# “Design and Construction of Vehicle Safety & Security System by using Arduino”


**Submitted by:**

**Mohin Uddin**

Student ID: BME1901017461

**Md Shahriar Rabby**

Student ID: BME1901017040

**Sadequl Islam**

Student ID: BME1901017509

**Sajol Kumar Kundu**

Student ID: BME1901017491

**Layle akther**

Student ID: BME 1901017014

**Supervised By**

**Mr. Md. Ali Azam**

**Lecturer, Department of Mechanical Engineering**

**Sonargaon University (SU)**


**September, 2022**

# “Design and Construction of Vehicle Safety & Security System by using Arduino”

**Submitted By:**


| SL. No | Student Name | Student ID |
|---|---|---|
| 01 | Mohin Uddin | BME1901017461 |
| 02 | Md Shahriar Rabby | BME1901017040 |
| 03 | Sadequl Islam | BME1901017509 |
| 04 | Sajol Kumar Kundu | BME1901017491 |
| 05 | Layle akther | BME 1901017014 |


This project “Vehicle Theft Alert & Engine Lock System” was submitted to the Department of Mechanical Engineering, Sonargaon University (SU) Bangladesh in partial fulfillment of the requirement for the Degree of Bachelor of Science in Mechanical Engineering.

**Approved By:**


**Mr. Md. Ali Azam**

**Lecturer** **Supervisor**

Department of Mechanical Engineering
Sonargaon University (SU)

Professor **Head**

Department of Mechanical Engineering
Sonargaon University (SU)

**External**

Department of Mechanical Engineering
Sonargaon University (SU)

# Declaration & Authorship

Bangladesh, Hereby declares that the internship report titled **“Design and Construction of Vehicle Safety & Security System by using Arduino”** is prepared after the completion of my internship **“Design and Construction of Vehicle Safety & Security System by using Arduino”**. We also declared that the internship report is prepared for academic purposes and had not been submitted by me before my degree.

We declared that the internship report embodies the result of own research work, perused under the supervision of MD. Ali Azam, Lecturer, Department of Mechanical Engineering Sonargaon University (SU)

We also confirm this report from any counterfeit and no other student either B.Sc. Or other disciplines have submitted partially or whole of it.

Signed:

Mohin Uddin

Md Shahriar Rabby

Sadequl Islam

Sajol Kumar Kundu

Layle akther

Supervised by

Md. Ali Azom

Date: 18.09.2022

# ABSTRACT

Transportation plays a vital role in human daily activities, resulting that the number of urban automobiles is quickly increasing. In contrast, car theft is now a great problem across the country various vehicle antitheft devices have been developed latterly, but the outcome is still unsatisfactory since every kind of device has its drawbacks. Therefore, an enhanced system has been proposed in this report to ensure vehicle safety and track the vehicle in the event of theft. This proposed system includes a smart vehicle security starting system based on the internet of things using RFID authentication to enable the engine ON in addition to the key mechanism. The user has to use both RFID and a key, to access the vehicle. The vehicle cannot be turned on even if one input out of the two is available. At a time fuel has been monitored in the fuel tank. This report mainly focuses on developing an android app that improves the problems of transport burglary, tracking, and monitoring system problems. RFID has been used as biometric recognition of the vehicle's user all the time, but in case of emergency (e.g., accidents or user's sickness, etc.) A limit switch has been placed for the door security system. Anyone can take the control of the vehicles taking permission from the authorized person. The grand feature of the presented vehicle security system is that it can track vehicles from anywhere in the globe with the help of a GPS module.

# ACKNOWLEDGEMENT

First of all, we would like to express our gratitude to the almighty Allah for providing us with the strength and energy to complete this project. we would like to express our gratitude and sincere thanks to our supervisor, **Mr. Md. Ali Azam**, Associate professor, Department of Mechanical Engineering, Sonargaon University (SU), for her patience, continuous supervision, guidance, advice, and support in completing this project. She is the backbone of this project by giving wonderful suggestions and constructive criticism to carry out this project. The guidance and inspiration of Prof. Md. Mostofa Hossain**,** Head of the Department of Mechanical Engineering, Sonargaon University (SU), regarding the analysis of work are greatly acknowledged. We would want to express our gratitude to all of our professors as well as lecturers, Department of Mechanical Engineering, Sonargaon University (SU) Without their assistance, doing the study would have been extremely difficult.

Finally, we would like to express our deepest acknowledgment and love to our parents for their lifetime dedication, support, and patience.

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF Tables

# CHAPTER 1

# INTRODUCTION

## 1.1 BACKGROUND

In the present age, everything is now under the control of the Internet. Modern control methods have made life easier through the use of information technology. If the terrestrial communication system can be controlled through information technology [1] - [2], it will be a revolutionary change. This is especially true of vehicle owners or agency dealers. It often faces various problems like vehicle theft, accidents, driver fraud, not getting the car to the destination on time, etc. Various high-priced, luxurious automobiles are available in today's world of comfort and luxury. Many of these automobiles came equipped with security systems from the start. Nonetheless, even though a significant amount of money is being invested in some sectors, vehicle theft is still on the rise, despite the improvements in the vehicle security system. [3] - [4] If it is possible to provide a second level of security in this case against vehicles stealing with duplicate keys or otherwise, then it will prevent vehicle stealing to a great extent.

In the case of vehicle agencies, taking a driver other than the designated driver of a designated vehicle is a scheduling disaster. Many times the car owners who rent a car cannot collect the rent on time and they cannot control it. If the biometric system can be used, then no unregistered person will be able to drive. There are various Biometric methods like face detection, optical detection, etc. available, however, this project uses RFID biometrics, which is readily available and its usage is low.

The fuel management system is an important portion of our vehicle. Fuel management systems are designed to effectively measure and manage the use of fuel within transportation. This information can be then stored in computerized systems and reports generated with data to inform management practices. This enables consumption control, cost analysis, and tax accounting for fuel purchases. Modern vehicle tracking systems commonly use GPS technology for locating the vehicle. As fuel cost is rising constantly, vehicle owners are facing fuel theft from their vehicle. In that case, vehicle owners do not calculate how much quantity of fuel needs in a day or a week. Time is important for efficient goods transportation system such as real-time tracking and reducing financial fuel loss of vehicles is rapidly increased. This can be overcome by using real-time tracking vehicle systems, such as a system that monitors the current amount of fuel via a mobile application. Using this approach, a vehicle owner will help the user to monitor and control all of the vehicles from a remote location. Again, real-time fuel-filled and fuel consumption in vehicles are not maintained. For this kind of problem, when the driver starts filling fuel in the tank, the floating sensor gets activated and stores data on the mobile application. Some of the drivers can drive without asking their vehicle owner. At that time, the driver used the vehicle for rental or personal use. By utilizing the mobile application, the owner can trace all the vehicles in the same period, find the very nearest fuel pump from the vehicle location, and notify when fuel goes to a certain level

The whole process will be controlled by a mobile-based app. In this case, the Card of the designated drivers will be taken into the database in advance. Each vehicle will have an RFID Card in addition to the car start switch. The owner of the car will be notified on the app by the number of the vehicle and the identity of the driver of the vehicle. Now if the owner of the car does not allow permission, no one will be able to start that car. Now in many cases it can happen that for some reason someone else has to drive the car in the absence of the specific driver or the driver has been injured in a car accident, it is needed to remove that car from the road by a second person. Based on the foregoing, the presented project having options of both enable and disable RFID Card is so designed that the owner can allow the car to run without fingerprints when needed.

This project is talking about a mobile-based app that has been developed with the help of MIT App Inventor. Also, Google Firebase is used as a database to store all the data, which will act as the database of the mobile app. In the process, a Wi-Fi module is needed to send the fingerprint from the car to the database. A microcontroller is also needed to handle the entire process. Many projects are managed using GSM but the ESP8266 microcontroller is used because it has a Wi-Fi module facility.

**IoT (Internet of Things):** The Internet of Things (IoT) is a new paradigm that has converted traditional lifestyles into high-tech lifestyles. IoT changes include smart cities, smart homes, pollution management, energy conservation, smart transportation, smart industries, and smart libraries. To advance technology via IoT, numerous key research studies and investigations have been done. However, several challenges and issues must be overcome to fully fulfill the potential of IoT. These issues and challenges must be assessed from a range of angles, including applications, roadblocks, enabler technologies, social and environmental effects, and so on. [3]

The Internet of Things (IoT) refers to physical things (or groups of such objects) which are connected with sensors, computing power, software, and other technologies to interconnect and transfer data with other devices and networks over the Internet or other communication systems. [1]

**ESP 8266:** In this system, the data transfer in the google firebase database is managed through IoT by ESP8266 (shown in figure 1.2). The ESP8266 is nothing but a low-cost Wi-Fi microchip. Espressif Systems in Shanghai, China designed the ESP8266 Wi-Fi module to support both the TCP/IP networking software and the microcontroller access to any Wi-Fi network. [6]-[7]

Embedded Systems produces the ESP8266 wi-fi SOC (system on a chip). It's a fully integrated chip that's meant to fit into compact packaging and give complete internet access. The ESP8266 may be used as an external Wi-fi module by connecting it to any microcontroller through the serial UART and using the regular AT Command set Software, but can also be used directly as a Wireless microprocessor by using the included SDK to create a w software.

**MIT app inventor:** MIT app inventor is a visual programming system. Through this, anyone, as well as children, can make an app very easily. Since the invention of the MIT app inventor, there is no need to write programs and it also saves time. Professor Hal Abelson leads a small group of CSAIL personnel and students who constitute the basis of an international movement of inventors. This core team manages the free online app creation environment that serves over 6 million registered users, in addition to directing educational outreach and doing research on its benefits. [5]

MIT App Inventor is a drag-and-drop visual programming tool for designing and building fully functional mobile apps for Android. App Inventor promotes a new era of personal mobile computing in which people are empowered to design, create, and use personally meaningful mobile technology solutions for their daily lives, in endlessly unique situations. App Inventor's intuitive programming metaphor and incremental development capabilities allow the developer to focus on the logic for programming an app rather than the syntax of the coding language, fostering digital literacy for all. Since it was moved from Google to MIT, several improvements have been added, and research projects are underway.

**Android app:** Android Inc. was founded in Palo Alto, California, in October 2003 by Andy Rubin, Rich Miner, Nick Sears, and Chris White. Rubin described the Android project as having "tremendous potential in developing smarter mobile devices that are more aware of its owner's location and preferences" Android, the operating system for cellular telephones and tablet computers (shown in figure 1.3).

Android began in 2003 as a project of the American technology company Android Inc., to develop an operating system for digital cameras. In 2004 the project changed to become an operating system for

Smartphones. Android Inc., was bought by the American search engine company Google Inc. in 2005. At Google, the Android team decided to base their project on Linux, an open-source operating system for personal devices.

On November 5, 2007, Google announced the founding of the Open Handset Alliance, a consortium of dozens of technology and mobile telephone companies, including Intel Corporation, Motorola, Inc., NVIDIA Corporation, Texas Instruments Incorporated, LG Electronics, Inc., Samsung Electronics, Sprint Nextel Corporation, and T-Mobile (Deutsche Telekom). The consortium was created to develop and promote Android as a free open-source operating system with support for third-party applications. Android-based devices use wireless networks to take full advantage of features such as one-touch Google searches, Google Docs (e.g., word editors, spreadsheets), and Google Earth (satellite mapping software).

The two main types of software are system software and application software. System software controls a computer’s internal functioning, chiefly through an operating system, and also controls such peripherals as monitors, printers, and storage devices. Application software, by contrast, directs the computer to execute commands given by the user and may be said to include any program that processes data for a user. Application software thus includes word processors, spreadsheets, database management, inventory and payroll programs, and many other “applications.” A third software category is network software, which coordinates communication between the computers linked in a network.

