

# A Comprehensive Study on Women Safety Devices and Mobile Safety Applications

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*Abstract— These Women’s safety remains a critical global concern and ensuring their protection is a shared responsibility of society. True social progress cannot be achieved unless the well-being and security of women are prioritized. Although women have historically been respected and valued, incidents of harassment, molestation, assault, and violence against women, girls, and even young children continue to occur across the world. Reports suggest that nearly 35% of women have experienced physical or sexual violence at some point in their lives, highlighting the urgent need for effective safety solutions.*

*This paper reviews various existing technologies, applications, and wearable devices developed by different researchers to enhance women’s safety. It analyzes the methodologies and innovations implemented using modern processors and communication technologies to reduce violence and provide timely assistance. In addition, the paper proposes a minor yet meaningful improvement to these systems, aimed at enhancing their performance and responsiveness. Such advancements can contribute to more reliable safety mechanisms and help create a safer environment for women, empowering them to live with confidence and dignity.*

*Index Terms— Two Parameter Physiological Sensing Systems, Healthcare, PCG and ECG.*

## I. INTRODUCTION

This paper discusses several precautionary devices and applications designed to help prevent or reduce the risks and challenges faced by women in their daily lives. These solutions are not only focused on prevention but also aim to support women who have experienced past incidents, enabling them to seek justice, assistance, and social support. Women’s safety can never rely solely on a single device or application; even with continuous technological advancements, there is always room for improvement and innovation.

It is not feasible to have constant physical protection for every woman at all times, but practical and discreet safety measures can be provided that can be easily activated during emergencies. Such tools can quickly alert nearby people and trusted contacts, ensuring timely help when a threat arises. Keeping these needs in mind, researchers and developers have introduced a variety of safety devices and applications that empower women with quick-response mechanisms and increased confidence in risky situations. This paper reviews some of these notable safety solutions and highlights their role in enhancing women’s security and well-being.

## II. LITERATURE REVIEW

Review of Existing Women’s Safety Devices and Applications (Humanized Reconstruction) Several research studies have proposed innovative devices and applications to enhance women’s safety by using modern technologies such as GPS, GSM, microcontrollers, sensors, and wearable

systems. These solutions aim to provide quick emergency response, location tracking, self-defense mechanisms, and awareness support. A summary of key contributions from different studies is presented below in a simplified and human-centered manner.

### Paper [1]: FEMME – ARM Controller Based Safety Device and App

This study introduces FEMME, a security solution designed specifically for women. It can be used either as a wearable device or as a smartphone application. The system offers a quick and easy way to seek help during emergencies. The app can be activated by pressing the volume and power buttons together. Once activated, it displays four options: audio recording, SOS messaging, video recording, and hidden camera detection. Based on the selected option, it sends alerts and recordings to preset contacts or detects hidden cameras.

The hardware device includes two buttons—an emergency button and a hidden camera detector. A single click sends live GPS location updates every two minutes, a double click records and sends audio with an emergency message, and a long press automatically calls a registered contact. Since it uses an ARM controller, the device works efficiently even without internet connectivity while consuming less power.

### Paper [2]: Belt-like Portable Safety Device

This research proposes a wearable safety belt inspired by earlier systems such as VithU app, SHE device, and ILA security alarms. The device includes an Arduino board, GSM shield, GPS module, screaming alarm, and pressure sensors.

When abnormal pressure is detected beyond a threshold, the system automatically activates, tracks the victim's location using GPS, and sends updates to emergency contacts and police every two minutes. Simultaneously, a loud alarm is triggered to attract public attention and signal distress.

**Paper [3]: Wearable Device with Camera and GPS Tracking**

This system focuses on protecting working women and school children through a portable wireless safety device. It includes an emergency button and a camera that captures the attacker's image when activated. GPS tracking determines the victim's location, and an emergency message with an image link is sent to registered contacts. The design uses Arduino-based Linux boards and algorithms such as Haversine and Trilateration for accurate location estimation. However, the system may face challenges like poor internet connectivity, device malfunction, and battery consumption.

