Mini Project – Internet of Everything (ITL 702)

Geotag - Advanced Security Device with GPS Tracking

B. E. Information Technology

By

Harshil Parmar	**55**
Rovin Quadros	**56**
Pratham Gaonkar	**57**
Balin Menezes	**58**

Under Guidance of
Dr. Nitika Rai
Associate Professor

Department of Information Technology
St. Francis Institute of Technology
(Engineering College)

University of Mumbai

2023-2024

CERTIFICATE

This is to certify that the project entitled **"Geotag - Advanced Security Device with GPS Tracking"** is a bonafide work of **"Harshil Parmar, Rovin Quadros, Pratham Gaonkar and Balin Menezes" 55, 56, 57 and 58** submitted to the University of Mumbai towards completion of mini project work for the subject of Internet of Everything

(Dr. Nitika Rai)
Supervisor/Guide

(Dr. Prachi Raut)
HOD-IT

Examiners

1.--

2.--

Date:

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

--------------------------------------	--------------------------------------
Harshil Parmar	**Rovin Quadros**
--------------------------------------	--------------------------------------
Pratham Gaonkar	**Balin Menezes**

ABSTRACT

Safety devices are important due to their paramount role in safeguarding users by providing help under unprecedented situations. This concept introduces a cutting-edge Internet of Everything (IOE) initiative aimed at creating an all-encompassing device designed to enhance safety. It achieves this by continuously monitoring a user's location and promptly detecting the presence of smoke in the event of a fire. Ensuring public safety has emerged as a matter of utmost significance, underscored by the alarming statistic that every 40 seconds, an individual becomes unaccounted for. The device integrates a GPS module for precise location tracking to help users when under threat. The device is also equipped with a smoke detection sensor that is activated by the detection of smoke surpassing a predetermined threshold, which will help provide assistance in the event of a fire. The device addresses personal safety by providing the users a way to alert authorities by the press of a button. Gas leaks and fires are most perilous domestic and workplace hazards, the devices ability to detect these gasses and send alters helps prevent catastrophic accidents.

Contents

List of Figures

List of Tables

CHAPTER 1
INTRODUCTION

1.1 Introduction to domain/area

IoE stands for Internet of Everything which is a concept related to Internet of Things (IoT). IoT is the interconnection of physical devices embedded with sensors, software and network allowing them to collect and exchange data. IoE goes beyond and encompasses the interconnection of not just devices but also people, processes and data. In a nutshell, it stands for a more comprehensive approach to networking. The concept of IoE helps to connect smart devices, sensors, people and organizations to communicate and share information that improves efficiency, productivity and innovation. A new paradigm of safety and security has emerged due to the convergence of cutting-edge sensor technology, wireless connectivity, and data analytics. The IoE project at hand is the embodiment of this transformation – a sophisticated safety device that hopes to become a sentinel of security, orchestrated with careful planning and design. At its heart lies the Neo-6M GPS module, a device of unparalleled precision that will capture the coordinates of the user's location in real-time with an accuracy of less than 2 meters. The coordinates are then transmitted to the dashboard, from which notifications are promptly dispatched to the authorities. These notifications are integrated with the Google Maps API, offering a pinpointed location on a digital map increasing the efficiency of the project. The device goes beyond geographical coordinates, venturing into smoke detection with the inclusion of the MQ-2 gas sensor. The sensor's ability to discern gasses and smoke assumes the role of safeguarding against a wide spectrum of dangers. Additionally, a push-button is incorporated, enabling users to activate the device when needed. This project offers a practical solution for providing user safety and timely response to critical situations, contributing to overall safety standards. The push-button springs the NodeMCU ESP8266 into action, which operates as a digital nucleus. It processes an intricate tapestry of data and executes instructions efficiently. It acts as a data aggregator and data transmission hub. The Wi-Fi module acts as a conduit between the GPS module and the dashboard to ensure that coordinates are sent to the dashboard and the authorities. Simultaneously the NodeMCU ESP8266 connects the device to ThingSpeak which is an analytics platform that helps analyze the data that we receive from the sensor. The potential impact of this device on the lives of people especially parents, children and women is transformative. For parents it acts like an ever watchful guardian so they can track their children whenever the children are in need. For women's safety this device will be a beacon of empowerment, offering a tangible sense of security. The gas sensor adds an additional layer of protection for people of all ages. Exposure to smoke can lead to losing consciousness in such dreadful scenarios the device will be of utmost importance in protecting the users.

1.2 Motivation to take area

The driving force behind this IoE project stems from a fundamental desire to revolutionize safety and security in our rapidly evolving world. As technology continues to advance, we believe it is our responsibility to harness its power for the greater good. The convergence of cutting-edge sensor technology, wireless connectivity, and data analytics presents us with an unprecedented opportunity to make a profound impact on people's lives. We are motivated by the vision of a safer and more connected society, where individuals and their loved ones can enjoy a newfound peace of mind. For parents, this project represents the embodiment of an ever-watchful guardian, allowing them to track their children's whereabouts and well-being in real-time. It's a source of reassurance that transcends physical boundaries. Moreover, we are deeply committed to empowering women with a tangible sense of security. In an age where safety concerns persist, particularly for women, our device serves as a beacon of hope and empowerment. It's a tool that not only offers protection but also empowers individuals to take control of their own safety, knowing that help is just a button press away. The inclusion of the MQ-2 gas sensor is a testament to our dedication to safeguarding lives from a wide spectrum of dangers, including the threat of smoke and gas exposure. We are driven by the belief that every life is precious, and every effort we make in enhancing safety standards can have a significant and far-reaching impact.

