Smart Tracking Device

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Abstract— Sometimes we forget our things where we put it and sometimes, we lose our important things like house keys, car keys, vehicles, and some precious things. If we lost our mobile phone so by using a Google account, we can track it, but in a similar way, we can't find any other object. This is a very common problem when we lose something, and we often face difficulties in finding it. Sometimes we simply replace our lost things with new ones instead of finding them. So, this project will help to find or track such lost things which are done by implementing IoT. This project can be done by using Bluetooth also, but it has some limitations which can be solved by using IoT. The components which we have used in this project are ESP32+SIM800L Module, Neo-6M GPS module, GSM, etc. We can get the location of the object which we are going to track by using GPS. Our communication device can't receive the signals directly which is transmitted from GPS so, for transferring these signals to the communication devices GSM is used. The main aim of this prototype is to trace the object by giving its location. This will help in finding both stables as well as moving objects like keys, vehicles, etc. This prototype will provide the location co-ordinates to the responsible person. This proposed prototype can be used by transport sector as well as for security purpose..

Keywords— Blynk mobile App, ESP32+SIM800 Module, GPS GSM Module, Internet of Things (IoT), Tracker.

I. INTRODUCTION

According to a study of economics in 2011, 3.3 million U.S. jobs and an astonishing $96 billion in annual direct economic benefit are based on GPS only. GPS has truly become an integral part of civilization. This technology can also help in tracking your belongings using Smart Tracking Device. With the advantage of IoT the Smart Tracking Device which is a small device prototype is made. The proposed prototype can track the live location co-ordinates of target and show it in Blynk App in the form of google maps which uses the GPS system. It also has the security features like emergency message sending and calling to responsible person for safety of Woman/ Child.

A review of paper Object Tracking System using Iot [1] which is done in the year 2020 by Yellamma P., Kaza L., etal. introduces the use of GPS-GSM module for effective tracking and communication. The structure comprises of three frameworks: a. essential plan in which GSM module, MCU, Relay and an LCD are the parts. b. middle of the road plan in which SMS is sent by client. c. development design which consists of a framework direction in phones using google maps. In their work they have used Raspberry Pi as an MCU which will get area information from GPS-GSM module and return by to client. MATLAB software is used to working of system implementation.

A review of paper Real Time Tracking System: An IoT Based Application [2] which is done in the year 2020 by Dheer D., Kushwant S., etal. which uses the cloud platform and Android app. The Arduino UNO is used as microcontroller, other components are GPS module and GSM module for tracking location and communication with cloud services respectively, a battery for power supply. The web portal is created using HTML, CSS, Java script and PHP/Python for use of system from anywhere anytime with any device.

A review of paper written by Vivian L., Jesse D., etal. [3] which is done in the year 2020 eradicate the problem of power problem in IoT devices using solar power. The system talks about traditional network infrastructures such as Wi-Fi, Bluetooth, and their limitations in rural areas. The system consists of solar cells to charge the lithium-ion battery for never ending power supply to device, MSP430 microcontroller, GPS tracker, LoRa transmitter, etc. LoRa (i.e., long range radio) is used to communicate between roaming node and central hub.

A review of paper IoT Asset Tracking System [4] which is done in the year 2019 by Indira R., Bhavya G., etal. which focuses on safety of women, children, people with mental disorder. The Radio Frequency (RF) technology comprises of transmitter which is placed on the asset and receiver which is placed with the guardian of the asset. The main idea is that as soon as the asset goes away from the guardian the GSM module alert the guardian and track the asset using GPS. Various sensors like sound sensor, vibration sensor to alert the guardian if the asset is in any danger. The microcontroller used in the system is Nano (MEGA 328P).

A review of paper written by A. Mounika, Anitha C., etal. [5] which is done in the year 2019 Introduces a tracker designed especially for vehicles. The tracking is done using a GPS-GSM module and for communication, the Thing speaks channel is used also, the security of the vehicle is ensured by Radio Frequency Identification technology. They have the Arduino UNO as their Microcontroller, a GPS module for tracking location on, a GSM module that consists of a sim holder, RFID tag so that only authorized users can use the tracking system.

