of 3V to 5 V;
- Fixed bolt hole, convenient installation

- Small board PCB size: 3.1 cm x 1.4 cm
- Used to trigger the effect of various vibration, theft alarm, intelligent car, Earthquake alarm, motorcycle alarm, etc.

Many Applications can be created by measuring Vibration level, but sensing vibration accurately is a difficult job. This article describes about vibration sensor SW-420 and Arduino interface then it may help you to design effort less vibration measurement. The vibration sensor SW-420 Comes with breakout board that includes comparator LM 393 and Adjustable on-board potentiometer for sensitivity threshold selection, and signal indication LED.

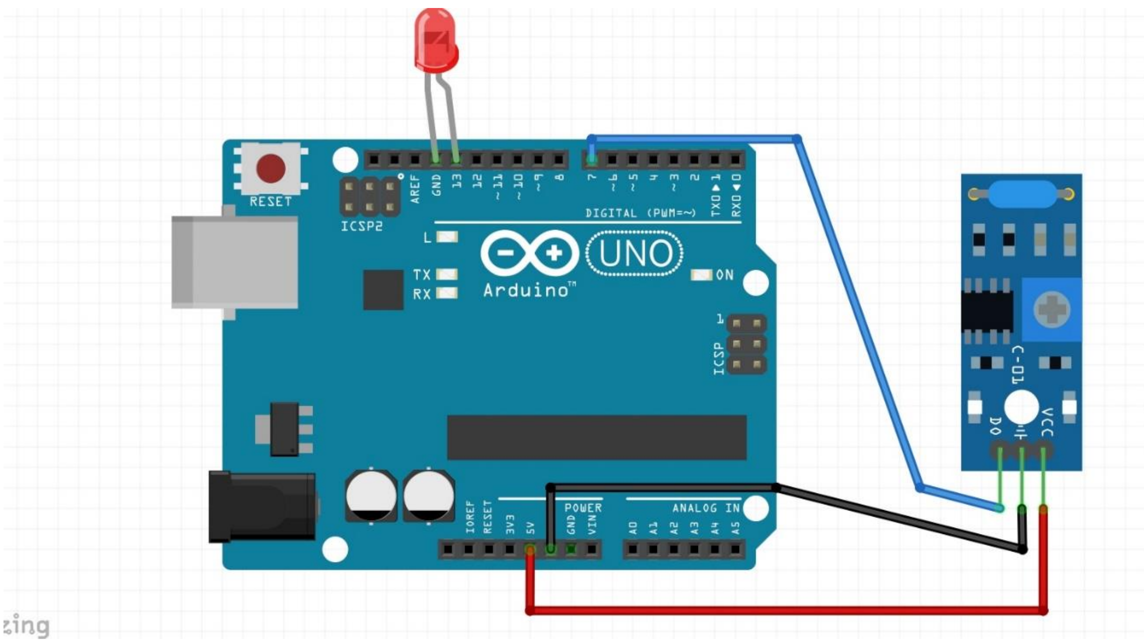

Fig. 6.2 Arduino Hookup with SW-420

6.3 APPLICATION IDEAS

- Vibration detecting
- Burglary protection system
- Object Movement detecting
- Triggering effect reported theft alarm
- Smart car
- Earthquake alarm
- Motorcycle alarm

6.4 BOARD SCHEMATIC

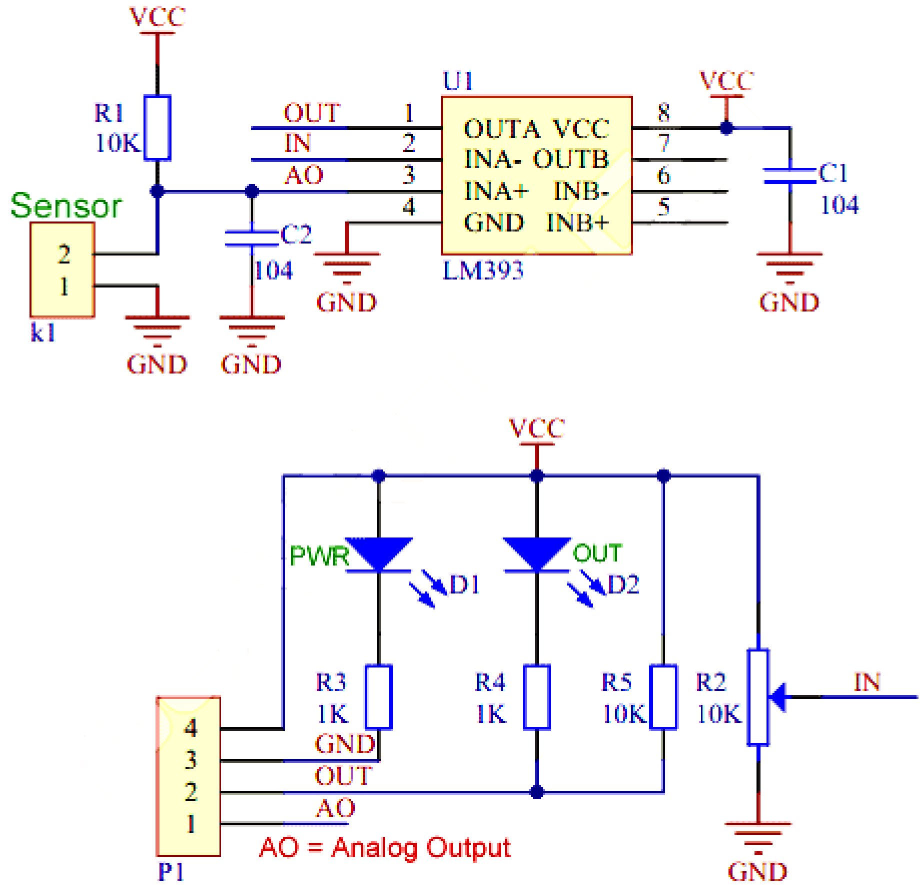

Fig. 6.3 Schematic Circuit

6.5 USE

- The module does not vibrate, vibrate switch is closed conduction state, the output low, the green indicator light comes ON.
- Vibration state, vibration switch instantly disconnects the output high, the green light is not on;
- The output is directly connected to the microcontroller to detect high and low, there by detecting the vibration environment, play an alarm role.

CHAPTER 7.
ULTRASONIC RANGING MODULE HC - SR04

7.1 INTRODUCTION

There are several advanced technologies and innovations are available for vehicle safety. Even though there are advanced technological innovations for vehicle safety, the growth in number of accidents is continuously increasing. And these accidents are due to collision inter sectional accidents. Collision of vehicles occurs due to mistakes done by driver and inter sectional accidents are caused due to bad weather conditions. Hence, to overcome these mistakes an intelligent collision avoidance system is proposed.

So, the mistakes done by the driver are eliminated. Only sports cars and other luxury cars consist of antilock brake system, speed sensor, and other automatic systems. But these cars cannot be affordable to everyone. So, this system is developed which can be implemented in every car.

A collision avoidance system consists of several sensors that are placed within a car which provide warning to the driver if there are any dangers that lie ahead on the road. These sensors include how close the car is to other cars, how much its speed needs to be reduced when obstacles closer to the car, how close the car going off the road, And the system consist of audio warning to prompt the driver, initiates braking if the driver fails to respond to the warning. Since the system consists of sensors which send and receive signals from other cars, obstacles on the road.

A good example of the system is how it works when a driver is about to change lanes, and there is an obstacle in his blind spot. The sensor will detect that obstacle and give information to driver before him start turning his car and prevent him from getting into serious accident.

There is lot of techniques available for distance measurements and to avoid forward collision but the one technique which introduced in our system is fast, effective, and cheap by using ultrasonic sensor. Ultrasonic sensor is used to measure the distance with respect to the preceding car. Hence, the rear end collision can be avoided by using ultrasonic sensor.

7.2 PRODUCT FEATURES

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules include ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least 10us high level signal,

(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time × velocity of sound (340M/S) / 2.

7.3 ELECTRIC PARAMETERS

Working Voltage	5 V
Working Frequency	40Hz
Max Range	4m
Min Range	2cm
Measuring Angle	15 degrees
Working Current	15mA
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and the range in proportion
Dimension	45*20*15mm

Vcc Trig Echo GND

Fig. 7.1 Ultrasonic Module

7.4 SCHEMATIC CIRCUIT

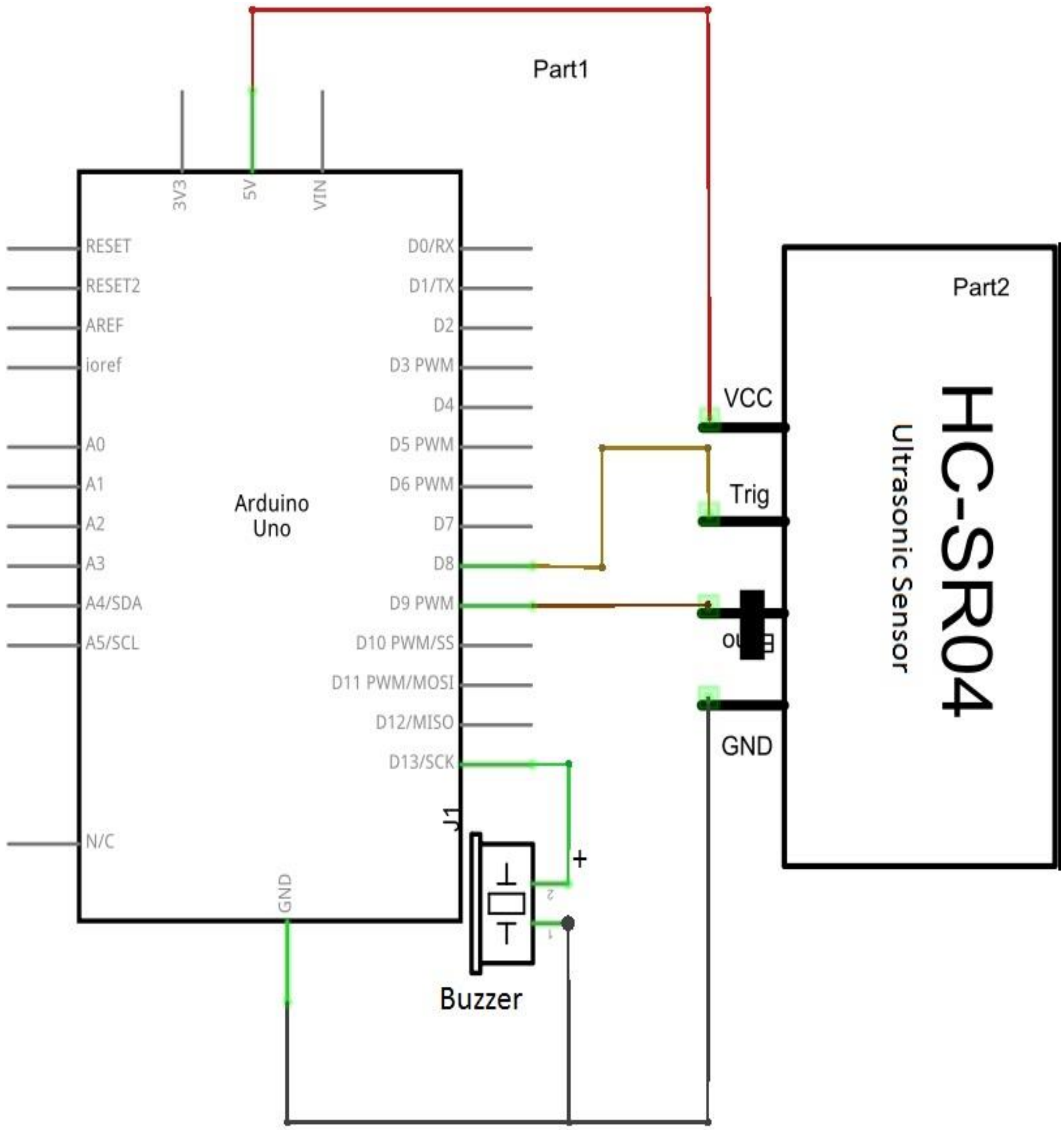

Fig. 7.2 Schematic Circuit Diagram using Arduino UNO

7.5 TIMING DIAGRAM

The Timing diagram is shown below. You only need to supply a short 10uSpulse to the trigger input to start the ranging, and then the module will send outan8-cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion. You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula: uS / 58 = centimeters or uS / 148 =inch; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60msmeasurement cycle, in order to prevent trigger signal to the echo signal.

