

Real-Time Women Security Assistance System with Enhanced Features

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Abstract

This paper provides improved security for women and children by implementing GPS and GSM modules into a system similar to a smartwatch-based device. The system was designed to provide real-time tracking, emergency alerts, and recorded evidence collection to ensure immediate assistance in emergency situations. When a wearable device's push button is repeatedly pressed, victims can send their location information to registered contacts and the closest police station, allowing for prompt action. Additionally, the device has audio and video recording features that will be activated automatically, preserving important proof for further investigation. Unlike basic safety applications that depend on internet connectivity, this work uses GSM-based SMS alerts, making it extremely effective even in low-network areas. The emergency function is activated only when the button is touched multiple times, which triggers the alert and sends it only to emergency contacts to prevent false alarms. An emergency contact can remotely access the user's location by sending a specific SMS message, providing an additional layer of security. By combining current technology with user-based safety measures, this device encourages women and children to take control and provides response controls, real-time tracking, and automatic operation, resulting in a dependable and efficient personal security solution.

Keywords: Women and Child Security, Real-Time Tracking, GPS, GSM Module, SMS-based Alert, Smart Wearable.

1. Introduction

Nowadays, it is more important to safeguard women and children because of increased harassment, abuse and kidnapping. The existing security systems depend on personal activation makes challenging to use the internet in an emergency situation. We propose an advanced safety system that uses GSM, GPS, pulse sensors and an emergency activation mechanism for real-time tracking, rapid notifications and automatic collection of evidence with a single button tap to control these restrictions. Investigators and emergency contacts receive real-time location data and warning signals from the technology. Additionally, this system automatically captures audio and video by storing all important data [6]. The device operates only when the button is pressed multiple times to prevent false alarms and emergency contacts remotely access the user's position via SMS. This GSM-based solution provides women and children is reliable, easily accessible and active safety decision because it uses standard mobile applications rather than the internet. The proposed work objective is to help in investigations and legal processes by collecting evidence in real-time through automatic audio and video records. The main aim of this proposed work is to provide assistance in emergencies through real-time tracking, instant alerts and evidence collection. This will encourage users with trust and independence by ensuring reliable protection in real-time.

2. Literature Survey

The research [1] explained that the WSS App (Women's Safety System) is a mobile application designed to send emergency alerts when the user shakes their phone or presses a button. Upon activation, the app sends a message to the police control room and includes a list of emergency contacts. The app is easy to install and can be further developed using new technology. Its simplicity makes it accessible, but the system's reliance on mobile actions may not be ideal in certain emergencies. Penchalaiah et al. (2021) introduced an advanced surveillance system designed to track movements in specific areas and identify unsafe environments using camera inputs. The system evaluates factors such as chaotic scenarios, gender detection, and face detection, using algorithms to determine crowd density and trigger alarms. However, its main limitation is the narrow range of its application, limiting its effectiveness in larger or more dynamic spaces [2]. A smart security system has been developed, incorporating multiple modules for various safety functions. It features an SOS button, voice recognition, automatic call reception, GPS, GSM, and area zone tracking. This

highly customizable system offers various tools tailored to specific needs. However, integrating and managing these diverse modules could present technical and operational challenges, especially in ensuring real-time responsiveness [3]. Bhate et al. (2019) represented that the Integrated Smart Safety System for Women merges a wearable device with a mobile app for enhanced protection. It features heart rate monitoring, GPS tracking, real-time alerts, and voice recognition for distress. The system offers comprehensive safety but is dependent on mobile battery life and signal strength, which can limit its effectiveness in some situations [4]. Elamathi et al. (2019) explains that the Wearable Smart Ring for Women's Safety is a small, discreet device equipped with GPS, a panic button, and motion sensors. It sends distress alerts and activates an audio-visual recorder during emergencies. The compact design makes it easy to wear, but its small size restricts the number of features and may lead to battery issues over time [5].

When compared with the existing system in this literature work discussed the proposed work designs the multi-layered, trigger-based architecture. The previous systems focused on continuous internet connectivity, single activation modes and limited sensing capabilities. This proposed system differentiates the false alarm prevention using multi-press activation, dual-trigger emergency detection combining biometric anomalies, manual SOS, GSM-based SMS alerts with individual internet availability and automatic audio-video evidence collection with cloud storage.

