

Women Safety Night Patrolling Device

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Abstract

With increasing societal concerns regarding women's safety, the Women's Safety Project emerges as a crucial response to empower women through a secure distress signal mechanism during emergencies. This comprehensive initiative seamlessly integrates advanced hardware, including a GPS module and a distress button connected to an Arduino, alongside a dynamic web platform. The escalating challenges faced by women underscore the pressing need for a reliable safety solution, prompting the development of this project to address and mitigate risks in various environments. Women's safety is a critical societal concern, necessitating innovative solutions that utilize modern technology. This project proposes an advanced women's safety system based on Arduino technology, aiming to enhance security and prompt response in potentially dangerous situations. The system incorporates features to allow women to send distress messages to the nearest police station based on their real-time location. The project places a central emphasis on user empowerment, real-time response coordination, and ensuring the security of women. Operating seamlessly in both normal and emergency modes, the system transmits distress signals to the web platform. The web platform, in turn, undertakes crucial tasks, such as processing distress signals, conducting location-based comparisons with nearby police stations, and initiating SMS alerts to predefined contacts. This initiative stands at the intersection of technology and societal well-being, exemplifying the transformative potential of innovative solutions in ensuring the safety of women. By providing a reliable and responsive mechanism for distress communication, the Women's Safety Project addresses a critical societal need, contributing to the ongoing discourse on leveraging technology for the betterment of individual safety and well-being.

Keywords: IOT, GPS, website, Arduino, NodeMCU

INTRODUCTION

In 2021, the National Crime Records Bureau (NCRB) unveiled a disconcerting truth, with over 378,000 crimes against women in India, occurring at a rate of nearly one every 2 min, a pervasive issue of women's safety was laid bare. From assaults, kidnappings, to rapes and dowry harassment, the spectrum of offenses presents a distressing tableau. Highlighted in the statistics are particular states like Rajasthan, Uttar Pradesh, and Madhya Pradesh, where crime rates against women soar, accentuating the stark regional disparities. The revelation of over 31,000 registered rape cases in the same year further accentuates the urgency for a comprehensive intervention to address the harrowing reality faced by women. Within these troubling statistics lies a clear call for innovative solutions to address the complex

challenges faced by women. The challenge is evident, and the mission for a meaningful, impactful Women's Safety Project begins now. What is required is a solution that does not just acknowledge the problems but actively works towards creating a safer, more secure environment for women in their everyday lives.

Women's safety stands as a paramount concern globally, with instances of violence, molestation, and harassment affecting a significant portion of the female population. Alarming statistics highlight the

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severity of the issue, where nine out of ten women have encountered some form of violence. The World Health Organization (WHO) reports that one in three women globally faces violence, and the Global Gender Gap Report underscores that every fifth woman experiences sexual violence. As women become increasingly unsafe, concerns extend beyond specific settings, encompassing public places, workplaces, and even homes. An overwhelming 80% of women express fears for their safety.

In the current landscape, where women actively participate in the workforce, ensuring their safety is a crucial societal concern. The rising incidence of crimes against women underscores the urgent need for efforts to prevent such occurrences, allowing women to navigate their lives with confidence and contribute effectively to society. Technological infusion, particularly through the lens of the Internet of Things (IoT), has shown promise in addressing prevalent challenges and difficulties. As technology continues to evolve, particularly within the realm of IoT, there is an opportunity to leverage these advancements to design a comprehensive Women's Safety Project.

In response to the escalating safety concerns for women, the proposed Women's Safety Project aims to develop a robust and accessible solution that leverages GPS technology integrated with Arduino. The primary goal is to empower women to trigger alerts swiftly and efficiently, ensuring a rapid response in times of distress. The multifaceted nature of the project incorporates hardware components, software interfaces, and secure communication channels to create a comprehensive safety ecosystem. This proposed project envisions a cost-effective, user-friendly, and efficient system that aligns with the growing need for women's safety. By combining hardware innovation, software development, and real-time communication, the Women's Safety Project strives to provide a tangible solution to enhance the security and well-being of women facing potential threats. The utilization of readily available technologies makes the project scalable and accessible, contributing to the broader objective of creating safer environments for women.

LITERATURE REVIEW

The GPS-Based Women's Safety Device, outlined by Shirley *et al.*, serves as a cost-effective emergency tool for women in India [1]. Triggering the panic button sends an SMS with location coordinates to predefined numbers, aiding in quick assistance. The device integrates an Arduino Uno microcontroller and a GSM module for connectivity. This innovative approach aims to reduce crimes against women in India by providing an affordable safety solution. The research, licensed under a Creative Commons Attribution 4.0 International License emphasizes low production costs for widespread accessibility and proposes a practical means of enhancing women's safety.

