

REAL TIME VEHICLE TRACKING USING CELLULAR HARDWARE AND THEFT DETECTION

Submitted in partial fulfillment of the requirements for the award of Masters of Engineering degree in
Embedded Systems and IoT.

by

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SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade "A" by NAAC
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of KEERTHANA MARIA LOURDES F (39108003) who carried out the project entitled REAL TIME VEHICLE TRACKING USING CELLULAR HARDWARE AND THEFT DETECTION under my / our supervision from December 2020 to April 2021

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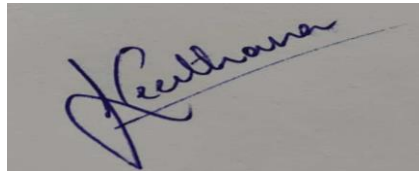
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DECLARATION

I KEERTHANA MARIA LOURDES F (39108003) hereby declare that the Project Report entitled **REAL TIME VEHICLE TRACKING USING CELLULAR HARDWARE AND THEFT DETECTION** done by me under the guidance of Dr. SUMATHI M is submitted in partial fulfillment of the requirements for the award of Masters of Engineering degree in Embedded Systems and IoT.

DATE: 17.4.2021

PLACE: CHENNAI

A photograph of a handwritten signature in blue ink on a light-colored surface. The signature is cursive and appears to read 'Keerthana'.

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

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ABSTRACT

The proposed system employs a compact Wireless Embedded Hardware (WEH). The WEH unit, fixed in vehicle is powered from the vehicle battery and communicates at set interval, to a remote server, through Cellular Mobile network. The Android App running on a mobile phone acquires the location information from the server, utilizes the Google map feature, and enables live location tracking.

The cellular board has an in-built Nano4FF SIM card which enables live tracking of the vehicle. The system also helps is theft detection and abortion of theft using a vibration sensor and stress gauge, along with alarm buzzer. Unauthorized access of the vehicle will be detected using the AND condition between vibration sensor and stress gauge. Theft notification and live tracking of the vehicle is viewed using Blynk application.

The proposed system uses GPS, GPRS, and a microcontroller to solve the problems of vehicle tracking and monitoring. The device is completely reliant and dependent on the internet connection quality. The accuracy of the vehicle's location is determined by the type of GPS module used. This device employs a GPS module with a location accuracy of 2.5 meters. It is proposed that an android application is superior to a web application because the former is faster and more accessible at all times. The web application, on the other hand, necessitates the use of a computer or laptop. The cost of the system's transition information is determined by the size of the HTTP requests received.

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CHAPTER 1

INTRODUCTION

1.1 EMBEDDED SYSTEMS

An embedded device is a collection of computer hardware and software that is designed to perform a specific task. Embedded systems can work as part of a larger system. The systems can be either programmable or fixed in operation. An embedded system could be used in industrial machinery, consumer electronics, agricultural and processing industry products, cars, medical equipment, cameras, digital watches, household appliances, aircraft, vending machines, and toys, as well as mobile devices.

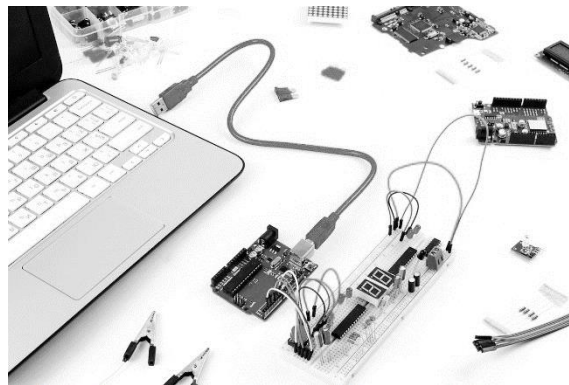


Fig 1.1 Embedded systems

Firmware is the term used to describe the software used in embedded systems. Rather than being stored on a disc, where several programs can be stored, an embedded system's single programs is typically stored on a chip and is known as firmware.

Embedded systems are special-purpose computer systems that offer specialized support and are embedded in application environments or other computing systems. The development and implementation of embedded computing systems in a wide variety of application environments has been helped by the declining cost of processing power, memory, and the ability to build low-cost systems on chip. Network adapters for computers and cell phones, control systems for air conditioning, industrial systems, and vehicles, and surveillance systems are only a few examples.

Infrastructure (core network) systems and end systems are two types of embedded systems for networking that are necessary for end-to-end service provision. All systems needed for the core network to run, such as switches, bridges, and routers,

fall into the first group, while systems visible to end users, such as cell phones and modems, fall into the second.

Because of the wide range of applications in which embedded systems are used, their significance is growing all the time. Embedded systems have long been used in a variety of important applications, including avionics and traffic control systems. Their widespread use emphasizes the significance of embedded systems, especially when considering the implications of their failure.

Embedded systems are made up of two main components:

Embedded system hardware: An embedded system, like any other electronic system, needs a hardware platform to operate on. A microprocessor or microcontroller would be used as the hardware. Memory, input output (I/O) interfaces, as well as the user interface and the monitor, will all be part of the embedded device hardware.

Embedded systems software: The embedded device software is designed to perform a specific task. It's usually written in a high-level language and then compiled into code that can be stored in the hardware's non-volatile memory.

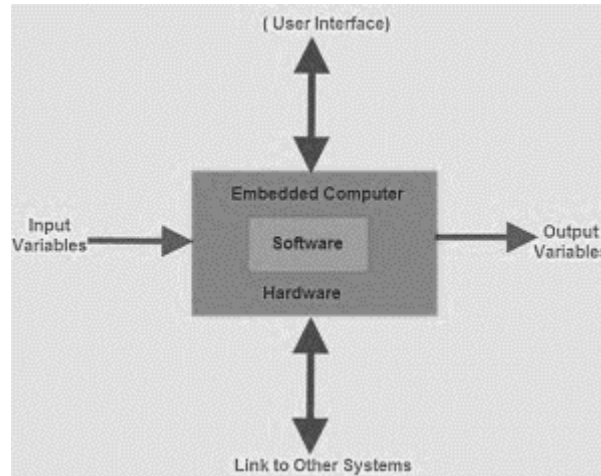


Fig 1.2 Embedded systems components

1.1.1. Embedded system hardware

When using an embedded device, you have the option of using a microcontroller or a processor.

Microcontroller based systems: A microcontroller is a central processing unit (CPU) or processor with integrated memory or peripheral devices. Embedded systems with

microcontrollers are more commonly used because they require less external components.

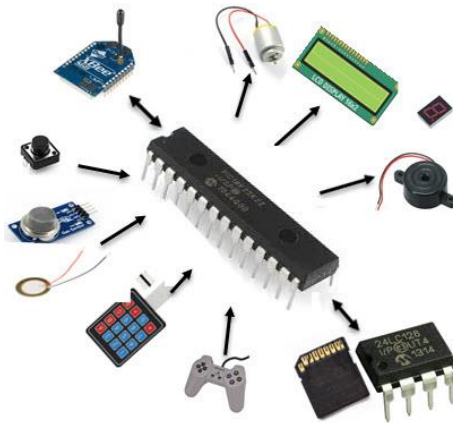


Fig 1.3 Microcontroller based systems

Microprocessor-based systems (microprocessor-based systems): Microprocessors have a CPU, but memory and peripheral interfaces are handled by external chips. This approach is typically used for larger embedded systems because it requires more devices on the board but allows for more expansion and customization of specific peripherals, etc.

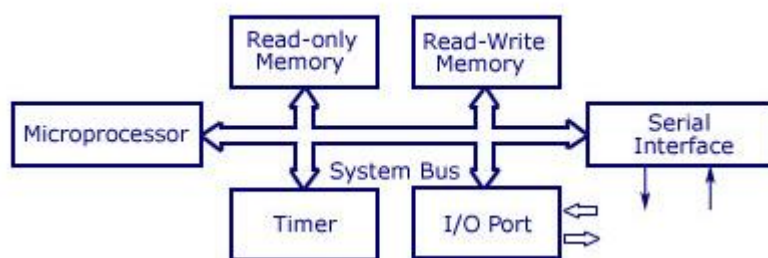


Fig 1.4 Microprocessor based systems

It may be a very general-purpose processor or one of the many highly specialized processors designed for a specific application, depending on the type of processor used in the embedded device. Custom-designed chips can be feasible for a specific application in certain cases if the amounts are large enough. The digital signal processor, or DSP, is a typical example of a standard class of dedicated processor. This form of processor is primarily used to process audio and image files. As they can be used in applications such as cell phones and the like, fast processing is needed.

1.1.2 Embedded systems software

The program that runs the microcontroller is one of the most critical aspects of any embedded device.

1.1.2.1 Device Driver

A system driver is a piece of embedded software designed to work with a specific piece of hardware. Device drivers allows the high level computer programs to interact with other hardware devices. They are the integral components of the operating system.

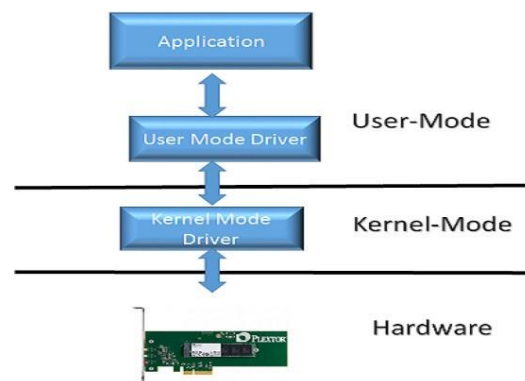


Fig 1.5 Device drivers

1.1.2.2 Operating System (OS)

RTOS (Real-time operating systems), handheld embedded, stand-alone, and network embedded systems are among the operating systems available for embedded systems.

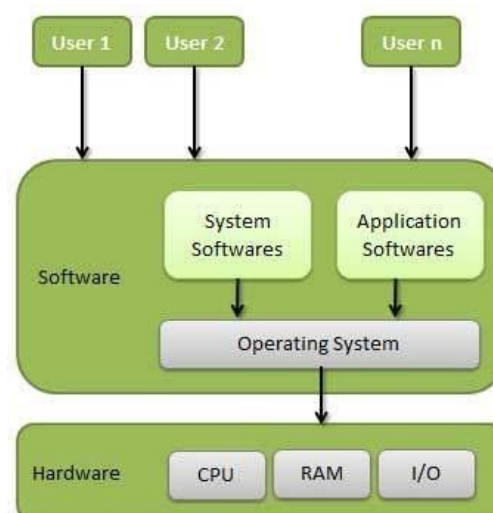


Fig 1.6 Operating system architecture

Machine code: The most basic code for the processor unit is called machine code. The code is usually written in hexadecimal and contains the basic instructions for each processor operation. These days, this type of code is rarely used in embedded systems.

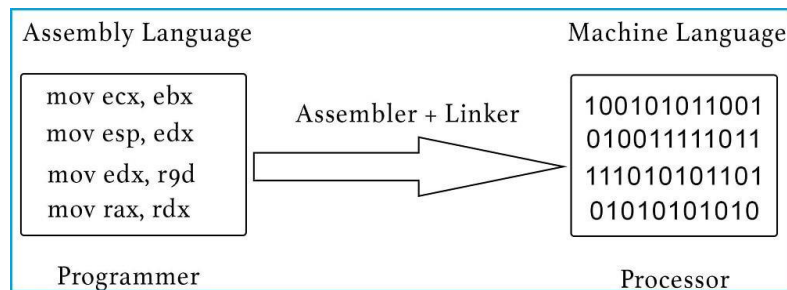


Fig 1.7 Machine code conversion

Programming language: It takes a long time and a lot of work to write computer code. It's difficult to comprehend and troubleshoot. High-level programming languages are widely used for solving this. C, C++, and other programming languages are widely used.

