INTEGRATED SECURITY SYSTEM FOR VEHICLE AND PASSENGER

A Project

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Submitted to the

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NOTATIONS

In this project we have used some shortcut keywords. For the reason, all the abbreviation are given below:

1. IoT Based – Internet of Thing Based.
2. PHP- Personal Home Page.
3. HTML- Hypertext Markup Language.
4. MySQL- My Structure Query Language (It is an open-source relational data-based system)
5. WAMP- Windows Apache, MySQL and PHP (it is a variation of LAMP for windows)
6. PC- Personal Computer.
7. OBD- Onboard Diagnosis Port.
8. OBD II- Onboard Diagnosis II Port.
9. EPA- Environmental Production Agency.
10. SAE- Society of Automotive Engineers.
11. VEDAS- Valcon Environmental Acquisition System (It is a mobile data stream mining environment)
12. MineFlect- It Is Also a Mobile Data Stream Mining Environment.
13. PCA- Principal Component Analysis.
14. SAWUR- Situation Awareness with Ubiquitous Data Mining for Road Safety.
15. NodeMCU- Open-Source Electronics Platform.
16. LED- Light Emitting Diode.
17. PCV- Printed Circuit Board.
18. Arduino- it is an Open Source Electronic Platform.
19. USB- Universal Serial Bus.
20. iOS- Internetwork Operating System.
21. Thunkable- The Easiest Way to Build Up an App.
22. APK- Android Application Package.
23. LCD- Liquid Crystal Display.
24. GPS- Global Positioning System.
25. Buzzer- An electronic device that makes a buzzing noise and used for signaling.
26. PVC board- Polyvinyl Chloride Board.

ACKNOWLEDGEMENT

First of all, we would like to express our gratitude to the almighty Allah for providing us with such strength and energy to complete our project on the integration of some modern security systems for the safety and security of vehicles and passengers as well.

Such task which includes numerous sorts of engineering knowledge is not possible without taking help from people who are expertise in their field and their guidance, advice, and motivation to understand goals and objectives. We are deeply indebted and thankful to our honorable Vice Chancellor **Prof. Dr. Md. Abul Bashar** sir to whom we owe a lot for allowing us to complete our project. Our sincere gratitude is to our supervisor **Md. Shadrul Alam** sir for his helpful guidance, suggestion, and encouragement throughout this study. He supported us in any possible aspect with strong dedication, patience, and humor. He made our time as project students enjoyable and fascinating by opening doors to new experiences in our life. The guidance and inspiration from **Professor Md. Mostofa Hossain** Sir, Head of the Department of Mechanical Engineering, Sonargaon University, Dhaka, related to the research work are greatly acknowledged.

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Finally, last but not least, we would like to give our gratitude and respect to the people whom we love most our parents, our brother and sisters for their understanding, helpfulness and faith in us during these eventful times.

ABSTRACT

This paper offers with layout and improvement of an IoT primarily based embedded device for GPS tracking, monitoring vehicle passengers, and counting the total passengers. At that time, it also calculates fuel consumption and finds the fuel theft, and also given safety from various parameters. Through this project, once the vehicle meets with an accident, the sensor presents inside the vehicle will respond immediately and sends a message (SMS) to the nearest concerns. In this project, an incorporated device is being evolved that is a right mixing of hardware (electronics) and the software program to display total passengers, fuel theft, the identity of fuel consumption, accident detection notification system which will notify the emergency services and transmit data to an internet server to keep those statistics along with a unique identity number, exclusive parameters along with date and time. This enables in growing lifestyle span of the vehicle in addition to the engine. It additionally enables abiding surprising multifunctioning of the vehicle while may also bring about any type of accident. Ended up, the proprietor may be notified of all parameters simulated facts via cellular utility in accordance to give circumstance of the owner vehicle.

CHAPTER 1

INTRODUCTION

1.1 Overview

Implementing accurate and reliable passenger detection and counting system is an important task for the correct distribution of available transport system. An updated security system with modern technologies could help the owner of the vehicle as well as the passengers at this concern. The integrated security system is designed to effectively ensure the security and the management of the vehicle and the passengers.

Passenger counting and detection is an important task for the traffic monitoring and utilization of resources for a public transport system in fig 1.1. It is important to monitor public traffic efficiently for a well-organized and cost-effective public transport system [1]. Nowadays, passenger counting systems are often developed on surveys, throughout the territory and using manual procedures. The manual procedures are not usually homogeneous in surveys, since they inevitably depend on the operator who performs them and may also be influenced by the time of the day – early morning versus the last hours of the day and by a repetitive task. In every city bus, an extra hand is always required to count the passenger, and notice their entry and exit. Sometimes dishonest personnel of this sector manage to steal the profits of the owner as there is nothing effective to observe their activities. On the other hand, the automatic passenger counting system can be much more appropriate and of greater interest, as related to this short analysis. The analysis of this data to count the passengers can be carried out using Iot based passengers monitoring system to avoid use of human efforts.

Fig 1. 4: Manual Passenger monitoring system (Source: Internet)

On the other side, fuel management system is the important portion in our vehicle. The cost of fuel is rising constantly, owners of the vehicles are facing fuel theft from their vehicle what has become a security risk. Sometimes dishonest drivers also involve with fuel theft in absence of owners. Usually, owners of vehicle do not check and analyze the consumption of fuel on a daily basis. Fuel management systems are designed to effectively measure and manage the use of fuel within the transportation [2]. This information can be then stored in computerized systems and reports generated with data to inform management practices.

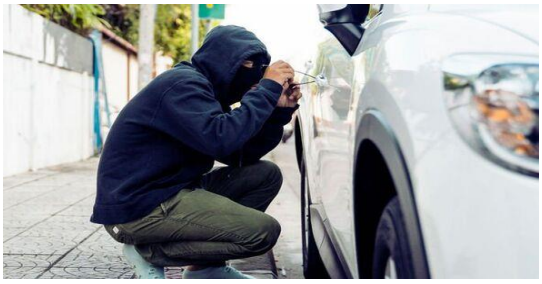

Fig 1. 5: Fuel theft from vehicle. (Source: Internet)

On the other hand, GPS tracking could locate the vehicle at any instance with the help of an internet system. In case of any misuse of the vehicle could be detected by a GPS tracking system. Even any lost vehicle could be found with the help of GPS. The integrated security system has included this effective technology as well.

The population of the world is growing rapidly so is the number of vehicles on the roads to meet the demand. With the increasing rate of transportation, every year number of accidents and the possibility of fatal accidents increases. In most these, lives could be saved if life-saving services such as rescue and primary treatment can be given at the moment when it is compulsory just after the incident. This integrated security system has also capable of sending

Fig 1. 6: Road accidents, a fatal curse of Bangladeshi roads and highways. (Source: The Daily Star)

calls for help to nearby hospitals, police stations, and firefighting stations so that in case of any accidental fatality, emergency measures can be taken within the best possible time.

According to a report by the WHO (World Health Organization), more than 3,500 people die from road accidents every year, while millions go through injuries that cause permanent or prolonged disability. These accidents not only take lives but also affect a family as most of the accident directly occurs with the earning member of a family.

According to “The Daily Star”, over the past few years there has been an alarming rise in road accidents, significantly highway accidents in Bangladesh. A study has been conducted by the Accident Research Centre (ARC) of BUET on this issue and it has found that road accidents claim on average 12,000 lives annually and lead to about 35,000 injuries. World Bank statistics say that the annual fatality rate from road accidents is found to be 85.6 fatalities per 10,000 vehicles. According to BRTA statistics, from 2009 to 2022 (up to December) 35,450 accidents occurred in Bangladesh causes18,510 deaths and 14,442 injured. Traffic hazards and road accidents have increased the suffering of people. One of the main reasons is the lack of emergency facilities available in our country. In most the cases, when an accident occurs, relatives of that injured person get the news of his/her accident not in time and the emergency rescue teams reach late on the accident spot and the traffic in between accident spot and hospital sometimes increase the chances of death of the victim. Tracing the accident spot is the major issue faced by the emergency unit. The guardian reported in 2016 that thirty-five patients had died in the past five years due to the late arrival of the ambulance.

