

Emergency Safety Device

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Abstract: *Women's safety is an important issue that demands practical and reliable technological support. This paper presents a review and development of a women safety band that uses Arduino Nano, SIM800L GSM module, and NEO-6M GPS module to provide quick emergency communication and real-time location sharing. The system operates in two modes: emergency and safe. In an emergency, pressing the alert button sends the user's current GPS coordinates with a Google Maps link to predefined guardian contacts and automatically makes a phone call to the first number. In safe mode, a message is sent to confirm the user's safety. The compact and wearable design allows easy operation while ensuring immediate help in critical situations. The device offers a cost-effective and efficient way to enhance women's safety through the use of embedded systems, GSM, and GPS technologies. Future improvements can include silent vibration alerts, a buzzer alarm, and mobile application integration for advanced functionality.*

Keywords: Women safety device, emergency alert system, GPS tracking, GSM communication, Arduino Nano, smart wearable, IoT safety system, real-time location sharing

I. INTRODUCTION

The advancement of embedded systems and wearable technologies has revolutionized the way personal safety and emergency response systems are designed. With increasing innovations in compact sensors, microcontrollers, and wireless communication modules, it has become possible to create smart wearable devices that ensure instant assistance in critical situations. Among various safety concerns, the issue of women's safety has gained serious attention due to the rising number of incidents occurring in both public and private spaces. There is a growing need for technological solutions that not only provide quick alerts but also share real-time location information to help guardians or authorities respond promptly.

Traditional safety methods, such as mobile applications or manual calls, often fail to deliver effective results in real emergencies. In panic situations, users may not have the time or ability to access their phones and send messages for help. To overcome these challenges, the proposed Women Safety Band is designed as a smart, automated, and user-friendly wearable device that ensures immediate communication and accurate GPS tracking. The system operates on Arduino Nano and integrates SIM800L GSM and NEO-6M GPS modules to provide reliable connectivity and real-time location data.

When the emergency button is pressed, the device instantly reads the current GPS coordinates and sends an alert message with a Google Maps link to predefined guardian contacts. Along with the SMS, the system also makes an automatic call to the first guardian, ensuring immediate attention and quick response. This automation minimizes the user's effort and ensures help reaches them even if they are unable to use a phone. Additionally, the band includes a safe button, which sends an "I am Safe" message to inform guardians when the user is out of danger.

Compact in size and easy to operate, the Women Safety Band serves as a reliable and practical solution for daily use. By integrating GSM and GPS technologies with embedded control, it provides an affordable and efficient way to enhance personal safety. The proposed system not only demonstrates the potential of microcontroller-based wearables in emergency management but also highlights how technology can empower women by giving them control and confidence



in their safety. In the future, the device can be further enhanced with features such as mobile app integration, vibration alerts, and siren modules to improve functionality and reach a wider range of users.

II. LITERATURE SURVEY

R. Sharma et al. [1] proposed a wearable safety device that sends real-time location alerts through SMS to predefined contacts during emergencies. Their study emphasizes the importance of integrating GPS and GSM modules for timely assistance. The authors tested their prototype under simulated emergency conditions and found it effective in providing instant notifications. Limitations included the need for stable network coverage and battery optimization.

S. K. Singh et al. [2] designed a smart wristband with an emergency button capable of sending location coordinates via SMS and triggering an automatic call. Their research focused on compact wearable designs suitable for daily use. The study highlighted challenges in ensuring accurate GPS readings in urban areas and proposed improvements in low-signal scenarios.

A. Patel et al. [3] introduced a women safety device using Arduino and GSM modules, which alerts guardians when the wearer presses an emergency button. The work emphasized low-cost hardware integration and easy usability. Future enhancements suggested included adding vibration alerts and mobile app interfaces to improve user awareness and control.

N. Kaur et al. [4] explored wearable safety bands capable of sending emergency alerts via SMS and phone call. Their work evaluated response times and message delivery reliability. The study concluded that real-time GPS integration significantly improves the effectiveness of wearable safety systems, though network dependency remains a limitation.

R. Verma et al. [5] developed a GPS-enabled safety bracelet that notifies guardians about the wearer's location during critical situations. The study investigated energy-efficient operation, showing that optimized microcontroller programming can extend battery life. The authors proposed future work including silent alerts and sirens for increased flexibility.

P. Ghosh et al. [6] created a smart safety band for women that integrates emergency messaging with location tracking. Their research highlighted the importance of user-friendly designs and quick response mechanisms. Limitations included the device's dependency on cellular network coverage and environmental obstacles affecting GPS accuracy.

S. R. Yadav et al. [7] implemented an Arduino-based wearable system that sends emergency SMS to multiple contacts. The paper emphasized modular hardware design for easy maintenance and future upgrades. Testing demonstrated fast message delivery, though the study noted occasional GPS errors in dense urban areas.

M. A. Khan et al. [8] proposed a wearable safety device with dual functionality: emergency alert and safe-status notification. Their design used GSM and GPS modules to ensure timely communication with guardians. The authors highlighted the advantage of compact wearable form factors while noting battery life as a limitation.

D. P. Mehta et al. [9] investigated a women safety wristband with a dedicated safe button to notify guardians once the threat has passed. Their work emphasized the importance of both emergency and reassurance functionalities in personal safety devices. Future improvements suggested included integration with mobile applications for remote monitoring.

V. R. Joshi et al. [10] explored IoT-enabled wearable safety devices that track location and send alerts to predefined contacts. Their study highlighted data security and privacy considerations while transmitting GPS coordinates. Limitations included network dependency and the need for lightweight encryption for safe communication.