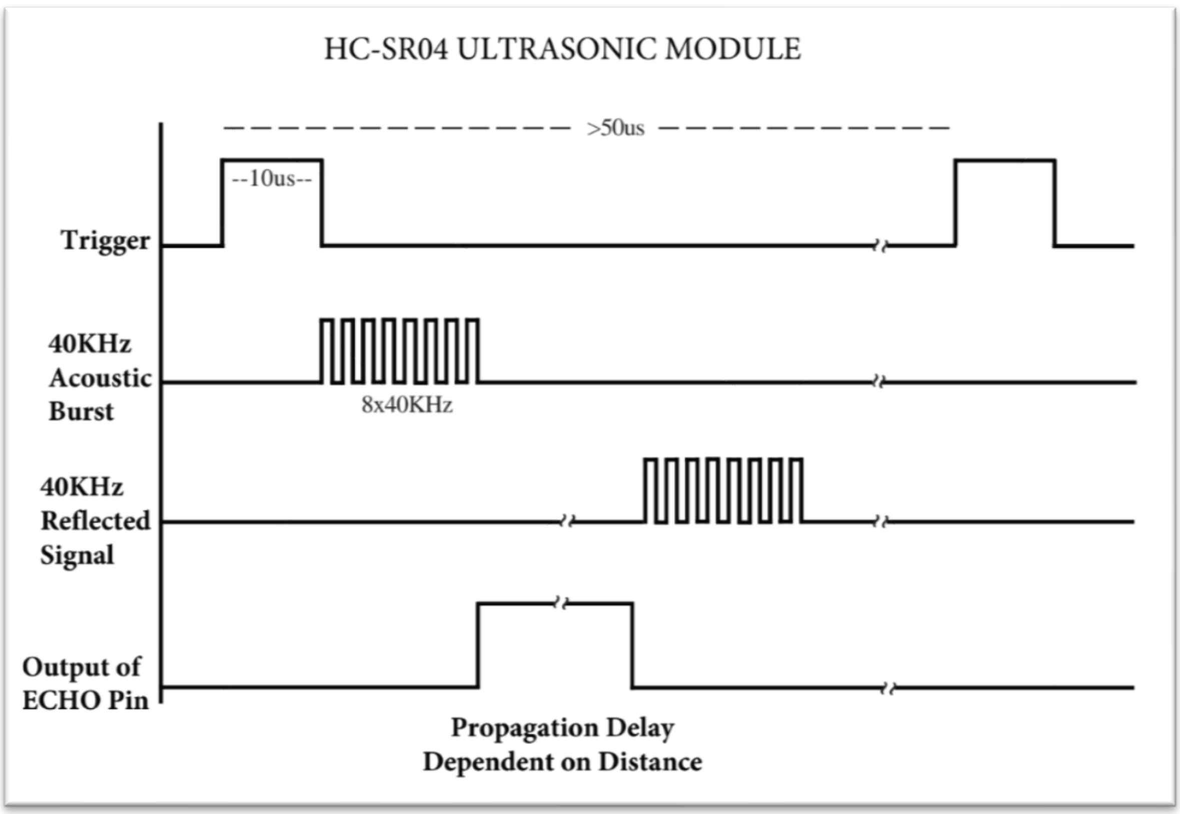

Fig. 7.3 Timing Diagram of Ultrasonic Module.

7.6 BASIC WORKING PRINCIPLE

It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

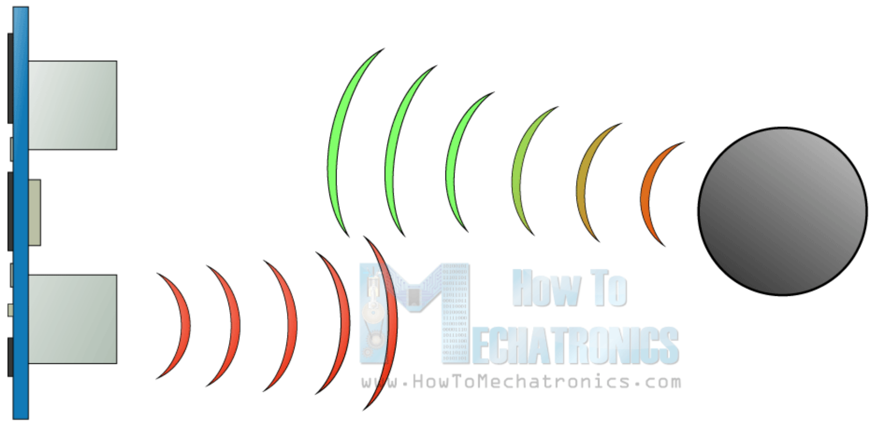

Fig. 7.4 (a) Working of Ultrasonic

For example, if the object is 10 cm away from the sensor, and the speed of the sound is 340 m/s or 0.034 cm/µs the sound wave will need to travel about 294 u seconds. But what you will get from the Echo pin will be double that number because the sound wave needs to travel forward and bounce backward. So, in order to get the distance in cm we need to multiply the received travel time value from the echo pin by 0.034 and divide it by 2.

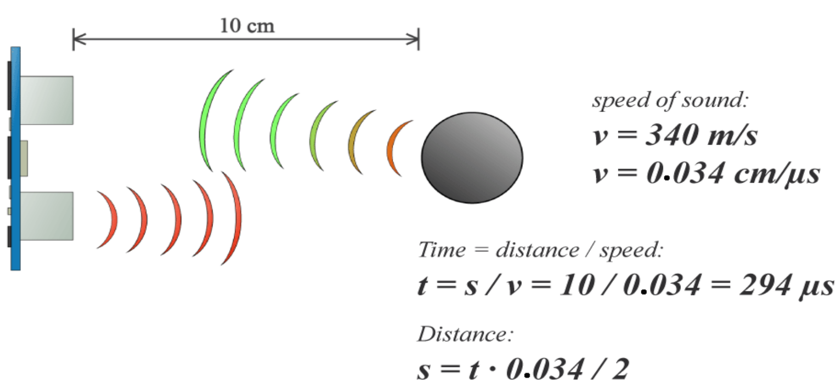

Fig. 7.4 (b) Working of Ultrasonic

7.7 ADVANTAGES

This system might have many advantages such as,

•Use the knows the distance about following vehicle

• In future, we are going to reduce the speed of one vehicle according to the following distance of another vehicle.

By this system, we may prevent many accidents and INDIA will become an accident less country.

CHAPTER 8.
GPS MODULE

8.1 INTRODUCTION

The **Global Positioning System** (**GPS**), originally **Navstar GPS**, is a satellite-based radio navigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geolocation and time information to a GPS Receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Obstacles such as mountains and buildings block the relatively weak GPS signals.

The GPS does not require the user to transmit any data, and it operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. The GPS provides critical positioning capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS Receiver

The GPS project was launched by the U. S. Department of Defence in 1973 for use by the United States military and became fully operational in 1995. It was allowed for civilian use in the 1980s. Advances in technology and new demands on the existing system have now led to efforts to modernize the GPS and implement the next generation of GPS Block IIIA satellites and Next Generation Operational Control System (OCX).

A **GPS navigation device**, **GPS receiver**, or simply **GPS** is a device that is capable of receiving information from GPs Satellites and then to calculate the device's geographical position. Using suitable software, the device may display the position on a map, and it may offer direction.

8.2 HISTORY

The GPS project was launched in the United States in 1973 to overcome the limitations of previous navigation systems,[11] integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. The U. S. Department of Defence developed the system, which originally used 24 satellites. It was initially developed for use by the United States military and became fully operational in 1995. Civilian use was allowed from the 1980s. Roger L. Easton of the Naval Research Academy, Ivan A. Getting of The Aerospace Corporation, and Bradford Parkinson of the Applied Physics Laboratory are credited with inventing it.

The design of GPS is based partly on similar ground-based radio navigation systems, such as LORAN and the Decca Navigator, developed in the early 1940s.

8.3 SEGMENTS IN GPS

1. Space Segment – The Space Segment consists of a nominal constellation of 24 operating satellites that transmit one-way signals that give the current GPS satellite position and time.

2. Control Segment – The Control Segment consists of worldwide monitor and control stations that maintain the satellites in their proper orbit through occasional commands and clocks. It tracks the status of the GPS data and checks whether all the sub-stations are working properly.

3. User Segment – The User Segment consists of the GPS receiver equipment, which receives the signal from the satellite and uses the transmitted information for calculating the three-dimensional position and time of the object.

8.4 BLOCK DIAGRAM

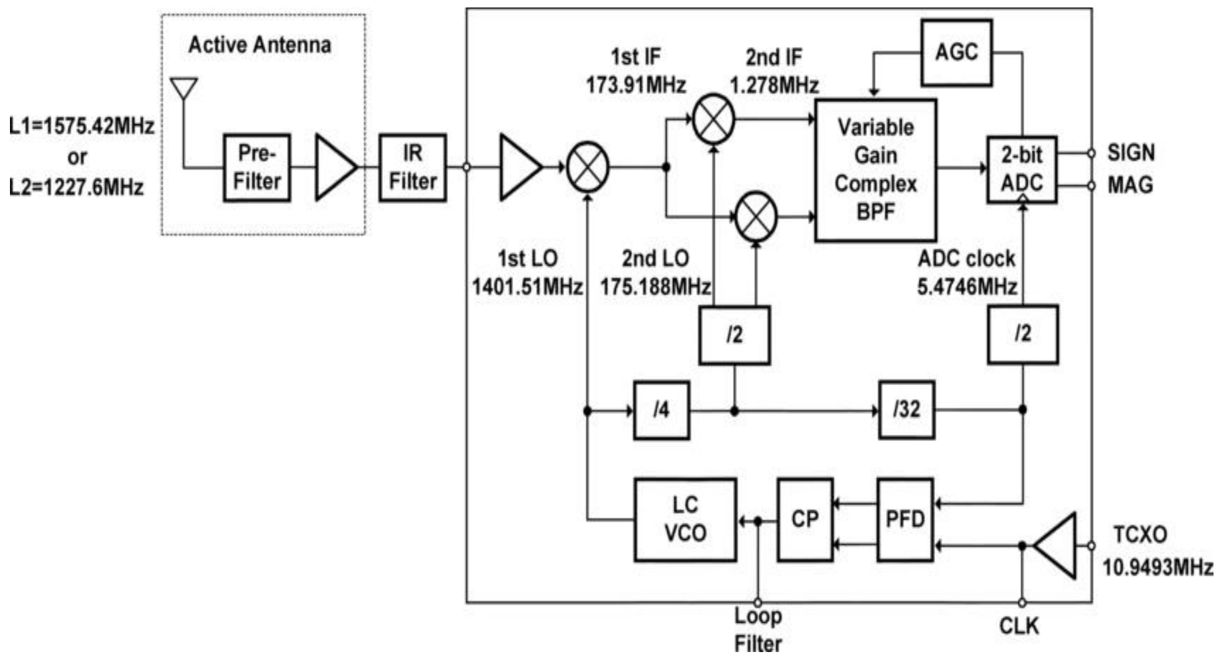

Fig. 8.1 Block Diagram of GPS System

8.5 APPLICATION OF GPS SYSTEM

- Dedicated GPS navigation devices
- GPS modules that need to be connected to a computer to be used

- GPS loggers that record trip information for download. Such GPS tracking is useful for trailblazing, mapping by hikers and cyclists, and the production of geocoded photographs .
- Converged devices, including GPS Phones and GPS camera, in which GPS is a feature rather than the main purpose of the device. The majority of GPS devices are now converged devices and may use assisted GPS or standalone (not network dependent) or both. The vulnerability of consumer GPS to radio frequency interference from planned wireless data service is controversial.