In the present situation, this project plays a vital role in vehicle activities. An IoT based the method has been proposed in this project to detect and count passengers during getting in and getting out of the train or bus. The IoT databased was used for the validation of the proposed passenger detection and counting system. This database contains passenger orientation, overlapping, and complex interaction. This was the most important task of the project since its successful conclusion was critical to the success of the entire project. The The reason for this was simple: If we managed to acquire a clear signal through the limit switches or sensors, then even moderately powerful pattern recognition algorithms would succeed in the passenger detection task. Again, real-time fuel-filled and fuel consumption in vehicles is 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, notify when fuel goes to a certain level. The proposed vehicle activities monitoring system

is reliable, easy to implement, and user friendly, which keeps monitoring through the mobile application. Tracking vehicles has always been a problem with transport vehicles or cargo vehicles for big companies dealing. This project is useful for transportation companies. Private car owners also can be benefited from using the project. We are dealing with another rising problem in our country is vehicle accidents. The presented project is based on IOT. Through this IoT based project, this system is also utilized to detect the location of the vehicle and prevent the vehicle from an accident by the use of an alarm. The person needs to introduce the application on their cell phone and register by giving the immediate contact numbers to which the alarm message would be sent. If the driver feels sluggish while driving and the vehicle is going to be smashed, the alarm buzzes, which makes the driver mindful of his status. This application uses GPS for locating the position of the vehicle.

So, the aim of this project is to design and implement of IoT based monitoring system for a vehicle which also monitor the passenger safety, fuel consumption and accident.

1.2 Background and Motivation

- Due to busy schedule of daily life, users cannot pay attention and spare time for the proper maintenance of their vehicle.
- There are in total 366 bus routes in Dhaka. More than 1.2 core people use local bus here. But the bus-passengers counting and monitoring system has not been upgraded yet. If we use the integrated security system, the bus authority can monitor the passenger management and also be able to know exact location of vehicle very easily. It also provides the information about the spot of accident.
- Public transportations are turning unsafe for women. The integrated security system could help police to rescue and safe victims.
- For these reasons, we have decided to develop a “Smart Vehicle Tracking and Passenger Monitoring System” with IoT based infrastructure. We have developed this system based on the Arduinos Uno and GPS.

1.3. Objectives

The objective of this project is to design and implement of Integrated security System for vehicle and passenger which is capable of doing the following functions:

- To count passenger number in vehicle.
- To notify the authority about the current location of the vehicle.
- To notify the authorities in case of any accident.
- To notify the fuel monitoring of the vehicle.

CHAPTER 2

LITERATURE REVIEW

We have studied some papers on IoT based Vehicle Passenger, Fuel and Accident Monitoring system which is discussed in the bellow:

Saddam et al. [1] studied the effect of the proposed a system for passenger detection and counting for public transport system.

This system is implemented using Histogram equalization method which is a widely used in the field of object detection to normalize the illumination. In this paper, an automated system has been proposed to deal with these two interrelated affairs. The use of time of flight (TOF) cameras and gas sensors for passenger counting are also used in this system. The reviewed paper proposed to develop passenger detection and counting whereas the proposed system develop vehicle activities such as fuel monitoring, accident spot tracing, find nearest fuel pump and get alerting notification.

Savitha S.C et al. [2] studied the effect of the Smart College Bus Tracking Management System and Its Application.

In the author proposed a system for overcoming fraud at petrol-pumps. In an instant, when agent starts filling fuel in vehicle tank the flow sensor gets activated and provides a series of pulses proportional to instantaneous flow rate. The ESP8266 sends the data to the cloud server. User application also locates the user throw GPS. The reviewed paper works with flow sensor for measuring fuel whereas the proposed system works with ultrasonic sensor which can measure fuel from various dimension fuel tanks. In this paper it includes the design and development of an IoT and mobile-based vehicle fuel activities such as real time fuel monitoring and GPS tracking system. When the vehicle tank of fuel reaches a certain level, driver gets notification through mobile application and also searches the nearest pump location for reloading fuel. The limitation of the proposed system used GPS tracking for showing current location of vehicle and finding nearest pump location.

B. N. Shankar et al [3] studied the effect of the Smart Vehicle Monitoring with Accident

In the author proposed a system to consist of Arduino, GPS, GSM, Ultrasonic sensor, vibration

sensor and speed sensor. It provides the outcomes from the interaction between the two vehicles. It detects the accident spot and also monitor the vehicle speed. It is a real time observations system which is connected with vehicle authority. The reviewed paper used GSM for sending data whereas the proposed system used NodeMCU (ESP8266) for sending data and it use web application to monitoring the system whereas the proposed system uses a mobile application to monitoring the system. When a vehicle meets with an accident, the installed Vibration sensor detects it and the location of the vehicle sent to respected authorities. Under certain condition the limitation of this project cannot control the owner or passenger.

Sanjana Srabanti et al [4] studied the effect of the A Proposed System for Automatic Vehicle Monitoring and Accident Detection.

In the author proposed a system for vehicle monitoring and accident detection systems using IoT platform acting as a medium for data transfer and visualization. This system is implemented using Ultrasonic sensor, Temperature sensor, Speed sensor, GPS. In this paper, an automated system has been proposed to deal with these two interrelated affairs. Alerting system uses GSM or GPRS for sending information. GPS is used to inform the user about exact location of vehicle. Our proposed system will also prevent the fuel theft.

Manini Kumbhar et al [5] studied the effect of the Real Time Web-Based Bus Tracking System.

This method automatically sends the information on the GPS system to a SMART phone. Supported by sophisticated GPS technology. The bus location applications are tested on their reliability to perform all the desired operations in real time. It is not comfortable for user and This Need proper time management system. Need speed of data transmission.

CHAPTER 3

METHODOLOGY

3.1 Introduction:

Methodology is the systematic, theoretical analysis of the methods applied to a field of Study. Actually, 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 completed by following some strategy, which are given below:

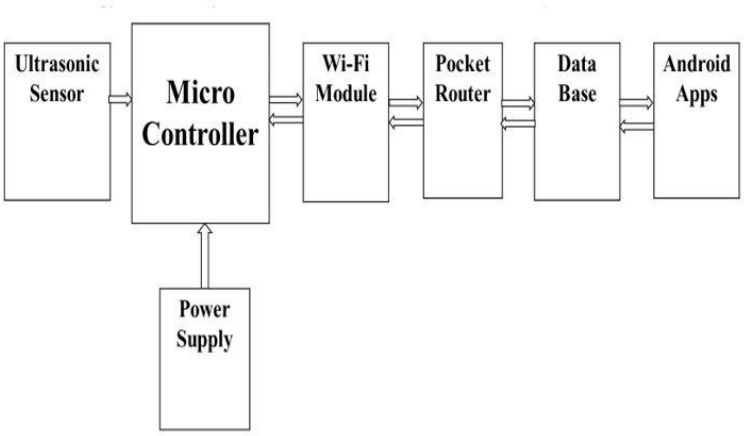

Fig 3. 3: Diagram of Methodology.

We divided the whole project in three steps which are input, processor and output. For input materials, we are used different types of sensors like fuel level sensor and also used different types of ultrasonic sensor. For processing unit, we used micro-controller. Here, we seen all output data by mobile application. This data gets through the Internet. The whole process shown in fig. 3.1 and discuss in the bellow:

- The fuel sensing system is located in the fuel tank. An ultrasonic sensor is placed in the fuel tank. From this sensor, we are got analog input for microcontroller. Ultrasonic

sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. When fuel level goes down, it is measured the distance. From this distance, we can identify the actual fuel level at real time. At a time when we fill up our tank, the value of sensor is changed.

