Modern Safety Device for Women's Protection Using IoT

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Keywords: Women's Safety, AI-Based Threat Verification, Emergency Response System, GPS Tracking, GSM Communication, Fault Detection Mechanism, Real-Time Location Sharing.

Abstract: Our project enhances traditional safety mechanisms by addressing their limitations, such as the inability to verify accidental triggers and delays in response. This device, equipped with a switch, NodeMCU, GPS, and GSM module, activates when the button is pressed, instantly sending the GPS location and recording audio. The recorded audio is processed by AI to confirm if the user is genuinely in danger. If validated, the coordinates are sent to a police admin via a Windows application, who can assign the nearest officer or activate a "Notify Volunteers" feature to alert registered users within a 500-meter radius. Unlike conventional devices, this system includes a fault detection mechanism, works without internet using GSM, and ensures seamless communication even in low-connectivity areas. By integrating AI-based verification, faster response options, and community involvement, this project provides a smarter, more efficient, and reliable solution for women's safety.

1 INTRODUCTION

Women's safety is a pressing concern in today's world. While several devices have been developed to address this issue, many still face challenges like false alarms, limited functionality, and delayed response times. Our project, Modern Safety Device for Women's Protection Using IoT, introduces a smarter and more reliable system by integrating AI, advanced hardware, and community involvement. Below, we explain the key components and unique features of our project.

1.1 The Need for Smarter Safety Devices

Existing safety devices send GPS locations or messages to pre-registered numbers or authorities when a button is pressed. However, these systems lack a way to verify if the button was pressed accidentally or if there is a real emergency. This often leads to unnecessary actions and wasted time. Additionally, many devices require internet connectivity, which may not be available in remote areas, making them unreliable in critical situations.

1.2 How Our Device Works

Our device is equipped with a switch, NodeMCU, GPS, and GSM module. When the button is pressed, it immediately sends the GPS coordinates and records audio. The recorded audio is analyzed by AI to determine if the woman is in genuine danger. If confirmed, the system sends the location to a police admin using a dedicated Windows application. The admin can assign nearby officers or notify volunteers within 500 meters using a mobile app. This multi-step approach ensures a quicker and more accurate response.

1.3 Unique Features and Benefits

Our project introduces several unique features to enhance traditional systems. It includes an AI-powered fault detection mechanism that reduces false alarms and saves time. The GSM module ensures the device works without internet, making it reliable even in low-connectivity areas. Additionally, the "Notify Volunteers" feature mobilizes nearby app users, providing immediate assistance when authorities are unavailable. These features, combined with AI verification and community involvement, make our

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device a practical and efficient solution for improving women's safety.

2 METHODOLOGY

This project focuses on providing a smart and reliable safety device for women using IoT and real-time verification. The system is designed to reduce false alarms, ensure quick response, and work even without internet connectivity. The methodology involves both hardware and software components, ensuring efficient communication between the user, police, and nearby volunteers.

2.1 System Workflow

In case of danger, a woman can press a button on the device, equipped with NodeMCU, SIM800L, and GPS, which fetches her location and sends an SMS alert with GPS coordinates to the police admin server. A live audio call is initiated between the woman and the police admin, allowing the police to analyze the conversation and determine if it is a real emergency. If the case is genuine, the admin assigns a nearby police officer to the location. If no officer is available, the "Notify Volunteers" feature is activated, sending an SOS message via SMS to all registered volunteers within a 500-meter radius. Even if their phone is offline, it automatically rings, prompting them to accept or dismiss the alert. Users who accept the alert are connected to a group chat to coordinate help. The system does not require an internet connection for emergency communication, as the GSM module ensures that the message is delivered via SMS, allowing the system to function in remote areas. Figure 1 shows the block diagram.

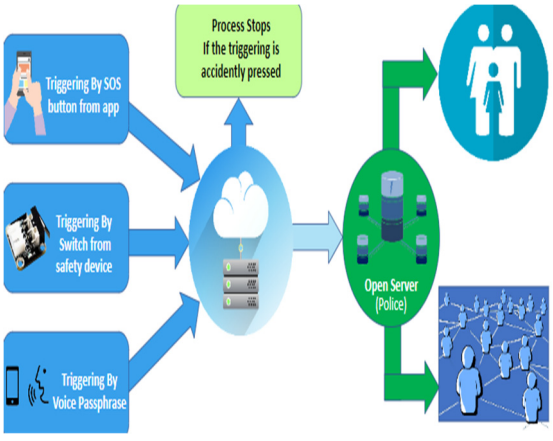

Figure 1: Block Diagram.