## 1.2 OBJECTIVES

The presented project aims to implement an app-based vehicle monitoring and security system. The main motive of this project is to increase the safety of vehicles. The owner of the vehicle should be able to monitor the condition of the vehicle around all the time. The vehicle system of this country with new technology can be developed using the applied method. That is to say, our system will have the following objectives:

- To start the vehicle through RFID.
- To monitor the level of fuel in the fuel tank.
- To ensure the door safety system for the vehicle by using IR Sensor.
- To show notifications on the Android app via IoT.
- To enable or disable the engine of the vehicle through the android app.
- To check the real-time location of vehicles via the app.

## 1.3 SCOPE AND LIMITATIONS OF THE STUDY

- Response of driver could not identify. So that some accidents would occur for incognizant of the driver.
- Total load could not measure in our vehicle. When it was overloaded, it was a risk for passengers and also destroyed our vehicle's lifetime. Implementation load cell sensor inside the vehicle, we will know the total weight of our vehicle. At that time vehicles will safe and accidents will decrease.
- This monitoring system would be lost in rural areas. For this reason, we could not monitor this system in our mobile application when vehicles went to a rural area.
- We could not calculate vehicle speed through mobile apps. If the driver drive the vehicle roughly, we could not understand. Accidents will be held for this reason.
- GPRS will also implement in the future. So that, we will not need to use a pocket router. It is a packet-oriented mobile data standard on the 2G and 3G cellular communication network's global system communications. After the implementation of this system, we can monitor our vehicles in a rural area

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Preamble

In this chapter, a brief literature survey in this field is presented. Some researchers used the new sensor to improve the work efficiency, while others used GSM and PIC18F4620 as micro controlling systems. In literature, we have found that most of the existing works presented a security system focusing on the complete app-based network.

## 2.2 LITERATURE REVIEW

A prototype of a car ignition system using an RFID Module was proposed [9]. Automobiles can't be stolen with this technology in place. It is designed to use an RFID to control the vehicle's ignition. This system comprises a GSM SIM 900 that is connected to the Arduino, the project's microcontroller to make certain only the approved RFID Card is matched with the Arduino to start the ignition, making the system safe. Vehicles start if the registered RFID is validated with the database's biometrics, however, users who have no match in the firebase are prevented from starting the car. A burglar alarm is activated by a buzzer, and a notice is sent to the landlord's handset through GSM SIM 900 and the LCD monitor screen are relevant signals to the operator. The ESP8266 module having a Wi-Fi module used rather than GSM SIM900 makes the presented project more convenient.

An RFID-based automobile starting system was designed to prevent burglary and illegal use [10]. They used the fingerprint module, PIC18F4620 microcontroller, and Liquid Crystal Display (LCD) module to do this. In this paper, they don’t develop android apps. Also, the ESP8266 module has been used rather than PIC18F4620, which includes a wi-fi module.

An app that minimizes traveler wait times at bus stops by exchanging bus information between drivers and passengers was designed [11]. The precise arrival and departure times of buses are provided to passengers so that they may conveniently wait. The most crucial feature of the presented app. is Real-time location tracking, which will keep the user of the vehicles informed. Bus and ETA information will be shown at checkpoints, as well as SMS and email warnings. However, they only designed it for the SU campus and check the traveling time and reduce it.

IoT is extensively used in everyday objects and its popularity is increasing day by day. This paper includes the design and development of IoT and mobile-based vehicle fuel activities such as real-time fuel monitoring and GPS tracking system. The proposed IoT device measures the amount of fuel by using an ultrasonic fuel sensor.

When the vehicle tank of fuel reaches a certain level, the driver gets a notification through a mobile application and also searches the nearest pump location for reloading fuel. The proposed system used GPS tracking for showing the current location of the vehicle and finding the nearest pump location.

A software prototype that utilizes the Global Positioning System (GPS) on a Mobile phone to detect the position of a car as well as stores the coordinates in a Firebase Real-time Database was designed [12] Vehicle monitoring software is essential for tracking the movement of vehicles including buses, trains, and taxis. The precision of vehicle tracking systems is one of the difficulties. It is feasible with the aid of technology. Enabling the drivers of the vehicles to offer an accurate time estimate. The time of arrival for the users is the goal of this research to enhance the accuracy of predicted vehicle time so that users know what to expect from the vehicle's appearance. In addition, the vehicle's projected arrival time is calculated using the Google distance matrix Application Programming Interface (API). Based on suggested path and traffic statistics, the Distance Matrix API can yield traveling timing sites. The software prototype underwent numerous levels of system testing and review. Based on customer input, the methods have improved their estimation of travel times. Throughout the project controlling precision is improved. The vehicle owners can stop the car anytime as well as can access to start the car through the app.

A prototype of the vehicle's working system was proposed to access the car using a node MCU [13] If the activation key is missing or misplaced, accessing the vehicle's working system is impossible. It allows drivers to maintain a connection with their cars. When the starter device is stolen, the car cannot be started because the ignite mechanism is still frozen on the vehicle start, and only the registered user with the pairing of ignition key and mobile phone application will be able to resume the vehicle at a sensible time. To evaluate the system, this research recommends using a node MCU, Bluetooth low energy (BLE), transistors, power relays, and a Mobile platform. It is also cost-effective, and once placed in the car, it requires no more servicing.

The development of a car guard and alarm system based on IoT technology that uses biometric authentication was designed [14]. For vehicle security concerns, the suggested system VSS IoT, which is based on the interface of a Raspberry Pi 3 Model B+ development board, Pi camera, PIR sensor, and smartphone, grants only complete access to recognized vehicle drivers. As a result, if the suggested system identifies an alleged infringer inside the car, it will inform and communicate his picture, as well as the vehicle's position, to the vehicle's owner and/or a police workstation through the Internet, in case the vehicle is robbed or harmed. The suggested solution is tested on two datasets: ORL and our own.

A GSM technology was applied to send messages [15]. The user may manage the vehicle and, if necessary, switch it off. The system additionally uses an alphanumeric pin (with a total of 3 attempts) to regulate the entrance of a security vault door and the use of a safety belt. If a window burglar is detected, the IR sensor identifies the thief, as well as any obstacles, and delivers a signal to the microcontroller. A Bluetooth module and a burglar alarm are both attached to the device. The system sends an alarm sound to the dashboard (which is essentially a smartphone), which then provides an alarm condition to the user’s smartphone.

Technology for automatic person identification was employed [15] Each bus and truck company is used to rent their vehicle. Similarly, protecting the car against theft is critical. Vehicle theft can be thwarted remotely by a trusted individual. Embedded computer technology is a new field that has been employed in a variety of applications. Embedded systems, as well as the Global System for Mobile (GSM) and Fingerprint Recognition, are used to create a reliable car security system.

The assessment focuses on two primary technologies for automatic person identification: RFID Card recognition and existing car security systems.

## 2.3 PROBLEM STATEMENT OF THE STUDY

- Here we only monitored the fuel consumption. We could not monitor the passenger's and drivers' responses. So that something accident would happen.
- We were informed that this monitoring system would be lost in a rural area. For this reason, we could not monitor this system in our mobile application when vehicles went to a rural area.
- We could not calculate vehicle speed through mobile apps. If the driver drive the vehicle roughly, we could not understand. The accident will be held for this reason.
- We could not place any shock sensor in the vehicle. So we cannot monitor the accidental area zone.

## 2.4 Finally

All the literature has tried to establish a security system controlled by the microprocessor. However, all the proposed security system has some disadvantages, which limits the application in practical use. There is a lot of scopes to improve the security system of the vehicles using advanced android and IoT technique. In Android and IoT-based security systems, the effectiveness of the system is monitored using an authentication system

# CHAPTER 3

# HARDWARE SETUP AND PROGRAMMING

## 3.1 Preamble

This project is specially designed for vehicle theft, and driver-to-vehicle conflict, at the same time more different types of problems are seen. Project assessment and monitoring, compliance with business and government requirements, and any data analysis pertinent to project tasks the authors have examined how this initiative will require critical and technical support. The need to identify the components, modules, interfaces and data for a system to meet specific criteria is known as system design. Mobile authentication signal provides by the authority so that driver can start the vehicle. ESP-8266, GPS Module, limit switch RFID Card sensor, relay module, motor, and wheel were used to construct the body of the body. In the project environment, there are a few challenges that arise. Patches have been provided to address these issues. RFID Module, ultrasonic sensors, GPS module, IR Sensor, and LCD other modules were connected with ESP-8266.

## 3.2 HARDWARE SETUP

It is always critical to have accurate knowledge about all of the project's equipment and computer software. To create idealization, we used electronic components. The main and most important component in our extension is the nodeMCU. Because it contains all of the computer program information, we consider this section to be the heart of our extension. We have utilized fingerprint and ultrasonic sensors. LCD unit has been placed for showing data whose size is 16x2. A GPS module was placed to check the coordinates and find the exact location of the vehicle. We have used lots of hardware and software components in our project. Now let’s discuss those components below:

- RFID Card
- Ultrasonic Sensor

- ESP-8266
- GPS Module
- LCD Display
- I2C Module
- Yellow Motor
- Limit Switch
- Push Button

### 3.2.1 RFID (Radio Frequency Identification)

Radiofrequency identification (RFID) is a part of our lives whether we realize it or not. RFID improves efficiency and convenience. The RFID module is shown in figure 4. RFID is used for hundreds, if not thousands, of applications, including preventing theft of automobiles and merchandise; collecting tolls without stopping; managing traffic; gaining entrance to buildings; automating parking; controlling vehicle access to gated communities, corporate campuses, and airports; dispensing goods; tracking library books; purchasing hamburgers; and the growing opportunity to track a wealth of assets in supply-chain management. RFID is also being used

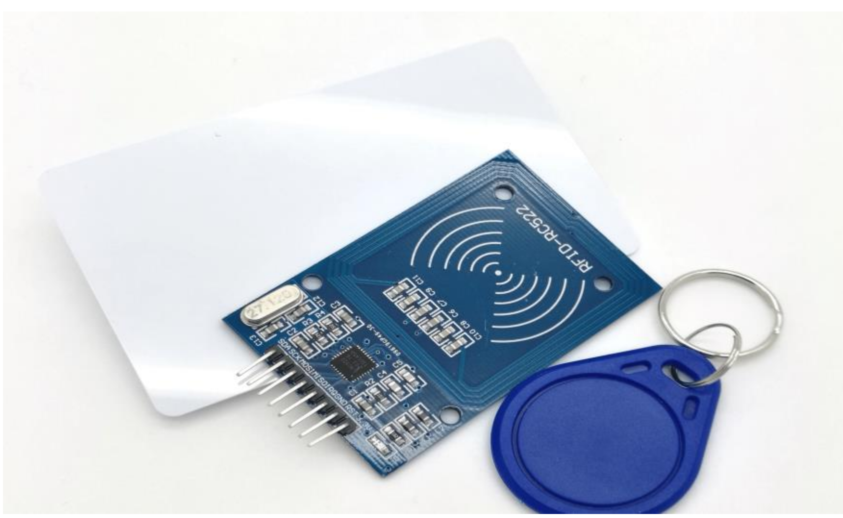



**Fig. 3.1:** RFID Module

In Homeland Security in the United States, with applications like protecting border crossings and intermodal container shipments while speeding up low-risk activities [16]. RFID stands for radio technology that communicates primarily digital information between a stationary site and a moving object, or between moving objects. RFID systems employ a range of radio frequencies and methodologies. The usage of basic devices on one end of the link and more complex devices on the other end of the link is a common feature of RFID. The simple devices (also known as tags or transponders) are small and inexpensive, may be deployed in huge numbers, are attached to the things to be managed, and run on their own. The more sophisticated devices (also known as readers, interrogators, and beacons) are more capable and are frequently connected to a host computer or network. The radio frequencies used ranged from 100 kHz to 10 GHz. The tags are typically made of CMOS circuitry, although other technologies such as surface acoustic wave (SAW) devices or tuned resonators can also be employed. Tags can be powered by a battery or by the reader's radio signal being rectified.

By changing the loading of the tag antenna in a programmed fashion or by producing, modulating, and transmitting a radio signal, tags can communicate data to the reader. Modulation and coding techniques of various kinds have been tried. Heinrich Rudolf Hertz, a German physicist, validated Maxwell's electromagnetic theory by producing and studying.