- When passengers sit on the seat, sensor is worked. It gives value 5v in microcontroller. From this value, microcontroller can understand that any passengers sit on the seat. When passengers leave from the seat, pressure switch gives voltage 0. For that, microcontroller understand someone get out of vehicle. In this way, it is calculated the passenger's number continuously and gives information vehicle owner how much passengers present in vehicle.
- A sensor is placed around outside of the vehicle. It gives digital value (High or Low) in microcontroller. When any vehicle will cross nearest side of the vehicle or contact with vehicle, then limit switch is on. Then microcontroller converted this value High (1). So that, vehicle owner can understand any accident will be occurred or any vehicle contact with this vehicle. Otherwise, limit switch is off and it gives the value Low (0). Thus, vehicle owner will be knowing his/her vehicle is safe.
- NodeMCU is used as a microcontroller for control unit. It converted all the analogue value converted to digital value. Fuel level sensor, pressure switch and limit switch are connected to the microcontroller. NodeMCU is got from all the input device and converted the data to signal. Then, send to the signal in WiFi module.
- ESP 8266mod is used as a Wi-Fi module. It is attached with microcontroller. ESP8266 is Wi-Fi enabled system on chip module developed by this system. It is mostly used for development of IoT (Internet of Things). This Wi-Fi module send all the signal of our base station like a Pocket router.
- A portable pocket router is wireless and usually uses the Internet from a SIM card, Local Area Network (LAN) connection, or public Wi-Fi. It collects data from Wi-Fi module and send this data in our database. Using Pocket router, we can control of our system from different places of the world which is shown in fig 3.2.

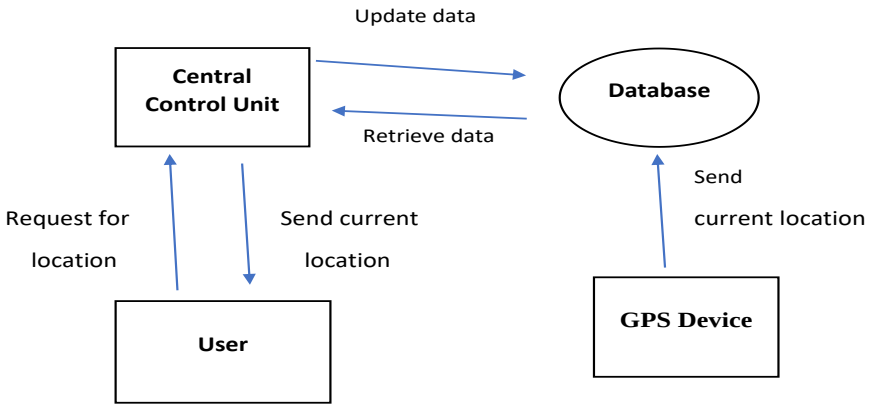

Fig 3. 4: Block diagram of the tracking system.

- All the data has to be stored in a standard database. So, we are used firebase as database. The Firebase Real Time Database can be accessed directly from a mobile device or web browser; there's no need for an application server. First, all the input data or signal send through the Wi-Fi module. Then this data store in firebase for real time monitoring. This firebase is directly connected to our mobile application.

- An android application is developed to connect with firebase. It is a user-friendly app. From firebase, we have seen of our mobile how much fuel present in the fuel tank and also known that passenger's position and passenger's number. If vehicle will crush any place or contact with other vehicle, a notification alarm will send in our mobile app. Through this apps, vehicle owner is easily monitoring everything.

CHAPTER 4

ANALYSIS OF REQUIREMENTS, DESIGN AND IMPLEMENTATION

4.1 Introduction

Requirement Analysis: Requirement analysis is the technical analysis of a system project that is critical to success or failure. There are two Requirement analysis process.

- Hardware
- Software

4.2 Hardware Requirements

- NodeMCU
- Power supply- 12 Volt DC
- MicroUSB Cable
- Breadboard
- Hall sensor
- Vibration sensor
- Connecting wires
- GPS Module
- Pocket router
- Buzzer etc.

4.2.1 NodeMCU

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. Figure 4.1 and 4.2 will depict this topic respectively.

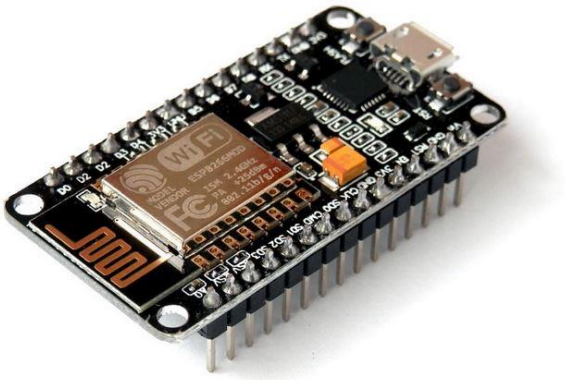

Fig 4.1: NodeMCU.

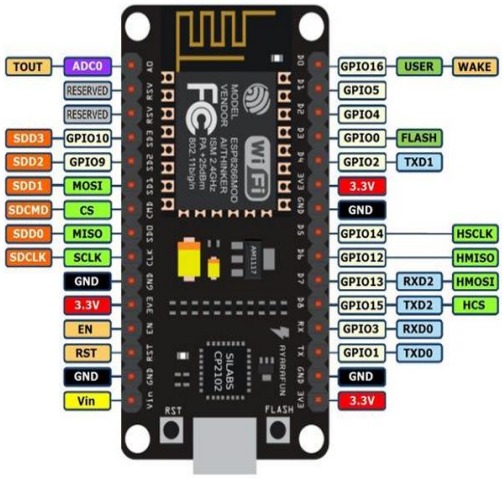

Fig 4.2: NodeMCU Pinout.

4.2.2 NodeMCU ESP8266 Specifications & Features:

- Microcontroller: - Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: - 3.3 Volt
- Digital I/O Pins (DIO): 16
- Analog input pins (ADC): 1
- SPIs: 1
- 12Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTLbased on CP2102 is included onboard, enabling plug n play
- PCB Antenna
- UARTs: 1
- Small sized module to fit smartly inside IoT project.

4.2.3 Power supply- 12 Volt

Plug Adapter AC 100-240V to DC 12V 2A Power Supply shown in figure 4.3.

Fig 4. 7: Power adopter 12V- 2Amp DC.

Specifications:

- Input: 100~240V AC, 50/60Hz
- Output: 12V DC, 2000mA: US plug
- Cable length: 100cm
- Net weight: 128g
- Package size: 9.5 * 7 * 6cm
- Package weight: 144g

4.2.4 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

Fig 4. 8: Ultrasonic sensor.

waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. In this time, we used this sensor for measuring level of fuel. From this sensor, we know that actual fuel level of our system which is shown in figure 4.4.

Specifications:

- Power Supply: DC 5V
- Working Current: 15mA
- Working Frequency: 40Hz
- Ranging Distance: 2cm – 400cm/4m
- Resolution: 0.3 cm
- Measuring Angle: 15 degrees
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

4.2.5 GPS Module:

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data**.**

One of the global positioning systems (GPS) devices utilizes data from satellites to locate a specific point on the Earth in a process named trilateration. Meanwhile, a GPS receiver measures the distances to satellites using radio signals to trilateration. And trilateration is similar to triangulation, which measures angles, depicted in this illustration (Tim Gunther, 2020). GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data. If the module's antenna can spot 4 or more satellites, it is able to accurately calculate its position and time.

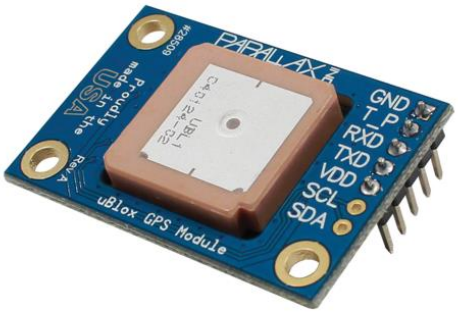

Fig 4. 9: GPS Module.

Specifications:

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

4.2.6. Pocket Router

A Pocket Wi-Fi works just like any internet connection device only that it is a lot smaller and portable than your traditional home Wi-Fi router. The device then omits a Wi-Fi signal just like your home Wi-Fi does, allowing any of your internet capable devices to connect via Wi-Fi.

Fig 4. 10: Pocket Router.