8.6 DEDICATED GPS NAVIGATION DEVICES

Dedicated devices have various degrees of mobility. *Hand-held*, *outdoor*, or *sport* receivers have replaceable batteries that can run them for several hours, making them suitable for hiking, bicycle touring and other activities far from an electric power source. Their screens are small, and some do not show color, in part to save power. Some use translative liquid crystal display, allowing use in bright sunlight. Cases are rugged, and some are water resistant.

Other receivers, often called *mobile* are intended primarily for use in a car but have a small rechargeable internal battery that can power them for an hour or two away from the car. Special purpose devices for use in a car may be permanently installed and depend entirely on the automotive electrical system.

8.7 MOBILE PHONES WITH GPS CAPABILITY

Due in part to regulations encouraging mobile phone tracking, including E911, most GPS receivers are built into mobile telephones, with varying degrees of coverage and user accessibility. Commercial navigation software is available for most 21st-century smartphones as well[l] as some Java-enabled phones that allows them to use an internal or external GPS receiver (in the latter case, connecting via serial/ Bluetooth). Some phones using assisted GPS (A-GPS) function poorly when out of range of their carrier's cell towers. Others can navigate worldwide with satellite GPS signals as well as a dedicated portable GPS receiver does, upgrading their operation to A-GPS mode when in range. Still others have a hybrid positioning system that can use other signals when GPS signals are inadequate.

More bespoke solutions also exist for smartphones with inbuilt GPS capabilities. Some such phones can use tethering to double as a wireless modem for a laptop, while allowing GPS-navigation/localization as well. One such example is marketed by Verizon Wireless in the U.S. and is called VZ Navigator. The system uses GPS1 technology to determine the location, and then uses the mobile phone's data connection to download maps and calculate navigational routes. Other products including iPhone are used to provide similar services. Nokia gives HERE Maps free on mobile operating systems: Windows Phone 8, Android, Sailfish OS and Firefox OS, but excluding iOS. Maps can be preloaded onto the device.

8.8 GPS MODULE

The NEO-6 module series is 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. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. The 50-channel u-blox 6 positioning engine boasts a Time-To-First-Fix0(TTFF) of under 1 second. The dedicated acquisition engine, with 2 million correlators, is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses jamming sources and mitigates multipath effects, giving NEO-6 GPS receivers excellent navigation performance even in the most challenging environments.

Fig. 8.2 GPS Module

8.8.1 SPECIFICATIONS

1.**Supply Voltage**:2.7 to 3.6V
2.**Supply current**:67 mA
3.**Antenna gain**:50 dB
4.**Operating temperature:** -40 to 85°C
5.**Antenna Type:** Passive and active antenna
6.**Interfaces**: UART, USB, SPI, DDC
7.**Sensitivity-**

- **Tracking & Navigation:** -160 dBm
- **Reacquisition: -**160 dBm
- **Cold Start (Autonomous): -**146 dBm

8.8.2 PIN DESCRIPTION

Vcc-Supply Voltage
Gnd-Ground pin
TX and RX-These 2 pins acts as an UART interface for communication.

8.8.3 HARDWARE AND SOFTWARE REQUIRED

- NEO6MV2 GPS Module
- Arduino UNO
- Arduino IDE(1.0.6V)

8.8.4 HARDWARE CONNECTIONS

The connections are made as follows:

- Vcc to 3.3V
- Gnd to Gnd
- TX to Digital pin 11
- RX to Digital pin 1

CHAPTER
9.
GSM MODULE

9.1 GSM HISTORY

The acronym for GSM is Global System for Mobile Communications. During the early 1980s, analog cellular telephone systems were experiencing rapid growth in Europe, particularly in Scandinavia and the United Kingdom, but also in France and Germany. Each country developed its own system, which was incompatible with everyone else's in equipment and operation. This was an undesirable situation, because not only was the mobile equipment limited to operation within national boundaries, which in a unified Europe were increasingly unimportant, but there was also a very limited market for each type of equipment, so economies of scale and the subsequent savings could not be realized.

The Europeans realized this early on, and in 1982 the Conference of European Posts and Telegraphs (CEPT) formed a study group called the Groupe Special Mobile (GSM) to study and develop a pan-European public land mobile system. The proposed system had to meet certain criteria:

Good subjective speech quality
Low terminal and service cost
 Ability to support handheld terminals
 Support for range of new services and facilities
 Spectral efficiency
ISDN compatibility

 Pan-European means European-wide. ISDN throughput at 64Kbs was never envisioned, indeed, the highest rate a normal GSM network can achieve is 9.6kbs.

In 1989, GSM responsibility was transferred to the European Telecommunication Standards Institute (ETSI), and phase I of the GSM specifications were published in 1990. Commercial service was started in mid-1991, and by 1993 there were 36 GSM networks in 22 countries. Although standardized in Europe, GSM is not only a European standard. Over 200 GSM networks (including DCS1800 and PCS1900) are operational in 110 countries around the world. In the beginning of 1994, there were 1.3 million subscribers worldwide, which had grown to more than 55 million by October 1997. With North America making a delayed entry into the GSM field with a derivative of GSM called PCS1900, GSM systems exist on every continent, and the acronym GSM now aptly stands for Global System for Mobile communications.

The developers of GSM chose an unproven (at the time) digital system, as opposed to the then-standard analog cellular systems like AMPS in the United States and TACS in the United Kingdom. They had faith that advancements in compression algorithms and digital signal processors Would allow the fulfillment of the original criteria and the continual improvement of the system in terms of quality and cost. The over 8000 pages of GSM recommendations try to allow flexibility and competitive innovation among suppliers but provide enough standardization to guarantee proper networking between the components of the system. This is done by providing functional and interface descriptions for each of the functional entities defined in the system.

9.2 SERVICES PROVIDED BY GSM

From the beginning, the planners of GSM wanted ISDN compatibility in terms of the services offered and the control signaling used. However, radio transmission limitations, in terms of bandwidth and cost, do not allow the standard ISDN B-channel bit rate of 64 kbps to be practically achieved.

Telecommunication services can be divided into bearer services, teleservices, and supplementary services. The most basic teleservice supported by GSM is telephony. As with all other communications, speech is digitally encoded and transmitted through the GSM network as a digital stream. There is also an emergency service, where the nearest emergency-service provider is notified by dialing three digits.

a) Bearer services: Typically, data transmission instead of voice. Fax and SMS are examples.

b) Teleservices: Voice oriented traffic.

c) Supplementary services: Call forwarding, caller ID, call waiting and the like.

A variety of data services is offered. GSM users can send and receive data, at rates up to 9600 bps, to users on POTS (Plain Old Telephone Service), ISDN, Packet Switched Public Data Networks, and Circuit Switched Public
Data Networks using a variety of access methods and protocols, such as X.25 or X.32. Since GSM is a digital network, a modem is not required between the user and GSM network, although an audio modem is required inside the GSM network to interwork with POTS.

Other data services include Group 3 facsimile, as described in ITU-T recommendation T.30, which is supported by use of an appropriate fax adaptor. A unique feature of GSM, not found in older analog systems, is the Short Message Service (SMS). SMS is a bidirectional service for short alphanumeric (up to 160 bytes) messages. Messages are transported in a store-and-forward fashion. For point-to-point SMS, a message can be sent to another subscriber to the service, and an acknowledgement of receipt is provided to the sender. SMS can also be used in a cell-broadcast mode, for sending messages such as traffic updates or news updates. Messages can also be stored in the SIM card for later retrieval.

Supplementary services are provided on top of teleservices or bearer services. In the current (Phase I) specifications, they include several forms of call forward (such as call forwarding when the mobile subscriber is unreachable by the network), and call barring of outgoing or incoming calls, for example when roaming in another country. Many additional supplementary services will be provided in the Phase 2 specifications, such as caller identification, call waiting, multi-party conversations.

9.3 MOBILE STATION

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive calls at that terminal, make calls from that terminal, and receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication, and other information. The IMEI and the IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

GSM phones use SIM cards, or Subscriber information or identity modules. They're the biggest difference a user sees between a GSM phone or handset and a conventional cellular telephone. With the SIM card and its memory, the GSM handset is a smart phone, doing many things a conventional cellular telephone cannot. Like keeping a built-in phone book or allowing different ring tones to be downloaded and then stored. Conventional cellular telephones either lack the features GSM phones have built in, or they must rely on resources from the cellular system itself to provide them. Let me make another, important point.

With a SIM card your account can be shared from mobile to mobile, at least in theory. Want to try out your neighbor's brand-new mobile? You should be able to put your SIM card into that GSM handset and have it work. The GSM network cares only that a valid account exists, not that you are using a different device. You get billed, not the neighbor who loaned you the phone.

This flexibility is completely different than AMPS technology, which enables one device per account. No switching around. Conventional cellular telephones have their electronic serial number burned into a chipset which is permanently attached to the phone. No way to change out that chipset or trade with another phone. SIM card technology, by comparison, is meant to make sharing phones and other GSM devices quick and easy.

Fig. 9.1 Mobile Station SIM Port

On the left above: Front of a Pacific Bell GSM phone.

In the middle above: Same phone, showing the back. The SIM card is the white plastic square. It fits into the grey colored holder next to it.

On the right above: A new and different idea, a holder for two SIM cards, allowing one phone to access either of two wireless carriers. Provided you have an account with both. The SIM card is to the left of the body.

9.4 BASE STATION SUBSYSTEM:

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the standardized Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers.

The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio-link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed, thus the requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

Fig. 9.2 Base Station Subsystem.

