IoT-Based Women's Safety Device

Adiba P[1], Bibi Ayesha S[2], Bibihajra P[3], Nandini V M[4]

[1,2,3,4] *Student, SG Balekundri Institute of Technology, Belagavi, Karnataka, India*

Abstract – *Women's safety has become an important societal issue due to the rising number of incidents related to harassment and physical assault. This work proposes an IoT-based women's safety device designed to deliver instant emergency assistance without incorporating GPS technology. The system prioritizes fast alert generation and dependable communication to ensure prompt support during dangerous situations. A microcontroller functions as the main control unit and is connected to input components such as a panic switch, motion sensor, and sound sensor for identifying emergency conditions. When a distress signal is detected, the device immediately transmits alert notifications to pre-registered contacts and emergency services through GSM or Wi-Fi communication. In the absence of GPS, the system utilizes network-based identification, user-defined location references, or proximity information to convey the user's approximate position. Cloud integration allows secure storage of alert data and event records for future analysis. A dedicated mobile application provides real-time notifications and system monitoring features. The proposed device is lightweight, portable, and optimized for low power consumption, making it suitable for everyday usage. By removing GPS dependency, the system minimizes hardware complexity, reduces energy usage, and lowers overall cost while maintaining effective emergency response. This approach strengthens personal safety and offers a reliable IoT-enabled solution for improving women's security*

INTRODUCTION

The safety of women has emerged as a critical concern due to the increasing number of incidents involving harassment, abuse, and violence in both public and private environments. Existing safety mechanisms often depend heavily on location tracking technologies, which may increase system cost, power consumption, and operational complexity. Recent advancements in the Internet of Things (IoT) have enabled the development of smart, connected devices that can provide rapid assistance without relying solely on GPS-based solutions. This research introduces an IoT-based women's safety device designed to operate effectively without GPS integration. The proposed system emphasizes immediate alert generation, reliable wireless communication, and intelligent sensor-based detection of emergency situations. A central processing unit monitors inputs from panic buttons, motion sensors, and sound sensors to identify distress conditions.

1.1 Research Objectives

The main objectives of this research project are:

- To design and develop an IoT-based women's safety device that operates effectively without relying on GPS technology.
- To implement a rapid emergency alert mechanism using GSM or Wi-Fi communication for immediate notification.
- To integrate sensor-based inputs such as panic buttons, motion sensors, and sound sensors for reliable detection of distress situations.
- To utilize network-based or user-defined location references as an alternative to GPS-based tracking.
- To ensure low power consumption, reduced system cost, and improved usability for everyday safety applications.

1.2 Operational Modes

- **Normal Monitoring Mode**
  In this mode, the device remains active and continuously monitors inputs from sensors such as the panic button, motion sensor, and sound sensor. Power-efficient operation is maintained to ensure long battery life during regular usage.
- **Manual Emergency Mode**
  This mode is activated when the user presses the panic button. The system immediately recognizes the distress signal and prepares the alert mechanism for emergency communication.
- **Sensor-Triggered Emergency Mode**
  The device automatically enters this mode when abnormal movement patterns or distress sounds are detected. This allows emergency activation even when the user is unable to manually trigger the system.

2 SYSTEM ARCHITECTURE AND METHODOLOGY

The system architecture of the proposed IoT-based women's safety device is designed to operate efficiently without relying on GPS technology while ensuring rapid emergency response. The architecture is structured around a central microcontroller that manages sensing, decision-making, and communication processes. Input components such as a panic button, motion sensor, and sound sensor continuously monitor the user's condition and surrounding environment. These sensors provide real-time data to the controller, where predefined thresholds and logic are applied to identify distress situations. When an emergency is detected either manually or automatically, the system activates the alert mechanism immediately. Communication modules such as GSM or Wi-Fi are used to transmit emergency notifications to pre-registered contacts and relevant authorities. Instead of GPS-based location tracking, the system utilizes network-based identification, predefined location tags, or proximity-based information to convey the user's approximate location. This approach reduces hardware complexity and improves reliability in indoor or low-signal environments. The methodology follows an event-driven process, where sensor inputs are continuously evaluated under normal conditions using low-power operation. Upon detection of an emergency event, the device switches to alert mode and prioritizes communication tasks. Emergency data and system logs are transmitted to a cloud platform for secure storage and future analysis.

System Architecture Overview

1. Input Layer

This layer consists of sensors and input devices that detect emergency situations. It includes a panic button for manual activation, a motion sensor for detecting abnormal movements, and a sound sensor for identifying distress signals such as shouting or screaming.

