VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELGAUM

A
PROJECT REPORT
On
"Smart IoT Device For Two Wheelers"

Submitted in partial fulfillment of the Bachelor Degree

In

INFORMATION SCIENCE AND ENGINEERING

VIII SEMESTER PROJECT WORK (10IS85)

By

AQUIB JUNAID S	**(1HK14IS005)**
IMRAN PASHA	**(1HK14IS010)**
R SKANDHAN	**(1HK14IS028)**
SHASHANK S	**(1HK14IS037)**

Under the guidance of

Dr. A Syed Mustafa

HOD, ISE

Department of Information Science and Engineering

2017-2018

(Accredited by NAAC)

HKBK COLLEGE OF ENGINEERING
22/1, Nagawara, Bangalore – 560 045.
E-mail: info@hkbk.edu.in, URL: www.hkbk.edu.in

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SHASHANK S
USN: 1HK14IS037

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CERTIFICATE

Certified that the Project entitled "Smart IoT Device For Two Wheelers" is a bonafide work carried out by Aquib Junaid S (1HK14IS005), Imran Pasha (1HK14IS010), R Skandhan (1HK14IS028) and Shashank S (1HK14IS037) in partial fulfillment for the award of Degree of Bachelor of Engineering in **Information Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2017-2018. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project prescribed for the Bachelor of Engineering Degree.

SHASHANK S (1HK14IS037)

Name and Signature of Examiners:

1. _____

2. _____

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Signature of the Guide (Dr. A Syed Mustafa)	Signature of the HOD (Dr. A Syed Mustafa)	Signature of the Principal (Dr. Muzzamil Ahamed S)

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I would like to place my regards and acknowledgement to all who helped in making this Project possible. There are many people who worked behind the screen to help make it possible the below listed are a few of them.

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AQUIB JUNAID S **(1HK14IS005)**
IMRAN PASHA **(1HK14IS010)**
R SKANDHAN **(1HK14IS028)**
SHASHANK S **(1HK14IS037)**

DECLARATION

We hereby declare that the entire work embodied in this Project work "Smart IoT Device For Two Wheelers" has been carried out by us during the Eighth semester of Bachelor of Engineering in Information Science and Engineering at HKBK College of Engineering, Bengaluru affiliated to Visvesvaraya Technological University, Belagavi, under the guidance of Dr. A Syed Mustafa, HOD, Information Science and Engineering, HKBK College Of Engineering, Bengaluru. The work embodied in this project work is original and it has not been submitted in part time or full time completion for any other degree in any other university.

AQUIB JUNAID S	**(1HK14IS005)**
IMRAN PASHA	**(1HK14IS010)**
R SKANDHAN	**(1HK14IS028)**
SHASHANK S	**(1HK14IS037)**

ABSTRACT

The prime concern now-a-days are the security of parked vehicles. A smart IOT device for two wheelers system is developed which can now not only track the vehicle also alerts the user even the slightest displacement in the vehicle. The device makes use of Global Positioning System (GPS) for the tracking the vehicle and electronic mail (EMAIL) for alerting or notifying the user. The system can exhibit 2 modes i.e., Active mode and Parking mode. In Active mode, the system is off which means the system is not connected to user's smartphone. In parking mode, the system is connected to a cloud server through Low Power Wide Area (LPA) where the system detects the movement in the vehicle from vibration sensor and alerts the user by sending the location coordinates using GPS. The user also gets a mail that the vehicle is on move and to check the application for location by making use of GSM (Global System for Mobile communication). In future, it becomes a small-size low price device by converting it all into a single chip.

Our project is useful in detecting the theft of the vehicle which is implemented based on GSM and GPS technology. With the dedicated smartphone-android application one can check for the location of the vehicle. Vibration sensor is fixed with the NodeMCU this helps in detecting any sudden impact or displacement in the vehicle. GSM, GPS and vibration sensor are interfaced on the NodeMCU board and GPS sends the data to the NodeMCU that is the location of the vehicle through GPS coordinates. GPS sends the latitude and longitude coordinates to the NodeMCU board. NodeMCU receives the data from the GPS. Then the GSM get the GPS value and notifies the user via EMAIL (ELECTRONIC MAIL).

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Chapter 1

INTRODUCTION

1.1 Introduction

The security and theft prevention are one of the main areas of the automobile field. An anti- theft system is any device or method utilized to prevent the unauthorized access to items that are appropriate which are considered to be valuable. Where the ownership of a physical possession can be varied without the rightful owner's consent, theft prevention has been introduced to maintain the ownership whenever the true owner is physically absent. Anti-theft systems have developed accordingly to prevent increasingly complex methods of stealing.

In India, it is noticed that two wheelers are the most commonly used locomotives. In the last 3 years, around 4.5 lakh vehicles have been stolen as per the Ministry of transport of India.

In a year, nearly 6,234 vehicles are stolen from Bengaluru, while more than 5,197 are two- wheelers itself. This brings us to the point that; every-day around 16 vehicles are stolen. The vehicle recovery rate is lesser than 25%. In some cases, the vehicles are towed by the traffic authorities due violation of traffic rules like No parking and in such situations it is difficult to find the vehicle. A smart IoT Device helps to solve 2 wheelers theft problems in India by tracking the vehicles location in real-time.

1.2 Objectives

Some of the objectives of this system are:

- To help the user in safeguarding his/her vehicle being stolen.
- To detect theft of the vehicle, that is present in parking mode and informs the user immediately.
- This provides a solution that avoids the 2 wheelers being stolen at a lower cost than the advanced security system that are already available in the market.
- Alerts the user when someone tries to steal the vehicle.
- Alerts the user even if there is a slight change in the displacement of the vehicle.
- The objective of this project is to route and track the vehicle in a large area

environment based on the Global Positioning System (GPS) and electronic mail (EMAIL).

- The system identifies the vehicle location and alerts the user via electronic mail (EMAIL).

Chapter 2

LITERATURE SURVEY

2.1 Literature survey

[1] RFID Tracking System for Vehicles

RFID tag is used to track a vehicle. The RFID tag is stuck on the windshield whenever it passes through a signal or a toll the information of the tag is stored in a database. The RFID tag can also be used for payments at toll plazas. If the vehicle is stolen, whenever it passes through a signal or a toll its location can be captured.

ADVANTAGES

- If the RFID tag is tried to be removed, the body tends to get damaged.
- Whenever a tampered RFID tag passes through a toll the detector senses it and marks the vehicle information in the wanted list.

DISADVANTAGES

- Police can identify a stolen vehicle only if the body is damaged (RFID part) and noticeable.
- The live location of the vehicle is not known.
- The location is detected only after the vehicle passes through a toll or a signal.
- If the tag is not tampered by thieves and is driven through tolls the vehicle won't be marked as wanted.

[2] Design and implementation of vehicle tracking system using GPS/GSM/GPRS technology and smartphone application

This device with the help of GPS and GSM technology tracks and locates vehicles that are stolen. The vehicle is fitted with a device that consists of both GPS and GSM module. Whenever the user asks the vehicle for its location the GPS sends its coordinates through the GSM module. The vehicle also notifies the user when the key position is turned to ignition and the vehicle starts to move. The GPS can also be used to get the mileage and speed of the vehicle. The location of the vehicle is continuously updated to a database even when the user doesn't ask for the coordinates. Whenever the user requests the coordinates are retrieved from the

database and sent to the user.

ADVANTAGES

- The vehicles location is monitored all the time.
- The vehicles location data is stored in a database for future use.
- User is informed through Smartphone when the vehicles ignition is turned on.

DISADVANTAGES

- The GPS module is kept on 24/7.
- The user is informed even if he is driving the vehicle.

[3] Vehicle Tracking Device

This device also uses GPS/GSM to track a vehicle. The device also has a panic button which can be pressed in case of emergencies. This button when pressed calls a secondary number or an emergency number for help. The device also sends its current location to the emergency number when the panic button is pressed. The users need to send a request through EMAIL (ELECTRONIC MAIL) for the location of the vehicle. When the microcontroller receives this message it sends back the coordinates collected from the GPS module to the user. The user can copy these coordinates and view them in Google maps.

ADVANTAGES

- In cases of emergency panic button can be pressed for help.
- The device monitors the location of the vehicle all the time.

DISADVANTAGES

- Due to the device being on 24/7 energy consumed is more.
- If the thieves know about the device attached to the vehicle they can disconnect the system by simply removing the connections from the battery.
- The user is not informed at the time of theft; the theft is known only when the owner reaches the site where he had parked his vehicle.

[4] Alarm System for Vehicles

Alarm systems in vehicle are one of the first safety devices invented to prevent theft. These devices detect motion all over the body of the vehicle. Even a small motion on the surface of the vehicle will tip of the alarm system. The alarm system makes loud noise to warn the owners of the theft taking place.

ADVANTAGES

- The noise makes the thieves run from the place leaving behind the vehicle.
- Trying to open the door using fake keys or break the handle lock or tamper the ignition system can set off the alarm system.

DISADVANTAGES

- If the thieves are experienced they can cut the power to the alarm system by just disconnecting it from the vehicles battery.
- Small motion or even birds sitting on the vehicle can set off the alarm.
- The sound is annoying and it's too loud.

2.2 Problem statement

In India, 1lakh cases of vehicle theft on average are reported each year, and the number is still increasing. If the vehicles that are being stolen are not recovered early they are mostly sold or some cases it is burned if the resale value is considered to be too low. In one case a vehicle is stolen, it becomes hard to situate it and cut through it, which considerably lessens the chances of recouping it. In this project, we propose the design and implementation of a vehicle tracking anti-theft system that will protect, secure vehicles.

- The main problem in the existing system is that the GPS tracker tracks and monitors the vehicle 24/7 as a result of which it consumes a lot of energy.
- Due to the absence of vibration (movement) sensor the theft of the vehicle cannot be detected immediately.

2.3 Existing System

There are plenty of devices available in the market which helps to keep the vehicle safe in the large area environment. Some of them are listed below:

- **Vehicle alarm system:** It consists of an array of sensors which includes switches, pressure sensors, and motion detectors. Often a siren creates a variety of distinct sound that helps user to identify the vehicle. The advanced touch mechanism detects the touch and generates the alarm thereby helping the user to protect the vehicle.
- **GPS Vehicle Tracking System:** This device with the help of GPS and GSM technology tracks and locates vehicles that are stolen. The vehicle is fitted with

a device that consists of both GPS and GSM module. Whenever the user asks the vehicle for its location the GPS sends its coordinates through the GSM module. The vehicle also notifies the user when the key position is turned to ignition and the vehicle starts to move. The location of the vehicle is continuously updated to a database even when the user doesn't ask for the coordinates. Whenever the user requests the coordinates are retrieved from the database and sent to the user.

- **Net-intelligent auto guard system:** This is beneficial more than the other two because this system consists of central control system that is being installed in the command center which efficiently retrieves the information such that mobile GPS terminal installed in the vehicle and GSM network**.** Global Positioning Satellite sends the positioning information**.** This system uses 24 hour uninterrupted and high-precision monitoring of the vehicle.

2.3.1 Advantages:

- Anti-theft.
- Tracking the device using GPS tracker.
- Saves time in finding the vehicle.

2.3.2 Disadvantages

- Consumes more energy.
- GPS tracker is ON 24/7.
- Doesn't notify the user.

2.4 Proposed System

The SIDTW (Smart IoT Device for Wheelers) system comprises of following components:

- **GSM module:** A Global System for Mobile communication in short GSM module is a chip or circuit which helps in establishing the communication between a computing machine and a GSM.
- **Vibration sensor:** The vibration sensors can detect any continuous vibration or sudden impact or displacement in the vehicle.
- **NodeMCU:** NodeMCU is an open source IoT platform that includes firmware which runs on the ESP8266 Wi-Fi SoC (system on a chip) from Espressif Systems. The hardware is based on the ESP-12 module. NODEMCU term refers to firmware.

- **GPS tracker:** A Global Positioning System (GPS) sends the coordinates (longitude and latitude) upon user request.
- **Battery:** A rechargeable battery is used for powering up all the devices.

The proposed system uses a switch to turn ON and OFF the device which is controlled by the user/owner. When the user turn OFF the switch, the device goes to active mode. When the user disconnects to the device goes to parking mode and device is connected to cloud server through LPWA (low- power wide range network). When the device is in parking mode, movement of the vehicle is sensed using vibration sensor and the owner is notified along with the GPS coordinates of the vehicle.

Advantages:

- Small size and light weight.
- Sophisticated security system.
- Consumes less energy.
- Notifies the user immediately.

Chapter 3

REQUIREMENTS

The main goal of Software Requirement Specification (SRS) documents a detailed overview of our software product, its parameters and goals. This paper identifies the project target audience, hardware, and software requirement. It depends on how our clients and team looks into the system and define its functionalities. An SRS also reduces time and energy for developers to reach their goals. Additionally this reduces the time and cost for the development also.

3.1 Software Requirements

- Programming Languages:
  - Java and XML for Android application Development.
  - C/C++ programming language for NodeMCU Programming.
- BLYNK
- NodeMCU Software

3.2 Hardware Requirements

- NodeMCU
- GSM Module
- Vibration Sensor
- GPS tracker
- Battery
- Breadboard

3.3 Specific Requirements

3.3.1 External Interface Requirement (User interface)

It is industrial design for human-computer interaction where a person may interact which includes screen, display, keyboard, mouse etc. It is way through which the user can interact with the application or website.

3.4 Functionality Requirements

In the context of hardware development process, functional requirements can be

considered as the functionalities or services the system must provide. In other words, functional requirements describe how a system is to react and behave given specific inputs.

- Notifying the User: Once there is a displacement/movement in the vehicle the user is notified by sending the alert mail to his smartphone through GSM.
- Tracking the vehicle: Based on the request made by the user the GPS send the location coordinates to the user.
- The description of control flow of the entire system is shown.
- Activation of GPS is shown.
- GPS live location tracking can be seen on Google maps.