II. Methodology

A *Components:*

1. ESP32+SIM800L Module:

Fig. No. 1 ESP32+SIM800L Module

ESP32 + SIM800L Module is the latest IoT device that consists of a microcontroller, sim card holder for network connectivity, an inbuilt Bluetooth module, and an inbuilt Wi-Fi module for communication with IoT devices. It has single/dual 32-bit LX6 microprocessor with QSPI flash 4MB or PSRAM 8MB, SRAM 520 kB. It has an onboard clock of 40MHz crystal oscillator with a working voltage of 2.7V-3.6V and 70mA of working current. Only supports Nano SIM card and 2G network. Size and weight are 78.83mm, 28.92mm, 8.06mm and 11.77g. It has a C-Type connector and IP5306 Battery Management System (BMS) so we can plug the battery to module for better project working.

2. Neo-6M GPS Module:

Fig. No. 2 Neo-6M GPS Module

Relative Humidity and Temperature are measured using the DHT11 sensor. The device is out there at a really low price. It is easy to interface with microcontrollers like Arduino and NodeMCU. Humidity is measured using capacitive sensing element and temperature using a thermistor. The capacitor has two electrodes and therefore the moisture maintaining substrate is employed as a dielectric between them. As humidity changes the capacitance and subsequently the resistance change and are transformed into a digital signal. The NTC thermistor sensor does the calculations of temperature. Resistance has an inverse relationship with temperature i.e., resistance decreases as the temperature increases.

3. Push Button:

Fig. No. 3 Push Buttons

The Push buttons are nothing but switches for controlling the power of machine and appliances. They are generally made up of metal or thermoplastic switches. They help the user to easy access of the devices.

4. 3.7V Lithium-ion Battery:

Fig. No. 4 3.7V Lithium-ion Battery

The project also comprises of a 3.7V Lithium-ion battery for providing power supply to the device. It has a 1000mAh capacity.

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5. **Blynk:**

Fig. No. 5 Blynk IoT App

Blynk app is a platform through which the Arduino, NodeMCU is internet controlled. Blynk app is mainly used for IoT-based systems. Having its own cloud server, it can connect to a microcontroller and our android devices for receiving and transmitting the data. It can be connected through r Wi-Fi, Ethernet, and Bluetooth. It enables the connection with the server with its own libraries and process all input and output information.

6. **Arduino IDE: -**

Fig. No. 8 Arduino IDE

The Arduino Integrated Development Environment or Arduino Software (IDE).

B. ***Algorithm***

The system of the Smart Tracker Device works on the following algorithm:

1. Start.
2. Initialize all the devices, ESP32+SIM800L Module, Neo-6M GPS Module, Push Buttons, Battery and Mobile application.
3. Neo-6M GPS Module take the location co-ordinates of the device and the user.
4. Display the location of the device on the Mobile app using google map.
5. If pressed push button 1 then call to registered mobile number.
6. If pressed push button 2 then the location coordinates of the device will be sent through message.
7. Return to step 3

As we can see in the block diagram when the system is provided with the power supply through the 3.7V Lithium-ion Battery two modules namely ESP32+SIM800L for controlling and Neo-6M GPS tracking location co-ordinates are activated. The synchronization between Neo-6M GPS Module and ESP32+SIM800 is done by using a single bus data format. There is the transmission of data. This data consists of the location coordinates of the device that is to be tracked down. For proper working and long life, the 3.7V Lithium-ion Battery is used. Also, push-button 1 is used for calling on the registered mobile number and push-button 2 is used for sending location coordinates on mobile through SMS.