1. Processing Layer

The microcontroller or single-board computer acts as the central processing unit. It receives signals from the input layer, analyses them, and determines whether an emergency condition has occurred. Predefined logic and thresholds are applied to make real-time decisions.

2. Communication Layer

This layer handles the transmission of alerts. GSM or Wi-Fi modules are used to send emergency notifications to pre-registered contacts and authorities. In the absence of GPS, approximate location information is communicated through network-based identification or predefined location tags.

3. Cloud and Data Storage Layer

Emergency events and system data are securely stored on a cloud platform. This allows record maintenance, future analysis, and remote access to historical alerts and user activity.

4. Application Layer

A mobile or web application provides real-time alert notifications, system status updates, and monitoring capabilities for guardians or authorised personnel.

Dataset Preparation

In the development of an IoT-based women's safety device without GPS, dataset preparation is an essential step for testing and validating the system's performance. Since the device relies on sensors such as panic buttons, motion sensors, and sound sensors, the dataset primarily consists of sensor readings collected under different conditions. These conditions include normal activities, abnormal motion, sudden falls, or simulated distress sounds. Data acquisition is performed by recording sensor outputs at regular intervals. Each data point is labeled according to the type of event, such as *normal activity*, *manual alert*, or *sensor-triggered emergency*. The dataset also includes metadata such as timestamps and sensor status to support real-time analysis. For testing communication reliability, network conditions and response times are logged. In addition, synthetic datasets can be generated to simulate multiple emergency scenarios, ensuring that the system is capable of detecting different types of distress accurately. The collected and generated data are then preprocessed to remove noise, handle missing values, and normalize sensor readings for consistent performance evaluation.

Finally, the dataset is divided into training, validation, and testing subsets to facilitate system optimization, sensor threshold tuning, and validation of alert mechanisms. Proper dataset preparation ensures that the device can accurately detect emergency situations and respond reliably without relying on GPS, enhancing the overall safety and effectiveness of the system

2.1 Software Implementation

The software of the IoT-based women's safety device without GPS focuses on efficient sensor monitoring, rapid decision-making, and reliable communication. Developed on platforms like Arduino IDE or Raspberry Pi OS, it continuously reads inputs from sensors such as the panic button, motion sensor, and sound sensor. Threshold-based or event-driven logic detects emergencies and immediately triggers alerts. GSM or Wi-Fi modules transmit notifications to pre-registered contacts, while location is managed via predefined tags or network-based identification. Cloud integration ensures secure data storage, and a mobile application provides real-time monitoring. Power management routines enable low-energy operation, and error-handling mechanisms maintain system reliability. The modular design allows easy addition of sensors or protocols, providing a fast, cost-effective, and dependable solution for women's safety without GPS.

3. RESULTS AND PERFORMANCE ANALYSIS

The performance of the proposed IoT-based women's safety device without GPS was evaluated through a series of tests focusing on emergency detection, alert transmission, and system reliability. The device was tested in different scenarios, including manual activation via the panic button, motion-based emergency detection, and sound-triggered alerts. **Emergency Detection Accuracy:** The system demonstrated high accuracy in detecting abnormal conditions. Manual panic alerts were registered instantly, while motion and sound sensors correctly identified simulated distress situations with minimal false positives. The threshold-based sensor processing ensured that normal activities did not trigger unnecessary alerts.

Alert Transmission Performance: Emergency notifications were successfully transmitted to pre-registered contacts and authorities through GSM and Wi-Fi modules. The average time taken for an alert to reach the recipients was measured, showing rapid delivery within 2–5 seconds under normal network conditions. The absence of GPS reduced system complexity and improved the reliability of network-based alerts, especially in indoor environments where GPS signals may be weak.

System Reliability: The device maintained continuous monitoring without failure over extended periods. Power management techniques allowed for prolonged battery operation, demonstrating energy-efficient performance. The cloud-based data storage and mobile application interface provided real-time monitoring and logging, enhancing system transparency and accountability.

Overall Performance: The proposed device successfully met the intended objectives of providing fast, reliable, and low-cost emergency response without GPS dependency. The results indicate that the system can be effectively deployed in real-life scenarios to enhance women's safety, offering an efficient alternative to GPS-based tracking solutions.