3.5 Non-Functionality Requirements

Non – functional requirement is not specific to the specific behaviors but is specific to certain criteria where the operation of the system is considered. Some of the nonfunctional requirements are:

3.5.1 Security

Any project should promise to provide security to the user by the system.

3.5.2 Maintainability

It should easy to maintain, the system that is developed. Large scale damaged should not occur due to some issues with the system and the repairs should be easy to perform.

3.5.3 Recoverability

Any existing system or proposed should that is developed should be in a position to recover if any faults occur.

3.5.4 Availability

The system should be available and service the user requests based upon the requests made by the user.

3.5.5 Scalability

The system that is developed should scale well that is expansion of the system should be accepted by the system in case by adding the components.

3.6 Software Quality Attributes

Software Quality Attributes should be measured during the course of design,

implementation, and deployment. No account quality attributes are entirely in need of design, nor are they

completely dependent on implementation or deployment. Suitable results are a problem of getting the big figure as well as details implementation. Software Quality Attributes are used to measure the product performance and the software that has been developed is up to the industry standard. We have explored below attributes to ensure our system meets these quality:-

3.6.1 Usability

Usability involves both architectural and non-architectural aspects. One of the aspects of non- architectural is making the user interface clear and easy to use. Usability involves both architectural and non-architectural aspects. User clear and easy to use for non – architecture is done by usability.

3.6.2 Modifiability

It is determined by how the functionality is divided and considering some of the coding techniques by architecture. Though we have the architecture most of the time it is tough to modify the code.

3.6.3 Performance

This involves both non-functionality and functional aspect as it depends upon how much communication is necessary among all the components partially on architectural.

3.6.4 Reliability

It is a useful quality attribute in any product. Because the products are used for a specific reason and if the product is not reliable it cannot be used. The main aim of our system is to make sure that the existing systems reliability is increased by using proposed system that is capable of producing good reliability.

Chapter 4

SYSTEM DESIGN

4.1 INTRODUCTION

System design is the process of describing the components, parts, interfaces, and data for a system to satisfy specified requirements. System expansion is the process of producing or changing systems, laterally with the processes, practices, models, and approaches used to expand them. In industry, System Design states the process of inspecting a business situation with the intending to improve it over better procedures and methods. System design narrates to determining organizations, improving presentation and succeeding objectives for productivity and progress. The importance is on systems in action, the connections among subsystems and their impact to meet a common goal.

The System Design is used to create a communication bridge between the requirements specification and the implementation. The system design stage shows the difference in viewing the system from a user's prospect to a programmer's prospect. To model a system, it is necessary to understand the concept of a system and the system boundary. A System is well-defined as a group of substances that are linked together in some fixed interaction or interdependence toward the achievement of some purpose.

System design arrangements can be categorized as discrete or continuous. "Few organizations in practice are entirely discrete or continuous, but from the fourth dimension when one type of change dominates for most organizations, it will usually be possible to organize a system as being either discrete or continuous". A discrete system is one in which the state variables change only at discrete set of full stops in time. A continuous system is one in which the state variable change continuously over time.

In our system design we have two modules and they are:

- Hardware Module
- Software Module

In this detailed explanation of the system design we will consider various

components.

4.2 SYSTEM ARCHITECTURE

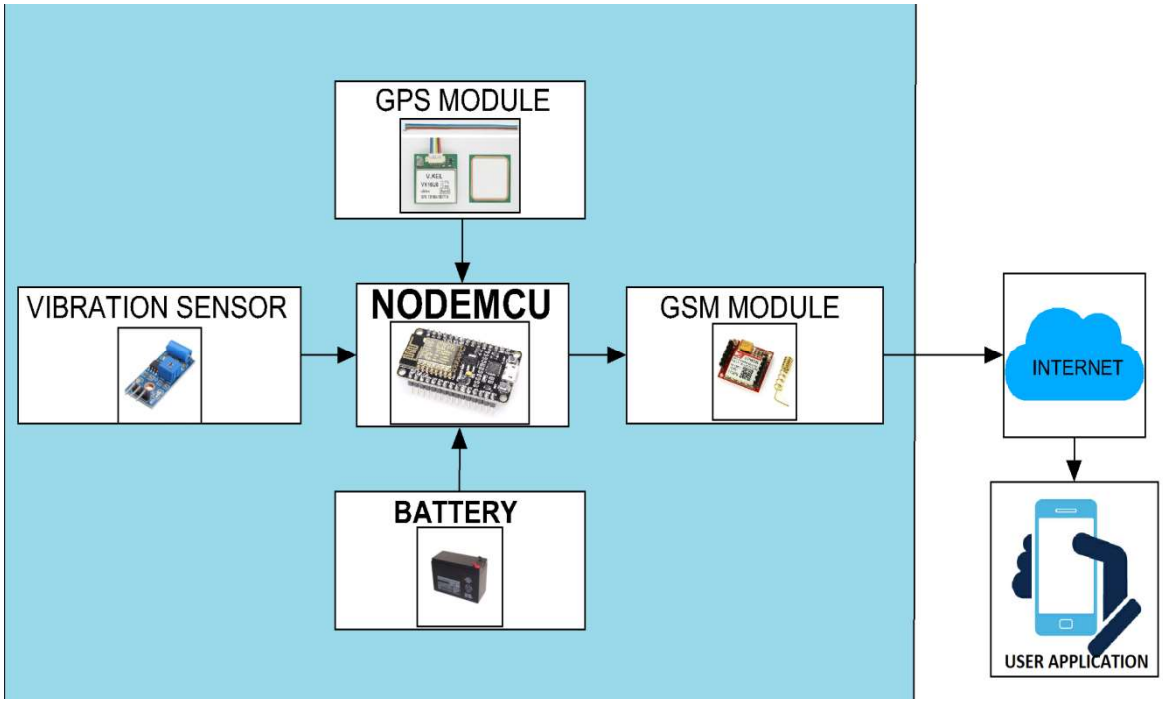


Fig: 4.1 System Architecture

The above diagram shows the detailed system architecture of our project. The blocks that are connected here are NodeMCU, GPS Sensor, Vibration Sensor, GSM Module, and Blynk Application.

In this Project, it is planned to develop an embedded system which is used for tracking and locating of any vehicle via Global Positioning System (GPS) and Global system for mobile communication (GSM).

In this project, NodeMCU is used for interfacing to various hardware peripherals. The NodeMCU board is the core of the entire setup. It is the brain of the setup. The present design is an embedded application, which will constantly monitor stationary motor vehicle and send the position of the Vehicle on request. For doing so an NodeMCU is interfaced serially to a GSM Module and GPS Receiver.

The power supply of 5V is set as the input of NodeMCU Microcontroller which accesses the VB-8205 Vibrating sensor, GPS Module as an input device and the output devices are SIM300, Blynk Application. The Input sensor tracks the data from its working tool and sends the data to the output devices. The Blynk Application gives the information to the Owner about the problem in the vehicle.

A GPS Module is used to show the location (Latitude and Longitude) of the vehicle from an isolated place. The GPS Sensor will constantly give the data i.e. the latitude and longitude indicating the spot of the vehicle.

The GPS Sensor provides various factors as the output, but only the individual data that gives a location of the vehicle is delivered and stored on the cloud. This data is sent to the smartphone at the other end from where the position of the vehicle is requested. The hardware interfaces to NodeMCU are Battery, GSM Module and GPS Sensor. Vibration Sensor is used for detecting problem encountered such as theft etc.

The sensor senses the vibration on the automobile with the vibration sensor from the Measurement Specialists. If there is any vibration, there occurs a pressure in the piezo substance that creates a change in value. This change is delivered to the NodeMCU which alert the user about theft activity. Once the user receives the warning message they can launch the application to check the coordinates (Latitude and Longitude) of the Vehicle.

This architecture consists of two modules:

1) Hardware Module
2) Software Module

4.2.1 Hardware Module

- NodeMCU
- GSM Module
- Vibration Sensor
- GPS tracker
- Battery
- Breadboard

1) NodeMCU

NodeMCU consists of Wi-Fi Module – ESP-12E module that is similar to ESP-12 module which has 6 extra GPIOs (General-purpose input/output pins). NodeMCU

is an open source IoT platform that includes firmware which runs on the ESP8266 Wi-Fi SoC (system on a chip) from Espressif Systems. The hardware is based on the ESP-12 module. NODEMCU term refers to firmware. NodeMCU has a micro USB port that is used for power, debugging and programming. It has128KB of RAM (Random Access Memory), 4MB of ROM (Read Only Memory) and it also has 10 digital pins and 1 analog pin. It uses 5V power from USB port and the board also consists of Reset and Flash buttons.

NodeMCU has dimensions of 49 x 24.5 x 13mm. it has integrated low power CPU and is embedded with logic level converter circuits. It also features +19.5dBm output power in 802.11b mode.

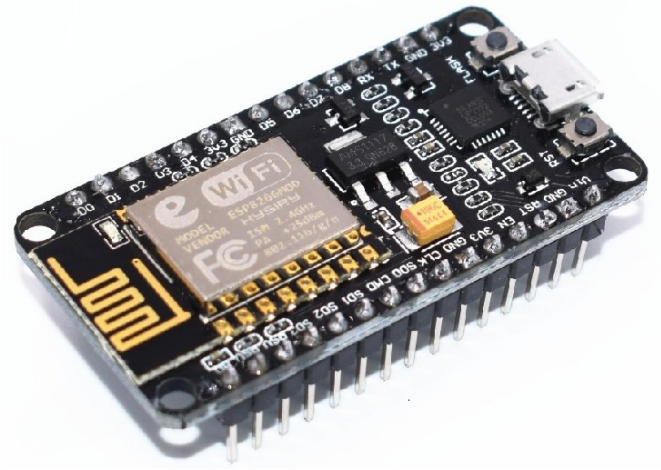


Fig: 4.2 NodeMCU

2) GSM Module

GSM Module has a slot where 2G bandwidth network Sim card can be placed. GSM Module helps in sending the message from the NodeMCU to the user smartphone. In our project we use SIM 800L GSM module which is a quad-band GSM/GPRS module that works on frequencies 850/900/1800/1900MHz.. The GPRS is a multi-slot class 12/10 with the use of mobile station class B which complaints to GSM phase 2/2+ Class 4 (2 W @ 850/900MHz) and Class 1 (1 W @ 1800/1900MHz). This features 0710 MUX protocol and embedded TCP/UDP protocol that can send requests through FTP/HTTP. The operating temperature ranges from -40 ~ 85°C.

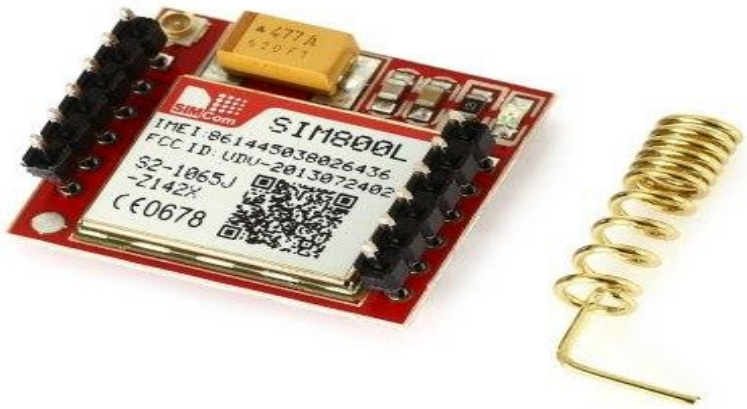


Fig: 4.3 GSM Module

3) Vibration Sensor

Vibration Sensor is used to detect any continuous vibration or sudden impact or displacement in the vehicle. In our project we make use of vibration sensor SW _420 model. The vibration sensor SW-420 comes with breakout board that includes comparator LM 393 and Adjustable on board potentiometer for sensitivity threshold selection, and signal indication LED. When there is no vibration this module gives logic LOW output. When it feels vibration then output of this module goes to logic HIGH. The working bias of this circuit is between 3.3V to 5V DC.

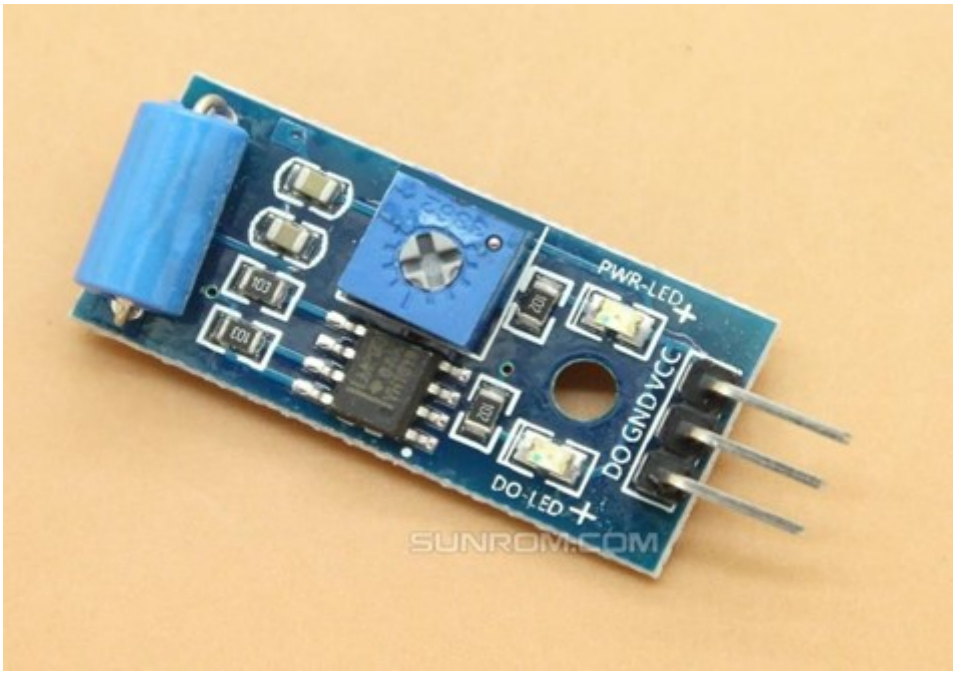


Fig: 4.4 Vibration Sensor

4) GPS tracker

A Global Positioning System (GPS) sends the coordinates (longitude and latitude) upon user request. In our project we are making use of GPS NEO -6M module. The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. Innovative design and technology suppresses jamming sources and mitigate multipath effects, giving NEO-6 GPS receivers excellent navigation performance even in the most challenging environments.