The BTS or Base Transceiver Station is also called an RBS or Remote Base station. Whatever the name, this is the radio gear that passes all calls coming in and going out of a cell site. The base station is under direction of a base station controller so traffic gets sent there first. The base station controller, described below, gathers the calls from many base stations and passes them on to a mobile telephone switch. From that switch come and go the calls from the regular telephone network. Some base stations are quite small; the one pictured here is a large outdoor unit. The large number of base stations and their attendant controllers are a big difference between GSM and IS-136.

9.4.1 BASE STATION CONTROLLER

The Base Station Controller manages the radio resources for one or more BTSs. It handles radio-channel setup, frequency hopping, and handovers, as described below. The BSC is the connection between the mobile station and the Mobile service Switching Center (MSC).

Another difference between conventional cellular and GSM is the base station controller. It's an intermediate step between the base station transceiver and the mobile switch. GSM designers thought this a better approach for high density cellular networks. As one anonymous writer penned, "If every base station talked directly to the MSC, traffic would become too congested. To ensure quality communications via traffic management, the wireless infrastructure network uses Base Station Controllers as a way to segment the network and control congestion. The result is that MSCs route their circuits to BSCs which in turn are responsible for connectivity and routing of calls for 50 to 100 wireless base stations."

Fig. 9.3 Siemens BSC

Many GSM descriptions picture equipment called a TRAU, which stands for Transcoding Rate and Adaptation Unit. Of course, also known as a Trans-Coding Unit or TCU, the TRAU is a compressor and converter. It first compresses traffic coming from the mobiles through the base station controllers. That's quite an achievement because voice and data have already been compressed by the voice coders in the handset. Anyway, it crunches that data down even further. It then puts the traffic into a format the Mobile Switch can understand. This is the Trans-Coding part of its name, where code in one format is converted to another. The TRAU is not required but apparently it saves quite a bit of money to install one.

Here's how Nortel Networks sells their unit: “Reduce transmission resources and realize up to 75% transmission cost savings with the TCU."

"The Trans-Coding Unit (TCU), inserted between the BSC and MSC, enables speech compression and data rate adaptation within the radio cellular network. The TCU is designed to reduce transmission costs by minimizing transmission resources between the BSC and MSC. This is achieved by reducing the number of PCM links going to the BSC, since four traffic channels (data or speech) can be handled by one PCM time slot. Additionally, the modular architecture of the TCU supports all three GSM vocoders (Full Rate, Enhanced Full Rate, and Half Rate) in the same cabinet, providing you with a complete range of deployment options."

Fig. 9.4 Siemens' TRAU

Voice coders or vocoders are built into the handsets a cellular carrier distributes. They're the circuitry that turns speech into digital. The carrier specifies which rate they want traffic compressed, either a great deal or just a little. The cellular system is designed this way, with handset vocoders working in league with the equipment of the base station subsystem.

9.5 ARCHITECTURE OF THE GSM NETWORK

A GSM network is composed of several functional entities, whose functions and interfaces are specified. Figure 1 shows the layout of a generic GSM network. The GSM network can be divided into three broad parts. The Mobile Station is carried by the subscriber. The Base Station Subsystem controls the radio link with the Mobile Station. The Network Subsystem, the main part of which is the Mobile services Switching Center (MSC), performs the switching of calls between the mobile users, and between mobile and fixed network users. The MSC also handles the mobility management operations. Not shown is the Operations and Maintenance Center, which oversees the proper operation and setup of the network. The Mobile Station and the Base Station Subsystem communicate across the Um interface, also known as the air interface or radio link. The Base Station Subsystem communicates with the Mobile services Switching Center across the A interface.

As John states, he presents a generic GSM architecture. Lucent, Ericsson, Nokia, and others feature their own vision in their own diagrams.

Lucent GSM architecture Ericsson GSM architecture Nokia GSM architecture Siemens's GSM architecture.

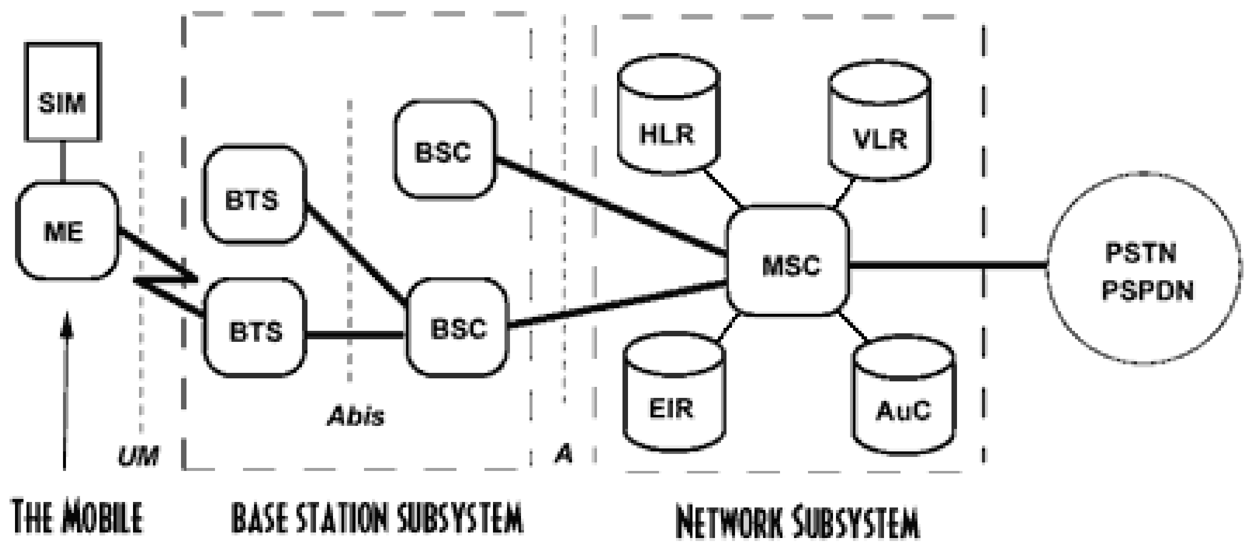

Fig. 7.5 General Architecture of a GSM network

9.6 RADIO LINK ASPECTS

The International Telecommunication Union (ITU), which manages the international allocation of radio spectrum (among many other functions), allocated the bands 890-915 MHz for the uplink (mobile station to base station) and 935-960 MHz for the downlink (base station to mobile station) for mobile networks in Europe. Since this range was already being used in the early 1980s by the analog systems of the day, the CEPT had the foresight to reserve the top 10 MHz of each band for the GSM network that was still being developed. Eventually, GSM will be allocated the entire 2x25 MHz bandwidth.

9.7 MULTIPLE ACCESS AND CHANNEL STRUCTURE:

Since radio spectrum is a limited resource shared by all users, a method must be devised to divide up the bandwidth among as many users as possible. The method chosen by GSM is a combination of Time- and Frequency-Division Multiple Access (TDMA/FDMA). The FDMA part involves the division by frequency of the (maximum) 25 MHz bandwidth into 124 carrier frequencies spaced 200 kHz apart. One or more carrier frequencies are assigned to each base station. Each of these carrier frequencies is then divided in time, using a TDMA scheme. The fundamental unit of time in this TDMA scheme is called a burst period and it lasts 15/26 ms (or approx. 0.577 ms). Eight burst periods are grouped into a TDMA frame (120/26 ms, or approx. 4.615 ms), which forms the basic unit for the definition of logical channels. One physical channel is one burst period per TDMA frame.

i) Traffic channels

A traffic channel (TCH) is used to carry speech and data traffic. Traffic channels are defined using a 26-frame multi-frame, or group of 26 TDMA frames. The length of a 26-frame multi-frame is 120 ms, which is how the length of a burst period is defined (120 ms divided by 26 frames divided by 8 burst periods per frame). Out of the 26 frames, 24 are used for traffic, 1 is used for the Slow Associated Control Channel (SACCH) and 1 is currently unused (see Figure 2). TCHs for the uplink and downlink are separated in time by 3 burst periods, so that the mobile station does not have to transmit and receive simultaneously, thus simplifying the electronics.

ii) Control channels

Common channels can be accessed both by idle mode and dedicated mode mobiles. The common channels are used by idle mode mobiles to exchange the signaling information required to change to dedicated mode. Mobiles already in dedicated mode monitor the surrounding base stations for handover and other information. Dedicated mode means a mobile is in use.

9.8 FREQUENCY HOPPING

The mobile station already has to be frequency agile, meaning it can move between a transmit/ receive, and monitor time slot within one TDMA frame, which normally are on different frequencies. GSM makes use of this inherent frequency agility to implement slow frequency hopping, where the mobile and BTS transmit each TDMA frame on a different carrier frequency. The frequency hopping algorithm is broadcast on the Broadcast

Control Channel. Since multipath fading is dependent on carrier frequency, slow frequency hopping helps alleviate the problem. In addition, co-channel interference is in effect randomized.
Here's a huge difference between conventional cellular (IS-136) and GSM: frequency hopping. When enabled, slots within frames can leapfrog from one frequency to another. In IS-136, by comparison, once assigned a channel your call stays on that pair of radio frequencies until the call is over or you have moved to another cell.

9.9 DISCONTINUOUS RECEPTION

Another method used to conserve power at the mobile station is discontinuous reception. The paging channel, used by the base station to signal an incoming call, is structured into sub-channels. Each mobile station needs to listen only to its own sub-channel. In the time between successive paging sub-channels, the mobile can go into sleep mode, when almost no power is used.

9.10 POWER CONTROL

There are five classes of mobile stations defined, according to their peak transmitter power, rated at 20, 8, 5, 2, and 0.8 watts. To minimize co-channel interference and to conserve power, both the mobiles and the Base Transceiver Stations operate at the lowest power level that will maintain an acceptable signal quality. Power levels can be stepped up or down in steps of 2 dB from the peak power for the class down to a minimum of 13 dBm (20 mill watts).

We need only enough power to make a connection. Any more is superfluous. If you can't make a connection using one watt then two watts won't help at these near microwave frequencies. Using less power means less interference or congestion among all the mobiles in a cell.
The mobile station measures the signal strength or signal quality (based on the Bit Error Ratio), and passes the information to the Base Station Controller, which ultimately decides if and when the power level should be changed. Power control should be handled carefully, since there is the possibility of instability. This arises from having mobiles in co-channel cells alternating increase their power in response to increased co-channel interference caused by the other mobile increasing its power. This in unlikely to occur in practice but it is (or was as of 1991) under study.

Two points: The first is that the base station can reach out to the mobile and turn down the transmitting power the handset is using, Very cool. The second point is that a digital signal will drop a call much more quickly than an analog signal. With an analog radio you can hear through static and fading. But with a digital radio the connection will be dropped, just like your landline modem, when too many 0s and 1s go missing. You need more base stations, consequently, to provide the same coverage as analog.

9.11 NETWORK ASPECTS

Ensuring the transmission of voice or data of a given quality over the radio link is only part of the function of a cellular mobile network. A GSM mobile can seamlessly roam nationally and internationally, which requires that registration, authentication, call routing and location updating functions exist and are standardized in GSM networks. In addition, the fact that the geographical area covered by the network is divided into cells necessitates the implementation of a handover mechanism. These functions are performed by the Network Subsystem, mainly using the Mobile Application Part (MAP) built on top of the Signaling.