4.2.7 Buzzer

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices. When a voltage is applied across the two electrodes, the piezoelectric material mechanically deforms due to the applied voltage. This movement of the piezo disk within the buzzer creates sound in a similar manner as the movement of the ferromagnetic disk in a magnetic buzzer or the speaker cone mentioned above (Internet) at fig.4.7.

Fig 4. 11: Buzzer.

Specifications:

- ❖ Color is black.
- ❖ The frequency range is 3,300Hz.
- ❖ Operating Temperature ranges from – 20° C to +60°C.
- ❖ Operating voltage ranges from 3V to 24V DC.
- ❖ The sound pressure level is 85dBA or 10cm.
- ❖ The supply current is below 15mA.

4.3. Software Requirements

- Arduino IDE
- MIT App Inventor 2
- Android app
- Firebase Database

4.3.1. Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on our computer, used to write and upload computer code to the physical board. In fact, Arduino language is merely a set of C/C++ functions that can be called from our code.

Our whole system is controlled by Arduino. Different types of logic develop through Arduino platform. All sensors and output device controlled this language. Developing this language, we are used Arduino IDE software.

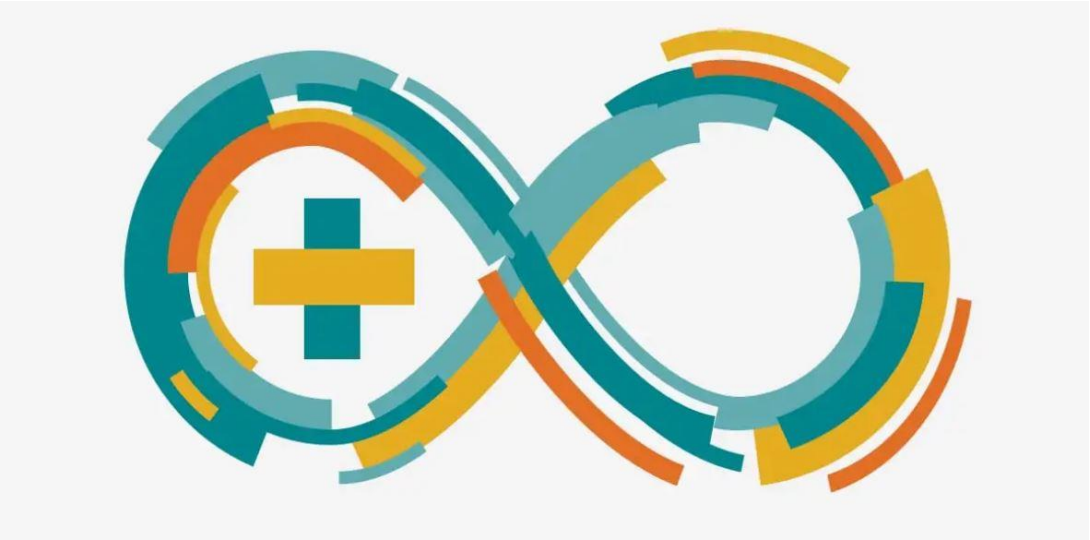

Fig 4. 12: Arduino Logo.

4.2.2. Arduino Nano

One of the most popular Arduino boards out there is the Arduino Nano. While it was not actually the first board to be released, it remains to be the most actively used and most widely documented on the market. Because of its extreme popularity, the Arduino Nano

has a ton of project tutorials and forums around the web that can help us get started or out of a jam. We're big fans of the Uno because of its great features and ease of use.

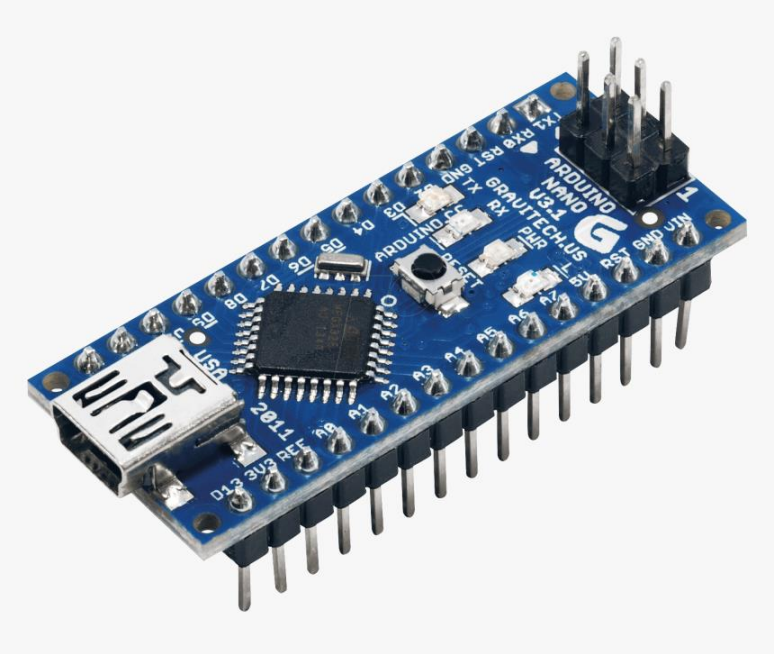

Fig 4. 13: Arduino Nano.

Here are the components that make up an Arduino board and what each of their functions are.

4.2.2.1 Pinout of Arduino Nano

- Reset Button – This will restart any code that is loaded to the Arduino board.
- AREF – Stands for "Analog Reference" and is used to set an external reference voltage.
- Ground Pin – There are a few ground pins on the Arduino and they all work the same.
- Digital Input /Output – Pins 0-13 can be used for digital input or output.
- PWM – The pins marked with the (~) symbol can simulate analog output.
- USB Connection – Used for powering up our Arduino and uploading sketches.
- TX/RX – Transmit and receive data indication LED.
- ATmega Microcontroller – This is the brains and is where the programs are stored.
- Power LED Indicator – This LED lights up anytime the board is plugged in a power source.
- Voltage Regulator – This controls the amount of voltage going into the Arduino

board.

• DC Power Barrel Jack – This is used for powering our Arduino with a power supply.

• 3.3V Pin – This pin supplies 3.3 volts of power to our projects.

• 5V Pin – This pin supplies 5 volts of power to our projects.

• Ground Pins – There are a few ground pins on the Arduino and they all work the same.

• Analog Pins – These pins can read the signal from an analog sensor and convert it to digital.

4.2.3. Programming on Arduino

Once the circuit has been created on the breadboard, we will need to upload the program (known as a sketch) to the Arduino. The sketch is a set of instructions that tells the board what functions it needs to perform. An Arduino board can only hold and perform one sketch at a time. The software used to create Arduino sketches is called the IDE which stands for Integrated Development Environment. The software is free to download and can be found at https://www.arduino.cc/en/Main/Software

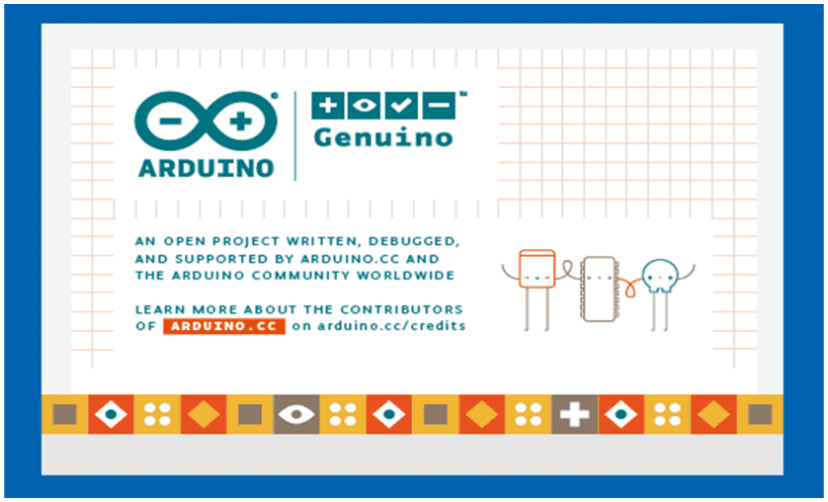

Fig 4. 14: Opening Arduino IDE.

