

A Comprehensive IoT-Based Unified Approach for Women Safety Alerts Using GSM

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Abstract: Women's safety is an urgent and multifaceted issue encompassing protection from violence, access to justice, and the right to live fearlessly. The crime rate against women remains a concern, highlighting the need for strict adherence to safety measures. Proposed a wearable wristband for women, integrating IoT and GSM technologies for real-time assistance and protection. The device includes a trigger, microcontroller, GSM module, GPS module, IoT module, Neurostimulator, Buzzer, Accelerometer sensor, and Vibrating Sensor. When activated, it sends an emergency message via GSM to a pre-registered mobile number, alerting authorities. The device's portability makes it easy for women to carry and enhance their safety. In emergencies, the neurostimulator can deliver non-lethal electric shocks to deter attackers, while a signal alarm notifies nearby individuals of the distress. The IoT component facilitates efficient global tracking and internet notification.

Keywords: IoT, Neurostimulator, Buzzer, GPS, GSM, Trigger accelerometer sensor, Vibration sensor.

1. Introduction

The protection of women, particularly in India, is in danger due to lewd behavior in the workplace and at home. Women are often kidnapped and assaulted, and their safety is often compromised due to physical disparities between men and women. Students face events like child trafficking and seizing, and advanced transportable devices can help submit crisis warnings and provide real-time location tracking.

Beyond the workplace, women face threats such as abduction and assault, and the fear of harassment extends beyond public spaces. Access to portable devices equipped with advanced functionalities could be invaluable in such situations, enabling individuals to send distress signals and provide location tracking.

Individuals in distress during nighttime or secluded areas often lack immediate assistance, making them vulnerable and isolated. Digital applications exist to address some concerns, but their efficacy may be limited in certain contexts. This paper proposes a comprehensive solution leveraging modern technology, integrating components into wearable devices like wristbands, to enhance women's safety and security.

2. Objective

The objective is to present a prototype device designed to protect working women and school children from safety concerns. It includes an emergency push-button, an electronic camera, GSM technology for location tracking, and a school bus surveillance system. The goal is to provide a roadmap for implementing innovative safety solutions in various contexts.

Aims to protect working women and school children by creating a prototype with embedded devices with a warning emergency push-button and camera. The GSM device monitors the victim's location and sends a recorded contact warning message. Use a legitimate product development process to design and develop the product, including paper goals, requirements, development stages, integration, testing, and troubleshooting.

3. Literature Review

[1] Proposed a smart intelligent security system designed for women to combat physical harassment. The system uses a wristband and spectacles, triggers alarms, deploys tear gas for self-defense, sends location and distress messages to emergency contacts, and uses live streaming video to identify attackers. This innovative solution enhances women's safety and security.

[2] Introduced an Android-based Child Monitoring System to address child security risks and dual parental responsibilities. The system provides real-time monitoring, safety information, and proactive alerts for children beyond predefined boundaries, enhancing parental supervision.

[3] Proposed a mechanism to aid women in distress situations by sending location information via SMS alerts. The system uses an ATMEGA328P controller, GPS module, GSM modem, and LCD. The aim is to provide security and assurance in potentially threatening situations, empowering women and enhancing their safety. The study emphasizes the need for proactive measures to combat gender-based violence and create safer environments for women.

[4] The surge in crimes against women, particularly those aged 25-35, is a pressing issue. Women often prioritize their responsibilities over personal health, exacerbating their vulnerability. The proposed solution is a smart, intelligent

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device to provide comprehensive support and assistance to women. This study highlights the need for proactive interventions to combat violence against women and empower them with confidence and security.

[5] The paper highlights the alarming prevalence of unethical physical harassment faced by women worldwide, accounting for 35% in public spaces. The model integrates real-time surveillance systems, emergency response mechanisms, community engagement initiatives, and awareness campaigns. This holistic security infrastructure can deter harassment, provide prompt assistance in emergencies, and foster a culture of respect and safety for women in public spaces.

4. Proposed System

The paper integrates a camera module to enhance incident documentation and aid in perpetrator identification when the panic switch is activated. The ESP32 CAM microcontroller, renowned for its comprehensive features, includes an integrated video camera capable of live-streaming footage via a mobile application.