The embedded system's code would most likely be stored on a non-volatile memory chip on the processor board. The code is known as firmware, and the theory is that it is not modified like software because it is stored in the embedded device and cannot be changed by the user. It is always possible to upgrade the program, but doing so can necessitate changing the memory card on which the firmware is stored, or upgrading it in another manner.

1.2 PROCESSOR

A microprocessor designed specifically for the needs of an embedded device is known as an embedded processor. Since embedded systems use less power, these processors are small and draw less power from the power supply.

Ordinary microprocessors and microcontrollers are the two main types of embedded processors. Embedded processors are used in systems that do not need the computing power of traditional devices like desktop computers, laptop computers, or workstations.



Fig 1.8 Intel Core i3 processor

An embedded processor can be configured to do exactly what it's supposed to do. As a result, it can accommodate a wide variety of CPU architectures. In these processors, the Harvard architecture is often used. They frequently use RISC and non-RISC architectures. The 8–16-bit word length is the most popular in these processors. Clock speed, storage capacity, and voltages are all factors that distinguish embedded processors. Embedded processors typically have storage capacities ranging from 4 kB to 64 kB, although some devices need more. Microcontrollers are commonly thought to be more useful than microprocessors since they need fewer help circuitry.

1.3 WORKING OF EMBEDDED SYSTEMS

Embedded devices are often part of a larger unit, which is what the word "embedded" implies. They are small computers that are embedded in other mechanical or electrical systems at a low cost and with low power consumption. A processor, power supply, memory, and communication ports are all common components. Embedded systems use communication ports to send data via a communication protocol between the processor and peripheral devices, which are often other embedded systems. With the aid of minimal software stored in the memory, the processor interprets this data. The embedded system's software is normally very unique to the role it performs.

A microprocessor or a microcontroller may be used as the processor. Microcontrollers are simply microprocessors with integrated peripheral interfaces and memory. Instead of using memory and peripherals on the chip, microprocessors use separate integrated circuits. Both can be used, but microprocessors usually need more support circuitry than microcontrollers due to the fact that the microprocessor has less integrated circuitry. Multiple processors and interfaces are integrated on a single chip in a SoC. They're frequently employed in high-volume embedded systems.

1.4 EMBEDDED AND IOT INTERFACE

A device's embedded system gathers data from a sensor and sends it to the cloud via a Wi-Fi module — in other words, you can transform your embedded device into an IoT device by simply supplying it with Internet access. Embedded devices are usually part of a larger system and perform a particular task for that device. Embedded systems will also serve as the foundation for many Internet of Things (IoT) solutions, especially in some industry verticals and Industrial Internet of Things (IIoT) applications.

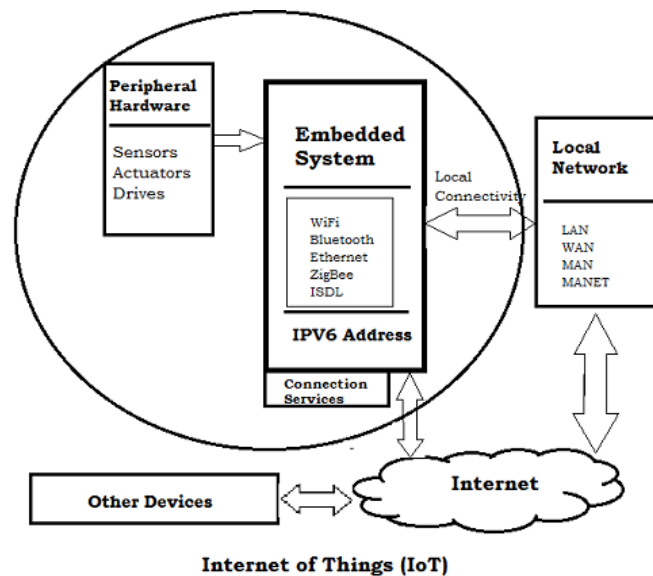


Fig 1.9 Interfacing of IoT

1.5 IOT

From an engineering standpoint, the Internet of Things refers to a network of embedded, microprocessor-controlled devices that are connected to the internet either directly or indirectly. As a result, the three foundations of IoT are:

1. Embedded programming
2. Network technology
3. Information technology

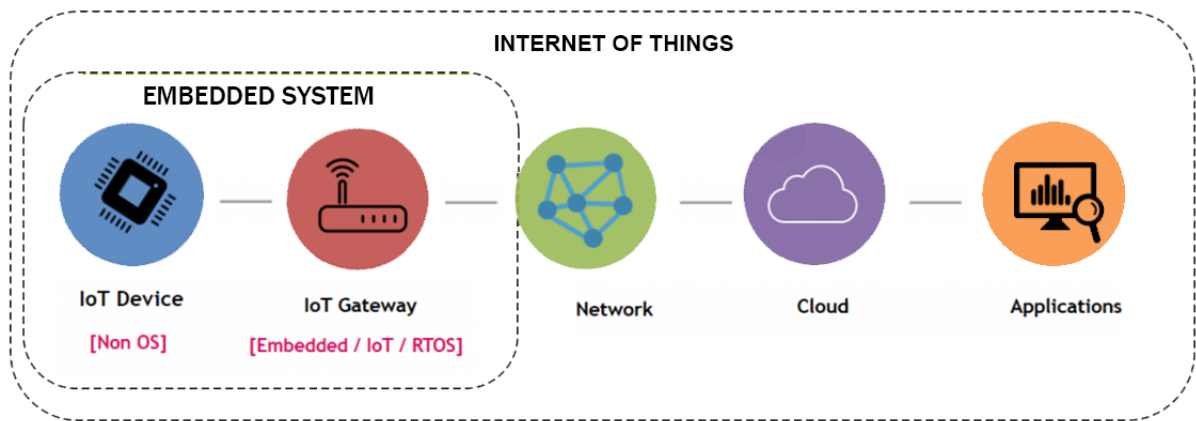


Fig 1.10 IoT

The internet of things, or IoT, is a network of interconnected computing devices, mechanical and digital machines, objects, animals, and people with unique identifiers (UIDs) and the ability to transmit data without needing human-to-human or human-to-computer interaction.

A human with a heart monitor implant, a farm animal with a biochip transponder, an automobile with built-in sensors to warn the driver when tyre pressure is low, or any other natural or man-made object that can be given an Internet Protocol (IP) address and can transmit data over a network are all examples of objects in the internet of things.

1.6 REAL TIME VEHICLE TRACKING

The vehicle tracking device is installed inside the vehicle and provides accurate real-time location information. The data can also be saved and transferred to a computer for later review. Real-time locating systems (RTLS), also known as real-time tracking systems, are used to detect and monitor the position of objects or people in real time, normally inside a building or other enclosed space.

It uses Global Positioning Systems (GPS satellites) to keep track of the location of the vehicle or equipment at all times. The data obtained from the vehicle is then stored on the computer inside the vehicle. The data is then sent over a wireless network, also known as a cellular network. Real-time monitoring is also beneficial from a security standpoint because it helps car owners to identify a vehicle's precise location at any given time. In addition, the vehicle's GPS monitoring device could be able to assist police in identifying where the vehicle was driven if it was stolen.

A passive GPS tracking device can monitor your position and save data on your journeys based on specific events. This type of GPS tracking device usually stores data in internal memory or on a memory card, which can then be transferred to a computer for review at a later time. Data can be submitted automatically for wireless download at predetermined points/times or requested at particular points along the journey in some cases.



Fig 1.11 Vehicle tracking with IoT

An active GPS tracking system is also known as a real-time system because it automatically sends data from the GPS system to a central tracking portal or system in real-time.

1.7 OVERVIEW

The vehicle tracking unit gathers data from the field and sends it to the operations center. The automated system for locating a vehicle using only an electronic device and computer software senses a vehicle's real-time location using the standard mobile phone network and the Internet. This framework combines internet technology, terrestrial networks, and GPS with the installation of an electronic device in a car. For locating the car, advanced vehicle tracking systems usually use GPS or GLONASS technology. Other types of automated vehicle position technology can also be used. The Internet, when combined with maps and apps, can provide us with useful vehicle knowledge.

The GPS data sent by the device is saved in the Vehicle Tracking application's secure database. SMS, which is based on GSM, serves as a backup in the event that data transmission fails. The GPS unit's data can be saved and downloaded to a computer. This information is then analyzed. When it comes to vehicle tracking systems, there are two types of requirements. The GPS position, as well as the speed and heading,

are stored in passive devices. Other functions or events, such as key on/off and door open/close, are also stored in these devices. Upon the vehicle's return to a predetermined location. We uninstall the unit and download the data to the computer when the vehicle is returned to a predetermined location. In passive systems, the download procedure is auto-defined, and data is transmitted wirelessly. Active devices capture the same data as passive devices, but they send it in real time to a computer or data center for analysis through cellular or satellite networks.

CHAPTER 2

LITERATURE SURVEY

2.1 GPS AND GSM

The proposed system [1] helps in solving the problems of tracking and monitoring of vehicles using GPS, GPRS and microcontroller. The system fully relies and depends on the quality of internet being used. The accuracy of the position of the vehicle depends on the type of GPS module that is used. In this system, GPS module of 2.5m position accuracy is being used. It is suggested that android application is greater than the web application since the former is faster and easily available anytime and anywhere. Whereas the web application requires a computer or laptop. The cost of transition information of the system depends on the data size of HTTP requests received. This system also calculates the number of HTTP requests transmitted and received per min by the embedded system.

A GPS-based vehicle tracking/navigation framework is implemented in the proposed model [6]. This is accomplished by using GPS and GSM to obtain vehicle information such as location, distance, and so on. The following features can be used to transform the data: The user specifies a time interval during which the vehicle's details, such as its location, is obtained. Then this location data is sent to a monitoring or tracking server on a regular basis. This data is shown on the display unit by using Google Earth to show the position of the vehicle in the electronic Google Maps.

The proposed system is beneficial for public transportation vehicles such as buses and taxis, as it provides a tele-monitoring and management system for taxi and bus transportation throughout the city. The device defined in this paper [8] consists of a "on-board module" installed in the vehicle to be monitored. The Global Positioning System, a GSM modem, and an ARM processor are all included in this on-board module. The GPS receiver in the vehicle terminal receives and resolves the navigation message transmitted by the GPS location satellite. This satellite calculates the longitudes and latitudes of vehicle coordinates, then converts them into a short message format with the help of a GSM communication controller, which is then sent to the monitoring center through the GSM network.

The paper [10] employs an RF transmitter, which is connected to a vehicle that has its own unique identification. The data that will be sent to the RF receiver connected to the microcontroller on a continuous basis. The GPS receiver will receive the vehicle's location and relay it to the microcontroller. If the RF transmitter does not receive the signal, the transmitting device sends a signal to the microcontroller, and we can deduce the theft from this signal. If the vehicle is determined to be stolen, the location of the vehicle is immediately sent to the owner of the vehicle via SMS via the GSM modem. This method is much less complicated and expensive than the others. If a password, such as an SMS, is submitted by the driver, the vehicle is immediately stopped.

2.2 FPGA AND GPS

In this paper [7] also the location of the vehicle is determined by using the Global Positioning System. With the assistance of GSM, the information from the GPS receiver is sent to the user in the form of SMS. Once the user's SMS has been received, a response form of message is sent to the vehicle's owner via the GSM modem. The accelerometer sensor is then used to detect any mishaps or incidents that occur with the car, as well as to cause some kind of warning in the event of any mishaps. In contrast to the microcontrollers used in many systems, this system employs an FPGA Spartan processor, which controls all of the system's components in accordance with the software.

