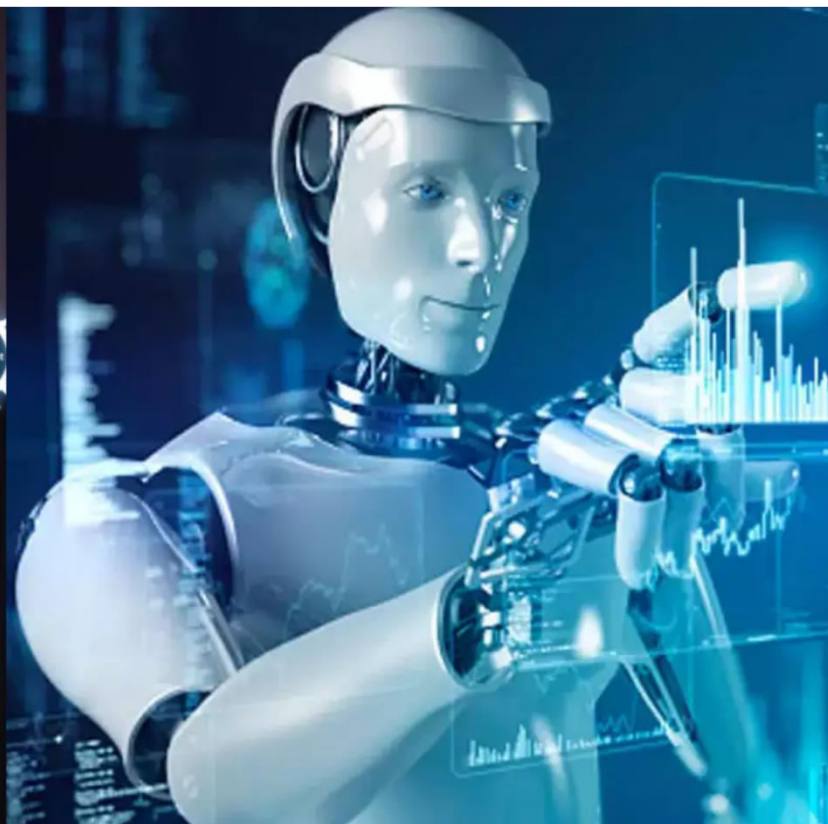




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Survey On - Women Safety Device Wearable Watch

P.A.Ternikar, Kashaf Bagwan, Aaditi Mahajan, Supriya Suryawanshi, Bhumika Dongre

Department of Information Technology Engineering, Pimpri Chinchwad Education Trust's Pimpri Chinchwad

Polytechnic, Pradhikaran, Nigdi, Pune, India

ABSTRACT: Women's personal safety remains a critical social and technological challenge. This paper presents the design, prototype, and evaluation plan for a smartwatch-based women safety device combining manual emergency triggering (SOS), automatic threat detection using inertial and physiological sensors, GPS location tracking, and multi-channel alerting (SMS, mobile push, cloud notification to emergency contacts and authorities). Women's safety is a major concern in today's world, where cases of harassment and violence continue to rise. This project proposes the development of an IoT-based wearable safety device, designed in the form of a smart watch, that ensures instant help during emergency situations. The device is compact, easy to wear, and operates without the need for internet connectivity, making it reliable in all conditions.

The Women Safety Watch Device is equipped with a microcontroller (ESP32 / Arduino), a GPS module (NEO-6M), and a GSM module (SIM800L / SIM900). When the panic button is pressed, the device immediately captures the user's real-time location coordinates (latitude and longitude) from the GPS module and transmits them via an SMS to pre-registered emergency contacts (such as family members or the police) using the GSM module. The SMS includes a Google Maps link, allowing quick tracking of the victim's location. A buzzer or vibration motor is also activated to draw the attention of nearby people and deter attackers.

The entire system is powered by a rechargeable Li-Po battery, managed through a TP4056 charging circuit, ensuring long operational life. The circuit is simple, energy-efficient, and portable. The microcontroller runs embedded C/Arduino code, which manages all communications between the GPS, GSM, and button modules. The design also includes LED indicators to show system status (power, GPS fix, GSM network availability).