Fig: 4.5 GPS tracker

5) Battery

A rechargeable battery is used for powering up all the devices. In our project we make use of RS 12V battery that is enough to power up the NodeMCU.

Fig: 4.6 Battery

6) Breadboard

A full size breadboard uses 830 tie points which is good for our project. It's 2.2" x 7" (5.5 cm x 17 cm) with a standard double-strip in the middle and two power rails on both sides. It weights around 79.0g. Breadboard is used to connect GSM module, Vibration sensor and GPS Tracker to the NodeMCU on the board.

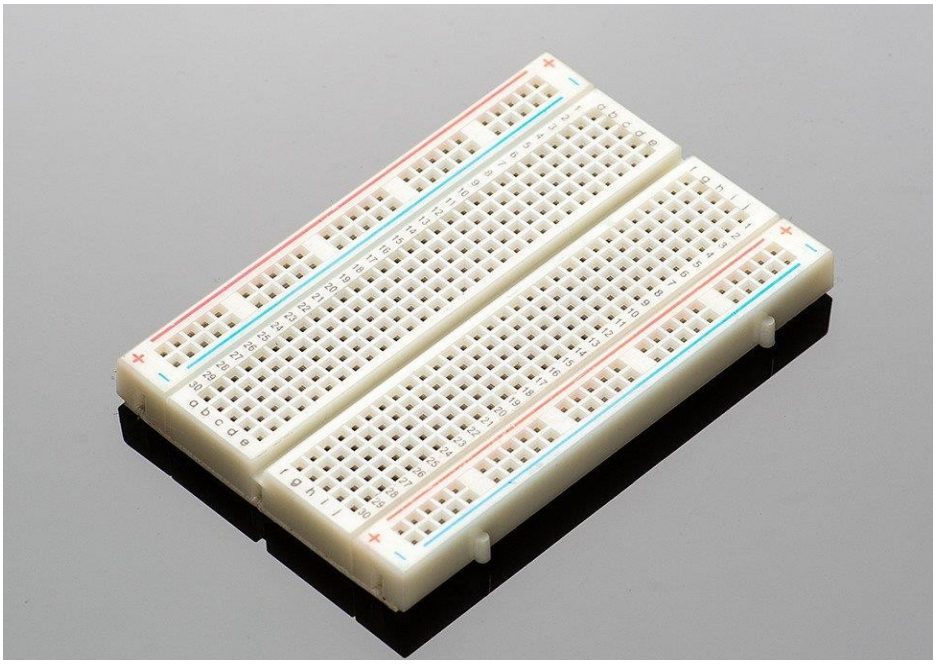


Fig: 4.7 Breadboard

4.2.2 Software Module

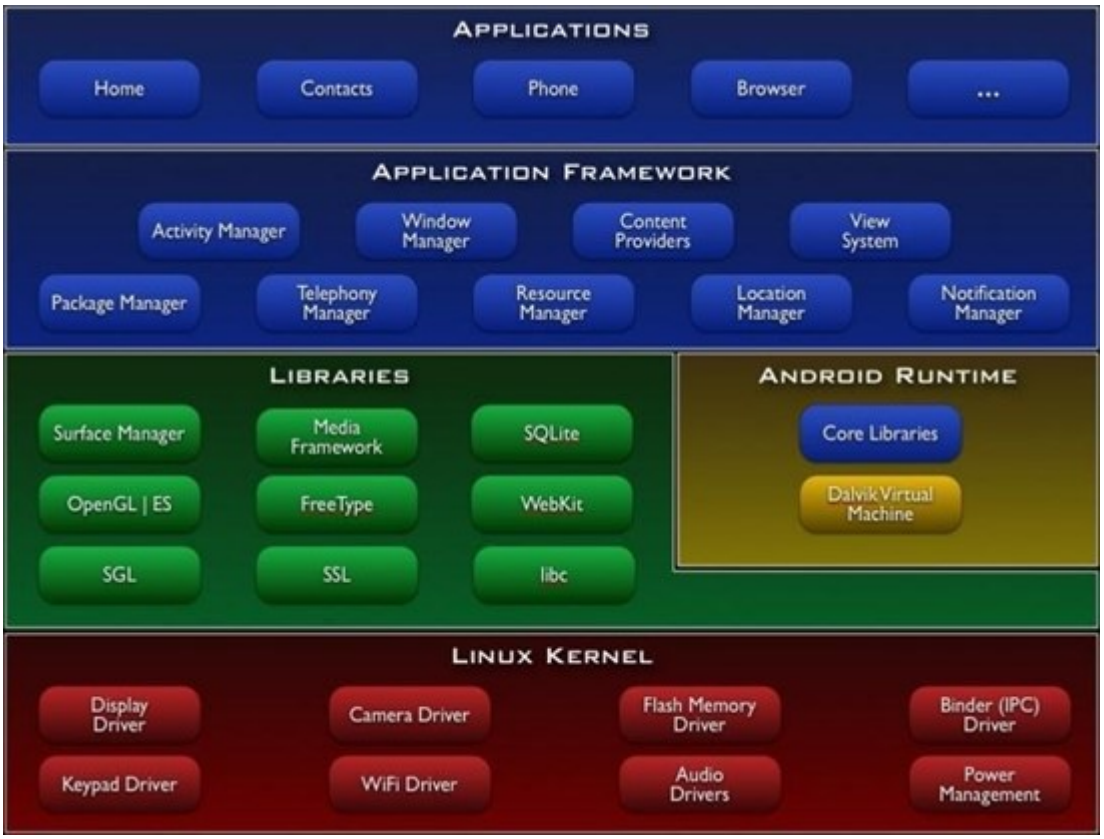


Fig: 4.8 Android architecture

1) Linux kernel

At the bottom of the layers is Linux - Linux 3.6 with approximately 115 patches. It also provides a level of abstraction which is between the device hardware and it also contains all the device efficient hardware like camera, keypad etc. The kernel handles all the things which compute that Linux is really good like networking and vast array of device drivers.

2) Libraries

These libraries are said to be on top of Linux kernel level which includes open source, web browser, engine web kit and well known library called LIBC and also SQL lite database this is a repository that is used for storing the data and sharing of the application data.

- **Android Libraries**

In this category we can use java based libraries that are specific to android development. Some of the examples of Android Libraries are application framework

library this is facilitated by user interface building, graphic drawing and database access.

- Android.app: this provides the access to application model.
- Android.Content: this facilities to content access, publishing and provides messaging between application and application components.
- Android.Database: this is used access the data published by content providers and includes SQL like database management classes.
- Android.OpenGL: this is the java interface to the OpenGL ES 3D graphics rendering API.
- Android.Text: this is used to render and manipulate on text on the device display.

➢ **Android runtime**

This is also called as dalvic virtual machine. This is like a java virtual machine and is specially designed and optimized for android applications.

3) Application Framework layer

This layer provides many higher level services to applications which is in the form java classes. This layer has following key services:

Activity manager: this controls all the aspect of application life-cycle and activity stack.

Content provider: this allows application to publish and share the data with the other applications.

Resource Manager: this provides the access to non-code embedded resources.

The figure below (figure 4.10) shows different versions of Android with their version numbers.

Android is continually developed by Google and the Open Handset Alliance and it has seen a number of updates to its base operating system since the initial release. The naming system in Android goes alphabetically, starting with letter C Android released first end-user furnished OS considering A (alpha) and B (Beta) the earlier iterations. Each Android version has a unique name and different symbols to represent it.

Fig: 4.9 Android versions

Below table provides the information regarding the Android version stats with version number, API and their release date. It provides the information about the different versions of the android with the API which is an integer value that helps in identifying uniquely the framework API revision offered by a version of Android platform and respective initial release date.

Codename	Version number	API	Initial Release Date
Cupcake	1.5	3	April 27, 2009
Donut	1.6	4	September 15, 2009
Éclair	2.0 – 2.1	5 - 7	October 26, 2009
Froyo	2.2 – 2.2.3	8	May 20, 2010
Gingerbread	2.3 – 2.3.7	9 - 10	December 6, 2010
Honeycomb	3.0 – 3.2.6	11 - 13	February 22, 2011
Ice Cream Sandwich	4.0 – 4.0.4	14 - 15	October 18, 2011
Jelly Bean	4.1 – 4.3.1	16 - 18	July 9, 2012
Kit Kat	4.4 – 4.4.4	19	October 31 ,2013
Lollipop	5.0 – 5.1.1	21 - 22	November 12, 2014
Marshmallow	6.0 – 6.0.1	23	October 5, 2015
Nougat	7.0 – 7.1.2	24 - 25	August 22, 2016
Oreo	8.0	26	August 21, 2017

4.3 DATA FLOW DIAGRAM

A data flow diagram (DFD) maps out the flow of information for whatever process or organization. It uses well-defined signs like rectangle, circle and arrow and small text labels, to show data input, output, storage period and the paths between each address. DFD can vary from simple, even hand-drawn practice synopses, to in-depth, multi-level DFDs that dig even deeper into how the data is handled. They can be used to analyse an existing system or design a new one. Like all the best diagrams and charts, a DFD can often visually “say” things that would be hard to explain in words. They can be used to analyze an existing system or design a raw ace. Wish all the best diagrams and charts, a DFD can often visually “say” things that would be difficult to explicate in words.

There are several techniques for drawing process models or diagrams at various levels

of detail and each has a specific focus. Data Flow Diagram denotes the workflow or phases within a method with a effort on the flow and change of data.

A curved rectangle (or a circle depending on which convention you follow) represents a process at some level of detail. The name of the process tells us what the process does, an arrow represents a data flow, meaning information coming from somewhere and going somewhere else. Because the data is moving from somewhere to somewhere, the arrow points in the direction of movement. Every data flow has to have a name. Since it represents data and data is an object.

Essentially, there are two good points why there is need of diagram. First, persons can point to the figure to discuss a process or flow as an alternative to using words to describe what they mean. The figure signifies a graphical mode of communication, which all trainings show is much more active than mere words. Pointing power proves that it works. Secondly, studying the diagram generates questions that might indicate missing steps or external entities.

4.3.1 Level 0 DFD: - Active Mode

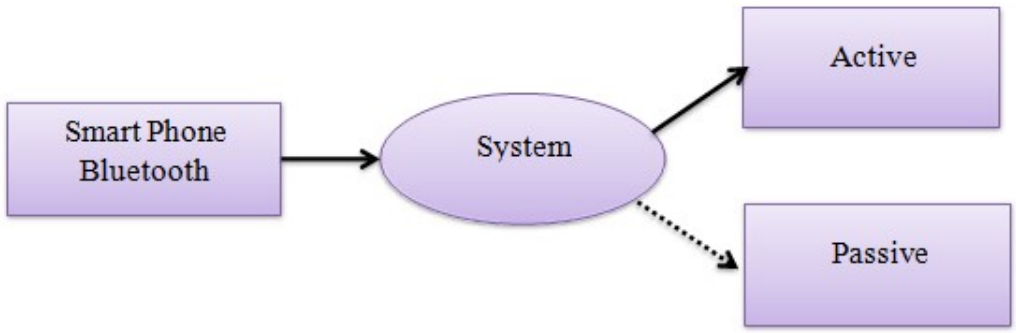


Fig: 4.10 Level 0 DFD - Active Mode

The level Zero DFD is normally referred to as the External Entity DFD. It shows the involvement of outsider's in the system. This is the level or mode where the system is said to be in "Active mode". In this level device is off which is done using a switch and the sensors like vibration sensor, GSM Module, GPS is OFF. The level 0 DFD's are explored to get a detailed description of the system. In the fig there is an entity that is the user controlling the system through the smartphone. In this situation the device goes to active state in which the system is not connected the user smartphone. This indicates the system is in Active mode.

4.3.2 Level 1 DFD: - Parking Mode

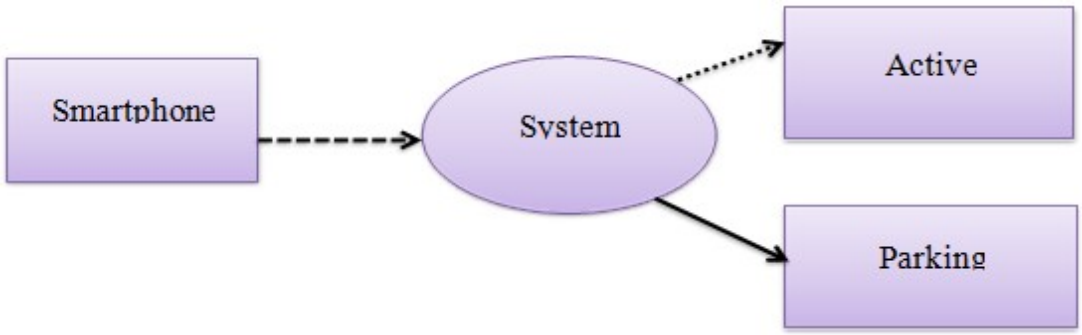


Fig: 4.11 Level 1 DFD - Parking Mode

In level 1 the secure connection between smartphone and the hardware module is established. The device gets disconnected from the smartphone of the user and the device goes into Parking Mode. From this point the user can access the device remotely and monitor the entire system. The user then waits for the vibration sensor to be detected and sent to the device. When the sensor detects any vibration it notifies the NodeMCU Controller. Since the entire system is synchronized the user can get updates and constantly monitor the system.

