iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IV **Month of publication:** April 2026

DOI: https://doi.org/10.22214/ijraset.2026.79366

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

Women Safety Device

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Abstract: ***Women safety is one of the major concerns in today's society due to the increasing rate of crime against women. In case of emergencies, women are not able to inform others or disclose their location immediately. To address this problem, a wireless women safety device is proposed that can offer timely help during emergency situations. The design of the system utilizes an ESP32 microcontroller, GPS module, and GSM module for the purpose of location tracking and emergency alerts. Once the panic push button is activated by the user, the device automatically sends the location of the user by utilizing the GPS module. This sends a message to the contacts that the user has specified in case of an emergency. Moreover, a buzzer is also included to produce an alarm sound that can be used to attract attention or even act as a deterrent to any possible threat. The device is also powered by a rechargeable battery to ensure that it can function properly. The proposed system is compact, portable, and easy to use. Therefore, it is suitable for personal safety. This device may help in improving the response time for emergency situations. This may help in improving the safety of women.***

Keywords: Women Safety, Wireless Safety Device, ESP 32 Microcontroller, GPS Tracking, GSM Tracking, Emergency Alert System.

I. INTRODUCTION

Women's safety is an issue of great concern in today's society due to the increasing number of crimes against women. Many women are exposed to unsafe situations while traveling alone or moving to isolated areas. In emergency situations like these, it is hard for women to immediately contact their family or concerned people to seek their assistance. Hence, there is a great need for a safety system that can provide timely aid to women. With the advent of technology, various electronic devices are available to ensure safety. A safety device that can send messages or even share the location of the woman can be helpful to ensure timely aid. This paper discusses the design and development of a wireless women safety device that employs an ESP32 microcontroller, GPS module, and GSM module. The safety device enables the user to send an alert message in an emergency by simply pressing a panic button. Once the user presses the panic button, the system can identify the user's current location by employing a GPS module and send the user's location details to predefined numbers via a GSM module. The system also employs a buzzer that can generate a sound in an emergency situation. The suggested system is portable and user-friendly and can be useful in enhancing the safety of women.

II. LITERATURE REVIEW

The safety and security of women have become a primary concern for all over the world due to an increase in crimes and harassment against women. Researchers and engineers have suggested many technological solutions for improving personal safety devices for women. The personal safety devices for women mainly focus on providing emergency communication and quick assistance using modern technologies such as the Internet of Things (IoT), GPS, GSM, and wearable technology.

The majority of the initial research works have suggested GPS-based safety devices that can help in identifying the location of a person during an emergency. The GPS-based safety devices can help in improving the response time by allowing the family members or the authorities to track the location of the victim. The safety devices for women using GPS technology have gained popularity due to the accurate positioning capabilities of GPS technology. The GPS technology can be effectively used in outdoor environments. Some researchers have also proposed women safety devices based on GSM technology. In general, a GSM module is used for sending emergency SMS messages to the contacts during emergency situations. When the emergency button is pressed on the device, it sends a message containing the location details along with the emergency message to the contact persons or authorities. This method is regarded as efficient since SMS technology does not require internet connectivity for transmission.

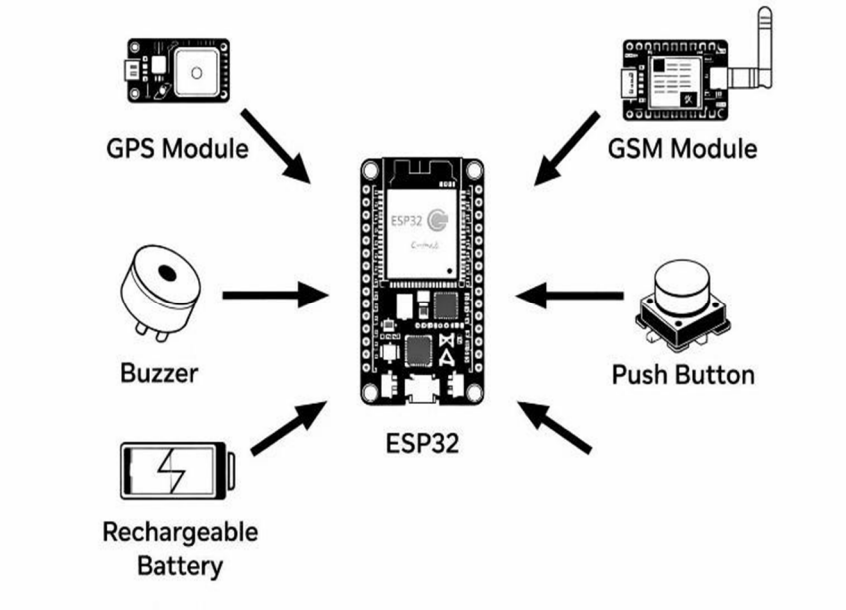
Recent research has focused on IoT-based smart safety devices that use a combination of sensors and communication modules for the provision of enhanced safety features. The smart safety devices use microcontrollers, which can range from Arduino, Raspberry Pi, or ESP-based microcontrollers, for the processing of information from a variety of sensors. The IoT technology used allows the device to send alerts, share location, and even store information on the cloud for analysis. This enhances the reliability of the system, as well as the communication with the user in real-time.