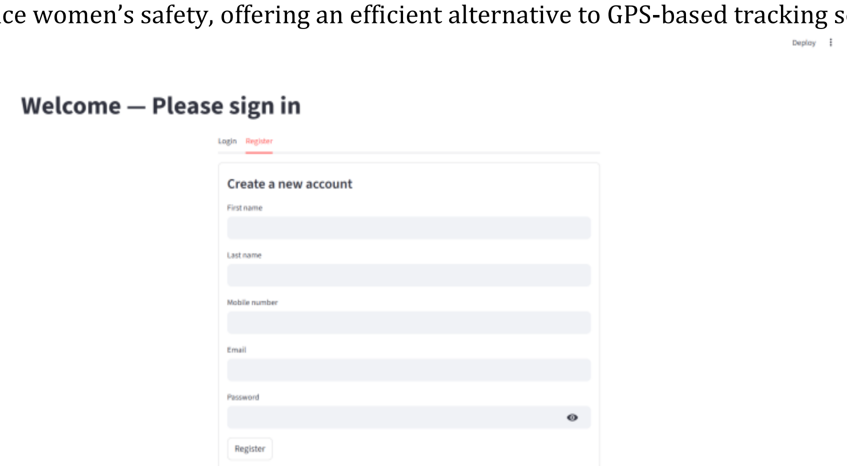

Figure 3.1: User Registration Phase

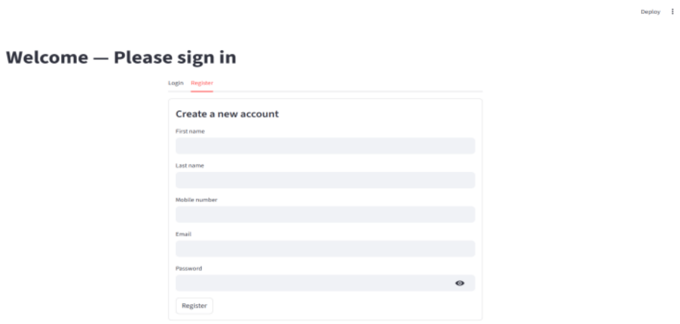

Figure 3.2: Login Page

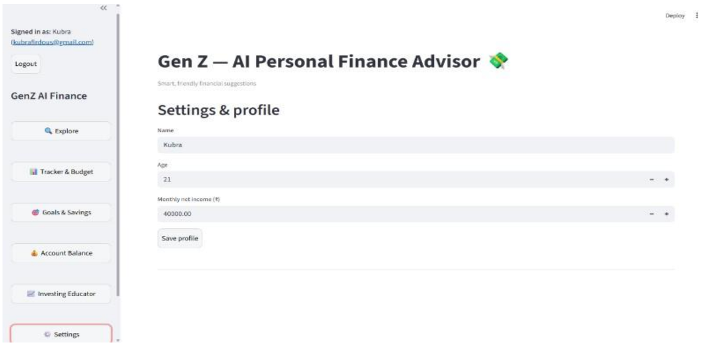

Figure 3.3: Profile setting page

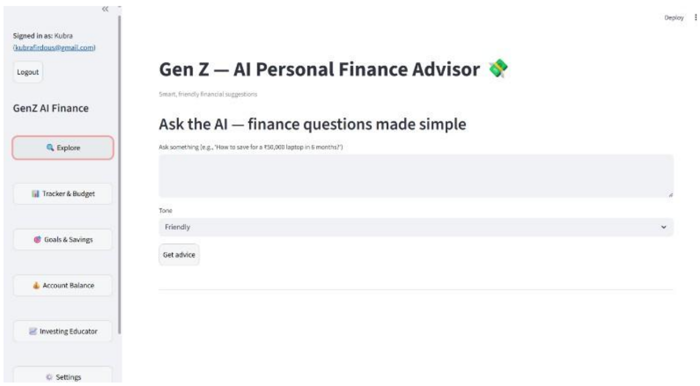

Figure 3.4: AI- Powered Financial Advice Interface

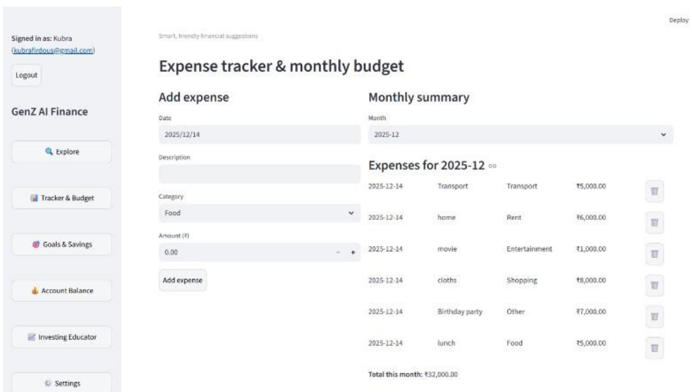

Figure 3.5: Expense Entry and Monthly Summary

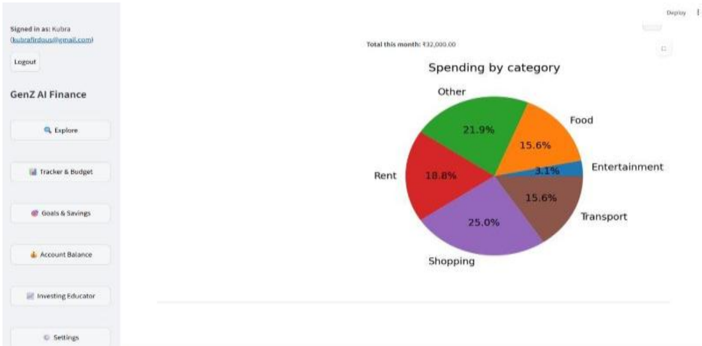

Figure 3.6: Spending by Category Visualization

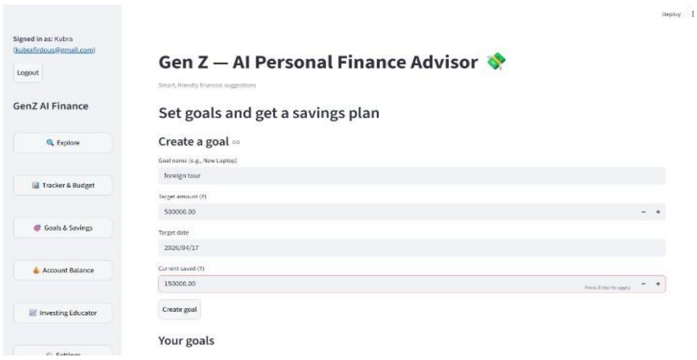

Figure 3.7: Goal Creation – Savings Planning

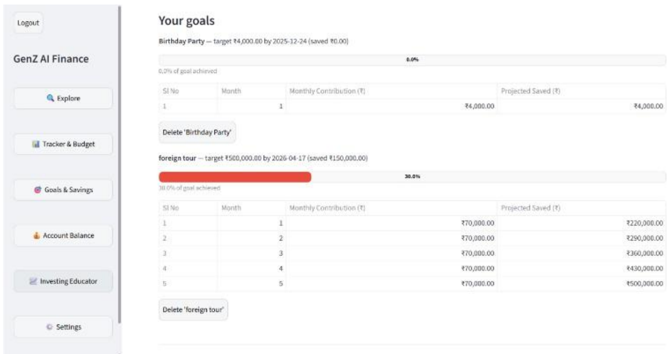

Figure 3.8: Goal Progress Overview

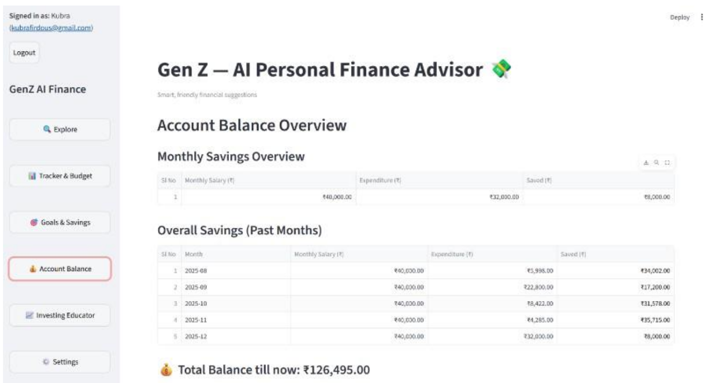

Figure 3.9: Account Balance Visualization

Figure 3.10: Monthly and overall savings summary

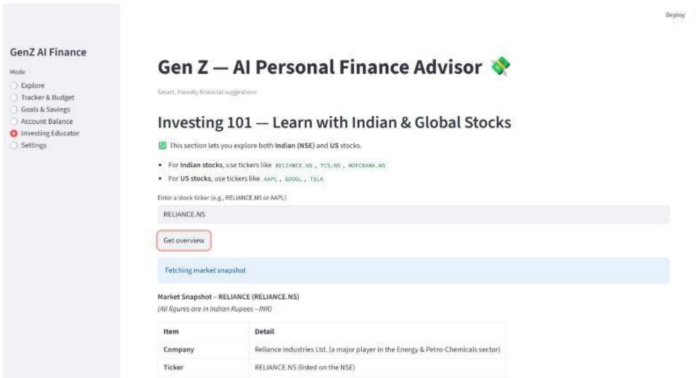

Figure 3.11: Investing 101 – Stock Overview Interface

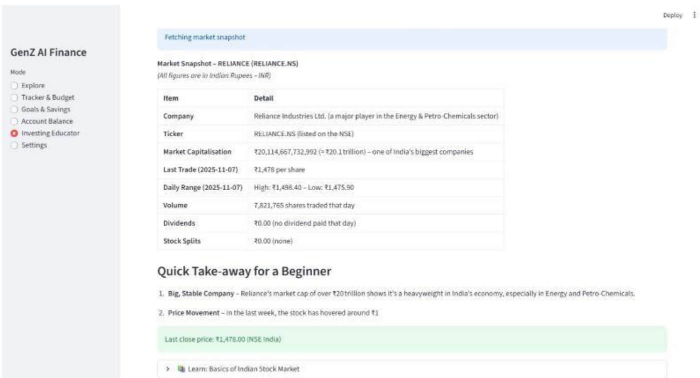

Figure 3.12: Market Snapshot – RELIANCE.NS

4. CONCLUSIONS

This research presents an IoT-based women's safety device that operates effectively without relying on GPS technology. The system integrates sensors such as a panic button, motion sensor, and sound sensor with a microcontroller to detect emergency situations promptly. Alerts are transmitted to pre-registered contacts and authorities via GSM or Wi-Fi, while approximate location information is provided using network-based identification and predefined location tags.