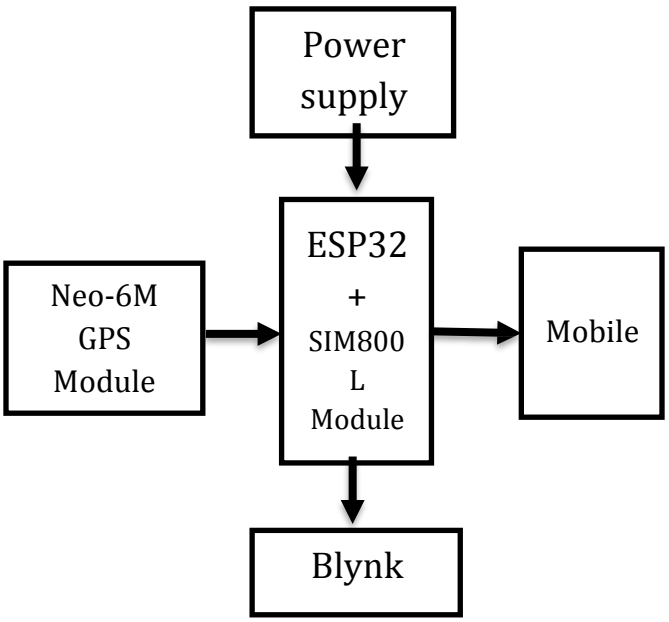

Fig.no.8 Block Diagram

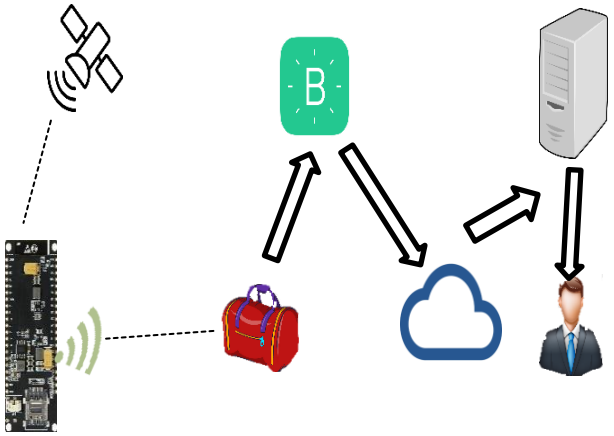

Fig. No. 9 System Architecture of the proposed system

C. *Circuit Diagram of the system*

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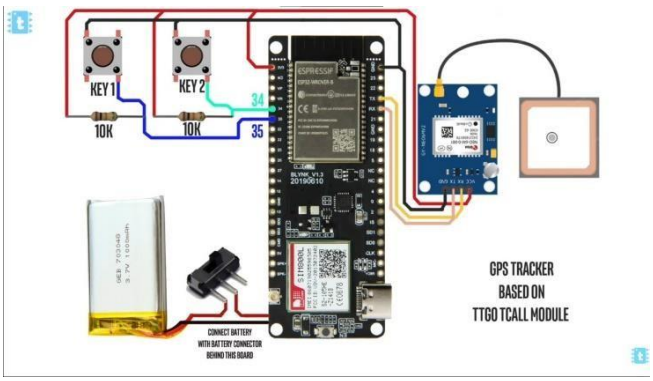

Fig.no. 10 Circuit diagrams of system

III. Results and Discussions

The most important part of our project is testing the prototype. At first, the connection of components with ESP32+SIM800L module and assembling all the components and fitting it into a compact size is very crucial. The size of the prototype is meant to be compact as the things it is going to track can be of different sizes as small as a key and as large as a vehicle. That's why we designed an outer case for our prototype as shown in the fig. no. After that we make the 3D printed outer case using 3D printing. Assembly of the prototype can be seen in the fig. no. 10.

Various test is taken for the proper working of prototype after the assembly of circuit is done. The most important amongst them is Accuracy Testing. It is done on the prototype especially for Neo-6M GPS Module. The test results can be seen in the GPS Accuracy Testing section.

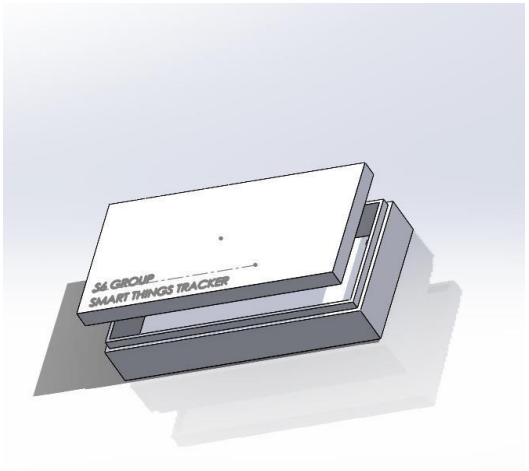

Fig No.10 3D Model of Outer Case for the Prototype

The presented prototype can track things and at the same time it can also provide security to child and women when needed. For this purpose, it can not only give the location co-ordinates of the prototype carried by the child/woman but also can give them the liberty of sending emergency message and make a direct call to the responsible person. The mobile number of the responsible person is inserted in the code. By using these two functions of the prototype we can make a call and send emergency message through push buttons as shown in the fig. no. 11 and fig. no. 12 The call and message take the response time nearly about 5 to 6 seconds to happen. This delay is caused due to server as the server take the time to ensure the proper and secure connectivity.