CHAPTER 2
REVIEW OF LITERATURE

2.1 Summary of Literature Review

Authors	Paper	Methodology	Gap Analysis
Shaista Khanam, Trupti Shah	Self Defense Device with GSM alert and GPS tracking with fingerprint verification for women safety.	The project critiqued current women's security solutions, proposing a portable baton-shaped device that integrates a GSM/GPS module for location tracking.	It lacks real-time application examples and a comprehensive exploration of safety measures. It strongly emphasizes the necessity for proactive self-defense and advocates for a transformative approach to women's security.
Achmad Mustofa Luthfi, Nyoman Karna, Ratna Mayasari	Google Maps API Implementation On IOT Platform For Tracking an Object Using GPS.	The project harmonized NodeMCU with the Neo-6m GPS Module and DHT-11 temperature sensor while also exploring different IoT platforms.	It highlighted the intermediary role of IoT platforms and their significance in facilitating connections between devices. It also suggested the promising potential for expanding IoT functionality, opening up opportunities for further advancements in the field.
Shaik Mazhar Hussain, Shaikh Azeemuddin Nizamuddin, Rolito Asuncion, Chandrashekar Ramaiah, Ajay Vikram Singh	Prototype of an Intelligent System based on RFID and GPS Technologies for Women Safety.	The project showcased a comprehensive system that incorporated RFID, GPS, AT89C52 microcontroller, and GSM modules, and conducted an extensive literature review focusing on these technologies.	It encompasses cost constraints and signal interferences, which can impede the effectiveness of the system. Moreover, there is a concern about potential access by invalid and unauthenticated users, raising security issues. Furthermore, the state of database security is currently inadequate, adding to the overall vulnerabilities that need to be addressed.

I Kadek Nuary Trisnawan, Agung Nugroho Jati, Novera Istiqomah, Isro Wasisto	Detection of Gas Leaks Using The MQ-2 Gas Sensor on the Autonomous Mobile Sensor.	The project utilized LiDAR and MQ-2 gas sensors for gas leak detection, implemented SLAM navigation and calibration techniques, and assessed the accuracy of the detection system.	It has accuracy issues. Since it uses SLAM methodology, other methods of navigation and detection could provide different and inaccurate results.

2.2 Problem definition

To develop a geotag-enabled safety device with emergency alarm and messaging features to enhance personal safety, empower individuals in distress, and alert others to potential threats using Node MCU-ESP 8266, Neo-6M GPS and MQ-2 Gas Sensor.

CHAPTER 3

SYSTEM DESIGN

3.1 Block diagram and Circuit Diagram

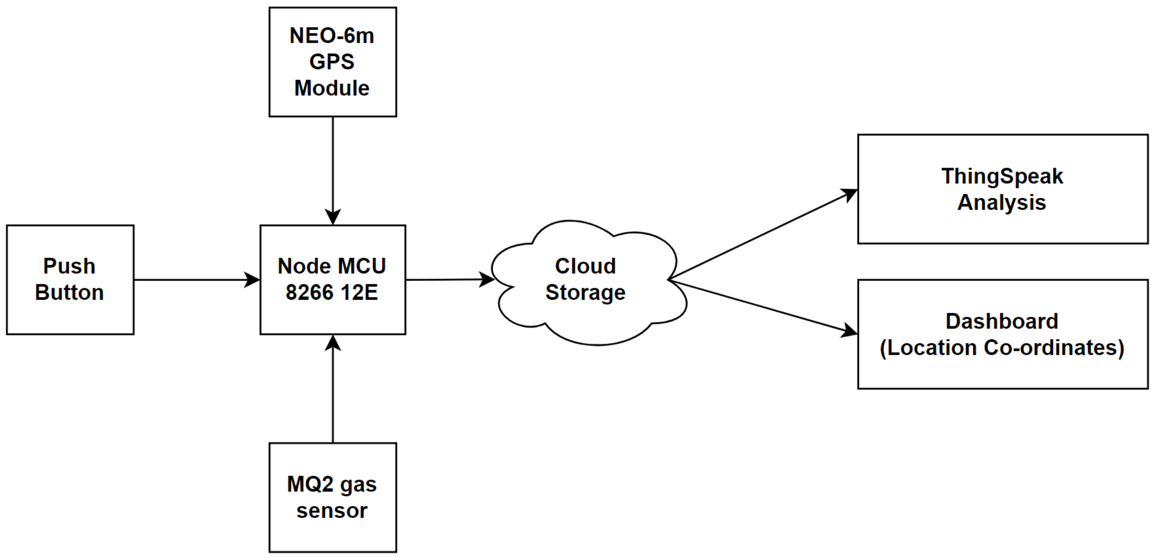

Fig 3.1: System Design

Fig 3.1 shows the system design. The device gets activated when the user presses the push button. This action triggers the device to send the gathered data from NEO 6M GPS Module and MQ2 Gas Sensor to ThingSpeak. This data transmission is possible due to the integrated WiFi module in the NodeMCU Esp8266. This process ensures that the device continuously shares real-time location data and gas sensor readings, which in turn enhances the user's safety. The device generates a web address, with the help of the serial monitor. This web address takes the viewer to a dynamic webpage enriched with user's real-time location data. The webpage has tabulated information such as latitude, longitude, date, and time. Of extreme significance is the clickable link that is provided under the table. This feature allows users and authorities alike to access an exact, pinpointed location of the user which is displayed on Google Maps.