The signaling protocol in GSM is structured into three general layers [119LAPD protocol used in ISDN (external link)], depending on the interface, as shown in Figure 3. Layer 1 is the physical layer, which uses the channel structures discussed above over the air interface. Layer 2 is the data link layer. Across the Um interface, the data link layer is a modified version of the, called LAPDm. Across the A interface, the Message Transfer Part layer 2 of Signaling System Number 7 is used. Layer 3 of the GSM signaling protocol is itself divided into 3 sub layers.

- Radio Resources Management
- Controls the setup, maintenance, and termination of radio and fixed channels,
- Including handovers.
- Mobility Management
- Manages the location updating and registration procedures, as well as security and authentication.
- Connection Management
- Handles general call control, similar to CCITT Recommendation Q.931, and manages Supplementary Services and the Short Message Service.

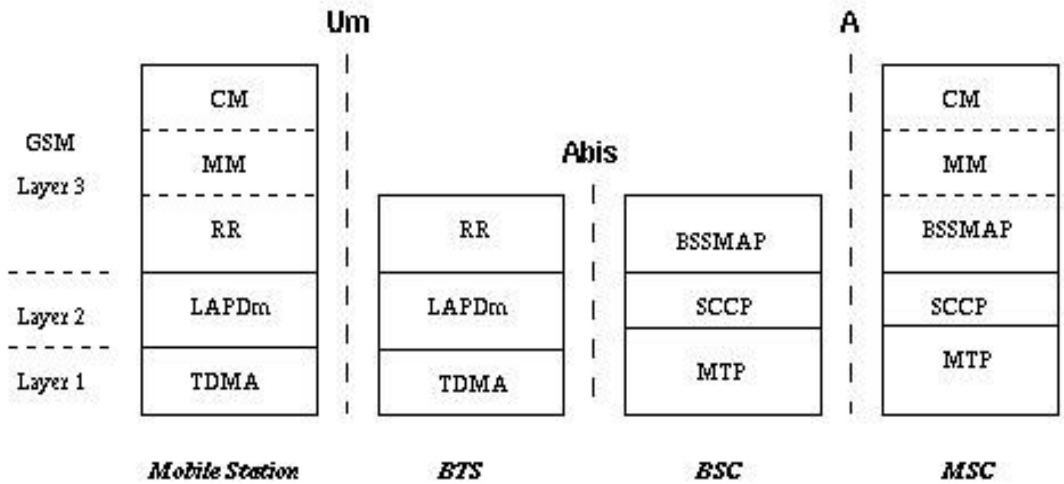

Fig. 9.6 Signaling Protocol Structure in GSM

9.12 RADIO RESOURCES MANAGEMENT

The radio resources management (RR) layer oversees the establishment of a link, both radio and fixed, between the mobile station and the MSC. The main functional components involved are the mobile station, and the Base Station Subsystem, as well as the MSC. The RR layer is concerned with the management of an RR-session [16], which is the time that a mobile is in dedicated mode, as well as the configuration of radio channels including the allocation of dedicated channels.

An RR-session is always initiated by a mobile station through the access procedure, either for an outgoing call, or in response to a paging message. The details of the access and paging procedures, such as when a dedicated channel is actually assigned to the mobile, and the paging sub-channel structure, are handled in the RR layer. In addition, it handles the management of radio features such as power control, discontinuous transmission and reception, and timing advance.

9.13 HANDOVER

In a cellular network, the radio and fixed links required are not permanently allocated for the duration of a call. Handover, or handoff as it is called in North America, is the switching of an on-going call to a different channel or cell. The execution and measurements required for handover form one of basic functions of the RR layer.

There are four different types of handover in the GSM system, which involve transferring a call between:

- Channels (time slots) in the same cell
- Cells (Base Transceiver Stations) under the control of the same Base Station Controller (BSC),
- Cells under the control of different BSCs, but belonging to the same Mobile services Switching Center (MSC), and
- Cells under the control of different MSCs.

The first two types of handover, called internal handovers, involve only one Base Station Controller (BSC). To save signaling bandwidth, they are managed by the BSC without involving the Mobile services Switching Center (MSC), except to notify it at the completion of the handover. The last two types of handover, called external handovers, are handled by the MSCs involved. An important aspect of GSM is that the original MSC, the anchor MSC, remains responsible for most call-related functions, with the exception of subsequent inter-BSC handovers under the control of the new MSC, called the relay MSC.

Handovers can be initiated by either the mobile or the MSC (as a means of traffic load balancing). During its idle time slots, the mobile scans the Broadcast Control Channel of up to 16 neighboring cells and forms a list of the six best candidates for possible handover, based on the received signal strength. This information is passed to the BSC and MSC, at least once per second, and is used by the handover algorithm.

The algorithm, for when a hand over decision should be taken is not specified in the GSM recommendations. There are two basic algorithms used, both closely tied in with power control. This is because the BSC usually does not know whether the poor signal quality is due to multipath fading or to the mobile having moved to another cell. This is especially true in small urban cells.

The 'minimum acceptable performance' algorithm gives precedence to power control over handover, so that when the signal degrades beyond a certain point, the power level of the mobile is increased. If further power increases do not improve the signal, then a handover is considered. This is the simpler and more common method, but it creates 'smeared' cell boundaries when a mobile transmitting at peak power goes some distance beyond its original cell boundaries into another cell.

The 'power budget' method uses handover to try to maintain or improve a certain level of signal quality at the same or lower power level. It thus gives precedence to handover over power control. It avoids the 'smeared' cell boundary problem and reduces co-channel interference, but it is quite complicated.

9.14 MOBILITY MANAGEMENT

The Mobility Management layer (MM) is built on top of the RR layer (radio resources) and handles the functions that arise from the mobility of the subscriber, as well as the authentication and security aspects. Location management is concerned with the procedures that enable the system to know the current location of a powered-on mobile station so that incoming call routing can be completed.

9.15 LOCATION UPDATING

A powered-on mobile is informed of an incoming call by a paging message sent over the PAGCH channel of a cell. One extreme would be to page every cell in the network for each call, which is obviously a waste of radio bandwidth. The other extreme would be for the mobile to notify the system, via location updating messages, of its current location at the individual cell level. This would require paging messages to be sent to exactly one cell but would be very wasteful due to the large number of location updating messages. A compromise solution used in GSM is to group cells into location areas. Updating messages are required when moving between location areas, and mobile stations are paged in the cells of their current location area.

In conventional cellular location messages are sent to the exact cell a mobile is in.

To review, the VLR Data Base, or Visited or Visitor Location Register, contains all the data needed to communicate with the mobile switch. Levine says this data includes:

- Equipment identity and authentication-related data
- Last known Location Area (LA)
- Power Class and other physical attributes of the mobile or handset
- List of special services available to this subscriber
- More data entered while engaged in a Call
- Current cell
- Encryption keys

The location updating procedures, and subsequent call routing, use the MSC and two location registers: The Home Location Register (HLR) and the Visitor Location Register (VLR). When a mobile station is switched on in a new location area, or it moves to a new location area or different operator's PLMN, it must register with the network to indicate its current location. In the normal case, a location update message is sent to the new MSC/VLR, which records the location area information, and then sends the location information to the subscriber's HLR. The information sent to the HLR is normally the SS7 address of the new VLR, although it may be a routing number. The reason a routing number is not normally assigned, even though it would reduce signaling, is that there is only a limited number of routing numbers available in the new MSC/VLR and they are allocated on demand for incoming calls. If the subscriber is entitled to service, the HLR sends a subset of the subscriber information, needed for call control, to the new MSC/VLR, and sends a message to the old MSC/VLR to cancel the old registration.

A procedure related to location updating is the IMSI (International Mobile Subscriber Identity) attach and detach. A detach lets the network know that the mobile station is unreachable and avoids having to needlessly allocate channels and send paging messages. an attach is similar to a location update and informs the system that the mobile is reachable again. The activation of IMSI attach/detach is up to the operator on an individual cell basis.

9.16 AUTHENTICATION AND SECURITY

Since the radio medium can be accessed by anyone, authentication of users to prove that they are who they claim to be is a very important element of a mobile network. Authentication involves two functional entities, the SIM card in the mobile, and the Authentication Center (AUC). Each subscriber is given a secret key, one copy of which is stored in the SIM card and the other in the AUC. During authentication, the AUC generates a random number that it sends to the mobile. Both the mobile and the AUC then use the random number, in conjunction with the subscriber's secret key and a ciphering algorithm called A3, to generate a signed response (SRES) that is sent back to the AUC. If the number sent by the mobile is the same as the one calculated by the AUC, the subscriber is authenticated.

The same initial random number and subscriber key are also used to compute the ciphering key using an algorithm called A8. This ciphering key, together with the TDMA frame number, use the A5 algorithm to create a 114-bit sequence that is XORed with the 114 bits of a burst (the two 57-bit blocks). Enciphering is an option for the fairly paranoid, since the signal is already coded, interleaved, and transmitted in a TDMA manner, thus providing protection from all but the most persistent and dedicated eavesdroppers.

Another level of security is performed on the mobile equipment itself, as opposed to the mobile subscriber. As mentioned earlier, each GSM terminal is identified by a unique International Mobile Equipment Identity (IMEI) number. A list of IMEIs in the network is stored in the Equipment Identity Register (EIR).

The status returned in response to an IMEI query to the EIR is one of the followings:

White-listed: The terminal is allowed to connect to the network. **Grey-listed:** The terminal is under observation from the network for possible problems. **Black-listed:** The terminal has either been reported stolen or is not type approved (the correct type of terminal for a GSM network). The terminal is not allowed to connect to the network.

9.17 COMMUNICATION MANAGEMENT

The Communication Management layer (CM) is responsible for Call Control (CC), supplementary service management, and short message service management. Each of these may be considered as a separate sub layer within the CM layer. Call control attempts to follow the ISDN procedures specified in Q.931, although routing to a roaming mobile subscriber is obviously unique to GSM. Other functions of the CC sub layer include call establishment, selection of the type of service (including alternating between services during a call), and call release.