Electromagnetic waves (radio waves). Hertz is recognized for being the first person to send and receive radio waves, and his experiments in Russia were immediately followed by Aleksandra Popov. The tiniest microwave tags of the twenty-first century are made up of only two components: a single bespoke CMOS integrated circuit and an antenna. Tags could now be made as sticky labels that could be readily attached to windshields and other manageable things. By 2001, the use of RFID for electronic toll collecting had grown to 3,500 lanes of traffic in the United States. The non-volatile memory of choice remained EEPROM. The hunt for a quick nonvolatile memory that meets RFID's specifications continues. The antenna's restrictions have now limited the size of tags. The search for superior nonvolatile memory and the construction of acceptable antennas are ongoing design difficulties. RFID's influence is frequently commended in the mainstream media, and its use is expected to become much more widespread. RFID will become even more accessible to consumers as interest in telematics, article tracking, and mobile shopping grows. The Federal Communications Commission (FCC) of the United States has allocated a 5.9 GHz spectrum for a massive expansion of intelligent transportation systems, with a slew of new applications and services planned. However, the equipment needed to support these new applications and services will require advances beyond "conventional" RFID technology.

### 3.2.2 Ultrasonic Sensor

**Fig. 3.2:** Ultrasonic Sensor

Ultrasonic sensing is one of the best ways to sense proximity and detect levels with high reliability. It is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. At this time, we are using this sensor for measuring the level of fuel. From this sensor, we know the actual fuel level of our system. Specification:

- Power Supply: DC 5V
- Working Current: 15mA
- Working Frequency: 40Hz
- Ranging Distance: 2cm – 400cm/4m
- Resolution: 0.3 cm
- Measuring Angle: 15 degree
- Trigger Input Pulse width: 10uS

**Working System:**

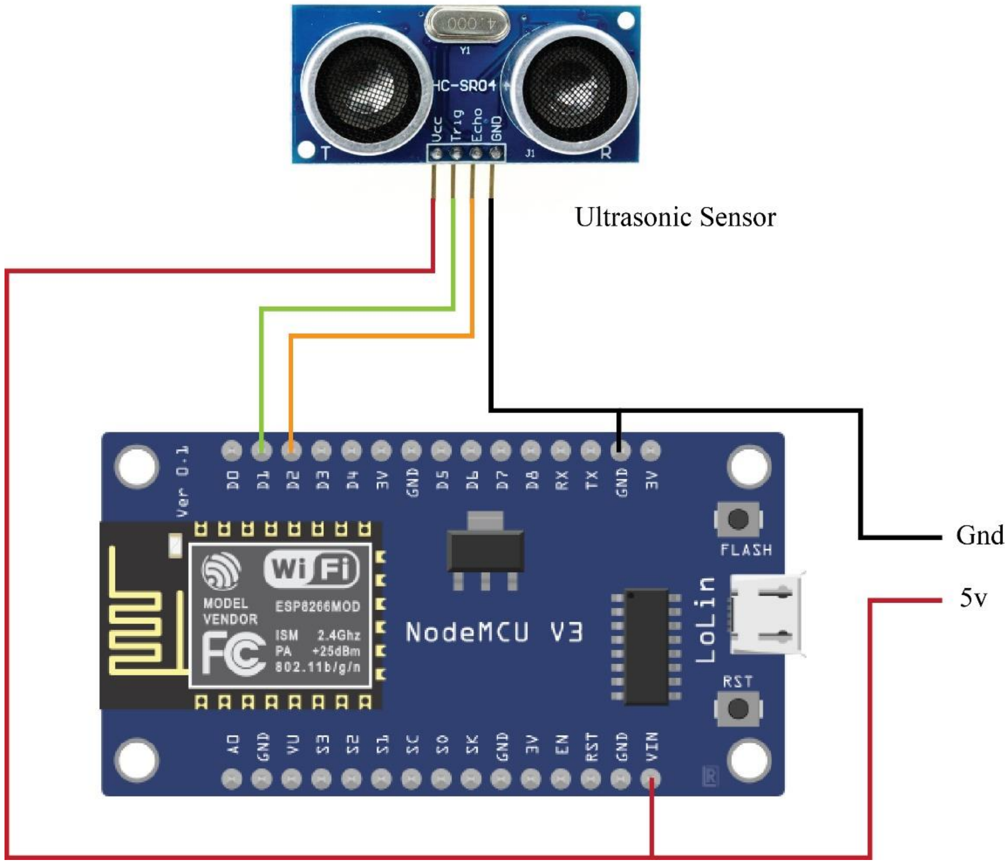



**Fig. 3.3:** Connection between ultrasonic sensor and nodeMCU

The sensor measures the distance between the fuel level and the bottom surface of the fuel tank. The sonar sensor has 4 Pin Examples: VCC, GND, TX (TRIG), and RX (ECHO). We will connect sonar sensor-1 TX Pic to the nodeMCU D1 no. Pin and RX Pin to the nodeMCU D2 no. Pin. And also connected VCC and GND Pin to the nodeMCU VCC and GND Pin. When fuel is filled up in the tank, the ultrasonic sensor sends a signal to the microcontroller. At first, the trig pin was sent an ultrasonic wave. These waves are pushed back to the ECHO pin of sensors. The microcontroller processed the signal and converted it into the distance. From this distance, we calculated the level of fuel in the tank. This output was shown on this LCD.

### 3.2.3 GPS Module

A GPS module is a tiny board on which a GPS sensor and other components are placed. In addition to the GPS module, a GPS receiver comprises a data display and additional components including memory for data storage

.


**Fig. 3.4:** GPS Module

A signal was used from orbiting satellites and ground stations on Earth to identify its precise location on the planet. The microcontroller interfaced the signal, the NEO-6M GPS receiver module uses USART communication. It checked the coordinate of the vehicle position. The distance was measured to each satellite by the amount of time it took to receive a transmitted signal. Vehicle positioned can be determined and displayed it. With distance measurements from a few more satellites.

**Working System:**

RX and TX pin of GPS module was connected with TX and RX. Power supplied was connected from both devices so that this module was activated properly. GPS module sends data in micro-controller. It was used in a vehicle to find the actual location of the vehicle. It was taken some time to initialize the device with a coordinate. Then it was sent data in ESP-8266. ESP-8266 was read data and output as shown in mobile apps. So authority or owner vehicle was easily known the location of the vehicle.

### 3.2.4 LCD Display

A 16x2 LCD can display 16 characters per line on each of its two lines. Each character is presented in a 5x7 pixel matrix on this LCD. The 224 distinct characters and symbols can be displayed on the 16 x 2 intelligent alphanumeric dot matrix display. Command and Data are the two registers on this LCD.

**Fig. 3.7:** LCD Display

**Working System:**

LCD was connected with the I2C module. It had 2 rows and 16 columns. So 16 variables were printed on display. The display was used to show the monitoring system of the vehicle. In initializing position, the staring and waiting command was shown on the LCD. The connection ID was also shown there.

### 3.2.5 I2C Module

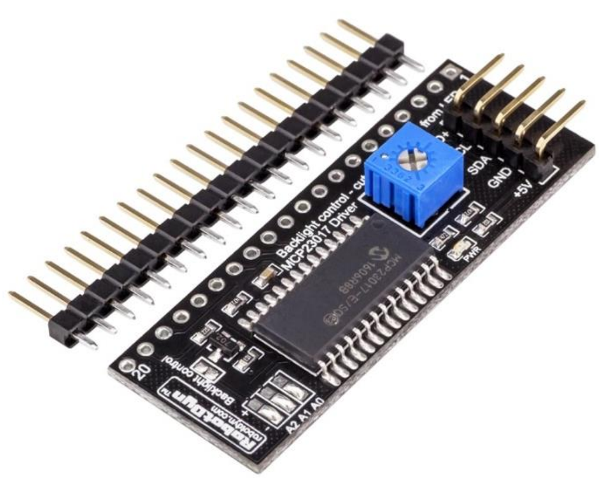



**Fig. 3.8:** I2C Module

**Working System:**

I2C is a single-ended serial bus that is a synchronous, multi-slave, multi-master packet switched. Multiple chips can be connected to the same bus, for example. Serial Data Line (SDA) and Seria Clock Line (SCL), both bidirectional open collector and open drain lines, are pulled up with resistors in I2C. SCL pin connected with D4 pin and SDA pin connected with D3 pin for bus communication. Again VCC and GND pin connected with Vin and Gnd of nodeMCU. A regulator was used to set the display brightness. This I2C module reduced the use of pins for nodeMCU. At a time, it worked as a protector for an LCD. A2, A1, and A0 pins were used for changing the address of I2C. By changing the address, we connected more I2C by using one nodeMCU for bus communications.

### 3.2.6 IR Sensor

The operation of an infrared sensor is similar to that of an object detection sensor. This sensor contains an infrared LED and an infrared photodiode, which when combined form a photo-coupler

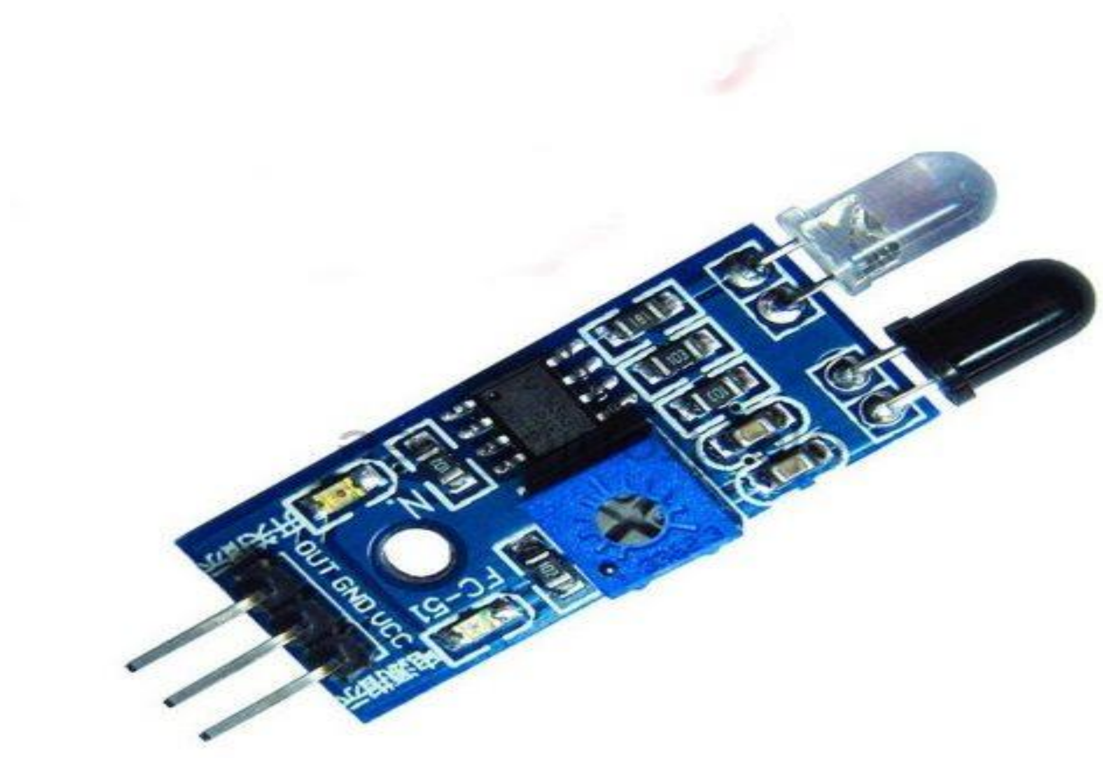



**Fig. 3.9:** IR Sensor

or optocoupler. This sensor employs the physics laws of planks radiation, Stephan Boltzmann, and Weins displacement.

An IR LED is a type of transmitter that emits infrared radiation. This LED appears to be a standard LED, and the radiation it emits is not visible to the naked eye. Infrared receivers detect radiation primarily through the use of an infrared transmitter. Infrared receivers are available as photodiodes.IR Photodiodes differ from conventional photodiodes in that they only detect IR radiation. There are various types of infrared receivers based on voltage, wavelength, package, and so on.