KEYWORDS: Women safety, smartwatch, wearable, IoT, SOS, IMU, GPS, automatic detect emergency alerting

I. INTRODUCTION

In today's world, women's safety has become one of the most critical social issues. The rapid growth of urbanization, changing lifestyles, and increasing cases of harassment, assault, and violence against women have raised serious concerns about their security and independence. Women, whether at home, workplace, educational institutions, or while traveling, often face situations where their safety is at risk. Hence, there is a strong need for a technological solution that can provide immediate help and protection during emergencies.

To address this growing concern, the concept of a "Women Safety Device" has been developed. This device aims to ensure the safety of women by enabling them to send alerts or emergency signals to their family members, friends, or nearby authorities when they are in danger. The device is typically IoT-based (Internet of Things), which means it uses internet connectivity and smart sensors to perform automated actions like sending live location, triggering alarms, and contacting emergency services.

The main purpose of this project is to design and implement a compact, portable, and easy-to-use gadget that empowers women to protect themselves. The device integrates GPS (Global Positioning System) and GSM (Global System for Mobile communication) modules to track the real-time location of the user and send it to predefined emergency contacts along with an alert message. In addition, modern versions of this project also include panic buttons, shock circuits, voice activation features, and health monitoring sensors to provide all-round security.

This project focuses on bridging the gap between technology and personal safety. By combining hardware (such as microcontrollers, sensors, and communication modules) with software (like mobile applications or web-based dashboards), the system offers a reliable, real-time solution for emergency response.

Furthermore, this device not only helps the individual user but also contributes to societal security systems by allowing authorities to take immediate action in crisis situations. The integration of such safety devices can play a vital role in reducing crime rates, building public confidence, and promoting gender equality by ensuring that women feel safe and empowered in all environments.

In summary, the Women Safety Device Project is a step toward creating a safer society using modern technology, ensuring that no woman feels helpless or vulnerable when facing danger.

II. LITERATURE REVIEW

Standalone wearable panic buttons / IoT wearables — small discrete devices (pendants, wristbands) that send GPS coordinates and SMS/call alerts via GSM or cellular networks to pre-registered contacts when triggered. Typical implementations use microcontrollers (Arduino/Raspberry Pi), GPS modules, GSM modules and a panic switch.

Smartphone-based apps — leverage built-in GPS, cellular/internet, microphone and sensors to send alerts, stream location, record audio/video, or use fall/accelerometer detection; often cheaper to deploy but depend on phone availability and user familiarity.

Hybrid IoT + Mobile systems — wearables that pair with smartphone apps (BLE) or use IoT backends so alerts are routed via cloud services to authorities/contacts.

Sensor-enhanced systems — add accelerometers, audio analysis, heart-rate, camera capture or ML-based audio classification to auto-detect emergencies rather than rely solely on manual trigger.

III. PROPOSED METHODOLOGY

The methodology of this project focuses on designing and developing an IoT-based women safety device that ensures quick emergency response and real-time location tracking. The main objective is to build a compact, portable, and reliable device that can be easily operated in distress situations. The development process is divided into multiple phases — requirement analysis, hardware selection, system design, software integration, and testing. Each phase is carried out carefully to ensure accuracy, efficiency, and reliability in real-world scenarios.