3. Work Description

An efficient tool for improving personal protection in a women's safety alert system includes a button, GPS, GSM, and audio-video modules. This section will examine each element and its functions.

Button: The system has a button that the user can access simply. The button will be pressed continuously to activate when the user detects danger or risk.

GPS (Global Positioning System): The device can track the user's location in real time due to a GPS module. In an emergency, accurate location on data can be transmitted using GPS technology which enables satellites to calculate the device's locations.

GSM (Global System for Mobile Communications): The GSM module facilitates communication by connecting to the mobile network. It enables the transmission of alert messages containing the user's real-time location to pre-selected contacts or a centralized monitoring system.

Audio & Video Module: This module captures the surroundings using a microphone and camera. The recorded data is securely stored in the cloud allowing emergency contacts to access real-time or saved footage when needed.

Operational Workflow: When the user activates the alert system by clicking the emergency button, the following sequence of actions will be triggered:

1. The button press activates the emergency response process.
2. The GPS module determines the user's exact location.
3. The GSM module establishes network connectivity for communication.
4. An alert message including the user's location is sent to designated emergency contacts or monitoring through SMS or data transmission.
5. The audio and video modules start recording the surroundings, securely saving the footage in the cloud.
6. The emergency contacts will receive a link to access the user's live location and recorded footage enabling them to monitor the situation and respond accordingly.

This integrated system improves personal security by providing real-time location tracking, instant alerts, and remote access to critical audio-visual evidence.

3.1 Proposed System

The methodology of this proposed work focused on validation, response and reliability in emergency situations. Previous works explain simulation based systems but this proposed work was implemented using real hardware components and evaluated in end-to-end operational testing. The key performance metrics of this work included alert latency, accuracy of GPS localization, reliability of GSM based communication in low-network environments and effectiveness of emergency techniques. The result section mainly highlights the low delay

between event detection and delivery alert to achieve real-time transmission using the specific application.

Two major advances are introduced by this system to improve privacy, security, and safety. They are

- The emergency button will only transmit the location when clicked multiple times to lower the risk of false alarms and ensure alerts are only delivered in actual conditions.
- Secondly, a responsible person (such as a pre-registered emergency contact) can safely recover the location of the victim without affecting privacy by sending a message to the device.

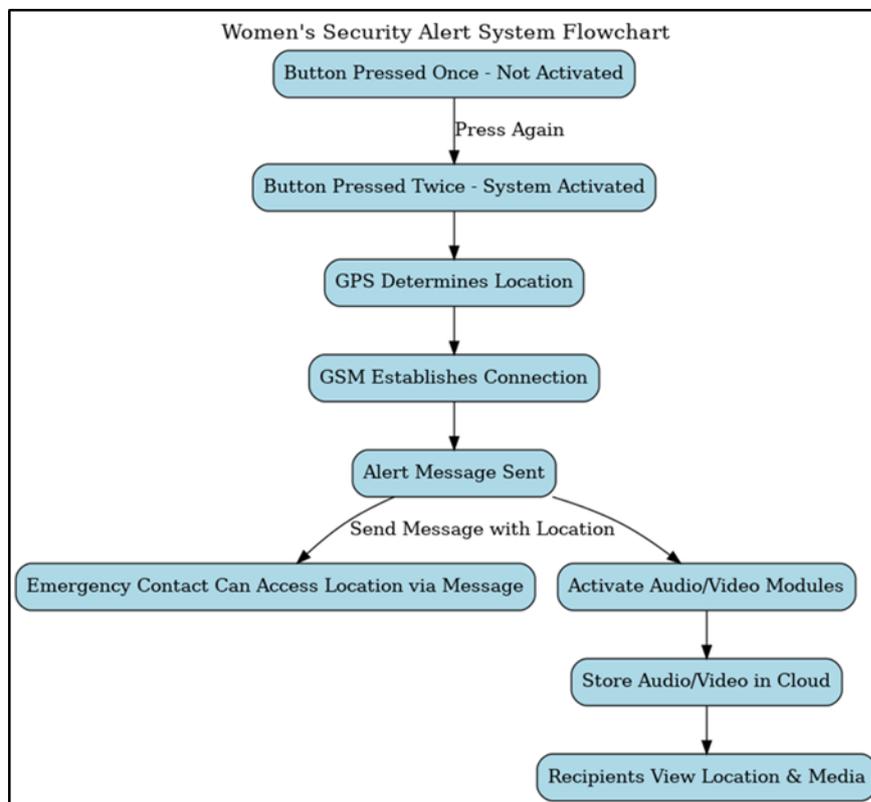


Figure 1. Flow Chart

Figure 1 flow chart shows that activating the audio/video modules turns on the audio and video recorders that captures the footage for 10 minutes as proof. The recorded audio and video files are securely stored in the cloud for later review. The emergency responders or contacts can monitor the user's movements in real time. The system will retrieve and review the recorded media for better situational awareness. The figure below explains the workflow

