CHAPTER 1

INTRODUCTION

1.1 OBJECTIVE

The number of loss of lives and damage to the property caused by accidents due to the violation of traffic rules has been exponentially increasing from day by day. As per records with the Kerala Police, a total of 38,470 accidents were reported in 2017, including 4,131 deaths. In 2018, the study says 39,205 accidents will be reported, leading to 4,290 deaths. The 2019 figures will rise to 39,581 accidents and 4,371 deaths while 2020 will see 39,958 accidents and 4,453 deaths. The state is likely to witness an increase of 3.86 per cent in the number of accidents. January, the study found, registers the most number of accident cases while July has registers the least The main reason for this is that the existing system is not sufficient enough for monitoring and implementation of the law. In this project we make a module which is capable of monitoring the vehicle parameters and compare it with the standard values, if the vehicle doesn't meet the standard value, a message is send to the corresponding RTO office. Apart from this it is used as a parental control measure by pre-setting a limiting speed value for the youngsters and if the value is crossed the system shows a warning and the engine goes off within five minutes. Another advantage of this is that both the insurance company as well as the client get benefited in case of an accident as this module has necessary details for getting the claim. Currently we are checking only speed limit violations by using the data we get from the google map and comparing it with module in the vehicle ,since speed violations are the main cause for traffic accidents and the future plans include prevention of overweight in the vehicle using corresponding sensors, automatic detection of traffic signals using a preinstalled camera in the vehicle, avoiding one hand drive in bikes by placing a sensor on the left handle bar, assurance of wearing helmet using facial recognition system and sensors to prevent sudden change of lane along with drunk and drive.

1.2 GENERAL BACKGROUND

The speed violation regulation systems currently used are surveillance cameras, traffic enforcement speed cameras, and radar speed gun, interceptor units. These systems have their own limitations hence the rate of accidents have not decreased rapidly as it should have. These systems are those which have been used for some time and must be updated for decreasing the accident rates. The surveillance cameras are cameras that can only be used to monitor the roads and review and see in case if any accidents occur in front of the camera. Traffic monitoring cameras typically sit on top of traffic lights and monitor traffic flowing through an intersection or on the highway. They do not take pictures of vehicles that over speed.

Fig 1.1: Surveillance cameras

A traffic enforcement camera is an automated ticketing equipment. This machine contains a camera that may be mounted beside a highway or on a traffic enforcement vehicle to detect traffic regulation violations. It is also known as road safety camera, road rule camera, photo radar, speed camera, or Gatso. Speed cameras operate automatically day and night. The cameras detect and record the speed of a vehicle by using vehicle tracking radar or electronic detectors that are embedded in the road's surface.

Fig:1.2 Traffic enforcement camera

A radar speed gun (also radar gun and speed gun) is a device used to measure the speed of moving objects. It is used in law-enforcement to measure the speed of moving vehicles. A radar speed gun is a Doppler radar unit that may be hand-held, vehicle-mounted or static. It measures the speed of the objects at which it is pointed by detecting a change in frequency of the returned radar signal caused by the Doppler Effect, whereby the frequency of the returned signal is increased in.

Fig :1.3 Radar speed gun

Proportion to the object's speed of approach if the object is approaching, and lowered if the object is receding. Such devices are frequently used for speed limit enforcer, although more modern LIDAR speed gun instruments, which use pulsed laser light instead of radar, began to replace radar guns during the first decade of the twenty-first century, because of limitations associated with small radar systems. A traffic enforcement camera (also red light camera, road safety camera, road rule camera, photo radar, photo enforcement, speed camera, Gatso, safety camera, bus lane camera, flash for cash, Safe-T-Cam, depending on use) is a camera which may be mounted beside or over a road or installed in an enforcement vehicle to detect motoring offences, including speeding, vehicles going through a red traffic light, vehicles going through a toll booth without paying, unauthorized use of a bus lane, or for recording vehicles inside a congestion charge area. This is the present system for traffic enhancement in order to limit speed violation in the restricted areas. The image obtained from this helps the authorities to know the law violated vehicle and hence to send the revenue pay letter through post. But this system has its own limitations. The camera systems can be easily cheated by the driver for escaping from the revenue may. Also there exists various legal issues arise from such cameras and the laws involved in how cameras can be placed and what evidence is necessary to prosecute a driver varies considerably in different legal systems. Even there occurs situation when the camera does not work as per the need. In the city of Fort Dodge, Iowa, speed camera contractor Red speed discovered a location where drivers of school buses, big panel trucks and similar vehicles have been clocked speeding by the city's mobile speed camera and radar unit even though they were obeying the 25 mph speed limit. The errors were due to what was described as an "electromagnetic anomaly". Police and government have been accused of "Big Brother tactics" in over-monitoring of public roads, and of "revenue raising" in applying cameras in deceptive ways to increase government revenue rather than improve road safety. Drivers can easily escape from this camera by doing some malfunctions. In order to avoid detection or prosecution from the camera drivers may

- Brake just before a camera in order to travel past its sensor below the speed limit. This is, however, a cause of collisions. Or brake suddenly, which results in rear-end crashes.

- Use GPS navigation devices, such as Waze, which contain databases of known camera locations to alert them in advance. These databases may, in some cases, be updated in near-real-time.

- Install active laser jammer or radar jammer devices which actively transmit signals that interfere with the measuring device. These devices are illegal in many jurisdictions.

Remove, falsify, obscure or modify vehicle license plate. Tampering with number plates or misrepresenting them is illegal in most jurisdictions.

1.3 SCOPE

The main aim of this project is to reduce the deaths due to speed violations and also provide a safe driving environment for drivers. Other reasons include introducing a better efficiency method so that it reduces amount of money and man power invested by the government in this cause so that it can be used for a much better cause. It will also induce a much fear among people as they knew violating the law will definitely get them caught and leads to less corruption as there is less or minimum human interference. The chances of manipulation from the user end is also very less to null.

This project has lot of future scope as small modifications in the system could lead to lot of new facilities. An example for the above mentioned statement is that, if a database is created according to each of the driver we can analyse the data and permanently suspend the license of those who are continuously rash driving. Also by introducing a sensor in the transmitter side of this device we can knew the time, date, location and speed at which the vehicle was travelling while an accident took place. This data is very important as it can be used by both insurance companies and police while investigating about the accident. This allows the police to finish the case faster and insurance companies to give claims to the needy in short time frame.

CHAPTER 2

LITERATURE SURVEY

2.1 WIRELESS TRAFFIC SYSTEM WITH SPEED CONTROL

This paper explores the possibility of providing traffic control signals through radio frequency (RF) transmission or by other means of wireless data communication and thereby reduce road accidents. Additional advantages can be reducing the car speed or stopping car at speed breakers, no entry zones or police barricade. This system if adopted by some state can effectively reduce the number of road accidents caused by speeding vehicles Losing control of the vehicle at speed breakers or by driver’s negligence towards traffic signals. The primary model of this system consists of a microcontroller controlled RF transceiver module, electronic controller unit (ECU) used in vehicles. In the system proposed the traffic sign boards including control signals are replaced with RF transmitters transmitting the specified coded data (about the traffic signal) for the traffic control receiver unit integrated in the in the car where the receiver unit is connected to the ECU and to display unit on the dashboard of the car which on coming in vicinity of the particular traffic signal transmitter starts displaying the very traffic signal on the displaying unit. For some specific signals, of the likes of speed breaker, police barricade it asks for response for the driver in specified time duration such as to reduce speed or stop down, if the driver does not respond in the required manner the controller unit takes control of car transmission and performs the specified operation.