SMARISA, a Raspberry Pi-based smart ring, empowers women against assault and harassment [2]. This wearable gadget, linked to a Raspberry Pi Zero, sends distress signals with location and assailant images to emergency services. Cost-effective and user-friendly, it offers an affordable means for effective self-defense. The paper explores IoT and Raspberry Pi tech, including GPS monitoring, alarm messaging, and assailant image capture. Victims can press a button to transmit their position and the attacker's photo to contacts or authorities.

The Raspberry Pi-based wearable device for women's safety integrates a Raspberry Pi 3 Model, B+, GPS module, GSM module, USB camera, buzzer, and a panic button [3]. Upon pressing the panic button, the GPS module locates the user, and the GSM module sends an SMS alert to emergency contacts and the police. Simultaneously, the USB camera captures images, emailing them to authorities. The device, initialized at startup, ensures quick response in emergency situations, utilizing technology for prompt assistance and alerting nearby individuals with a buzzer.

"Lifecraft", an Android-based safety application, offers a distinctive approach to emergency situations [4]. Usable by both women and men, it responds to voice commands or the SOS button, sending location alerts every 5 min to user-defined contacts. Notably, it includes features like

continuous location tracking, displaying safe zones, offline mode for limited resources, and audio recording for evidence preservation.

Developed using Android Studio 3.3.2 and Java JDK 11.0, "Lifecraft" operates without additional hardware, compatible with any GPS enabled Android phone. Registration involves entering three contact numbers, stored in the Firebase Database. The app activates with an on/off button press, triggering emergency services upon SOS activation or voice command, continuously updating contacts on the user's location. Live streaming, audio recording, and offline mode further enhance its utility in crisis situations.

The IoT-based Night Patrolling Robot for Women Safety employs an Arduino-based GSM module with GPS to send location-specific emergency messages and sound alerts, triggered by a push button [5]. The device, adaptable to physical accessibility, notifies relatives, family, and the police control center [6]. Cost-effective, lightweight, and portable, it operates without internet access, utilizing embedded systems like Arduino, wireless technologies like Bluetooth, and sensors (e.g., temperature and heart rate) to identify potential threats and send alerts. The primary strategies include the use of Arduino and GSM modules with GPS, wireless technologies, and sensors for a lightweight, cost-effective, and internet-independent safety solution.

Several papers explore GPS-based solutions for real-time tracking and emergency response. Studies by Ramachandiran *et al.* propose mobile apps that track a user's location and automatically alert authorities in case of distress signals or deviations from designated routes [7]. These systems offer potential for immediate intervention and deterring potential threats.

All above innovative safety solutions, ranging from GPS-based devices and smart rings to wearable gadgets and mobile applications, collectively strive to redefine women's safety in India. Each approach harnesses technology to address unique aspects of the safety spectrum, offering cost-effective, user-friendly, and prompt responses to emergencies. As we transition to the next part of the project report, it becomes evident that the challenges outlined demand a comprehensive Women's Safety Project, incorporating these technological insights and more, to create a holistic and impactful solution [8].

PROPOSED SYSTEM AND WORKING

Proposed system consists of two parts: Hardware and Software. Before looking at actual implementation, let us have look at components used in both parts' hardware as well as software.

Arduino and NodeMCU [9]

- At the core of the hardware system, Arduino and NodeMCU collaborate to manage data flow and communication effectively.
- Arduino collects real-time sensor data, including GPS information, and processes emergency signals.
- NodeMCU ensures seamless communication between the hardware components and the online platform.

Switch Button

- A user-friendly physical switch button on the wearable device is designed for convenient activation of distress signals.
- Easily accessible, it ensures swift response in emergency situations.

Power Supply System

- A robust power supply system is implemented to ensure continuous and reliable operation of the hardware components.
- Considering the portable nature of the system, special attention is given to power efficiency for prolonged usage.

Buzzer

- The buzzer functions as an audible alert, capturing attention when the distress signal is activated.
- It acts as a secondary notification layer, providing an additional alert for nearby individuals.

Neo 6 GPS Module

- The Neo 6 GPS module plays a vital role in providing accurate real-time location data.
- Integrated with Arduino, it enhances the effectiveness of the safety system by enabling precise location tracking.

Software components used are as below:

HTML

Hypertext Markup Language (HTML) is the fundamental language for web design, providing the structure and content of a webpage. It employs specific keywords and commands to organize content, enabling web browsers to interpret and display it effectively.

CSS

Cascading Style Sheets (CSS) complements HTML by focusing on the presentation and layout of a webpage. It separates content from presentation, ensuring a visually appealing and consistent design for websites.

PHP

PHP, a server-side scripting language, manages dynamic content on websites. Operating on the server, PHP acts as middleware between databases and HTML/CSS, contributing to interactive and functional web applications.