Once the software has been installed on our computer, go ahead and open it up. This is the Arduino IDE and is the place where all the programming will happen.

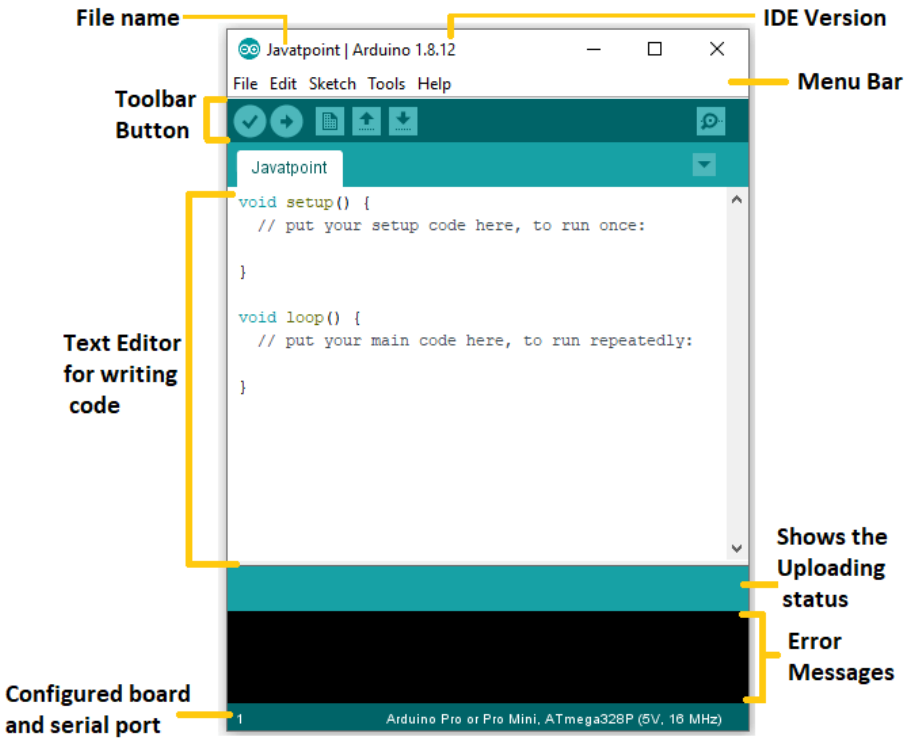

Fig 4. 15: Sketch of Arduino IDE.

- Menu Bar: Gives us access to the tools needed for creating and saving Arduino sketches.
- Verify Button: Compiles our code and checks for errors in spelling or syntax.
- Upload Button: Sends the code to the board that's connected such as Arduino Nano in this case. Lights on the board will blink rapidly when uploading.
- New Sketch: Opens up a new window containing a blank sketch.
- Sketch Name: When the sketch is saved, the name of the sketch is displayed here.
- Open Existing Sketch: Allow us to open a saved sketch or one from the stored examples.
- Save Sketch: This saves the sketch we currently have open.
- Serial Monitor: When the board is connected, this will display the serial information of our Arduino.
- Code Area: This area is where we compose the code of the sketch that tells the board what to do.
- Message Area: This area tells us the status on saving, code compiling, errors and more.
- Text Console: Shows the details of an error messages, size of the program that was compiled and additional info.

- Board and Serial Port: Tells you what board is being used and what serial port it's connected to.

At this point we are ready to connect our Arduino to our computer. Plug one end of the USB cable to the Arduino Uno and then the other end of the USB to our computer's USB port. Once the board is connected, we will need to go to Tools then Board then finally selects Arduino Uno.

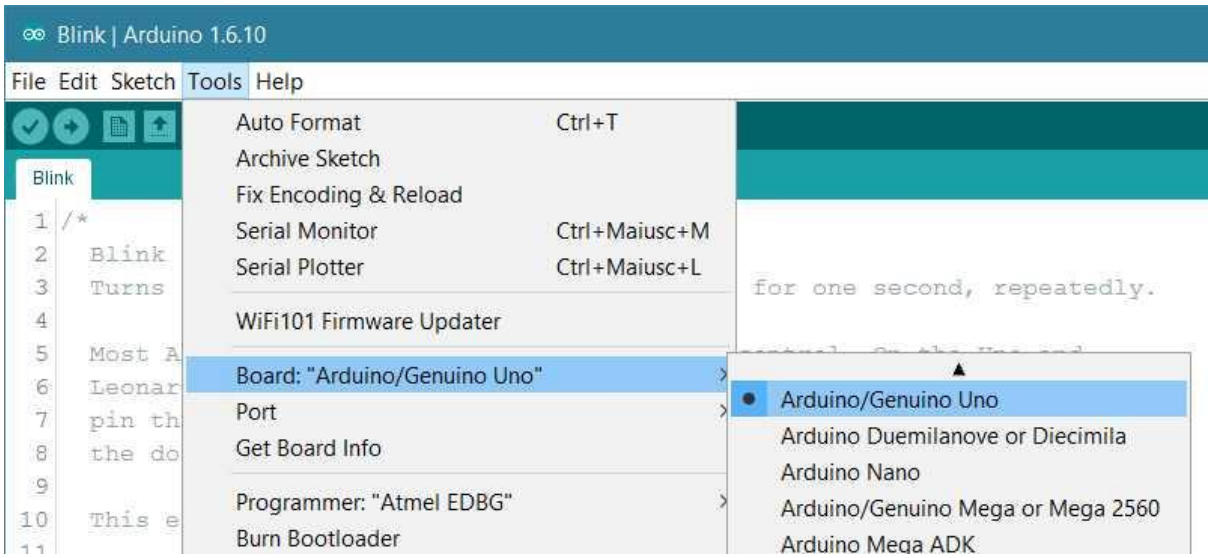

Fig 4. 16: Arduino Board Selection.

Next, we have to tell the Arduino which port we are using on our computer. To select the port, go to Tools then Port then select the port that says Arduino which is shown in fig.4.12.

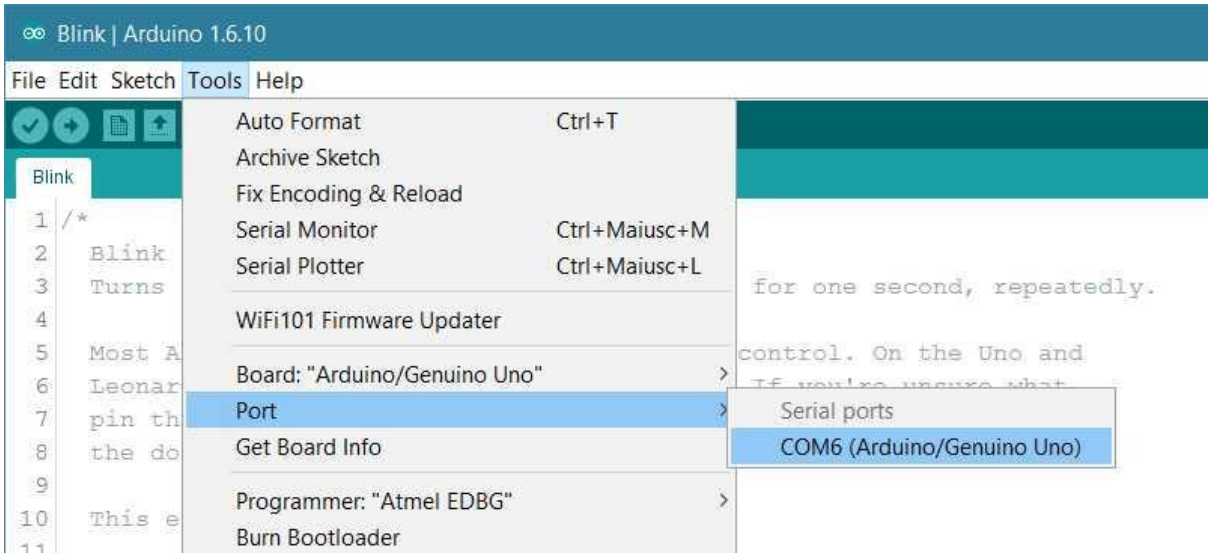

Fig 4. 17: Arduino Port Selection.