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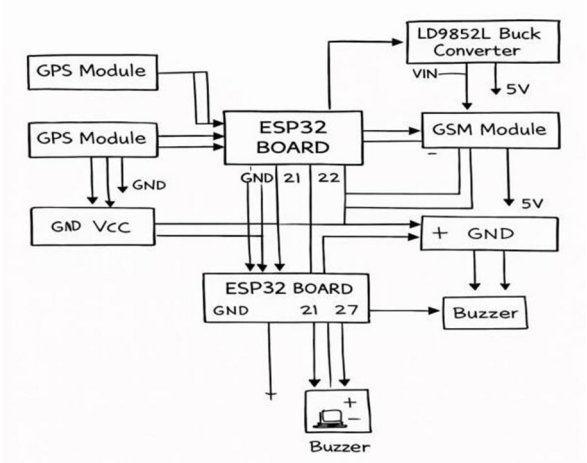
Other advanced systems include additional sensors and intelligent technology like accelerometers, cameras, and biometric sensors that help improve safety monitoring. These devices are capable of detecting abnormal situations or physical distress and automatically send emergency alerts. There are also IoT-based systems that utilize machine learning algorithms that automatically detect unusual behavior or threat detection. Researchers have also done a systematic review of women safety technologies, which emphasizes the increased adoption of IoT devices, wearable sensors, GPS tracking devices, and mobile applications for improving women safety. The increasing adoption of wireless communication technology has also improved the efficiency of personal safety devices. Even though many safety devices have been created for women safety, some challenges are associated with their adoption. Thesesmartphones, their cost, and their unreliability. Therefore, there is a need to develop a safety device that is easy to operate, portable, and reliable for sending emergency messages to the police or emergency contacts.

Based on the challenges identified with the previous studies, the proposed system aims to develop a wireless women safety device using ESP32, GPS, and GSM modules to ensure quick response to emergency situations by sending the user's location to their contacts when the panic button is pressed to improve the safety and security of women.

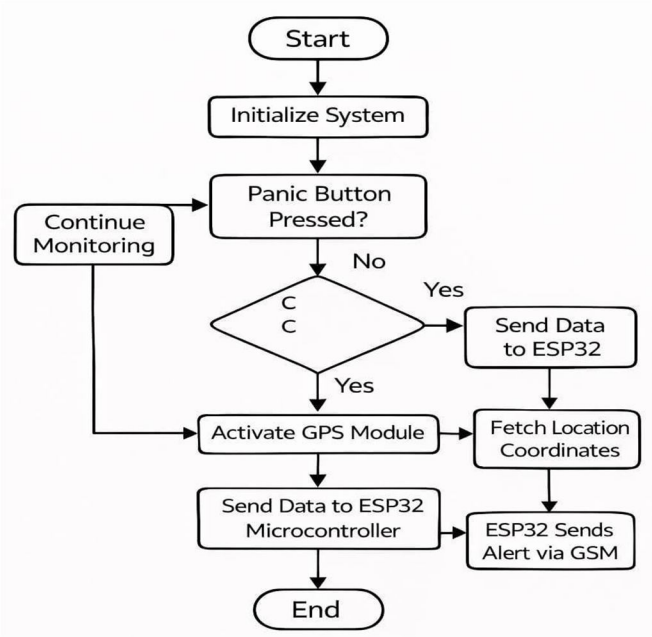
III. PROPOSED SYSTEM



A. System Architecture



B. Methodology and Algorithm



The proposed wireless women safety device is expected to offer immediate assistance in case of any emergency situation with the help of real-time location tracking and wireless communication. The proposed methodology highlights the overall working process of the proposed system.

1) Power Supply And Voltage

The system uses a rechargeable lithium-ion battery rated at 7.4V, which is used as the power source. Since all the components, such as ESP32, GPS, and GSM, require a lower voltage, a buck converter (LM2596) is used to reduce the voltage from 7.4V to 5V.
This ensures:

- All components operate stably
- Components are protected against voltage changes
- Components use power effectively

2) System Initialization

When the device is turned ON:

- The microcontroller initializes all GPIO pins of ESP32
- Serial communications are initialized with:
- GPS Module- to obtain location information
- GSM Module - to obtain communication information
- The system is put into a standby mode
- In this mode, there are no actions taken until an emergency is identified

3) Input Mechanism (Panic Mechanism)

- A push button is used as an input device to identify an emergency
- The push button is connected to a digital input pin of ESP32
- The system is designed to continuously monitor this push button
- Two scenarios are considered:
- If the push button is not pressed, the system remains idle
- If the push button is pressed, an emergency mode is triggered
- This input mechanism is simple to use in emergency situations

4) Emergency Detection and Activation

When the push button is pressed:

- The system immediately identifies this through the microcontroller
- The system leaves standby mode
- Emergency mode is triggered
- This is a critical factor in emergency situations, as a timely response is required.