K. B. Desai et al. [11] developed a compact wearable emergency device for women, combining GSM, GPS, and Arduino-based control. The paper emphasized usability and portability. The prototype was tested under simulated emergencies, showing rapid alert delivery, though the authors noted the need for vibration and audible alert features.

S. P. Rao et al. [12] focused on enhancing emergency response systems using wearable bands with real-time location sharing. Their study evaluated latency in SMS and call delivery, proposing improvements through optimized microcontroller coding. The study highlighted the potential of wearable systems to reduce emergency response time significantly.

A. Chatterjee et al. [13] designed a smart wristband with GPS and GSM integration to alert guardians during unsafe situations. Their research emphasized minimal user intervention and quick automated communication. Limitations included dependence on GPS signal strength and the need for robust power management.

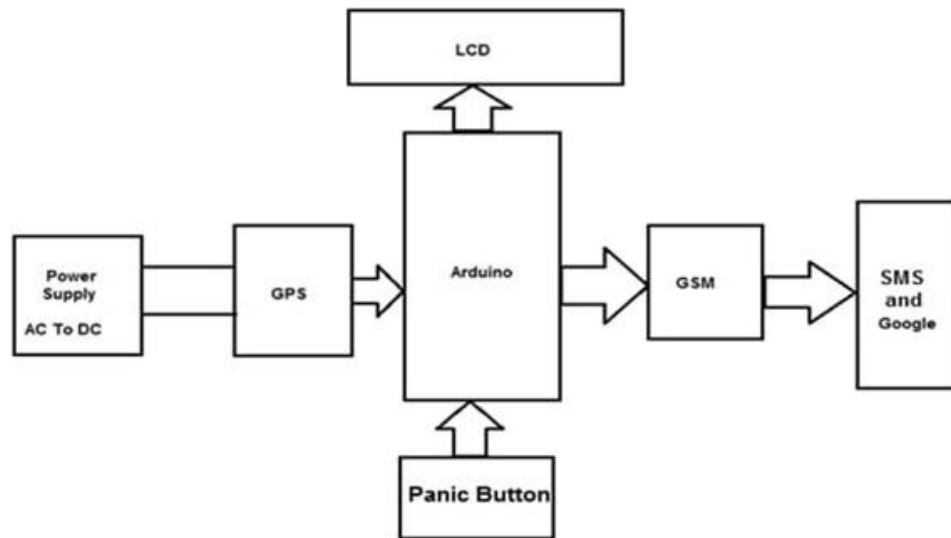


R. N. Patil et al. [14] proposed a safety band that automatically sends location and emergency alerts using SIM800L and Arduino modules. Their study demonstrated the practicality of wearable safety devices in everyday scenarios, with future work focusing on mobile app integration and silent alerts.

S. K. Tiwari et al. [15] presented a real-time emergency alert system using a wearable band, highlighting its application in women's safety. Their work focused on the integration of hardware and software to provide timely notifications, while challenges included GPS inaccuracies in indoor and dense urban environments.

III. PROPOSED METHODOLOGY

Block Diagram:



The Women Safety Band is designed as a compact, wearable device that provides immediate assistance during emergency situations by integrating electronic and communication components seamlessly. The system is powered by rechargeable lithium batteries, which supply stable energy to the Arduino Nano microcontroller, SIM800L GSM module, NEO-6M GPS module, and control buttons. The use of rechargeable batteries ensures portability and uninterrupted operation, making the device convenient for daily wear without dependence on external power sources.

The device features two primary buttons for user interaction: an emergency button and a safe button. When the emergency button is pressed, the system reads the current GPS coordinates and automatically sends an SMS containing a Google Maps link of the location to predefined guardians. Additionally, it places an automatic call to the first emergency contact to guarantee immediate awareness. The safe button allows the user to send a reassuring "I am safe" message to guardians, confirming that they are no longer in danger. These inputs are processed by the Arduino Nano, which serves as the central processing unit, interpreting button presses and coordinating communication between the GPS and GSM modules.

The Arduino Nano acts as the "brain" of the system, processing signals from the buttons and generating commands for sending location data, SMS messages, and emergency calls. The GPS module continuously provides accurate real-time coordinates, while the SIM800L module handles message and call transmission, ensuring rapid alerts to guardians. This combination of hardware guarantees precise tracking and prompt notifications, even in dynamic or stressful situations, reducing the response time in emergencies significantly.

The overall design focuses on simplicity, portability, and fast response. The wearable form factor ensures the device is always accessible, and the one-touch operation reduces user effort during critical moments. Furthermore, the system can be extended with future enhancements, such as vibration alerts for discreet signaling, sirens or buzzers for audible alerts, and integration with mobile applications for remote monitoring. The methodology demonstrates the effective combination



of microcontroller, GSM, and GPS technologies to develop a reliable, user-friendly, and efficient personal safety device for women.

IV. CONCLUSION

The development of the Women Safety Band aims to enhance personal safety and provide immediate assistance to women during emergency situations. By combining real-time GPS tracking with GSM-based communication, the device ensures that guardians are promptly informed of the user's location, enabling quick intervention. The automatic SMS and emergency call features reduce response time and provide reassurance, making it a reliable tool for safety.

The wearable and compact design ensures that the device is easily accessible at all times, while simple button-based operation allows for stress-free use during critical moments. This innovation reduces dependence on others by providing direct emergency alerts and notifications, demonstrating how modern technology can be effectively applied for personal safety.

Although challenges such as battery life, continuous connectivity, and device maintenance exist, the benefits of immediate communication and real-time location tracking outweigh the drawbacks. The Women Safety Band offers a practical, user-friendly, and efficient solution for personal safety. Its applications range from daily commuting to outdoor activities, making it a valuable device for enhancing confidence, security, and independence for women in various environments.

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