2.2 UBIQUITOUS GPS VEHICLE TRACKING AND MANAGEMENT SYSTEM

Global Positioning System (GPS) is becoming widely used for tracking and monitoring vehicles. Many systems have been created to provide such services which make them popular and needed more than ever before. In this paper a “GPS vehicle tracking system” is proposed. This system is useful for fleet operators in monitoring driving behaviour of employees or parents monitoring their teen drivers. Moreover, this system can be used in theft prevention as a retrieval device in addition of working as a security system combined with car alarms. The main contribution of this paper is providing two types of end user applications, a web application and a mobile application. This way the proposed system provides a ubiquitous vehicle tracking system with maximum accessibility for the user anytime and anywhere. The system`s tracking services includes acquiring the location and ground speed of a given vehicle in the current moment or on any previous date. It also monitors the vehicle by setting speed and geographical limits and therefore receiving SMS alerts when the vehicle exceeds these pre-defined limits. Additionally, all the movements and stops of a given vehicle can also be monitored. Tracking vehicles in our system uses a wide range of new technologies and communication networks including General Packet Radio Service (GPRS), Global System for Mobile Communication (GSM), the Internet or the World Wide Web and Global Positioning System (GPS).

2.3 A REAL TIME GSM/GPS BASED TRACKING SYSTEM BASED ON GSM MOBILE PHONE

A GPS based tracking system is proposed which keeps track of the location of a vehicle and its speed based on a mobile phone text messaging system. The system is able to provide real-time text alerts for speed and location. Particularly, the present location can be locked and the system will alert the owner if the vehicle is moved from the present locked location. In addition, the speed can be locked and an alert texted if this speed is exceeded.

2.4 DEVELOPMENT OF A PROTOTYPE TO DETECT SPEED LIMIT VIOLATION FOR BETTER TRAFFIC MANAGEMENT

Due to the extreme fast movement of traffic in the busy localities, the cases of road accidents are increasing day by day. Traffic Control Board made different speed limit for different places to limit the speed, but it is not possible to always monitor the infringements manually due to several factors. This paper proposes development of a prototype by which the Traffic Control Board automatically gets the details of the over speed vehicles in any place. Specifically, a network of Master XBees are installed in every locality that will broadcast the information regarding the speed limit of the region. The vehicle will have a device that has a CPU, a speedometer along with another XBee. This XBee will get the speed limit of the region from the Master XBee and the CPU will compare that with the instantaneous speed of the vehicle. If the instantaneous speed is higher than the speed limit of the region, then a warning message will be displayed and a particular time slot is given to check the speed. After the time if the speed is not reduced, then the information regarding the Registration number of the vehicle is transmitted to the master XBee. This information is then stored into a server, from which the data can be accessed anywhere via internet.

CHAPTER 3

METHODOLOGY

The proposed system mainly comprises of a Global Positioning System (GPS) Receiver equipped with Global System for Mobile Communication (GSM), and micro-controller. The proposed work is going to be an effort to control and regulate the speed of the vehicles augmented with computer software to enable the third party or owner/supervisor to know the location, speed and activity of the driver. The system will transmit information in real time. The use of GSM/GPRS technologies will allows the system to track the objects and provide the up to-date information. The proposed equipment/device will compare the present position and speed of the vehicle with applicable traffic rules and on occurrence of any violation, will caution the driver and will also send the violation information to the supervising authorities

This device consists of mainly two parts, a transmitter side that mainly consists of GPS, GSM and Arduino mega and a receiver side with GSM, Arduino uno and a display system. In the transmitter side the Arduino continuously checks the location and speed limit of the location with respect to the data it receives from the GPS and the speedometer. If the vehicle violates speed limit of a particular location a message is send to the transmitter side through the GSM module with information such as location, time, date and speed at which the vehicle was moving. On the receiver it receives the information through the GSM module in the receiver side and process the data using Arduino uno and display the information.

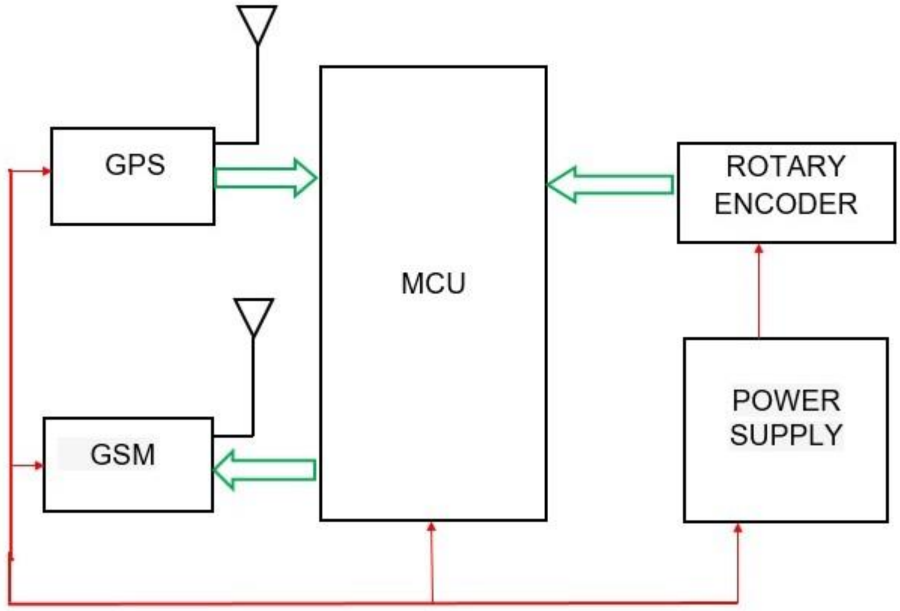


Fig:3.1 Block Diagram of Transmitter Unit

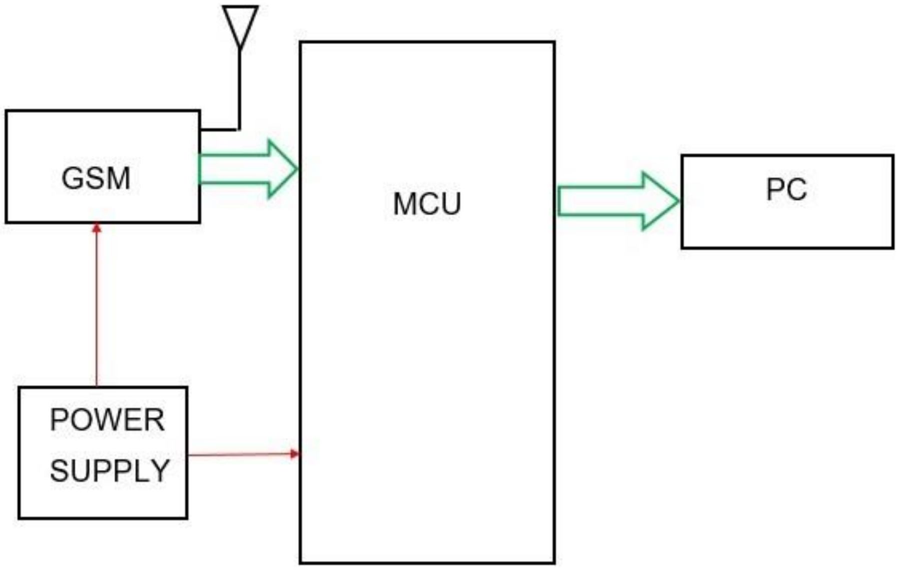


Fig:3.2 Block Diagram of Receiver Unit

CHAPTER 4

HARDWARE DESCRIPTION

4.1 COMPONENT STUDY

4.1.1 ARDUINO MEGA 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Mega 2560 is an update to the Arduino Mega.

(i) TECHNICAL SPECIFICATIONS

- Microcontroller ATmega2560
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 54 (of which 14 provide PWM output)
- Analog Input Pins 16
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 256 KB of which 8 KB used by bootloader
- SRAM 8 KB
- EEPROM 4 KB
- Clock Speed 16 MHz

(ii) PINS IN MEGA 2560

Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX). Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega16U2 USB-to-TTL Serial chip.