4.3.3 Level 2 DFD

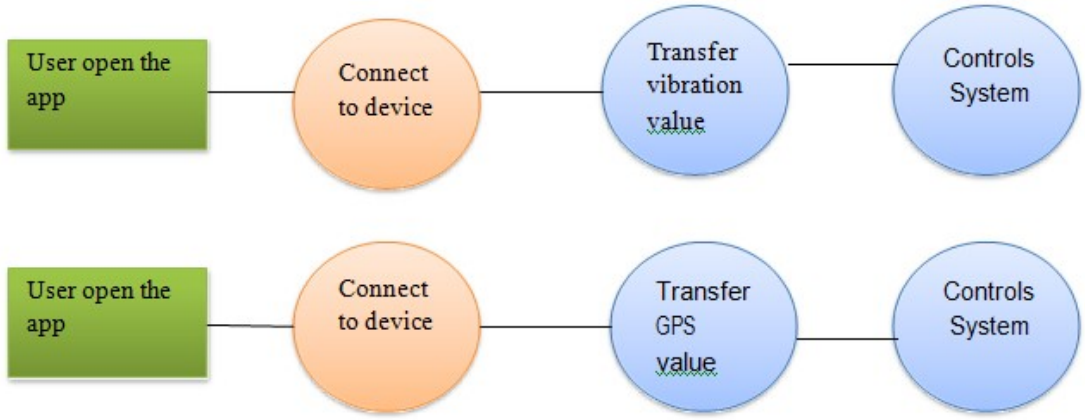


Fig: 4.12 Level 2 DFD – Vibration sensor, GPS

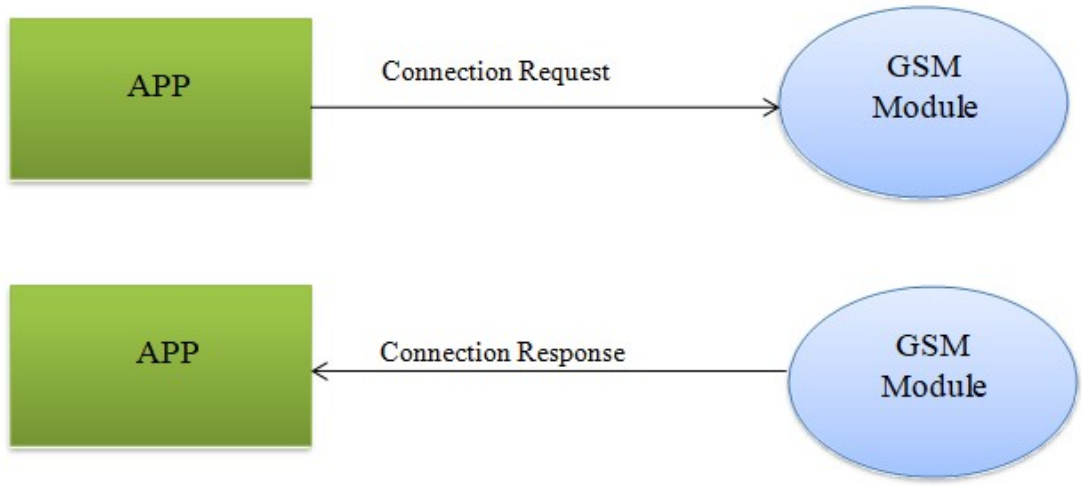


Fig: 4.13 Communication between GSM and Application

The above figs show the communication between GSM Module and Application.

In the first figure there is connection request sent from the application to the GSM Module.

In the second figure there is connection response sent from the GSM Module to thee application.

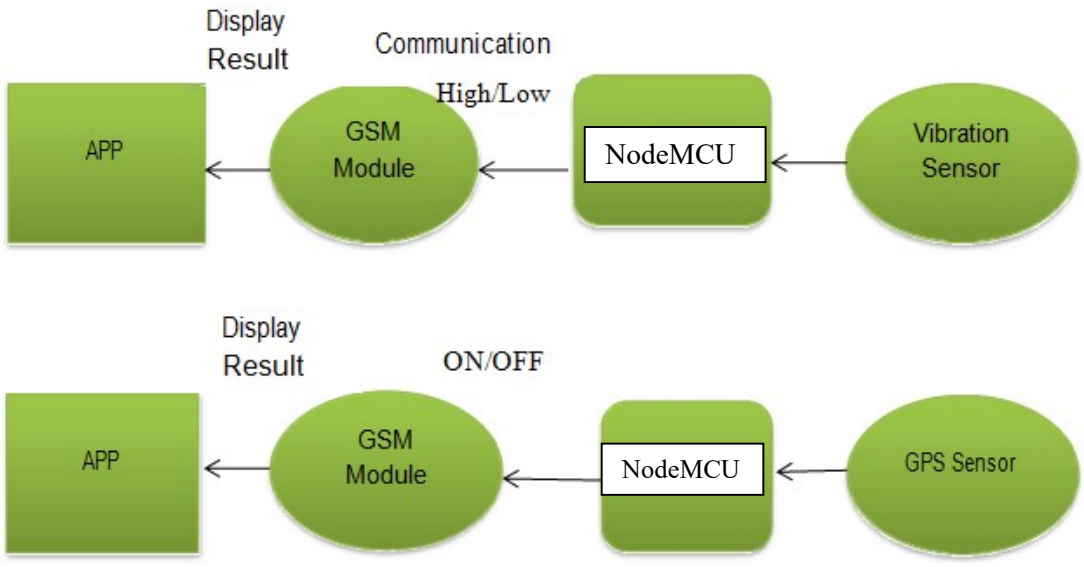


Fig: 4.14 Displaying the result of Vibration sensor and GPS sensor

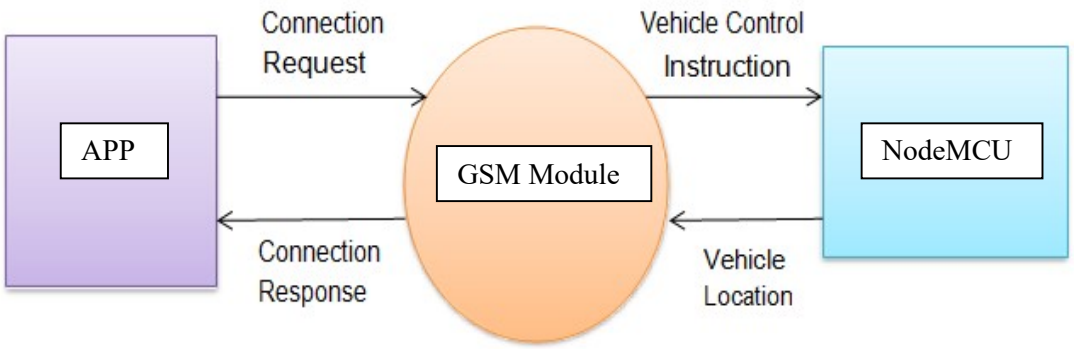


Fig: 4.15 Communication between Application, GSM Module, NodeMCU

In level 2 Data Flow Diagram it shows the entire system functionalities where we can see how user communicates to the device via Application. The user can monitor are locate the position of the vehicle from the application. If the vibration is detected in the vehicle the user can take necessary actions like verify the position of the vehicle through the App. Initially user Launch the app in his smartphone and connect it to the device. Then the user transfers the value of the vibration sensor to the controlling system. In the next phase if the vibration sensor detects high or low value of vibration it sends he data to NodeMCU board. The NodeMCU then communicates with the GSM module to display the result in the user app.

4.3.4 GSM DATA FLOW DIAGRAM

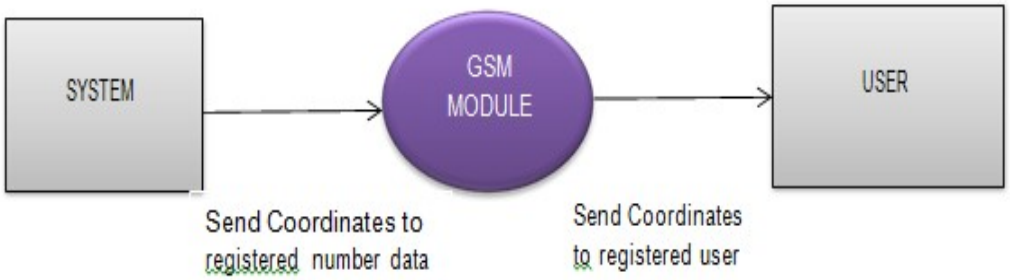


Fig: 4.16 GSM Data flow diagram

In GSM data flow the system sends the coordinates to the GSM module from there the data or information is transferred to the registered user through GSM network via EMAIL (ELECTRONIC MAIL).

4.3.5 GPS DATA FLOW DAIGRAM

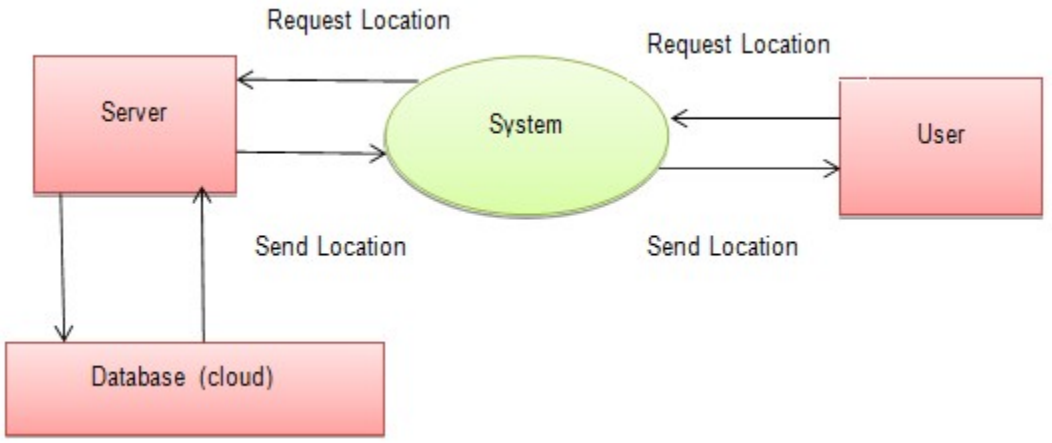


Fig: 4.17 GPS Data flow diagram

In GPS data flow user requests for the location to the system explicitly and then the system requests the server for the location. Server checks from the database (cloud) and sends the location through latitude and longitude to the user through the system.

4.4 Use Case Diagram

A use case diagram at its simplest is a presentation of a user interface with the arrangement that displays the link between the user and the different use cases in which the user is required. A use case diagram can make out the different kinds of users of a system and the diverse use cases and will often be convoyed by other types of diagrams, as well. The use case graphs are utilized to examine prerequisites of the context from an abnormal state viewpoint. The second thing significant in a utilization case is the performing artists, and they are something that communicates with the system. Although a use case might practice a lot of detail almost each and every opportunity, a use-case diagram can help offer a upper-level understanding of the system. It has been said earlier that "Use case diagrams are the outlines for your system". They offer the basic and graphical demonstration of what the system must essentially do.

Because of their basic nature, use case diagrams can be a good communication device for stakeholders. The diagrams try to mimic the actual world and offer an observation for stakeholder to know how the system is going to be

developed. Actors are human user, computers, apps or AI. Here we are designed to draw use case diagrams for our system and try to analyse the various user interactions possible with our system and how each of these use cases are relevant in the working of our system.

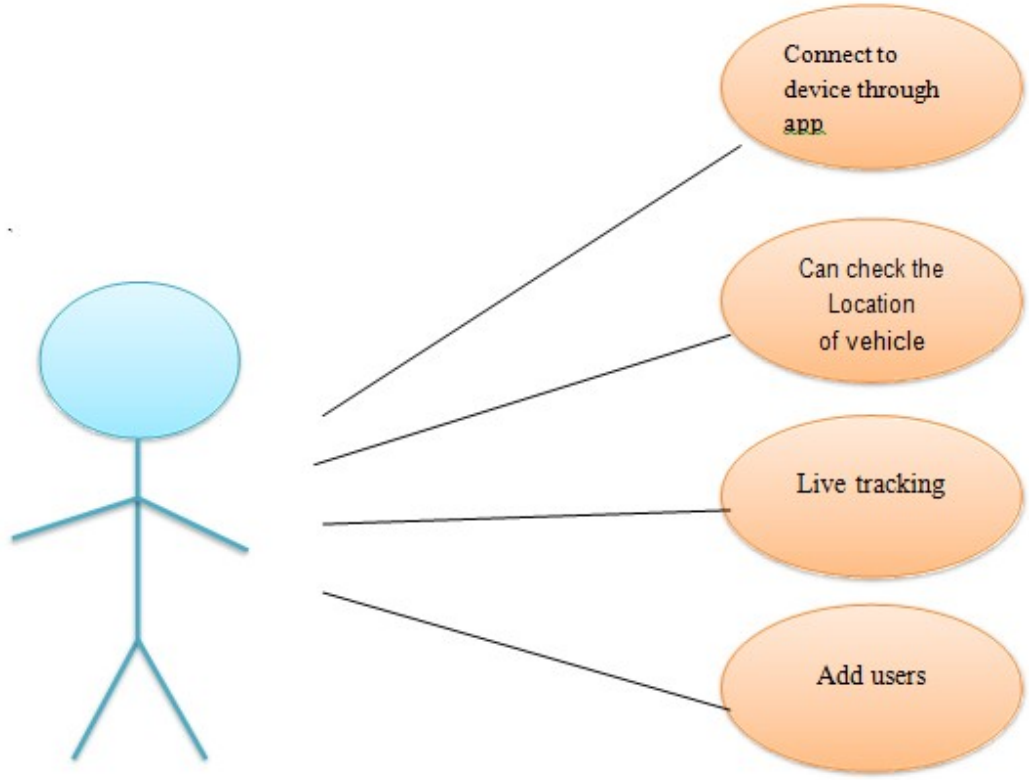


Fig: 4.18 Use Case Diagram

4.5 Sequence Diagram

A sequence diagram indicates object interfaces organized in phase sequence. It describes the object and class used in the scenario and the order of messages exchanged between the objects required to carry out the functions of the scenario. Sequence diagrams are employed to trace the flow of messages of restraint from one part of the arrangement to the others. In other words, it describes clearly how each element in the system interacts with each other and what all messages are passed between them to do certain activities. A sequence diagram displays, as equivalent vertical lines (lifelines), dissimilar processes or objects that live instantaneously, and, as flat arrows, the messages transferred between them, in the order in which they come. This let the description of simple runtime scenarios in a graphical mode.