2.3 DEEP NEURAL NETWORKS

Dynamic vehicle detection and tracking can provide essential data to solve the problem of road planning and traffic management. A method for real-time vehicle detection and tracking using deep neural networks is proposed in this paper [2] and a complete network architecture is presented. Using this model, the vehicle candidates, vehicle probabilities, and their coordinates are obtained in real-time. The proposed model is trained on the PASCAL VOC 2007 and 2012 image set and tested on ImageNet dataset. By design, the detection speed of the model is fast enough to process streaming video. This system includes 9 convolution layers, 4 inception modules, 1 SPP layer and 4 fully connected layers which help in providing accuracy in vehicle detection. It can be used in road routing, traffic control and road planning.

The limitations of this model is that it struggles with small objects and nearby objects in groups. For image recognition, a Deep Learning approach is used in this implementation. The remarkable ability of Convolutional Neural Networks (CNNs) is used to identify images in particular.

The task at hand, however, is to point to a vehicle's position rather than just detect its presence. CNNs, it turns out, are also ideal for these types of problems. Localization is the subject of a lecture in the CS231n Course, and the theory I used in my approach is based on the concept of a region proposal discussed in that lecture and implemented in architectures like Faster R-CNN.

The basic concept is that, since there is a binary classification problem (vehicle/non-vehicle), a model could be built with a limited training sample (e.g., 64x64) and a single-feature convolutional layer of 1x1 at the top, the output of which could be used as a classification probability value.

Following the training of this type of model, the input's width and height dimensions can be arbitrarily increased, converting the output layer's dimensions from 1x1 to a map with an aspect ratio that is roughly equal to that of a new wide input.

2.4 LIDAR BASED SYSTEMS AND TRACKING

Autonomous vehicles need a real-time traffic tracking system in order to interact with multiple moving vehicles in urban situations. Most existing works rely on camera sensors to interpret the surrounding environment. However, camera sensors degrade in conditions of lighting, shadows, and extreme weathers such that they can hardly detect objects. The light detection and ranging (LiDAR) sensors promise to be a good substitute, as they enable highly precise and robust localization across a wide range of conditions. This paper presents a new LiDAR-based online multiple maneuvering vehicle tracking problem and proposes a novel online multi-model smooth variable structure filter to address the problem. The proposed LIDAR system [3] has 2 main components which are the upper sub-model and the low sub-model. The real-time experiments show that this method is able to deliver superior performance compared to other conventional methods.

In this paper, the GPS model is used for real time tracking of the vehicle. This system prevents the hijack or theft of the vehicle even before the implementation. This acts

as the main advantage of this model. This system can monitor the desired vehicle as similar to CCTV usage. The prototype model [4] was tested on a remote control car and obtained the proposed results. This model is implemented using raspberryPi controller. The system has 2 phases: the 1st phase comprises of detection of the vehicle and the determination of location of the vehicle is done in phase 2. The notification is sent to the user via email which requires a login and password.

During vital information, this system uses the Global Positioning System (GPS), which receives the coordinates of latitude and longitude from the satellite. This device [9] can be used to control troops, as well as to track vehicle theft and a number of other applications. Microcontroller, Global Positioning System (GPS), and Global System for Mobile Communication are all used in this system (GSM). Only one GPS unit is used in this framework, and GSM allows for two-way communication. A SIM card is included with a GSM modem, which uses the same and consistent communication mechanism as a regular smart phone.

2.5 EXISTING SYSTEM

The proposed system uses GPS, GPRS, and a microcontroller to solve the problems of vehicle tracking and monitoring. The device is completely reliant and dependent on the internet connection quality. The accuracy of the vehicle's location is determined by the type of GPS module used. This device employs a GPS module with a location accuracy of 2.5 meters. It is proposed that an android application is superior to a web application because the former is faster and more accessible at all times. The web application, on the other hand, necessitates the use of a computer or laptop. The cost of the system's transition information is determined by the size of the HTTP requests received.

2.5.1 Block diagram

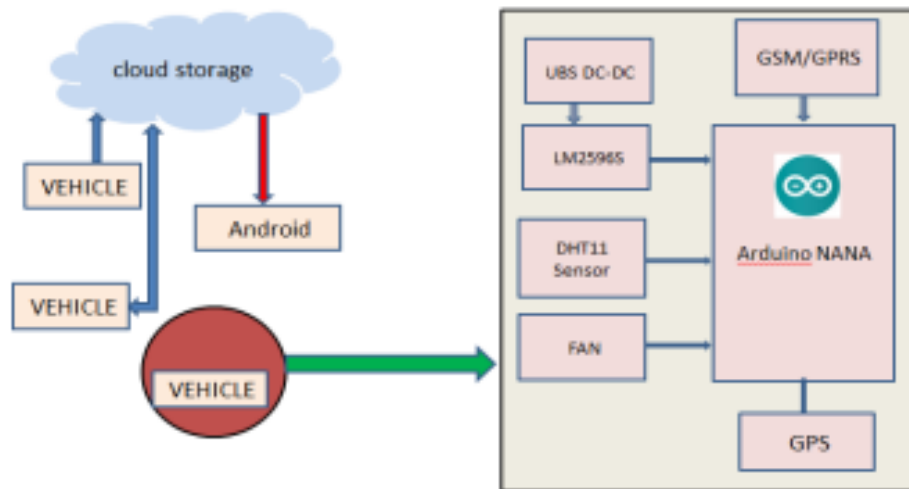


Fig 2.1 Existing Block diagram

2.5.2 Drawbacks of existing system

The longer the object is tracked, the higher the probability of a correct identification is by the HMM. Although HMM provides probability from the very beginning as a trace is detected, it will be uncertain if the time for displaying motion tendency is insufficient. This time depends on the vehicle speed and how wide the environment is. The distant background in the forward direction requires a long time to classify.

Different vehicles may have different lengths, leading to significant differences of the distances of switched reference points. Too long distance may cause the interruption of tracking. Moreover, the distance of switched reference points is not the actual moving distance, which will result in speed jumps. Some system struggles with small objects and nearby object in groups. However, existing researches on tracking based on the LiDAR sensor have not paid attention to reference point switch.

CHAPTER 3

3. PROPOSED SYSTEM

3.1 INTRODUCTION

Vehicle tracking systems are a well-established technology in this era, and fleet systems and vehicle owners all over the world use them. It is a technology that is incredibly secure and dependable. We plan to develop a device that uses the Global Positioning System [GPS] and cellular hardware to track and position any vehicle in our thesis. We'll be concentrating on using a particle electron module and GPS to track a vehicle. The concept is an embedded system that will continuously track and report on the status of a moving vehicle using the Blynk app on demand.

The cellular board is serially connected to a GPS receiver to accomplish this. The particle electron modem is used to continuously track and detect vehicle theft as well as submit the vehicle's location from a remote location. The GPS modem's navigation system, which relies on satellite technology, can continuously provide data such as longitude, latitude, direction, and distance travelled. If the vehicle is mishandled by an unauthorized user, the device sends an SMS message to the cell phone, indicating the vehicle's location in terms of latitude and longitude. We'll also use tools over the Internet to display the location of the vehicle on a digital map (Google map).

3.2 BLOCK DIAGRAM

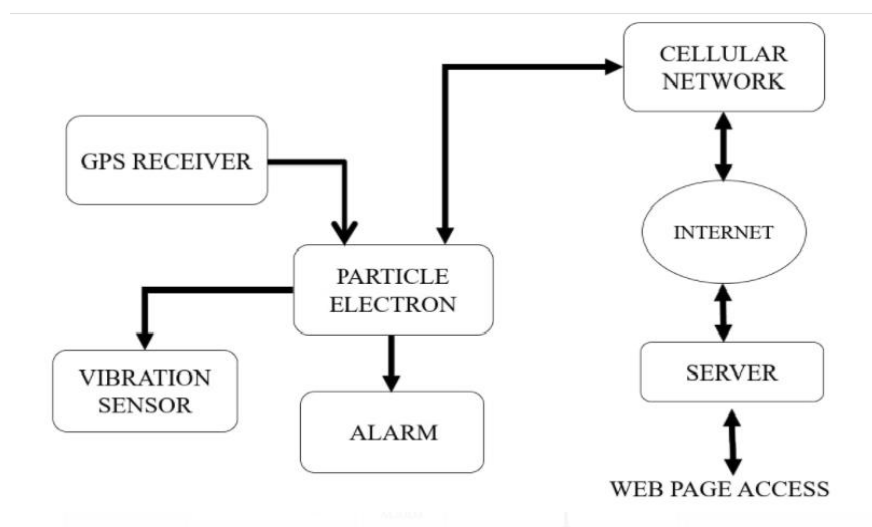


Fig 3.1 Block diagram

3.3 WORK FLOW

The cellular module is initialised to begin collecting geolocation data from the satellite; system configuration uses AT commands and requires the GPS and cellular module; to turn on the GPS, it must first be turned on and reset. The module will then be prepared to receive satellite coordinates. The Blynk app is then activated, which involves Blynk activation and service provider APN configuration. The device's initialization process will take up to one minute to warm up and determine the precise location.

In the event of a network outage, the acquired GPS coordinates and other data such as time and speed are temporarily stored until the network is restored. Once the network is restored, the stored coordinates are transmitted along with their time stamp and speed. A 2A peak current is needed by the cellular board. As a result, power is provided by an external power source, such as a 12V-2A battery. The GPS antenna and Blynk are both attached to the cellular module's port. The software, which was written in the C programming language, was uploaded into the cellular microcontroller. The Arduino IDE software is used to upload the application to the cellular.

3.4 HARDWARE COMPONENTS

3.4.1 GPS

The US Department of Defence established the Global Positioning System (GPS) as a worldwide navigation and positioning facility for both military and civilian use. The NEO-6MV2 is a navigational GPS (Global Positioning System) module. The module essentially determines its position on the globe and outputs the longitude and latitude of its position. It's part of a line of standalone GPS receivers that use the u-Blox 6 positioning engine for high performance. In a small box, these versatile and cost-effective receivers provide a variety of networking options. NEO-6 modules are ideal for battery-operated mobile devices with strict cost and space constraints due to their compact architecture, power, and memory options. Even in the most difficult conditions, the NEO-6MV2's revolutionary architecture provides excellent navigation efficiency.

GPS sends out specially coded satellite signals that a GPS receiver can decode and use to calculate position, velocity, and time.

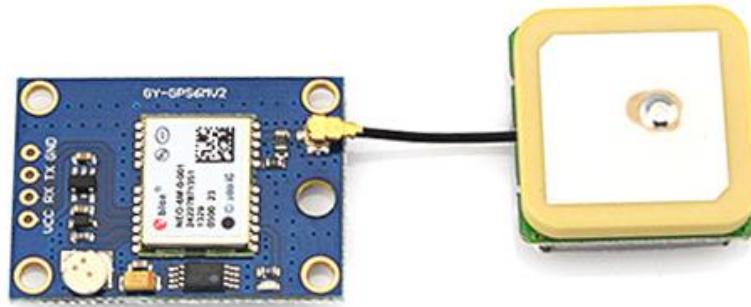


Fig 3.2 GPS and antenna

3.4.1.1 Working principle of GPS

The Global Positioning System is made up of 24 transmitting satellites orbiting the earth at a distance of 20,200 kilometres. The GPS system also includes ground-based receivers that listen to and interpret satellite transmissions.

The best way to understand the idea of ranging is to look at an illustration. Consider a satellite that is 25,000 kilometres away from someone using a GPS receiver. The person's location is then calculated to be somewhere on a sphere with a radius of 25,000 kilometres, centered on the satellite. The precise position of the individual on that sphere, however, is still unknown. If the distance between the person and a second satellite is discovered to be 20,000 km at the same time, a second sphere with a radius of 20,000 km can be calculated on which the person is located.

