GPS Tracking System

IoT PROJECT REPORT

Submitted in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

(Department of Information Technology)

Submitted to

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY BHOPAL (M.P.)

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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY BHOPAL (M.P.)

CERTIFICATE

This is to certify that the work embodied in this report entitled **"GPS Tracking System"** has been satisfactorily completed by **Jagruti Madavi (21U03005), Aastha Dhurwey (21U03056), Geetika Bheel (21U03058)** and **Yash Shejwal (21U03063)**. It is a bonafide piece of work, carried out under our guidance in the **Department of Information Technology**, **Indian Institute of Information Technology, Bhopal** for the partial fulfillment of the Bachelor of Engineering during the academic year 2023-24.

Date: 29th April 2024

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DECLARATION

We hereby declare that the following major project synopsis entitled "GPS Tracking System" presented in the is the partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology in** Information Technology. It is an authentic documentation of our original work carried out under the able guidance of **Dr. Vijay Bhaskar**. The work has been carried out entirely at the Indian Institute of Information Technology, Bhopal. The project work presented has not been submitted in part or whole to award of any degree or professional diploma in any other institute or organization.

We, with this, declare that the facts mentioned above are true to the best of our knowledge. In case of any unlikely discrepancy that may occur, we will be the ones to take responsibility.

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AREA OF WORK

This project encompasses several key areas. Firstly, the design and development of a cost-effective, space-efficient, and secure GPS tracking system that can be integrated into various industries and scenarios is a primary focus. This involves utilizing GPS and GSM technologies to provide real-time location data, speed tracking, and geo-fencing capabilities.

In addition, the project will adapt the GPS tracking system for use in fleet management and logistics, enabling companies to track their vehicles in real-time, reducing the risk of theft and improving delivery times. The system will also provide valuable insights into driver behavior, allowing companies to identify areas for improvement and increase productivity.

Furthermore, the project will explore the potential of the GPS tracking system to make a significant impact on women's safety, providing them with a personalized and proactive tool for self-defense in times of distress. This will involve developing a system that allows women to send emergency alerts and location data to designated contacts, ensuring timely assistance and support.

The project will also involve thorough testing and evaluation of the GPS tracking system to ensure its reliability, accuracy, and efficiency. This will identify areas for improvement and optimize the system's performance. Finally, the project will plan and execute the implementation and deployment of the GPS tracking system in various industries and scenarios, ensuring seamless integration with existing systems and infrastructure.

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INTRODUCTION

This project aims to design and develop a cost-effective, space-efficient, and secure GPS tracking system that can be seamlessly integrated into various industries and scenarios. The system will utilize GPS and GSM technologies to provide real-time location data, speed tracking, and geo-fencing capabilities. This will enable businesses and individuals to optimize routes, reduce fuel consumption, and improve response times. By doing so, our system will increase operational efficiency and reduce costs.

The system's versatility allows it to be adapted for use in a wide range of applications, from fleet management and logistics to security and surveillance. In the context of fleet management, our system will enable companies to track their vehicles in real-time, reducing the risk of theft and improving delivery times. Additionally, our system will provide valuable insights into driver behavior, allowing companies to identify areas for improvement. This will lead to increased productivity and reduced costs.

Moreover, our GPS tracking system has the potential to make a significant impact on women's safety, providing them with a personalized and proactive tool for self-defense in times of distress. The device will allow women to send emergency alerts and location data to designated contacts, ensuring timely assistance and support. This will provide women with a sense of security and independence, empowering them to live their lives without fear.

This research aims to explore the design, development, and implementation of a GPS tracking system that can be applied to various contexts, including vehicle management and women's safety. We will examine the benefits and challenges associated with GPS tracking technology, identifying areas for improvement and opportunities for innovation. By doing so, we hope to contribute to the development of innovative solutions that address pressing social and economic concerns.

Through this project, we hope to demonstrate the potential of GPS tracking technology to transform industries and improve lives. We believe that our system has the potential to make a significant impact, and we are excited to explore its possibilities. By pushing the boundaries of what is possible with GPS tracking technology, we hope to create a better future for all.

LITERATURE REVIEW

The literature review reveals a significant body of research and development efforts in the field of personal safety and security technologies, particularly in the context of sexual assaults and kidnappings. The alarming rates of violence against women and children, which have serious effects on their physical and mental health as well as their general quality of life, are the driving force behind these efforts. The proposed device, which incorporates a microcontroller, GSM, and GPS module, facilitates real-time location tracking and emergency notifications, empowering women and children to communicate their current location and alert emergency contacts in case of danger.