- External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. The attachInterrupt() function is used for interrupts

- PWM: 0 to 13. Provide 8-bit PWM output with the analogWrite() function.

- SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS). These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Uno, Duemilanove and Diecimila.

- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

- TWI: 20 (SDA) and 21 (SCL). Support TWI communication using the Wire library. Note that these pins are not in the same location as the TWI pins on the Duemilanove or Diecimila.

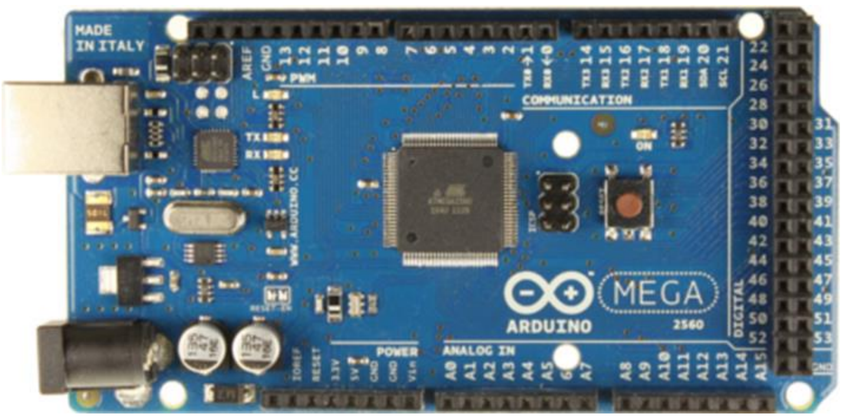


Fig:4.1 Arduino Mega 2560

The Mega2560 has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function.

There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with analogReference().
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block

(iii) COMMUNICATIONS

The Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega16U2 (ATmega 8U2 on the revision 1 and revision 2 boards) on the board channels one of these over USB and provides a virtual com port to software on the computer (Windows machines will need a .inf file, but OSX and Linux machines will recognize the board as a COM port automatically. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATmega8U2/ATmega16U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Mega2560's digital pins.

(iv) USB OVERCURRENT PROTECTION

The Arduino Mega2560 has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

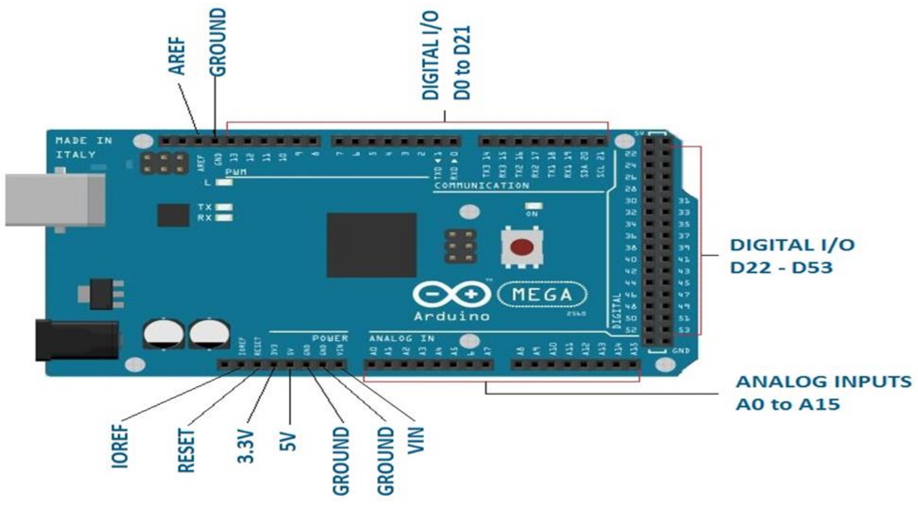


Fig:4.2 Pinout Diagram of Arduino Mega 2560

4.1.2 ARDUINO UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes pre-programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

(i) TECHNICAL SPECIFICATIONS

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volt
- Input Voltage: 7 to 20 Volts

- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

(ii) PINS IN UNO BOARD

- LED: There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- VIN: The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- 3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND: Ground pins.
- IOREF: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the

IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

• Reset: Typically used to add a reset button to shields which block the one on the board.

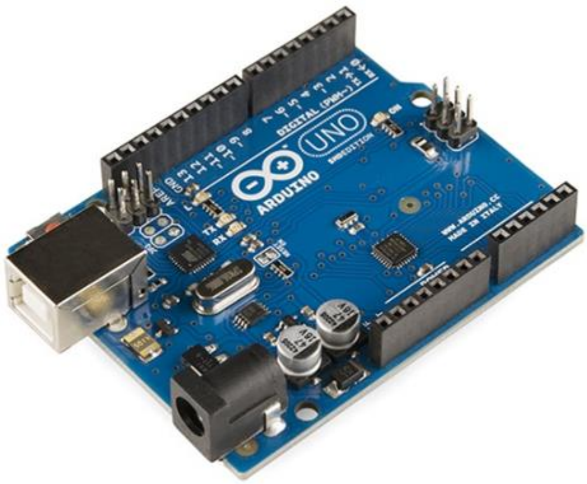


Fig:4.3 Arduino UNO

(iii) SPECIAL PIN FUNCTIONS

Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

In addition, some pins have specialized functions:

• Serial / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

• External Interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

• PWM (Pulse Width Modulation): 3, 5, 6, 9, 10, and 11 Can provide 8-bit PWM output with the analogWrite() function.

• SPI (Serial Peripheral Interface): 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

• TWI (Two Wire Interface) / I²C: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

• AREF (Analog REFerence): Reference voltage for the analog inputs.

(iv) COMMUNICATION

The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB

to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

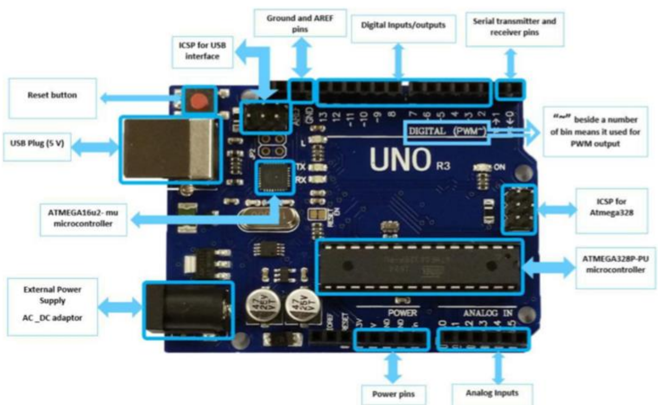


Fig:4.4 Pinout Diagram of Arduino Uno

4.1.3 GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM)

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. TDMA technique relies on assigning different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and can carry 64kbps to 120Mbps of data rate. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates. There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.

(i) ARCHITECTURE

A GSM network consists of the following components:

- A Mobile Station: It is the mobile phone which consists of the transceiver, the display and the processor and is controlled by a SIM card operating over the network.

- Base Station Subsystem: It acts as an interface between the mobile station and the network subsystem. It consists of the Base Transceiver Station which contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of the Base Station Controller which controls the Base Transceiver station and acts as a interface between the mobile station and mobile switching center.

- Network Subsystem: It provides the basic network connection to the mobile stations. The basic part of the Network Subsystem is the Mobile Service Switching Centre which provides access to different networks like ISDN, PSTN etc. It also consists of the Home Location Register and the Visitor Location Register which provides the call routing and roaming capabilities of GSM. It also contains the

Equipment Identity Register which maintains an account of all the mobile equipment's wherein each mobile is identified by its own IMEI number. IMEI stands for International Mobile Equipment Identity.