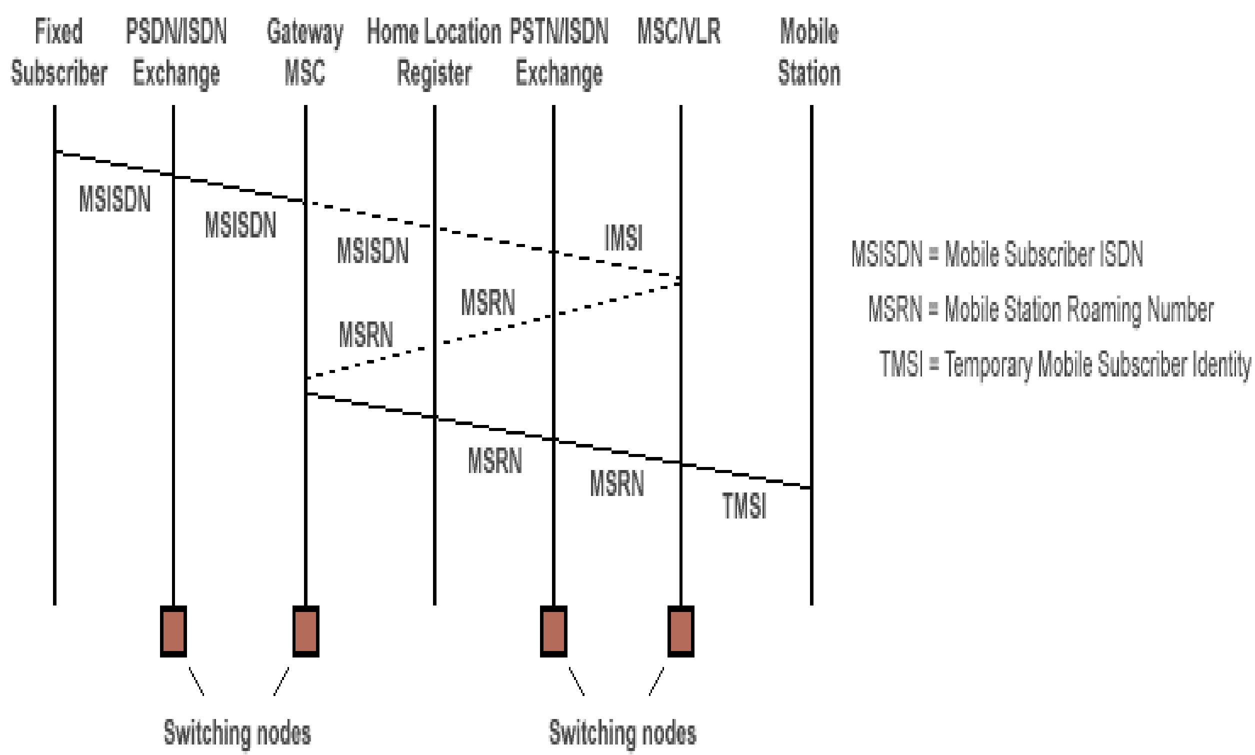

Fig. 9.6 Signaling protocol structure in GSM

9.18 CALL ROUTING

Unlike routing in the fixed network, where a terminal is semi-permanently wired to a central office, a GSM user can roam nationally and even internationally. (With, if needed, a properly enabled handset.) The directory number dialed to reach a mobile subscriber is called the Mobile

Subscriber ISDN (MSISDN), which is defined by the E.164 numbering plan. This number includes a country code and a National Destination Code which identifies the subscriber's operator. The first few digits of the remaining subscriber number may identify the subscriber's HLR within the home PLMN.

An incoming mobile terminating call is directed to the Gateway MSC (GMSC) function. The GMSC is basically a switch which is able to interrogate the subscriber's HLR to obtain routing information, and thus contains a table linking MSISDNs to their corresponding HLR. A simplification is to have a GSMC handle one specific PLMN. It should be noted that the GMSC function is distinct from the MSC function but is usually implemented in an MSC.

PLMN: Public land mobile network. In this context a cellular telephone network. PLMN is chiefly a European usage.

The routing information that is returned to the GMSC is the Mobile Station Roaming Number (MSRN), which is also defined by the E.164 numbering plan. MSRNs are related to the geographical numbering plan, and not assigned to subscribers, nor are they visible to subscribers.

The most general routing procedure begins with the GMSC querying the called subscriber's HLR for an MSRN. The HLR typically stores only the SS7 address of the subscriber's current VLR and does not have the MSRN (see the location updating section). The HLR must therefore query the subscriber's current VLR, which will temporarily allocate an MSRN from its pool for the call. This MSRN is returned to the HLR and back to the GMSC, which can then route the call to the new MSC. At the new MSC, the IMSI corresponding to the MSRN is looked up, and the mobile is paged in its current location area.

9.19 GSM MODULE (SIM 800)

9.19.1 OVERVIEW

Designed for global market, SIM800 is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 24*24*3mm, SIM800 can meet almost all the space requirements in users' applications, such as M2M, smart phone, PDA and other mobile devices.

SIM800 has 68 SMT pads and provides all hardware interfaces between the module and customers' boards.

- Support up to 5*5*2 Keypads.
- One full function UART port and can be configured to two independents serial ports.
- One USB port can be used as debugging and firmware upgrading.
- Audio channels which include a microphone input and a receiver output.
- Programmable general-purpose input and output.
- One SIM card interface.
- Support Bluetooth function.
- Support one PWM.
- PCM/SPI/SD card interface, only one function can be accessed synchronously. (default is PCM)

SIM800 is designed with power saving technique so that the current consumption is as low as 1.2mA in sleep
mode.

SIM800 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer.
applications. For details about TCP/IP applications,

Fig. 9.7 GSM Module

9.19.2 SIM800 KEY FEATURES

POWER SUPPLY:- 3.4V ~4.4V
Power saving Typical power consumption in sleep mode is 1.2mA (BS-PA-MFRMS=9)

FREQUENCY BANDS
 SIM800 Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900. SIM800 can search the 4 frequency bands automatically. The frequency bands also can be set by AT command “AT+CBAND”. For details, please refer to *document [1]*.
 Compliant to GSM Phase 2/2+
Transmitting power
 Class 4 (2W): GSM850, EGSM900
 Class 1 (1W): DCS1800, PCS1900
GPRS connectivity GPRS multi-slot class 12（default）
 GPRS multi-slot class 1~12 (option)
Temperature range Normal operation: -40°C ~ +85°C
 Storage temperature -45°C ~ +90°C

GPRS
 GPRS data downlink transfer: max. 85.6 kbps
 GPRS data uplink transfer: max. 85.6 kbps
 Coding scheme: CS-1, CS-2, CS-3 and CS-4
 PAP protocol for PPP connect
 Integrate the TCP/IP protocol.
 Support Packet Broadcast Control Channel (PBCCH) CSD
 Support CSD transmission
 CSD transmission rates:2.4,4.8,9.6,14.4 kbps
USSD Unstructured Supplementary Services Data (USSD) support

SMS
 MT, MO, CB, Text and PDU mode
 SMS storage: SIM card
SIM interface Support SIM card: 1.8V, 3V
Antenna Interface Antenna pad
Audio features

SPEECH CODEC MODES:
 Half Rate (ETS 06.20)
 Full Rate (ETS 06.10)
 Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80)

 Adaptive multi rate (AMR)
 Echo Cancellation
 Noise Suppression

SERIAL PORT:

 Full modem interface with status and control lines, unbalanced, asynchronous.
 1200bps to 460800bps
 Can be used for AT commands for data stream
 Support RTS/CTS hardware handshake and software ON/OFF flow control
 Multiplex ability according to GSM 07.10 Multiplexer Protocol
 Autobauding supports baud rate from 1200 bps to 115200bps

USB INTERFACE:

 Can be used as debugging and firmware upgrading
Phonebook
management
Support phonebook types: SM, FD, LD, RC, ON, MC
SIM application
toolkit
GSM 11.14 Release 99
Real time clock Support RTC
Alarm function Can be set by AT command.

PHYSICAL CHARACTERISTICS

Size:24*24*3mm
Weight:3.2g
Firmware upgrade Firmware upgrading by serial port or USB interface (recommend to use USB port)

9.19.3 SIM800 FUNCTIONAL DIAGRAM

The following figure shows a functional diagram of SIM800:
 GSM baseband engine
 PMU
 RF part
 Antenna interfaces
 Other interfaces

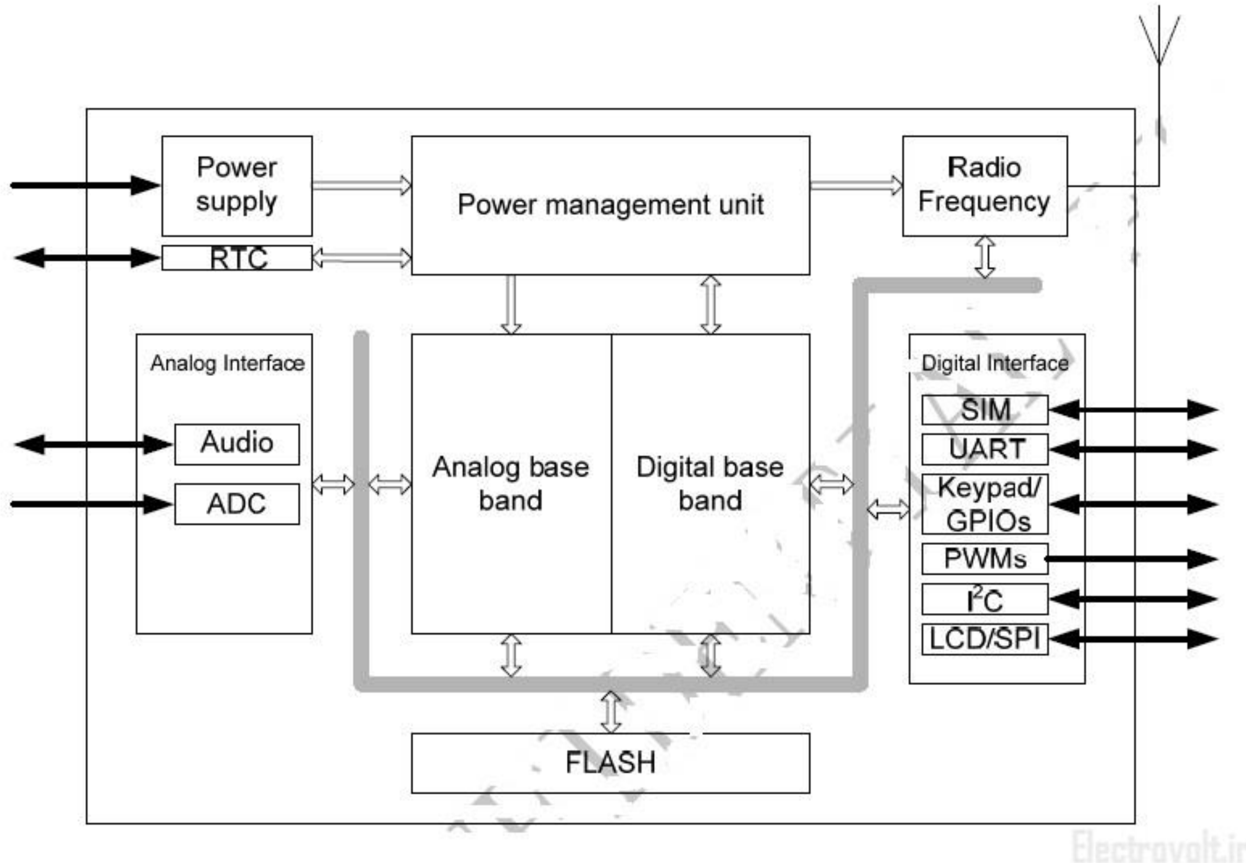

Fig. 9.8 Functional Diagram of GSM module SIM800

9.19.4 PINOUT DIAGRAM

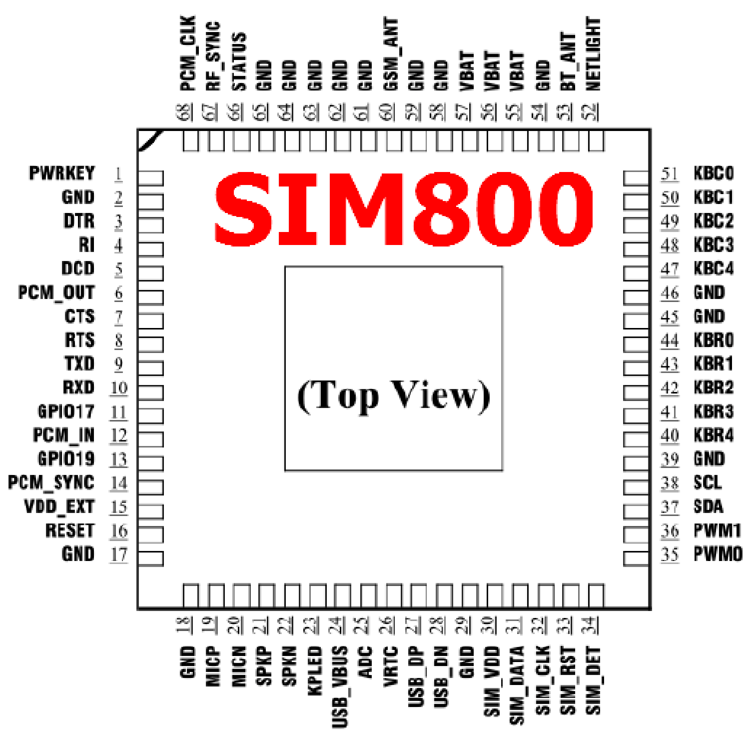

Fig. 9.9 PIN Diagram

CHAPTER 10.
ARDUINO UNO BASED ACCIDENT PREVENTION & DETECTION SYSTEM

10.1 INTRODUCTION

The project on Arduino UNO Based Accident Prevention and Detection System is a project which focuses on preventing the accidents and if any accident has occurred then sending its report to the Emergency Contact Nos. Our project is a prototype of the actual automobile which can make the transportation a safer way to travel. We have made use of Ultrasonic Sensors, Global Positioning System (GPS) Module, Global System for Mobile Communication (GSM) Module, Vibration Sensors and Arduino UNO board to synchronize all the components together.