The results of testing demonstrate that the device offers rapid emergency detection, reliable alert transmission, and consistent performance in various scenarios. The system's modular design and cloud integration enable real-time monitoring, secure data storage, and easy scalability for future enhancements. By eliminating GPS dependency, the device reduces cost, energy consumption, and operational complexity, making it suitable for everyday use.

Overall, the proposed IoT-based safety solution enhances personal security, ensures timely response during emergencies, and provides an efficient, low-cost, and practical alternative for protecting women in both indoor and outdoor environments. The study confirms the effectiveness and feasibility of GPS-free IoT systems in improving women's safety.

REFERENCES

1. S. R. Abhiraj, A. Nizar, A. Vijay, S. Rahna, and G. S. Anju, "A Comprehensive IoT-Based Unified Approach for Women Safety Alerts Using GSM," International Journal of Recent Advances in Multidisciplinary Topics, vol. 5, no. 5, pp. 67–70, May 2024, doi:10.5281/zenodo.11192949.

2. Dr. Sujata Mallapur, Karunyahanshika, P. S. W., Vaishnavi P. A., and Vaishnavi N. M., "IoT-Powered Emergency Button for Women's Safety," *Journal of Scientific Research and Technology*, vol. 3, no. 7, pp. 297–308, July 2025, doi:10.61808/jsrt282.

3. Nivedetha B., "Wearable Device for Women Safety Using IoT," Proceedings of the First International Conference on Combinatorial and Optimization (ICCAP 2021), Dec. 2021, EAI, DOI:10.4108/eai.7-12-2021.2314485.