(ii) FEATURES

- Improved spectrum efficiency
- International roaming
- Compatibility with integrated services digital network (ISDN)
- Support for new services.
- SIM phonebook management
- Fixed dialling number (FDN)
- Real time clock with alarm management
- High-quality speech
- Uses encryption to make phone calls more secure
- Short message service (SMS)

(iii) SIM 900A GSM MODULE

This is an ultra-compact and reliable wireless module. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications allowing you to benefit from small dimensions and cost-effective solutions. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900A can fit almost all the space requirements in your applications, especially for slim and compact demand of design.

(iv) GENERAL SPECIFICATION

- Dual-Band 900/ 1800 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B

- Dimensions: 24x24x3mm
- Weight: 3.4g
- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- SIM application toolkit
- Supply voltage range: 3.2 ... 4.8V
- Low power consumption: 1.0mA (sleep mode)
- Operation temperature: -40°C to +85 °C

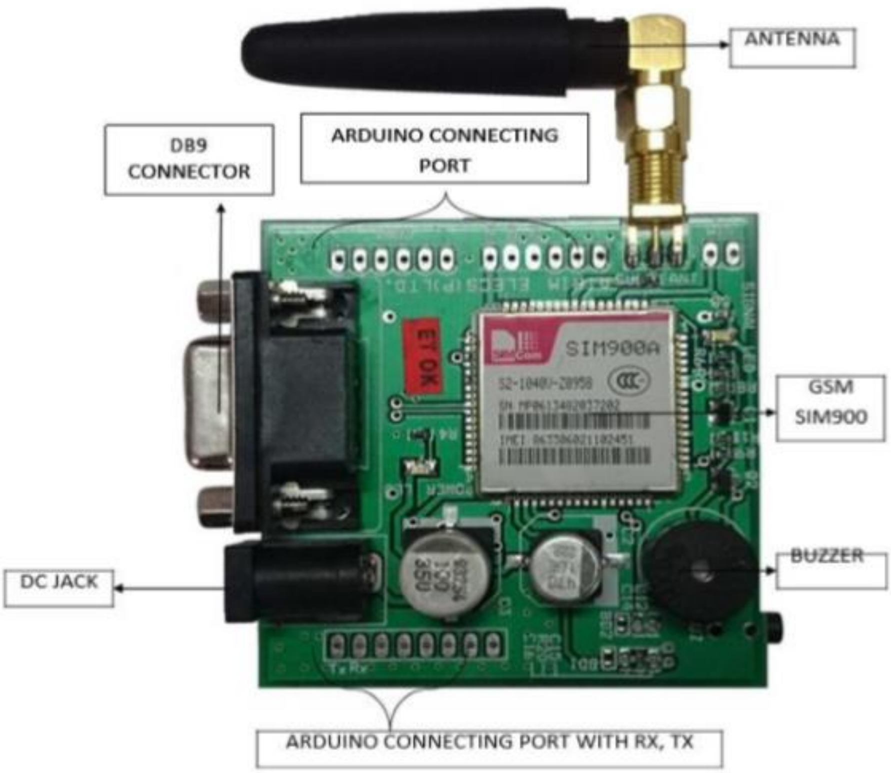


Fig: 4.5 Pinout Diagram of SIM 900A GSM Module

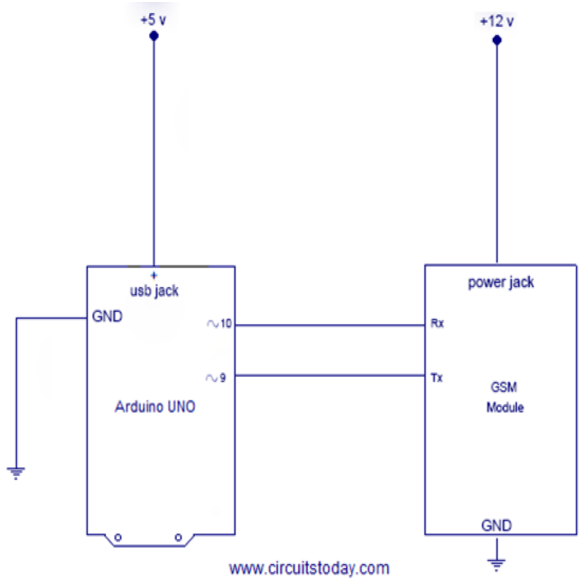


Fig: 4.6 GSM Module interfacing with Arduino

(v) COMMONLY USED AT COMMANDS

Change mode to sms: AT+CMGF=1

Read SMS in text mode: AT+CNMI=2,2,0,0,0

Make a call: ATD+1123456789; //replace with number and country code you like

Disconnect / hang-up call: ATH

Receive a phone call: ATA

4.1.4 GLOBAL POSITIONING SYSTEM (GPS)

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.

(i) PRINCIPLE

There are total four satellites. Firstly, the signal of time is sent from a GPS satellite at a given point. Subsequently, the time difference between GPS time and the point of time clock which GPS receiver receives the time signal will be calculated to generate the distance from the receiver to the satellite. The same process will be done with three other available satellites. It is possible to calculate the position of the GPS receiver from distance from the GPS receiver to three satellites. However, the position generated by means of this method is not accurate, for there is an error in calculated distance between satellites and a GPS receiver, which arises from a time error on the clock incorporated into a GPS receiver. For a satellite, an atomic clock is incorporated to generate on-the-spot time information, but the time generated by clocks incorporated into GPS receivers is not as precise as the time generated by atomic clocks on satellites. Here, the fourth satellite comes to play its role: the distance from the fourth satellite to the receiver can be used to compute the position in relations to the position data generated by distance between three satellites and the receiver, hence reducing the margin of error in position accuracy.

(ii) USES

1. Location - determining a position

2. Navigation - getting from one location to another

3. Tracking - monitoring object or personal movement

4. Mapping - creating maps of the

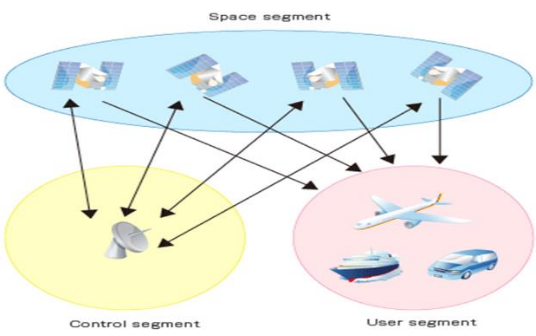


Fig: 4.7 Three elements of GPS

(iii) FACTORS WHICH DETRMINES TYPE OF GPS

Size: GPS modules are getting ever-smaller but in general, the antenna has to shrink to fit the module which will affect things like lock time and accuracy.

Update Rate: The update rate of a GPS module is basically how often it recalculates and reports its position. The standard for most devices is 1Hz (Only once per second). However, UAVs and other flying or fast vehicles may require faster update rates to stay on track. 5 and even 10Hz update rates are becoming more and more available for cheap. A fast update rate means that there’s more NMEA sentences flying out of the module, some microprocessors will be quickly overwhelmed trying to parse that much data. On the plus side, a module that runs at 5 or 10Hz, it can usually be configured to run at an easier pace.

Power Requirements: GPS use a lot of power. On average, around 30mA at 3.3V. Also, that GPS antennas usually enlist the help of an amplifier that draws extra power. If a unit appears to have low power consumption, make sure there’s an antenna attached.

Number of Channels: Even though there are only so many GPS satellites in view at any given time, the number of channels that module runs will affect time to first fix. Since the module doesn’t know which satellites are in view, the more frequencies that it can check at once, the faster it will find a fix. After it get a lock, some modules will shut down the extra blocks of channels to save power.

Antennas: Many modules come with this chunk of something on top of it. That is a precisely made chunk of ceramic. Each antenna is finely trimmed to pick up the GPS L1 frequency of 1.57542 GHz.. There are some other GPS antenna technologies (chip, helical), but they are not as common, a bit more expensive, and require significantly more amplification and filtering.

