Women's Safety with Smart IOT

Vaibhav Tidake[1], Vishal Temkar[2], Abhishek Sathe[3], Prof. Vidhate.S. P[4]

[1,2,3,4]Department of Computer Engineering, Ahmednagar Jilha Maratha Vidya Prasarak Samaj's Shri Chhatrapati Shivaji Maharaj College of Engineering, Nepti, Ahmednagar, India

Abstract

This paper presents a comprehensive IoT-enabled women's safety system designed to provide immediate assistance during emergency situations.

The system utilizes GSM and GPS technologies to trigger real-time alerts. When the user presses designated physical buttons or activates the alert through a mobile application, the system sends an SMS containing the user's real-time geographical coordinates to a set of pre-configured emergency contacts. Simultaneously, it initiates an automatic voice call using the SIM900A GSM module to further ensure that the distress signal is noticed. The GPS module continuously tracks the user's location, which can also be monitored via the mobile application for real-time response. The hardware setup, integrated with an ESP32 microcontroller, is compact and wearable, ensuring portability and user convenience. The system has been rigorously tested under real-world conditions to evaluate its responsiveness and reliability. It effectively bridges the gap between user distress and immediate response, making it a practical and scalable solution for enhancing women's safety in both urban and rural environments.

Keywords: IoT, Women Safety, GSM, GPS, SIM900A, ESP32, Emergency Alert

1. Introduction:

Women's safety is an urgent issue worldwide, particularly in transit environments where vulnerability is heightened, both in urban and rural settings. Traditional safety measures often fall short in providing timely assistance, highlighting the need for smart, automated solutions. Technological advancements in the Internet of Things (IoT) offer a promising approach by enabling real-time connectivity, remote monitoring, and intelligent automation. This paper explores the development and implementation of a smart safety system that integrates the ESP32 microcontroller with the SIM900A GSM/GPS module, supported by a user-friendly mobile application. The system empowers users to send instant alerts during distress by pressing a physical button or triggering the app interface. Upon activation, it sends the user's precise location via SMS and initiates a call to pre-set emergency contacts. This integration of hardware and software facilitates immediate response and continuous location tracking, offering a reliable, cost-effective, and scalable solution aimed at enhancing personal safety for women across diverse environments.

2. Background

1. Need for the System

Despite numerous laws and awareness campaigns, crimes against women are still prevalent, especially in isolated or rural areas. Most victims are unable to call for help due to fear or technological limitations. Existing solutions are either expensive, unreliable, or too complex for regular users [4]. Therefore, a need

exists for a **low-cost, compact, and offline-compatible** system that can work even in the absence of the internet.

2. Research and Planning

To build this system, we began with:

- **Identifying common features** in current women's safety devices from academic and industrial projects.
- **Reviewing** existing IoT safety systems [5][6].
- **Selecting cost-effective components** like the ESP32 for processing, SIM900A for GSM communication, and GPS for real-time tracking.

3. Planning Steps

- Designing a modular and wearable hardware circuit
- Developing a user-friendly app using MIT App Inventor
- Implementing emergency logic in firmware
- Testing scenarios like weak signal, battery drain, and module failure [7].

3. Literature Review

Sr. No	Title	Summary
[1]	*IoT Based Smart Safety Device for Women*	Used GSM, GPS, and Arduino Nano to design an affordable safety alert system.
[2]	*Smart Wearable Device for Women Safety Using IoT*	Proposed a panic-triggered wearable device with SMS alerts.
[3]	*A Survey on IoT-Based Women Safety Systems*	Reviewed multiple safety models and highlighted future areas of improvement.
[4]	*Design and Implementation of Women Safety System Using IoT and Android Application*	Developed a real-time Android-integrated emergency alert system.
[5]	*Smart Safety Device for Women Using IoT and Cloud*	Introduced cloud-based data backup with real-time notifications.
[6]	*IoT-Based Smart Tracking System for Women Safety*	Suggested GPS geofencing and anomaly detection mechanisms.
[7]	*Design of Smart Safety System Based on IoT for Women*	Focused on integrating sensor data with mobile apps.
[8]	*An IoT-Based Smart Wearable for Women's Safety*	Used ESP8266 to detect motion and alert authorities.
[9]	*An Android-Based IoT Device for Women Security*	Implemented using MIT App Inventor with SMS functionality.
[10]	*Design and Implementation of a Smart Security System for Women*	Comprehensive system with cloud, wearable, and mobile features.