3.4.1.2 Longitude and Latitude

Angles that describe points on a sphere are known as latitude and longitude. The angles form a coordinate scheme that can be used to locate or mark spatial locations on planets like the earth's surface.

The equatorial reference plane is used to describe latitude. This plane includes the great circle that represents the equator, as well as moving through the sphere's centre C. The angle that a straight line passing through both P and C subtends with respect to the equatorial plane defines the latitude of a point P on the earth.

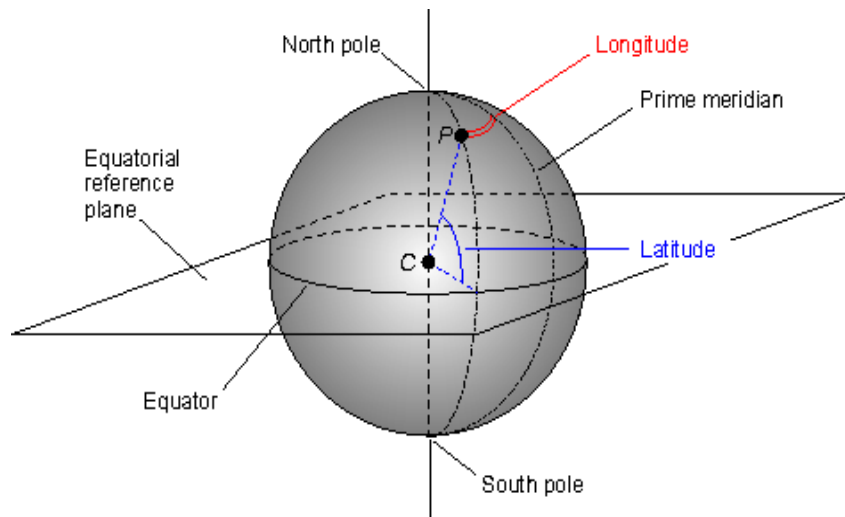


Fig 3.3 Longitude and latitude

3.4.1.3 GPS in three stages

- STAGE 1: The satellites act as reference points.

The nominal GPS Operational Constellation is made up of 24 satellites orbiting at a height of 20,100 km (12,500 mi) and with a duration of 12 hours. Every day, the satellite orbits follow a nearly identical ground track (as the earth rotates underneath them). Six orbital planes, each with four satellites, are evenly spaced (60 degrees apart) and inclined at around 55 degrees relative to the equatorial plane to ensure coverage of the Polar Regions.

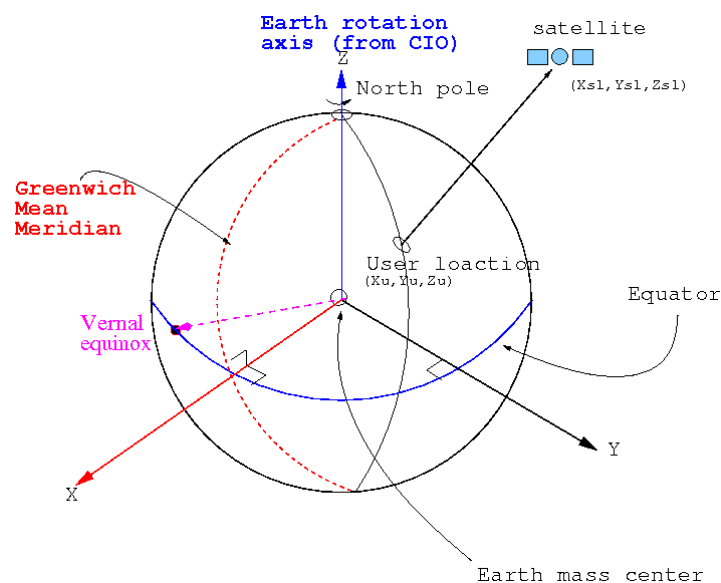


Fig 3.4 Satellite reference points

This constellation gives the user access to between five and eight satellites that can be seen from anywhere on the planet. The satellites, which are powered by solar cells, constantly adjust their orientation to point their solar panels toward the sun and their antennas toward the earth. There are four atomic clocks on each satellite.

- STAGE 2: The signal travel time gives distance information.

The atomic clocks carried by GPS satellites have extremely accurate time. The time information is included in the satellite's transmission codes so that a receiver can keep track of when the signal was broadcast.

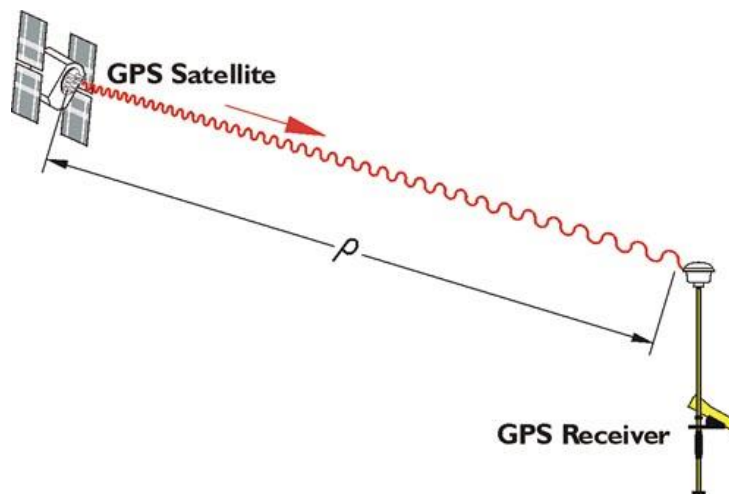


Fig 3.5 Distance calculation

The distance, or range, between the receiver and the satellite is measured using the time difference between signal reception and broadcast time. Propagation delays, or changes in signal speed induced by the environment, must be taken into account by the receiver. The receiver multiplies the transit time by the speed of light to measure the distance between itself and any given satellite. This is a central principle in GPS.

- STAGE 3: Three distances gives the position.

After completing stages 1 and 2, we now have distance information for a range of satellites whose positions we know with great precision. The receiver triangulates an exact location using this information. To determine latitude and longitude, three satellites are needed, while altitude requires a fourth satellite. To calculate ranges from these three signals, an atomic clock synchronised to GPS is needed. Assume that the receiver estimates that it is 20,000 kilometres away from a specific satellite.

A third measurement attaches another sphere to the circle created by the first two, intersecting it. Since this intersection occurs at two locations, the GPS receiver has narrowed down its position to just two points in the entire universe using these three dimensions.

Table 3.1 Pin configuration of GPS

Pin Name	Description
VCC	Positive power pin
RX	UART receive pin
TX	UART transmit pin
GND	Ground

3.4.2 Vibration sensor

Vibration sensors can be used in a variety of projects, computers, and applications. A vibration sensor is a system that can be used to determine the speed of a vehicle or the magnitude of an imminent earthquake. By changing to an electrical charge, this sensor uses piezoelectric effects to measure changes in acceleration, friction, temperature, force, and strain. Some are self-contained, whereas others need their own power source.



Fig 3.6 Vibration sensor

Temperature extremes, magnetic fields, vibration range, frequency range, electromagnetic compatibility (EMC) and electrostatic discharge (ESD) conditions, as well as the requisite signal quality, necessitate the use of a wide range of sensors.

3.4.2.1 Working Principle:

It operates on the electromechanical principle. Vibration velocity sensors operate on the electrodynamics principle and are used to calculate absolute bearing vibration using the piezoelectric effect. Change in resistance as a result of force acting on it and convert to 4 - 20 mA. We have a piezoelectric sensor that measures the vibration produced on the surface. They are measuring variations in oscillation, so they probably want a -12 and +12 swing with 0 as the base lineal. Shock sensors may also be used to track vibrations.

The working theory of a vibration sensor is that it is a sensor that senses device vibrations using different optical or mechanical principles.

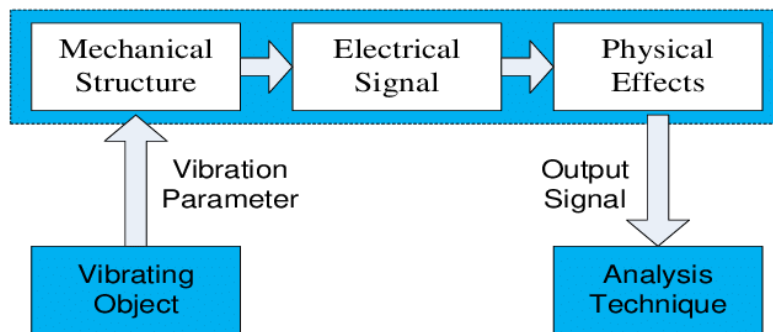


Fig 3.7 Working flow of vibration sensor

These sensors' sensitivity usually ranges from 10 mV/g to 100 mV/g, but lower and higher sensitivities are also available. The sensor's sensitivity can be adjusted depending on the application. As a result, knowing the levels of vibration amplitude range to which the sensor will be exposed during measurements is important.

3.4.2.2 Measurement of Vibration:

The vibration sensor module SW-420 uses the vibration sensor SW-420 and the comparator LM393 to detect any vibrations that exceed the threshold. An onboard potentiometer can be used to adjust the threshold. When there is no vibration, this module's output logic is LOW, indicating that the LED light is turned off, and vice versa.

The vibration switch was in the closed state, the output was powered low, and the indicator light was on if the module did not vibrate. The product vibrates, causing a momentary disconnect, causing the output to be pushed high and the light to be turned off.

The output can be connected to a microcontroller that can detect high and low levels of vibration in the region.

Table 3.2 Pin configuration of vibration sensor

Pin Name	Description
VCC	The VCC pin powers the module, typically with +5V
GND	Power Supply Ground
DO	Digital Out Pin for Digital Output.

3.4.3 Strain Gauge:

A strain gauge (also known as a strain gauge) is a sensor whose resistance varies with applied stress; it transforms force, pressure, friction, weight, and other variables into an electrical resistance change that can be measured. Stress and strain are created when external forces are applied to a stationary object. The internal resisting forces of an object are known as stress, and the displacement and deformation that occurs are defined as strain.

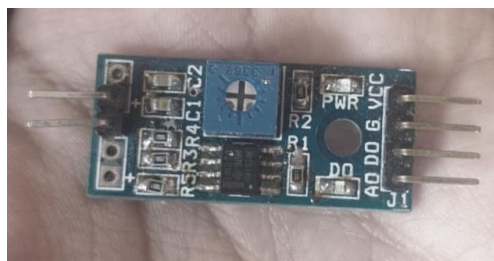


Fig 3.8 Stress gauge sensor

The strain gauge is one of the most important sensors used in electrical measurement techniques for mechanical measurements. Strain gauges, as their name suggests, are used to measure strain. Tensile and compressive strains are characterized by a positive or negative sign in the technical term "strain." As a result, strain gauges can detect both expansion and contraction.

An external force or an internal impact is often the source of a body's pressure. Strain may be caused by stresses, pressures, moments, heat, material structural changes, and other factors. The volume or value of the influencing quantity may be calculated from the measured strain value if certain conditions are met. This function is commonly

used in experimental stress analysis. The strain values measured on the surface of a specimen, or structural component, are used in experimental stress analysis to state the stress in the material and to predict its protection and durability. Forces or other derived quantities, such as moments, stresses, accelerations, displacements, vibrations, and others, may be measured using special transducers. A pressure sensitive diaphragm with strain gauges is typically used in a transducer.

3.4.4 Particle Electron

The Electron is a small development kit that helps you to make cellular-connected electronics projects and products. It comes with a Nano 4FF SIM card and a low-cost data plan for low-bandwidth activities.