The integration of GPS and GSM technologies in safety devices for women and children is crucial, as highlighted by the literature. The use of a microcontroller, such as the ESP32, is essential for processing data from the GPS and GSM modules, enabling the device to send location updates and alerts to emergency contacts. The inclusion of a button and touch sensor further enhances the device's functionality, allowing for immediate activation in emergency situations.

In addition to personal safety, vehicle tracking systems have become increasingly important, addressing fleet management, individual safety, and logistical issues. These systems utilize GPS technology in conjunction with either General Packet Radio Service (GPRS) or General System for Mobile Communications (GSM) to provide real-time location data. Current studies have focused on developing affordable and intuitive solutions to improve the use and accessibility of vehicle tracking for consumers and businesses.

The implementation of vehicle tracking systems has resulted in major transformations in various businesses, particularly in the field of public transportation. For example, the combination of GPS and GSM technologies in bus monitoring and management systems has led to increased operational efficiency, reduced waiting times, and increased passenger satisfaction. These systems are also used in supply chain management, providing instantaneous information about the location and state of cargo shipments and fleets of vehicles.

Several research studies have employed the GPS and GSM concepts for vehicle tracking, using a variety of approaches. For instance, Dinesh et al. addressed different methods of tracking transportation systems, highlighting the importance of navigation for both drivers and passengers. Sandeep et al. proposed a system to send updates to particular individuals via SMS and display bus location information at bus stops, using GPS devices to set up a centralized monitoring system. Kunal et al. created an affordable car tracking system for both owner and third-party use, continuously tracking and transmitting the position of the vehicle using a microcontroller interfaced with GPS and GSM modules.

Mashood Mukhtar focused on remote vehicle location and control, underscoring the significance of security and tracking systems in day-to-day living. Supriya et al. sought to develop a low-cost positioning system for fleet operators using GPS-GPRS technology. Mohammad et al. covered the use of IoT to improve efficiency, particularly in university campus vehicle monitoring systems, using GPS and ESP32 modules to calculate location and arrival times, and broadcasting the data to users through social media sites such as Google Earth.

In conclusion, the literature survey underscores the critical role of technology in addressing the safety concerns of women and children, as well as the importance of vehicle tracking systems in various industries. The proposed device, with its integration of GPS, GSM, and microcontroller technologies, represents a significant advancement in the field of personal safety and security, providing real-time location tracking and emergency alert capabilities to empower women and children with the tools necessary to protect themselves and ensure their safety in an increasingly unsafe world.

PROPOSED METHODOLOGY AND WORK DESCRIPTION

We've developed a budget-friendly and effective vehicle tracking system that can be managed via a smartphone (through Blynl app), employing GPS, GSM technology, and ESP 32 as the microcontroller. This system emphasizes affordability, space efficiency, and safety. The core components include the SIM808-GPS & GSM shield with an integrated antenna, operating within a specified frequency range and voltage requirements, ensuring precise location tracking.

Here's how the system operates: upon receiving an initialization message from the user via the GSM module, the ESP 32 processes the request and establishes serial communication on designated pins. If the GPS module detects a signal, the system retrieves the vehicle's coordinates and promptly sends this data to the user through Alert generated by Blynk App, along with a convenient Google Maps Coordinates (latitude and longitude) for visual tracking of the vehicle's real-time location.

Continuously monitoring the vehicle's movements, the system provides real-time status updates as per user requests. In instances where the GPS module faces signal issues, the system notifies the user to wait until a stable GPS connection is established.

Our cost estimation highlights the system's affordability, while accuracy metrics showcase its ability to deliver precise location information. The GSM module enables seamless communication, allowing users to request location updates and receive comprehensive SMS notifications containing location coordinates of Google Maps .

In summary, our system offers a reliable, user-friendly, and cost-effective solution for vehicle tracking, ensuring users have easy access to accurate location data and stay informed about their vehicle's whereabouts at all times.

