Visvesvaraya Technological University, Belagavi

A Project report on

GPS Location Tracker Using Node MCU and GPS Module

Submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering
in
Electronics and Communication Engineering

Submitted by

AKSHATHA N	(4MH18EC004)
MANJUNATHA K L	(4MH18EC061)
PALLAVI M R	(4MH18EC076)
SOUNDARYA S	(4MH18EC100)

Under the guidance of

Mr. Shivaprasad K
Assistant Professor
Dept. of E&CE,
MIT MYSORE

Department of Electronics & Communication Engineering
Maharaja Institute of Technology Mysore
(Approved by AICTE, New Delhi, accredited by NBA, NAAC & Affiliated to VTU, Belagavi)

2021-22

Visvesvaraya Technological University, Belagavi

Maharaja Institute of Technology Mysore

Department of Electronics and Communication Engineering

Certificate

Certified that the Project work entitled **"GPS Location Tracker Using Node MCU and GPS Module"** is a Bonafide work carried out by **AKSHATHA N (4MH18EC004), MANJUNATHA K L (4MH18EC061), PALLAVI M R (4MH18EC076), SOUNDARYA S (4MH18EC100),** and this report of project is submitted in partial fulfillment for the award of **Bachelor of Engineering** in **Electronics and Communication Engineering** of **Visvesvaraya Technological University, Belagavi** during the year **2021-2022.** It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the project report and has been approved as it satisfies the academic requirements in respect of project work prescribed for the said Degree.

Signature of the Guide	Signature of the HOD	Signature of the Principal
Mr. Shivaprasad K Asst. Professor Dept. of E&CE MIT Mysore	**Dr. Ravichandra** Assoc. Prof., & HOD Dept. of E&CE MIT Mysore	**Dr. B.G. Naresh Kumar** Principal MIT Mysore

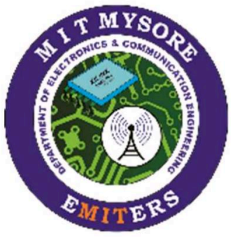
Examiners:

Name of the Examiner	Signature with date
1.	
2.	

MAHARAJA INSTITUE OF TECHNOLOGY MYSORE
Belawadi, S.R. Patna Taluk, Mandya – 571477

(Approved by AICTE, New Delhi, accredited by NBA, NAAC & Affiliated to VTU, Belagavi)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



Department Vision

To be recognized by the society at large as offering value based quality education to groom the next generation entrepreneurs, leaders and researchers in the field of Electronics and Communication to meet the challenges at the global level.

Department Mission

1. To groom the students with the strong foundation of Electronics and Communication Engineering and to facilitate them to pursue higher education and research.
2. To educate and prepare the students to be competent to face the challenges of industry\society and\or to become successful entrepreneurs.
3. To provide ethical and value-based education by promoting activities addressing the societal needs.
4. Enable students to develop skills to solve complex technological problems of current time and also provide a framework for promoting collaborative and multi-disciplinary activities.

Acknowledgement

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned our efforts with success.

We take this opportunity to express my profound gratitude to our respected Principal **Dr. B.G. Naresh Kumar** for his constant support and encouragement. We would like to thank **Dr. Ravichandra,** Head of Electronics and Communication Engineering Department, MIT Mysore for being supportive for our work throughout the project work.

Guidance and deadlines play very important role in successful completion of the project report on time. We also convey our gratitude to **Mr. Shivaprasad K** Assistant Professor, Department of ECE, for having constantly monitored the development of the project report and setting up precise deadlines.

Finally, a note thanks to the Department of Electronics and Communication Engineering of all teaching and non-teaching staff for the co-operation extended to us. We thankful to all those who have helped us directly or indirectly in our project work.

Last but not the least, we wish to express a special thanks to our family for their love and support during critical phases of our work.

Akshatha N

Manjunatha K L

Pallavi M R

Soundarya S

Abstract

Increasing commercial use of the Global Positioning System will soon make it possible to locate anything, anywhere, and anytime. The Global Positioning System can give extremely accurate position information for mobile objects and people, which is far superior to earlier tracking ways. The challenge Moment is integrating the necessary factors into aged systems and perfecting GPS delicacy in areas with multitudinous obstructions. As more devices becomes GPS enabled, accuracy will increase and the system's scale and global reach will benefit everyone. Wireless technology promises to be a crucial element in any long-term result. Designing location tracker with low cost is also important.

In this design, we're going to make an IOT-based location tracker using NEO-6M GPS Module. This position tracker consists of a node MCU, OLED display module, NEO-6M GPS Module, and 3.7 to 6v supporter circuit. We have also created a simple local Webserver and Blynk app to display the position details in real-time.

Contents

List of Figures

Chapter 1

1.1 INTRODUCTION

The Global Positioning System (GPS) is a space based Global navigation satellite system that provides location and time information. The project was started in 1973 to overcome the limitation of previous navigation systems. GPS was created by the US department of defense and was originally run with 24 satellites. Since 1994 the GPS has been available for civilian use at no cost. It is freely accessible by anyone with a GPS receiver. The main functions of the GPS are Real-time position coordination, Travel progress reports, and accurate time measurement.

Increasing US security is a task for the Department of Defense. We need to track vital people immediately during emergencies, hence GPS is necessary. Personal valuables and car products when stolen or lost are not easy to find using GPS. Logistic companies need to trace their fleet for reliable operations using GPS.

GPS has three segments-space segments, a control segment, and a user segment

Space Segment: The space segment consists of 24 satellites circling the earth at 12,000 miles in altitude. This high altitude allows the signals to cover a greater area. The satellites are arranged in their orbits so a GPS receiver on earth can always receive a signal from at least four satellites at any given time.

Control segment: The control segment tracks the satellites and then provides them with corrected orbital and time information. The control segment consists of four unmanned control stations and one master control station.

User segment: The user segment consists of the users and their GPS receivers. The number of simultaneous users is limitless.

GPS satellites send synchronized signals that specify their position and time at any moment. A GPS device receives signals from at least four satellites and compares the differences in their arrival times to pin point its position. Position codes align the receiver's clock with automatic clocks on the satellites, giving the exact time.

