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A SMART WOMEN PROTECTION SYSTEM USING IOT AND OPEN - SOURCE

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I. ABSTRACT

Women's safety remains a critical issue even in today's technologically advanced world. Despite legal and social improvements, incidents of harassment and violence against women continue to rise, especially in isolated and crowded places. Existing safety devices often require internet access or conscious manual activation, limiting their effectiveness in emergencies.This work proposes an IoT-based women safety system integrated into a handbag, featuring a hardware controller, Android app, and Bluetooth connectivity. With a single button press, alerts are sent to pre-registered contacts and police without requiring internet access. The system also includes a theft-alert feature for protecting personal belongings, heartbeat monitoring for health emergencies, and fingerprint authentication for secure device access. This solution aims to offer a reliable, real-time support system for women, enhancing both safety and health monitoring in a single compact device.

KEYWORDS: Women safety, IoT device, Emergency alert system, Bluetooth connectivity, Anti-theft alarm, Health monitoring.

II. INTRODUCTION

Women's safety has become a major concern in modern society due to the continuous rise in incidents of harassment, assault, and violent crimes against women in public and private spaces. Despite advancements in technology and law enforcement, conventional safety methods remain inadequate because they rely heavily on manual communication, physical

intervention, or internet-based applications that may not always be accessible during emergencies. This gap highlights the urgent need for a smart, automated, and reliable protection system that ensures fast emergency response and real-time security support. To address this challenge, the Smart Women Protection System using IoT and open-source technology is designed to offer a portable safety solution capable of sending instant alerts, sharing live location, and activating emergency alarms with minimal user effort. The system integrates multiple sensors—including panic button, heartbeat sensor, fingerprint authentication, and anti-theft module—connected to a microcontroller. Through Bluetooth or other low-power communication technologies, the device communicates with a mobile application to transmit alerts to family members and nearby authorities, even without internet connectivity. By automating emergency response, health monitoring, and theft protection, this system enhances personal safety and empowers women to travel and work independently.

IoT Communication Architecture and Data Flow

The IoT-based Smart Women Protection System follows a layered communication architecture that ensures efficient sensor data acquisition, secure transmission, emergency alert triggering, and real-time user interaction. This architecture enables automated safety mechanisms without depending entirely on internet connectivity, making it reliable in critical emergency scenarios**.**

A. Sensor and Device Layer

This is the foundational layer where physical components and sensors operate. The system includes:

- Panic Button / Emergency Switch
- Heartbeat Sensor
- Fingerprint Module for authentication
- Buzzer / Alarm System
- GPS Module

All hardware components are connected to a microcontroller

B. Gateway and Network Layer

This layer enables wireless communication between the device and mobile application via:

- Bluetooth (HC-05 / BLE / ESP32 Built-In) Responsibilities:
- Transmit emergency alert signal to the paired smartphone

- Ensure low-latency communication without internet requirements
- Reduce power consumption for wearable use

Bluetooth communication ensures the device works even in remote or low-network areas.

C. Cloud and Data Processing Layer (Optional Internet Mode)

Internet services are available, the smartphone app forwards user data to cloud platforms like:

- Firebase / Blynk / MQTT Server Functions:
- Store alert logs
- Maintain tracking history
- Enable extended emergency broadcast to police hotline / relatives This layer ensures scalability when the system expands for city-wide adoption.

D. Application and User Interface Layer

The mobile application acts as the user control and monitoring interface. It enables:

- Real-time alert notification to emergency contacts
- Live location sharing (GPS-based)
- Health status monitoring
- Emergency call / SOS features
- Device configuration & fingerprint enrollment

Family members receive notifications, SMS alerts, location details, and emergency sound alarms.

E. Security and Reliability Considerations

Since the system deals with personal security & sensitive location data, safety mechanisms include:

- Fingerprint-based access to prevent misuse
- Secure Bluetooth pairing & encrypted data exchange
- Emergency activation only via deliberate trigger
- Fail-safe mode to work even without internet

F. Data Flow Summary

Step	Operation
1	Sensors detect emergency / fingerprint authentication
2	Microcontroller processes emergency logic
3	Bluetooth transmits alert to mobile app
4	Mobile app alerts contacts, triggers SOS features
5	Optional cloud logging and GPS tracking
6	Authorities & family respond to location alert

III. LITERATURE SURVEY

Anitha et al. [1] developed an "IoT-Based Women Security System Using Wearable Device", emphasizing the rising need for real-time protection technologies for women in public spaces. Their solution utilizes a panic switch integrated with GSM and GPS modules to send alert messages along with the victim's location to registered mobile numbers. The authors highlighted the limitations of traditional emergency applications that require manual phone operation, proposing instead a compact wearable device that functions independently of the smartphone in emergencies.

Devadhanishini et al. [2] presented a "Smart Safety Device for Women Using Arduino and GPS", aimed at providing rapid response during distress situations. Their system connects a pulse sensor, panic button, and GPS sensor to an Arduino microcontroller. Upon activation, the system sends instant SMS alerts with live coordinates to family members and nearby authorities. They emphasized the role of physiological monitoring, where an abnormal heart rate may trigger an auto-alert to safeguard unconscious victims.