3.4.4.1 Features:

- U-blox SARA-U260/U270 (3G with 2G fallback), G350 (2G), or R410M (LTE Cat M1) cellular module
- STM32F205RGT6 120MHz ARM Cortex M3 microcontroller
- 1MB flash, 128KB RAM
- BQ24195 power management unit and battery charger
- MAX17043 fuel gauge
- RGB status LED
- 30 mixed-signal GPIO and advanced peripherals
- Open-source design
- Real-time operation system (RTOS)
- FCC, CE and IC certified

3.4.4.2 Block diagram

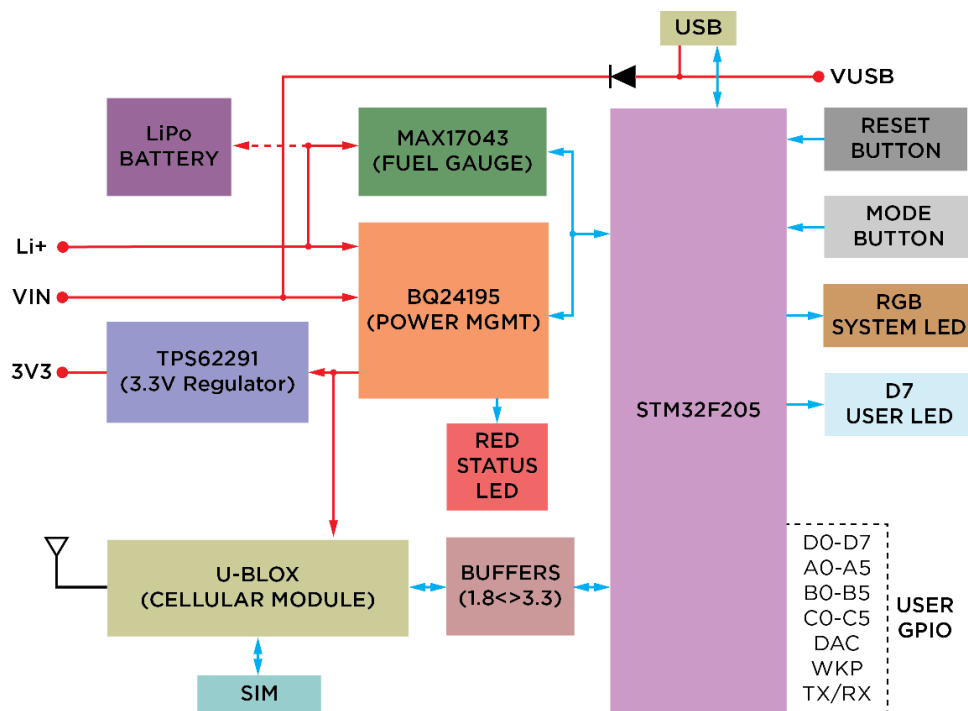


Fig 3.9 Block diagram

3.4.4.3 Pin diagram:

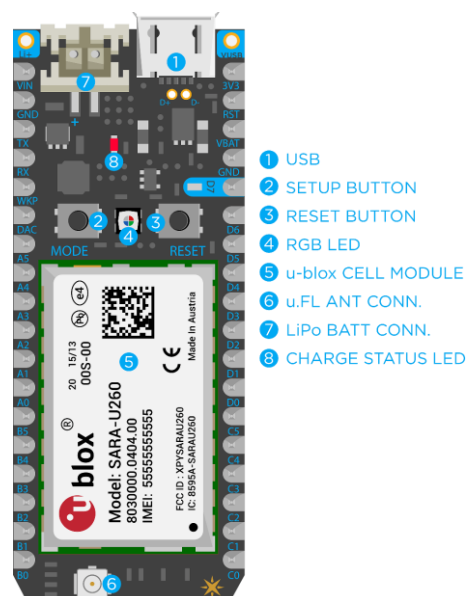


Fig 3.10 Pin representation

The minimum input voltage is software determined, with a range of 3.88V to 5.08V in 80mV increments that can be selected by the user. The minimum input voltage is set to 4.36V out of the box in order for the LiPo battery to charge properly.

3.4.5 Alarm

A buzzer is a small but effective component that can be used to add sound to our project or system. Its small and compact 2-pin configuration allows it to be used on a breadboard, a Perf Board, or even a PCB, making it a popular component in most electronic applications.

There are two forms of buzzers available on the market. The one shown here is a simple buzzer that, when driven, produces a continuous beep. It produces sound due to an internal oscillating circuit. However, the one shown here is the most common because it can be easily customized with the aid of other circuits to suit our application.

This buzzer can be used by simply connecting it to a DC power supply between 4 and 9 volts. A simple 9V battery can also be used, but a controlled +5V or +6V DC supply is preferred. The buzzer is usually connected to a switching circuit that turns it on and off at predetermined times and intervals.

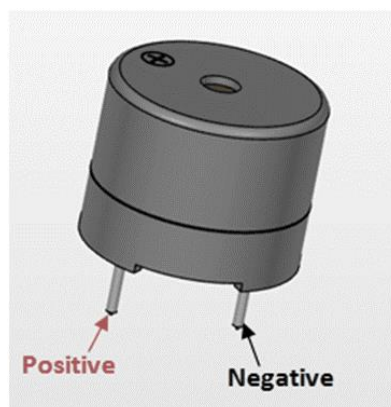


Fig 3.11 Buzzer

A buzzer receives an input and responds by emitting a signal. They can make the sound with a number of tools, including metal clappers and electromechanical devices. A buzzer must be able to take in energy and transform it to acoustic energy in some way. Many buzzers are part of a larger circuit and are powered by the device's power source. In certain situations, however, the buzzer is battery-operated and will sound if there is a power outage.

3.4.5.1 Buzzer Features and Specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

3.4.5.2 Buzzer circuit

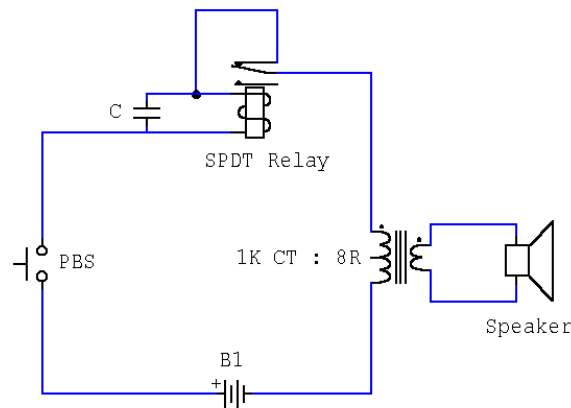


Fig 3.12 Buzzer circuit

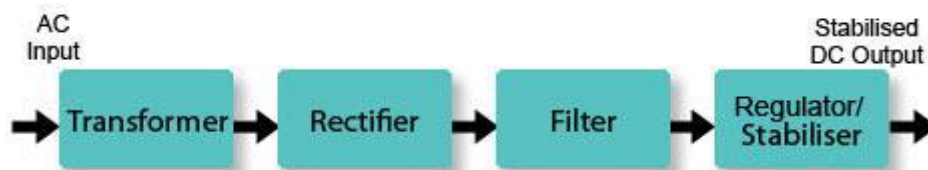
A relay is connected in series with a small audio transformer and speaker in this novel buzzer circuit. The relay will work through the transformer primary and closed relay contact when the switch is pressed. The usually closed contact opens as soon as the relay works, withdrawing power from the relay; the contacts close, and the process repeats; all of this happens so rapidly that the pulse of current triggers fluctuations in the transformer main, and therefore secondary.

Table 3.3 Pin configuration of buzzer

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

3.4.6 Power board

A source of electrical power is referred to as a power supply. A power supply unit, or PSU, is a device or system that provides electrical or other forms of energy to an output load or group of loads. The term is most widely used to describe electrical energy sources, with mechanical energy sources being used less frequently and others being used only occasionally.

**Fig 3.13 Power board****Table 3.4 Power board specifications**

Pin Name	Description
LEFT Jumper	5V, OFF (0V), 3.3V Selection
RIGHT Jumper	5V, OFF (0V), 3.3V Selection
4-Berg Header	GND
2-Berg Header	3.3V
2-Berg Header	5V

3.4.7 Connectors



Fig 3.14 Jumper wires

Male-to-male, male-to-female, and female-to-female jumper wires are the most common. The gap between them is in the wire's end point. Male ends have a protruding pin and can be plugged into things, while female ends do not have a protruding pin and are used to plug into things. Male-to-male jumper wires are the most popular and the ones you'll most likely need.

3.5 SOFTWARE REQUIREMENTS

3.5.1 Arduino IDE

The Arduino Software (IDE) includes a text editor for writing code, a message field, a text console, a toolbar with buttons for common functions, and a set of menus. It interacts with the Arduino and Genuino hardware by connecting to them and uploading programs.

Sketches are programs created with the Arduino Software (IDE). These sketches were made in a text editor and saved with the .ino file extension. Cutting/pasting, as well as searching/replacing text, are all possible in the editor. The message area shows errors and provides input when saving and exporting. The Arduino Program (IDE) outputs text to the console, which includes complete error messages and other information. The designed board and serial port are shown in the window's bottom right-hand corner. You can verify and upload programs, make, open, and save sketches, and open the serial monitor using the toolbar buttons.

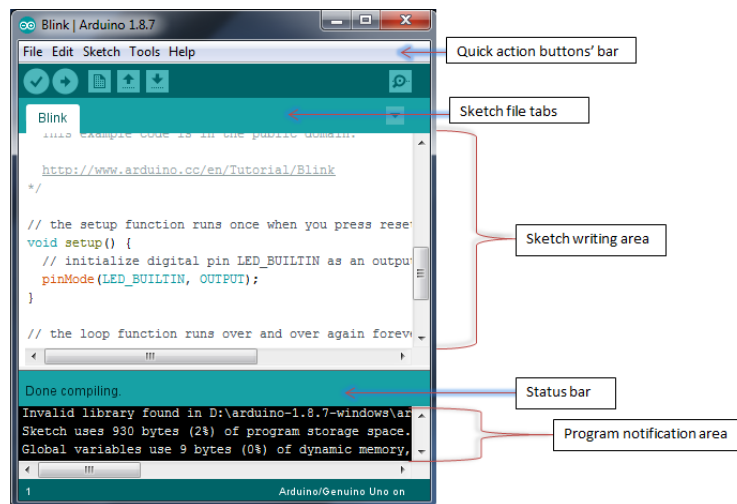


Fig 3.15 Arduino IDE

3.5.1.1 Upload Process

You must pick the correct items from the Tools > Board and Tools > Port menus before uploading your sketch. On Windows, it's either COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - search for USB serial device in the Windows Device Manager's ports section to find out. Click the upload button in the toolbar or pick the Upload item from the Sketch menu once you've selected the right serial port and board. Current Arduino boards will automatically reset and start uploading. You'll need to click the reset button on the board just before beginning the upload on older boards that don't have auto-reset. When the sketch is posted, the RX and TX LEDs on most boards can blink. When the upload is complete, the Arduino Software (IDE) will show a message or an error.

When you upload a sketch, you're will use Arduino bootloader, which is a tiny program loaded onto your board's microcontroller. It enables you to upload code without the need for any extra hardware. When the board resets, the bootloader is active for a few seconds before starting whatever sketch was most recently uploaded to the microcontroller.

3.5.2 Blynk

Blynk is a new framework that lets you easily construct interfaces to manage and track your hardware projects from your iOS or Android device. You can build a project dashboard after installing the Blynk app and arranging buttons, sliders, graphs, and other widgets on the computer. You can use the widgets to switch pins on and off, as

well as display data from sensors. Blynk currently supports the majority of Arduino boards, Raspberry Pi models, the ESP8266, Particle Core, and a few other common microcontrollers and single-board computers, with more to come in the future. While you can access devices plugged into a computer's USB port, Arduino Wi-Fi and Ethernet shields are supported.