of the proposed work. When the button is pressed once, the system does not activate. This prevents accidental triggers. When the button is pressed twice, the system activates and indicates a critical situation. The GPS module retrieves the user's current location with latitude and longitude coordinates. The GSM module connects to the network to transmit the emergency alert. An alert message will be sent to emergency contacts or secondary contacts of the users, and includes the user name, current location and heart rate. Finally, the emergency contacts will receive a message that contains a link to track the user's live location.

3.2 Implementation

The Real-Time Women Security and Alert System is designed to ensure women's safety by integrating Arduino UNO, Raspberry Pi, ESP32-CAM, GSM, GPS, a heart rate sensor, an SOS button and a buzzer for real-time monitoring and emergency response. Figure 2 explains the proposed system block diagram. The system operates based on the following working principles:

Heart Rate Monitoring: A heart rate sensor continuously measures the user's heart rate. If the system detects an abnormal heart rate (too high or irregular), an emergency alert is triggered.

Emergency Trigger via SOS Button: In case of immediate danger, the user can manually press the SOS button to initiate the security protocol.

Camera Activation and Video Transmission: When an irregular heartbeat or SOS activation is detected, the Arduino UNO and the ESP32-CAM communicate with the Raspberry Pi and starts recording right away. A specific Telegram channel receives the recorded video, enabling real-time analysis of the circumstances.

Location Tracking and Emergency Alert: The system collects the user's location coordinates from GPS. An approved mobile device receives an SMS from a GSM module that contains the GPS location to facilitate rapid help.

Buzzer Activation: The buzzer is activated to attract attention from those nearby and prevent any threats by creating an audible alarm.

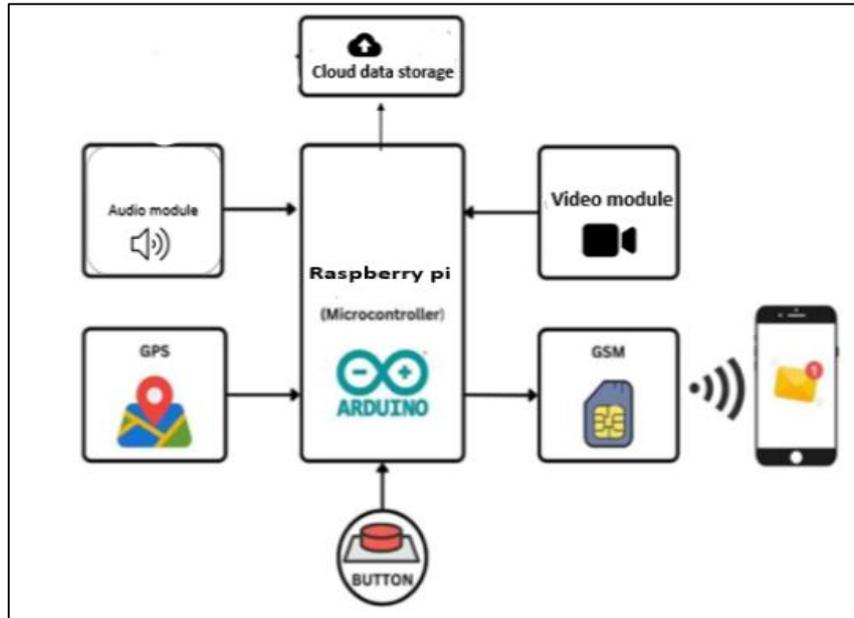


Figure 2. Proposed System Block Diagram

4. Hardware Requirements

Raspberry Pi

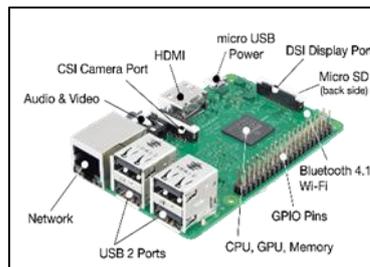


Figure 3. Raspberry Pi

The Raspberry Pi [Figure 3] is ideal for this safety system due to its powerful processing capabilities, built-in connectivity options, and extensive peripheral support, including GPS, GSM, and cameras. Its versatility, affordability, and ability to run a full operating system enable real-time alerts, location tracking, and multimedia evidence capture. Additionally, its GPIO pins allow seamless integration with various sensors and modules, making it a suitable choice for developing advanced, wearable, and user-friendly safety devices [7].