The Ultrasonic Sensor senses a vehicle approaching from behind the vehicle and gives an alarm to be careful while changing lanes on highways, applying brakes, overtaking vehicles, etc. It has got a transmitter and a receiver which calculates the distance of the approaching vehicle. Unfortunately, if any accident has occurred then the Vibration Sensor will detect the accident and send the report to the Emergency Contact Nos. using the GPS Module and GSM Module along with the location's latitude and longitude.

The Prototype works on battery and is driven by a Bluetooth Module. The Bluetooth Module is connected with an Arduino UNO. The technique which we have used, can be implemented in the real world and become beneficial to the common public. This system can decrease the no. of casualties caused due these activities.

10.2 BLOCK DIAGRAM AND SCHEMATIC CIRCUIT

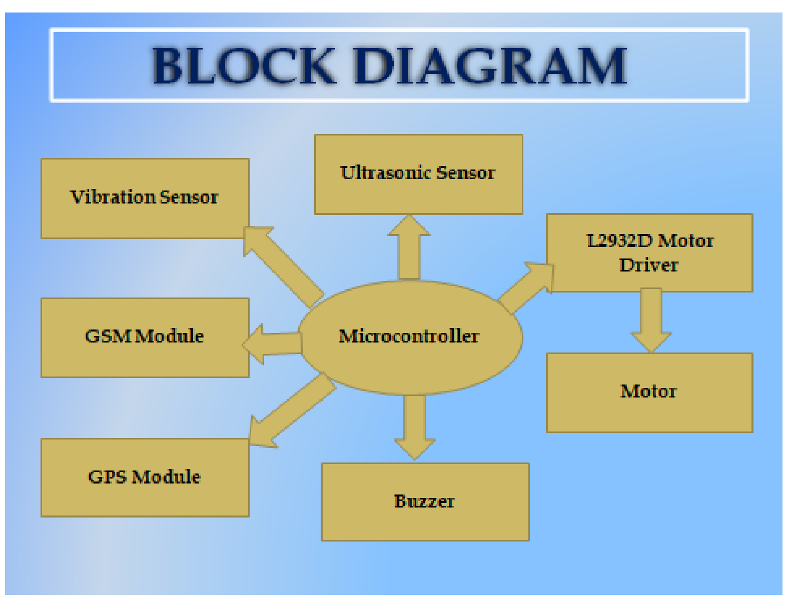

Fig. 10.1 Block Diagram of complete Project

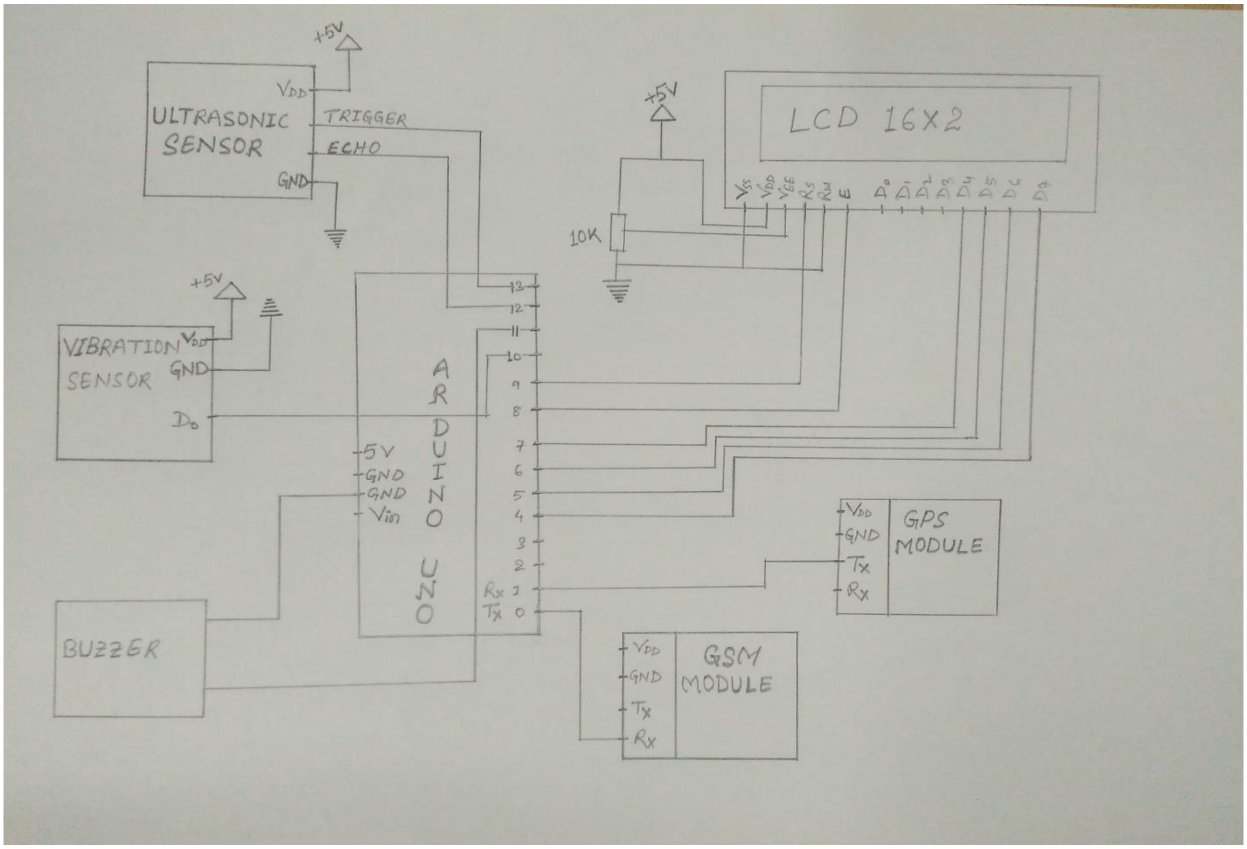

Fig. 10.2 Schematic Circuit

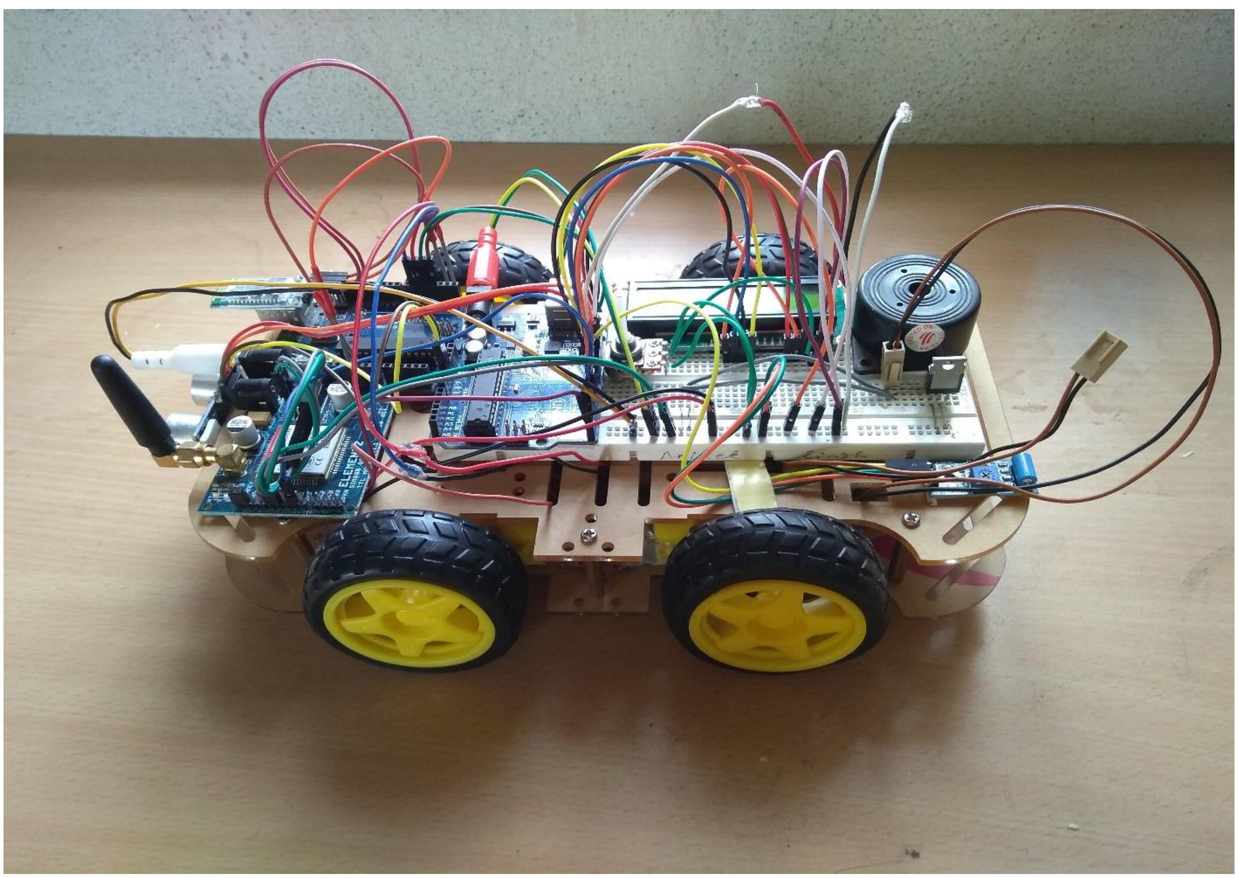

Fig. 10.3 Project Prototype

10.3 CIRCUIT EXPLANATION

Working: -

The **Ultrasonic Sensor** senses a vehicle approaching from behind the vehicle and gives an alarm to be Careful while changing lanes on highways, applying brakes, overtaking Vehicles, etc. It has got an Ultrasonic sound wave Transmitter and receiver which is used to calculate the distance of the Approaching vehicle. Unfortunately, if any accident has occurred then the Vibration Sensor will detect the accident and send the report to The Emergency Contact Nos. using the GPS Module and GSM Module along with the location's latitude and longitude. A LCD display is also attached with the circuit for showing the warning for the user. In Normal condition LCD will display the latitude, longitude and Distance safe. But in case of collision LCD Display will display the message "are you safe?????? Press Reset" if user will press the reset button then System will run normal condition otherwise it will wait for 10 secs then it will send an accident alert SMS with the location to the given phone number. And it Will hold the last latitude and longitude on display. In case some vehicle is approaching towards the User's vehicle from back side and if the distance between two objects will be less than 30 centimeters, then a warning message will have displayed on the LCD screen with the distance and buzzer will be activated.