4.2.4 MIT App Inventor

MIT App Inventor is an online platform designed to teach computational thinking concepts through development of mobile applications. Students create applications by dragging and dropping components into a design view and using a visual blocks language to program application behavior.

MIT App Inventor is a web application integrated development environment originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to computer programming to create application software(apps) for two operating systems (OS): Android, and iOS, which, as of 8 July 2019, is in final beta testing. It is free and open-source software released under dual licensing: a Creative Commons Attribution ShareAlike 3.0 Unported license, and an Apache License 2.0 for the source code.

It uses a graphical user interface (GUI) very similar to the programming languages Scratch (programming language) and the StarLogo, which allows users to drag and drop visual objects to create an application that can run on Android devices, while a App-Inventor Companion (The program that allows the app to run and debug on) that works on iOS running devices are still under development. In creating App Inventor, Google drew upon significant prior research in educational computing, and work done within Google on online development environments.

App Inventor and the other projects are based on and informed by constructionist learning theories, which emphasize that programming can be a vehicle for engaging powerful ideas through active learning. As such, it is part of an ongoing movement in computers and education that began with the work of Seymour Papert and the MIT Logo Group in the 1960s, and has also manifested itself with Mitchel Resnick's work on Lego Mindstorms and StarLogo.(Internet).
App Inventor also supports the use of cloud data via an experimental Firebase#Firebase Realtime Database component. (Wikipedia)

CHAPTER 5

EXPERIMENTAL SETUP AND DESCRIPTION

5.1. Working Procedure

We divided the whole project in three steps which are input, processor and output. To solve any kind of problem or error it should arrange the whole work in the segment so that it can provide its validity. We have collected all possible requirements which are very well documented there are no ambiguous requirements. All requirements are clear and fixed. Now discuss the working procedure in the bellow:

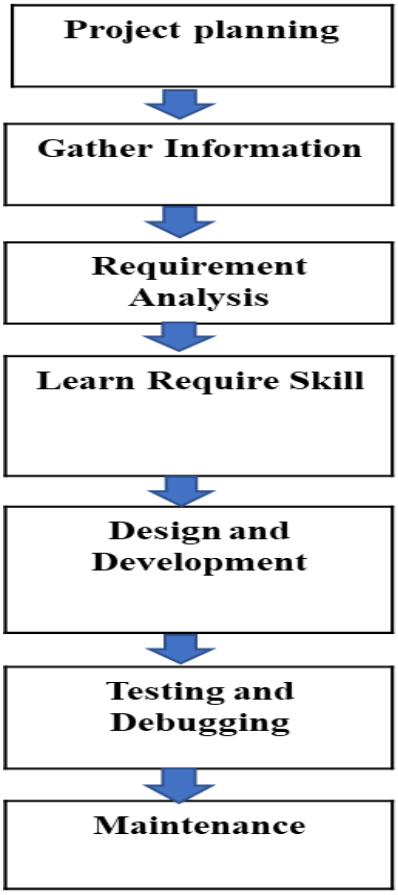

Fig 5.4: Block diagram of the project.

5.1.1 Introduction

Working procedure is the systematic, theoretical analysis of the methods applied to a field of study. Actually 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 completed by following some strategy which is shown in fig.4.1. Full work has been divided into some parts which are discussed in the bellow:

5.1.2 Project Planning

Project planning is a discipline for stating how to complete a project within a certain timeframe, usually with defined stages, and with designated resources. First of all, we found some regular problems in our real life. Then find this problem and think to solve it by some smart way within a certain timeframe. We discussed with our team members and teachers. In order to overcome this problem, we have taken plan a smart system which can detect rpm, and send data to nodeMCU etc. It can also determine the rpm of the motor for the specific command which is needed. The device will help operator with some useful information which support them to controlling motor.

5.1.3 Project Analysis

The project analyst provides critical data support to a technical team. Research and analysis functions may include budget tracking and financial forecasting, project evaluation and monitoring, maintaining compliance with corporate and public regulations, and performing any data analysis relevant to project tasks. We have analyzed how to need critical and technical support in this project. Also, we have analyzed whether this plan is possible after it is planning and its requirements in the society and how it can be applied easily.

5.1.4 Gathering Information

After finding problem we gathered some information about this problem that how to solve it in smartly. We read some research paper about this problem. We search in internet to find the solutions.

5.1.5 Requirement Analysis:

Requirements analysis encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product or project.

After gathering the information, we are thinking about requirement to make this project successful. Three sensors have been utilized in the proposed system.

5.1.6 Learn Required Skill:

For completing the project, we had to know about Android language Java, Hardware connection.

5.1.7 Necessary skill study:

To complete this project, we had to learn many things related to hardware and some programming languages. Such as Arduino, many sensors and Arduino programming, c programming language etc. we have collected different type of information such as.

5.1.8 Hardware:

Hardware is the context of technology, refers to the physical elements. We have used many hardware elements such as sensor, register, sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. We have learned about four sensors and, what it is work? How it is work? Where it is used?

5.1.9 Design and Development:

System design is the process of defining the components, modules, interfaces, and data for a system to satisfy specified requirements. System development is the process of creating or altering systems, along with the processes, practices, models, and methodologies used to develop them.

Authors has designed system architecture using NodeMCU and power supply also web interface server, Android app. To develop the device used a Methodology here maintenance some stage.

5.1.10 Testing and Debugging:

A device under test also known as equipment under test (EUT) and unit under test (UUT), is a manufactured product undergoing testing, either at first manufacture or later during its life cycle as part of ongoing functional testing and calibration checks.

We have tested device in real life use device under test method. We got some results and it works well.

5.1.11 Maintenance:

There are some issues which 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 is depending on IoT based embedded system so inter facing of all hardware with Wi-Fi and internet is very important part in its functioning. An IoT based counting system has been proposed in this project to count passengers using pressure switch. This pressure switch is placed under the seat of each passenger. When passengers sit on the seat, a signal sent to Mobile app through the internet. So that, authors are easily calculated how much passengers sit in the vehicle. Besides, a floating sensor is placed in the fuel tank. It can calculate the level of fuel tank. From this fuel level, vehicle owners easily monitor fuel consumption. So, anybody theft fuel from vehicle, vehicle owner will notify through mobile app. The main advantage of this system is that along with the detection of an accident it is also capable of preventing it. The sensor situated at all the 4 sides of the vehicle. So, it will prevent vehicle from being too close from any object. If in case vehicle meets an accident or small-scale collision, the device will detect the accident. A GPS is placed in the front part of the vehicle and it gives longitude and latitude values. The values of sensor and GPS are collected by NodeMCU as it has inbuilt Wi-Fi module all the data is transferred to the cloud through Wi-Fi and analysis is done in mobile application and notifications are sent according to the conditions.

5.2 Working Principle

This is the working procedure of this project that means how can work done by the circuit diagram which is shown in fig.4.2. Now write down and discuss the working principle with circuit diagram in the bellow:

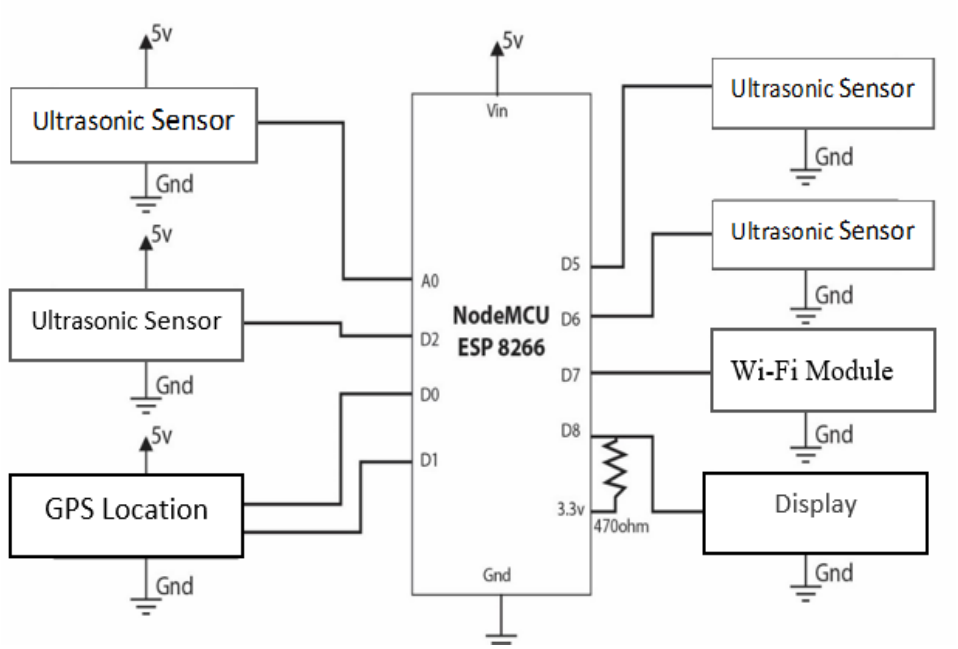

Fig 5. 5: Circuit Diagram of Project.