Thin arrow head denote synchronous event, open arrow head denote asynchronous event, and dashed lines denote reply messages. If a user sends a synchronous message, it should wait until the message is executed, such as invoking a procedure. If a caller sends an asynchronous message, it can continue processing and doesn't hold to wait for a reply.

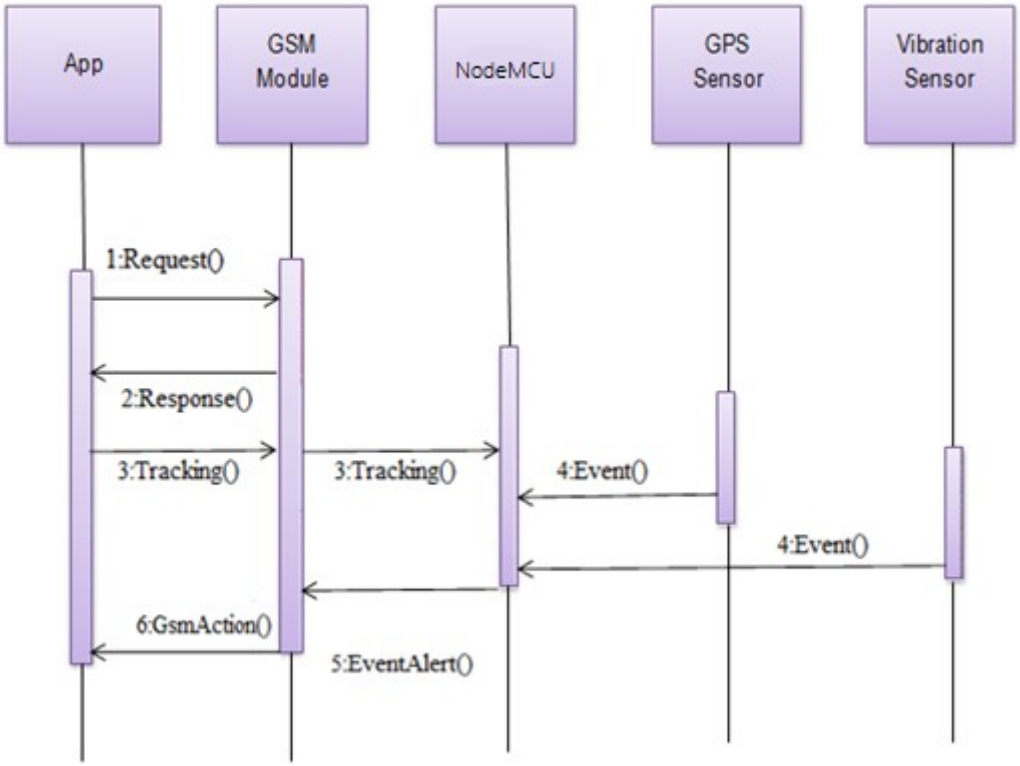


Fig: 4.19 Sequence Diagram

Chapter 5

IMPLMENTATION

5.1 Introduction

Implementation simply means carrying out the activities described in your work plan. Based on regular approach implementation stage is considered after the execution of system design, considering the requirements and specifications of the system that is to be implemented. Implementation is basically the conversion of system design into a real world system. According to system architecture the system design with various functionalities is obtained based on the requirements and this help in implementation of both hardware and software.

5.2 Software Module Implementation

The implementation of software module includes Blynk Application. The Blynk App is a well-designed interface builder. Blynk application provides platform as service for IOS (IPhone operating system) and variety of android applications which can control Raspberry and NodeMCU via Internet. Blynk application uses Raspberry, NodeMCU or similar kit for development.

As we all know that Blynk application works on internet which means the hardware that we use should be able to connect to the internet. Some of boards like NodeMCU UNO will need an Ethernet or Wi-Fi Shield to communicate; others are already Internet-enabled: like the NodeMCU, Raspberry Pi with Wi-Fi dongle, Particle Photon or Spark Fun Blynk Board. But even if you don't have a shield, you can connect it over USB to your laptop or desktop which is a complex method for the beginners.

There are 3 main components used in Blynk platform and they are:

- Blynk App: This component is based on the widgets provided it allows the user to create good number of interfaces for the projects.
- Blynk Server: This component is helpful for the communication between the smartphone and hardware. Blynk cloud is available or we can choose our own private Blynk server locally which is an open source server that can handle millions of devices.

- Blynk Libraries: Libraries are useful in incoming or outgoing of commands which are enabled by the communication between the server and the hardware platforms.

One of the main advantages of using Blynk application is that it store up to 1000 values sensor data when the application goes offline. If more values are required then we need to install the Blynk Server locally.

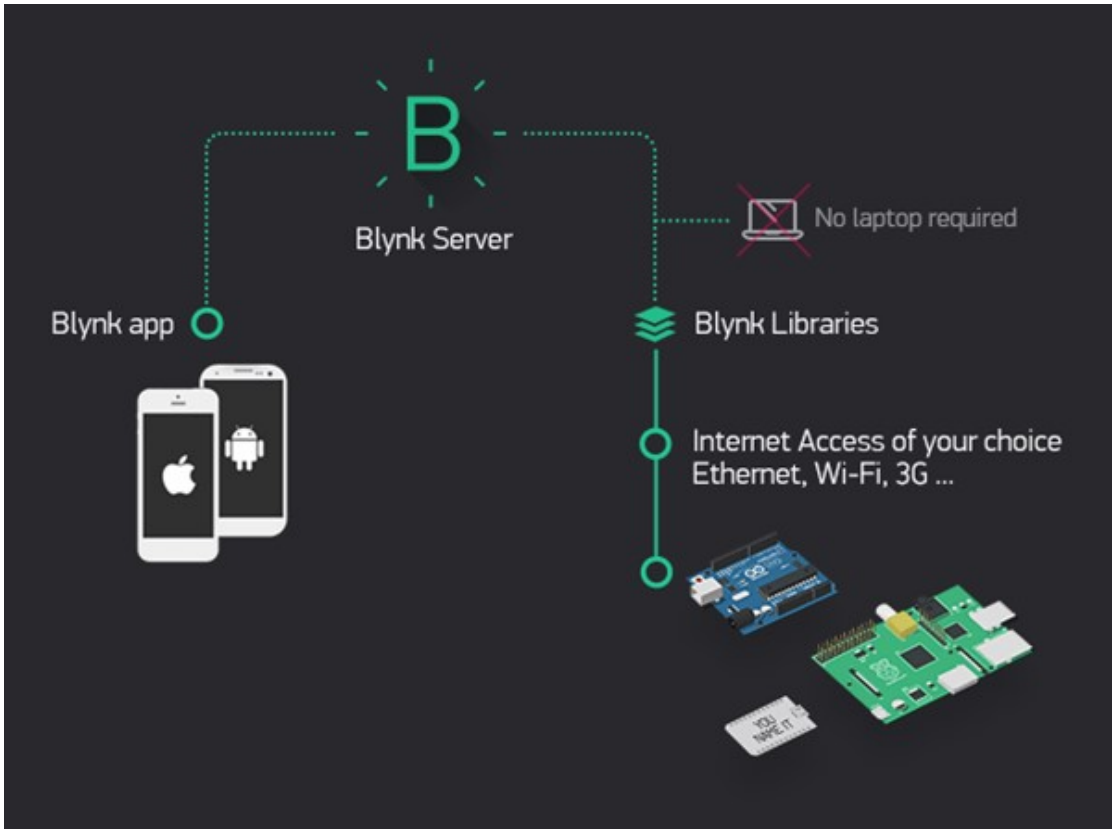


Fig: 5.1 Blynk Application

5.3 Hardware Module Implementation

NodeMCU consists of Wi-Fi Module – ESP-12E module that is similar to ESP-12 module which has 6 extra GPIOs (General-purpose input/output pins). NodeMCU is an open source IoT platform that includes firmware which runs on the ESP8266 Wi-Fi SoC (system on a chip) from Espressif Systems. The hardware is based on the ESP-12 module. NODEMCU term refers to firmware. NodeMCU has a micro USB port that is used for power, debugging and programming.

NodeMCU uses ‘C’ type NodeMCU language that performs all functions required by the user. We have connected various components which is connected to various pins of NodeMCU.

5.3.1 GSM module and NodeMCU.

GSM Module SIM 800L is connected to NodeMCU and is powered up by an external 3.7V. GSM module ground is connected to the negative terminal of the battery. GSM module's Vcc is connected to positive terminal of the battery. TX pin of the GSM module is connected to RX pin of NodeMCU.

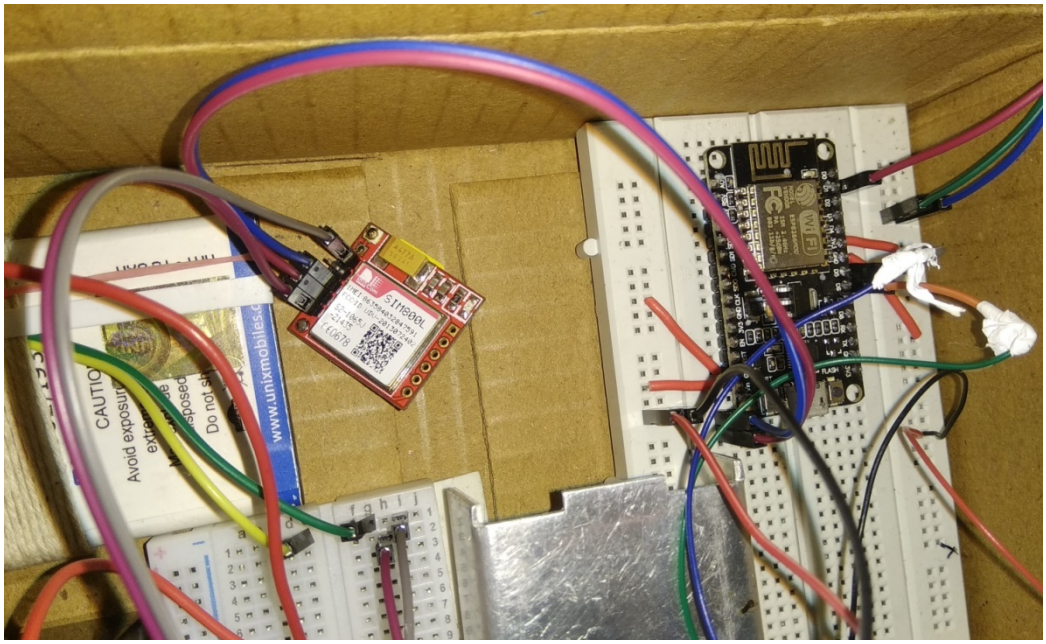


Fig: 5.2 GSM module and NodeMCU

5.3.2 GPS tracker and NodeMCU

GPS tracker is connected to NodeMCU with pin numbers as follows TX, RX of GPS module is connected to 11th, 10th pin of NodeMCU respectively. The VCC of GPS module is connected to 5v and GND of GPS module is connected to GND of NodeMCU.

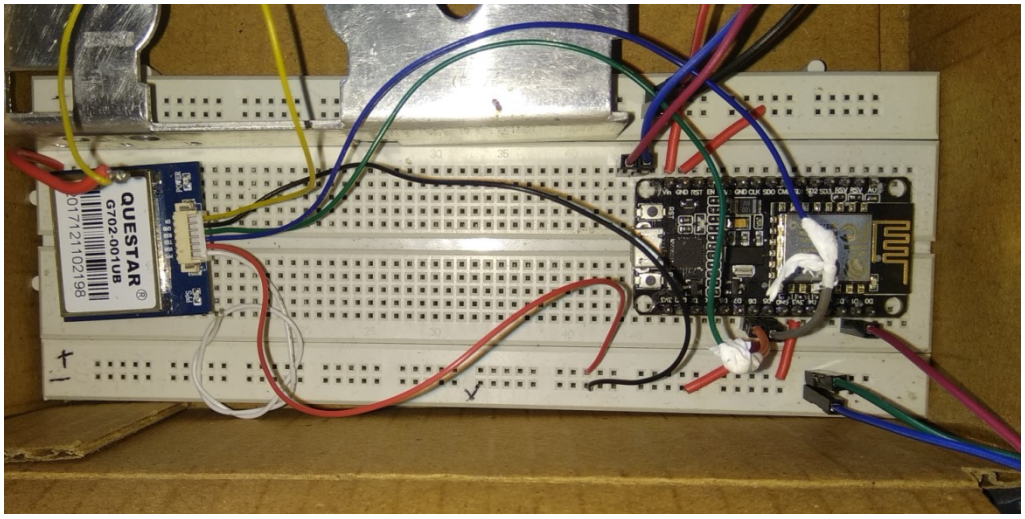


Fig: 5.3 GPS tracker and NodeMCU

Hardware implementation code for GPS Tracker

```
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
SoftwareSerial serial_connection(5,6);
 //TX of GPS to D5(RX) and RX of GPS to d6(TX)
TinyGPSPlus gps;
//This is the GPS object
void setup()
{
   Serial.begin(9600);
//This opens up communications to the Serial monitor
   serial_connection.begin(9600);
//This opens up communications to the GPS
   Serial.println("GPS Start");
//To indicate start of the program
}

void loop()
{
   while(serial_connection.available())
//While there are characters to come from the GPS
   {
      gps.encode(serial_connection.read());
//This feeds the serial NMEA data into the library
   }
   if(gps.location.isUpdated())
//This will fired only after a package comes in
   {
      //Get the latest info from the gps object which it derived by the GPS unit
      Serial.println("Satellite Count of the device:");
      Serial.println(gps.satellites.value());
      Serial.println("Latitude of the device:");
      Serial.println(gps.location.lat(), 6);
      Serial.println("Longitude of the device:");
      Serial.println(gps.location.lng(), 6);
```

```
        Serial.println("Speed of the device in MPH:");
        Serial.println(gps.speed.mph());
        Serial.println("Altitude Feet of the device:");
        Serial.println(gps.altitude.feet());
        Serial.println("");
    }
}
```

5.3.3 Vibration sensor and NodeMCU

The connection of vibration senor to NodeMCU is as follows: the VCC of vibration sensor is connected to 3.3v of the NodeMCU and GND of vibration sensor is connected to GND of NodeMCU. The digital output (DO) of vibration sensor is connected to D1 pin of NodeMCU.