**Paper [4]: Raspberry Pi-Based Intelligent Security Wristband**

This study proposes a smart wearable device resembling a wristband that integrates Raspberry Pi 2, GSM SIM900A, GPS receiver, and live video streaming using a webcam. The system can send SMS alerts, track location, and stream real-time video during emergencies. Additional features include a tear gas mechanism attached to spectacles and a buzzer alarm to call for help. Inspired by apps like VithU and tools like stun guns and Fight Back, this system aims to provide multi-layered protection through wearable technology.

**Paper [5]: Smart Safety Band with Sensors**

This model presents a compact wearable band equipped with an ARM7 microcontroller, temperature sensor, motion sensor, heartbeat sensor, GPS, GSM, and a panic button. The device operates in two ways:

Manual activation through the panic button sends the victim's location and emergency message to contacts.

Automatic activation occurs when abnormal sensor readings exceed threshold values, indicating distress or immobility.

This ensures help can be requested even if the victim is unable to respond physically.

**Paper [6]: Portable Security Device with Electric Shock Feature**

This system includes a transmitter unit with an emergency key, GPS, GSM module, microcontroller, buzzer, and LCD display, while the receiver is a mobile phone. When activated, the device sends the victim's location via SMS to registered contacts and control rooms. At the same time, it delivers an electric shock to the attacker and activates a buzzer to alert nearby people. The portable device can be easily hidden in a purse and consumes low power due to the use of microcontrollers.

**Paper [7]: Women Empowerment Mobile Application**

This application integrates three main modules: Violence Against Women (VAW), Women's Health (WH), and Emergency Call System (ECS). The VAW module provides information on legal rights and contact details of lawyers and NGOs. The WH module offers health-related guidance on topics like pregnancy, mental health, fitness, and nutrition. The ECS module allows users to save emergency contacts and send alerts, make repeated calls, and share GPS location during danger. Unlike many other apps, it combines safety, legal awareness, and health support in a single platform.

**Paper [8]: Smart Band with Multiple Sensors**

This research reviews various safety technologies such as SHE shock devices, ILA security alarms, and AESHS systems. It proposes a smart band integrated with Bluetooth Low Energy (BLE), motion sensors, pulse sensors, and temperature sensors. The band can send location updates to family members, nearest police stations, and nearby people for immediate attention. Its low power consumption and smartphone integration make it efficient and cost-effective.

**Paper [9]: Portable ARM-Based Safety Equipment**

This concept introduces a portable safety device built using an ARM7 LPC2148 microcontroller along with GPS, GSM module, LCD display, and an emergency button. It consumes low power and efficiently notifies authorities and contacts about the victim's location. The system could be further improved by adding a camera to capture evidence against the attacker.

**Paper [10]: Survey and Integrated Model**

This survey analyzes multiple women safety technologies and categorizes them based on functionality. It proposes an improved integrated model combining key features such as:

- Auto call receiving from registered contacts
- Spy camera detection module
- Fake call generation tool for escaping risky situations
- Electric shock module for self-defense

The goal is to merge the strengths of existing systems while overcoming their limitations to provide a more comprehensive and reliable safety solution.

Overall, these studies highlight the growing use of wearable devices, mobile applications, sensors, GPS tracking, alarms, and AI-based mechanisms to improve women's safety. Each system offers unique advantages such as quick alerts, evidence collection, real-time tracking, and self-defense features. Despite some limitations like battery consumption or connectivity issues, these innovations collectively contribute to building smarter, more responsive, and empowering safety solutions for women.

**Gaps Identified in Existing Literature (Humanized Reconstruction)**

Although the reviewed studies propose several innovative devices and applications for women's safety, certain

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limitations and areas for improvement have been identified. Addressing these gaps can help develop more efficient, user-friendly, and reliable safety systems.

### **III. GAPS FOUND IN THE LITERATURE**

#### **Paper [1] – FEMME Device and Application**

The FEMME system is effective, but its usability could be enhanced by reducing its size so that it can be worn discreetly as a watch or pendant. Additionally, integrating voice keyword recognition could allow the device to trigger emergency alerts automatically, making it more convenient during critical situations.

#### **Paper [2] – Portable Belt-like Safety Device**

While the device provides tracking and alarm features, it lacks a self-defense mechanism. Adding a protective element such as a shock module or deterrent tool could help the user defend herself if help is delayed.