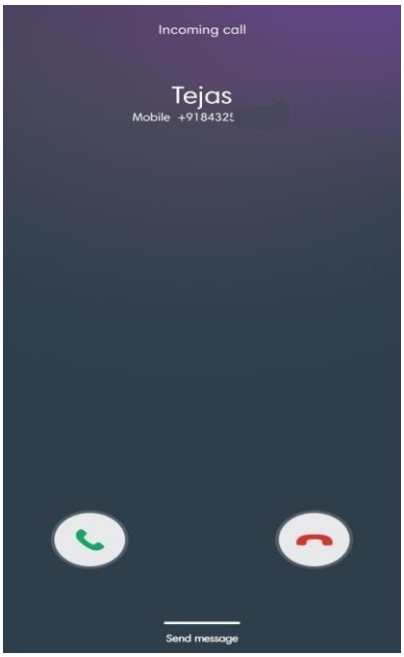

Fig. No. 11 Call made using Push Button 1

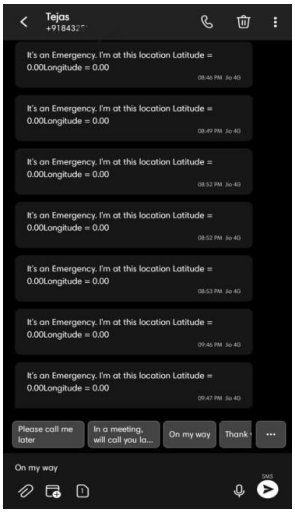

Fig. No. 12 Alert Message Sent using Push Button 2

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The continuous live-location of the prototype can be seen in the Blynk App at any given time. This is shown in the fig. no. and the location can be seen in the google map format.

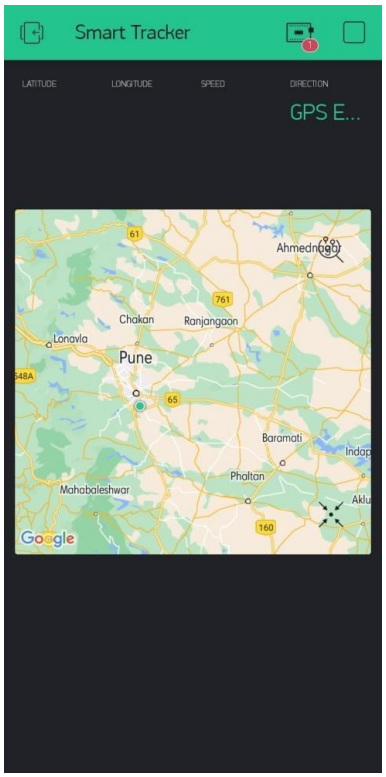

Fig. No.13 Location Co-ordinates of Device in Blynk App

GPS Accuracy Testing: The significant amount of time and energy is given to this section as the accuracy is the key player in our prototype. More the accuracy more the benefit of the proposed prototype. While doing the GPS accuracy testing, we came to know that the deviation in reading the location is around 10 – 15 m. [6] The prototype works well in open space so the accuracy is more however in the closed area the accuracy decreases.

We have done the GPS accuracy testing at SukhSagar Nagar Pune by keeping the prototype at 10 different locations. Then we take the readings from the prototype and compared it with the actual reading of Google Maps. The result of this test is shown in the table no. 1

Actual Point No.	Latitude	Longitude	Distance from the actual point
1	18.45573383204576	73.8694732802262	15.6
2	18.453888502093623	73.87069090973421	12.3
3	18.458238909819652	73.87445378206922	17.4
4	18.4644434854898	73.86821841152155	10.7
5	18.45812029967888	73.87447254232822	4.3
6	18.46340111918967	73.86523858206934	0.5
7	18.46595403780116	73.86436874363669	13.8
8	18.462677335679555	73.87367560264578	6.2
9	18.457546528092546	73.86929190888739	10.2
10	18.4553236255502	73.87352671784566	15.1
		Average=	105.9/10=10.59

Table No. 1 Result of GPS Accuracy Testing

IV.FUTURE SCOPE

In future the size of the prototype can be reduced using other modified components. The prototype can be made so compact that it can be fit in your wallet. Also, the cost of the proposed system can be reduced in future. The security can be increase in future for woman/ child by adding the feature of calling to nearest police station as well as the responsible person. The accuracy of the prototype can be enhanced using NAVIK navigation system of ISRO instead of the GPS of Google for better accuracy and reliability in India. ISRO is a government entity unlike the google which is private so the trust will be more.

IV. CONCLUSIONS

Smart Tracking Device will help for locating lost items using GPS technology. The device also consists of a Wi-Fi module, which makes wireless communication convenient. We performed the test by placing the device in many locations and it exactly gives the latitude and longitude of the object that we are tracking. This device will work without any problem due to the battery power supply.

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