GPS (Global Positioning System)



Figure 4. GPS

GPS [Figure 4] provides real-time location tracking, navigation, and timing services. It helping to determine precise geographic locations.

GSM (Global System for Mobile Communications)



Figure 5. GSM

GSM [Figure 5] provides voice calls, SMS, and data transfer. It enables devices to communicate, send messages, and access the internet, making it essential for remote communication and IoT applications over long distances [12].

Audio Module



Figure 6. Audio Module

An audio module [Figure 6] allows devices to play, record, or process sound. It can be used in applications like voice recognition, audio notifications, and alerts [8].

Video Module



Figure 7. Video Module

A video module [Figure 7] in IoT enables devices to capture, process, or display video. It is used in applications like video surveillance, streaming and interactive displays.

Pulse Sensor

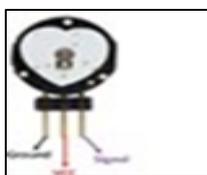


Figure 8. Pulse Sensor

A pulse sensor [Figure 8] is a device designed to monitor a person's heartbeat by utilizing infrared rays. It works by detecting changes in blood flow, allowing for accurate heart rate measurement. The sensor operates by emitting infrared light which interacts with the skin and reflects based on blood circulation. This data is then processed to determine the heartbeat, making it a reliable tool for health monitoring and biometric applications [9].

Push Button



Figure 9. Push Button

Push button [Figure 9] serves as the trigger for the entire process. When pressed, the GPS module tracks the user's location, the pulse sensor measures the heart rate, and the GSM module activates. An alert message containing the user's location and pulse rate is then sent to designated emergency contacts [10].

4.1 Software Requirements

Arduino IDE



Figure 10. Arduino IDE

The Arduino IDE [Figure 10] is a software application designed to upload and run code on the Arduino UNO board enabling it to perform various programmed tasks. The software serves as an interface between the user and the hardware, allowing code compilation, debugging, and execution for microcontroller-based projects [11].

5. Results and Discussion

The proposed real-time women security and alert system was implemented and examined under various situations to ensure its effectiveness in emergency situations. The system continuously monitored the heart rate and detected abnormalities using the heart rate sensor. The system quickly activated the ESP32-CAM is effectively recorded video footage and sent it to the Telegram application in real time. When the heart rate reached an established limit, then the SOS button activated. Furthermore, the GPS module accurately recorded the exact coordinates and sent them to an approved mobile number via GSM-based SMS. The buzzer activated immediately alerting everyone in the region. A minor average latency between event detection and video transmission provided real-time emergency notifications after analysing the system's response time. The system is a useful tool for improving women's security; testing the results shows high dependability, minimal latency, and precise position monitoring. Figure 11 represents the hardware setup and Figure 12 shows the SMS-based alert results.