5.3 Hardware implementation and testing

Now the total implementation of the hardware and software is shown in fig 6.3 in the bellow:

Fig 5. 6: Hardware and Software implementation.

CHAPTER 6

INVESTIGATIONS, RESULTS & DISCUSSION

6.1 Introduction

This chapter is about the laboratory experiment of the smart vehicles tracking and monitoring system. The electrical testing equipment has been used for the testing purpose. We connected this test to get some parameters such current, voltage, and power drawing of each component. After analyzing this project, we were found the following results:

6.1.1 Counting Passenger on Display

The filled up sit and empty sit can be seen in a display in the bus which can be monitored by the supervisor and the helper. This help them to count the passenger instantly and can make a decision that should he peak more passenger or not? Which is shown in fig.8.1.

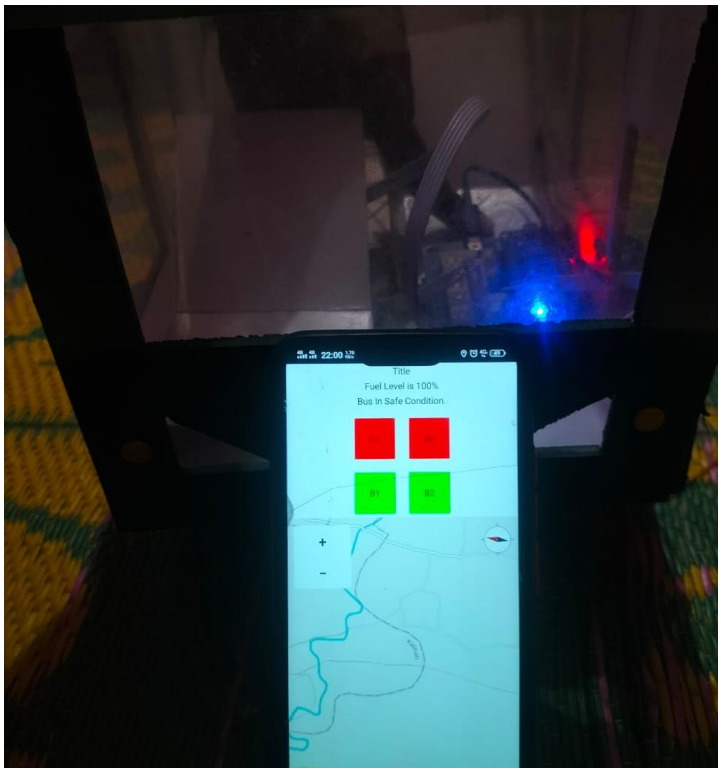

Fig 6. 8: Filled up and empty seats at display.

6.1.2 Monitoring Passenger by the App

The filled up sit or empty sit can be also observed by using an apps from the owner side from any place which is beneficial for owner which is shown in fig.8.2.

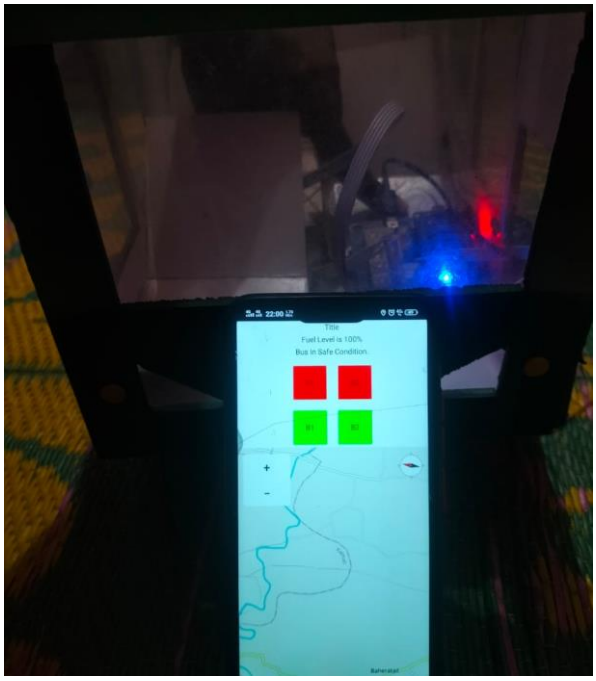

Fig 6. 9: Distance and sit fill up or empty also shown in app.

6.1.3 Monitoring a safe distance from the accident

The distance of any front car can be shown in bus display or in owner apps both. Maintaining a safe distance helps owner to keep a good driver and which will keep the bus and passenger safe from accident shown in fig 5.3.

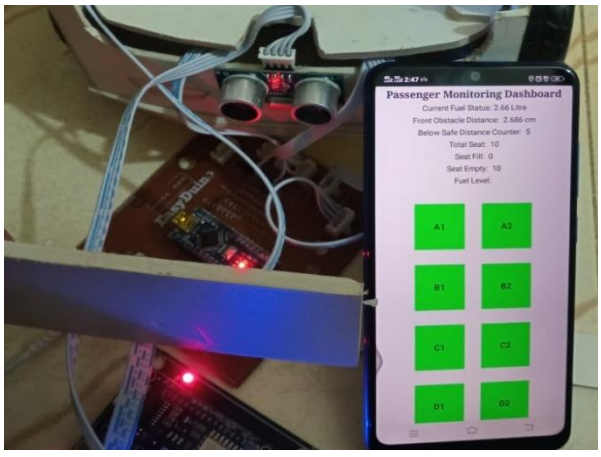

Fig 6.10: Counting the distance shown on app display.

6.1.4 Monitoring the tracking location of vehicle

The bus owner can also track the location of the vehicle from his android apps to prevent the hijacking of the bus from thief or robber which is shown in fig 8.4

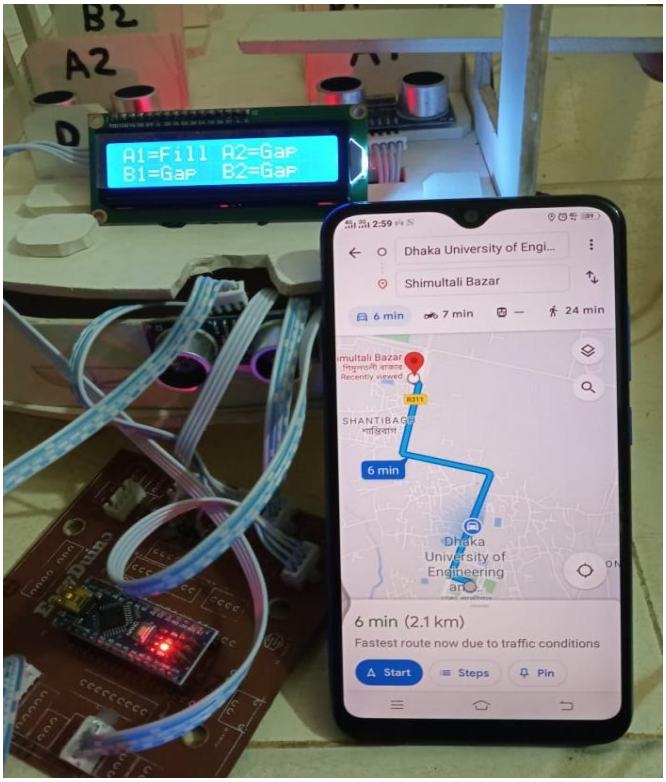

Fig 6. 11: Tracking location on display.