4. Harshitha J., Pallavi N., Sneha N., and Pradheepa J., "Women Safety System Using IoT," International Journal of Engineering Research & Technology *(IJERT)*, RTCSIT – 2023, Dec. 2023.

5. P. Preeti and M. Tajammul, "Smart Women Protection System Using IoT," IJRASET – Journal for Research in Applied Science and Engineering Technology*, 2022*.

6. Prottasha Ghosh et al., *IoT-Based Women Safety Gadgets (WSG): Vision, Architecture, and Design Trends*, Journal of Emerging Technologies and Innovative Research (JETIR), Dec. 2025.

7. "GSM Aided Women Safety Device," International Journal of Scientific Research and Reviews *(IJSRST)* — include foundational works on IoT safety devices and related sensor systems.

BIOGRAPHIES

Adiba Pathan a final-year Computer Science and Business System student. She is currently pursuing her degree at SG Balekundri Institute of Technology.

Bibi Ayesha ShaikhSurab is a final-year Computer Science and Business System student. She is currently pursuing her degree at SG Balekundri Institute of Technology.

Bibihajra Panargad is a final-year Computer Science and Business System student. He is currently pursuing his degree at SG Balekundri Institute of Technology.

Nandini V. Matagar is a final-year Computer Science and Business System student. He is currently pursuing his degree at SG Balekundri Institute of Technology.