EQUIPMENTS USED

1. **SIM808 GPS and GSM Module:**

- It is a module combining GPS and GSM functionalities, featuring integrated circuitry for satellite positioning and cellular communication.
- It Provides GPS location data acquisition, GSM network connectivity for data transmission, and SMS capabilities for communication.
- It Receives GPS signals, calculates coordinates, communicates with mobile networks via GSM, and facilitates the transfer of location data to remote servers for tracking purposes.

2. **ESP 32 Micro-controller:**

- The ESP32 microcontroller is a vital component that processes data and enables internet connectivity, allowing the device to send and receive information.
- By combining the ESP32 with other components, features such as real-time location tracking, fall detection, and emergency alarm sending can be enabled, increasing the device's safety and usefulness for women.
- To build a comprehensive IoT-based women's safety device, the ESP32 must be integrated with additional components, including sensors, a battery, a protective casing, and possibly other features like audio recording or emergency buttons.

3. **GPS Antenna:**

- A specialized antenna designed to receive signals from GPS satellites, allowing the system to determine the device's precise location.
- It captures satellite signals containing location and timing data, which are processed by the SIM808 module to derive GPS coordinates.
- It enables accurate positioning and tracking of vehicles by receiving and decoding GPS signals, essential for real-time location monitoring.

4. **GSM Antenna:**

- An antenna designed for GSM (Global System for Mobile Communications) signals, used for cellular communication and data transmission.
- It receives and transmits GSM signals, including SMS messages and data packets, for communication with mobile networks.
- It Enables the GPS tracking system to communicate with remote servers, transmit location data, and receive commands or alerts via cellular networks.

5. **Power Source:**

- A rechargeable battery or power source that provides electrical energy to the entire tracking system, ensuring continuous operation.
- It Powers the SIM808 module, and associated peripherals such as GPS and GSM antennas without relying on external power supplies.
- A battery charger is essential to the design of an IoT-powered women's safety gadget since it guarantees dependability and continued operation.
- It Sustains the functionality of the GPS tracking system in vehicles, offering mobility and independence from fixed power sources during operation.

6. **RS232 to USB Connector:**

- It is used to interface the SIM808 GPS and GSM module with the ESP 32 microcontroller, facilitating serial communication.
- It Converts the RS232 serial signals from the SIM808 module to USB signals compatible with the ESP 32.
- It Enables data transmission and reception between the SIM808 module and ESP 32 for GPS and GSM functionalities.

7. **Type A to USB Cable:**

- A Type A to USB Cable is used to connect the microcontroller (such as ESP32) to a computer for programming and debugging.
- It enables the transfer of data and power between the device and the computer, allowing for easy software updates and testing.
- The cable is a necessary tool for developers to upload code, test, and iterate on the device's functionality, ensuring a reliable and efficient women's safety solution.

8. **Jumper Wires:**

- These are small wires with connectors at each end used to establish electrical connections between components on a breadboard or circuit.
- It Facilitates the connection of various pins and modules within the GPS tracking system, ensuring proper communication and power supply.
- It Links the SIM808 module, ESP 32, GPS antenna, GSM antenna, and other components as per the circuit design, forming a functional tracking system.

9. **Breadboard:**

- A breadboard is a fundamental tool for connecting and developing electronic components in an IoT-based women's safety gadget, allowing for easy testing and experimentation with circuits.
- It enables the simple integration and reconfiguration of components such as sensors, LEDs, buttons, and the microcontroller to optimize the device's functionality and ergonomics.
- The breadboard's simplicity and versatility make it an essential tool in the iterative process of creating a reliable and user-friendly women's safety solution.

10. **Blynk App:**

- Blynk is a popular IoT platform that allows users to control hardware remotely using a mobile app.
- Blynk supports a variety of hardware platforms and microcontrollers, including Arduino, Raspberry Pi, ESP8266, ESP32, and more. This compatibility makes it versatile for different IoT projects.
- Users can set up notifications based on sensor data or specific events. This feature is useful for receiving alerts or notifications on your mobile device**.**
- Blynk prioritizes security by using secure communication protocols and encryption methods to protect user data and device interactions.

Each component plays a crucial role in the overall functionality of the GPS tracking system, contributing to accurate positioning, reliable communication, and autonomous operation in vehicles.

FLOW CHART

Figure 1 is the flowchart that illustrates the logic and decision-making process of the GPS tracking system. The system initializes the ESP 32 and peripherals, reads GPS data, processes the data, and sends it to a remote server or mobile device via GSM. The system also receives commands from the remote server or mobile device and performs actions based on those commands. The flowchart shows the sequence of events and decision-making processes involved in the system's operation.