5) GPS Module Operation

- Once activated, the following steps take place:
- ESP32 sends commands to GPS module (NEO-6M)
- GPS module connects to satellites
- GPS module receives:
- Latitude
- Longitude
- This is the precise location of the user.

6) Data Processing and Formatting

- Data received from the GPS module is:
- Processed by the ESP32
- Converted to a readable format
- Example of message format:
- "Emergency Alert! I need help. My location is:
- Latitude: XX.XXXX
- Longitude: YY.YYYY"
- This message is then ready to be sent using the GSM module.

7) GSM Module Communication

Data processed is sent to the GSM module (SIM800L).

Steps:

- ESP32 sends AT commands to GSM module
- GSM module connects to network
- Send SMS alert to contacts Contacts:

1. Family members
2. Friends

8) Buzzer Activation

- ESP32 activates buzzer
- Alarm sound is generated Purpose:
- To attract people around
- To create panic among attacker
- To ensure quick help is available

9) Continuous Operation

- Once the alert is sent, the system will:
- Continue to be in operation
- Can do the following:
- Send repeating alerts (if programmed)
- Keep the buzzer ON for a while
- This will increase the reliability of the system in real-time emergencies.

10) Reset and Power Control

- The system will continue to function until it is reset or the power is turned OFF.
- This will ensure that the alert sending process is not disrupted unintentionally.

11) Overall Working Summary

- Turn the power ON
- Initiate the ESP32 modules
- Wait for the panic button to be pressed
- If the panic button is pressed, the GPS will be activated
- Coordinates will be sent to the GSM module
- GSM sends an SMS with the alert
- Buzzer turns ON
- Continue the system until reset

IV. IMPLEMENTATION AND RESULTS

A. Implementation Details

The system is implemented by using an ESP32 microcontroller, a GPS module, a GSM module, a push button, a buzzer, and a power supply circuit.

The programming of the microcontroller is done by using an Arduino IDE. The GPS module is used for providing real-time location, and the GSM module is used for sending SMS. The push button is used for emergency situations, and the buzzer is for providing an alarm signal.

The components are connected as per the circuit diagram. The power is supplied by a rechargeable battery with a buck converter. The system is always ready to receive the input from the push button by staying in standby mode. Serial communication is also established for data transfer. The system is compact and portable for easy use. Connections are properly made for reliable operation. The implementation is done considering cost and efficiency.

B. Results

It works in emergency situations.

When the panic button is pressed, the device sends an SMS with the location.

- It shows accurate location using the GPS.
- It sends messages using the GSM.
- It produces sound using the buzzer.
- The response time of the device is fast.
- It works in all conditions.

It doesn’t require internet connectivity, so the chances of failure are reduced.

It is easy to use the device, and the device is user-friendly.

It is a fast and effective device for safety.

V. ADVANTAGES AND DISADVANTAGES

A. Advantages

1) Quick Emergency Response: The device sends an alert immediately after pressing the panic button, helping in faster response during dangerous situations.

2) Real-Time Location Tracking: The GPS module provides accurate latitude and longitude, making it easy to track the user’s exact location.

3) Quick Emergency Response: The device sends an alert immediately after pressing the panic button, helping in faster response during dangerous situations.

4) Low Cost and Efficient: The components used are affordable, making the system cost-effective and suitable for large-scale use.

5) Immediate Alert with Buzzer: The buzzer generates a loud sound, which can attract nearby people and help in emergency situations.

6) Reliable Communication: GSM-based SMS alerts ensure that messages are delivered even with weak network conditions.

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B. Disadvantages

1) Dependence on Network Availability: The GSM module needs network coverage, and if there is no network, SMS cannot be sent.
2) GPS Delay in Some Conditions: It takes GPS sometime to get the location, especially in areas with a large population, e.g., indoors.
3) Limited Features: The system can only send SMS; it cannot send other types of messages, e.g., through a mobile app.
4) Battery Dependency: The system is battery-dependent; if the battery is drained, the system cannot function.
5) No Automatic Detection: The system cannot automatically detect a dangerous situation; it needs a button press.
6) Basic Security System: The system is basic compared to other IoT security systems, which are more advanced.

VI. CONCLUSION

The proposed wireless women safety device offers a simple solution to enhance personal safety in emergency situations. This system uses an ESP32 microcontroller along with a GPS and a GSM module to send location alerts to predefined contacts in real-time upon pressing the panic button.