When used in conjunction with an IR transmitter and receiver, the wavelength of the receiver must equal that of the transmitter. The transmitter in this case is an IR LED, and the receiver is an IR photodiode. The infrared photodiode is sensitive to infrared light emitted by an infrared LED. The resistance of the photodiode and the change in output voltage is proportional to the amount of infrared light obtained. This is the fundamental working principle of an infrared sensor.

When the infrared transmitter emits an emission, it reaches the object, and some of the emission reflects toward the infrared receiver. The IR receiver can determine the sensor output based on the intensity of the response.

### 3.2.7 Relay Module

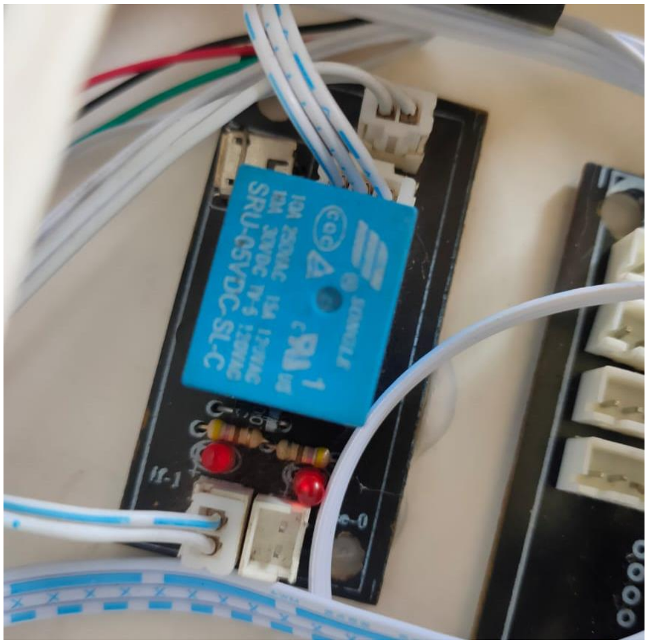



**Fig. 3.10:** Relay Module Setup

The relay module is an electrically controlled switch that can be turned on or off, allowing or disallowing current flow. A relay module was used to drive the motor. The motor should not connect to a microcontroller. Because the controller could be destroyed to follow the back EMF from the motor. So that reason motor was operated by using a relay module. Relay switched the motor with the power supply. They're made to run on low voltages like 3.3V (like the ESP32, ESP8266, and others) or 5V (like our Arduino).

### 3.2.10 Motor

This Yellow Dual Axis Gear Motor is perfect for a robotic automobile or a line-tracing robot. The DC gear motor is 2.5 inches long, 0.85 inches wide, and 0.7 inches thick, with a bright yellow plastic structure. It was used to show the engine starting. If the motor was started so the vehicle was run.

- Motor Voltage 3-9 V
- Gear Ratio: 48:1
- No-Load Current: at 3V 0.12 A
- No-Load Speed: at 3V 110 RPM

**Fig. 3.11:** Yellow Motor

### 3.2.10 NodeMCU

NodeMCU is an electronics platform or device, as well as the software that runs on it. ESP-8266 was used in creating interactive objects or surroundings that can use electronics more accessible.

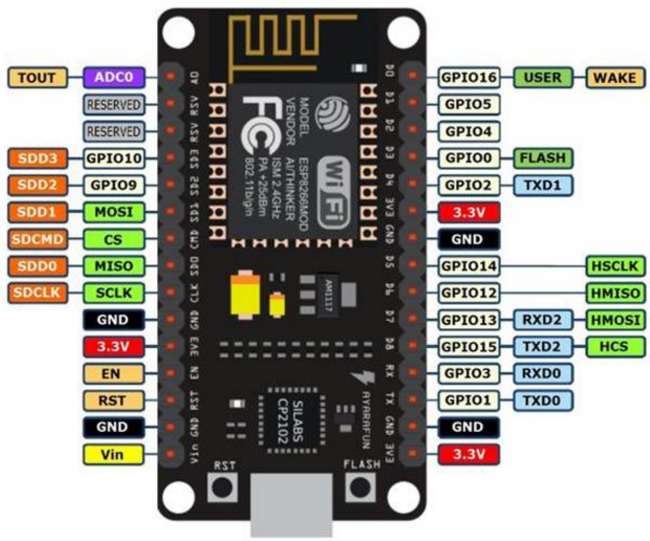



**Fig. 3.13**: NodeMCU Controller

NodeMCU is an open-source hardware and software platform, project, and user community that creates single-board microcontrollers and microcontroller developers for the creation of digital devices. It was operated 5v. Wi-Fi MOD was attached with ESP-8266 to transfer the data to the database. This MOD connected with a Wi-Fi router by mentioning the address. NodeMCU was connected to a computer via USB and then to the Arduino software platform (IDE).

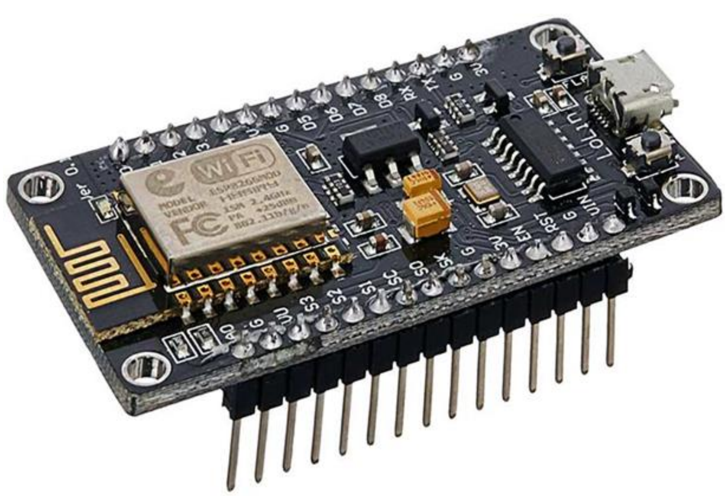


**Fig. 3.14:** NodeMCU Pin Configuration

**Specification of NodeMCU:**

- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz

**Working System:**

NodeMCU is the microcontroller of this project. It has some digital pins, one Rx Tx pin, and one analog pin, etc. This pin is also used to control input and output devices. For the analog input signal, we have only used the A0 pin. For the digital input signal, we have used D0-D8 pins. These pins are also used as digital input/output. We have connected an external power supply for activating this controller. Here, the positive point of the power supply connects with the VIN pin and the negative point connects with the GND pin. All the input and output devices connect between D0 to D8. For the input signal, we have declared this pin as input and for the output signal, we have also declared this as output.

# CHAPTER 4

# SOFTWARE DEVELOPMENT


**Fig. 4.1:** Arduino IDE Software

Writing code and uploading it to the board is simple with open-source Arduino Software (IDE). Any Arduino board could be used with this software. The Arduino software was written in C++. C/C++ had the option of writing our code in an inline assembler, assembler, or a combination of these languages. Although the Arduino Uno was a wonderful board for novices, it had certain restrictions. On an Arduino Uno, memory restrictions might be a concern, especially when working on larger projects like establishing an Arduino web server.

## 4.1 Introduction of Arduino

The function of Arduino IDE software was shown there. There were shown some function-able portions. Menu bar, serial monitor, variable declaration, void setup, void loop, verify button, and output pane were shown here. The menu was used to file save and create a new file. Verify port was used to upload and compile the code. Tools port was used to select the control board and port. An error was shown to check the error.

## 4.2 Variables Declaration and Library Included

Variables were declared in this part. Also, the variable was initialized because so Garber value was shown in serial print. Connector1, SmartKey, Engine, scanned, and Connector variables were declared as integer type data.
Some library was added to this Arduino IDE software. Because this library was not included in Arduino IDE. #include was used for including the library. #include <LiquidCrystal_I2C.h> ,<Adafruit_RFID.h>, "FirebaseESP8266.h" and <ESP8266WiFi.h> was included. I2C was used to control the I2C module. Besides other library was used to fully work this code.
Some variable was defined in this code. IREBASE_HOST, FIREBASE_AUTH WIFI_SSID, and WIFI_PASSWORD were defined in this code.

#define FIREBASE_HOST "IoT-load.firebaseio.com"

#define FIREBASE_AUTH "Jnq5ikOjpEl0G2atw5Q6oI8wdLUi1UvtixTPQEGj"

#define WIFI_SSID "Vehicle"

#define WIFI_PASSWORD "12345678"

## 4.3 Code Compile & Upload

After coding, it would be tested for checking any compile error. If any error did not found. So the code had no error. Another error was found, it was fixed by changing parameters. When the compilation is done.
After compiling, this code was uploaded in Arduino by using a USB cable. Before uploading we select the node MCU board and select the port. The system was shown in Figure 3.32. Port was selected by using this format. Then click the upload button for uploading code into Arduino. The procedure was almost done.

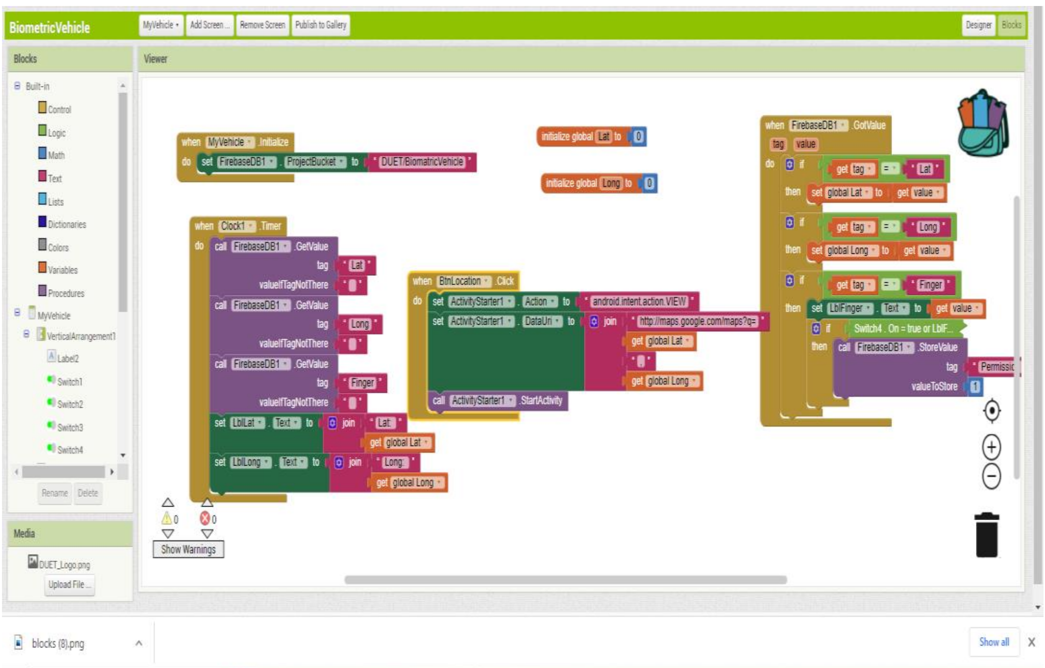
Finally, compile this code and upload this code in Arduino by using a loader cable. This is the final code of the Vehicle Theft Alert & Engine Lock System.

## 4.4 APPS DEVELOPMENT

We develop an app for monitoring this project. It is an android app. It is a user-friendly app. This app is built with help of the MIT app inventor platform. It is an intuitive, visual programming environment that allows everyone to build fully functional apps for Android phones, iPhones, and Android/iOS tablets. Blocks-based coding programs inspire intellectual and creative empowerment. In this app, four parking slots are shown here. At first home page design for android apps. The University logo and authority name was included here.

This is the main front page of this project. This is built by block programming in MIT app inventor. All most information's given here. It is IoT-based vehicle safety and cloud monitoring app which is shown here in the title name of this app.

This was done by using block programming methods. Some label and tag value.  The text was added by using additional functions.



.

**Fig. 4.2:** Monitoring Page Development

The second page was designed by using the if condition and some variables. This app was connected to the o database. Value was read from the database and sent any value into the database using the second page. All notification shows on this page.