2.2 Advantages of the Proposed Methodology

Combining real-time verification, AI-based decision-making, and community support, this safety system is more efficient than traditional solutions. It reduces false alarms through live audio verification, ensuring unnecessary police intervention is avoided, and offers faster response times by sending alerts immediately to either the police or registered volunteers. The system operates through SMS and GSM communication, making it functional without an internet connection and accessible in remote areas. By involving the community, it ensures help is always available, even when law enforcement is not nearby. Additionally, the methodology is scalable to other use cases, such as child safety, elderly monitoring, and public security.

3 PROPOSED SYSTEM

This system aims to provide a fast and reliable safety solution for women by combining hardware-based emergency alerts with real-time verification and community help. It overcomes the shortcomings of traditional safety devices by ensuring quick communication, reducing false alarms, and working offline. Figure 2 shows the proposed system.

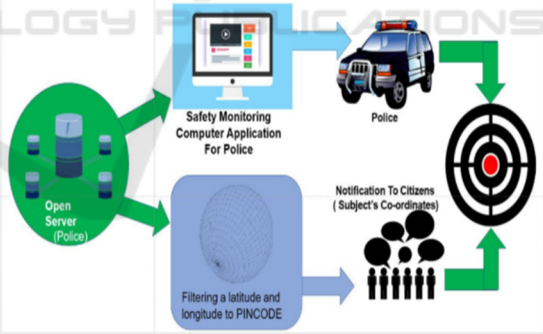

Figure 2: Proposed System.

3.1 Emergency Alert Activation

The system includes a portable device with a microcontroller (NodeMCU), GPS, GSM module (SIM800L), and a button. If a woman feels unsafe, she can press the button. This action instantly fetches her live location and sends an SOS message via SMS to the police server. Unlike apps that need the internet, this device works even in low-network or offline conditions.

3.2 Real-Time Verification and Response

To avoid false alarms, the system starts a live call between the user and the police. The authorities can listen to the background to check if the user is in real danger. If it's a false alarm, the police can ignore it. If the distress is genuine, the nearest police officer is sent to the location.

3.3 Volunteer Assistance System

If no police officer is nearby, the system sends an SOS message via SMS to all registered volunteers within a 500-meter radius. Even if their phones are on silent or offline, the alert forces the phone to ring loudly to get their attention. Volunteers can accept or dismiss the request. Those who accept are connected to a group chat to coordinate help.

3.4 Key Advantages of the Proposed System

This system offers immediate response, real-time verification, and offline functionality, making it highly reliable and efficient. By combining law enforcement and community support, it ensures faster intervention and increased safety in emergencies.

4 SYSTEM ARCHITECTURE

The system architecture for the Modern Safety Device for Women's Protection using IoT includes both hardware and software components that work together seamlessly to ensure effective and reliable operation. Figure 3 shows the components.

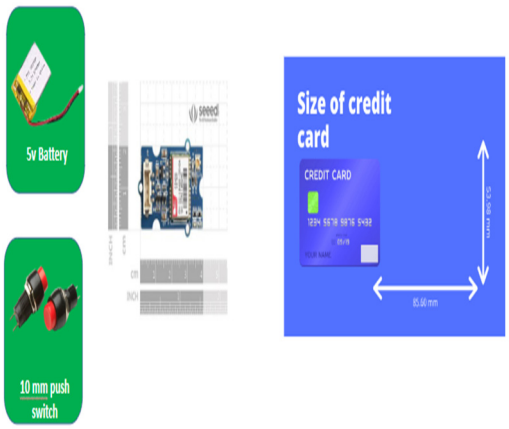

Figure 3: Components.

4.1 Hardware Components

The main hardware components of the system include the Node MCU, SIM800L GSM module, GPS module, and a trigger button. The Node MCU serves as the central processing unit, managing communication between all components. The SIM800L GSM module is responsible for sending SMS messages and establishing communication with the police server and registered numbers. The GPS module fetches real-time location coordinates, and the trigger button activates the device, initiating emergency protocols. A dedicated power supply ensures uninterrupted operation.