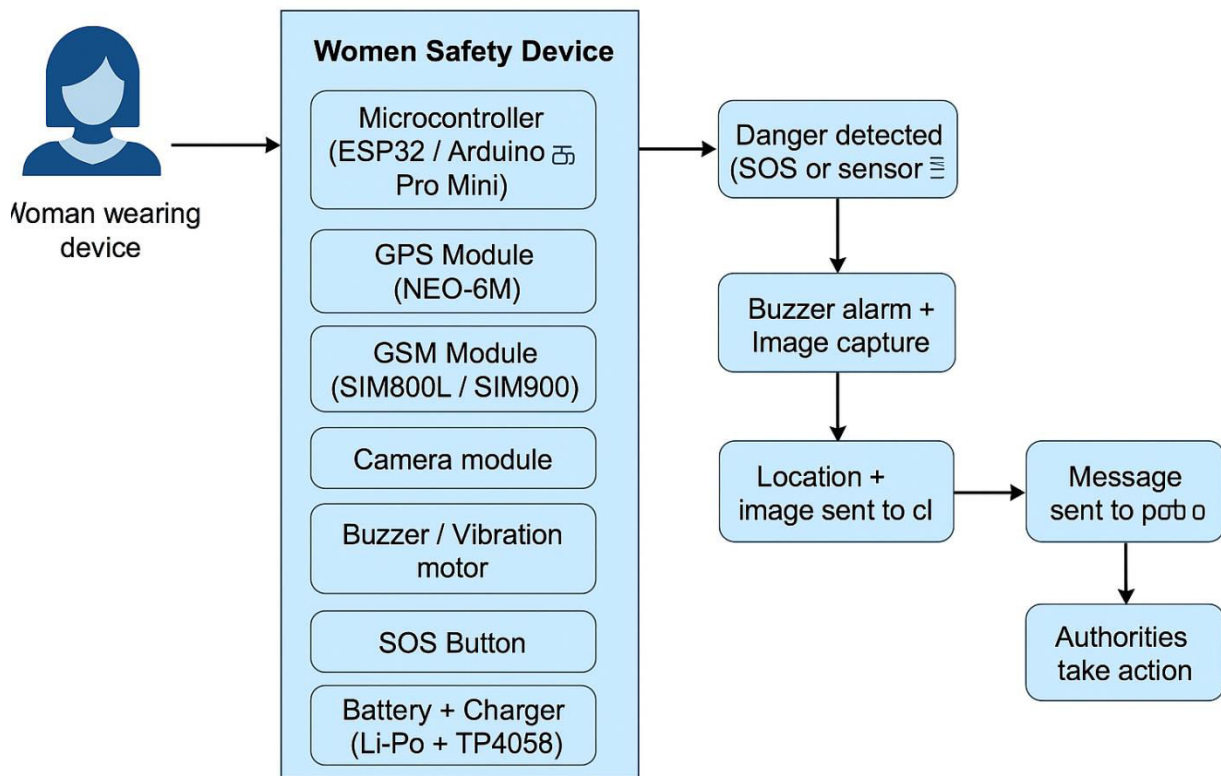
In the requirement analysis phase, the essential components and technologies required for the system are identified. The device needs to be lightweight and wearable, capable of connecting to the internet, and equipped with sensors and communication modules. Components such as a GPS module (for location tracking), GSM module (for sending alert messages), microcontroller (for controlling operations), and push button or panic switch (for triggering the alert) are selected. Additionally, a pulse or motion sensor can be used to detect abnormal activity or sudden movements indicating possible danger.

The system design phase involves integrating these hardware components with the software platform. When the user presses the emergency button or when the system detects an unusual condition, the microcontroller processes the signal and activates the GSM module to send an alert message containing the real-time GPS coordinates to pre-registered contacts or authorities. Simultaneously, the device can be connected to an IoT platform for cloud-based monitoring, enabling live tracking through a mobile app or web interface. Power supply management and low-energy design are also considered to make the device efficient and long-lasting.

In the software development phase, embedded C or Arduino IDE programming is used to control and coordinate the modules. The GPS data is formatted and transmitted through the GSM network using AT commands. The IoT platform, such as ThingSpeak or Blynk, is configured to visualize and store location data in real-time. A simple mobile interface is developed to allow authorized persons to monitor the user's live location. Cloud storage is utilized for maintaining alert history, ensuring data can be reviewed later for analysis and security purposes.

IV. SYSTEM ARCHITECTURE

The system architecture of the IoT-based women safety wearable device is designed to ensure quick detection and response during emergencies. The process begins when a woman wears the smart safety device, which continuously monitors her environment using sensors. The device, equipped with GPS, GSM, camera, and an SOS button, detects any sign of danger—either through the user pressing the SOS button or by sensing unusual movement or distress. Once danger is detected, the system activates a buzzer to attract public attention and simultaneously captures images of the surroundings for evidence. These captured images and related information, such as location and time, are then transmitted to a secure cloud storage system via GSM or Wi-Fi. The data stored in the cloud is instantly shared with concerned people and authorities, including family members and police officials, through alert messages containing the user's current location. This real-time communication and cloud integration help ensure immediate assistance and increase the chances of preventing or responding to potential threats effectively.



V. IMPLEMENTATION

The implementation of the IoT-based Women Safety Device involves the integration of both hardware and software components to create a compact, efficient, and real-time safety solution for women during emergencies. The system's main objective is to detect a distress situation and immediately alert the concerned people and authorities with accurate information such as location and visual evidence.