Accuracy: We can locate our location, anywhere in the world, within 30 seconds, down to +/- 10m. Say +/- because it can vary between modules, time of day, clarity of reception, etc. Most modules can get it down to +/-3m, but if you need sub meter or centimetre accuracy, it gets really expensive.

(iv) NEO 6M

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.

Specifications

- Power Supply Range: 3 V to 5 V
- Model: GY-GPS6MV2 Ceramic antenna
- EEPROM for saving the configuration data when powered off Backup battery
- LED signal indicator
- Mounting Hole Diameter: 3 mm Default Baud Rate: 9600 bps
- Module size: 23mm * 30mm
- Antenna size: 12 * 12mm

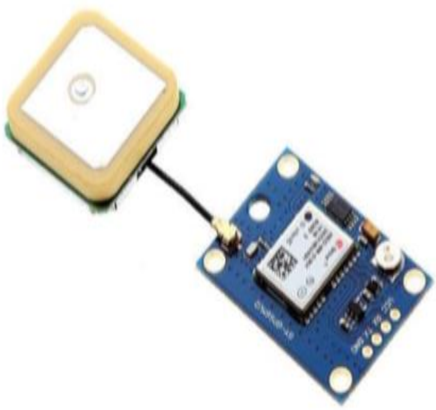


Fig: 4.8 NEO 6M

4.1.5 ROTARY ENCODER

A rotary encoder is a type of position sensor which is used for determining the angular position of a rotating shaft. It generates an electrical signal, either analog or digital, according to the rotational movement.

Fig: 4.9 Rotary Encoder

There are many different types of rotary encoders which are classified by either Output Signal or Sensing Technology. The particular rotary encoder that we will use in this tutorial is an incremental rotary encoder and it's the simplest position sensor to measure rotation.

In principle, with a RT we have two square wave outputs. The figure shown above describes how the phases (A and B) relate to each other when the encoder is turned clockwise (→) or counter clockwise (←). By monitoring the outputs with a microcontroller it is possible to determine the direction← of turn and how far it has turned. Besides, we can count the frequency of the pulses to determine how fast it is being turned. Literally, RT is a wonderful digital alternative to the old analog potentiometers. Rotary encoders are useful as rotation sensors (or selectors) and look similar to potentiometers, but rotate all the way around continuously, and are divided up into many segments. Each segment has a clicky feeling to it and each clockwise or counter-clockwise movement causes the two built-in switches to open and close. Most RTs also has built in 'push-on' momentary switch, usually one side has 3-pins (two coding pins and one common/ground pin) and the other side has 2-pins (N/O switch contacts) for the push-on switch.

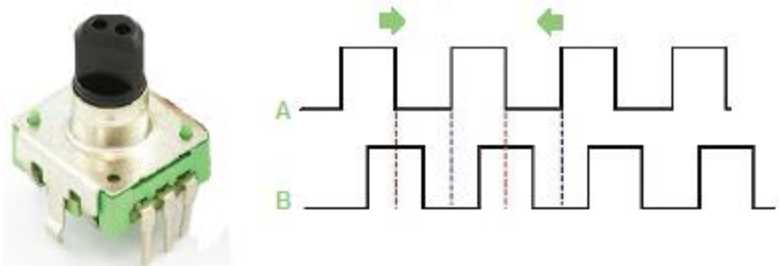


Fig: 4.10 Output waveforms in Rotary Encoder

As stated, the rotary encoder has 2 coding pins that are either HIGH (1) or LOW (0). If you treat the pins as binary, you can read them as 00, 01, 10, or 11 (sequence the encoder outputs while spinning clockwise is 00, 01, 11, 10). If you have a reading of 01, the next reading can either be 00 or 11 depending on the direction the knob is turned. Now that your rotary encoder hardware is up and running it's time to tell your Arduino what to do with the encoder signals. There are the two basic ways to read a microcontroller's digital input. With polling you read the input all the time inside a loop. With interrupts the microcontroller does any other job, and when a signal arrives from the encoder the controller stops its job, jumps to the interrupt routine and then returns to the previous job. This way the microcontroller is concerned with the encoder signal only when a new pulse comes. Since the interrupt signal comes from outside the Arduino it is called as external interrupt. Arduino Uno R3 has two external interrupts: int.0 (pin 2) and int.1 (pin 3).

While connecting a RT to Arduino, it is better to add a suitable 'debouncer' with the setup to avoid possible encoding errors. This is necessary because inside the rotary encoder two pieces of metal contacts touching each other in an imprecise way as in the case of a mechanical switch, and this will manifest itself as missed steps or even steps back when going forward.

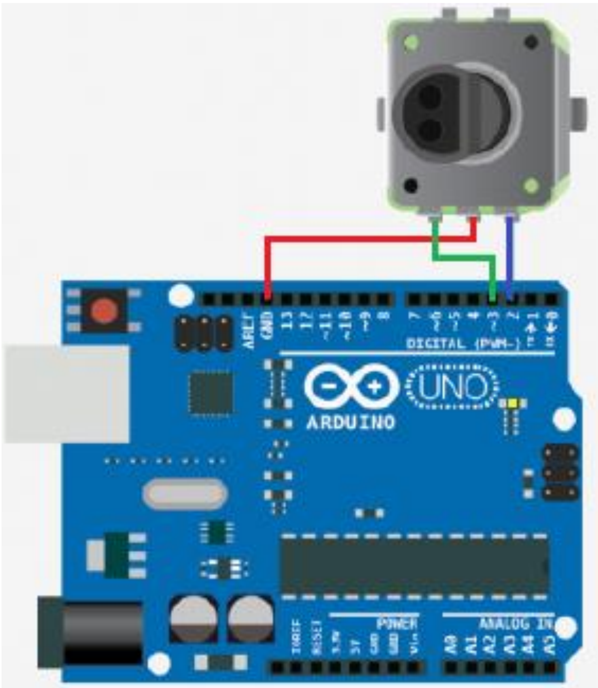


Fig: 4.11 Rotary Encoder Interfacing with Arduino

4.2 CIRCUIT DIAGRAM

4.2.1 TRANSMITTER SIDE

The transmitter side consists of a core component as Arduino mega 2560 to which the peripheral components are connected. Interfacing with Arduino mega 2560 helps the peripheral components to communicate with each other. The peripheral components are SIM 900A GSM module, NEO 6M GPS module and a rotary encoder. Arduino interfacing programming are already installed into the Arduino memory which link with the peripheral components for communications. Each component is powered by providing the needed power supply. A 12-volt dc power source is connected to energize the components. Every component is grounded by connecting its ground pin to the Arduino ground pin. Separate transmitter and receiver pins are provided in Arduino for each peripheral components to its respective transmitter and receiver pins for signal transmission.