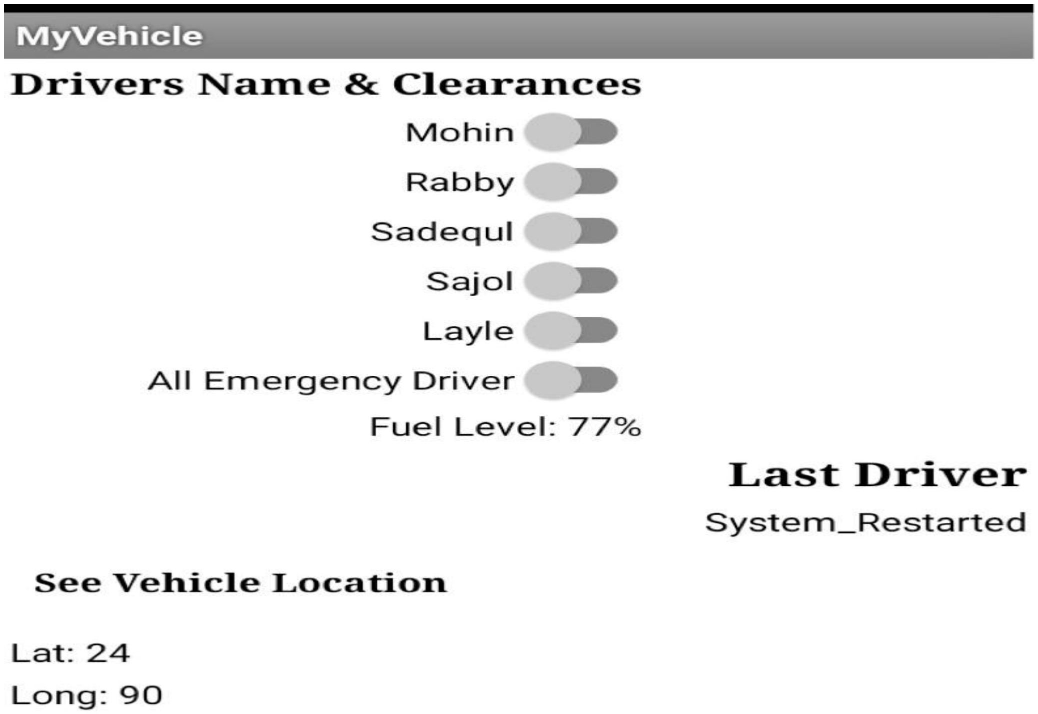



**Fig. 4.3:** System monitoring page from a mobile

# CHAPTER 5

# METHODOLOGY

## 5.1 METHODOLOGY OF THE STUDY

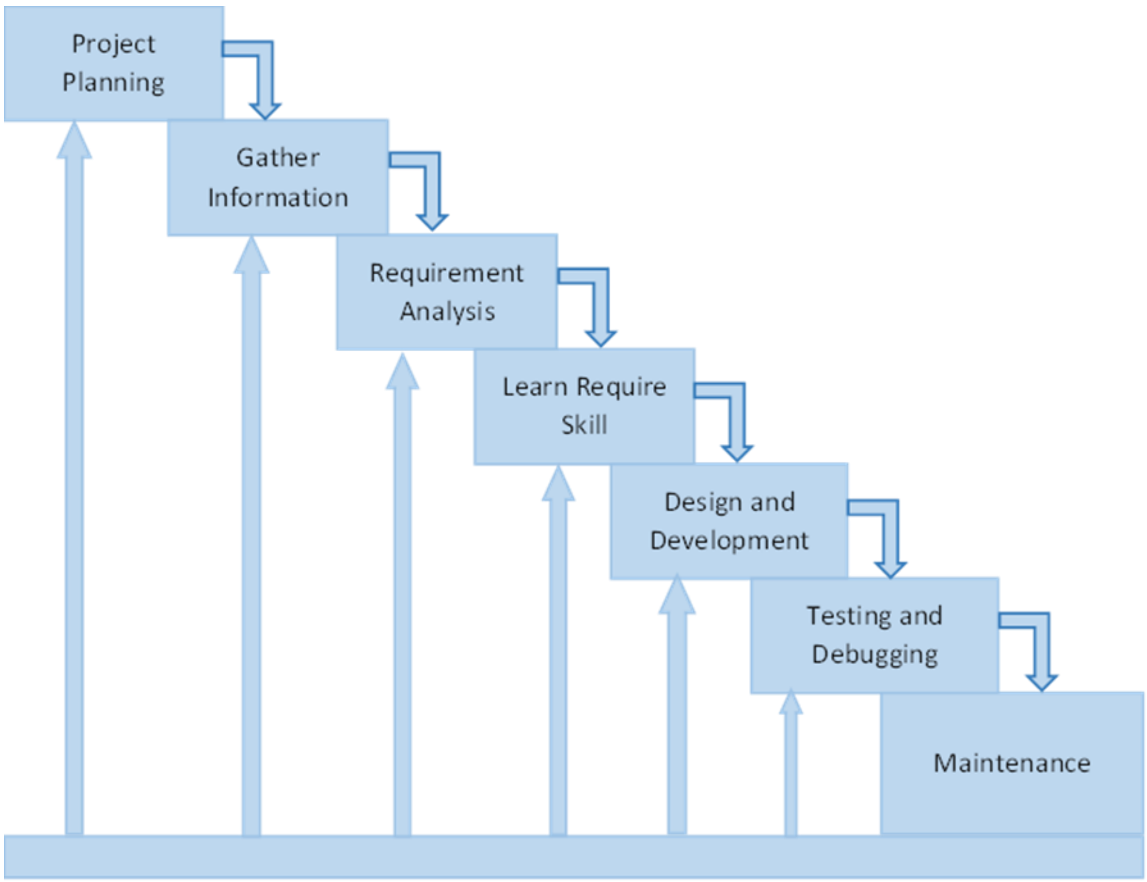



**Fig. 5.1:** Methodology diagram of the project

The methodology is the systematic, theoretical analysis of the methods applied to a field of study. The methodology is some theoretical step or work schedule that flowed by any project. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases, and quantitative or qualitative techniques. Our project work has been completed by following some strategies, which are given below.

## 5.2 Project Planning

Project planning is a discipline that specifies how to accomplish a project in a specific amount of time, typically with specified stages and resources. First, we discovered a few common issues in our day-to-day lives. Then locate this issue and consider a clever solution within a set time limit. With our team members and teachers, we had a discussion. We have devised a clever mechanism that can feed data to nodeMCU. For the particular command that is required, it can also determine the condition of the vehicle.

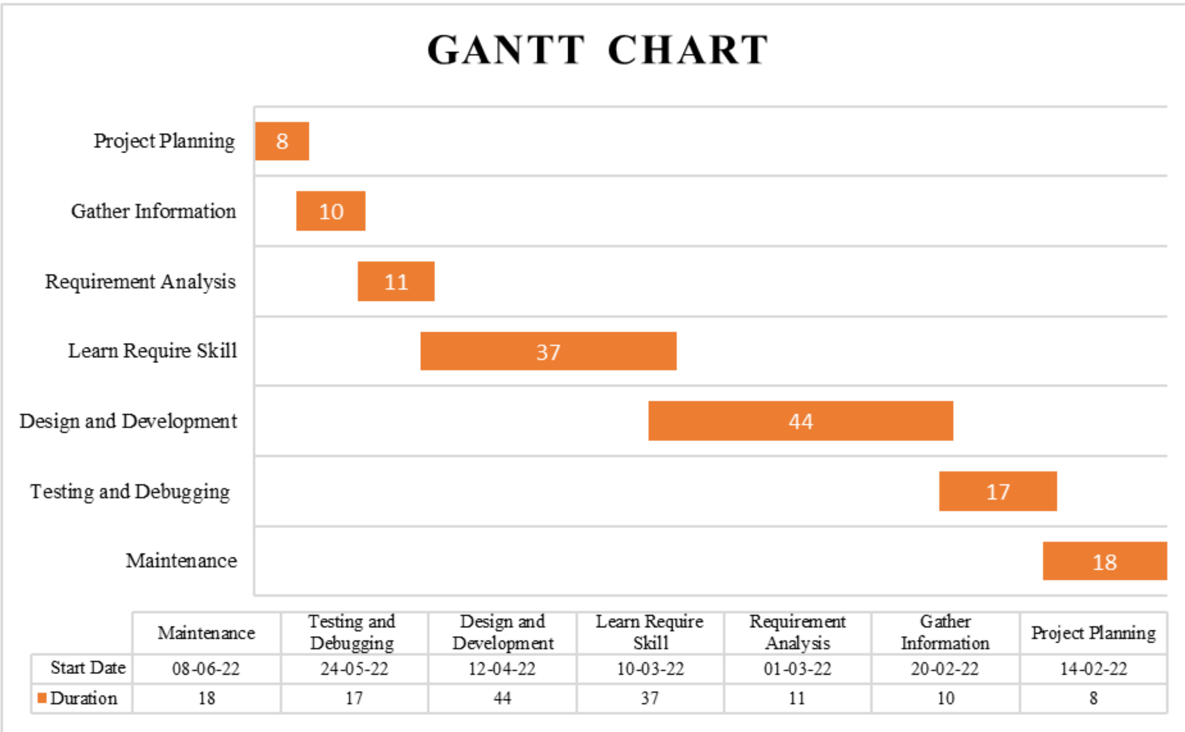



**Fig. 5.2:** Gantt chart of this project

## 5.3 Requirements Analysis

The tasks involved in figuring out the requirements or conditions that must be met for a brand-new or modified project or product are included in the requirements analysis. We are considering the requirements to make this project effective after acquiring the necessary data. The suggested system makes use of three sensors. The writers had to study a lot of hardware-related information as well as a few computer languages to finish this project like Arduino, numerous sensor programming, the C programming language, etc. The information that the authors have gathered includes.

### 5.4 Learn Required Skill

For completing the project we had to know about Android language Java, Hardware connection. We practice Arduino IDE programming and developed code in this software. At that time, we learned about block programming for developing android apps. We have to use MIT App Inventor to develop the apps. We have trained about DC circuit design which is implemented in our project. We develop our primary circuit in the breadboard. Different types of sensors, modules, and micro-controller were used to develop this project. We also created a database to store data on the server.