MySQL Database

MySQL, a robust Relational Database Management System (RDBMS), structures data in tables. Each database can have multiple tables, resembling classes in a school. Tables store data in rows and columns, essential for temperature and heater status data.

SMS Gateway

Incorporating an SMS gateway enhances communication capabilities. This component facilitates the sending of SMS alerts to predefined contacts, ensuring real-time notifications for users.

Web Hosting

Web hosting is vital for global accessibility, involving the storage of website code and databases on a central server accessible over the internet. Hostinger.com serves as a cost-effective hosting solution for our project, providing the necessary infrastructure [10].

Code Editor

A code editor, such as Sublime Text Editor, is crucial for writing and editing error-free code. It highlights syntax errors, ensuring accuracy in coding. The editor supports HTML, CSS, PHP, and other languages, facilitating the development of a robust web application [11].

GPS Tracking

Integrate a GPS module into the device to track the user's location in real-time.

- *Emergency Button:* Include a prominent and easily accessible emergency button on the device.
- *Sensors:* Integrate various sensors like accelerometers to detect sudden movements or falls, and sound sensors to analyze the surrounding environment.
- *Mobile Connectivity:* Connect the device to a mobile app via Bluetooth or cellular data to establish communication.

- *Alert System:* When the emergency button is pressed or a significant disturbance is detected by the sensors, it triggers an alert through the mobile app.
- *Automatic Police Notification:* Implement a feature that automatically notifies the local police or a designated law enforcement agency when an emergency is detected.
- *Live Audio/Video Feed:* If possible and permissible, include a camera and microphone for live audio/video streaming. This could provide the police with real-time information about the situation.

Two-way Communication

Enable two-way communication between the user and the police through the device or the connected mobile app.

- *Geo fencing:* Implement geo fencing capabilities to alert the police if the user enters or leaves predefined areas.
- *Authentication Mechanism:* Add an authentication mechanism to ensure that only genuine emergencies trigger police notifications.
- *Power and Battery Management:* Optimize power consumption to ensure the device has a reliable and long-lasting battery life.
- *User Verification:* Integrate features for user verification, such as voice recognition or fingerprint scanning, to prevent misuse.
- *Response System:* Define a response protocol for the police, including dispatching officers to the user's location.
- *Legal and Privacy Considerations:* Adhere to legal and privacy guidelines when implementing features like audio/video recording and location tracking.

This women's safety night patrolling device aims to provide a quick and efficient way for women to seek help in emergency situations by establishing a direct connection with the police.

WORKING

The proposed women's safety system intricately integrates hardware components to fortify its operational capabilities, ensuring the collection and transmission of real-time data for prompt emergency responses. At the core of the hardware system are the Arduino microcontroller and NodeMCU module, both working in tandem to create a seamless data flow process. Arduino serves as the primary data collector and interfaces with essential sensors such as the Neo 6 GPS module and a physical switch button. The Neo 6 GPS module continuously reads and transmits the user's live coordinates, while the switch button acts as an interface for manually triggering a distress signal in emergency scenarios [12]. NodeMCU, functioning as the communication hub, facilitates the transmission of collected data from Arduino to the web-based platform. It ensures a robust and efficient exchange of information, acting as the intermediary between the hardware and the server. This includes sending GPS coordinates and panic signals to the designated web server for further processing [13]. On the software front, a dynamic web-based platform has been meticulously crafted using HTML, CSS, and PHP, hosted on a dedicated server. The MySQL database serves as the backbone, storing crucial information ranging from user profiles and GPS coordinates to panic flags and police station locations. The platform features an intuitive admin panel, empowering administrators to manage user accounts and police station data seamlessly.

During emergency situations, the system's operational workflow becomes particularly sophisticated. When a panic signal is detected, either manually triggered by the user or automatically sensed through the switch button, the website dynamically processes the incoming GPS coordinates. An innovative aspect of the system is its real-time analysis, comparing the user's current location against the stored locations of nearby police stations. This dynamic analysis ensures that the distress signal is swiftly routed to the nearest police station, minimizing response times and optimizing emergency assistance. The SMS functionality, a crucial element of the system, is seamlessly integrated using an SMS gateway.

Once the nearest police station is identified, the system triggers SMS alerts to notify them of the emergency, including critical information such as the user's current location. Simultaneously, designated relatives of the user also receive SMS alerts, providing comprehensive details about the distress situation. This multi-layered approach ensures that relevant authorities and individuals are immediately informed, enhancing the overall efficiency of emergency responses. In essence, the hardware components, with Arduino and NodeMCU at their core, collaboratively establish a robust foundation for the proposed women's safety system. By seamlessly integrating these components with a sophisticated software platform, the system not only enhances security measures but also ensures timely and effective assistance during critical situations, addressing the imperative need for bolstered women's safety across various contexts (Figure 1).