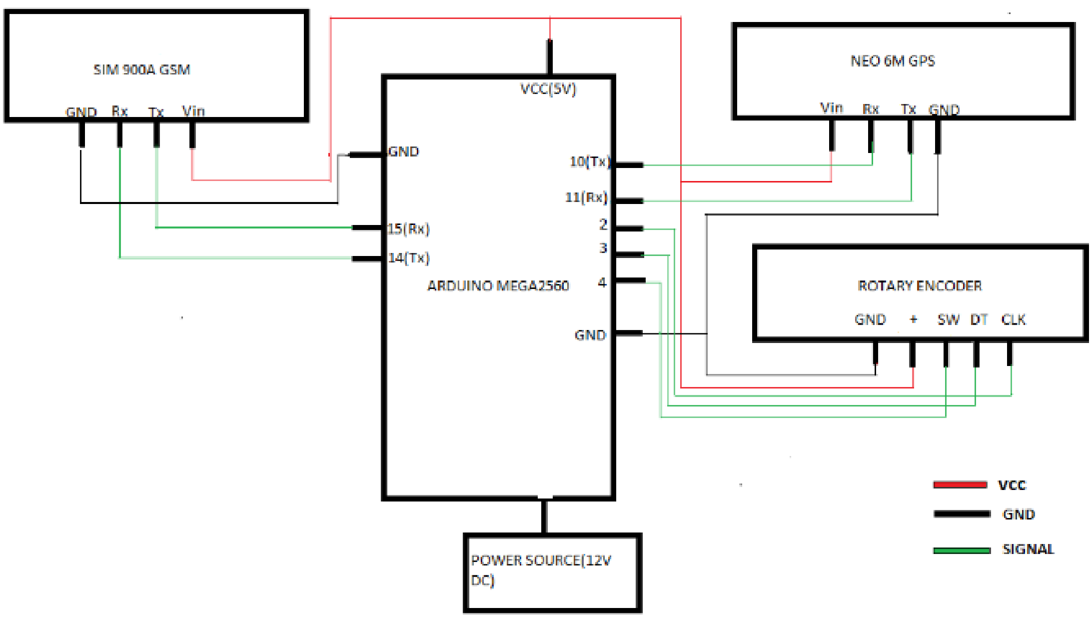


Fig: 4.19 Circuit Diagram of Transmitter Unit

Initially Arduino and NEO 6M GPS module interfacing track the real time location of the vehicle for comparison of speed of the present location with that of the database. Here rotory encoder plays the role of the moving vehicle. Any increase in the speed of rotation leads the initialisation of the SIM 900A GSM module to send the message to the receiver unit.

4.2.2 RECEIVER UNIT

The receiver side consists of an Arduino UNO and SIM 900A GSM module. The components are powered by connecting a 12-volt dc power source. The message transmitted from the transmitter unit is received by the receiving antenna of GSM module. This message is transmitted to the Arduino in order to display the violation message.

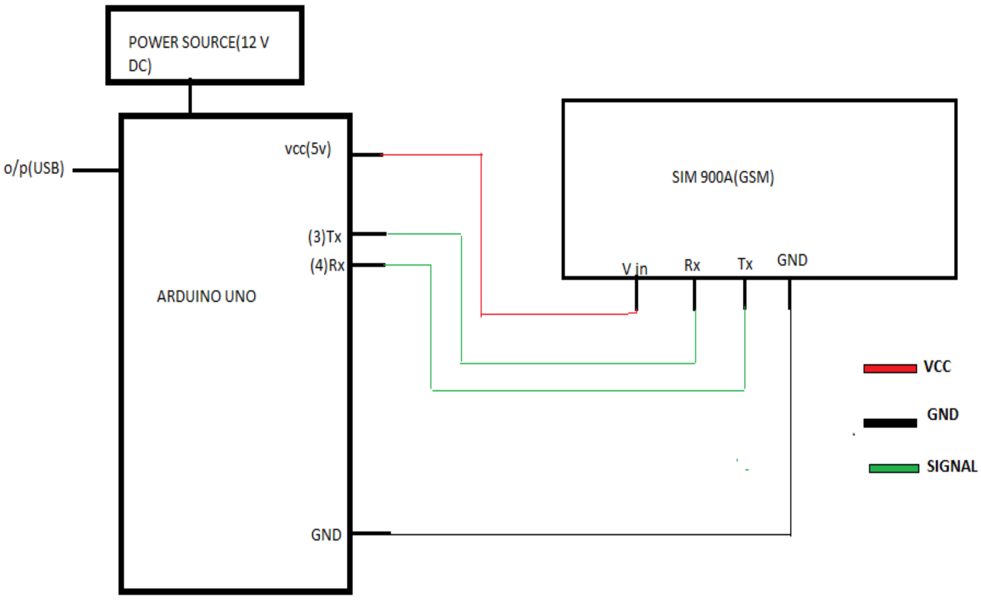


Fig: 4.20 Circuit Diagram of Receiver Unit

CHAPTER 5

SOFTWARE DESCRIPTION

5.1 ARDUINO IDE

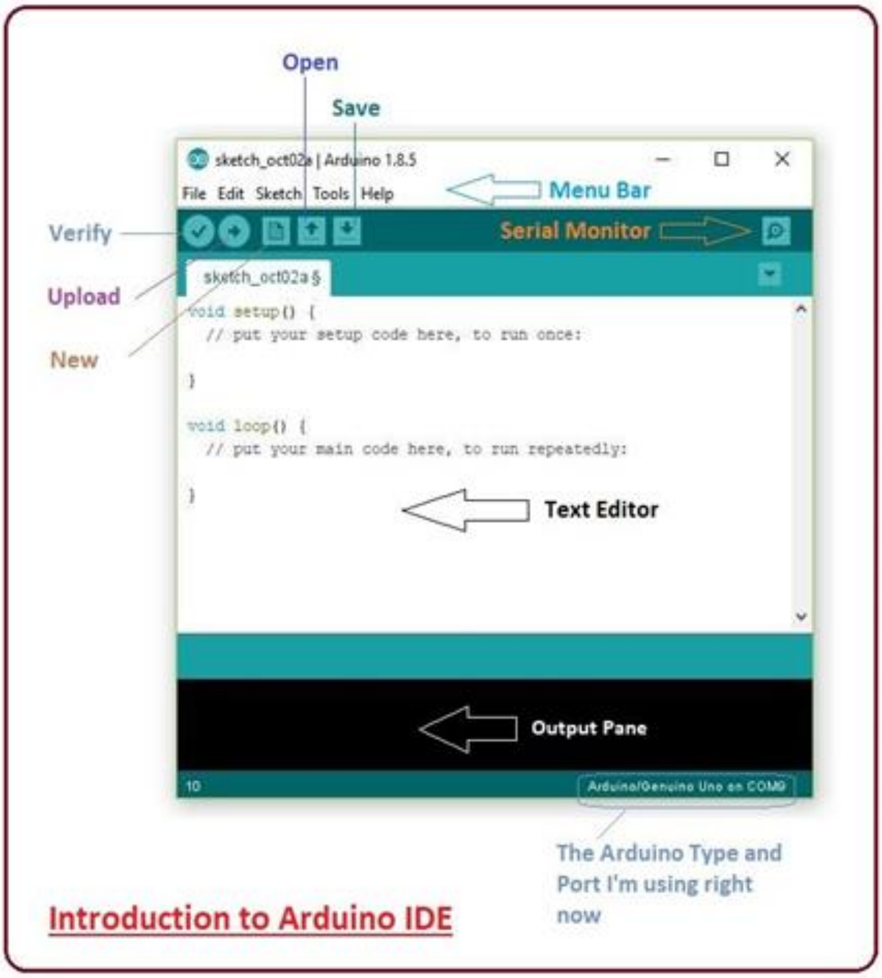
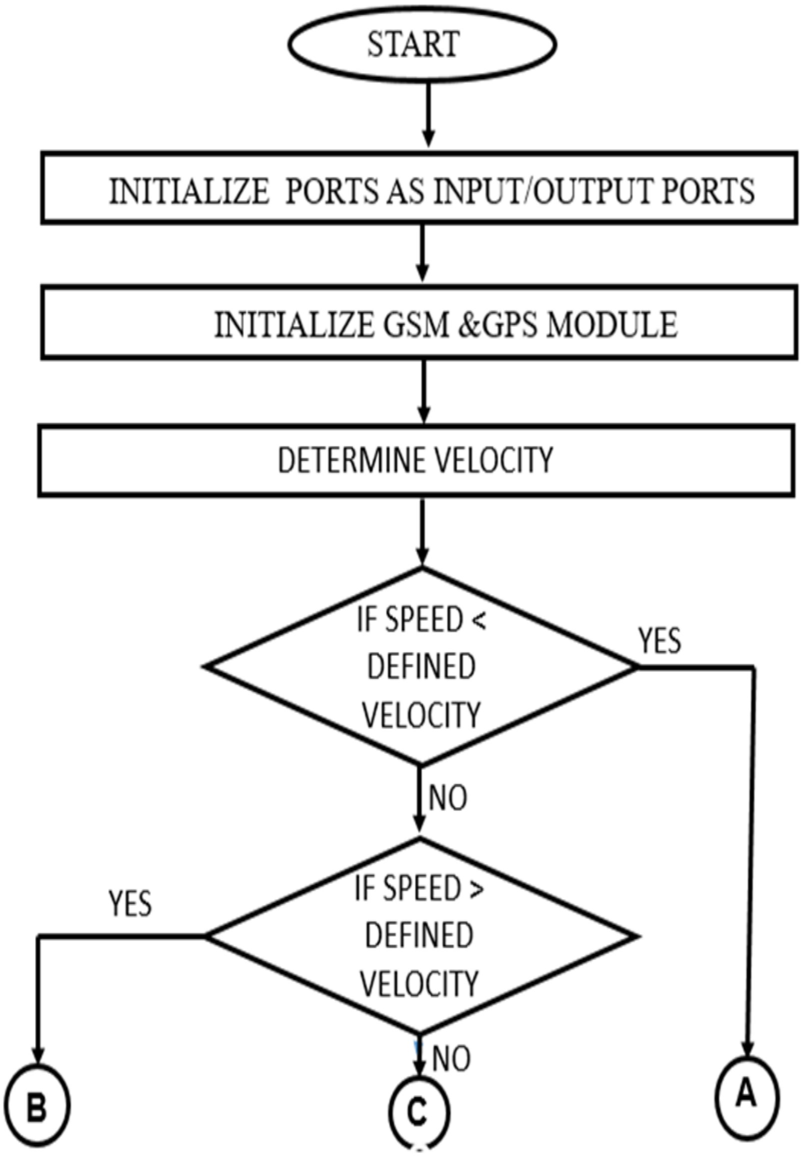