## 5.5 Design and Development

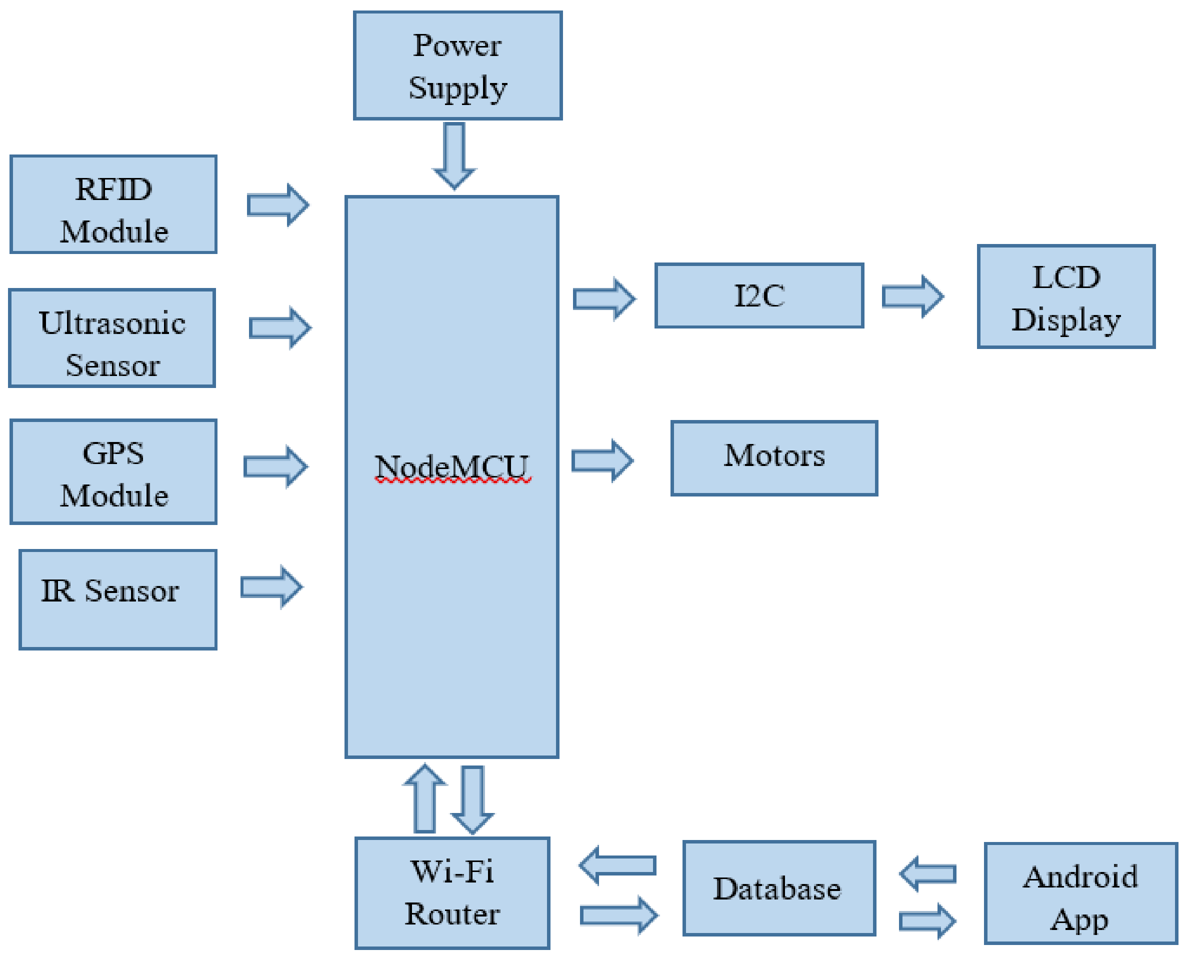



**Fig. 5.3:** Block diagram of the system

The process of defining a system's modules, interfaces, components, and data to meet predetermined requirements is known as system design. The process of building or changing a system, as well as the procedures, techniques, models, and development approaches, is referred to as system development. Utilizing NodeMCU, a power supply, a web interface server, and an Android app, we created the system architecture. Here, some stage of methodology was employed to construct the device.

## 5.6 Testing and Debugging

A device that is being tested also known as equipment under test or unit under test, is a manufactured product that is being tested, either during its initial manufacturing or later in its life cycle as part of continuing functional testing and calibration checks. We check the value of the sensor at maximum and minimum levels of fuel in the tank. Also, check the trig point of the limit switch. The whole process has checked the part-to-part segment.

## 5.7 Maintenance

Some issues come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment. The main methodology of this entire project depends on IoT based embedded system so interfacing all hardware with Wi-Fi and the internet is a very important part of its functioning. An ultrasonic sensor was placed in the fuel tank. It could calculate the level of the fuel tank. From this fuel level, vehicle owners easily monitor fuel consumption. If anybody theft fuel from the vehicle, the vehicle owner will notify through the mobile app. A GPS is placed in the front part of the vehicle and it gives longitude and latitude values. The values of the sensor and GPS are collected by NodeMCU as it has an inbuilt Wi-Fi module all the data is transferred to the cloud through Wi-Fi and analysis is done in the mobile application and notifications are sent according to the conditions.

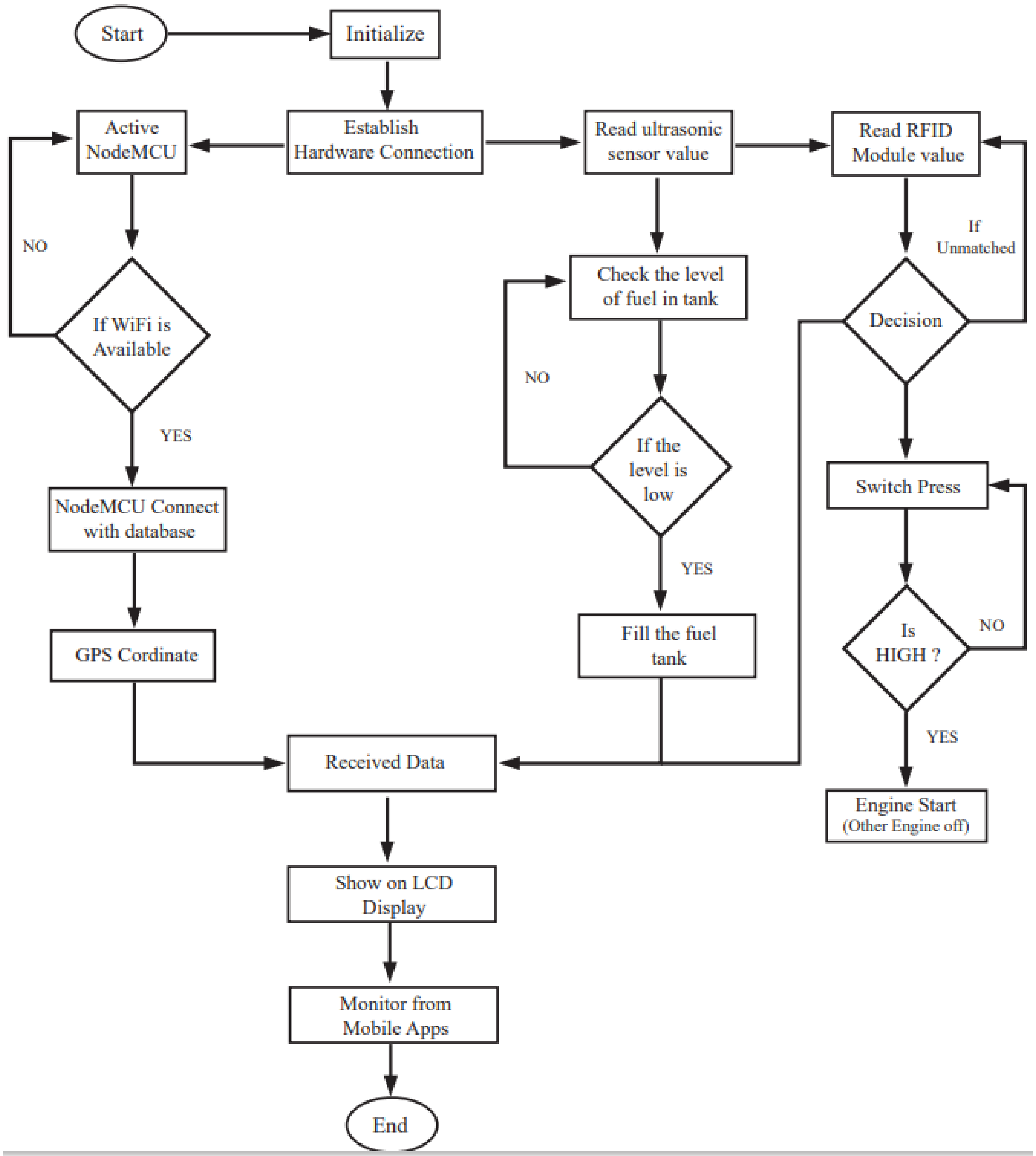



**Fig. 5.4:** Flow Chart of the project


**Fig. 5.5:** Total setup of the whole system

# CHAPTER 6
# RESULT AND DISCUSSIONS

## 6.1 INTRODUCTION

Data collection and analysis tools are defined as a series of charts, maps, and diagrams designed to collect, interpret, and present data for a wide range of applications. The choice of data collection method is a critical point in the research process. Quantitative data collection typically involves one or more of the following: Surveys, tests, or questionnaires administered in groups, one-on-one, by mail, or online, and reviews of records or documents. It is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. We have collected data from simulation software. Also calculated time concerning internet speed.

## 6.2 DATA COLLECTION METHOD

Methods of quantitative data collection and analysis include questionnaires with closed-ended questions, methods of correlation and regression, mean, mode, and media,n, and others. Quantitative methods are cheaper to apply and they can be applied within a shorter duration of time compared to qualitative methods. We have collected data by observing, online tracing, and histories. We have collected data on ultrasonic sensors by using a serial monitor in Arduino IDE software. Flash memory (program space), is where the Arduino sketch is stored. SRAM (static random access memory) is where the sketch creates and manipulates variables when it runs. We can use the serial port on any Arduino, including one with a USB connection, to send data to a computer running a terminal program like Putty, Hyperterm, TeraTerm, etc., and "log" the data to a file.

## 6.3 DATA COLLECTED

We measured the distance of the ultrasonic sensor by using this formula.

Distance = (Time x Speed of Sound) / 2.

The "2" is in the formula because the sound has to travel back and forth. First, the sound travels away from the sensor, and then it bounces off of a surface and returns. The easy way to read the distance as centimeters is to use the formula: Centimeters = ((Microseconds / 2) / 29). For example, if it takes 100µs (microseconds) for the ultrasonic sound to bounce back, then the distance is ((100 / 2) / 29) centimeters or about 1.7 centimeters.

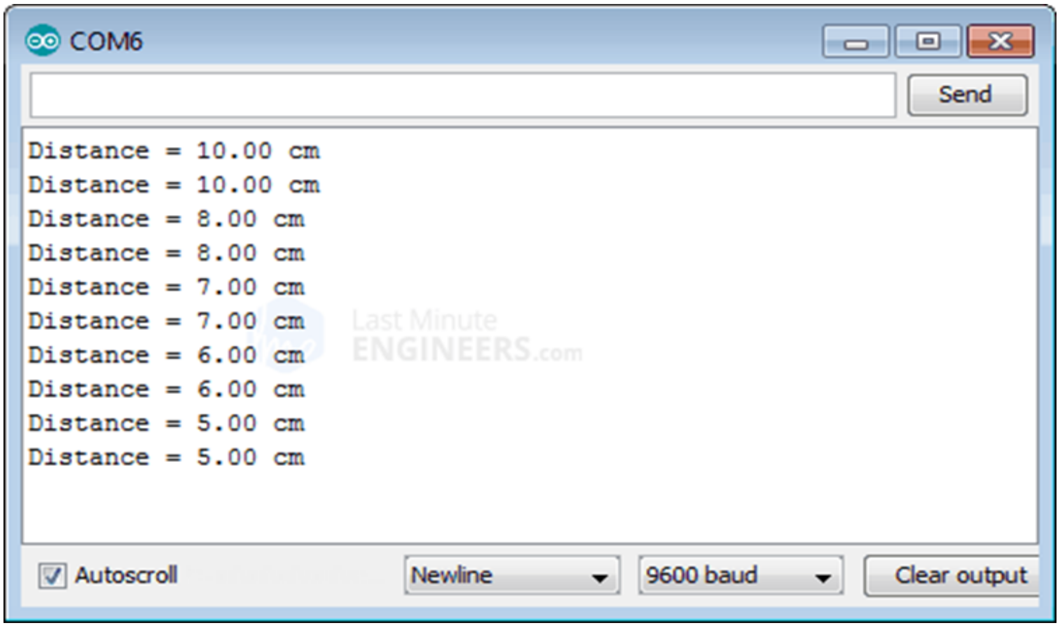



**Fig. 6.1:** Measured the distance of fuel level in the tank

We have also collected the value of the GPS module. GPS uses a lot of complex technology, but the concept is simple. The GPS receiver gets a signal from each GPS satellite. The satellites transmit the exact time the signals are sent. By subtracting the time the signal was transmitted from the time it was received, the GPS can tell how far it is from each satellite. The latitude and longitude values of each coordination are shown in the serial monitor. Latitude and longitude are broken into degrees, minutes, seconds, and directions, starting with latitude. For instance, an area with coordinates marked 41° 56' 54.3732” N, 87° 39' 19.2024” W would be read as 41 degrees, 56 minutes, 54.3732 seconds north; 87 degrees, 39 minutes, 19.2024 seconds west.