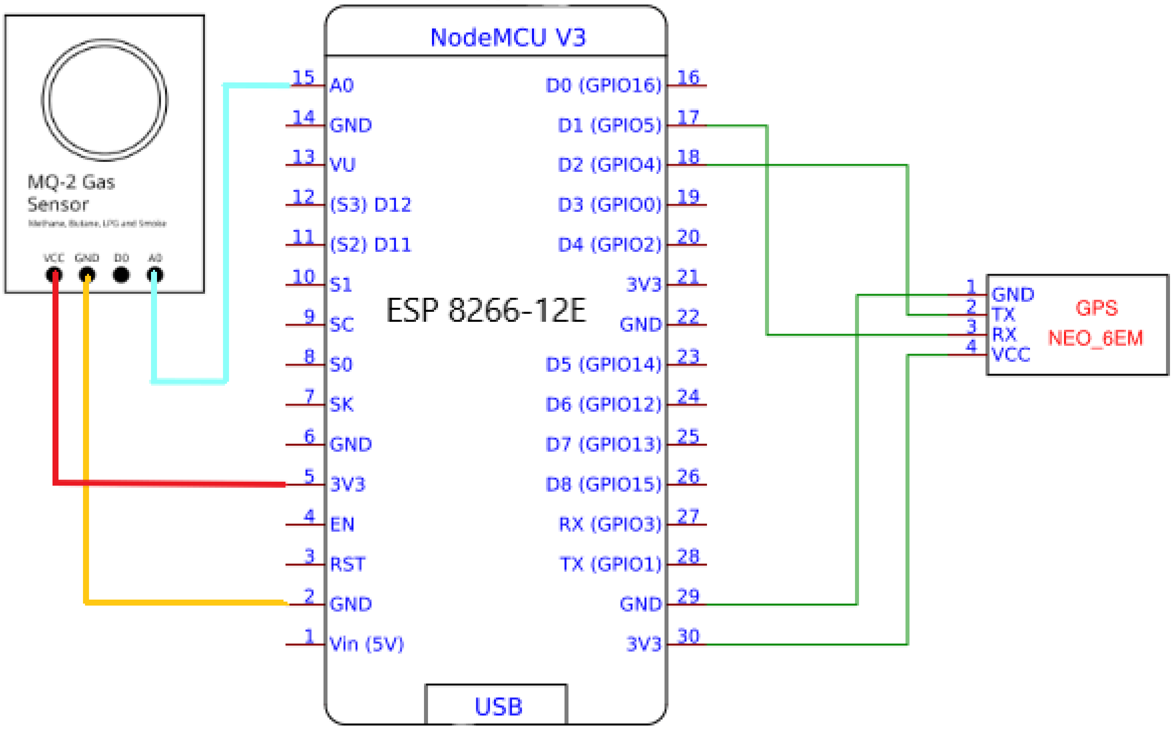

Fig 3.2: Circuit Diagram

Fig 3.2 shows the circuit diagram. The NEO-6M GPS module has 4 terminals which are connected with the ESP8266 NodeMCU. The VCC terminal is connected with the 3V3 pin of ESP 8266, the TX (transmitter) terminal and the RX (receiver) terminal of the GPS module with the GPIO pins. Software serial will be used for communicating between the two devices. Hence, we will set GPIO4 for TX and GPIO5 for RX in the program sketches and the Ground pin of the GPS module is connected to the ground pin of NodeMCU. Similarly, VCC pin of MQ-2 is connected to 3V3 pin of NodeMCU, GND pin of MQ-2 is connected to GND pin of NodeMCU and A0 pin of MQ-2 is connected to A0 pin of NodeMCU.

3.3 Hardware and software requirements

Software:

- Arduino IDE
- Google Maps

Hardware:

- NodeMCU ESP8266 Breakout Board
- Adafruit Ultimate GPS Breakout
- Pushbutton Switch, Momentary
- Fingerprint sensor
- Diode board
- Cables

3.4 Application areas of project

1. Personal Safety and Security: The IoE safety device can be used by individuals, especially women and children, to enhance their personal safety and security. It serves as a beacon of empowerment, providing a tangible sense of security and allowing users to send distress signals in critical situations.

2. Child Safety: Parents can use the device to track the whereabouts of their children and ensure their safety. It acts as a guardian, offering peace of mind to parents by allowing them to monitor their children when they are away from home.

3. Emergency Response: In the event of emergencies such as accidents, medical crises, or dangerous situations, users can activate the device to send their precise location to authorities. This ensures a timely and accurate response from emergency services.

4. Environmental Monitoring: The inclusion of the MQ-2 gas sensor allows the device to detect various gasses and smoke. This feature can be used for environmental monitoring, especially in areas prone to air pollution, industrial emissions, or potential gas leaks.

5. Elderly Care: The IoE safety device can also be beneficial for the elderly, providing them with a means to seek assistance in case of falls, health emergencies, or other safety concerns. It offers an added layer of protection for senior citizens.

6. Workplace Safety: Employees working in potentially hazardous environments can use the device to signal for help or report safety issues. It can contribute to improved workplace safety standards and emergency response.

7. Community Safety Initiatives: Communities and neighborhoods can implement these devices as part of their safety initiatives. It enables residents to collaborate on improving security and responding swiftly to incidents.

8. Disaster Management: During natural disasters or emergencies, the IoE safety device can play a crucial role in locating and assisting affected individuals. It aids in efficient disaster management and response efforts.

9. Educational Institutions: Schools and universities can distribute these devices to students and staff to enhance campus security. In case of threats or emergencies, users can activate the device to alert authorities.