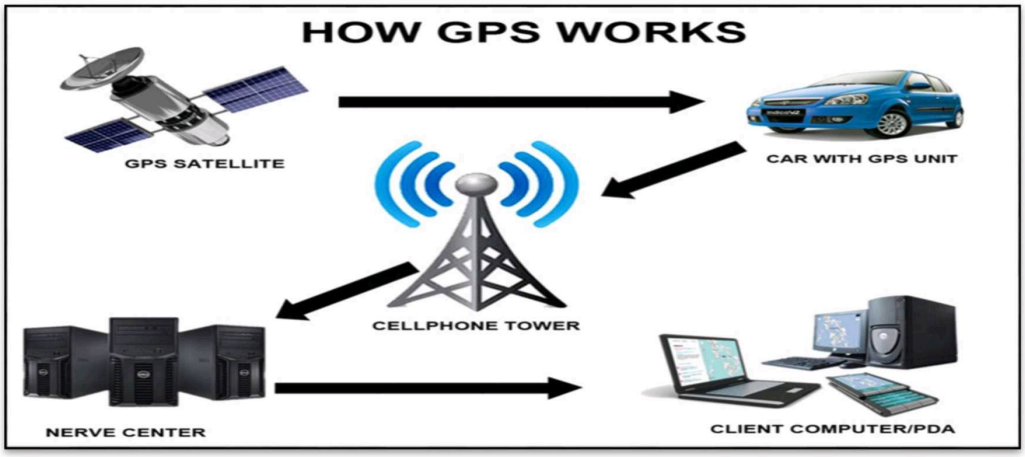


Fig.1.1.Working on GPS module

Global Positioning Satellites network is known to have offered numerous operations, especially in the area of tracking. Example, the fisher who got lost in the water may use a GPS receiver that was set up on their boat to find their location. Then they can request a rescue team to save them. GPS is utilized for navigation and offers continuous and precise timing information about the position of effects everywhere in the world during any type of environmental condition. For the GPS receiver to determine the precise location, satellites transmit signals. To ensure that they are operating properly, these satellites are regularly monitored.

The technology of the GPS is allowing for huge changes in society. The applications using GPS are constantly growing. The cost of the receivers is dropping while at the same time the accuracy of the system is improving this affects everyone with things such as faster internet speed with safer plane landings.

1.2 LITERATURE SURVEY

1.2.1 GPS location tracking implementation by Kama Azure Othman and Hafizes Aziz.

The goal of this work is to build and implement a low-cost GPS that may be used to train for activities like hiking, climbing, and sailing. To locate the stoner, the GPS must be used. Also researched are the offline sights concerning several tested locations. The PIC18F4520 tackle, which is integrated with a GPS receiver housed in an FV-M8 compartment, is used in this design. The GPS modules will calculate the bearing angles between two sites as well as the latitude and longitude values.

1.2.2 A Budget-Friendly GPS-GPRS Based Object Tracking System: BY Khondker Abul L. Haque, Tanzil Rahman, M. Mahbubur Rasheed, M. Abdur Rahman, Shajadul Hasan, and Mashiur Rahman.

This research is a suggested low-cost object shadowing system that makes use of GPS and GPRS. The technology allows a stoner to view a target object's recorded and current positions on Google Maps over the internet. The system uses GPS to determine the object's present location, and data is sent from the GSM network to a web server through GPRS using the HTTP POST protocol.

1.2.3 An anti-theft tracking system that uses real-time vehicle tracking technology combined with GSM and GPS by Mandeep Singh, Neelu Jain, and Kunal Maurya.

The design of a car tracking system employing GPS and GSM technology was suggested in this research. It would be the most affordable method of vehicle shadowing and serve as an anti-theft system. It is an embedded system that uses the Global Positioning System (GPS) and the Global system for mobile communication to track and position any vehicle (GSM). With this concept, a moving vehicle will be continuously covered and its status will be reported as needed. To do this, a GSM modem and GPS receiver are connected serially to an AT89C51 microcontroller. To capture the vehicle's position (Latitude and Longitude) from a distant location, a GSM modem is needed.

1.2.4. IoT-based Vehicle Monitoring and Tracking System Implementation Using Node MCU: By Venkata Ratnam Kolluru, Syam Sai Kota, and Boddapati Venkata Sai Padmaja.

The Blynk platform is used in this study to implement vehicle monitoring and tracking systems, serving as a conduit for the transfer and viewing of data. The system is designed to take into account a variety of driver assistance parameters, including eye blinking and alcohol consumption, as well as vehicle parameters, such as machine temperature, the distance between vehicles, and shadowing of the vehicle's live position.

1.2.5 Intelligent Real-Time System for Bus Tracking and Monitoring Based on the Internet of Things, by Mona Kumari, Ajitesh Kumar, and Arbaz Khan.

The design and maintenance of an IOT-based system that enables parents, seminaries, and no supervising bodies to monitor the comfort and safety conditions inside a machine in real-time are presented in this study. This real-time providing total sight of motorcars generates a variety of reports for colorful conditioning for machine comfort and attendance.

1.3 PROBLEM STATEMENT

- If a person's smartphone is equipped with a GPS module, GPS tracking offers a futuristic way of life in which they can follow an object or vehicle and receive real-time location updates.

- It will cost a lot of money to construct this facility, which allows you to track objects.

- As a result, it is critical to make it affordable and simple to configure; if it is made available to people, they will gladly utilize it in their cars, school buses, taxis, etc. The main cause of the lack of demand and interest in vehicle monitoring is this.

1.4. OBJECTIVE AND SCOPE OF THE PROJECT

The goals of our initiative are as follows:

• To create a Global Positioning System (GPS) tracking system that is both affordable and simple to set up.

• Obtaining an online page's longitude and latitude coordinates for the object's location.

• Show the location of the object on Google Maps.

• Also, track the history of the route in which the object traveled.