The proposed system is simple to use, portable, and does not require an internet connection, making it a reliable solution in emergency situations. Adding a buzzer also helps to grab the attention of people around to help in emergency situations.

The proposed system offers a fast response, accurate location tracking, and effective communication, making it a valuable tool to enhance women's safety and help in emergency situations.

VII. FUTURE SCOPE

The proposed system may be enhanced in various ways by incorporating more advanced features and technologies into it. A mobile application may be incorporated into it for better user interaction and live tracking capabilities.

The device may be enhanced by incorporating IoT technology to store and track data from cloud platforms.

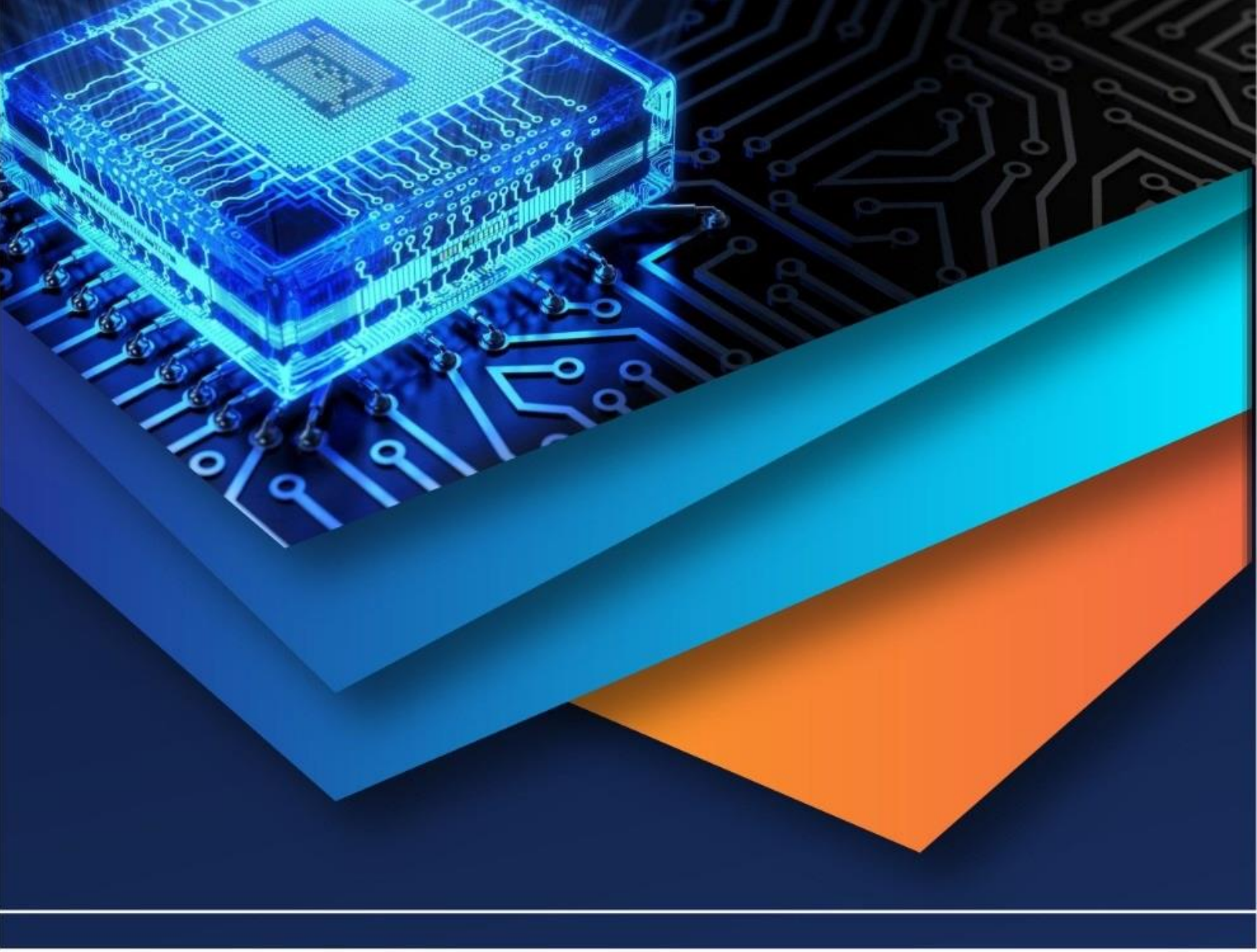
Additional features such as voice activation and automatic detection of danger may be incorporated into it for better user interaction.

The system may be enhanced to send alerts to police stations and emergency services for better and faster response.

Moreover, the device may be made more convenient by designing it in a wearable form such as a smart band or pendant.

Improvements in battery efficiency and reduction in its size may be made to design a more compact and reliable device.

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