CHAPTER 4
IMPLEMENTATION AND RESULTS

4.1 Flowchart

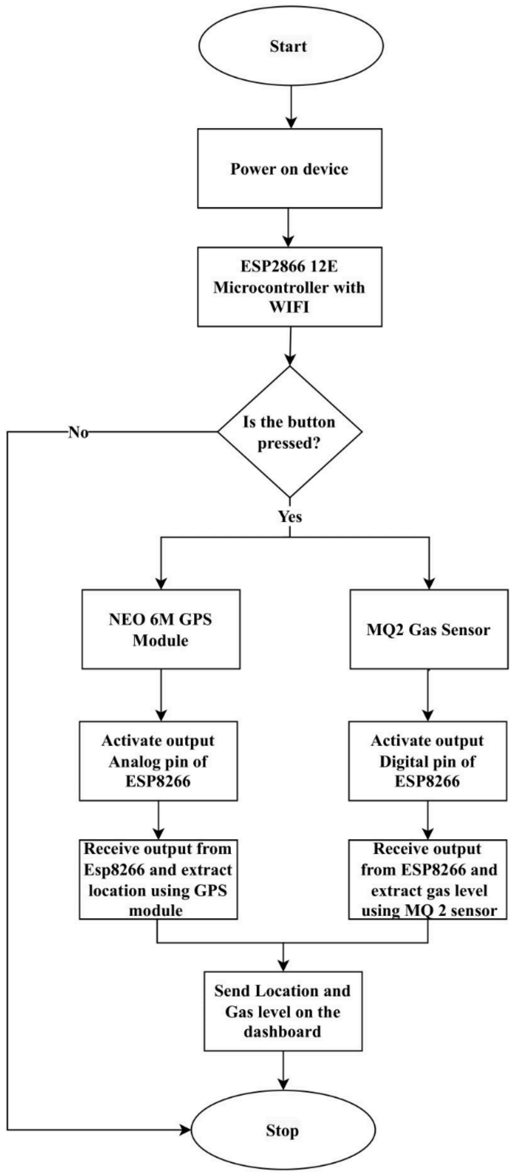

Fig 4.1 : Flowchart

4.2 Results

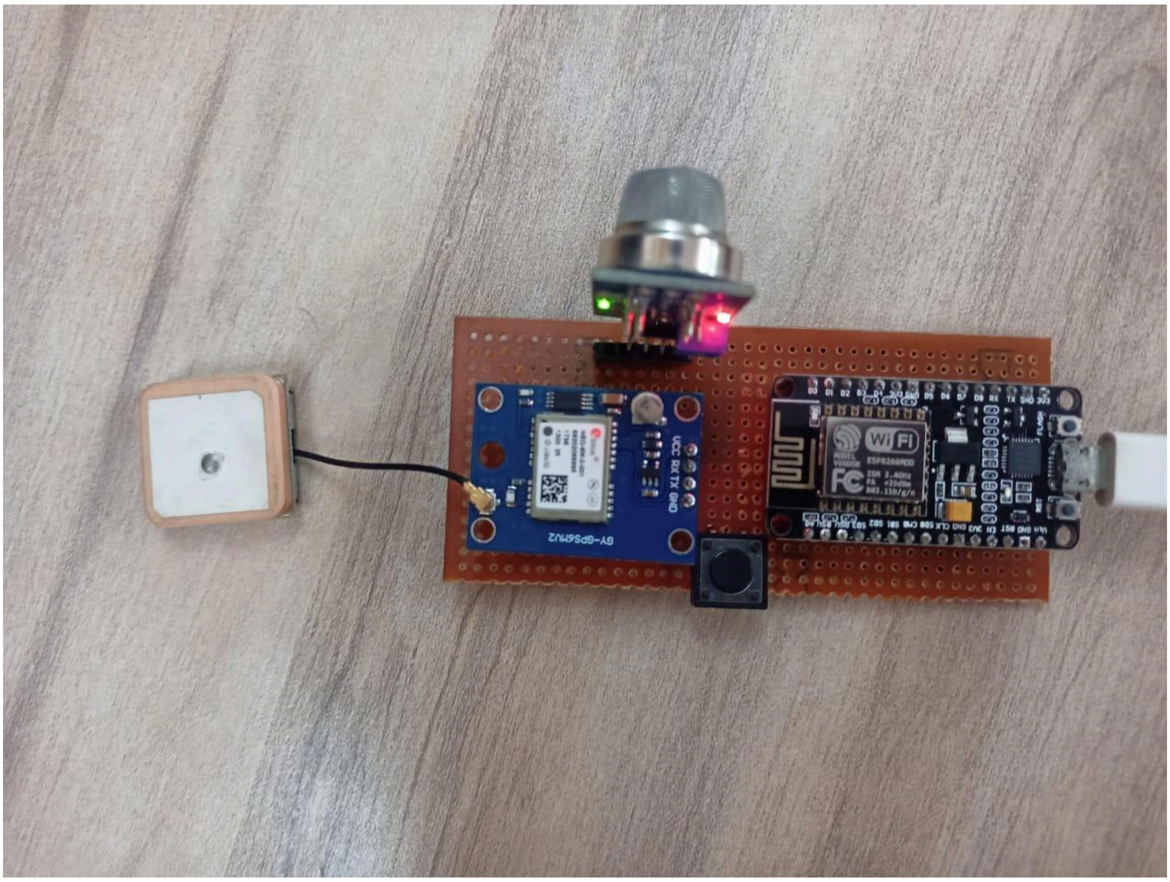

Fig. 4.2.1 : Physical Device

In Fig 4.2.1, the hardware components are connected with one another and are ready to send data.

