WOMEN SAFETY WEARABLE WITH AUDIO TRACKING

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ABSTRACT

Ensuring the safety of women has become a significant issue due to rising incidents of crime and harassment. A wearable safety device for women offers a smart and reliable solution for personal protection in emergency situations. This device uses modern technologies such as GPS for location tracking, GSM for communication, and audio recording features to provide quick assistance. Designed to be lightweight and easy to carry as a wristband, pendant, or clip, it allows users to send an instant alert by pressing an SOS button. Once activated, the device shares the user's real-time location and emergency message with selected contacts or authorities. Some models also include alarms or shock mechanisms to discourage attackers. By enabling quick response and continuous monitoring, the wearable safety device improves personal security and builds confidence, helping women feel safer in both public and private spaces.

KEYWORDS:*Women Safety, Wearable Device, GPS Tracking, Emergency Alert System, Personal Security*

1.INTRODUCTION

In today's rapidly developing world, ensuring the safety and security of women has become an important social concern. Increasing cases of harassment, assault, and other crimes highlight the urgent need for effective personal protection systems. Technology plays a vital role in addressing this issue by providing smart and reliable safety solutions. A women wearable safety device is a modern technological innovation designed to enhance personal security and provide immediate help during emergency situations.

These devices are compact, user-friendly, and can be worn easily as a wristband, pendant, or smart accessory. They are equipped with features such as GPS tracking, GSM communication, and SOS alert systems that allow users to send instant notifications and real-time location details to predefined contacts or authorities. Some advanced devices also support live audio recording, alarm systems, or self-defense mechanisms to deter potential threats [1] [2].

The main objective of a wearable safety device is to ensure quick response and continuous monitoring, helping women feel safer and more confident in both public and private environments. This technology contributes to building a safer society by empowering women with reliable and accessible security support.

2. LITERATURE REVIEW

Women's safety has become an important research area due to increasing crime rates and the need for quick emergency support. Many researchers have proposed smart wearable devices that use modern technologies such as GPS, GSM, and IoT to provide real-time protection and assistance.

Kane et al. (2025) developed an IOT enabled women's safety system that automatically identifies emergency conditions and send alert messages to the registered contact.It includes GPS for real time location tracking and GSM module for sending alerts and SMS notification, allowing the device to operate independently of internet. This research shows the effectiveness of IOT-based automation in stregthningwomens safety[7].

Kale (2025) introduced the *Stay Safe Security App with Scream Alert Detection System*, it has scream alert detection system which is use for identifying emergency situation using sound based analysis. This application applies the audio signal processing using machine learning algorithm which helps the system to analyze the frequency andand intensity of sound which will help system in distinguish between panic scream and normalspeech. Once the abnormal sound is recognized the system detects the abnormal sounds and quickly send the emergency responses[3].

Ebenezer et al. (2023) presented a IoT-based wristband for women's safety, published in the *Journal of Advances in Information Technology*. This device is designed to improves the womens security and to detect emergency conditions and quickly send alerts to the pre-registered contact. It has some components which makes it more powerful, it has GPS for live location or to send the live location to the registered conatacts GSM module for sending SMS alerts that too without interenet, a manually operable panic button and health sensor for monitoring health of user[8].

Prakruthi et al. (2024) presented a survey titled *Women Safety Alert System with Location-Based Notification*, published in IJARSCT. The paper provides a structured review of multiple implementation models, including mobile applications, wearable safety device, and IOT integrated alert systems designed to facilitate immediate assistance during emergencies. In this paper the author discuss how location tracking system, communication components and notifications framework collectively contributed faster responses and improve security[6].

The body of domain indicates substantial advancement in technology-womens safety solutions particularly in area of IOT-enabled devices[9][10], A large portion of study concentrate on GPS for live location tracking GSM for quick SMS alerts without internet distress detection with audio signal processing combined with machine learning teachniques[5].

3. METHODOLOGY-WOMEN WEARABLE SAFETY DEVICE

The methodology of the women wearable safety device focuses on designing a smart system that provides quick assistance during emergency situations. The proposed system integrates hardware and software components to ensure real-time monitoring, communication, and user safety[9][10].

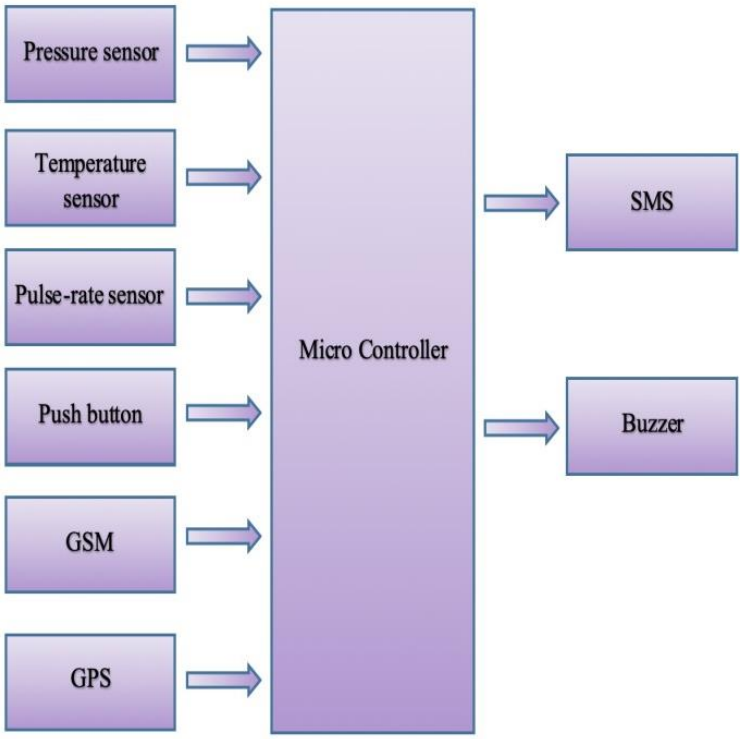
First, the device is designed using a microcontroller such as Arduino or ESP32, which acts as the central processing unit. It is connected to a GPS module for tracking the user's real-time location and a GSM module for sending alert messages and calls to predefined contacts. An SOS push button is included so that when the user feels unsafe, they can immediately activate the system.

