International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 10, Issue 3, pp 7-10, March-2026

https://doi.org/10.47001/IRJIET/2026.103002

Safety: Women Safety Device

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***Abstract* - This project presents a compact and wearable Women's Safety Device aimed at enhancing personal security through real-time technological solutions. Designed to be discreet and easily accessible like a pendant, bracelet, or clip-on the device can be activated instantly in emergency situations using a panic button. Upon activation, it performs multiple safety functions simultaneously, including sending live GPS location to trusted contacts, making emergency calls, and initiating voice and video recording for evidence collection. The device integrates key hardware components such as an Arduino microcontroller. It also supports mobile connectivity via Bluetooth for app integration. Programmed using Embedded C/Arduino and Android-based languages like Java or Kotlin, the system ensures fast, reliable communication and data sharing. The objective is to offer women a smart, portable, and tech-driven safety solution that empowers them and ensures timely assistance during distress, ultimately promoting greater independence and peace of mind.**

Keywords: Women Safety, Wearable Device, GPS Tracking, Emergency Alert System, IoT, Embedded Systems.

I. INTRODUCTION

Women's safety has become a critical concern worldwide, particularly in countries like India where incidents of harassment, assault, and violence continue to rise. Despite the presence of traditional safety measures such as helpline numbers, security patrols, and awareness campaigns, they often prove insufficient during emergencies when immediate help is required. Many women face situations where timely intervention could prevent harm, yet the lack of real-time communication tools and personal protection devices leaves them vulnerable. Traditional safety measures depend heavily on external support systems, which may not always be accessible in distress situations. Challenges such as delayed response from authorities, lack of precise location sharing, and absence of immediate evidence collection often hinder justice and timely rescue. This creates a pressing need for a modern, technology-driven solution that can act as a personal safeguard. With the rise of advanced technologies like the Internet of Things (IoT), embedded systems, GPS tracking, and mobile applications, new possibilities are emerging to enhance women's safety. Wearable safety devices integrated with panic buttons, real time tracking, and multimedia evidence collection are gaining momentum as reliable tools for protection. These solutions provide instant connectivity, enabling women to reach out to trusted contacts or emergency services with just a single click.

1.1 Problem Statement

Women's safety remains a critical concern despite government initiatives, helplines, and awareness programs, as crimes like harassment, stalking, kidnapping, and assault continue to increase. In emergency situations, women often struggle to access timely help due to delayed emergency responses and the absence of real-time communication systems. Many existing safety measures fail to provide live GPS tracking, making it difficult for authorities or family members to locate victims quickly. Additionally, the lack of automated alert systems prevents women from sending distress signals during high-stress situations. Network dependency further reduces reliability, especially in areas with poor connectivity. Limited awareness, complex interfaces, and non-discreet designs also discourage regular use of current safety tools. To address these challenges, a compact wearable Women's Safety Device is proposed. This device integrates IoT, GPS, microphone, and Bluetooth technologies with a mobile application to provide instant alerts, live location sharing, emergency calling, and voice recording for evidence collection.

1.2 Objectives of the System

The main goal of the Women's Safety Device project is to enhance personal security by integrating IoT-enabled wearable technology with real-time communication systems. The system aims to empower women with immediate access to help during emergencies through location tracking, automated alerts, and evidence collection. Provide flexibility for future enhancements such as AI-based distress detection, integration with police hotlines, and cloud-based evidence storage. Lay the foundation for expansion into smart city safety networks and broader IoT security ecosystems.

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II. PROPOSED SYSTEM AND METHODOLOGY

The proposed system is an IoT-based women's safety solution consisting of a compact wearable device integrated with a mobile application. The wearable device includes a panic button, GPS module, GSM module, Bluetooth connectivity, microphone, camera, and battery management unit, all controlled by a microcontroller. Upon emergency activation, the system automatically sends live GPS location details to predefined contacts, initiates emergency calls and SMS alerts, and records audio and visual evidence. The mobile application enables contact configuration, real-time location tracking, alert notifications, and storage of emergency data. This integrated system ensures rapid response, reliability, and usability, even in low-connectivity environments.

An Agile development methodology was adopted to design and implement the system through iterative cycles of planning, development, testing, and feedback incorporation. Object-Oriented Programming (OOP) principles were applied to build modular, reusable, and maintainable software components for both the embedded system and the mobile application. Mathematical and algorithmic techniques were used to process GPS coordinates, manage sensor data, and optimize battery consumption. These calculations ensured accurate location tracking, efficient communication between hardware and software modules, and timely emergency alert delivery, resulting in a robust and scalable safety system.

2.1 System Architecture

The proposed Women's Safety System follows an IoT-based architecture comprising a wearable safety device, a mobile application, and communication services. The wearable device acts as the primary unit and is controlled by a microcontroller that manages all hardware components. It includes a panic button or voice trigger for instant activation during emergencies. A GPS module continuously fetches the user's real-time location. The GSM module transmits emergency alerts through SMS and voice calls to predefined contacts and helpline numbers. Bluetooth connectivity enables seamless communication between the device and the mobile application. The microphone and camera modules are activated upon emergency to record audio, images, or short video clips for evidence collection. A buzzer or vibration motor provides confirmation of successful activation. The device is powered by a rechargeable battery with battery-level monitoring. The mobile application allows users to configure contacts, receive push notifications, and view live location tracking. It also stores alert history and recorded evidence for later access. This architecture ensures fast response, reliability, and continuous monitoring even in low-connectivity conditions.