GPS tracing is currently accessible and not just for large corporations or governmental organizations. Prices for similar trackers are low because there is a huge requirement for them. Small businesses and even individuals may be subject to these biases. Individuals could take advantage of tracking systems. Family members may provide coverage for any teen drivers in the family. Trackers may also be useful for ensuring older citizens' safety and covering them once they fall on the road.

1.5 BLOCK DIAGRAM

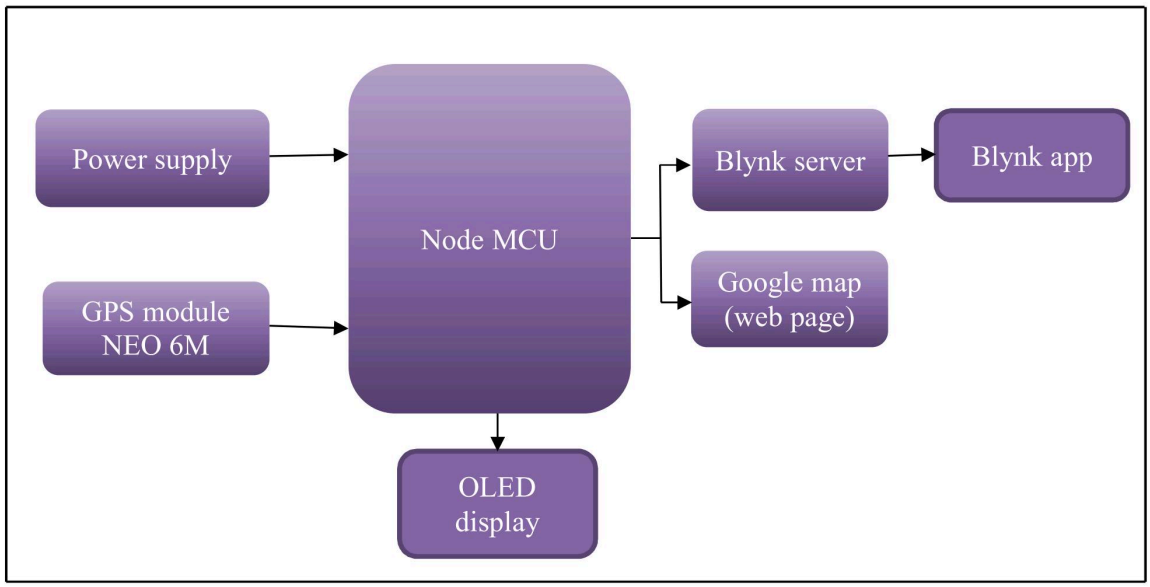


Fig.1.2. Block diagram of Location Tracker using Node MCU and GPS module

The module consists of microcontroller Node MCU, GPS module, OLED display. The GPS module and OLED display are connected to the Node MCU and power supply is given to the Node MCU. GPS module gets the location coordinates details and the same is sent to the Node MCU. The Node MCU displays the longitude and latitude coordinates in OLED display. The blynk application that is interfaced with Node MCU is gets the same location coordinates and display the location.

1.6 REPORT ORGANIZATION

Chapter 1: A generalized block diagram is used in this chapter to offer a brief introduction to "GPS Location Tracker Using Node MCU and GPS module", and describes the goals, literature review, and scope of this system as well.

Chapter 2: This chapter focuses on every single hardware component used and its specifications, as well as necessary software needs.

Chapter 3: The system design is described in this chapter.

Chapter 4: The results are discussed in this chapter.

Chapter 5: This chapter tell about the conclusion and the project's future work.

Chapter 2

SYSTEM REQUIREMENT STUDY

2.1 SYSTEM STRUCTURE

2.1.1 ESP8266 Node MCU:

The Node MCU ESP8266 development board comes with the ESP- 12E module, which has the ESP8266 chip with a ten-silica-ten-ax 32-bit LX106 RISC microprocessor. This CPU supports RTOS and operates at malleable timepiece frequencies between 80 MHz and 160 MHz. The Knot MCU has 128 KB of RAM and 4 MB of flash memory for data and programme storage. Due to its powerful processing capabilities, built-in Wi-Fi, and deep sleep operating features, it is ideal for IoT devices.

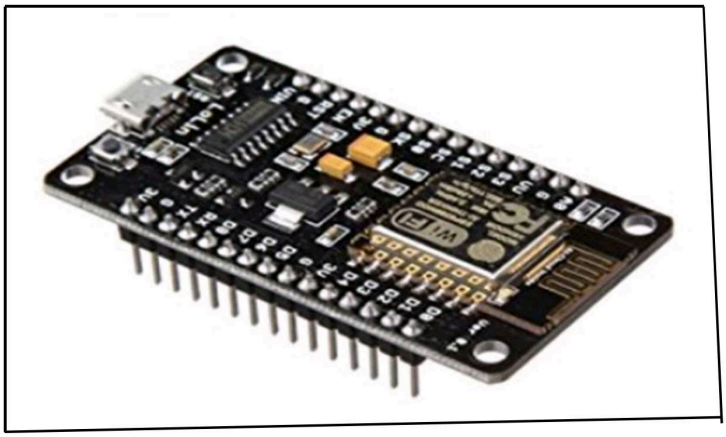


Fig.2.1.Node MCU

The Node MCU ESP8266 can be powered using a Micro USB jack and a VIN pin (External supply pin). SPI, UART, and the 12C interface are all supported.

Node MCU ESP8266 Specifications and Features:

• The Tense LX106, a 32-bit RISC CPU made of ten-silica.