When the SOS button is pressed, the microcontroller collects the location from the GPS module and sends it through the GSM network as an emergency message to family members or authorities[7][8]. Some advanced systems also activate a buzzer or alarm to attract nearby attention and may start live audio recording for evidence and monitoring [3][5]. The device is powered by a rechargeable battery and designed in a compact wearable form such as a band or pendant for easy usage.

4.SYSTEM ARCHITECTURE

The system architecture of a women wearable safety device is developed to provide immediate assistance and reliable protection during emergency situations. This system is designed by integrating various hardware and communication modules that work together to ensure user safety. At the core of the architecture is a microcontroller, such as Arduino or ESP32, which functions as the main control unit. It manages all operations and coordinates between the different components of the device [1][2]. The wearable device includes an SOS push button that allows the user to quickly activate the system whenever they feel unsafe. Once the button is pressed, the microcontroller collects the user's real-time location through the GPS module.

The gathered location information is then transmitted using a GSM or IoT communication module to predefined emergency contacts, such as family members or authorities. This alert message may include the user's location link and a request for immediate help. In addition, the system can activate a buzzer or alarm to attract nearby attention and discourage potential threats. Some advanced versions of the device also support live audio recording or tracking features to provide additional evidence and monitoring [3][8]. The entire system is powered by a rechargeable battery, making the device portable and convenient to use. Overall, the architecture ensures continuous monitoring, fast communication, and effective response, enhancing personal security and confidence for women in both public and private environments.



5. APPLICATIONS

1. EmergencyAlert &Response
   - Whenawearerfeelsthreatened,theycantriggeranalert (viaabuttonoragesture), notifyingtrusted contacts or emergency services.
   - Theliveaudiofeedhelpsrespondersunderstand*what'shappening*:Isthethreat verbal?Physical?Faraway?Thiscontextualinformationcanguidemoreeffective help.
   - Some systems(likeWearsafe)even buffer*prior* audio(e.g. 60 seconds) to give context before activation.
2. Real-timeLocationTracking
   - Integration of GPS allows continuous tracking of the wearer's location. This is especiallyusefulwhentravelingalone, commuting at night,orbeing inunfamiliar areas.
   - Lovedonesorsafetynetworkscan"virtuallyescort"thepersonbytrackingtheir movement.
   - Insomesystems,ifasafe-zoneisdefined(geofencing),leavingthatzonecan automatically trigger alerts.
3. IncidentDocumentation&EvidenceGathering
   - Audio recording during an alarm can serve as evidence later (for police, legal, or investigative purposes).
   - Biometricorsensordata(likesuddenheartratespike) couldbeusedtocorroborate claims of distress. Some wearable safety research proposes integrating physiological sensors.
4. DeterrencethroughAlarm/AudibleAlert
   - Many wearables include a loud siren or alarm to draw attention, potentially deterring attackers.
   - Alternatively, there can be a silent alert mode if discretion is needed (e.g., in a crowd or with an aggressor nearby).
5. Wearable based safety monitoring
   - The system can be integrated into wearable devices such as smart wristbands for continuous safety monitoring.
   - The wearable design ensures portability, convenience, and quick activation when required.

6. ContinuousMonitoring&Prevention
    - Beyondemergencysituations,wearablescanmonitorstressorvitalsigns(likeheart rate)indicatingpotentialrisk(e.g.,stressspike).Thisdatacanproactivelywarnthe user or their network.
    - Somedevicescancheckdevicehealth(e.g.,battery)soit'salwaysready.

6.LIMITATIONS

1) Network dependency
a) The system relies on GSM or network connectivity for sending emergency alerts.
b) In remote or low-signal areas, alert transmissionmaybedelayed or unsuccessful.
c) Poor network coverage can reduce the reliability of real-time communication.

2) Possibility of false alerts
a) Voice-based scream detection may generate false positives due to background noise.
b)Loudenvironmental sounds may bemisinterpreted as distress signals.
c) False alerts can reduce system credibility and cause unnecessary panic.

3) Battery consumption issues
a) Continuous GPS tracking and sensor monitoring consume significant battery power.
b) Wearable devices require regular charging for uninterrupted operation.
c) Low battery levels during emergencies can limit system effectiveness.

4) Limited accuracy in complex environments
a)Sound detection accuracy may reduce in crowdedor noisy environments.
b) Sensor-based detection may not always correctly interpret emergency situations.
c) Environmental factors can affect system performance.

7.CONCLUSION

This paper presented the design and development of an IoT-based women safety system aimed at providing real-time emergency assistance through intelligent detection and automated alert mechanisms. The study focused on integrating key functional components such as GPS tracking, GSM communication, panic activation modules, wearable support, and sound-based distress detection to enhance personal security. The proposed framework combines IoT connectivity with basic machine learning techniques to ensure rapid response and reliable alert transmission during critical situations.

The implementation highlights that a modular and integrated architecture is essential for building an efficient and scalable women safety system. By combining location tracking, automated distress recognition, and instant notification services, the system improves emergency responsiveness and user safety. Although challenges related to network dependency, false alerts, and hardware limitations still exist, the results demonstrate strong potential for further enhancement through advanced AI integration and improved sensor accuracy. This study provides a practical foundation for future research and development in intelligent women safety and personal security systems.

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