

# Nirbhaya Band A Wearable Emergency Response System

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**Abstract:** Women's safety has become a major concern globally due to increasing incidents of harassment and violence. This paper presents an IoT-based smart wearable emergency safety system designed using an ESP32 microcontroller, SIM800L GSM module, NEO-6M GPS module, and VC-02 voice recognition module. The system provides dual activation modes: manual (panic button) and voice based triggering. Upon activation, the device transmits real-time location coordinates via SMS to predefined contacts. The proposed solution operates without internet connectivity, ensuring reliability in remote areas. Experimental validation shows quick response time, accurate location tracking (~2.5 m), and reliable alert delivery. The system is cost-effective, compact, and suitable for daily wearable use.

**Keywords-** Women Safety, IoT, ESP32, GPS, GSM, Wearable Device, Emergency Alert.

## I. INTRODUCTION:

Ensuring women's safety is a critical global challenge that demands effective technological interventions. Traditional safety solutions such as mobile applications rely on manual interaction, which may not

be feasible during emergency situations. This work proposes a wearable emergency system capable of automatic alert generation and location tracking using embedded and IoT technologies. The system integrates ESP32 for processing, GPS for location tracking, GSM for communication, and a voice module for hands-free activation. The proposed device ensures rapid response even when the user cannot access a smartphone.

## II. LITERATURE REVIEW

Various safety systems have been developed using IoT, GSM, and GPS technologies. Raspberry Pi based wearable devices offer real-time alerts but are relatively bulky and power-consuming. SOS alert bands using mobile applications provide additional features but depend heavily on internet connectivity. IoT-based

solutions using cloud platforms enable monitoring but introduce latency and complexity. The proposed system improves upon these limitations by providing an independent, low-cost, and real-time alert mechanism without requiring internet connectivity.

## III. PROPOSED SYSTEM

The proposed system consists of ESP32 microcontroller, SIM800L GSM module, NEO-6M GPS module, VC-02 voice recognition module, panic button, and buzzer. The ESP32 acts as the central controller, processing inputs and coordinating communication. The system operates in two modes: manual activation via a push button and voice activation using predefined keywords. Once triggered, the device retrieves GPS coordinates and sends an SMS alert containing the Google Maps location link to registered contacts.

#### IV. SYSTEM DESIGN BLOCK DIAGRAM :



Fig. 1: Block Diagram of System Block Diagram Description:

The system consists of input components such as a panic button, VC-02 voice recognition module, and GPS module, all connected to the ESP32 microcontroller, which acts as the central processing unit. The panic button allows the user to manually trigger the emergency alert, while the VC 02 module enables hands-free activation by detecting predefined keyword "HELP ME." The NEO-6M GPS module continuously provides real-time location data in the form of latitude and longitude, which is essential for tracking the user during emergencies. All these inputs are

processed by the ESP32, which monitors for trigger conditions and controls the overall system operation. Once the system is activated, the ESP32 initiates the emergency response by first activating the buzzer to indicate that the alert process has started. It then retrieves the current GPS location and communicates with the SIM800L GSM module to send an SMS alert to predefined emergency contacts. The message includes a distress notification such as "Help me, I am in danger" along with a live location link for quick assistance. The power supply ensures stable operation of all components, providing the required voltage levels for the ESP32 and other modules. The entire system works without the need for internet connectivity, making it reliable in remote or low-network areas.

#### Circuit Diagram:

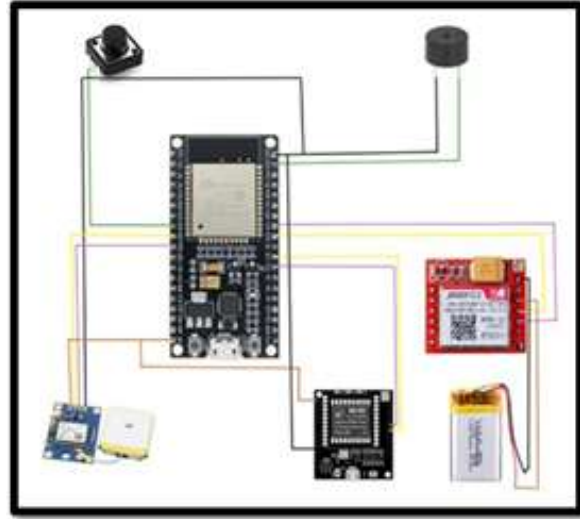


Fig. 2: Circuit Diagram

#### V. RESULTS



Fig. 3: Hardware Implementation

The system was successfully implemented and tested. The response time for sending SMS alerts was observed to be within a few seconds after activation. GPS module provided accurate location data with an error margin of approximately 2.5 meters under open sky conditions. Voice activation demonstrated reliable performance in controlled environments. Compared to traditional

mobile based safety systems, the proposed solution offers faster response and independence from internet connectivity.

## **VI. CONCLUSION**

This paper presents a reliable and efficient wearable safety system using IoT and embedded technologies. The integration of GPS, GSM, and voice recognition enables rapid emergency response. The system demonstrates effectiveness in real-time alert transmission and location tracking. Future enhancements may include mobile app integration, cloud connectivity, and AI based threat detection.

## **REFERENCES**

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