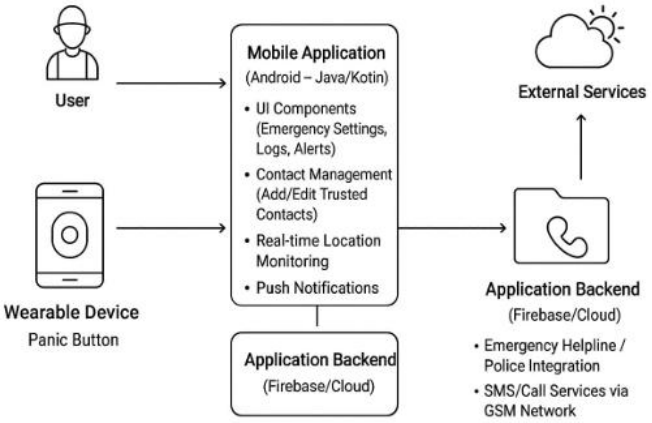

Figure 1: Women's Safety Device Architecture Diagram

2.2 Data Collection and Preprocessing

The proposed system collects data primarily during emergency events through the wearable device and the associated mobile application. The key data sources include GPS coordinates obtained from the GPS module, audio data captured through the microphone, images or short video clips collected using the built-in camera, and system-generated metadata such as timestamp, battery level, and device status. Additionally, user-configured information such as emergency contacts and alert preferences is collected through the mobile application during the initial setup.

Once collected, the data undergoes preprocessing to ensure accuracy, reliability, and efficient storage. GPS data is filtered to remove inaccurate or noisy location readings and is converted into standardized latitude–longitude formats with timestamps. Audio recordings are compressed, normalized, and trimmed to reduce background noise while preserving relevant evidence. Captured images and videos are resized and encoded into standard formats to minimize storage requirements without compromising clarity. All collected data is tagged with unique identifiers and timestamps before being securely stored locally on the device or synchronized with the mobile application. This preprocessing ensures optimized performance, faster transmission, and reliable retrieval of emergency data when required.

III. RESULTS AND DISCUSSIONS

To demonstrate the feasibility of the proposed Women's Safety Device, a small prototype was implemented using Python to simulate emergency alert generation and system response logic. The prototype focuses on validating the core functionalities of the system, including panic activation, GPS location handling, emergency alert transmission, and evidence recording triggers. Sample input data such as user ID, panic

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button status, GPS coordinates, and battery level were used to emulate real-world emergency conditions.

When the panic button was activated for a test user, the system successfully classified the situation as an emergency and triggered multiple actions simultaneously. The prototype generated an alert message containing live GPS coordinates, initiated a simulated emergency call, and activated voice recording for evidence collection. The results confirm that the proposed system can reliably detect emergency events and execute predefined safety actions in real time. This prototype validates the decision-making logic of the system and demonstrates how software-driven automation can enhance women's personal safety through timely alerts, location tracking, and evidence preservation.

CODE

```
class Women's SafetyPrototype:

def __in it__(self, user, contacts):
self. User = user
self. Contacts = contacts
self. Lat = 18.5204
      self. log = 73.8567

   def trigger emergency(self, escalate=False):
alert type = "EMERGENCY" if escalate else "ALERT"
      location = f"https://maps.google.com/?q={self.
Lat},{self.log}"

print("Voice recording started")
      for c in self. Contacts:
print(f"SMS to {c}: {self. User} needs help ({alert type})")
print("Location:", location)

      if escalate:
print("Calling police: 100")

# Test Case
system = Women's SafetyPrototype("User_01",
["9876543210", "9123456789"])
system. trigger _emergency(escalate=True)
```

OUTPUT

```
Voice recording started
SMS to 9876543210: User_01 needs help (EMERGENCY)
Location: https://maps.google.com/?q=18.5204,73.8567
SMS to 9123456789: User_01 needs help (EMERGENCY)
Location: https://maps.google.com/?q=18.5204,73.8567
Calling police: 100
```

Figure 2: Output of the sample code

IV. CONCLUSION

The proposed Women's Safety Device provides an innovative and reliable solution to address the growing concerns of women's security in society. By integrating technologies such as GPS, microphone the device ensures real-time location tracking, instant emergency alerts, and evidence collection during distress situations. The inclusion of a panic button enables quick activation, while mobile app connectivity allows seamless communication with emergency contacts and authorities.

This project successfully demonstrates how a compact, wearable, and user-friendly device can play a crucial role in preventing crimes and ensuring timely assistance. It bridges the gap between technology and personal safety, empowering women to move confidently and independently in any environment. With further enhancements like AI integration, cloud storage, and smart-city connectivity, the device holds strong potential to become a vital part of the future of women's safety technology.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Prof. Sakshi Kasar, for their valuable guidance, constant encouragement, and insightful suggestions throughout the course of this project. The authors also extend their heartfelt thanks to Prof. Mayuri Narudkar, Head of the Department, Artificial Intelligence and Machine Learning, for their continuous support, motivation, and for providing a conducive academic environment to successfully carry out this research work. The authors are also thankful to all faculty members and the institution for their cooperation and support.

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https://doi.org/10.47001/IRJIET/2026.103002

Citation of this Article:

Khadija Chaman Shaikh, Samyak Chandre, Saksham Chimurkar, & Sanchi Jadhav. (2026). Safety: Women Safety Device. *International Research Journal of Innovations in Engineering and Technology - IRJIET*, 10(3), 7-10. Article DOI https://doi.org/10.47001/IRJIET/2026.103002

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