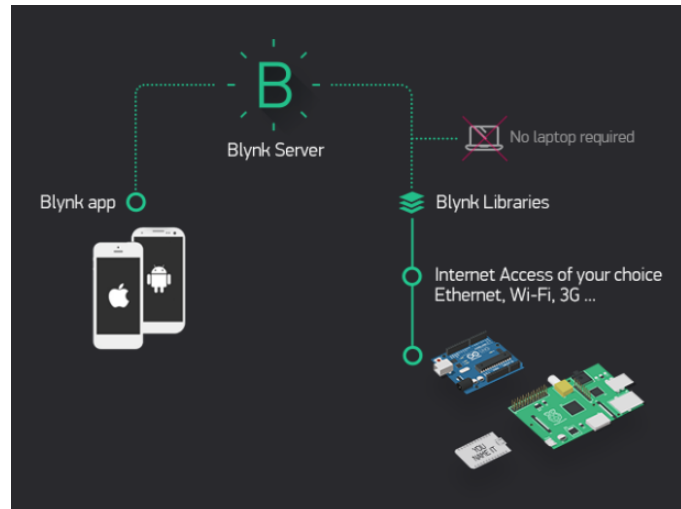


Fig 3.16 Blynk Application

3.5.2.1 Major components

- Blynk Software - helps you to create beautiful interfaces for your projects by combining our widgets.
- Blynk Server - in charge of all contact between the smartphone and the hardware.
- Blynk Libraries - allow communication with the server and process all incoming and outgoing commands for all common hardware platforms.

3.5.2.2 Creating Blynk Account

1. Sign up for a Blynk account.

You'll need to build a new Blynk account after downloading the app. If you already have a Blynk Forums account, this one is different from that. We suggest using a real email address because it will make things easier in the future.

To save your projects and access them from different devices from anywhere, you'll need to create an account. It's also a safety precaution. You can always build your own Private Blynk Server with complete power.

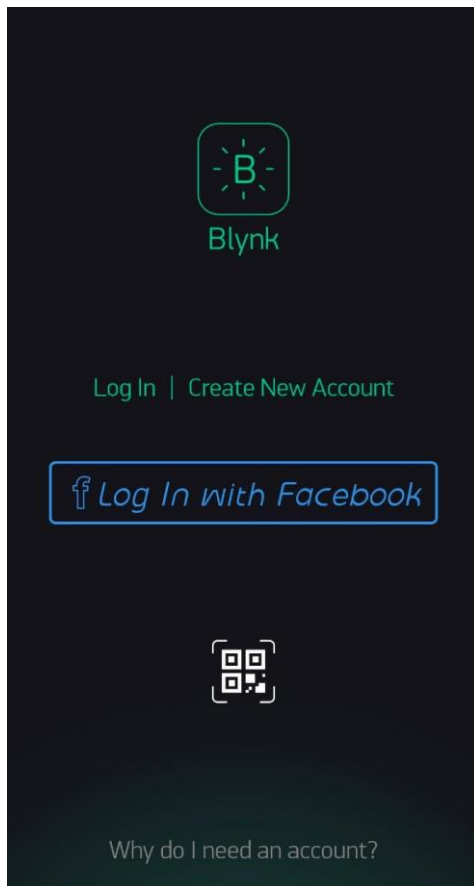


Fig 3.17a Blynk app

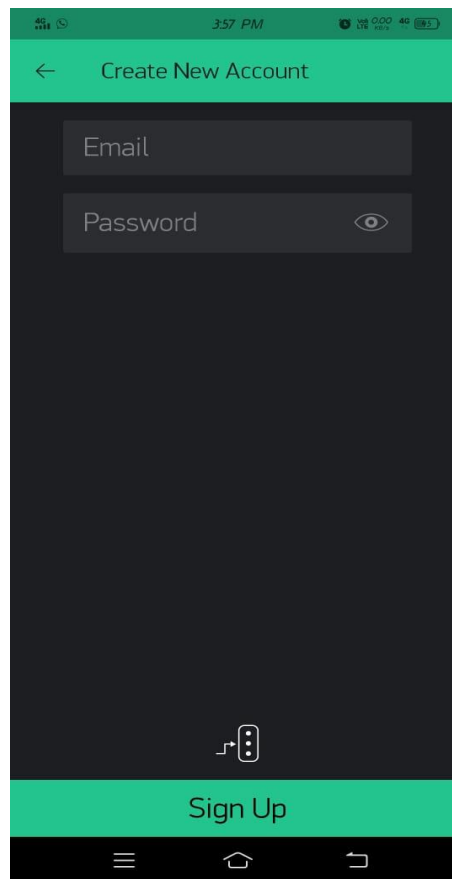


Fig 3.17b Signing-up Blynk

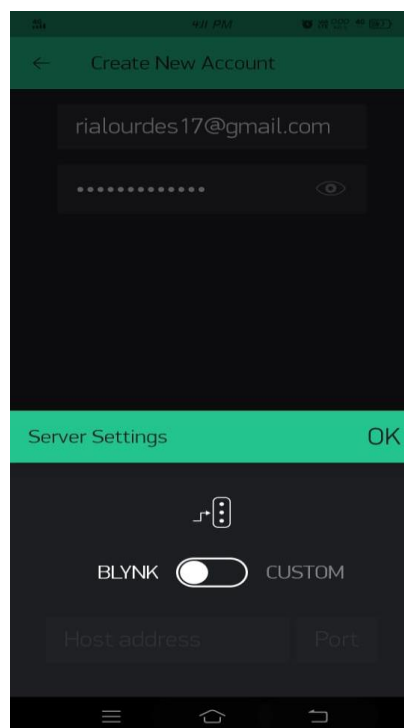


Fig 3.17c Create Blynk account

2. Begin working on a new project.

Start by creating a new project after you've successfully signed into your account. Start a new project and choose the hardware you want to use. Choose between a dark and a light UI GUI.

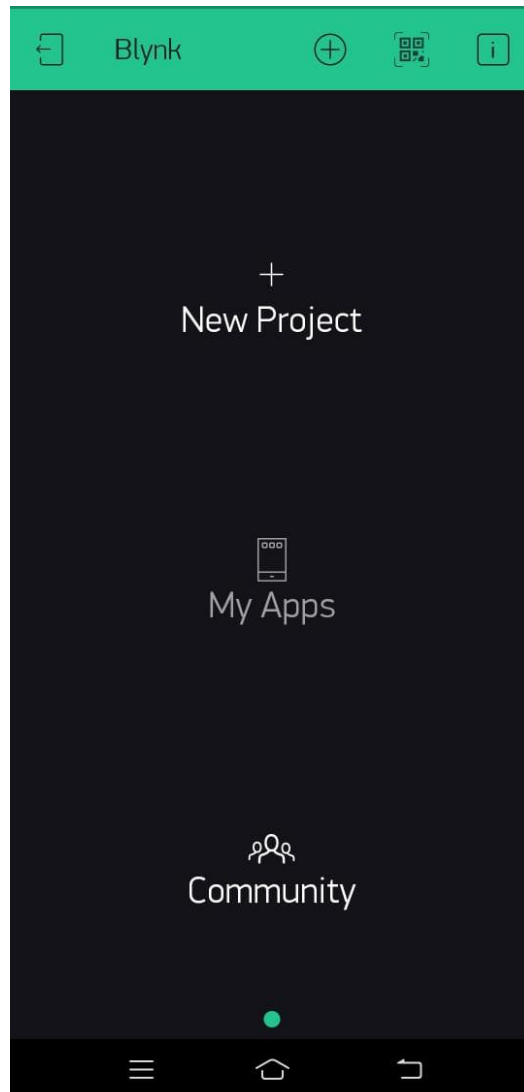


Fig 3.18 Create new Blynk project

3. Choosing Hardware

Choose the hardware model you'll be using. Check out the list of hardware that is supported. Choose Generic Board if you can't find the hardware you're looking for.

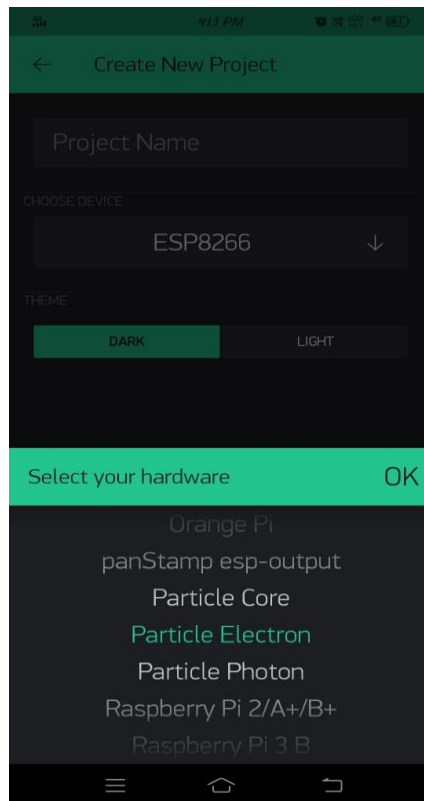


Fig 3.19 Selecting hardware

4. Authentication Token

The Auth-Token is a one-of-a-kind identifier that is required to link your hardware to your smartphone. Your Auth Token will be special to each new project you create. After you build a project, you'll receive an email with an Auth Token. You may also manually copy it. Select the appropriate device from the devices section.

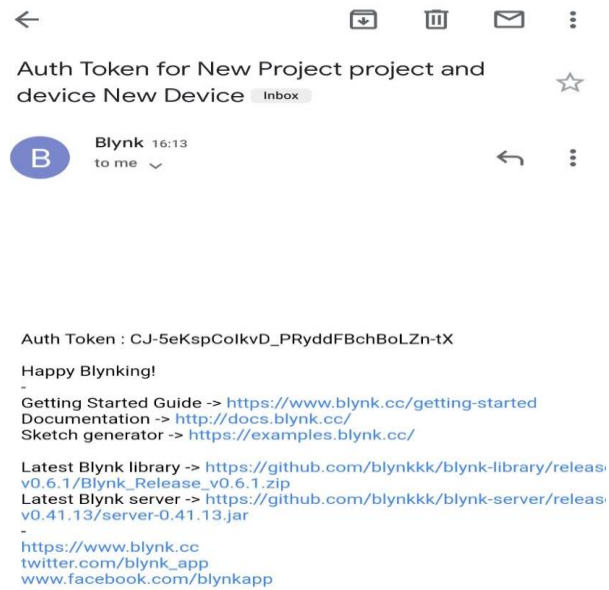


Fig 3.20a Authentication code via email

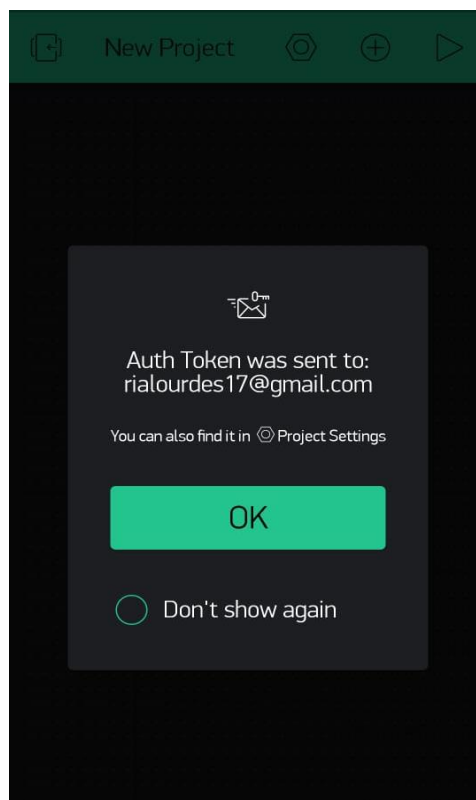


Fig 3.20b Auth Token verification

5. Create and run the application.

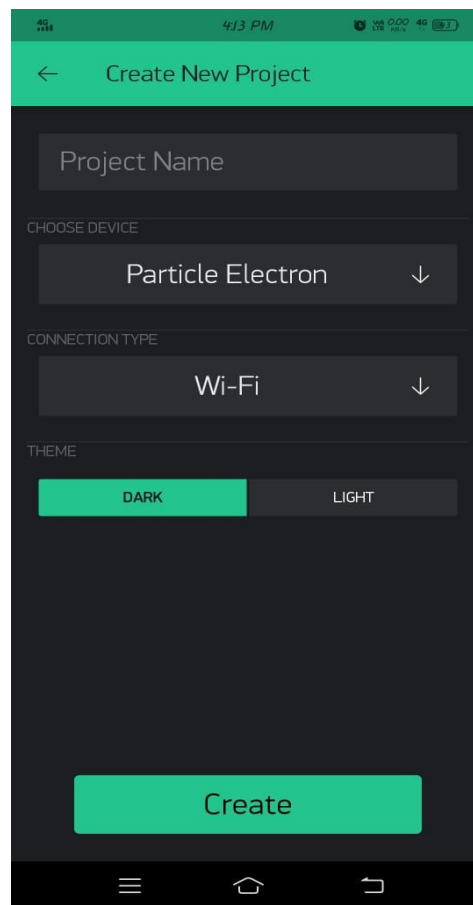


Fig 3.21 Create Blynk application

3.5.3 Google Map

Google Maps is a web-based website that offers comprehensive information about geographic regions and locations all over the world. Aerial and satellite views of several areas are available on Google Maps in addition to traditional road maps. Google Maps provides street views based on images taken from automobiles in several towns.