Fig: 5.1 Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

5.2 FLOWCHART



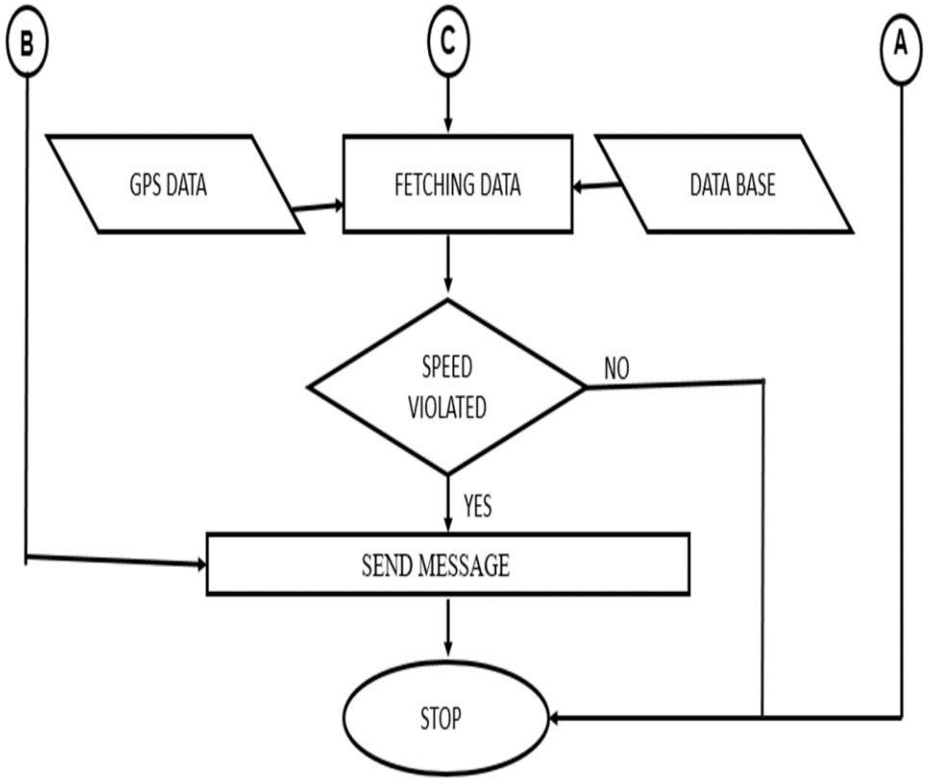


Fig: 5.2 Flow Chart of Transmitter Unit

At transmitter part the process begins with the initialization of the input output ports, GSM module, GPS module. The real time speed of the moving vehicle is tracked continuously. A predefined minimum speed value and maximum speed value is determined. If the speed of the vehicle is less than that of the predefined minimum value, then no need of checking violation. If the speed of vehicle is greater than the predefined maximum value it results to violation and send message to the receiver server irrespective of the location. If the speed of the vehicle is in between the data is always compared with the database data by fetching it. If the over speeding occurs the violation message is send to the receiver server. The process continues occur as a loop function.

The receiver consists only a core processor and a GSM module, so here the process is much simpler. The process begins with initialization of input output ports and GSM module. The message received from the transmitter is received if a violation occurs.

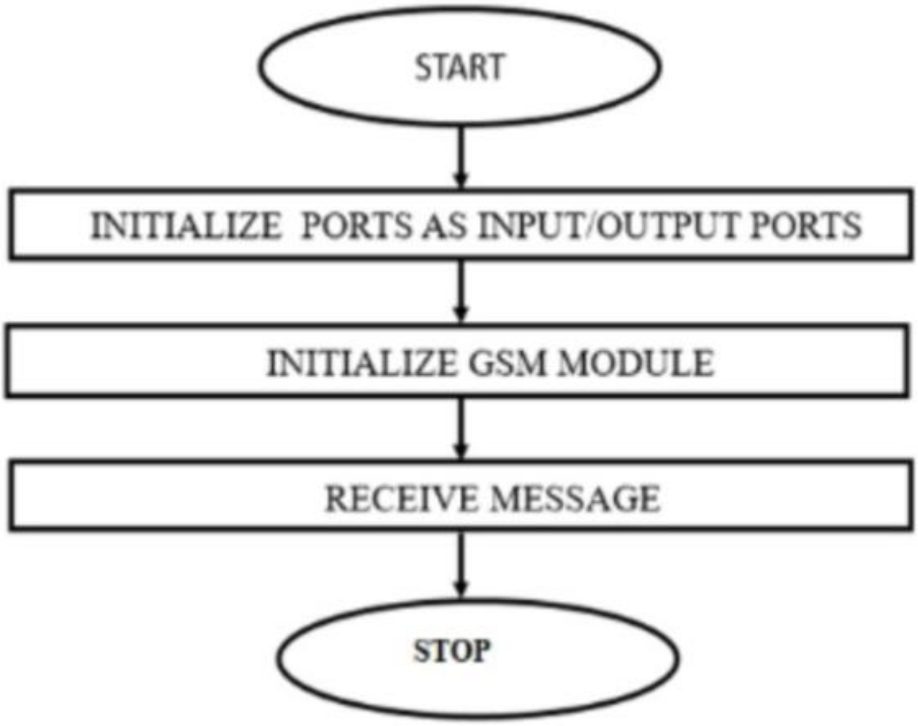


Fig: 5.3 Flow Chart of Receiver Unit

CHAPTER 6

RESULT AND DISCUSSIONS

While driving, the device continuously evaluates the real time location and speed of the vehicle. The real time speed with respected to the real time location of the vehicle is repeatedly cross checked with the datas stored in the database. If the speed of the vehicle exceeds the speed limit at that particular location violation of law occurs. Thus a message of speed violation is sent to the both driver as well as the RTO server. The later can get the needed details of the driver and the vehicle for further operations.