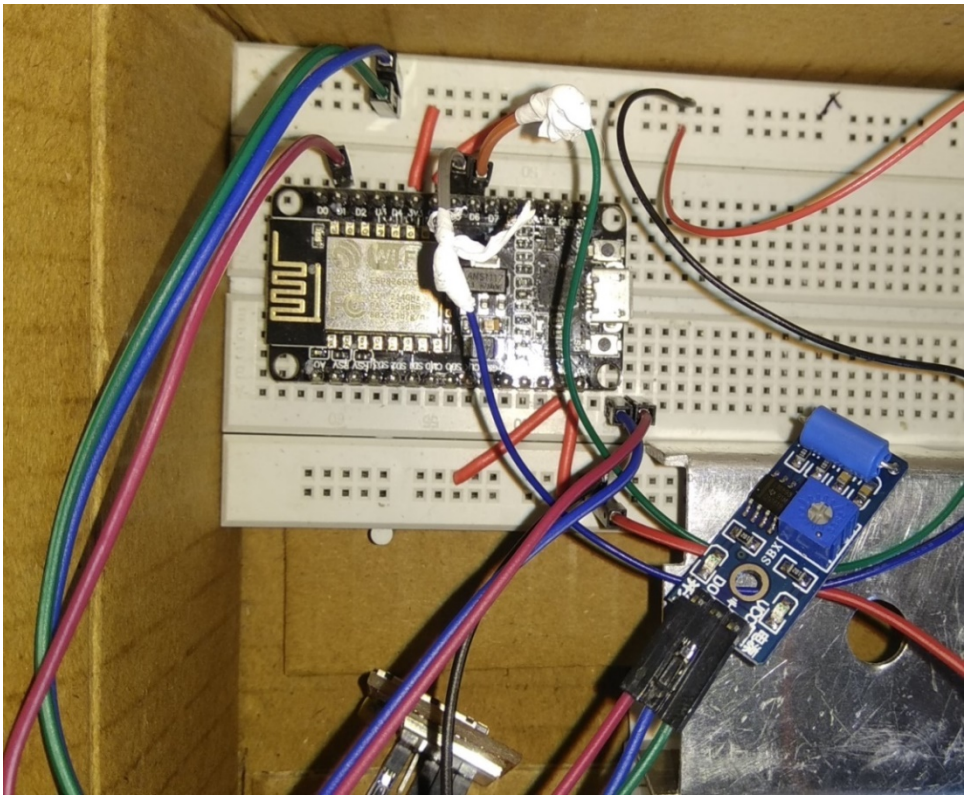


Fig 5.4 Vibration sensor and NodeMCU

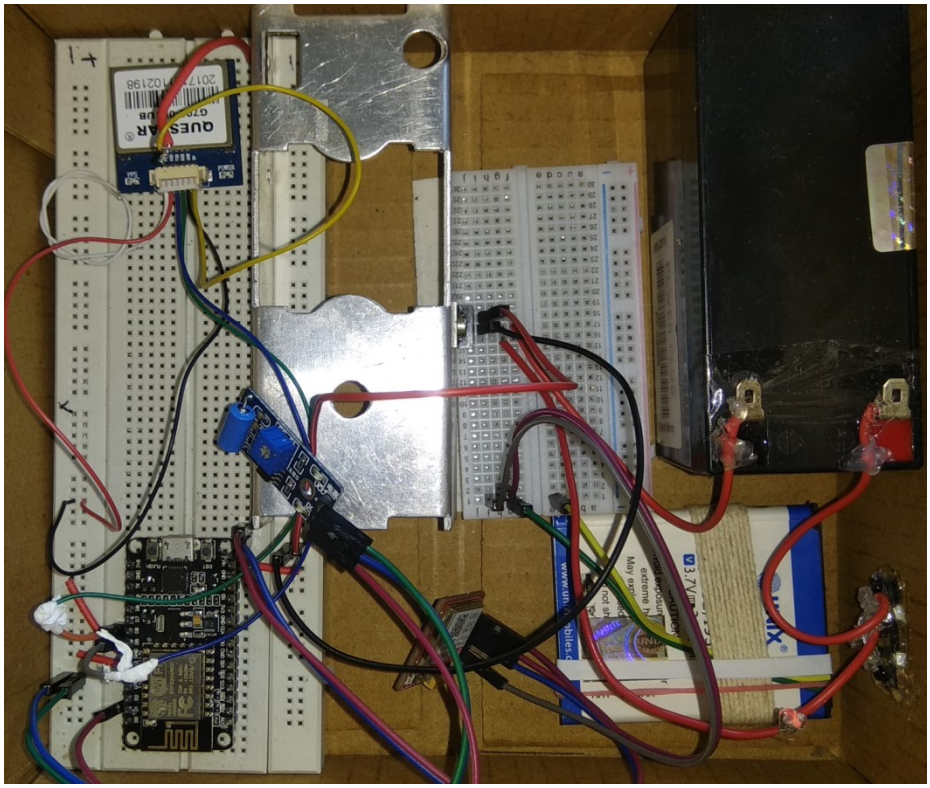
Hardware implementation code for Vibration sensor

```
int vib_pin=7;
void setup()
{
Serial.begin(9600);
```

```
pinMode(vib_pin,INPUT);
        /*vibration sensor gives input to NodeMCU when vibration/movement is detected*/
}

void loop()
{
if(digitalRead(vib_pin)==1)
Serial.println("MOVEMENT DETECTED");
}
```

5.4 Hardware Implementation code



5.5 Hardware setup

```
#define BLYNK_PRINT Serial      //For the purpose of debuging
#include <BlynkSimpleEsp8266.h>
#include <SoftwareSerial.h>
#include <TinyGPS++.h>              //library for GPS
#include <TinyGsmClient.h>          //library for GSM
```

```
#include <BlynkSimpleSIM800.h>    //library for GSM

SoftwareSerial serial_connection(D5, D6);    // RX, TX for gps
SoftwareSerial SerialAT(D2, D3);             // RX, TX for gsm
#define vib_pin 5
TinyGPSPlus gps;
WidgetMap myMap(V0);
TinyGsm modem(SerialAT);
char auth[] = "605e4e76571940839a7959bcd7291ad1";   //Blynk token
char apn[]  = "Tata.docomo.internet";                //APN of TATA DOCOMO
char user[] = "";
char pass[] = "";
bool moving = false;
bool sent=false;
BLYNK_WRITE(V4)     //To get location on users request
{
   int pinValue = param.asInt(); //Assigning incoming value from pin V4 to a variable
   if(pinValue==1)
   {
      Blynk.notify("Please wait while the location of your vehicle is updated!!");
      while (serial_connection.available())
      {
         gps.encode(serial_connection.read());
      }
      double gps_latitude = (gps.location.lat());
      double gps_longitude = (gps.location.lng());
      Blynk.virtualWrite(V2, String(gps_latitude));
      Blynk.virtualWrite(V3, String(gps_longitude));
      myMap.location(1, gps_latitude, gps_longitude, "GPS_Location");
      Blynk.virtualWrite(V4,LOW);
   }
}
BLYNK_WRITE(V5)     //To reset all the data to default
{
```

```
  int pinValue = param.asInt(); // assigning incoming value from pin V5 to a variable
  if(pinValue==1)
  {
    Blynk.notify("RESETTED");
    moving=false;
    Blynk.virtualWrite(V1, "STATIC");
    Blynk.virtualWrite(V5,LOW);
    sent=false;
  }
}

void setup()
{
  Serial.begin(9600);
  serial_connection.begin(9600);
  pinMode(vib_pin, INPUT);
  SerialAT.begin(115200);// Set GSM module baud rate
  Blynk.begin(auth, modem, apn, user, pass);
}

bool mov()  //To detect movement of the vehicle
{
  int Time = millis();
  while (millis() - Time < 2000) //runs for two seconds
  {
    if (digitalRead(vib_pin) == 1)
    return true;
    delay(20);
  }
  return false;
}

void loop()
{
```

```
Blynk.run();
if (!moving)
{
   Blynk.virtualWrite(V1, "STATIC");
   //first movement
   if (mov())
      {
      Blynk.virtualWrite(V1, "DISTURBED");
      delay(4000);
      //second movement(checked after 4 seconds of first movement)
      if (mov())
      {
         moving = true;
         Blynk.virtualWrite(V1, "MOVING");
         Blynk.notify("YOUR VEHICLE IS ON MOVE!!");
               //Notification to the user
      }
      else
      {
         Blynk.virtualWrite(V1, "STATIC");
      }
   }
}
else
{
   while (serial_connection.available())
   {
      gps.encode(serial_connection.read());
   }
   if (gps.location.isUpdated())
   {
      double gps_latitude = (gps.location.lat());
      double gps_longitude = (gps.location.lng());
      Blynk.virtualWrite(V2, String(gps_latitude));
```

```
        Blynk.virtualWrite(V3, String(gps_longitude));
        myMap.location(1, gps_latitude, gps_longitude, "GPS_Location");
        if(!sent)
        {
          sent=true;
          String msg="KINDLY CHECK YOUR APPLICATION TO KNOW THE
                      LOCATION OF YOUR VEHICLE \n Lattitude:" +
                      String(gps_latitude) + " \n Longitude" +
                      String(gps_longitude);
          Blynk.email("rskandhan@gmail.com", "YOUR VEHICLE IS ON MOVE",
                      msg);
          //Email to the user
        }
       delay(5000);
       // to save battery delay is given
     }
   }
}
```

Chapter 6

SYSTEM TESTING

Testing a system is the most significant role in the production. Without testing it's not possible to recognize whether the system will work upwards to the expectation or not. It's also practiced to find out whether all the prerequisites are satisfied or not. There are basically 4 parts is testing:

- Unit Testing
- Integration Testing
- System Testing
- Acceptance Testing

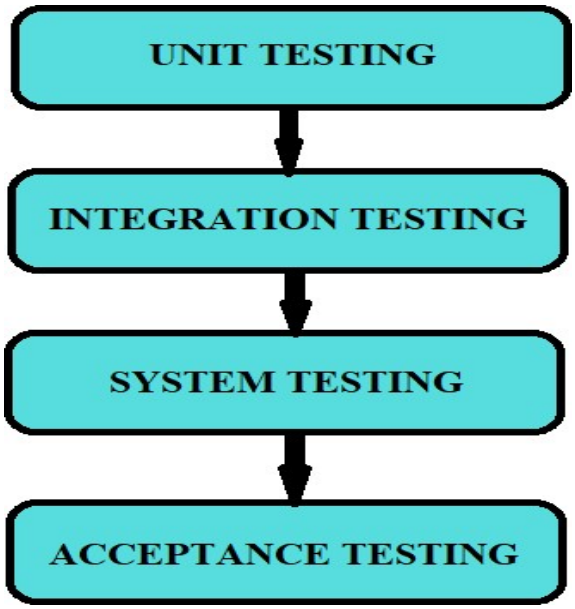


Fig: 6.1 Testing methods

6.1 UNIT TESTING

It is the first function of system testing. Unit testing is likewise the smallest section of testing. Unit testing basically checks or tests single/private components of a device. These components are given 1 or a few inputs and the ingredient is expected to yield a single production. Unit testing is applied so that one's confidence in a device can be increased by making certain that the parts work. If the codes of the elements are made independent then it's easier to find faults while performing integration testing as the examiner knows the code for the component is acting completely fine. This

likewise reduces the cost and time to find an erroneous belief in integration testing. This testing is done using “White Box Testing” method.

Testing Strategy

The strategies that are used to perform unit testing are:

- **Features to be tested**

The features that are to be tested are the individual components of a device and their operation

- **Items to be tested**

The items that are to be tested are the individual components that when integrated form the device

- **Purpose of testing**

The purpose of using unit testing is to check whether the components are working correctly as per the requirements of the device

- **Pass/Fail Criteria**

The pass/fail criteria depends on the basis of how the components perform when a particular code (required for the device) is given

6.2 INTEGRATION TESTING

Integration testing is the second function of system testing. This character of testing is where all the individual components tested in unit testing are integrated or brought together as a group and tested. Integration testing checks for whatever wrongdoings that occur after the ingredients are integrated.

Integration testing has 4 approaches

- Big Bang
- Top Down
- Bottom Up
- Sandwich/Hybrid

The big bang approach is a type where all the parts are integrated and examined. This approach is practiced when the tester receives all the factors together. The tester just mixes them and examines them for mistakes.

Top Down approach is where first the upper layer components are tested, and then the lower level parts are tested step by step. This type of attack is only employed when the development of the components is also served in top down attack.

Bottom Up approach is the precise antonym of the Top Down approach. In this type of approach the lowest level elements are tested first and then the upper layer are tested step by step. This attack is utilized alone when the development is done in Bottom Up approach.

Sandwich/Hybrid approach is a compounding of both Top Down approach and Bottom Up approach.

Integration testing can be done using BLACK BOX TESTING, GREY BOX TESTING or WHITE BOX TESTING methods. The type of testing depends on what type of testing the tester has made out in the Unit testing. Testing System is the tertiary section of testing. In this type of testing the solid device is examined after being mixed. The device is examined for errors and it also tests whether the device satisfies the necessities that are rendered. System testing is normally done using BLACK BOX TESTING method.