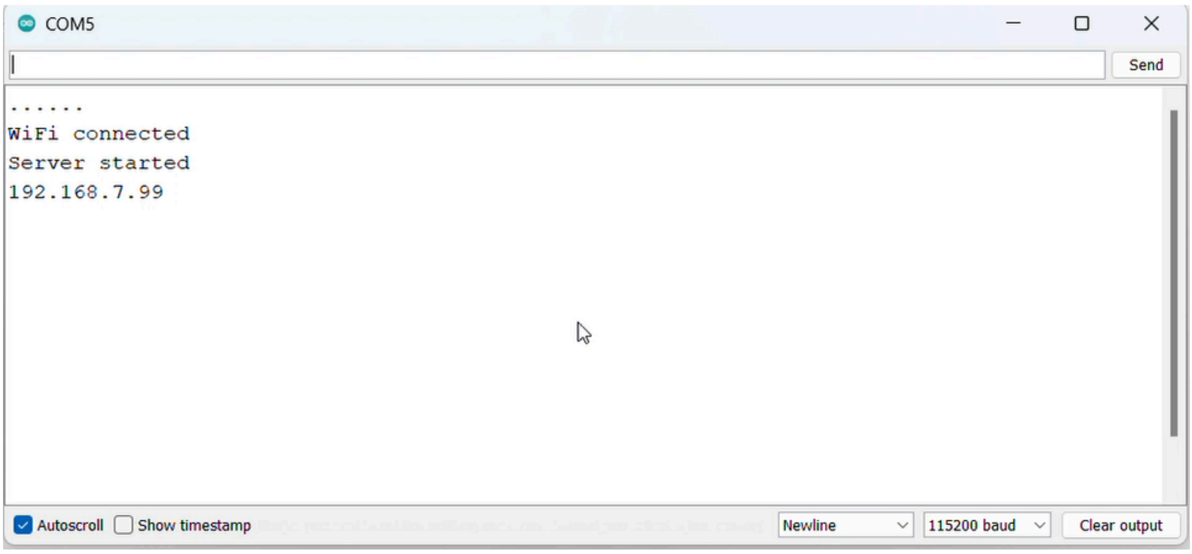

Fig 4.2.2: COMS panel

In Fig 4.2.2, after successfully compiling and uploading the code, an IP address is displayed on the serial monitor of the Arduino IDE.

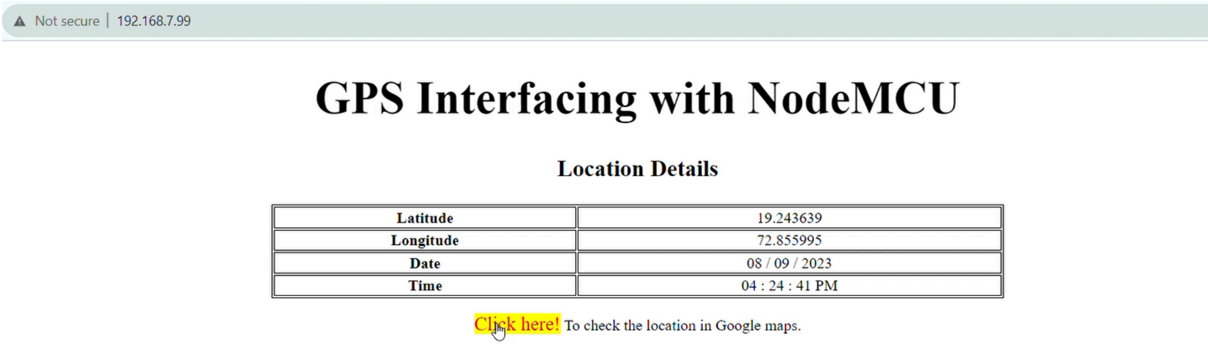

Fig 4.2.3: Web Page with location coordinates

In Fig 4.2.3, the IP address routes us to the website displaying the Latitude and Longitude coordinates.

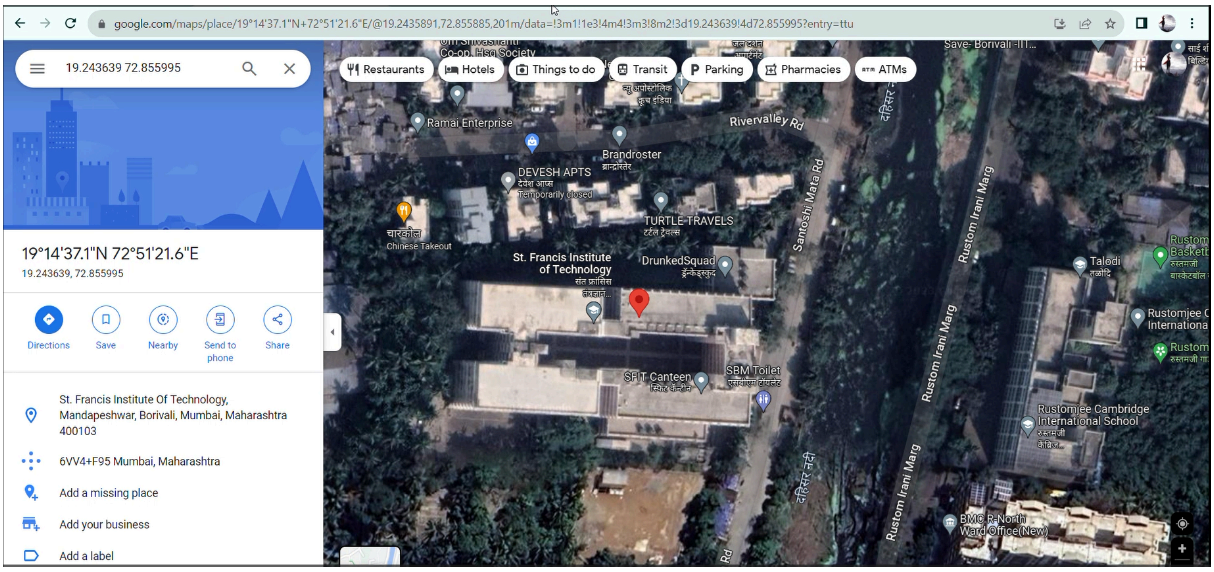

Fig 4.2.4: Pinpointed location on Google Maps

In Fig 4.2.4, the website is also integrated with Google Maps link which when clicked pinpoints the exact location on Google Maps.