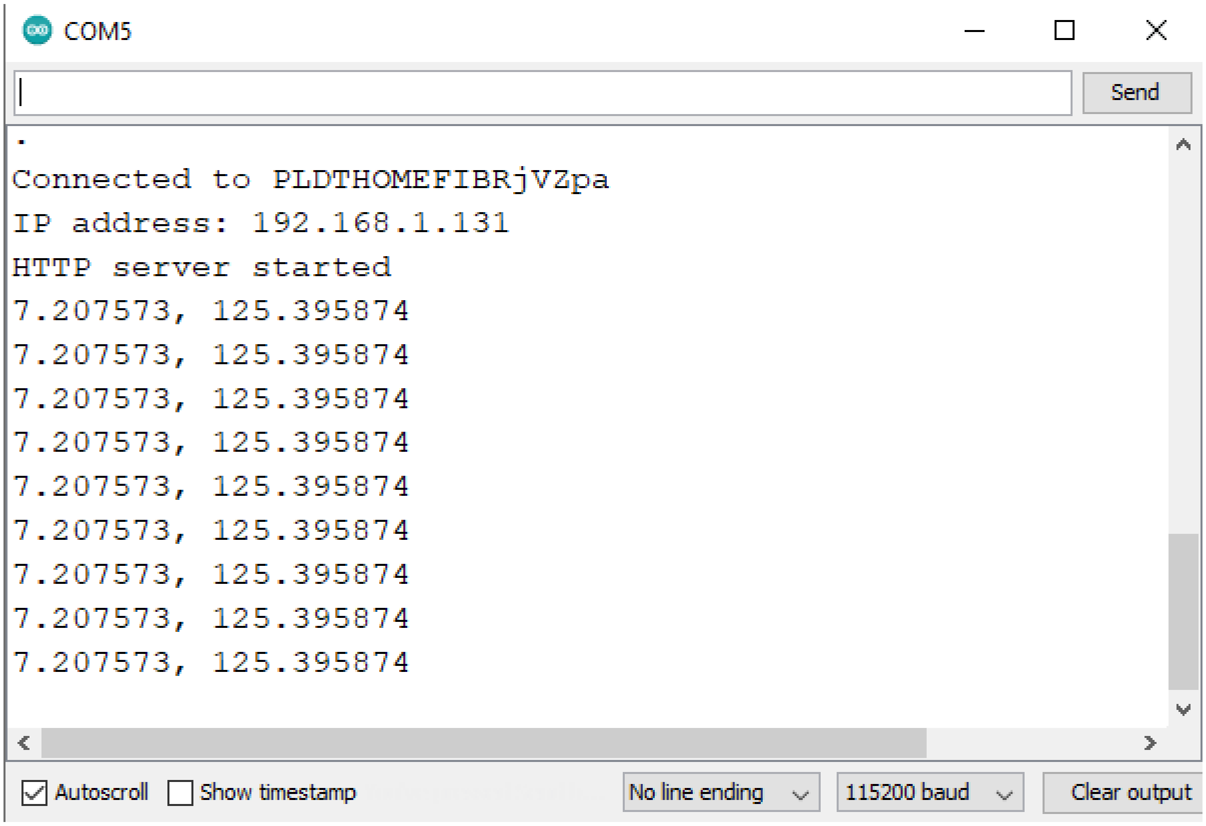



**Fig. 6.2:** GPS coordinate value showed in the serial monitor

We have collected some data based on data transmission speed. It was taken little more delay to transfer data from nodeMCU to the database or firebase. This time depended on the 2G, 3G, and 4G network speeds. We collected data for 3G and 4G networks which was shown in table 6.1.

Table 6.1: Operating Time Calculation for 3G and 4G network

| Operating System | Time for 3G | Time for 4G |
|---|---|---|
| Delay for two-way data transmission | 5 seconds | 3 seconds |
| From Scanner to Database | 2 seconds | 1 second |
| Database to App | 3 second | 2 second |
| App to Microcontroller | 2 seconds | 1 second |

We have also measured voltage and current for each component and module The pump gained maximum voltage and current. Other equipment absorbed little voltage which was around 3.3v. The average current of the components was around 30 Amp.

Table 6.2: Measured Voltage and Current for each component.

| Operating Time | Voltage (V) | Current (mA) |
|---|---|---|
| RFID Module | 3.3 | 50.1 |
| GPS Module | 3.28 | 38.6 |
| LCD Display | 3.3 | 20.2 |
| I2C Module | 3.3 | 20.6 |
| Relay Module | 3.31 | 90.1 |
| Pump | 4.98 | 180 |
| Push Button | 3.3 | 10.3 |
| Motor | 4.99 | 104 |

## 6.4 DATA ANALYSIS

After collecting this data, we have to analyze the data very carefully. We have done several trials for observing this data. At first, we checked the fingerprint sensor. We have taken 100 number of trial for this experiment.

Table 4.3: Scanning Accuracy for RFID Module

| Matched | Unmatched |
|---|---|
| 93 | 7 |

Accuracy = 93%
Authorized ID Detection Accuracy = 93%
Unauthorized ID Rejection Accuracy = 100%
Sometimes it failed for the position of RFID. It was very careful to set the finger on the sensor.

Table 6.4: Performance test of android app

| Item | Success | Failure | Total Trial |
|---|---|---|---|
| Disable System | 50 | 0 | 50 |

| | | | |
|---|---|---|---|
| Day- 1 | 30 | 0 | 30 |
| Day- 2 | 30 | 0 | 30 |
| Day- 3 | 30 | 0 | 30 |

No of the Success rate of App performance for disabling system 50 trials = 100%

No Success rate for App performance for the specific driver for 30 trials each = 100%

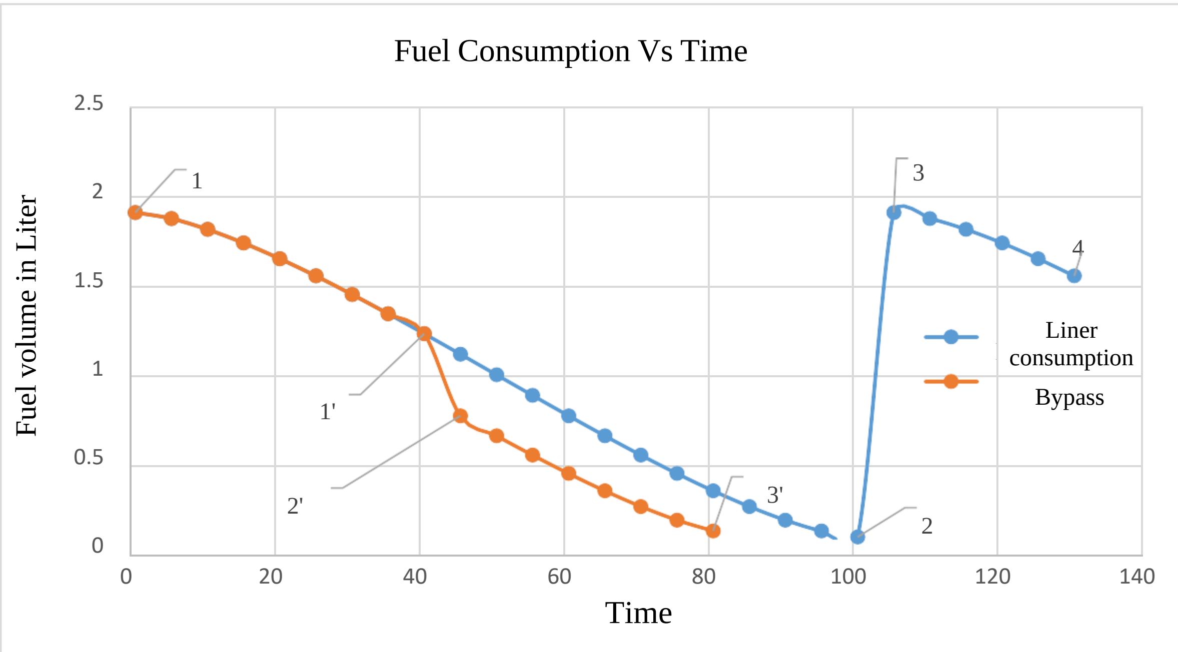



**Fig. 6.3:** Linear and bypass Fuel consumption system

In this graph, the fuel consumption rate was shown here. The blue line represented the linear consumption and the orange line represented the bypass line of fuel. Does anybody theft fuel through this line? The area between 1` and 2` represented the fuel consumption rate was so high. At this point, fuel theft happened. So authority easily knowknowser analyzing this graph.

## 6.5 DISCUSSIONS

This work is a well-operating prototype of a sensor-based vehicle starting system, fuel monitoring, door locking, and safety system.  The authorized users of the vehicles have to use fingerprint detection techniques to start the vehicle. The function of tracking the proposed vehicle security system is to monitor the Real-time location with the help of a GPS module. The data transmission rate for the 3G system is a bit slower than the 4G system. This is because the ITU-R has set standards for 4G connectivity. It is requiring all networks described as 4G to adhere to the required set of speed and connection standards. In table 4.3 we calculated the accuracy here the security is 100% protected and accurate for 100 trials authorized ID detection accuracy = 93%, unauthorized ID rejection accuracy = 100%. That means the system is accurate. In table 4.4 the app performance for disabling the system where the vehicle starts only by keys is 100%. In table 4.5 app performance for specific drivers is 100%. The application is highly targeted, especially for those people who are not capable of leaving their private cars and reaching their desired destination in due course. The prototype of the application went through several stages of software testing and evaluation.

# CHAPTER 7
# CONCLUSIONS

## 7.1 CONCLUSIONS

- This project describes the implementation of a vehicle security starting system based on the internet of things and has completed its whole goal of protecting the vehicle starting system to improve the existing auto security systems based on the results acquired.
- The installed phone application aids in the control of the ignition system and prevents unauthorized persons from accessing the automobile unless they have both the ignition key and the application to enable vehicle starting.
- The system alert has also been utilized to wear the automobile owner if they attempt to use just the ignition keys. The verification shows that the IoT-based advanced vehicle system is realistic and able to control the stealing automatically.
- The response time delay is also less compared to previously presented methods. This IoT-based advanced vehicle system enables user safety by seat belt compulsion, and a keyless locking /unlocking system to operate the vehicles.
- The system can be used for any vehicle too by using these components and modules used in this project.
- IoT-based advanced vehicle system offers utmost efficiency, convenience, safety & reliability. Several tests were done and it is noticed that this system works as required and couldn’t be readily hacked by unauthorized persons. This implemented method is an ideal solution for users to improve vehicle security.

# CHAPTER 8
# RECOMMENDATIONS & FURTHER STUDY

## 8.1 RECOMMENDATIONS

- RFID reader will be used to start the vehicle.
- Face recognition sysystemsill be included in the future.
- Web interface will be shown on the monitor.
- Float sensors will be implemented here in the future.

## 8.2 SUGGESTION FOR FURTHER STUDY

- Our project is particularly used to safeguard vehicles. But by adding some more features we can make it useful for a cruise control system with the help of which we can easily make a certain limit on the speed of the vehicle from anywhere to avoid fatal accidents.
- As the system takes some time to send confirmation via IoT, so to minimize this delay we can use the remote locking feature with our system. As the user wants to go somewhere he can turn ON the system from a distance, by doing so, he gets the OTP in the meantime he reaches his / her vehicle, and the vehicle is ready for access.

# REFERENCE


[1] F. Y. W. H. M. A. H. N. Motoyoshi G, "Overall Architecture and Traffic Dynamic Control Method in the Satellite/Terrestrial Integrated Mobile," Communication System. In 29th AIAA International Communications Satellite Systems Conference (I).

[2] F. S. G. Z. W. J. Umehira M, " Location-based centralized dynamic channel assignment with channel segregation for multi-beam mobile satellite networks.," Location-based centralized dynamic channel assignment with channel segregation for multi-beam mobile satellite networks. In 2014 , 2014.

[3] S. Z. a. G. H. Song, "Svats: A sensor-network-based vehicle anti-theft system," “Svats: A sensor-network-based vehicle anti-theft system,” IEEE INFOCOM 2008, pp.2128-2136, April.2008., 2008.