Testing Strategy

The strategies that are used to perform integration testing are:

- **Features to be tested**

The feature that is to be tested here is the integration of 2 or more individual components of a device and their operation

- **Items to be tested**

The items that are to be tested are the individual components that are to be integrated to form the device

- **Purpose of testing**

The purpose of using integration testing is to check whether the components that are integrated work as expected and also check the functionality that the integrated components offer

- **Pass/Fail Criteria**

The pass/fail criteria depends on the basis of how the components interact with each other and complete the tasks given to them

6.3 ACCEPTANCE TESTING

Acceptance testing is the concluding portion of testing. In this testing the device developed is checked whether it will exist and be accepted in the market or not. Once

this testing is done its result will tell whether the device developer is ready to be available to the end users or not. Acceptance Testing is done using BLACK BOX TESTING method.

Testing Strategy

The strategies that are used to perform unit testing are:

- **Features to be tested**

The feature that is to be tested is whether the device built for the end users is available for use

- **Items to be tested**

The item that is to be tested is the device developed

- **Purpose of testing**

The purpose of using acceptance testing is to check whether the device will be accepted in the real world and will it survive the market

- **Pass/Fail Criteria**

The pass/fail criteria depends on the basis of how the device performs according to the users (other than developers and testers) i.e. people who were not a part of development of the device

6.4 SYTEM TESTING

According to one of the IEEE paper, System testing can be described as the testing of both software and hardware system and to verify that the system meets the specific requirement. It may include tests based on risks and/or requirement specifications, business procedure, usage cases, or other high level descriptions of organization behavior, interactions with the operating systems, and system resources. System testing is almost often the final test to verify that the system to be delivered meets the specification and its use. It is the final test to verify that the product to be delivered meets the specifications mentioned in the requirement document. System testing is held out by specialist testers or independent examiners. System testing should investigate functional and non- functional requirements.

System Testing is the third part of testing. In this type of testing the whole device is tested after being integrated. The device is tested for errors and it also tests whether the device meets the requirements that are given. System testing is usually done using BLACK BOX TESTING method.

Testing Strategy

The strategies that are used to perform system testing are:

- **Features to be tested**

The feature that is to be tested is the working of the device and its operation

- **Items to be tested**

The item that is to be tested is the complete device that was developed

- **Purpose of testing**

The purpose of using system testing is to check whether the device works according to the requirements that were specified

- **Pass/Fail Criteria**

The pass/fail criterion depends on the basis of whether the device meets the requirements that it was developed for.

The below fig shows the testing of all 4 parts of testing which includes, Unit testing, Integration testing, System testing and Acceptance testing.

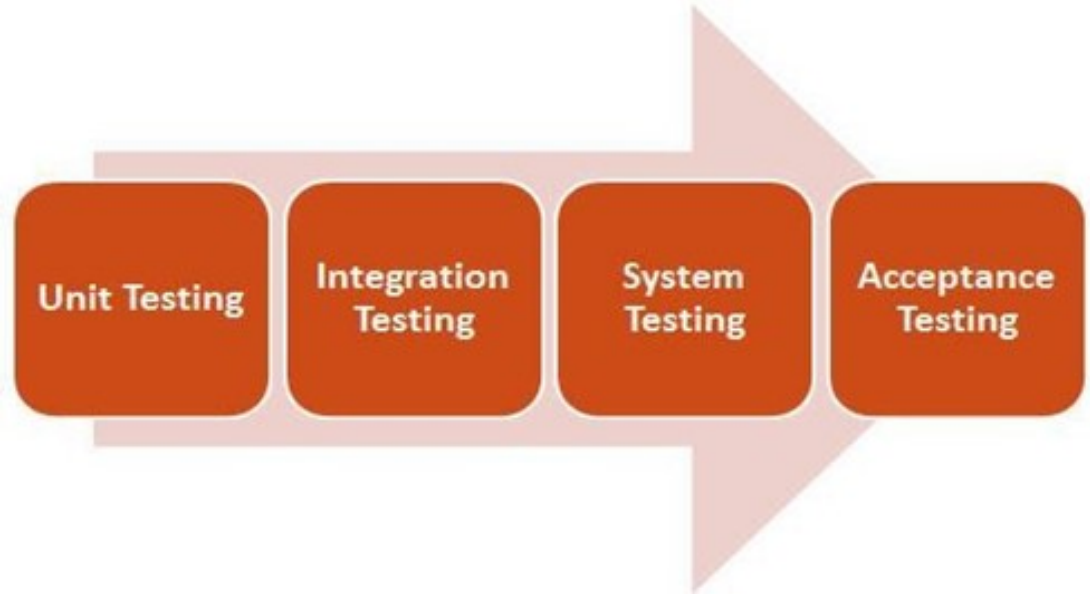


Fig: 6.2 Four parts of Testing

System testing mainly focuses on following properties:

1. External interfaces
2. Multiprogramming and complex functionalities
3. Security
4. Recovery

5. Performance
6. Operator and user's smooth interaction with system
7. Installability
8. Documentation
9. Usability
10. Load / Stress

If there is failure in working of any the components then it said to have some bug which can be rectified and corrected accordingly and successfully run the test cases. Each module is been tested with different testing methods like unit testing, integration testing, this helps in successfully execute the code without any bug or minimal bug in the code. Here are some of the test cases that are generated for successful completion of the project:

Sl # Test Case : -	1
Name of Test: -	Slight Movement of Vibration Sensor
Item being tested: -	Vibration Sensor
Sample Input: -	Vibration sensor is moved little bit
Expected output: -	NodeMCU is notified
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	2
Name of Test: -	Movement of Vibration sensor for long duration
Item being tested: -	Vibration Sensor
Sample Input: -	Vibration sensor is moved for more than 4 seconds
Expected output: -	NodeMCU, user are notified
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	3
Name of Test: -	Location testing
Item being tested: -	GPS
Sample Input: -	User request for GPS location from his device
Expected output: -	Location coordinates of the device is sent to the user
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	4
Name of Test: -	Power testing
Item being tested: -	IC7085
Sample Input: -	A 9V battery is connected instead of 12V
Expected output: -	The IC automatically regulates the voltage to 5V
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	5
Name of Test: -	AT testing of GSM Module
Item being tested: -	GSM Module
Sample Input: -	AT
Expected output: -	OK
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	6
Name of Test: -	AT testing of GSM Module
Item being tested: -	GSM Module
Sample Input: -	AT+CPIN
Expected output: -	+CPIN READY
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	7
Name of Test: -	AT testing of GSM Module
Item being tested: -	GSM Module
Sample Input: -	AT+CSTT=?
Expected output: -	+CSTT: “APN” , “USER”, “PWD”
Actual output: -	As expected
Remarks: -	Pass

Sl # Test Case : -	8
Name of Test: -	AT testing of GSM Module
Item being tested: -	GSM Module
Sample Input: -	AT+CSTT?
Expected output: -	+CSTT: “CMNET”, “”, “”
Actual output: -	As expected
Remarks: -	Pass

Chapter 7

SNAPSHOTS

7.1 Experimental Results

In this part the implementation seen from the last section can be discussed and displaying of the snapshots of the application can be observed. This provides the information regarding the each module that is discussed in the previous section is implemented and the expected results obtained. The implementation of the modules can be shown in the application with the help of screenshots and it also displays the interaction of each module after the implementation. As we know that the working model of the project cannot be displayed with the help of screenshots we can integrate all the modules and display the results of the entire model.

7.1.1 Splash Screen

This is the screen that appears when the application is opened. This is also called as load or boot screen or welcome screen. This is the introduction page for any application where we can see the project title and logo of the project. This screen often appears when the application is loading or booting occurs.

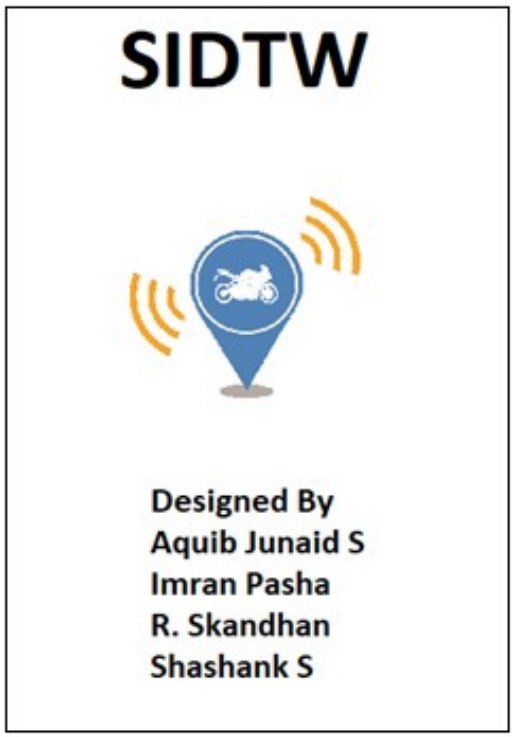


Fig: 7.1 Splash / Welcome Screen

7.1.2 Main Activity Screen (GPS)

- This screen displays the vehicle location once the vehicle is parked based on the request made by the user explicitly.
- It even displays the vehicle is in static position in parking, also if the vehicle is moving from parking.
- It provides the longitude and latitude coordinates as the location of the vehicle.
- In Main Activity screen , we have included 2 buttons which helps the user to reset the device using his/her smartphone itself through the Blynk Application and the button is for the GPS coordinates where the user can explicitly requests for the location of the vehicle.

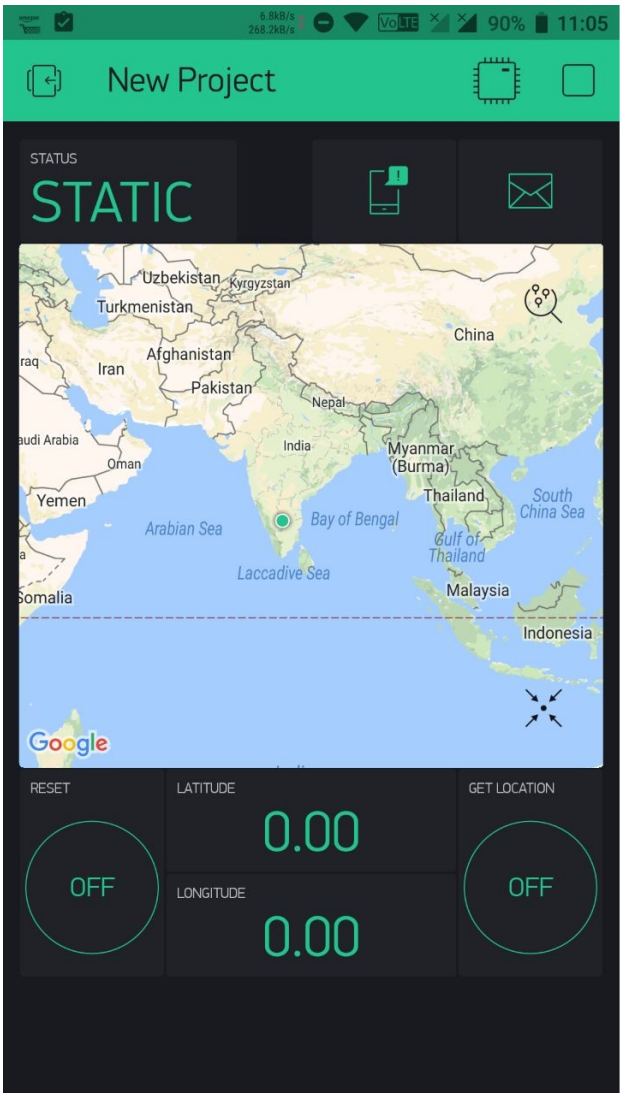


Fig 7.2 Main Activity screen

7.1.3 Smartphone Message Screen (GSM)

Smartphone screen displays various alerts like vehicle is disturbed, vehicle is moved, sends the GPS coordinates using the GSM Module. In case of disturbance in the vehicle which is carried for about 4 seconds and then if the vehicle is still moving then the vehicle is on “move” notification is obtained by the user. After which the GPS coordinates is sent to the registered GSM network via EMAIL (ELECTRONIC MAIL). This can be used to track the location of the vehicle on the maps from the mobile application. User gets an notification as the vehicle is on move as shown below.