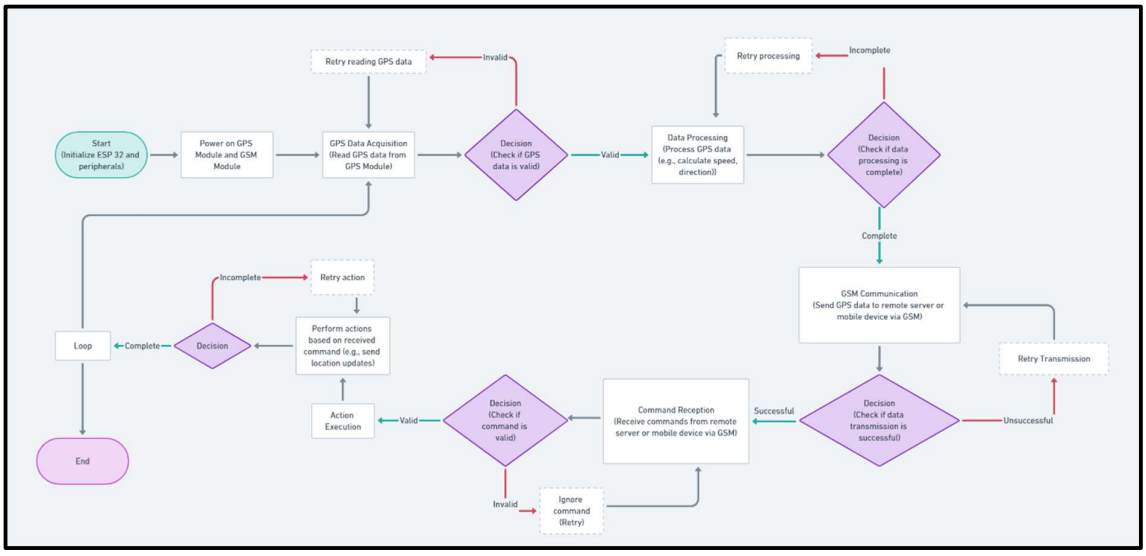
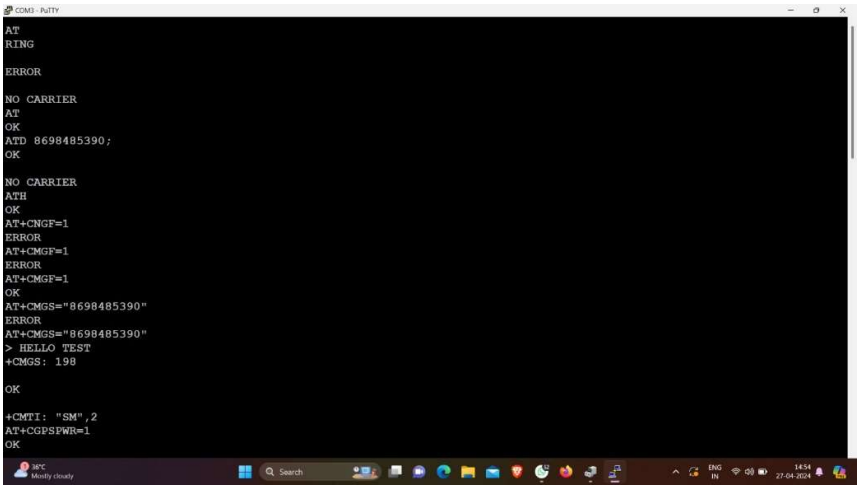
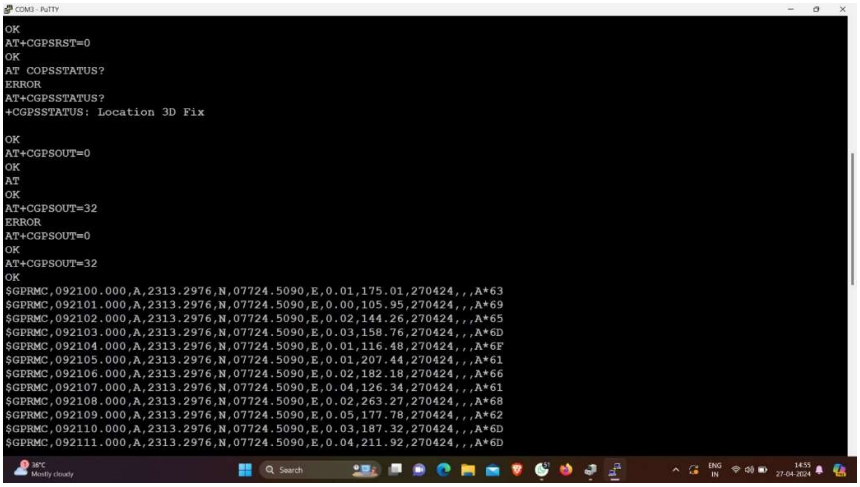