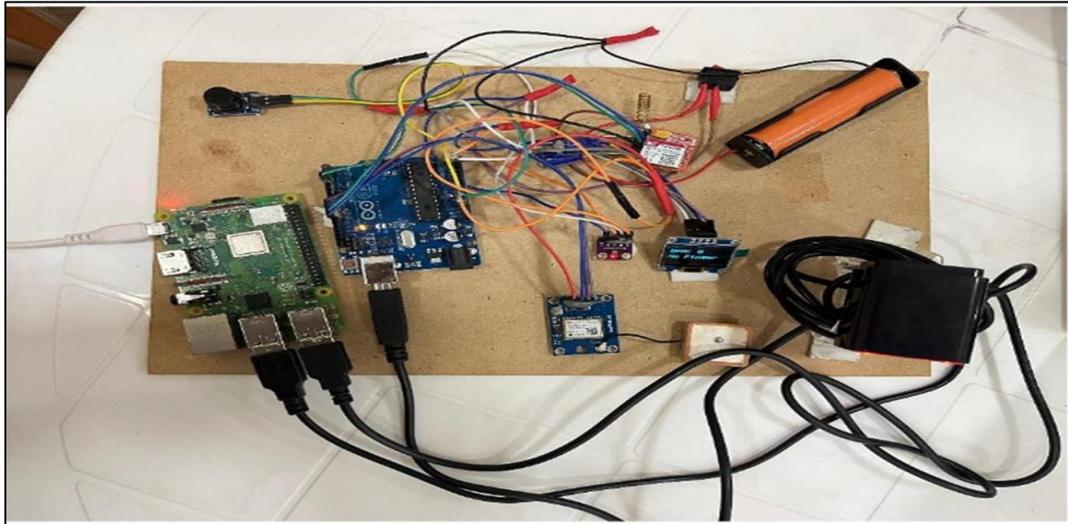


Figure 11. Hardware Setup

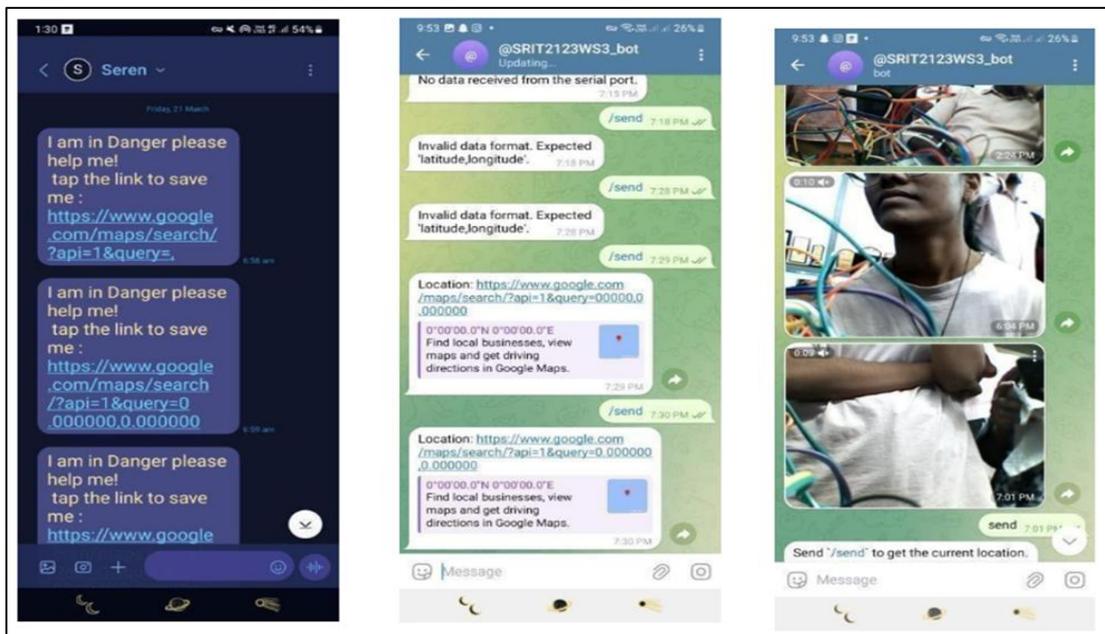


Figure 12. Output of SMS-based Alert of the Proposed Work

6. Conclusion and Future Work

The proposed work will provide immense advancement over existing available personal safety devices because it incorporates features like GPS, GSM, multimedia evidence gathering, and risk analysis within a smartwatch interface. Current devices simply perform reactive actions like medical alarms, GPS tracking systems, personal alarms, or provide personal protective weapons in the form of self-defense tools, whereas this system is proactive in its approach to personal safety. Unlike current systems, which only offer emergency notification

systems, real-time tracking, automated evidence collection, AI-powered behavior analysis, and system integration with authority databases, this device minimizes variations in current systems in addition to providing immediate assistance in regions where network connectivity is limited. The system is able to detect its environment through the analysis of unusual behaviors, and in emergency situations, the system will assist users with a voice activation feature. This device will be further improved by modern technologies in IoT, AI, and 5G, enabling prediction of challenges, quicker communication, and smart emergency response. This research will enhance women's and children's security in the future by creating a more independent, efficient, and accessible solution. Safe data encryption and smart biometric authentication also provide further security measures.

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