RESULT AND DISCUSSION

The implementation of the proposed women's safety system has yielded promising results, showcasing its efficacy in addressing critical aspects of safety and emergency response. Through the seamless integration of hardware components, including Arduino and NodeMCU, with a sophisticated software platform, the system has successfully demonstrated its ability to collect, process, and transmit real-time data, ensuring prompt and effective emergency responses. The system excels in real-time data collection, capturing live GPS coordinates and panic signals for a comprehensive understanding of the user's emergency.

Communication efficiency is achieved through Arduino and NodeMCU, leveraging a simple serial protocol. A dynamic web platform, employing HTML, CSS, PHP, and MySQL, facilitates robust data storage, user management, and emergency response coordination [14]. The system dynamically analyses the user's location, optimizing distress signal routing by comparing live coordinates with nearby police stations. SMS integration enhances effectiveness, triggering alerts to the nearest police station with critical user details, while designated relatives receive simultaneous notifications for a multi-layered emergency response.

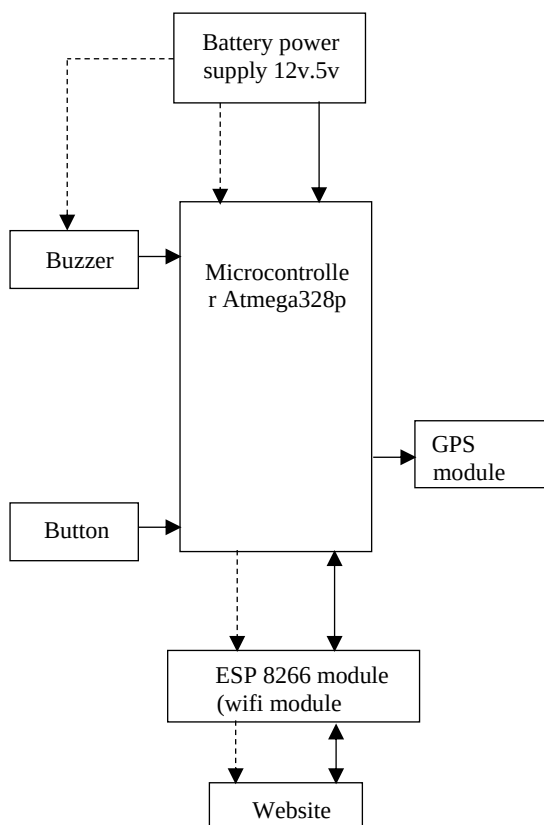


Figure 1. Block diagram of the system.

Immediate Distress Alerts

The device allows users to send immediate distress alerts, notifying predefined contacts or authorities about their safety concerns, helping to make sure that a quick response is generated spontaneously in case of an emergency.

Location Tracking

It provides real-time GPS tracking, enabling friends, family, or authorities to know the user's precise location, which is crucial for rescue and assistance efforts.

Deterrent Mechanisms

Many such devices incorporate audible and visual deterrents like loud alarms and flashing lights, which can scare away potential threats and attract attention from passersby, increasing safety.

Data Collection

They often have data storage capabilities that record location and event details. This information can be invaluable for providing evidence in legal cases or for tracking patterns of harassment or unsafe areas.

Remote Monitoring

Some devices offer remote monitoring, where designated contacts or authorities can track the user's location in real-time through a web service or mobile app, ensuring continuous support.

CONCLUSION

The successful implementation of the women's safety system underscores its potential to significantly contribute to enhancing women's safety and security. The combination of hardware and software elements creates a comprehensive solution that not only empowers users in distress but also facilitates efficient coordination with law enforcement agencies. The dynamic nature of the system's response, particularly in analyzing and determining the nearest police station in real-time, sets it apart as an innovative and adaptive safety solution. The integration of SMS alerts ensures that multiple stakeholders, including law enforcement and designated relatives, are promptly informed, fostering a collaborative approach to emergency assistance.

As the project aligns with the pressing need for improved women's safety measures, the positive results obtained in the testing phase affirm its viability as a practical and impactful solution. Moving forward, further refinements and scalability considerations can be explored to adapt the system to diverse contexts and geographical locations, with the ultimate goal of creating a widely accessible and effective tool for enhancing women's safety in various settings.

The development of a women's safety night patrolling device with police interaction holds significant promise in addressing safety concerns for women in various communities. This multifaceted initiative involves technological innovation, collaboration with law enforcement, and a commitment to user empowerment. In essence, the successful implementation of a women's safety night patrolling device with police interaction requires a holistic approach that combines technological innovation, legal adherence, community involvement, and a commitment to user safety. Through thoughtful discussions and collaboration, stakeholders can work together to create a solution that not only enhances the safety of women but also contributes to building safer and more resilient communities.

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