• 7–12V input voltage

• Operating Voltage: 3.3V

•Flash Memory: 4 MB

•SRAM: 64 KB

•Digital I/O Pins (DIO): 16

•Analog Input Pins (DIO): 16 80 MHz clock speed

•Digital I/O Pins (DIO): 16

• The onboard USB-TTL based on CP2102 enables Plug n Play;

• PCB Antenna

• Small module that tidily fits inside of your IoT projects

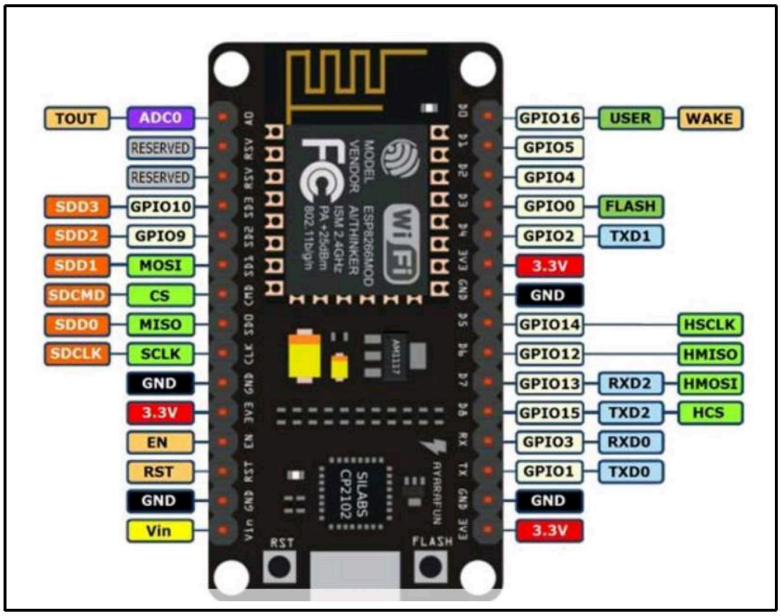


Fig.2.2. Pin Details

2.1.2. GPS Module:

The Global Positioning System (GPS) is a network of 24 orbiting satellites with a total distance of 11,000 nautical miles and six different orbital trajectories that is used for navigation. The satellites orbit the Earth twice in less than a day thanks to their continual movement. These satellites' orbital trajectories place them between 60 degrees North and 60 degrees South of the equator. The global

positioning system is abbreviated as GPS. The signals are tracked by the Global Positioning System using satellite technology. It operates on the 2D trilateration theory. When an item sends signals to satellites, the satellites give feedback signals back to the object. The time needed to shoot the feedback signal is calculated to identify the exact location of the object. The GPS tracking system uses the Global Navigation Satellite System (GNSS) network to pinpoint the exact location of the vehicle. It connects to the microcontroller through a compartment for periodicals. The GPS receiver transmits position information to the regulator. Using GSM, the regulator receives the data and sends it to the stoner. Globally, GPS systems are widely utilized and may be found in a wide variety of devices, including smartwatches, cars, and mobile phones. The NEO-6 module series is a line of standalone GPS receivers created by u-box. Due to its numerous benefits, this line of GPS receivers is appropriate for use in a wide range of applications.

Fig.2.3. GPS Module

2.1.3. OLED Display:

Fig.2.4. OLED Display

A light-emitting diode (LED) with an organic emissive electroluminescent subcase is an organic light-emitting diode (OLED or organic LED), often referred to as an organic electroluminescent

(organic LED) diode. This type of LED generates light in response to an electric current. This organic sub caste is sandwiched between two electrodes, usually with at least one transparent electrode. OLEDs are utilized to create digital displays for mobile devices like cellphones and handheld gaming systems, computer observers, and TV defense consoles. The creation of white OLED bias for solid-state lighting operations is a key topic of investigation.

2.4. Lithium Ion Battery:

Fig.2.5.Lithium-ion Battery

Lithium ions move from the negative electrode to the positive electrode during discharge and back again during charging. This form of rechargeable battery is called a lithium-ion battery, or Li-ion battery. In lithium-ion batteries, the positive electrode is composed of a worked lithium mixture, and the negative electrode is frequently formed of graphite. Except for LFP cells, Li-ion arrays have a high energy viscosity, no reminiscence problem, and tropical tone discharge. It is possible to create cells that emphasize either energy or power reliability. They may nevertheless provide a safety risk since they contain delicate electrolytes that, if damaged or handled incorrectly, can cause eruptions and fires. Stanley Whittingham developed the initial rechargeable lithium-ion battery in the 1970s. It was based on a lithium-aluminum anode and a titanium disulfide cathode was patented in 1977 and was given to Exxon. By utilizing lithium cobalt oxide as a cathode, John Goodenough improved upon this work in 1980. Akira Yoshino created an example Li-ion battery in 1985, building on John Goodenough's earlier research. M. A marketable Li-ion battery was created by a Sony and Asahi Kasei firm under the direction of Yoshio Nishi in 1991. It had previously been developed by Stanley Whittingham, Rachid Yazmin, and Koichi Mizushima in the 1970s and 1980s. Typically employed for portable electronics and electric devices, the aircraft and courtesy sectors are using lithium-ion batteries more and more.

2.2 SYSTEM DESIGN

2.2.1. Arduino IDE:

The Arduino Integrated Development Environment, also known as the Arduino Software, includes a special editor for writing code, a communication area, a manual press, a toolbar with buttons for common connections, and various cards (IDE). It establishes a connection with the Arduino hardware to upload calendars and transfuse with them. To write and upload code to Arduino boards, one uses free software known as the Arduino IDE. The IDE functionality is compatible with Windows, Mac OS X, and Linux operating systems. There is support for the C and C programming languages. Another acronym is IDE, which stands for Integrated Development Environment. While delivering and exporting, the dispatch zone flags violations and offers comments. The media distributes textual material created by the Arduino Software (IDE), which includes precise error alarms and other information. In the bottom-right corner of the window, the configured council and newly granted harborage are displayed. You can authenticate and upload calendars using the toolbar buttons because the Arduino IDE is a variation of the Processing IDE. However, the Visual Factory Law-Exceed their IDE settings will take the role of the Processing IDE as of version 2.0. Due to Arduino's growing popularity as a software platform, several vendors have seized the opportunity to utilize user-contributed open-source.