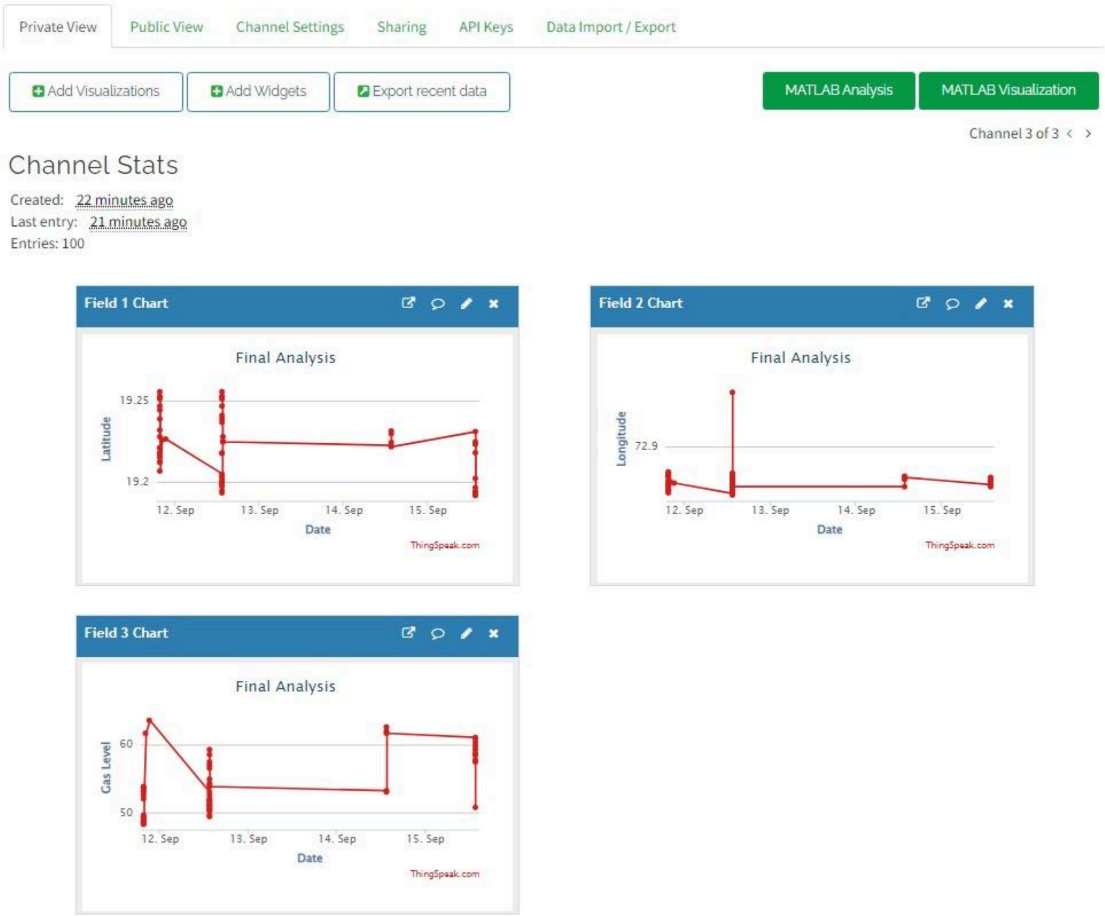

Fig 4.2.5: ThingSpeak Dashboard

In Fig 4.2.5, a new Channel is created on thingspeak for collecting, analyzing and visualizing the data from GPS module and gas sensor