[4] J. A. J. W. A. I. W. A. Y. K. V. S. a. D. A. P. P. J. Alsayaydeh, "Development of vehicle ignition using fingerprint.," "Development of vehicle ignition using fingerprint." ARPN Journal of Engineering and Applied Sciences 14, no. 23 (2019): 4045-4053.

[5] C. O. L. A. A. A. A. A. a. K. O. Folorunso, "Design and development of fingerprint-based car starting system," "Design and development of fingerprint-based car starting system." In NIEEE International Conference and Exhibition on Power and Telecommunications. 2015..

[6] N. A. R. a. P. K. Chadil, "Real- time tracking management system using GPS, GPRS and Google earth," "Real- time tracking management system using GPS, GPRS and Google earth." In 2008 5th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications an.

[7] A. S. A. J. M. H. A. W. J. N. P. S. K. S. a. T. E. Shibghatullah, "Vehicle Tracking Application Based on Real Time Traffic," . "Vehicle Tracking Application Based on Real Time Traffic." (2022)..

[8] T. J. I. V. I. J. P. a. M. D. Claude, "Development of Security Starting System for Vehicles Based on IoT," "Development of Security Starting System for Vehicles Based on IoT." In 2021 International Conference on Information Technology (ICIT), pp. 505-510. IEEE, 2021.

[9] A. A. a. M. K. Elngar, "Vehicle security systems using face recognition based on internet of things.," . "Vehicle security systems using face recognition based on internet of things." Open Computer Science 10, no. 1 (2020): 17- 29..

[10] D. M. G. T. A. P. C. a. V. P. Mukhopadhyay, "An attempt to develop an IOT based vehicle security system.," "An attempt to develop an IOT based vehicle security system." In 2018 IEEE International Symposium on Smart Electronic Systems (iSES) (Formerly iNiS), pp. 195-198. 2.

[11] N. a. L. L. Kiruthiga, "A study of biometric approach for vehicle security system using fingerprint recognition," . "A study of biometric approach for vehicle security system using fingerprint recognition." International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) 1, no. 2 (2014)..

[12] L. Hardesty, "The MIT roots of Google's new software," (August 19, 2010). "The MIT roots of Google's new software". MIT News Office.

[13] B. Benchoff, "New Chip Alert: The ESP8266 wi-fi Module," (August 26, 2014). "New Chip Alert: The ESP8266 wi-fi Module (It's$5)". Hackaday. Retrieved 2015-06-24..

[14] a. jon, "ESP8266 Overview," "ESP8266 Overview". Espressif Systems. Retrieved 2017-10-02..

[15] B. Benchoff, "New Chip Alert: The ESP8266 wi-fi Module," (August 26, 2014). "New Chip Alert: The ESP8266 wi-fi Module (It's $5)". Hackaday. Retrieved 2015-06-24..

# APPENDIX

**Codes of the Project**

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);
#include <Adafruit_Fingerprint.h>
#include "FirebaseESP8266.h"
#include <ESP8266WiFi.h>
#define FIREBASE_HOST "iot-load.firebaseio.com"
#define FIREBASE_AUTH "Jnq5ikOjpEl0G2atw5Q6oI8wdLUi1UvtixTPQEGj"
#define WIFI_SSID "Vehicle"
#define WIFI_PASSWORD "12345678"

FirebaseData firebaseData,loadData;
FirebaseJson json;
int Connector=D4;
int Connector1=D0;
int StartKey=D3;
int Engine=D5;
int scaned=0;
int loadR(String field)
  {
    if (Firebase.getString(loadData, "/DUET/Biometric/"+field))
    {
      return loadData.stringData().toInt();
    }
  }

#if (defined(__AVR__) || defined(ESP8266)) && !defined(__AVR_ATmega2560__)
// For UNO and others without hardware serial, we must use software serial...
// pin #2 is IN from sensor (GREEN wire)
// pin #3 is OUT from arduino  (WHITE wire)
// Set up the serial port to use softwareserial..
SoftwareSerial mySerial(D7, D6);

#else
// On Leonardo/M0/etc, others with hardware serial, use hardware serial!
// #0 is green wire, #1 is white
```

```
#define mySerial Serial1
#endif
Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);
void setup()
{
  pinMode(StartKey,INPUT_PULLUP);
  pinMode(Engine,OUTPUT);
  lcd.init();
  lcd.clear();
  lcd.backlight();
  lcd.setCursor(0,0);
  lcd.print("....Starting....");
  lcd.setCursor(0,1);
  lcd.print("Please Wait...");
  delay(3000);
  Serial.begin(9600);
  pinMode(Connector,OUTPUT);
  pinMode(Connector1,OUTPUT);
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to Wi-Fi");
  while (WiFi.status() != WL_CONNECTED)
  {
    lcd.setCursor(0,0);
    lcd.print("Connecting       ");
    lcd.setCursor(0,1);
    lcd.print("to Wi-Fi       ");
    digitalWrite(Connector,1);
    Serial.print(".");
    delay(200);
    lcd.setCursor(0,1);
    lcd.print("                ");
    digitalWrite(Connector,0);
    Serial.print(".");
    delay(200);
  }
  while (!Serial);  // For Yun/Leo/Micro/Zero/...
  delay(100);
  Serial.println("\n\nAdafruit finger detect test");

  // set the data rate for the sensor serial port
  finger.begin(57600);
```

```
  delay(5);
  if (finger.verifyPassword()) {
    Serial.println("Found fingerprint sensor!");
  } else {
    Serial.println("Did not find fingerprint sensor :(");
    while (1) { delay(1); }
  }
  Serial.println(F("Reading sensor parameters"));
  finger.getParameters();
  Serial.print(F("Status: 0x")); Serial.println(finger.status_reg, HEX);
  Serial.print(F("Sys ID: 0x")); Serial.println(finger.system_id, HEX);
  Serial.print(F("Capacity: ")); Serial.println(finger.capacity);
  Serial.print(F("Security level: ")); Serial.println(finger.security_level);
  Serial.print(F("Device address: ")); Serial.println(finger.device_addr, HEX);
  Serial.print(F("Packet len: ")); Serial.println(finger.packet_len);
  Serial.print(F("Baud rate: ")); Serial.println(finger.baud_rate);
  finger.getTemplateCount();
  if (finger.templateCount == 0) {
    Serial.print("Sensor doesn't contain any fingerprint data. Please run the 'enroll' example.");
  }
  else {
    Serial.println("Waiting for valid finger...");
      Serial.print("Sensor contains "); Serial.print(finger.templateCount); Serial.println("
templates");
  }
  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();
  lcd.setCursor(0,0);
    lcd.print("Connected     ");
    lcd.setCursor(0,1);
    lcd.print(WiFi.localIP());
  delay(6000);
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);
  Firebase.setString(firebaseData, "/DUET/Biometric/Permission","0");
  Firebase.setString(firebaseData, "/DUET/Biometric/Requested","System_Restarted");
}
void loop()                    // run over and over again
{
```

```
  if(WiFi.status() != WL_CONNECTED)
  {
     while (WiFi.status() != WL_CONNECTED)
       {
    lcd.setCursor(0,0);
    lcd.print("Connecting       ");
    lcd.setCursor(0,1);
    lcd.print("to Wi-Fi       ");
    digitalWrite(Connector,1);
    Serial.print(".");
    delay(200);
    lcd.setCursor(0,1);
    lcd.print("                ");
    digitalWrite(Connector,0);
    Serial.print(".");
    delay(200);
    }
  }
  getFingerprintID();
  delay(50);            //don't ned to run this at full speed.
}
uint8_t getFingerprintID() {
  uint8_t p = finger.getImage();
  switch (p) {
    case FINGERPRINT_OK:
      Serial.println("Image taken");
      break;
    case FINGERPRINT_NOFINGER:
      Serial.println("No finger detected");
      if(loadR("Permission")==0)
      {
        lcd.setCursor(0,0);
        lcd.print("Machine Message  ");
        if(scaned==0)
        {
          lcd.setCursor(0,1);
          lcd.print("Scan Your Finger ");
        }
        else
        {
                lcd.setCursor(0,1);
```

```
      lcd.print("Autonticating....");
     }
    }
    else
    {
  lcd.setCursor(0,0);
  lcd.print("Machine Message  ");
  lcd.setCursor(0,1);
  lcd.print("Have Safe Driving");
  if(digitalRead(StartKey)==0)
    {
     digitalWrite(Engine,1);
    }
    }
    return p;
  case FINGERPRINT_PACKETRECIEVEERR:
    Serial.println("Communication error");
    return p;
  case FINGERPRINT_IMAGEFAIL:
    Serial.println("Imaging error");
    return p;
  default:
    Serial.println("Unknown error");
    return p;
}

// OK success!
p = finger.image2Tz();
switch (p) {
  case FINGERPRINT_OK:
    Serial.println("Image converted");
    break;
  case FINGERPRINT_IMAGEMESS:
    Serial.println("Image too messy");
    return p;
  case FINGERPRINT_PACKETRECIEVEERR:
    Serial.println("Communication error");
    return p;
  case FINGERPRINT_FEATUREFAIL:
    Serial.println("Could not find fingerprint features");
    return p;
```

```
  case FINGERPRINT_INVALIDIMAGE:
    Serial.println("Could not find fingerprint features");
    return p;
  default:
    Serial.println("Unknown error");
    return p;
}

// OK converted!
p = finger.fingerSearch();
if (p == FINGERPRINT_OK) {
  Serial.println("Found a print match!");
} else if (p == FINGERPRINT_PACKETRECIEVEERR) {
  Serial.println("Communication error");
  return p;
} else if (p == FINGERPRINT_NOTFOUND) {
  Serial.println("Did not find a match");
  lcd.setCursor(0,0);
  lcd.print("Did not match");
  lcd.setCursor(0,1);
  lcd.print("Try again...     ");
  digitalWrite(Connector1,1);
  delay(1000);
  digitalWrite(Connector1,0);
  Firebase.setString(firebaseData, "/DUET/Biometric/Requested","Unknown Person");
  return p;
} else {
  Serial.println("Unknown error");
  return p;
}

// found a match!
Serial.print("Found ID #"); Serial.print(finger.fingerID);
Serial.print(" with confidence of "); Serial.println(finger.confidence);
scaned=1;
lcd.setCursor(0,0);
  lcd.print("Mached:");
  if(finger.fingerID==1 ||finger.fingerID==5)
  {
  lcd.setCursor(7,0);
  lcd.print("Mehedy   ");
```

```
    Firebase.setString(firebaseData, "/DUET/Biometric/Requested","Mehedy");
    }
    else if(finger.fingerID==2 ||finger.fingerID==6)
    {
    lcd.setCursor(7,0);
    lcd.print("Humaun   ");
    Firebase.setString(firebaseData, "/DUET/Biometric/Requested","Humaun");
    }
    else if(finger.fingerID==3 ||finger.fingerID==7)
    {
    lcd.setCursor(7,0);
    lcd.print("Saddam   ");
    Firebase.setString(firebaseData, "/DUET/Biometric/Requested","Saddam");
    }
    digitalWrite(Connector1,1);
    delay(50);
    digitalWrite(Connector1,0);
    delay(50);
    digitalWrite(Connector1,1);
    delay(50);
    digitalWrite(Connector1,0);
    lcd.setCursor(0,1);
    lcd.print("Request to Autor ");
    lcd.print(finger.fingerID);
  return finger.fingerID;
}
// returns -1 if failed, otherwise returns ID #
int getFingerprintIDez() {
  uint8_t p = finger.getImage();
  if (p != FINGERPRINT_OK)  return -1;
  p = finger.image2Tz();
  if (p != FINGERPRINT_OK)  return -1;
  p = finger.fingerFastSearch();
  if (p != FINGERPRINT_OK)  return -1;

  // found a match!
  Serial.print("Found ID #"); Serial.print(finger.fingerID);
  Serial.print(" with confidence of "); Serial.println(finger.confidence);

  return finger.fingerID;
}
```