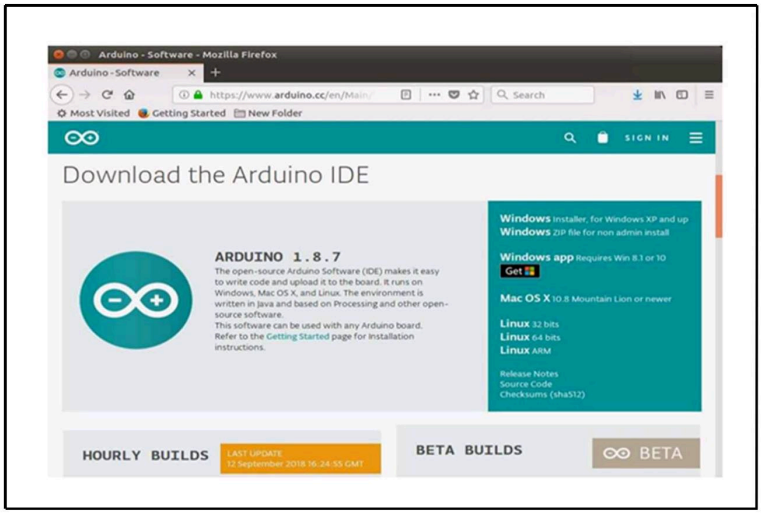


Fig.2.6.Arduino IDE

2.2.2. Blynk App

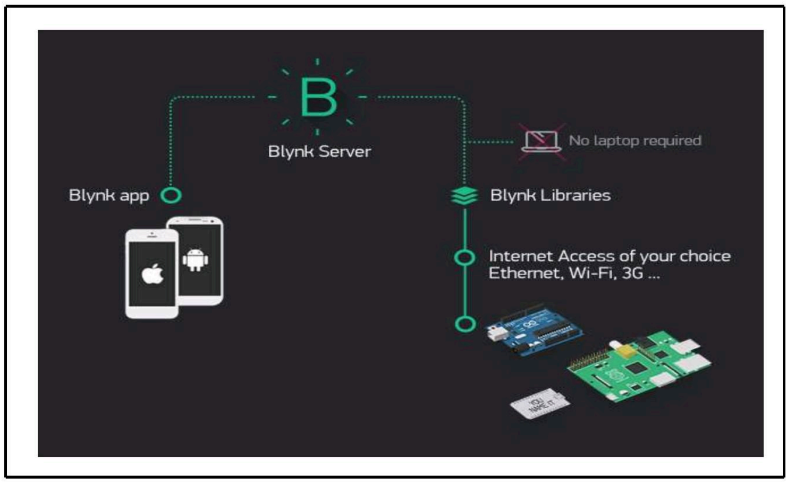


Fig.2.7.Blynk App.

Using the Internet, Blynk operates. This signifies that the Internet connection should be possible with the tackle you select. Some of the tables, such as the Arduino Uno, require an Ethernet or Wi-Fi shield to interact, while others, such as the ESP8266, Raspberry Pi with a Wi-Fi dongle, bit Photon, or Spark Fun Blynk Board, were Internet-capable before. However, if security is not a concern, you can connect it through USB to a laptop or desktop (it's a little more difficult for beginners, but we can help you with that). The long list of tackles that Blynk is compatible with and will commemorate rearing is cool. Somehow, Blynk has power over things. It may display characteristics and detector data. Blynk's three key components are its app, its libraries, and its garcon. Using the Blynk software, we may create many gadgets as needed. The communication between the smartphone and the tackle is handled by Blynk Garcon.

Specifications of the Blynk platform:

1. Using Wi-Fi, Bluetooth, USB, or GSM, you can connect Shadow.

2. Simple to utilize technology

3. Announcements, emails, and sweat can all be packed.

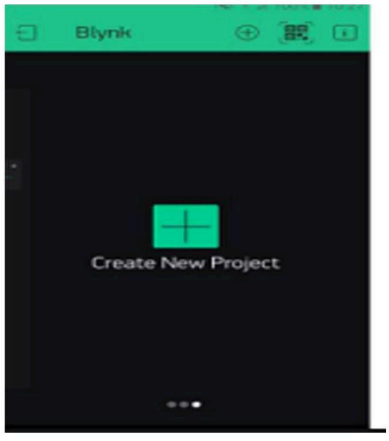


Fig.2.8.Picture Representing Blink application

2.2.3 Google Earth and Google Map API

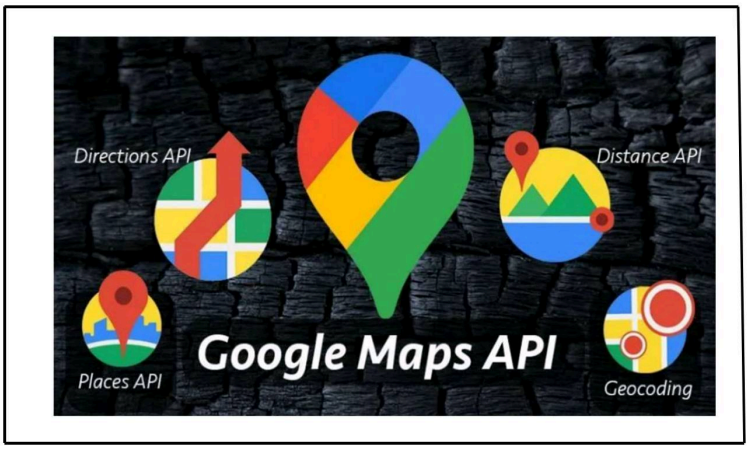


Fig.2.9. Google Map API

A very well-liked free program called Google Earth offers maps based on satellite photographs all across the world. A web server and a web browser are used to display the maps online in Google Map, a version of Google Earth. The program offers plug-ins so that users can display program objects. Examples of these objects include 3D models of buildings created with the software Sketch Up, pin objects that designate points of interest (POI), and line objects that depict a track. Such items are displayed using Google Earth's KML (Keyhole Markup Language) programming language, which is an extensible markup language (XML) designed to specify how the objects are rendered. Google Map can also be utilized with the KML-based objects to display lines.