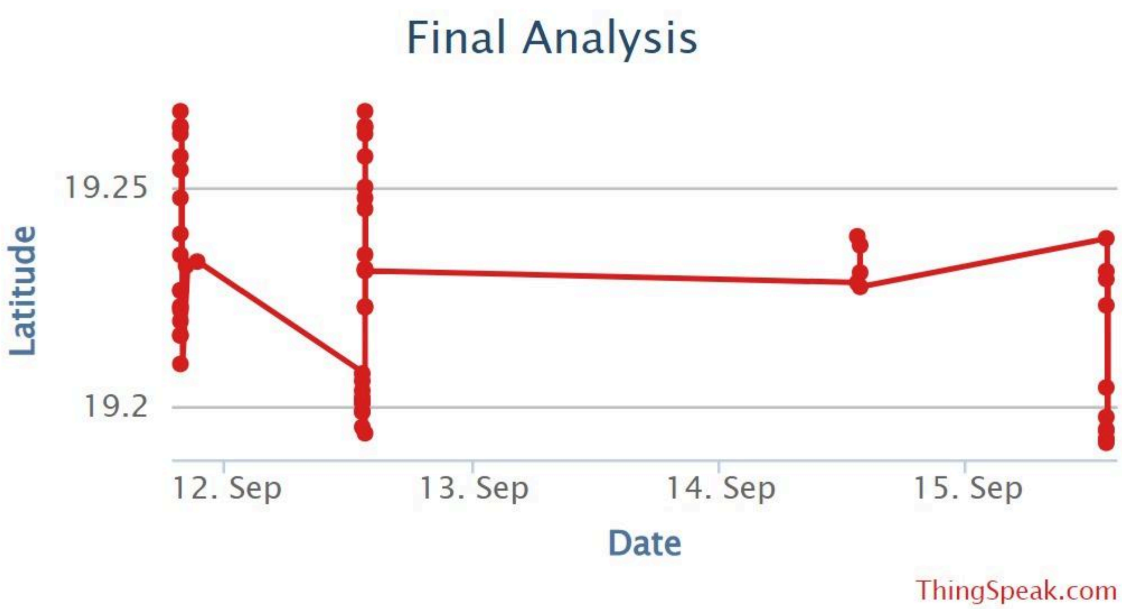

Fig 4.2.6: Graphical representation of Latitude with correspondence to Date

In Fig 4.2.6, Analysis and Visualization of Latitude coordinates with respect to Date is done on Thingspeak.

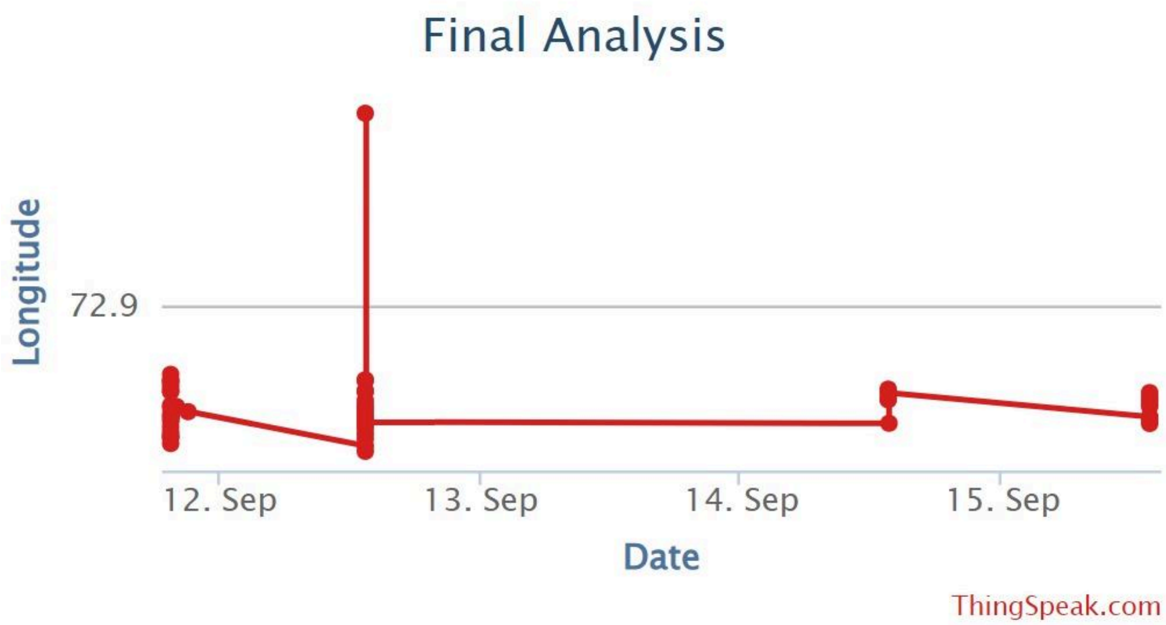

Fig 4.2.7: Graphical representation of Longitude with correspondence to Date

In Fig 4.2.7, Analysis and Visualization of Longitude coordinates with respect to Date is done on Thingspeak.

Fig 4.2.8: Graphical representation of Gas Level with correspondence to Date

In Fig 4.2.8, Analysis and Visualization of gas levels with respect to Date is done on Thingspeak.