Fig 3.22 Google maps

As part of the wider Web application, Google Maps provides the following services.

- A route planner provides instructions for cars, cyclists, walkers, and public transit riders who wish to travel from one place to another.
- Web site administrators can insert Google Maps into a proprietary site, such as a real estate guide or a community service page, using the Google Maps application program interface (API).
- Google Maps for Mobile provides a location service for drivers that combines data from wireless and cellular networks with the Global Positioning System (GPS) location of the mobile device (if available).
- Users can view and navigate through horizontal and vertical panoramic street level views of different cities around the world using Google Street View.
- For amateur astronomers, supplementary resources contain images of the moon, Mars, and the heavens.

CHAPTER 4

RESULTS AND ANALYSIS

4.1 OUTPUT OF VEHICLE TRACKING AND THEFT ALERT

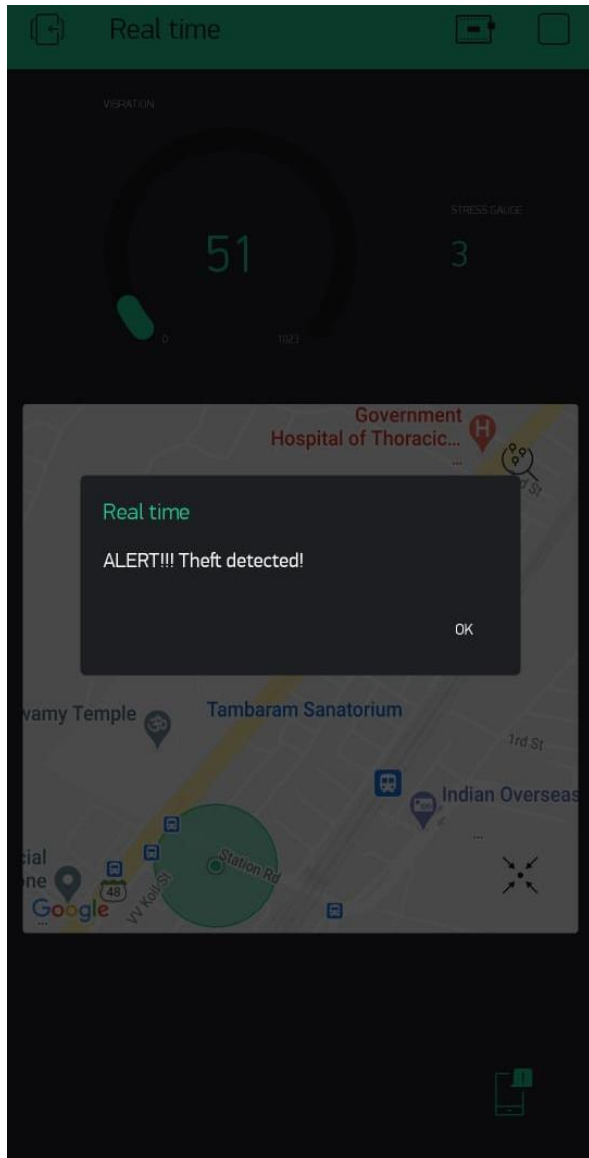


Fig 4.1 Theft detection alert

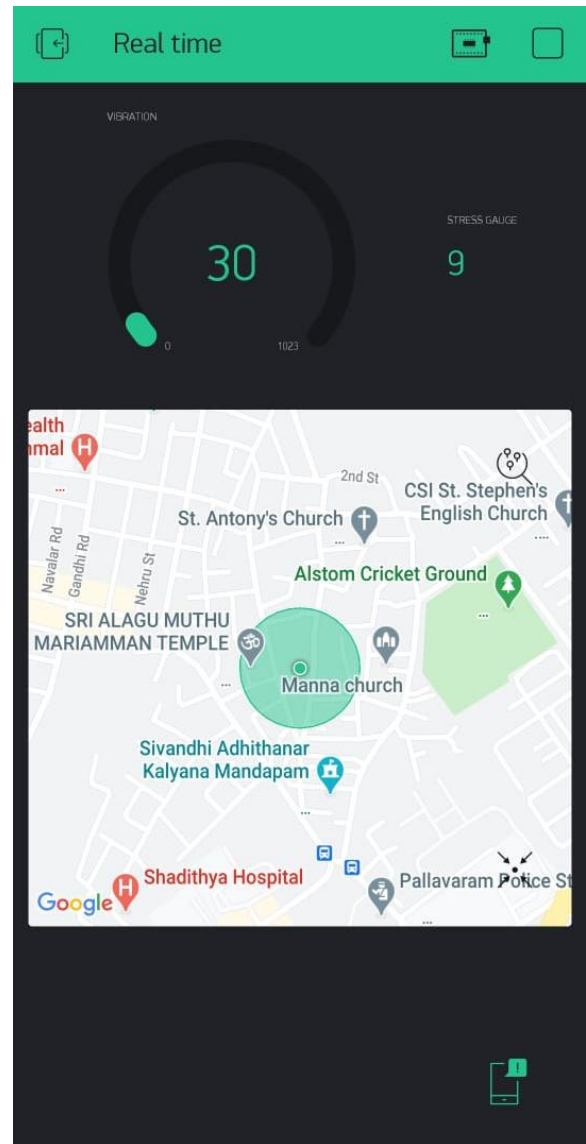


Fig 4.2 Tracking of location 1

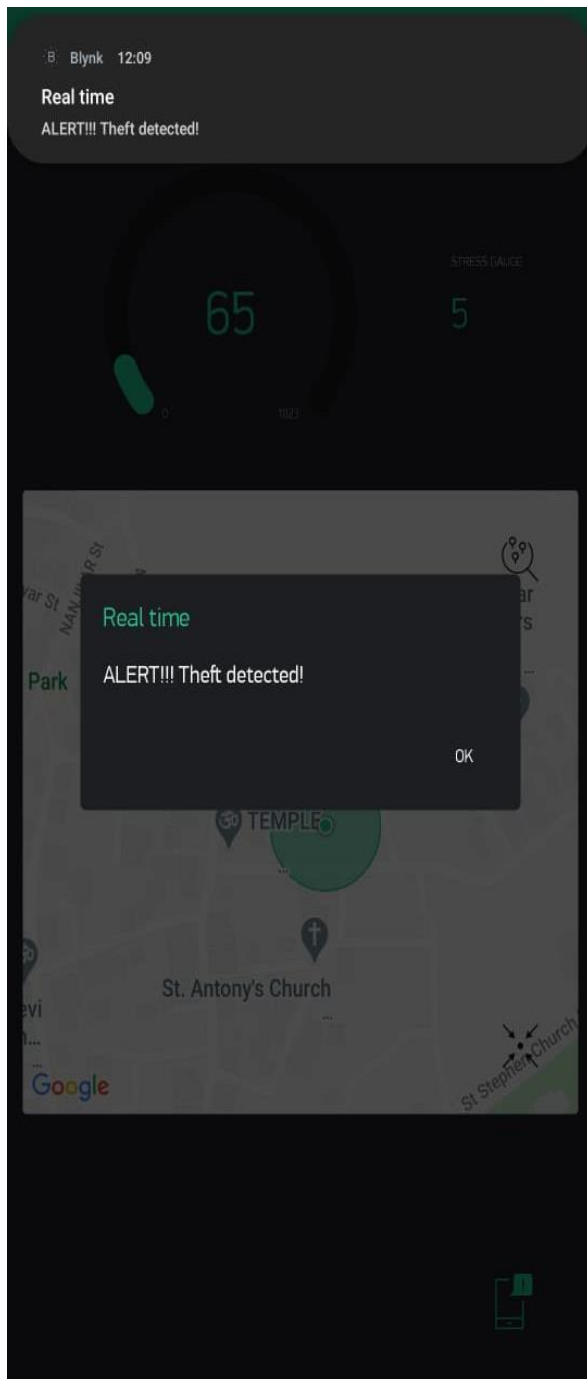


Fig 4.1a Theft alert 1

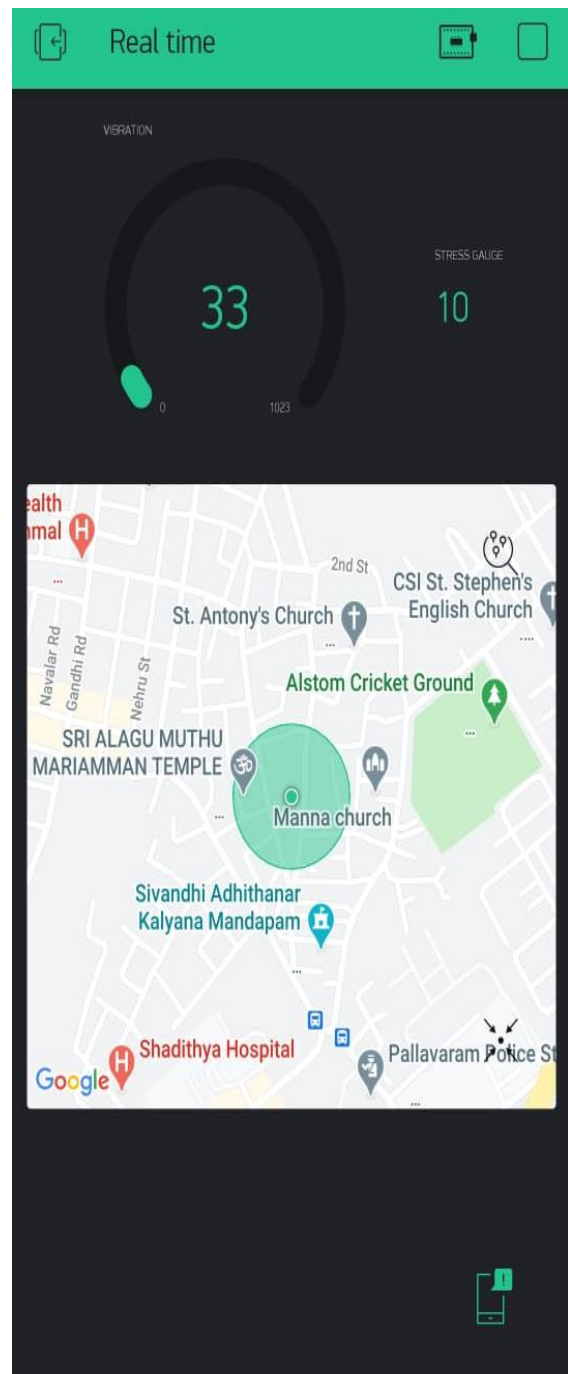


Fig 4.2a Theft not detected

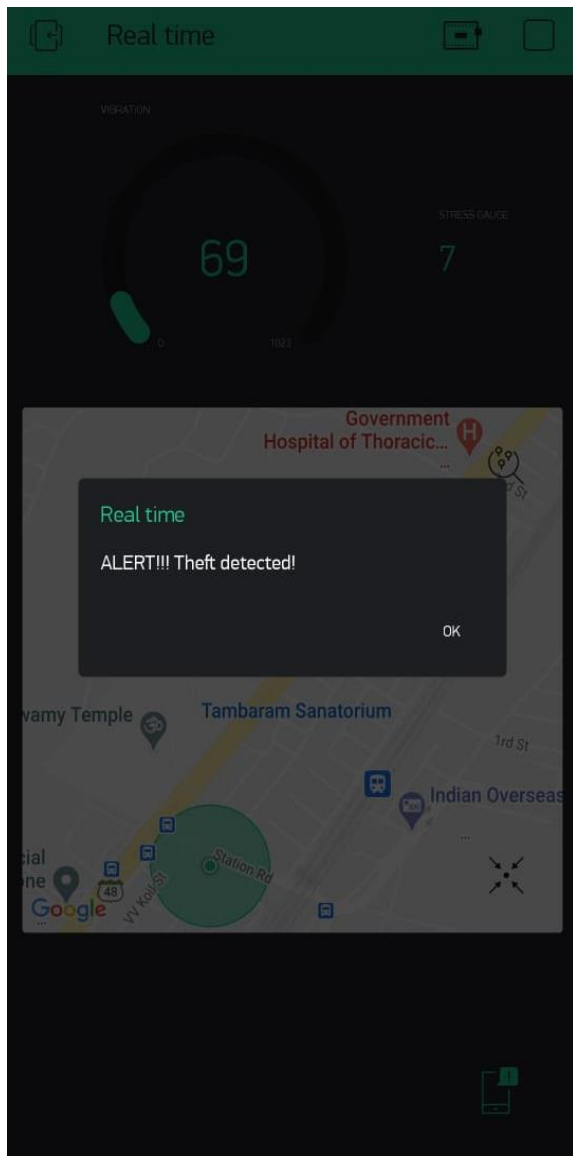


Fig 4.1b Theft alert 2

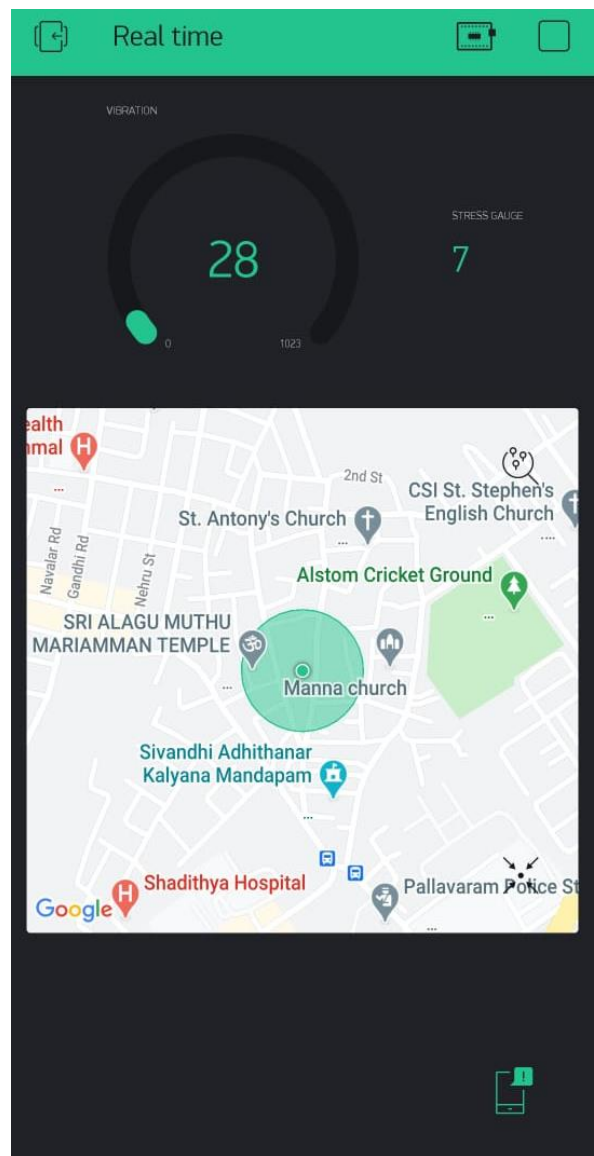


Fig 4.2b Vibration < threshold value

4.2 PERFORMANCE ANALYSIS OF THE SYSTEM

The concept of the proposed system is to track the vehicle in real time using map concept in Blynk application along with the detection of theft. To indicate the unauthorized access of the vehicle, standard conditions are programmed into the circuit. The values of the vibration sensor and stress gauge sensor can be monitored using the Blynk application. If the vibrator sensor value exceeds the threshold value and the stress gauge is active, then theft is detected and indicated. The location of the vehicle can also be traced via Blynk application. Since the threshold value is

programed to 49, theft will be indicated if the vibrations are above the value. The threshold value can be altered with respect to the user's needs.

In fig 4.1, since the vibration value is 51 i.e. greater than threshold value and the stress gauge is active i.e. greater than 0, theft is detected and the alert is notified in Blynk application. The location of the vehicle, if moving, can be traced in the same application. The same is being done in figures 4.1a and 4.1b, with different vibration values above the threshold value.

In fig 4.2, though the stress gauge is active with the value 9, theft is not detected since the vibration value is 30 i.e. lesser than the threshold value. In this condition, theft does not occur and so no notifications will be displayed in the Blynk application. The same condition is being displayed in figures 4.2a and 4.2b with different vibration values below the threshold value.

4.3 CONDITION AND DATA ANALYSIS

Table 4.1 Condition to detect theft

CONDITION	OUTPUT
Vibration>49 && stress>0	Theft detected
Vibration<49 stress>0	Theft not detected

Table 4.2 Data values for theft detection

VIBRATION VALUE	STRESS GAUGE VALUE	ALERT
30	9	NO
51	3	YES
33	10	NO
65	5	YES
69	7	YES
29	7	NO

CHAPTER 5

SUMMARY AND CONCLUSION

5.1 SUMMARY

The proposed device makes use of wireless embedded hardware that is small and light. The embedded hardware in the vehicle is driven by the vehicle battery and communicates with a remote server via cellular mobile network at predetermined intervals. The android app on a phone obtains location data from the server, uses the Google Maps feature, and allows for real-time location tracking.

If a vehicle tracking system is used in any business or agency for any form of delivery, it is important. Since the driver is aware that the car is continuously tracked, he or she can drive cautiously and take the shortest path possible to arrive at their destination on time.

The in-vehicle tracking system or unit, which works in conjunction with a central server and software to allow the user or owner of a car to track his or her own vehicle, has a number of advantages. The GPS and cellular board mounted inside the vehicle retrieves its location information and sends it to the owner at predetermined intervals based on the user's preferences, ensuring that the vehicle is still up to date. Since all pertinent information is displayed on the screen, the user can easily monitor and respond in the event of an emergency.