#### **Paper [3] – Wearable Camera and GPS-Based System**

This system offers useful features like location tracking and image capture, but its high battery consumption is a major drawback. Introducing better power management or a backup battery option would improve reliability and continuous operation.

#### **Paper [4] – Raspberry Pi-Based Security Wristband**

The proposed wearable device includes multiple safety features such as SMS alerts, alarms, and defensive elements. However, its effectiveness could be further improved by adding sensors like pressure sensors and hidden camera detection to enhance situational awareness.

#### **Paper [5] – Sensor-Based Safety Band**

The band effectively sends alerts using sensors and GPS, but it relies heavily on internet connectivity. Including an alarm or buzzer to alert nearby people would provide immediate local assistance even when network access is unavailable.

#### **Paper [6] – Portable Security Device with Shock Feature**

This device offers quick alerts and self-defense through electric shock, but it lacks an evidence collection mechanism. Incorporating audio/video recording and automatic sensor-based activation could make the system more robust and helpful in legal proceedings.

#### **Paper [7] – Women Empowerment Application**

The application provides legal awareness, health guidance, and emergency alert features. However, adding a self-defense mechanism or quick protective response feature would allow women to handle threats immediately instead of relying solely on external help.

#### **Paper [8] – Smart Band with Multiple Sensors**

Although the smart band integrates several sensors and tracking features, it lacks a strong public alert system. Including a loud alarm or buzzer could help attract nearby attention and encourage faster public intervention.

#### **Paper [9] – ARM-Based Portable Safety Device**

This device sends the victim's location instantly, but sharing real-time continuous location updates would be more effective. During emergencies, victims may move rapidly, and real-time tracking would reduce the chances of losing their trace.

#### **Paper [10] – Integrated Multi-Feature Safety Model**

The proposed integrated model combines several innovative features into one system. However, integrating all functionalities increases both cost and device size, making it less portable and potentially difficult to use regularly.

Overall, the literature reveals that while many safety systems provide valuable features such as tracking, alerts, and defensive mechanisms, improvements are needed in areas like portability, battery efficiency, real-time monitoring, automatic activation, and cost optimization. Addressing these gaps can lead to the development of a more compact, affordable, and comprehensive safety solution that better meets the real-world needs of women.

### **IV. CONCLUSION**

Proposed User-Friendly Safety Device for Rural and Less-Tech-Savvy Women (Humanized Reconstruction)

Many existing safety applications and devices are built using advanced technologies and modern processors. While these innovations are powerful, they can be difficult to operate for women in rural areas or for those who are not familiar with smartphones and their complex features. In addition, if a mobile phone runs out of battery, the safety applications installed on it become unusable during emergencies. These challenges highlight the need for a simpler and more accessible safety solution.

To address this issue, a novel and easy-to-use device is proposed that can be operated by women with minimal technical knowledge. The device can include two or three clearly marked colored buttons, each programmed with a specific safety function. For example, the design may consist of four buttons:

- I. Red button: Activates a loud alarm sensor to attract nearby attention.
  - II. Blue button: Sends an emergency alert message to preset contacts.
  - III. Green button: Starts audio recording to capture evidence of the incident.
  - IV. Yellow button: Detects hidden cameras in the surroundings.
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Such a simple button-based interface ensures quick response during emergencies without requiring complex navigation or smartphone expertise. Although smartphones offer numerous features and remain highly useful, they still depend on battery life and user familiarity with applications. While portable chargers can help extend phone usage, they may not always be available or practical in every situation.

For users who are uncomfortable with smartphone-based applications, standalone wearable devices can serve as a reliable alternative. These devices can be designed in various convenient forms such as belts, wristbands, pendants, or even cosmetic-shaped items. For example, self-defense tools like lipstick-shaped stun guns or compact wearable alarms can be discreetly carried and easily activated when needed. Because attackers may not recognize these items as safety devices, they provide an element of surprise and increase the chances of escape.

Overall, this approach focuses on simplicity, accessibility, and practicality, ensuring that women from all backgrounds—including rural and less-educated communities—can use safety devices confidently and effectively during threatening situations.

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