Mohammed H. et al. [3] proposed a "Women Safety System with Live Audio and Location Tracking", explaining the importance of audio evidence in harassment and assault cases. Their model integrates a microphone, GSM module, and Google Maps API to simultaneously transmit voice clips and real-time GPS location to predefined contacts. The study stressed that combining communication, tracking, and evidence collection drastically improves rescue response time.

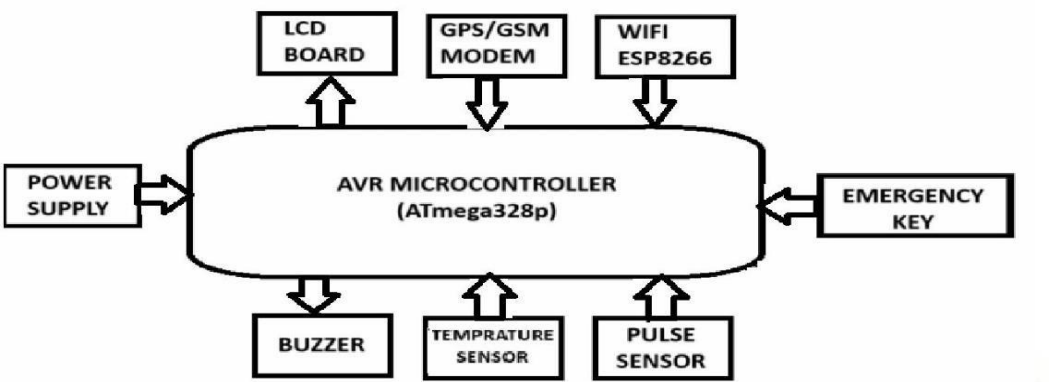
Himanshu Patel et al. [4], in their work titled "Portable Smart Band for Women Security", designed a wearable band incorporating GSM, accelerometer, and shock module for self-defense. Their system automatically detects sudden force or abnormal body movement that

may indicate physical assault. Upon detection, it sends alert messages, shares location, and triggers a mild electric shock mechanism intended to disorient the attacker temporarily.

Bibek Barman et al. [5] introduced "An IoT-Enabled Smart SOS Device for Women", focusing on energy-efficient emergency alerting using Bluetooth Low Energy (BLE). Their system uses a BLE module to communicate with a smartphone, enabling alert transmission even in low-network zones. Notifications, GPS tracking, and SOS calling are handled through a mobile app interface. The authors highlighted reduced cost, compact hardware, and low power consumption as primary strengths.

Garrab et al. [6] proposed an "Automatic Women Distress Detection System Using Sensors and Cloud Services", where multiple sensors like heart-rate, motion, and pressure sensors detect abnormal human activity. The system uses Wi-Fi communication to upload location, sensor readings, and emergency alerts to cloud servers for remote monitoring. The authors focused on public safety and argued that smart cloud-supported systems could improve emergency response management significantly

IV. BLOCK DIAGRAM



Smart Women Protection System Using IoT And Open Source

V. SYSTEM COMPONENTS

1. Microcontroller Unit

- ESP32 *(*recommended) *or* *Arduino UNO + HC-05 Bluetooth)
- Functions:
  - Interfaces with sensors and buttons
  - Handles emergency logic
  - Communicates with smartphone app (Bluetooth/Wi-Fi)

2. **Panic / Emergency Button**

- A push-button switch for instant alert activation
- Sends SOS to contacts when pressed

3. **Fingerprint Sensor**

- Used to authenticate the owner
- Prevents unauthorized access and false activation

4. **Heartbeat / Health Sensor**

- Pulse/Heartbeat Sensor (MAX30102)
- Continuously monitors heart rate
- Auto-trigger alert when abnormal rate detected (stress/shock)

5. **GPS Module (Optional)**

- NEO-6M GPS (if not using phone GPS)
- Provides location coordinates during emergency (If using smartphone GPS, no GPS module needed)

6. **Bluetooth Communication Module**

- ESP32 built-in Bluetooth *(*or HC-05 if Arduino*)*
- Connects hardware device to smartphone app
- Allows message transfer without Internet

7. **Smartphone (Android)**

- Manages alerts via mobile app
- Sends:
  - SMS alerts
  - Emergency calls
  - Live GPS location
- Pushes data to cloud (if internet available)

8. **Alarm / Buzzer Unit**

- Loud buzzer to alert nearby people and scare attacker

9. Battery & Power Unit

- Rechargeable Li-ion / Li-Po battery
- Charging module: TP4056
- Voltage regulator for components

VI. CONCLUSION

The Smart Women Protection System using IoT and open-source technology provides an effective, reliable, and real-time safety solution for women in emergency situations. This system integrates panic alerts, biometric security, health monitoring, and wireless communication to ensure immediate assistance when danger is detected. By combining hardware components such as sensors, microcontroller, buzzer, and Bluetooth/GPS with a mobile application, the system enables rapid transmission of location details and emergency alerts to family members or authorities. The wearable and portable design makes it convenient for women to carry in daily life, ensuring continuous safety support. Overall, this solution not only enhances personal security and emergency response but also contributes to building a safer society by leveraging smart, affordable, and scalable IoT technology. In future developments, features such as AI-based threat detection, GSM support, and advanced tracking can be added to further improve system intelligence and usability.

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