4.3 Code

```
##include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include <ESP8266WiFi.h>

TinyGPSPlus gps;  // The TinyGPS++ object
SoftwareSerial ss(4, 5); // The serial connection to the GPS device

const char* ssid = "LAB-320";
const char* password = "lab320ap";

float latitude , longitude;
int year , month , date, hour , minute , second;
String date_str , time_str , lat_str , lng_str;
int pm;

WiFiServer server(80);

const char* writeAPIKey = "U8167Y7D8HL7RIKB";
const char* thingspeakServer = "api.thingspeak.com";

// WiFi settings for ThingSpeak
const char* ts_ssid = "LAB-320";
const char* ts_pass = "lab320ap";
const char* ts_server = "api.thingspeak.com";
WiFiClient ts_client;

void sendToThingSpeak(float lat, float lon, float gasLevel) {
  if (ts_client.connect(ts_server, 80)) {
      String ts_data = "api_key=" + String(writeAPIKey) + "&field1=" + String(lat, 6) +
"&field2=" + String(lon, 6) + "&field3=" + String(gasLevel);
    ts_client.println("POST /update HTTP/1.1");
    ts_client.println("Host: api.thingspeak.com");
    ts_client.println("Connection: close");
    ts_client.println("X-THINGSPEAKAPIKEY: " + String(writeAPIKey));
    ts_client.println("Content-Type: application/x-www-form-urlencoded");
    ts_client.println("Content-Length: " + String(ts_data.length()));
    ts_client.println();
    ts_client.println(ts_data);
    ts_client.println();
    delay(1000);
    ts_client.stop();
    Serial.println("Data sent to ThingSpeak: " + ts_data);
  } else {
    Serial.println("Connection to ThingSpeak failed");
```

```
  }
  delay(15000); // Send data to ThingSpeak every 15 seconds (ThingSpeak limit)
}

void setup() {
  Serial.begin(115200);
  ss.begin(9600);
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  server.begin();
  Serial.println("Server started");
  Serial.println(WiFi.localIP());
}

void loop() {
  while (ss.available() > 0) {
    if (gps.encode(ss.read())) {
      if (gps.location.isValid()) {
        latitude = gps.location.lat();
        lat_str = String(latitude , 6);
        longitude = gps.location.lng();
        lng_str = String(longitude , 6);
      }

      if (gps.date.isValid()) {
        date_str = "";
        date = gps.date.day();
        month = gps.date.month();
        year = gps.date.year();

        if (date < 10)
          date_str = '0';
        date_str += String(date);
        date_str += " / ";

        if (month < 10)
          date_str += '0';
        date_str += String(month);
        date_str += " / ";

        if (year < 10)
          date_str += '0';
        date_str += String(year);
```

```
    }

    if (gps.time.isValid()) {
      time_str = "";
      hour = gps.time.hour();
      minute = gps.time.minute();
      second = gps.time.second();
      minute = (minute + 30);

      if (minute > 59) {
        minute = minute - 60;
        hour = hour + 1;
      }

      hour = (hour + 5) ;

      if (hour > 23)
        hour = hour - 24;

      if (hour >= 12)
        pm = 1;
      else
        pm = 0;

      hour = hour % 12;

      if (hour < 10)
        time_str = '0';
      time_str += String(hour);
      time_str += " : ";

      if (minute < 10)
        time_str += '0';
      time_str += String(minute);
      time_str += " : ";

      if (second < 10)
        time_str += '0';
      time_str += String(second);

      if (pm == 1)
        time_str += " PM ";
      else
        time_str += " AM ";
    }
  }
}

// Read gas level
float gasLevel = analogRead(A0) / 1023.0 * 100.0;

// Send data to ThingSpeak
```

```
  sendToThingSpeak(latitude, longitude, gasLevel);

  // Check if a client has connected
  WiFiClient client = server.available();
  if (!client) {
    return;
  }

  // Prepare the response
    String s = "HTTP/1.1 200 OK\r\nContent-Type: text/html\r\n\r\n <!DOCTYPE html>
<html> <head> <title>GPS Interfacing with NodeMCU</title> <style>";
  s += "a:link {background-color: YELLOW;text-decoration: none;}";
  s += "table, th, td {border: 1px solid black;} </style> </head> <body> <h1  style=";
  s += "font-size:300%;";
  s += " ALIGN=CENTER> GPS Interfacing with NodeMCU</h1>";
  s += "<p ALIGN=CENTER style=""font-size:150%;""";
  s += "> <b>Location Details</b></p> <table ALIGN=CENTER style=";
  s += "width:50%";
  s += "> <tr> <th>Latitude</th>";
  s += "<td ALIGN=CENTER >";
  s += lat_str;
  s += "</td> </tr> <tr> <th>Longitude</th> <td ALIGN=CENTER >";
  s += lng_str;
  s += "</td> </tr> <tr>  <th>Date</th> <td ALIGN=CENTER >";
  s += date_str;
  s += "</td></tr> <tr> <th>Time</th> <td ALIGN=CENTER >";
  s += time_str;
  s += "</td>  </tr> </table> ";

  if (gps.location.isValid()) {
          s += "<p align=center><a style=""color:RED;font-size:125%;""
href=""http://maps.google.com/maps?&z=15&mrt=yp&t=k&q=";
    s += lat_str;
    s += "+";
    s += lng_str;
    s += """ target=""_top"">Click here!</a> To check the location in Google maps.</p>";
  }

  s += "</body> </html> \n";
  client.print(s);
  delay(100);
}
```

CHAPTER 5
CONCLUSION

Internet of Everything (IoE) represents a significant shift in networking, offering a comprehensive approach to connectivity. The discussed IoE project showcases the transformative potential of advanced sensor technology, wireless connectivity, and data analytics in enhancing safety and security.

This project, centered on a sophisticated safety device equipped with precision GPS tracking and a gas sensor, aims to provide practical solutions for critical situations. It has the potential to empower parents to track their children, enhance women's safety, and protect people of all ages from various dangers, including smoke exposure. In summary, the IoE project embodies the promise of technology to improve safety standards and offers a proactive approach to security. It signifies the evolution of safety solutions in an interconnected world, bringing us closer to a safer and more empowered future.

CHAPTER 6
REFERENCES

[1] S. Khanam and T. Shah, "Self Defence Device with GSM alert and GPS tracking with fingerprint verification for women safety," 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2019, pp. 804-808, doi: 10.1109/ICECA.2019.8822114.

[2] A. M. Luthfi, N. Karna and R. Mayasari, "Google Maps API Implementation On IOT Platform For Tracking an Object Using GPS," 2019 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob), Bali, Indonesia, 2019, pp. 126-131, doi: 10.1109/APWiMob48441.2019.8964139.

[3] S. M. Hussain, S. A. Nizamuddin, R. Asuncion, C. Ramaiah and A. V. Singh, "Prototype of an intelligent system based on RFID and GPS technologies for women safety," 2016 5th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India, 2016, pp. 387-390, doi: 10.1109/ICRITO.2016.7784986.

[4] I. K. N. Trisnawan, A. N. Jati, N. Istiqomah and I. Wasisto, "Detection of Gas Leaks Using The MQ-2 Gas Sensor on the Autonomous Mobile Sensor," 2019 International Conference on Computer, Control, Informatics and its Applications (IC3INA), Tangerang, Indonesia, 2019, pp. 177-180, doi: 10.1109/IC3INA48034.2019.8949597.