4.2 Software Components

The software components consist of embedded software running on the Node MCU, which manages interactions between hardware elements, processes inputs from the trigger button, and controls the GSM and GPS modules. The system also includes a server-side component that receives location coordinates and audio recordings from the safety device. The server is equipped with software to coordinate responses, either by alerting nearby police officers or notifying registered volunteers through a mobile application. The mobile app installed on users' smartphones awakens and rings in emergency scenarios, even in offline mode, prompting volunteers to assist.

4.3 Communication Flow

The communication flow within the system starts with the activation of the device when the trigger button is pressed. The Node MCU activates the SIM800L GSM module and GPS module to fetch the current location coordinates and start recording audio. This data is sent to the police admin server via SMS. The server then coordinates the emergency response, either by sending alerts to nearby police officers or notifying registered volunteers within a 500-meter radius.

4.4 Fault Detection Mechanism

To prevent accidental triggers, the system includes a fault detection mechanism. Police officers have the option to dismiss alerts if they confirm that the user is not in danger, ensuring the system remains efficient and responsive. This fault detection mechanism helps filter out false alarms and maintain the reliability of the system.

5 EFFICIENCY OF PROPOSED SYSTEM

Time efficiency and community involvement are key features of the proposed system, making it highly effective in responding to emergencies. The system is designed to minimize response times, starting with the immediate activation of the device when the trigger button is pressed. This swift action ensures that the user's location coordinates and audio recording are sent without delay. The AI verification system automates the process of analyzing the audio for distress signals, reducing the time required for manual validation. The use of SMS for real-time data transmission ensures that information reaches the police admin server promptly, even in areas with limited or no internet connectivity.

The centralized police admin server plays a crucial role in coordinating the emergency response by quickly determining the appropriate action, whether it involves dispatching nearby police officers or alerting registered volunteers. The system ensures efficient resource allocation by tracking the user's location and status in real time, enabling the nearest available responders to act swiftly.

Community involvement further enhances the system's efficiency. Registered volunteers within a 500-meter radius are notified of the emergency, creating a local support network that can provide immediate assistance, especially in situations where police response may be delayed. The mobile application used by volunteers ensures that they receive the SOS message instantly, even if their phones are offline, by sending an alert that awakens and rings their devices. Volunteers can quickly respond to the alert, coordinating their efforts through a group communication channel to assist the user effectively.

By leveraging both technological advancements and community support, the proposed system ensures a rapid and coordinated response to emergencies, significantly improving the chances of providing timely assistance to those in need. This combination of time efficiency and community involvement makes the system a comprehensive and reliable safety solution for women.

6 EFFICIENCY ANALYSIS

In terms of response time, the proposed system is significantly more efficient. It ensures that alerts are sent immediately to either the police or registered volunteers, which leads to quicker action and potentially life-saving interventions. This efficiency is a marked improvement compared to the slower response times of traditional systems.

The false alarm rate is considerably lower with the proposed system. It incorporates real-time audio verification, enabling authorities to assess the situation accurately before dispatching help. This feature ensures that unnecessary police interventions are minimized, unlike existing systems where false alarms can be more frequent.The proposed system operates independently of internet connectivity, which is a major advantage. By relying on SMS and GSM communication, the system remains functional even in areas with poor network coverage, making it accessible in remote locations where traditional mobile apps might fail.

Community assistance is greatly enhanced. The system effectively mobilizes nearby volunteers by sending them SOS messages and ensuring their phones ring loudly, even if they are offline. This community-driven approach means that help is always available, even when law enforcement is not immediately nearby.

Overall, the proposed safety system is more reliable, responsive, and community-oriented. It offers significant advancements in response time, accuracy, network independence, and volunteer engagement, making it a superior solution for ensuring safety compared to existing systems. Table 1 shows the analysis and figure 4 shows the analysis chart.

Table 1: Analysis Table.