Chapter 3

SYSTEM DESIGN STUDY

Microcontroller End:

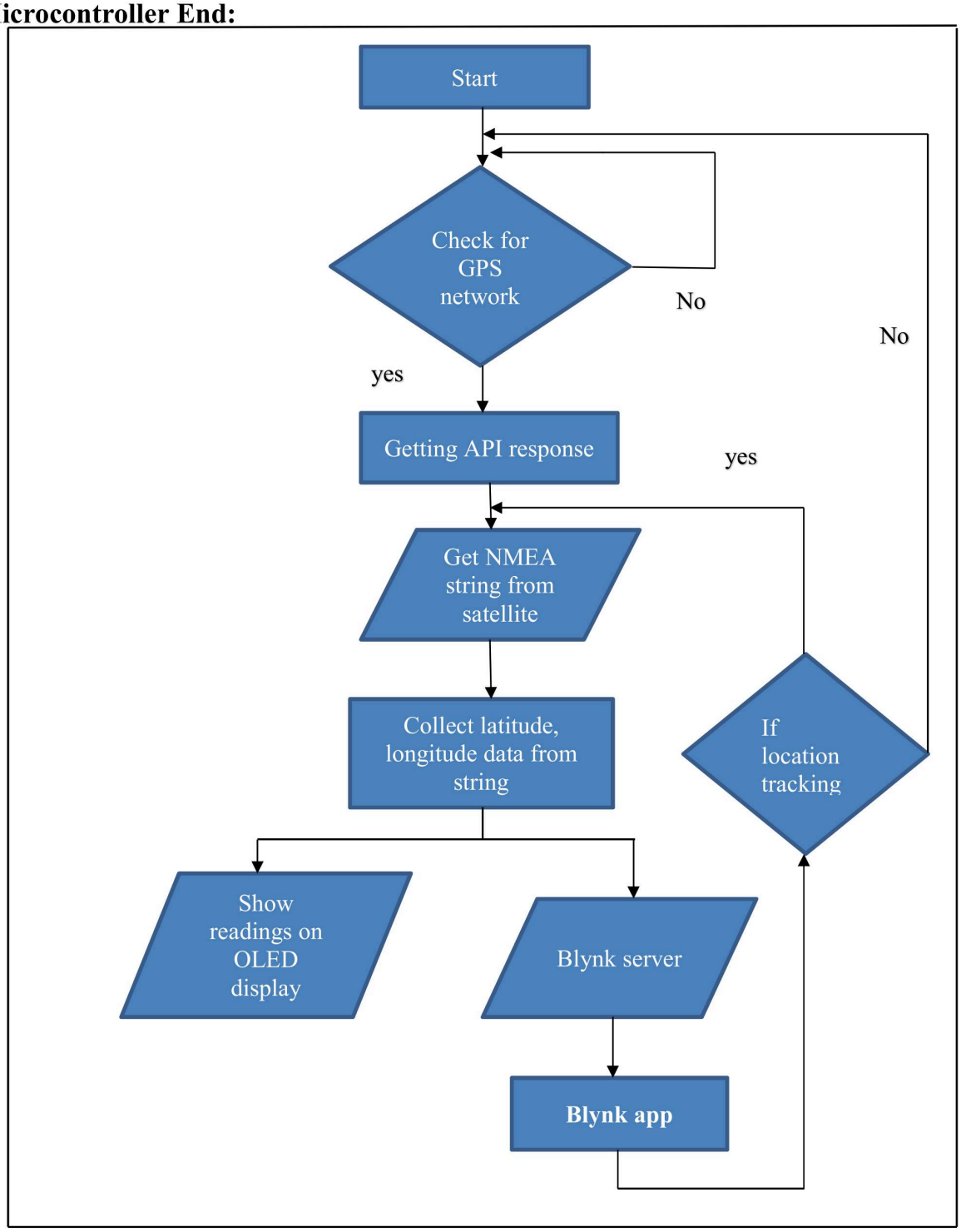


Fig.3.1.Flowchart of the Microcontroller End

Webserver End:

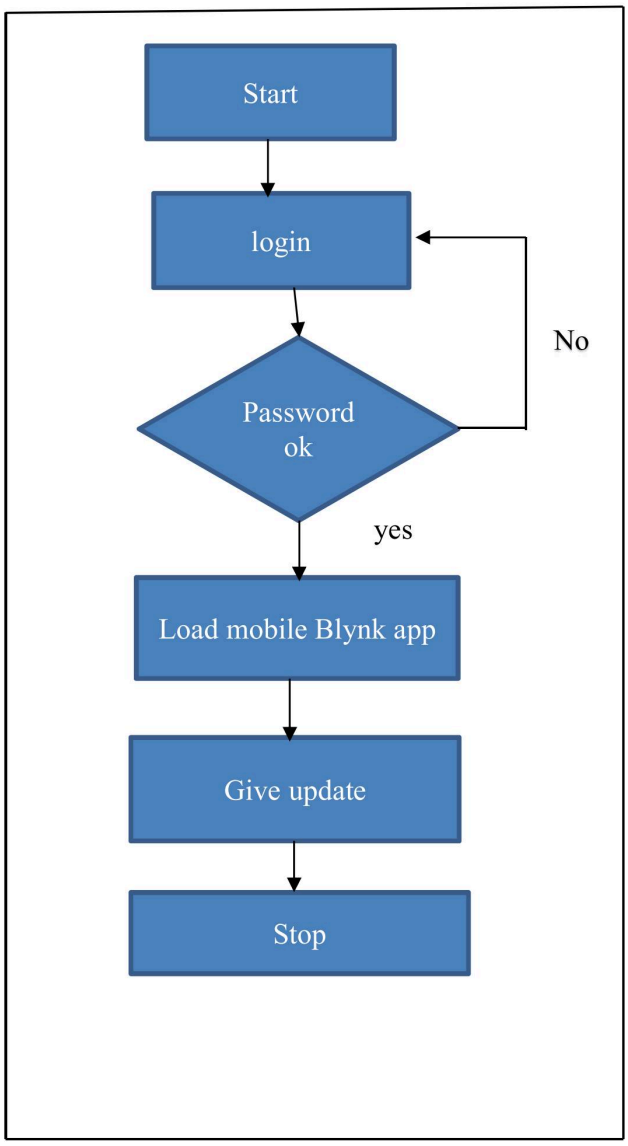


Fig.3.2.Flow chart of the Webserver End

Working Principle:

The GPS module starts looking for satellites as soon as the device is turned on. The GPS module receives synchronized signals that identify the position and time of the satellite at any given moment after the link between the GPS module and the satellites are established. To determine its real-time position, the GPS module evaluates the signals it receives from at least 4 satellites based on their arrival times. The codes determine the precise time where the module is traveling by synchronizing the receiver clocks with automatic clocks on the satellite. The Node MCU microcontroller receives the same time and date as the position and modifies the data that will be displayed on the webpage. It takes the GPS module a few seconds to obtain the coordination information. Depending on the weather where the module is located, the time varies. The object tracking system uses the first set of location coordinates that the GPS module receives from the satellite network and saves them. The location coordinates that the object uses to travel are stored when it begins to move from its initial place, and they are displayed on the web page of Google GPS API. The blynk application receives the same beginning position and the coordination points that the object traveled through. The tracked journey and current location are displayed by the Blynk app when it is connected to a Node MCU.

Chapter 4

RESULTS AND DISCUSSIONS

Experimental Setup:

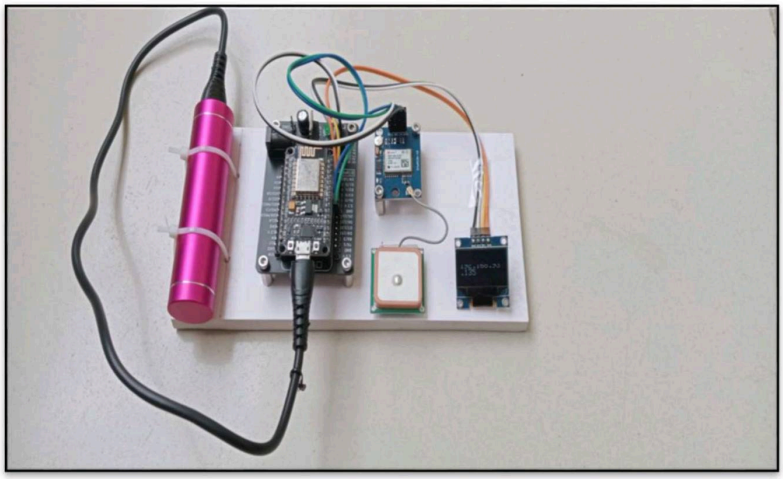


Fig.4.1.Set up of Location Tracker

Location Tracker attempts to connect with the mobile Wi-Fi module after uploading the source code to the Node MCU and turning on the device, as shown in Fig.4.2.

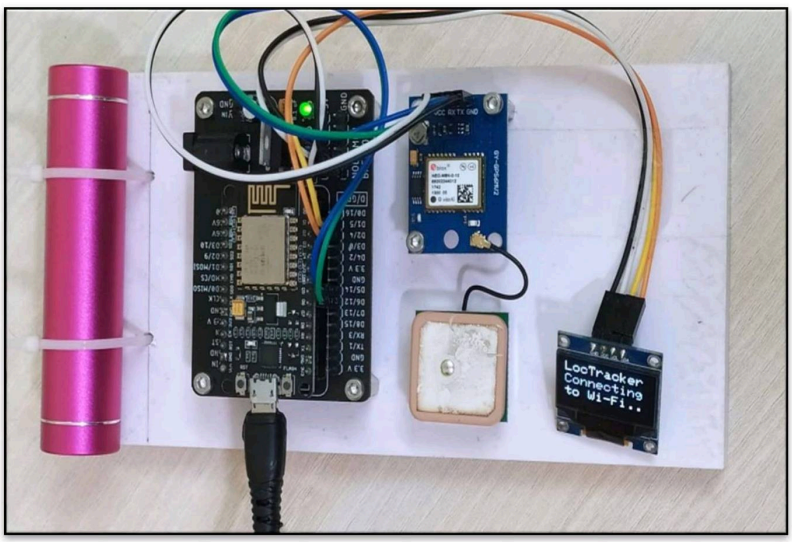


Fig.4.2.Connecting to Wi-Fi module

The IP address of the device that is connected with Node MCU is displayed on the OLED display and it changes each time the browsers used to load internet pages that is shown in Fig.4.3.

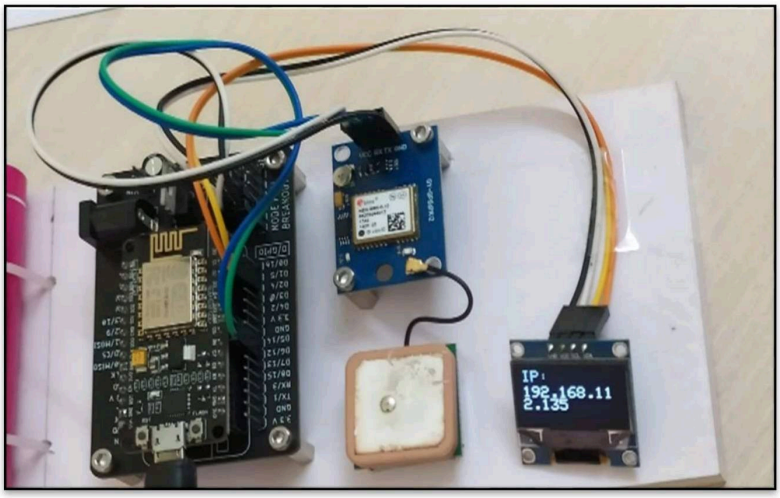


Fig.4.3.Displaying IP address

The information about the object is displayed in the form of latitude and longitude values in an OLED display once the GPS module has tracked it, as seen in Fig.4.4.