5.2 CONCLUSION

We developed a vehicle tracking system that is scalable, adjustable, and reliable in our thesis. The cellular board was set up and checked, and the tracking system was put in place to track the vehicle's position using the Blynk app and Google Maps. We used Google map API to display the location on a Google map. The system's brain is the cellular board, and the GPS modem is operated by AT commands that allow data to be transmitted over the network while the GPS provides location data. When the GPS receives new details, the database is updated, and we can see the location on the Google map.

This system may also be referred to as an anti-theft detection system because it allows the recovery of stolen vehicles as well. If the car does not arrive at the specified

location or is being used by an unauthorized person, the location can be tracked and police can be dispatched to the unauthorized location where the vehicle is located, ensuring car safety.

Vehicle tracking systems are becoming increasingly common, not only in metropolitan areas but also in small towns, as the most critical device for those who want their car's protection in capable hands. This device is fully integrated, allowing the user to easily monitor his vehicle at any time and from any place.

Vehicle theft is on the rise, but people can't resist buying cars, so they've devised a clever way to keep an eye on them without having to be in near proximity to them. These systems can help keep robberies under control and, to some degree, prevent them. The user will use this device to find out where the car is, how far it has travelled, and how far it has travelled. At any point in time, the user can check the location of his car. This system is both dependable and stable. This setup is very simple to upgrade, which allows it to adapt to future needs without having to rebuild it from the ground up, making it more effective.

5.3 FUTURE SCOPE

The features aren't limited to what we've included; more technical features can be added to boost the tracking function. For example, in conjunction with this tracing system, a camera may be installed inside the vehicle to protect it from unauthorized users. Installing a camera inside will allow for the capture of images of the rightful owner, as well as audio and video, which will be sent over an M2M connection.

REFERENCES

- [1] Ali Mustafa, Mohammed I. A al-Nouman and Osama A. Awad, "A Smart real-time tracking system using GSM/GPRS technologies", 1st International Conference of Computer and Applied Sciences (CAS), 2019.
- [2] Xiao-feng gu1, Zi-wei Chen and Long yan, "Real-time vehicle detection and tracking using deep neural networks", 2016.
- [3] Zhongzhen Luo, Mina Attari, Saeid Habibi and Martin Von Mohrenschildt, "Online Multiple Maneuvering Vehicle Tracking System Based on Multi-Model Smooth Variable Structure Filter", 2018.
- [4] Mohammed Hazim Alkawaz, Maran Tamil Veeran and Omar Ismael Al-Sanjary, "Vehicle Tracking and Reporting System using Robust Algorithm", 2019 IEEE 7th Conference on Systems, Process and Control (ICSPC 2019), 2019.
- [5] m. Qian, H. Gao, and W. Liu, "Android based vehicle anti-theft alarm and tracking system in hand-held communication terminal," 2018 IEEE int. Conf. Consum. Electron. ICCE-TW, 2018, pp. 1–2, 2018.
- [6] Sowjanya kotte & Hima Bindhu Yanamadala —Advanced Vehicle Tracking System on Google Earth Using GPS and GSMII, International Journal of Computer Trends and Technology (IJCTT)II – volume 6 number 3– Dec 2013
- [7] Hubert Vijay A, Karthikeyan N & Prabhu K —Vehicle tracking and accident warning System using GPS and its implementation in FPGAII.
- [8] Abid Khan & Ravi Mishra —GPS – GSM Based Tracking SystemII International Journal of Engineering Trends and Technology- Volume 3 Issue 2- 2012 ISSN: 2231-5381.
- [9] Pankaj Verma & J.S.Bhatia —Design and development of GPS-GSM based tracking system with Google map based monitoring.II International journal of computer science, engineering and applications (ijcsea) vol.3, no.3, June 2013
- [10] Baburao Kodavati, V.K.Raju, S.Srinivasa Rao, A.V.Prabu, T.Appa Rao, Dr.Y.V.Narayana, —GSM and GPS based vehicle location and tracking systemII International journal of engineering research and applications (ijera) issn:2248-9622 vol. 1, issue 3,pp.616-625