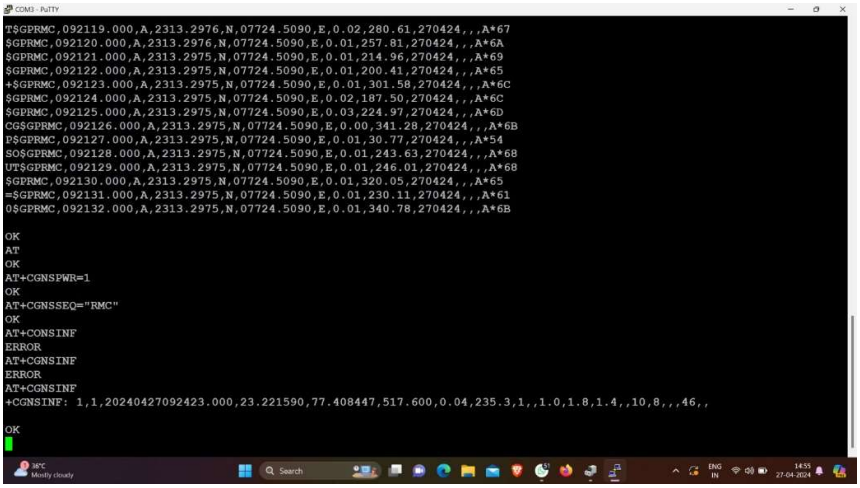
Fig. 1: Flow chart of GPS Tracking system

CODE AND SIMULATION

PUTTY Terminal Commands and Responses:







IDE Code:

```
#define BLYNK_TEMPLATE_ID "TMPL3WksliEvY"
#define BLYNK_TEMPLATE_NAME "message sender"
#define BLYNK_AUTH_TOKEN "ZZfb3O0mTcGpyXdLfEOnJLzZsJBdbWzD"
#define BLYNK_PRINT Serial

#include <WiFi.h>
#include <BlynkSimpleEsp32.h>
#include <TinyGPS++.h>
#include <BlynkWidgets.h> // Include Blynk button widget

char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "9179493035";
char pass[] = "987654321";

// Define the pin connected to the LED
const int ledPin = 2; // Change this to the GPIO pin connected to your LED

// Define GPS serial port
HardwareSerial gpsSerial(1);

// Create a TinyGPS++ object
TinyGPSPlus gps;

void setup() {
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);

  pinMode(ledPin, OUTPUT); // Set the LED pin as an output

  // Initialize GPS serial port
  gpsSerial.begin(9600, SERIAL_8N1, 16, 17); // TX pin: GPIO 16, RX pin: GPIO 17
}

void loop() {
  Blynk.run();
  readGPSData();
}

// Function to read GPS data
void readGPSData() {
  while (gpsSerial.available() > 0) {
    if (gps.encode(gpsSerial.read())) {
```

```
      if (gps.location.isValid()) {
        // Send GPS data to Blynk app
        Blynk.virtualWrite(V1, gps.location.lat(), gps.location.lng());
      }
    }
  }
}

// Function to handle virtual pin writes (LED control)
BLYNK_WRITE(V0) {
  int buttonState = param.asInt(); // Read the state from the Blynk app (0 or 1)

  if (buttonState == HIGH) {
    // Button is pressed, send location
    sendLocation();
  }
}

// Function to send location via SMS or other method
void sendLocation() {
  if (gps.location.isValid()) {
    // Retrieve latitude and longitude
    float latitude = gps.location.lat();
    float longitude = gps.location.lng();

    // Format the location information
    String locationMsg = "Latitude: " + String(latitude, 6) + ", Longitude: " + String(longitude,
6);



    // Send the location message via SMS using Blynk's notification feature
    Blynk.notify("Location: " + locationMsg );

    // Print debug information to Serial Monitor
    Serial.println("Location sent:");
    Serial.println(locationMsg);

  } else {
    Serial.println("Invalid GPS location, unable to send location.");
  }
}
```