Upon activation of the panic switch, the camera module initiates live streaming directly to the designated mobile application. This real-time streaming feature serves a dual purpose: providing immediate visual evidence of the incident and facilitating the identification of potential attackers.

The live-streaming functionality enables swift response measures, empowering users with crucial evidence and facilitating law enforcement authorities in apprehending perpetrators. This integration of advanced technology not only enhances incident documentation but also serves as a deterrent against potential threats, thereby bolstering overall safety and security.

5. Components

A. ESP32 microcontroller

The ESP32 is a low-power SoC series with Wi-Fi and Bluetooth capabilities, featuring a dual-core or single-core Tensilica Xtensa LX6 microprocessor. It has built-in antenna switches, RF balun, power amplifier, filters, and power management modules. Designed using TSMC ultralow power 40 nm technology, it offers optimal power performance, RF performance, robustness, and versatility. Its compact design makes it ideal for mobile, wearable electronics, and IoT applications. Key features include pin headers, 3.3V Power On LED, USB-to-UART bridge, reset button, micro-USB port, boot button, and RGB LED.

B. Accelerometer Sensor

An accelerometer sensor is a crucial component found in many devices, from smartphones to wearable fitness trackers and even vehicles. Its primary function is to measure acceleration forces, including gravity. This enables devices to detect changes in orientation, movement, and vibration. Whether it's adjusting screen orientation, tracking steps, or deploying airbags in cars during a collision, accelerometers play a vital role in enhancing user experience, safety, and

functionality across various technologies.

C. Vibration Sensor

A vibration sensor measures acceleration, pressure, and vibrational changes in devices or systems, generating alarm signals for security purposes. It uses mechanical displacement and acoustic sound detection for better accuracy. The Vibration Sensor Module features the SW-420 vibration sensor, adjustable sensitivity via a potentiometer, and a 3-pin interface. It supports 3.3V and 5V power and is compatible with microcontrollers like PIC, Arduino, and Raspberry Pi. The module's straightforward interface ensures seamless integration and reliable performance.

D. GSM Module

The SIM800C module is a crucial component for GSM and GPRS communication, enabling devices to initiate calls, transmit SMS messages, and establish internet connections. It's essential for remote monitoring, IoT deployments, and Wi-Fi-free regions, bridging communication gaps for real-time communication, data exchange, and remote management.

E. GPS Module

The NEO-6M GPS module is a crucial component for GPS satellites, providing precise location coordinates for various applications like vehicle tracking, asset management, and navigation systems. It consists of a GPS Receiver Chip, antenna, microcontroller, serial interface, power supply circuitry, integrated circuits, and external interfaces. The module's functionality is essential for various applications, including vehicle tracking, asset management, navigation systems, and location-based services. Additional ICs may be included for enhanced functionality.

F. Neurostimulator

A neurostimulator electric shock unit is a device designed to deliver non-lethal electric shocks for self-defense purposes. It consists of a trigger mechanism, a microcontroller, an electric shock circuitry, a power source, safety features, a user interface, an enclosure, and compliance with regulations. The trigger mechanism initiates the shock, while the microcontroller processes input signals and controls the delivery. The electric shock circuitry includes capacitors, resistors, and transistors, all of which must comply with safety standards. The user interface provides feedback on the device's status. The enclosure is durable, lightweight, and ergonomically designed.

G. LCD

LCD controller chips have revolutionized LCD usability, making them accessible in commercial products and hobbyist projects. LCD modules simplify complex driving tasks by incorporating hardware. They can be categorized into built-in controller and driver chips or driver chips. HD44780-based displays use a standard 14-wire interface, allowing seamless adaptation of code and hardware across different sizes. They are affordable, ranging from \$3 for small displays to \$20 for larger ones.

H. Camera Module

The ESP32-CAM module is a versatile platform with an image sensor, microcontroller, Wi-Fi, and Bluetooth capabilities. It features a high-resolution OV2640 2MP sensor for visual monitoring and surveillance. The ESP32-S module provides Wi-Fi and Bluetooth connectivity, enabling seamless integration with external devices. The Wi-Fi + Bluetooth module integrates Wi-Fi and Bluetooth functionalities for wireless communication. The module operates at 3.3V to 5V DC, offering flexibility in power source selection. Its compact form factor and versatile features make it suitable for various projects.