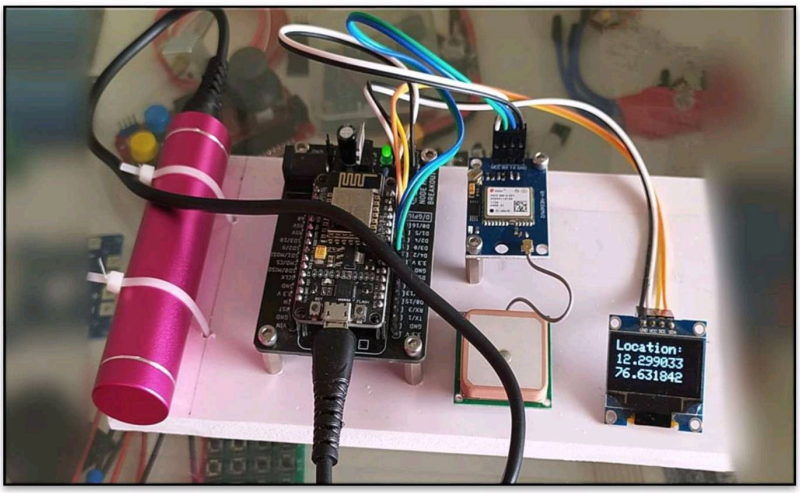


Fig.4.4.Displaying Latitude and longitude values

Additionally, as shown in Fig.4.5, we can generate a web page using an IP address.

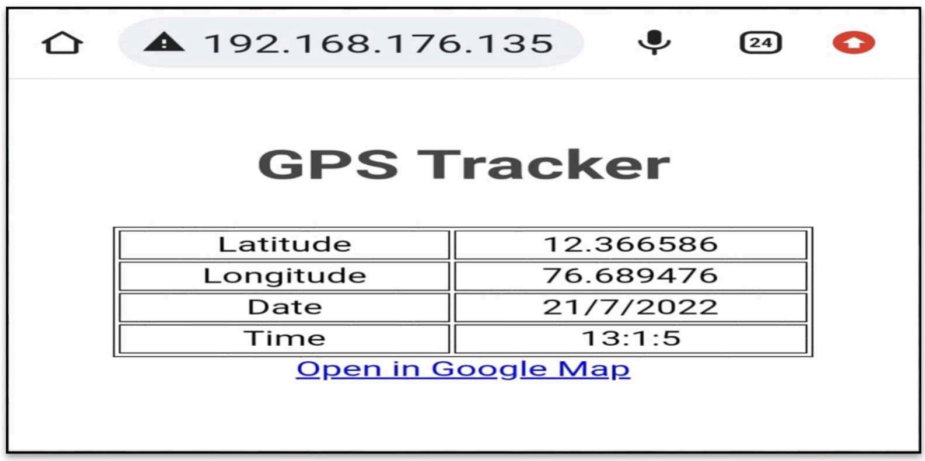


Fig.4.5. web page

As demonstrated in Fig.4.6. The GPS module uses a web server to display object information in the form of latitude and longitude values on a Google map.

Fig.4.6. Result displayed in the Google map

Values are also presented on the blink platform, and the Blynk app, which is depicted in Fig.4.7. displays the object's live location.

Fig.4.7. Result displayed in the Blynk app

Finally, we may also view the output on a serial monitor, which includes the time, latitude, and longitude data, and IP address of the near area.

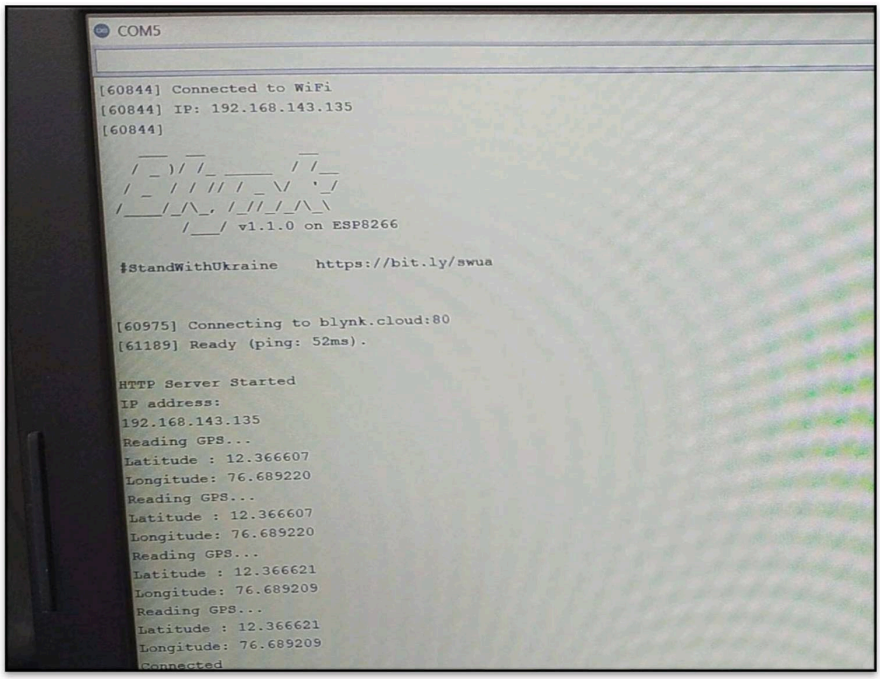


Fig.4.8. Result display in the serial monitor

Chapter 5

Conclusion and Future Work

Using a GPS module and Node MCU, this project was successfully implemented and locations are tracked. As a result, the Blynk platform will show the latitude and longitude values of any real-time location.

The system is dynamic, cost-effective, and efficient. This module can be implemented in a military operation, to detect theft and also in finding the location of Dementia Patients.

The system can be implemented in the school bus tracking system with some modifications like the addition of an LPG sensor and Temperature sensor.

References

[1]. Tom Logsdon, “Understanding the NAVSTAR GPS, GIS”, 1st Ed, 1995.

[2]. Michael Kennedy, “The Global Positioning System and GIS”, an Introduction: Ann Arbor Press, 2003.

[3]. Ezekiel oghenerueum Paul, "Overview of global positioning system-based tracking system”, February 2017.

[4]. Krunal Surya,” Real-time vehicle tracking system using GSM and GPS technology-an any theft tracking system, June 2012.

[5]. “Introduction to GPS,” Crankshaft Publications. [Online]. Available:http://www.what-when how.com/gps/introduction-to-GPS, February 2017