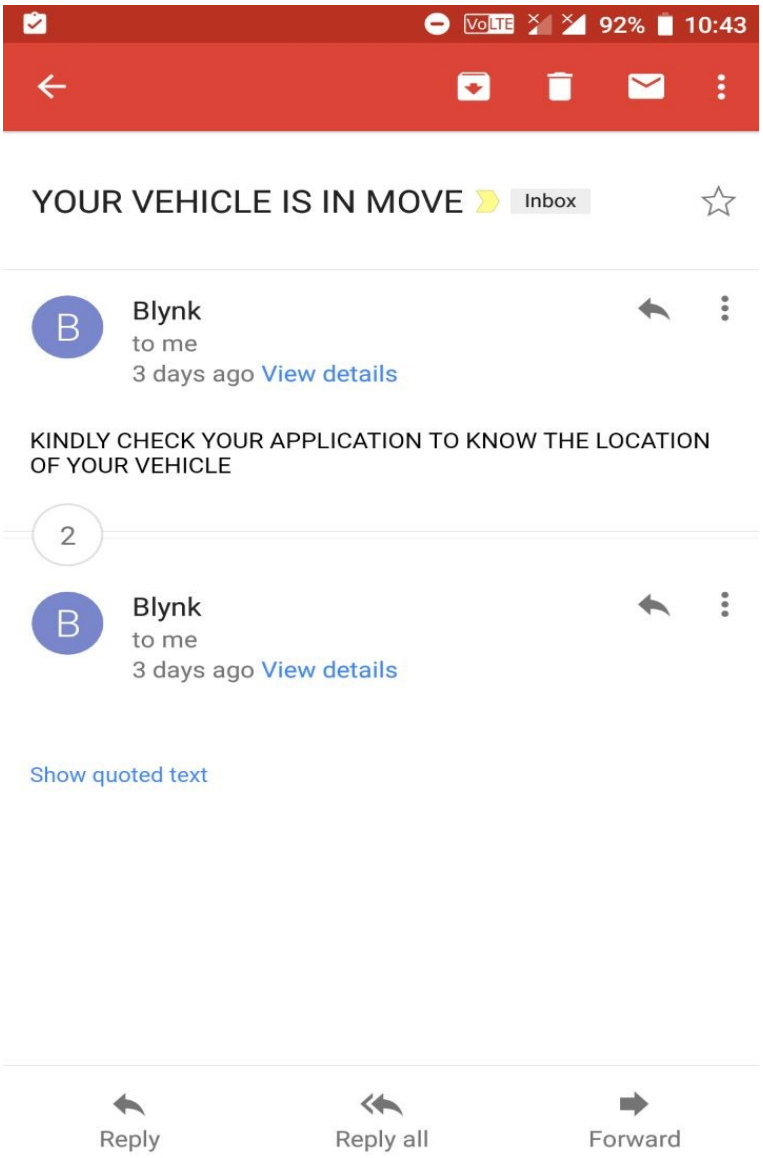


Fig: 7.3 Alert Message(Email)

7.1.4 Tracking the location

Tracking of vehicle takes place in 2 modes that are:

a) Active mode

b) Parking mode

In Active mode, the user is not connected to the device. This means, the device is turned OFF and the sensors like vibration sensor, GSM Module and GPS are OFF. This tells us the vehicle is in static position i.e., the vehicle is not moving as displayed below.

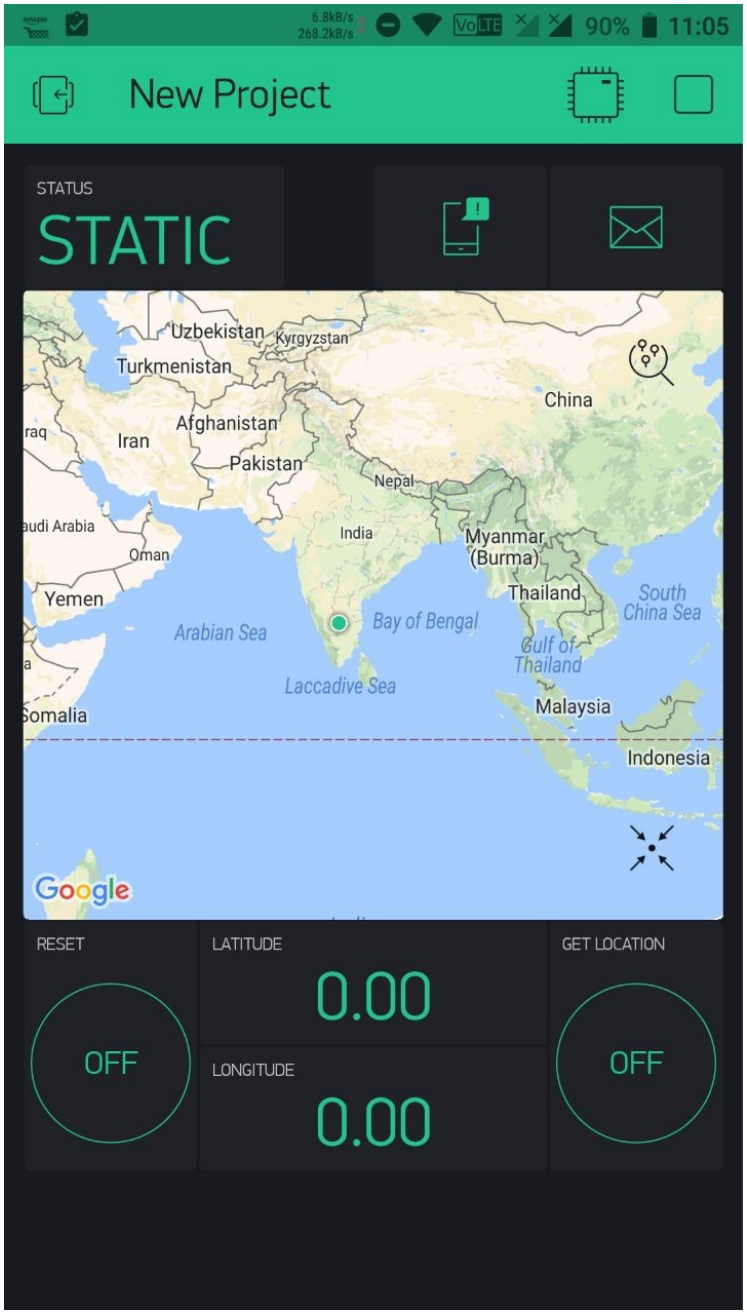


Fig: 7.4 Device is in Static position / Active Mode

Now let's consider that someone accidently touches the vehicle or watchman or some random person wants to move the vehicle. To keep up to that in our project we have introduced a delay for about 4 seconds which means for 4 seconds the device goes to "OFF" state. And after 4 seconds if the device detects any movement or disturbance it notifies the user. The delay of 4 seconds can be increased or decreased based on the standards. The disturbance in the vehicle is shown below with a snapshot.

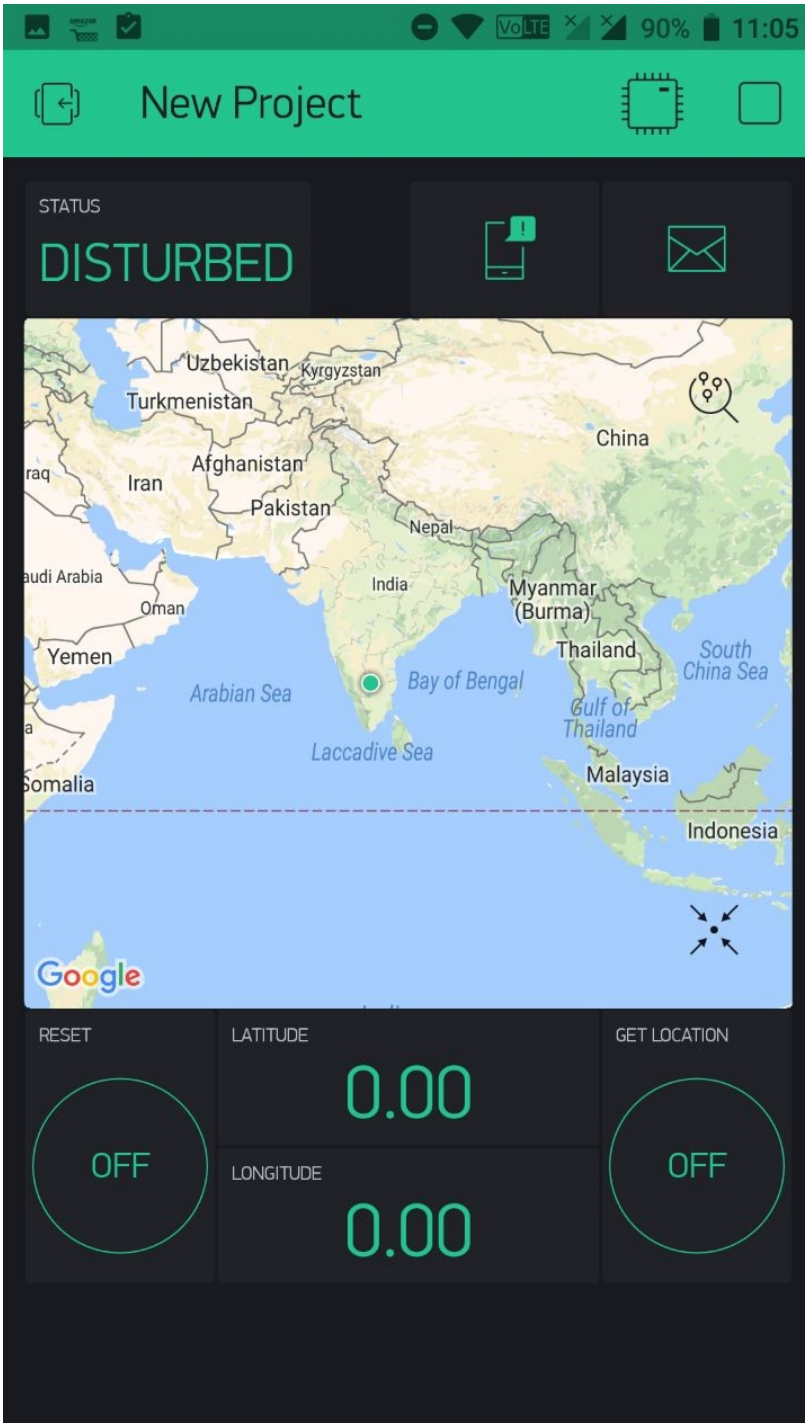
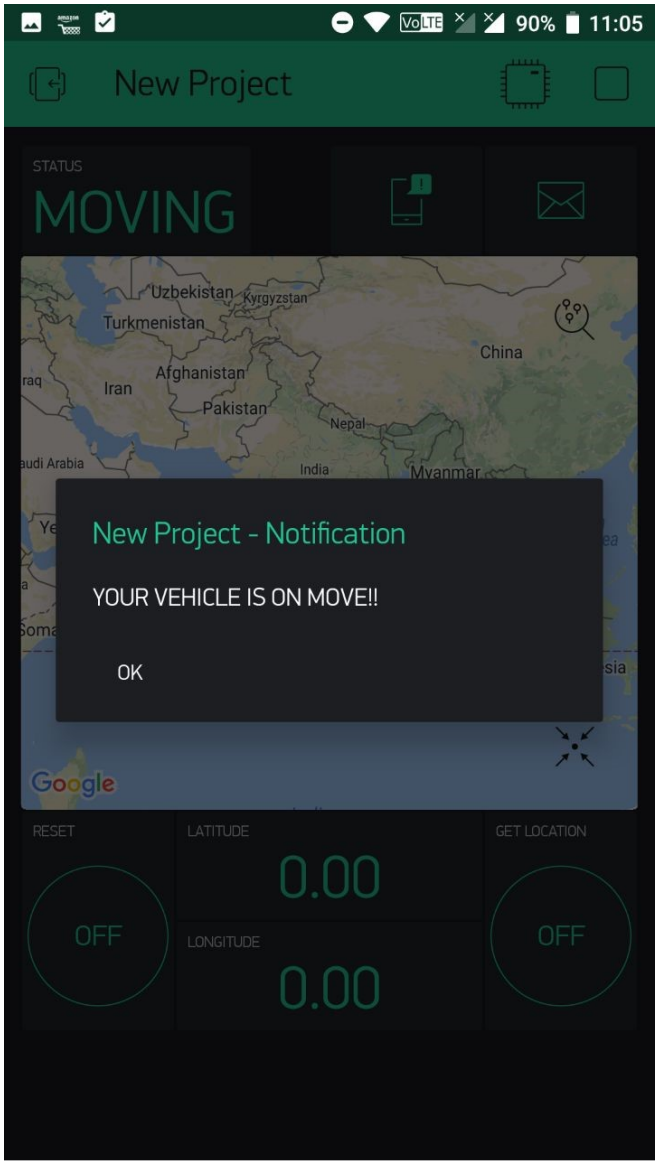


Fig: 7.5 Disturbed state

In parking mode, as soon as the user turn ON the switch, the device goes to parking mode and device is connected to cloud server through LPWA (low-power wide range network) and the user receives the Email as well as notification in the application from the GSM module if any displacement or disturbances or movement in vehicle is encountered. When the device is in parking mode, movement of the vehicle is sensed using vibration sensor and the owner is notified along with the GPS coordinates of the vehicle. The vehicle which is under move is shown below with a snapshot.



7.6 Device is in moving state

Chapter 8

FUTURE SCOPE

[1] We can use EEPROM to store the Previous Navigation position up to 256 locations.

[2] We can increase the accuracy up to 3m by increasing the cost of GPS receiver.

[3] With the help of high sensitivity sensors we can detect the accidents.

[4] As the technology advances the components can be molded on a single chip.

[5] We can reduce the size of the kit by combining GPS and GSM Module.

[6] By using the vibration sensor it is easy to detect if any accidents on the road occur and inform the near-by hospital and police.

[7] With the advancements in the software, Real-time data on specific location of any tracked vehicle or asset has proved invaluable to the shipping and aviation industries with the help of GPS devices.

[8] The same model can be implemented for four wheelers and six wheelers also.

[9] With some up gradations, it can be used in cabs for tracking the speed location of the vehicles.

[10] Camera and microphone can be added as enhancement.

CONCLUSION

After the implementation of the all the modules successfully the final device will be in a posture to make all of our objectives with which we started our project. This project has implemented our intentions that are: detecting if any displacement occurring in the vehicle, alerting user by sending an EMAIL (ELECTRONIC MAIL), tracking the vehicle based upon the request made by the user through means of and2roid application. To power up all the components in our project vehicle battery is used.

This project consists of anti-theft system that is useful in detecting the theft of the vehicle which is implemented based on GSM and GPS technology. With the dedicated smartphone-android application one can check for the location of the vehicle. Vibration sensor is fixed with the NodeMCU this helps in detecting any sudden impact or displacement in the vehicle. GSM, GPS and vibration sensor are interfaced on the NodeMCU board and GPS sends the data to the NodeMCU that is the location of the vehicle through GPS coordinates. GPS sends the latitude and longitude coordinates to the NodeMCU board. NodeMCU receives the data from the GPS. Then the GSM get the GPS value and notifies the user via EMAIL (ELECTRONIC MAIL). By such method, theft is prevented by the user itself. As vehicle tracking brings us safety and security this plays an important role in our day-to-day life. Main motto of this task is to comprise different types of sensing elements and devices so that they assist in decreasing the chances of vehicle theft.

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