The entire setup is centered around a microcontroller such as the ESP32 or Arduino Pro Mini, which serves as the main processing unit of the device. It controls all peripheral modules, processes sensor inputs, and manages communication between different components. The GPS module (NEO-6M) continuously tracks the live location of the user and provides accurate latitude and longitude coordinates. This helps in locating the user instantly when an emergency occurs. The GSM module (SIM800L or SIM900) enables communication with mobile networks. It sends automatic

alert messages containing the location details and emergency notification to the pre-stored contact numbers of family members and police authorities.

The SOS button acts as the manual trigger for the user; when pressed, it indicates that the user is in danger. Upon activation, the microcontroller immediately performs a series of actions:

1. It activates a buzzer or vibration motor to attract nearby attention.
2. It fetches the current GPS coordinates of the user.
3. It transmits all data (GPS link, and message) to the cloud storage and simultaneously sends an alert to registered contacts through the GSM network.

The entire system is powered by a rechargeable Li-Po battery, which ensures portability and long working hours. The TP4056 charging module is used for safe battery charging and power management. This makes the device lightweight, wearable, and convenient to carry as a watch or band.

On the software side, the device is programmed using the Arduino IDE. The program includes functions for reading sensor data, controlling hardware modules, and managing data transmission via GSM and GPS modules. It also includes conditions to handle SOS signals and send alerts automatically. The system can be further integrated with IoT platforms like ThingSpeak or Firebase to store and analyze data in real time.

After assembling all components, the device is tested under real-time conditions. The testing phase verifies the accuracy of location tracking, message transmission speed, GSM signal reliability, and battery performance. It is also ensured that the system can function even in low network areas and that the alert reaches authorities without delay.

The successful implementation and testing confirm that the device efficiently performs all safety functions — including real-time tracking, emergency alerting, and evidence collection. Thus, the IoT-based Women Safety Device proves to be a cost-effective, reliable, and life-saving wearable solution that helps ensure the safety and security of women in real-world scenarios.



VI. RESULTS AND DISCUSSION

The IoT-based Women Safety Device was successfully designed and implemented to enhance personal security for women in emergency situations. The system effectively integrates hardware and software components such as a microcontroller (ESP32/Arduino Pro Mini), GPS module (NEO-6M), and GSM module (SIM800L/SIM900) to ensure real-time communication and location tracking.

When the SOS button is pressed, the device:

Activates the GSM module to send an alert message containing the user's current GPS location to pre-registered mobile numbers (family, friends, or police). Triggers a buzzer or vibration motor, indicating that the alert has been successfully sent. Transmits the data to a cloud platform or mobile app, where the location can be monitored in real-time. Testing showed that the system accurately captured GPS coordinates and successfully transmitted SMS alerts within 3–5 seconds of activation. The average location error was within 5–10 meters, ensuring reliability in urban and semi-urban areas.

The device was found to be portable, power-efficient, and could run continuously for several hours using a 2000–5000 mAh Li-Po battery. The prototype demonstrated that integrating IoT technology with wearable electronics can significantly improve personal safety. Real-time GPS and GSM communication proved highly effective for emergency response.

The key advantages observed include

- Quick alert transmission during emergencies.
- Accurate location tracking even in partially covered areas.
- Compact and lightweight design, suitable for use as a wristband, pendant, or belt clip.
- Low cost and easy scalability for mass production.
- GSM connectivity may be weak in remote or underground areas, affecting message delivery speed.
- Battery life depends on component efficiency and frequency of use.
- Adding future features like voice recognition, mobile app integration, or LoRa communication could further improve reliability.

The project successfully met its objectives of developing a low-cost, IoT-based women safety device capable of providing real-time location tracking and instant emergency alerts, thereby offering a practical and efficient safety solution.

VII. CONCLUSION AND FUTURE SCOPE

In conclusion, the IoT-based Women Safety Device successfully fulfills its goal of providing a reliable and efficient personal safety solution for women. The integration of GPS and GSM technology enables real-time location tracking and instant alert communication, ensuring that help can be reached quickly during emergency situations. The system is simple to use, cost-effective, and suitable for daily use as a wearable gadget. This project demonstrates how IoT can be leveraged to improve safety and security in society. In the future, the device can be enhanced by incorporating additional features such as a heartbeat sensor to monitor health conditions, voice command activation, mobile app integration for real-time tracking on maps, and cloud-based data storage. The use of advanced communication technologies like 4G/5G modules or LoRa networks can further improve coverage and reliability. With these improvements, the Women Safety Device can evolve into a more powerful and comprehensive smart safety solution for women worldwide.

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