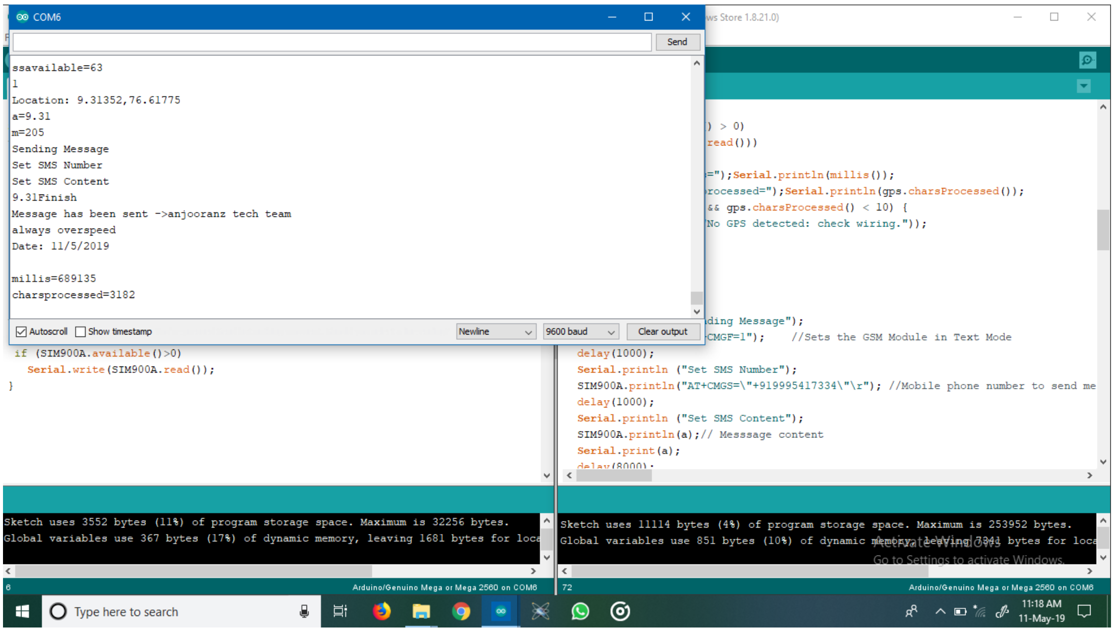


Fig: 6.1 The details displayed towards driver

The final device is fabricated using acrylic material which is a good insulator, due to its ease of fabrication and cheaper in rate. The transmitter device consists of two ports: (i) Ports to connect the power supply (ii) Port to connect the device which measure the speed of the vehicle. The receiving device consists of two ports: (i) Port to connect the power supply (ii) Port connect to the receiver system.

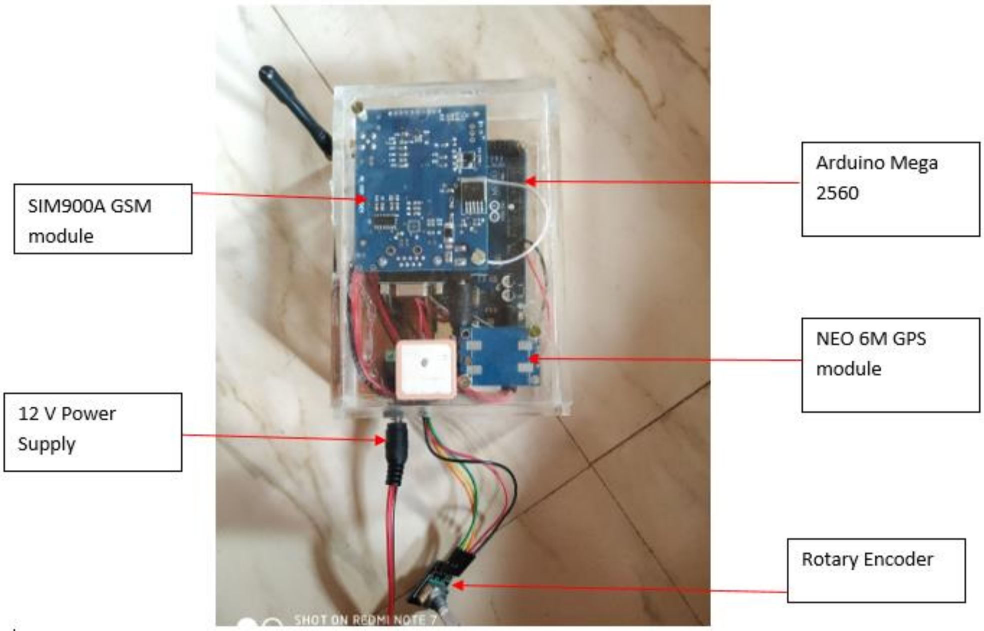


Fig: 6.2 Transmitter Device

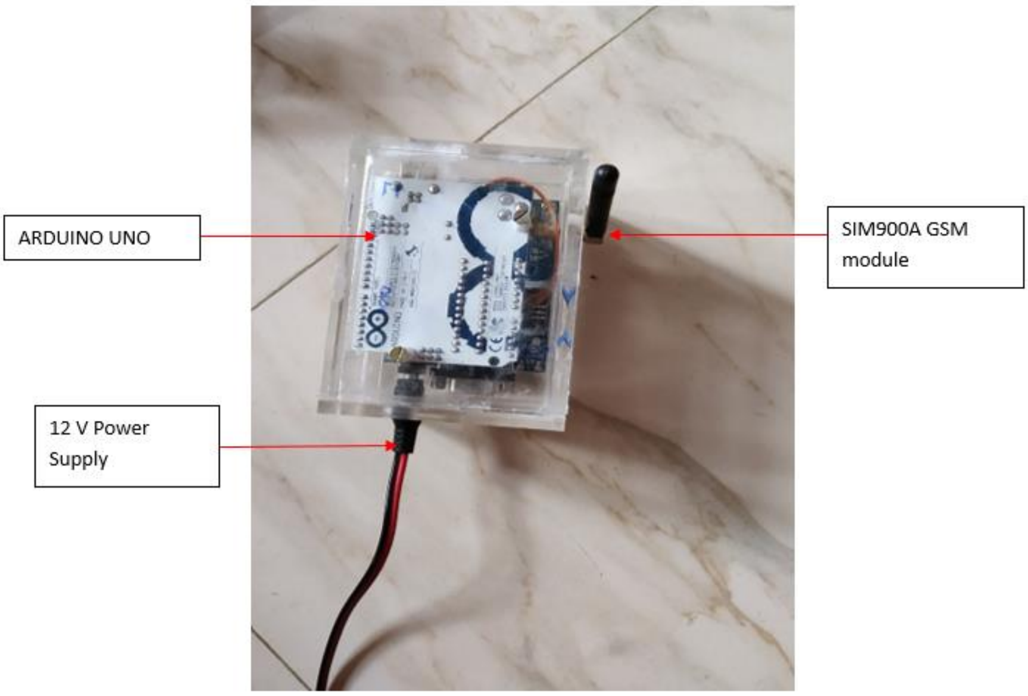


Fig: 6.3 Receiver Device

CHAPTER 7

CONCLUSION

This Research presents the design and implementation of remote monitoring and vehicle speed management systems. The proposed system provides a good means of tracking vehicle speed in real time and is a cost-effective solution. In addition to the longevity of the vehicle, the system also reviews security issues and provides a means to track your vehicle 24/7 whether it is on the road or not. The system is designed to have applications in all areas of transportation, from taxi to heavy vehicles. The unique features of this research are to show the real-time vehicle location, speed at every point, which can be marketed and produced at large scale. The development system provides solutions that apply to car crawling and remote monitoring based on windows. In the future, it is worth developing stronger functions like data analysis and processing and information sharing. It is also worthwhile to enhance the server's ability to track more information such as real-time traffic conditions, road conditions, and crash scenes.

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