Explanation: -

Whole system can be divided into 2 parts one is Vehicle Accident Alert System and another one is Collision Detection system.

Vehicle Accident Alert System: -

Circuit Connections of this **Vehicle Accident Alert System** is simple. Here TX pin of **GPS module** is directly Connected to RX pin of Arduino. By using default Serial pins here, we have allowed serial Communication on TX and RX pins of GPS and Arduino left the Rx pin of 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 supplies is used to power the GPS Module. **GSM module's** RX pin is directly connected to TX pin of Arduino. For GSM interfacing, here We have also used default serial pins. GSM module is also powered by 9v supply. An **optional LCD's** data pins D4, D5, D6, and D7 are connected to pin number 7, 6, 5 and 4 of Arduino. Command Pin RS and EN of LCD are connected with pin number 8 and 9 of Arduino and RW pin is directly Connected with ground. A Potentiometer is also used for setting contrast or brightness of LCD.

And another is A **vibration sensor** is added in this system for detecting an accident and its D0 output **Pin** is directly Connected to pin no 10 of Arduino Uno.

CHAPTER 11.

CONCLUSION & FUTURE SCOPE

11.1 CONCLUSION

The project on Arduino UNO Based Accident Prevention and Detection System is one of the very valuable projects considering the present-day scenario. The project includes the use of Ultrasonic sensors, Global Positioning System (GPS) Module, Global System for Mobile Communication (GSM) Module, Vibration Sensors which are synchronized using the Arduino Board.

In the past two decades, there has been a tremendous increase in the no. of automobile users and the world has also seen an increase in the no. of accidents. These are mainly caused due to carelessness, drunken driving, over speeding, etc. So, we need to implement some measures to make driving a safer mode of transportation.

The Ultrasonic Sensors detects any vehicle approaching from behind the automobile and alerts the driver when he changes lanes on highways, apply brakes or overtake other vehicles. The vibration sensor senses the occurrence of accident and then using the GPS Module and GSM Module sends the accident report to the Emergency Contact no. After any accident has occurred, the time taken for sending the information to the Ambulance or relatives or any Emergency no. will also be reduced by implementing our technique.

11.2 FUTURE SCOPE

In future we will be focusing on starting the automobile’s engine only after the driver of the vehicle has passed the alcohol test. We will be using a Alcohol/Gas Sensor. We will be using a drowsiness detector which will detect the blinking of eyes with the help of Camera module. This will enhance the safety of the people who are travelling. As our project is a prototype, in future we will implement this on an actual vehicle which will be helpful to the common man.

ANNEXURE-I

SOURCE CODES

```
#include <TinyGPS++.h>
#include<LiquidCrystal.h>
LiquidCrystal lcd(13,12,11,10,9);
double logitude;
double latitude;
int temp=0;
int vibration = 5;
int count=0;
int timesTosend = 4;
const int trigPin = 7;
const int echoPin = 8;
int buzzerPin = 6;
long int duration;
int distance;
TinyGPSPlus gps;
void setup()
{
  pinMode(trigPin,OUTPUT);
  pinMode(echoPin,INPUT);
  pinMode(buzzerPin,OUTPUT);
  Serial.begin(7600);
  lcd.begin(16,2);
  welcomeMsg();
  lcd.clear();
  teamMembers();
  lcd.clear();
}
void loop()
{
  objectDistance();
  while (Serial.available() > 0)
  if (gps.encode(Serial.read()))
```

```
 displayInfo();
 if (millis() > 3000 && gps.charsProcessed() < 10)
 {
   Serial.println(F("No GPS detected"));
   lcd.setCursor(0,0);
   lcd.print("GPS MODULE IS");
   lcd.setCursor(1,0);
   lcd.print("NOT DETECTED");
   while(true);
   lcd.clear();
 }
 cheakAccident();
 if(temp==1)
 {
   lcd.setCursor(0,0);
   lcd.print("Are u Safe????");
   delay(2000);
   lcd.setCursor(0,1);
   lcd.print("Press Reset");
   delay(10000);
   lcd.clear();
 while (count<timesTosend)
 {
  delay(1000);
  sendAlert();
  lcd.clear();
  count++;
 }
 temp=0;
 count--;
 }
 }
void displayInfo()
{
 Serial.print("Location: ");
 if (gps.location.isValid())
```

```
{
  Serial.print(gps.location.lat(), 6);
  Serial.print(F(","));
  Serial.print(gps.location.lng(), 6);
  delay(200);
  latitude=gps.location.lat();
  logitude=gps.location.lng();
  lcd.setCursor(0,0);
  lcd.print("LAT:");
  lcd.print(latitude);
  lcd.print(",");
  lcd.setCursor(8,0);
  lcd.print("LNG:");
  lcd.print(logitude);
if(distance <= 30)
{
  digitalWrite(buzzerPin,HIGH);
  lcd.setCursor(0,1);
  lcd.print("DISTANCE:");
  lcd.print(distance);
  lcd.setCursor(10,1);
  lcd.print("CM");
}
else
{
   digitalWrite(buzzerPin,LOW);
   lcd.setCursor(0,1);
   lcd.print("DISTANCE:");
   lcd.print("SAFE");
}
delay(2000);
lcd.clear();
}
else
{
  Serial.print("GPS MODULE NEED SOME TIME");
```

```
 lcd.setCursor(0,0);
  lcd.print("GPS MODULE NEED");
  lcd.setCursor(0,1);
  lcd.print("SOME TIME");
  lcd.clear();
 }
  Serial.println();
}
void cheakAccident()
{
 if(digitalRead(vibration)==1)
  {
   temp=1;
   Serial.println("Accident has happened");
   delay(1000);
  }
}
void sendAlert()
{
 Serial.println("AT+CMGF=1");
 delay(1000);
 Serial.println("AT+CMGS=\"+918210339664\"\r");
 delay(1000);
 Serial.println("Vehicle Accident Happend at Place:");
Serial.print("http://maps.google.com/maps?&z=15&mrt=yp&t=k&q=");
 Serial.println(latitude);
 Serial.print(",");
 Serial.println(logitude);
 Serial.print("Help Please");
 delay(100);
 Serial.println((char)26);
 delay(1000);
 Serial.println();
 delay(100);
 lcd.setCursor(0,0);
 lcd.print("ACCIDENT ALERT");
```

```
 lcd.setCursor(0,1);
 lcd.print("HAS SENT");
 delay(750);
}
void teamMembers()
{
 lcd.setCursor(0,0);
 lcd.print("TEAM MEMBERS:");
 delay(3000);
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("1. PANKAJ");
 lcd.setCursor(3,1);
 lcd.print("ORAON");
 delay(5000);
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("2. PIJUSH");
 lcd.setCursor(3,1);
 lcd.print("MONDAL");
 delay(5000);
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("3. RAJA");
 lcd.setCursor(3,1);
 lcd.print("KUMAR");
 delay(5000);
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("4. MD SARFRAZ");
 lcd.setCursor(3,1);
 lcd.print("ANSARI");
 delay(5000);
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("5. SHUBHANKAR");
```

```
  lcd.setCursor(3,1);
  lcd.print("CHOUDHARY");
  delay(5000);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("6. VIKKY KUMAR");
  lcd.setCursor(2,1);
  lcd.print("DAS");
  delay(4000);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("MENTOR:");
  lcd.setCursor(0,1);
  lcd.print("TAMALIKA PANDA");
  delay(5000);
}
void welcomeMsg()
{
  lcd.setCursor(12,0);
  lcd.print("WELCOME TO THE FUTURE OF");
  for (int i = 0; i < 24; i++)
  {
    // scroll one position left:
    lcd.scrollDisplayLeft();
    // wait a bit:
    delay(250);
  }
  lcd.clear();
  delay(50);
  lcd.setCursor(15,0);
  lcd.print("SAFE DRIVING");
  for (int j = 0; j < 25; j++)
  {
    // scroll one position left:
    lcd.scrollDisplayLeft();
    // wait a bit:
```

```
 delay(250);
}
lcd.clear();
delay(500);
lcd.setCursor(0,0);
lcd.print("PROJECT NAME:");
delay(500);
lcd.setCursor(0,1);
lcd.print("SUMIT");
delay(3000);
lcd.clear();
lcd.setCursor(15,0);
lcd.print("PROJECT DESCRIPTION:");
 for (int j = 0; j < 25; j++)
{
  // scroll one position left:
  lcd.scrollDisplayLeft();
  // wait a bit:
  delay(250);
}
delay(100);
lcd.clear();
lcd.setCursor(15,0);
lcd.print("AN INTELEGENT SYSTEM FOR");
for (int k = 0; k < 25; k++)
{
  // scroll one position left:
  lcd.scrollDisplayLeft();
  // wait a bit:
  delay(250);
}
lcd.clear();
delay(50);
lcd.setCursor(15,0);
lcd.print("ACCIDENT");
for (int l = 0; l < 11; l++)
```

```
{
  // scroll one position left:
  lcd.scrollDisplayLeft();
  // wait a bit:
  delay(250);
 }
 lcd.clear();
 delay(50);
 lcd.setCursor(15,0);
 lcd.print("PREVENTION AND DETECTION.");
 for (int l = 0; l < 26; l++)
 {
  // scroll one position left:
  lcd.scrollDisplayLeft();
  // wait a bit:
  delay(250);
 }
}
void objectDistance()
{
 digitalWrite(trigPin,LOW);
 delay(2);
 digitalWrite(trigPin,HIGH);
 delay(10);
 digitalWrite(trigPin,LOW);
 duration = pulseIn(echoPin,HIGH);
 distance = duration*0.034/2;
}
```

ANNEXURE-II

DATA SHEETS

REFRENCES

- Tutorial Points – www.tutorialpoints.com
- SlideShare – www.slideshare.com
- Google images –www.images.google.com
- LCD interfacing, the microcontroller and embedded systems by Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay.
- HCSR-04 Configuration https://www.optimusdigital.ro/index.php?controller=attachment&id_attachment=1
- Arduino: - https://www.elexp.com/PDFs/01ARDUNO.pdf
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- http://www.tdk.co.jp/tefe02/ef532_ps.pdf
- https://www.google.co.in/search?q=BLUETOOTH+MODULE&rlz=1C1CHZL_enIN782IN782&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiFsLnoz5LbAhUKpo8KHXn2AMQQ_AUICigB&biw=1366&bih=637#imgrc=_OcprclsO7wmmM:
- Arduino Home:- https://www.arduino.cc/
- GPS Module http://www.sensomat.info/Catalog/Sensors/Wireless/GPS%20Module.pdf