APPLICATION

Utilizing GPS and GSM technologies, the SIM808 vehicle tracking system provides many applications for managing and monitoring vehicles, including:

1. **Fleet Management**: Companies that own or operate a fleet of vehicles, like transportation providers or delivery services, can use the SIM808 system to track the location of every vehicle in their fleet in real time. This makes it possible to schedule more effectively, optimize routes more effectively, and increase overall efficiency.

2. **Theft Prevention**: If a car is moved without permission, the system can prevent theft by sending out immediate alerts. Notifications can be sent by SMS or other methods to owners or authorities, allowing for quick action to recover stolen vehicles.

3. **Remote Monitoring**: The SIM808 system allows vehicle owners or managers to remotely monitor a number of parameters, including speed, fuel level, and engine status. Identification of problems like excessive speeding or unapproved vehicle use can be aided by this information.

4. **Emergency Assistance**: Drivers and passengers can utilize the system to transmit distress signals and their exact location in the event of an emergency. For prompt action in circumstances such as accidents or medical emergencies, this feature is priceless.

5. **Asset Tracking**: The SIM808 system can be modified to track other important assets, such as construction equipment, trailers, or rental cars, in addition to automobiles. This lessens the chance of asset loss or improper use.

6. **Maintenance Scheduling**: Maintenance schedules can be optimized by keeping an eye on vehicle usage and performance data gathered by the SIM808 system. Based on engine hours or miles, alerts can be configured to notify fleet managers or owners of impending maintenance requirements.

7. **Insurance Premium Reduction**: If a car has a GPS-based tracking system installed, several insurance companies will reduce your premium. The SIM808 system's implementation may result in lower insurance costs for car owners.

8. **Driver Behavior Monitoring**: Metrics related to rapid braking, sudden acceleration, and cornering can be monitored and analyzed by the system. By using this data, drivers may receive feedback, safety can be increased, and fuel consumption can be decreased.

All things considered, the SIM808 vehicle tracking system has flexible applications that can improve security, efficiency, and operational performance for a range of customers and industries.

RESULT AND DISCUSSION

The development of an IoT-based system with GPS tracking has resulted in a functional prototype that integrates various components, including GPS modules, microcontrollers, and communication modules. The system is capable of tracking location in real-time, sending location data to a remote server, and enabling remote monitoring and tracking. The prototype has been tested and validated, demonstrating its potential to provide a reliable and efficient tracking solution.

The development of an IoT-based system with GPS tracking highlights the potential of IoT technology in various applications, including logistics, fleet management, and personal tracking. The system's ability to track location in real-time provides a critical advantage in terms of efficiency, accuracy, and safety. The integration of GPS modules, microcontrollers, and communication modules demonstrates the complexity and multifaceted nature of IoT-based solutions.

As a side development, the women's safety system was also explored, leveraging the same IoT-based system with GPS tracking. The system's ability to track location in real-time and send emergency alerts has the potential to provide a reliable and efficient safety solution for women, especially in situations where they may be vulnerable to violence or harassment.

The results of this project demonstrate the feasibility of developing an IoT-based system with GPS tracking that is reliable, efficient, and scalable. The use of microcontrollers such as ESP32 has proven to be effective in processing data and connecting to the internet, enabling the system to send location data and emergency alerts. The breadboard has been instrumental in the development process, allowing for easy testing and experimentation with different components and circuits.

Figure 2 shows the alert with coordinates that were sent by this system and Figure 3 shows the map location of the coordinates.