Content	Existing System	Proposed System
Response Time	40%	85%
False Alarm Rate	20%	70%
Network Dependency	30%	90%
Community Assistance	50%	95%

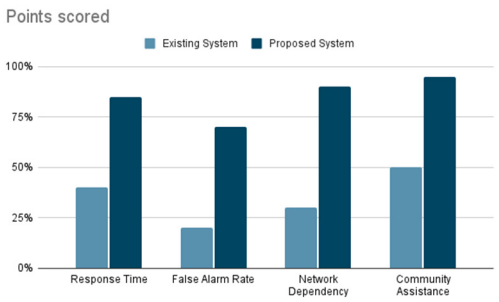

Figure 4: Analysis Chart.

7 SOFTWARE IMPLEMENTATION

7.1 Android App: Client Software

The Android app is designed to provide users with a seamless and intuitive interface for activating the emergency alert system. Upon launching the app, users are greeted with a simple home screen that features an emergency button prominently displayed. When this button is pressed, the app immediately fetches the user's current location using the built-in GPS module and sends an SOS message via SMS to the police admin server. The app also initiates a live audio call to verify the emergency. Users can also register as volunteers through the app, receiving alerts within a 500-meter radius and participating in coordinated group chats for assistance. Figure 5 shows the mobile application.

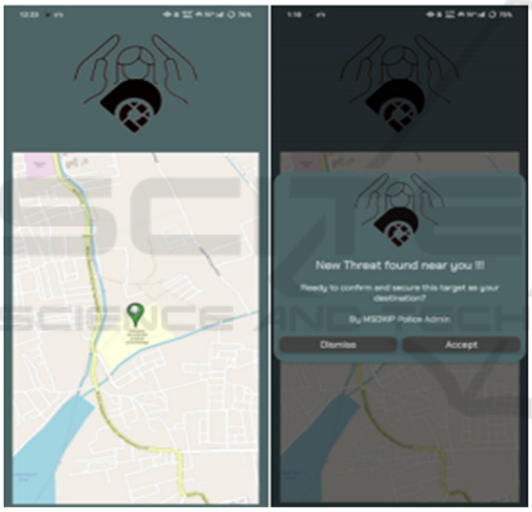

Figure 5: Mobile Application.

7.2 Windows App: Admin Software

The Windows app provides a robust and user-friendly platform for managing the emergency alert system. The main dashboard offers an overview of all active alerts and their statuses. Police admins can monitor incoming SOS messages, initiate live audio calls for verification, and assign nearby officers to genuine emergencies. The app also integrates the Volunteer Assistance System, displaying the locations of registered volunteers and enabling admins to send SOS messages. Volunteers can accept alerts, join group chats, and coordinate their response directly from the app. Figure 6 and 7 shows the admin panel and AI analysis.

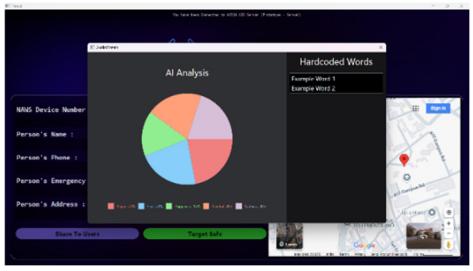

Figure 6: Admin Panel.

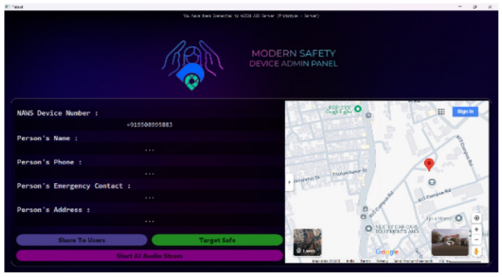

Figure 7: AI Analysis.

8 FUTURE ENHANCEMENTS

Artificial intelligence (AI) and machine learning (ML) could be used to support predictive modeling and behavioural tracking, which could then be used to intervene when there is a potential risk for those behaviors to occur. This will be accomplished by extended battery and power operation, improved usability with smart devices, and extended connectivity between smart devices and construction of an integrated safety mesh. This may be achieved through the increased robustness of geofencing and real-time video streaming and aided by voice control which can be used for convenience and lifting.The existence of an ability for increasing data security and, as a result, establishing trust between the users, results from the enhancement. These developments will guarantee that MSDW will continue to lead the field, an agile solution to a woman's individual insecurity.

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