6.1.5 Search the nearest vehicle by app

Passenger can find the nearest vehicles which is travelling towards him from his handset by app which is shown in fig 8.5 in bellow:

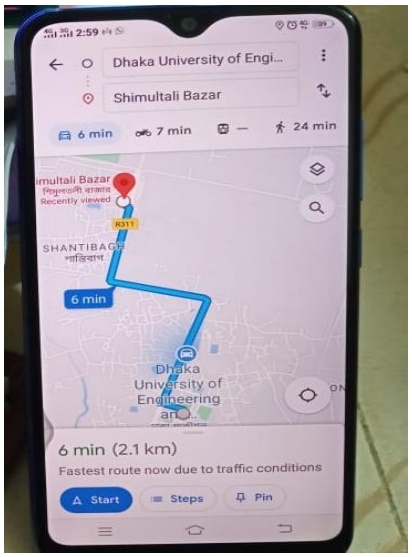

Fig 6. 12: Passenger can find the nearest buses from his handset.

6.1.6 Alarming system to driver

Bellow safe distance, A buzzer can make attention of driver to drive safely which is shown in the fig 8.6

Fig 6. 13: Alarming system.

6.1.7 Fuel monitoring system

Fuel can also be monitored by owner and driver by monitoring system on the display which is shown in fig 5.7 in the bellow

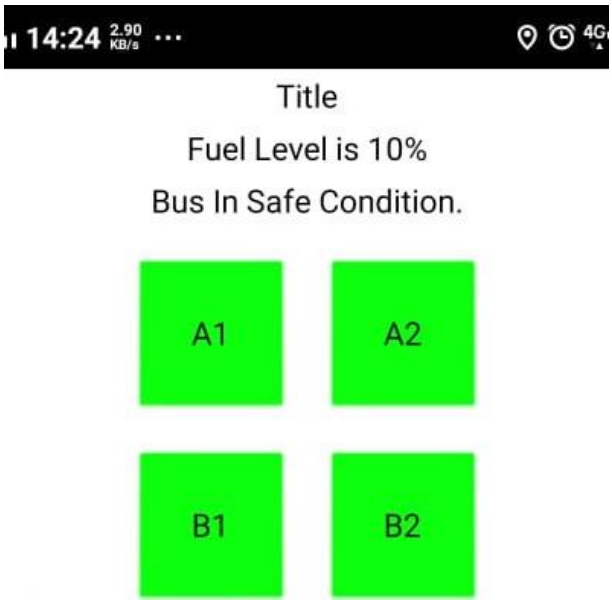

Fig 6. 14: Fuel monitoring system.

Here the result show that this project is not only beneficial to the bus owner but also beneficial for the passenger. As it is possible to observe the nature of the bus driver, so it will reduce the accident which is big benefit for passenger.

In future it can be possible to develop an apps with this project which will be used by any user to find the nearest buses which is travelling towards him and also user can see the approximate time for arriving a nearest bus at the bus stand.

6.2 Discussions:

We have developed smart vehicle tracking and passengers monitoring and fuel consumption system with accident monitoring. This project can develop with help of our supervisor. He guides us proper way. Withed the co-operation of microelectronics technology, we can apply electronics and programmable related device within an automobile several systems where it could increase the efficiency, security and longevity of an automobile as well as providing digitalize service for consumers. Doing this project, we can gain electronics knowledge and work hardware software combination. We learned programing C and also Arduino App (MIT App Inventers) programing. Within this project we have tried to show the actual calculation of fuel (in litter), monitoring the passengers, and indication of fuel theft, excess load detection and accidental location of vehicle. Each output data driver can see onto the dashboard even owner can know all of it through mobile application wherever owner is stayed. We optimize, the mobile application and the systems would be more beneficial for owners. As commercially we can get scopes for attaching or installing our project, it will must secure the vehicle, reduce maintenance cost and look after from wherever wants. Each system of this project is customer demands from the field study we have abled to understand. So, we have inspired to develop this project.

CHAPTER 7

CONCLUSION, LIMITATIONS AND FUTURE WORKS

7.1 Conclusion

This project is not only beneficial to the bus owner but also beneficial for the passenger. As it is possible to observe the nature of the bus driver, so it will reduce the accident which is big benefit for passenger.

This project can develop with help of our project supervisor. He guides us proper way. Withed the co-operation of microelectronics technology, we can apply electronics and programmable systems where it could increase the efficiency, security and longevity of an automobile.

7.2 Limitations:

There are some limitations of this project which is given in the bellow:

- This system can calculate the number of passengers having seat. But it can't take the passengers standing inside the vehicle into calculation. So, it is not possible to get the actual passenger number.
- This system cannot showing the signal when people come into the near of vehicle.
- This system is showing the oil level in unit of percent.
- The major problem is the financial support, for the lack of enough money we could not proper implementation of our goal.
- This system monitors the passengers only. It cannot identify the driver's response. So, there is a risk for accident.
- When a vehicle is overloaded, it is risky for passengers, and it also destroys vehicle life-time. This monitoring system is not able to measure total load of the vehicle.

7.3 Future works:

The work could have been more accurate and precise by investing more money and time to experiment again and again. Some interesting works are being discussed below what could be done in future to have a sustainable security system for vehicle:

- In this project we have only implementation for one vehicle but in future we have implementation for a large vehicle company to run our project.
- Implementation of load cell sensor inside vehicle, we will know total weight of our vehicle. At that time vehicle will safe and accident will decrease. From this load sensor, we are easily known age of passengers. It is divided children and adult. So, vehicle authority will take amount on the base of passenger age.
- Here we have used only GPS but GPRS will also implement in future. So that, we will not need to use pocket router. It is a packet oriented mobile data standard on the 3G and 4G cellular communication network's global system communications. After implementation this system, we can monitor our vehicle in rural area.
- We also monitor Irish camera in front of driver. In this way, we can see our driver attention. It also provides vehicle safety to assess the driver's alertness and warn the driver if needed and eventually apply the brakes.
- In future, we will also implementation speed meter. When any vehicle drives roughly or passing high speed, authority will know this information. It also decreases accident and give us safe journey.
- Sensor is need to modify for also detect when people come to near of the vehicle.
- We will update the apps for change the unit of oil level from percent to liter.

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APPENDIX

```
#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;
FirebaseJson json;

void setup() {
  pinMode(A0,INPUT);
  pinMode(D2,INPUT_PULLUP);
  pinMode(D5,INPUT_PULLUP);
  pinMode(D6,INPUT_PULLUP);
  pinMode(D7,INPUT_PULLUP);
  pinMode(D8,INPUT_PULLUP);
  Serial.begin(9600);
  pinMode(D4,OUTPUT);
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to Wi-Fi");

  while (WiFi.status() != WL_CONNECTED)
  {
    digitalWrite(D4,1);
    Serial.print(".");
```

```
    delay(200);
    digitalWrite(D4,0);
    Serial.print(".");
    delay(200);

  }

  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();

  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);
}

void loop() {
  if(WiFi.status() != WL_CONNECTED)
  {
     while (WiFi.status() != WL_CONNECTED)
       {
         digitalWrite(D4,1);
         Serial.print(".");
         delay(200);
         digitalWrite(D4,0);
         Serial.print(".");
         delay(200);
    }
  }
```

```
  Firebase.setInt(firebaseData,
"/ProjectDevelopment/PassengerMonitor/A0",analogRead(A0));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/PassengerMonitor/D5",digitalRead(D5));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/PassengerMonitor/D6",digitalRead(D6));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/PassengerMonitor/D7",digitalRead(D7));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/PassengerMonitor/D8",digitalRead(D8));


 if(digitalRead(D2)==0)

    Firebase.setInt(firebaseData, "/ProjectDevelopment/PassengerMonitor/D2",0);

  delay(200);


}
```