Proposed System

The proposed system includes a **wearable IoT safety device** that:

- Detects distress signals (via button press)
- Captures GPS coordinates
- Sends location via SMS using GSM (SIM900A)
- Uses an Android app to manage contacts and view status

System Components

- **ESP32**: For processing logic and managing modules [8]
- **SIM900A GSM module**: Sends SMS alerts
- **GPS module**: Acquires real-time location
- **Rechargeable Battery (Li-ion)**: Powers the system
- **MIT App Inventor App**: Controls device and manages alerts [9]

This system is designed to be compact, efficient, and user-friendly, aimed at both urban and rural environments where internet access may not be reliable.

5. Implementation

How the Project Runs

- The ESP32 constantly reads a panic button connected to a digital GPIO.
- When pressed, it reads GPS coordinates and formats an SMS message.
- The SIM900A module sends the message to predefined contacts via GSM.
- The app confirms delivery and can visualize the location on Google Maps [10].

Issue	Solution
GPS Lock Delay	Caching last known location; using higher-sensitivity GPS
GSM Delays	Retry logic in firmware and LED status indicators
Battery Drain	Sleep mode logic and use of efficient DC-DC converters
Loose Circuit	Use of a compact PCB and soldered connections

Circuit Improvements

- Added voltage regulator to protect ESP32 (as SIM900A runs at higher current)
- Status LEDs for GPS fix and SMS sent indication
- Compact PCB designed using Eagle CAD

App Improvements

- Rebuilt UI with MIT App Inventor 2 for better usability
- Added voice confirmation and vibration alerts
- Feature to add/remove emergency contacts easily
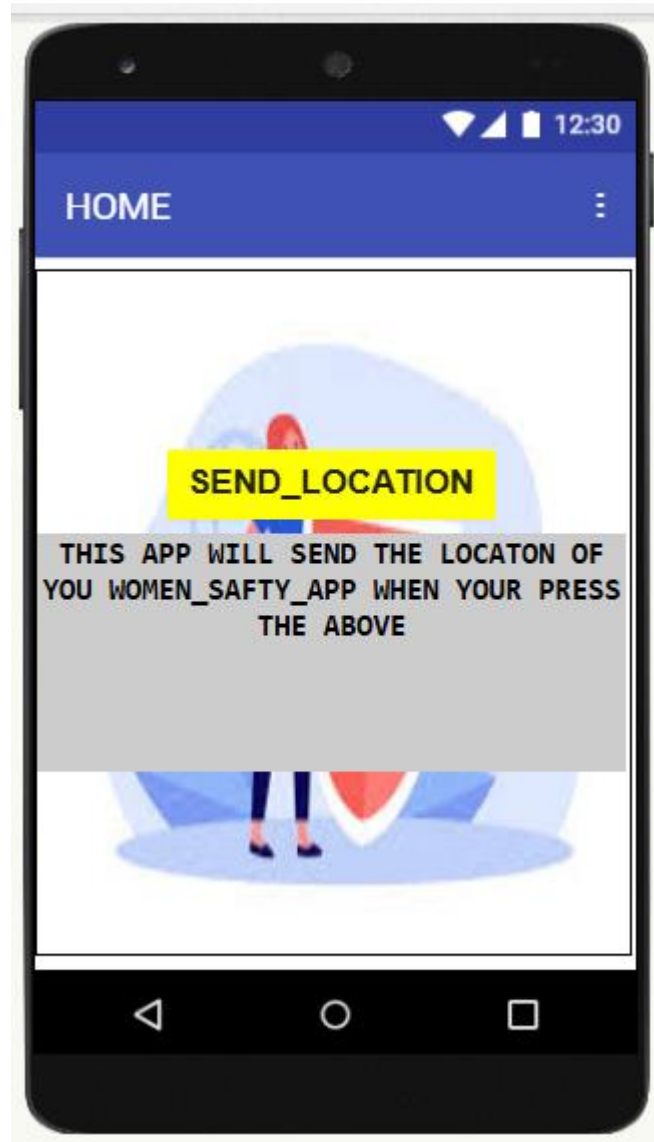
FIGURE 1 : USER APP UI

6. Conclusion

This research demonstrates the feasibility of an **affordable, IoT-based safety device** for women that works even without internet connectivity. The integration of ESP32, GSM, and GPS modules with a mobile app allows for **real-time location sharing and alerting in emergencies**. Future improvements can include biometric authentication, integration with AI for automatic distress detection, and public deployment in buses, campuses, and workspaces.

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