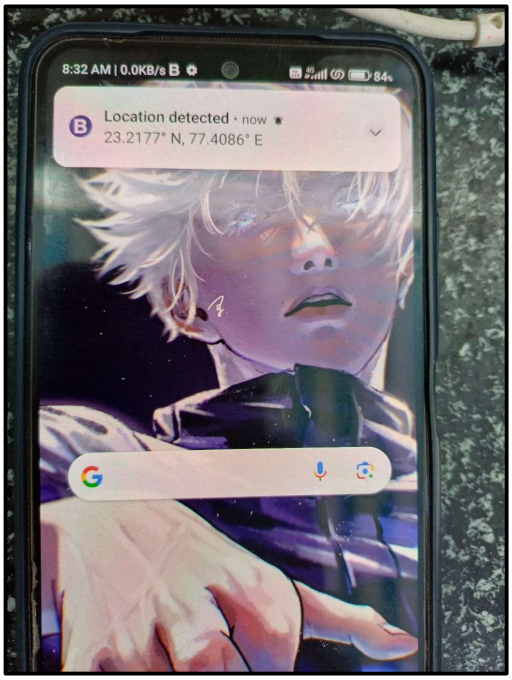


Fig. 2: Alert received on phone

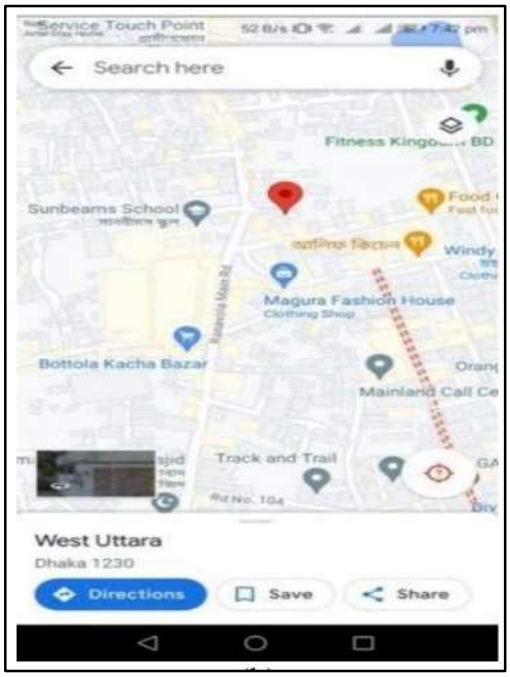


Fig. 3: Map Location of the coordinates

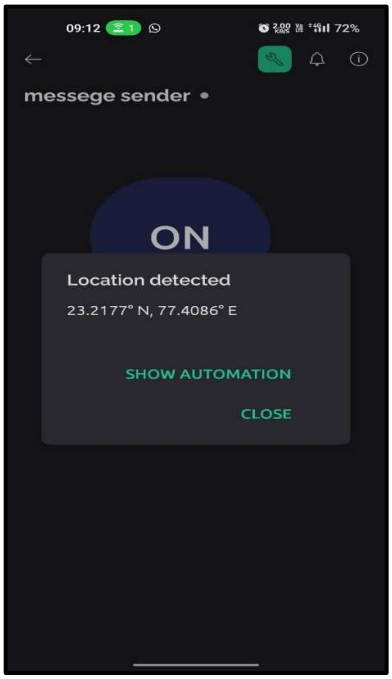


Fig. 4: Pop-Up of Detected location

Table 1 shows the expenses of this system.

Table 1: Component Prices

Sr. No.	**Components**	**Price (INR)**
1.	SIM808 GPS GSM Modem	1550
2.	ESP 32	450
3.	Jumper Wires	40
4.	RS232 to USB	280
5.	Type A to USB	80

CONCLUSION AND FUTURE SCOPE

In conclusion, the development of an IoT-based system with GPS tracking has demonstrated the potential of IoT technology in providing a reliable and efficient tracking solution. The system's ability to track location in real-time and send location data to a remote server has far-reaching implications for various applications, including logistics, fleet management, and personal tracking.

The side development of a women's safety system leveraging the same IoT-based system with GPS tracking has highlighted the potential of IoT technology in addressing social issues. The system's ability to track location in real-time and send emergency alerts has the potential to provide a reliable and efficient safety solution for women, especially in situations where they may be vulnerable to violence or harassment.

This project has demonstrated the feasibility of developing an IoT-based system with GPS tracking that is reliable, efficient, and scalable. The use of microcontrollers such as ESP32 and breadboards has proven to be effective in processing data and connecting to the internet, enabling the system to send location data and emergency alerts.

Future research and development in this area should focus on refining the system's functionality, improving its accuracy, and ensuring its scalability and affordability. Additionally, the social and cultural implications of such systems, including issues of privacy, consent, and accessibility, should be explored.

Overall, this project has demonstrated the potential of IoT technology in providing innovative solutions to real-world problems, and has highlighted the importance of continued research and development in this area.

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