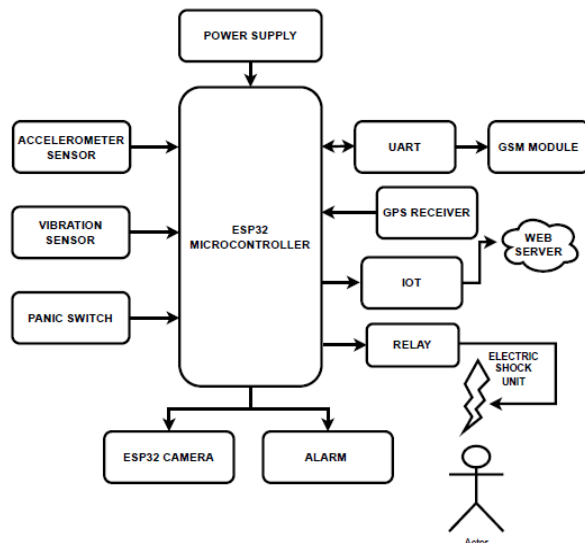


Fig. 1. Block diagram

6. Results and Discussion

This paper discusses the performance of a GSM device with GPS, neurostimulator, panic switch, sensors, and camera unit for women's safety alerts. The GPS module showed high accuracy, with an average error margin of less than 5 meters in outdoor environments. The neurostimulator triggered rapid responses in emergencies, and the panic switch was robust and user-friendly. Sensors provided real-time data for situational awareness, and the camera unit provided clear images for remote monitoring. The system's seamless integration with various smartphones and operating systems ensured widespread usability. User testing revealed a positive experience, and the system demonstrated high reliability during field tests. The system's effectiveness in real-world scenarios was demonstrated in case studies. Future enhancements focus on AI-driven threat detection algorithms, expanded sensor capabilities, and strategic partnerships for wider deployment.

7. Conclusion

The objective is to address the safety and security concerns of women, especially those engaged in night shift work. It highlights a significant statistic from India, revealing that 53 out of 100 working women do not feel safe. Moreover, out of 86 surveyed working women in India, many encounter obstacles,

particularly in cities like Delhi, Mumbai, Hyderabad, Kolkata, and Pune.

To tackle these challenges, the passage suggests the development of a wearable safety device, similar to a watch, accompanied by relevant applications. This proposed solution aims to alleviate the safety concerns of women, particularly those working night shifts, by providing them with a sense of security and reassurance.

Expanding on this concept for paper publication entails comprehensive background research on the current state of women's safety, particularly in India. This involves gathering data, statistics, and reports from various reputable sources, including government agencies, NGOs, and academic institutions.

Additionally, exploring existing technological solutions such as wearable devices, mobile applications, and IoT systems is crucial. This exploration should delve into the effectiveness, limitations, and scalability of these technologies, considering their potential adoption in addressing women's safety concerns.

Moreover, discussing design considerations, IoT infrastructure requirements, collaborative approaches, policy implications, impact assessment, and future directions are essential aspects to be elaborated upon. By delving into these areas, the paper can provide valuable insights and recommendations for policymakers, researchers, technologists, and practitioners striving to enhance women's safety and security in society.

8. Future Works

Incorporating biometric authentication features like fingerprint or voice recognition enhances the security of wristband devices, ensuring that only authorized users can access sensitive data. Studies highlight the reliability and convenience of biometric methods compared to traditional password-based systems, with fingerprint and voice recognition technologies showcasing notable advancements in accurately identifying individuals. These features bolster user privacy and safeguard against unauthorized access. Moreover, the development of companion mobile applications that sync with the wristband extends its functionality, offering features such as location history tracking and personalized safety tips. These apps facilitate efficient management of emergency contacts and require extensive research and collaboration to ensure usability and effectiveness. Overall, the integration of biometric authentication and companion apps represents a significant stride in enhancing user safety and security, requiring ongoing innovation and collaboration to address evolving challenges in personal safety technology.

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