An AI-Powered Proactive Women's Safety Device

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Abstract- *Rising concerns over women's safety necessitate advanced protective technologies. This project introduces a next-generation, autonomous safety device for proactive threat detection and response. Its core innovation is a dual-mode stress detection engine, integrating physiological sensor data with a machine learning model that analyzes vocal patterns to accurately identify distress. The device operates on an AI-driven, automatic-alert system and includes an optional manual trigger. Upon detecting a threat, a built-in communication module transmits distress signals with precise GPS coordinates, functioning independently of any smartphone. An integrated camera captures the surroundings, and a high-intensity buzzer activates to deter assailants. Critically, the system is designed to be proactive, sending alerts even if the user is incapacitated, providing a dependable and life-saving tool for personal security.*

I. INTRODUCTION

Women's safety has become a critical global concern, demanding reliable technological solutions capable of responding effectively during emergency situations. Despite advancements in legal systems, surveillance infrastructure, and social awareness programs, incidents of harassment, assault, and violence against women continue to occur across both urban and rural environments. In many cases, victims are unable to seek immediate help due to physical restraint, unconsciousness, fear, or psychological stress. This highlights the need for intelligent safety mechanisms that function autonomously without depending on user intervention.Existing women's safety solutions such as smartphone applications, panic buttons, and Bluetooth-enabled wearables are predominantly reactive in nature. These systems require manual activation and often depend on smartphone availability, battery power, and continuous internet connectivity. During real-world emergencies, these constraints significantly reduce system reliability, especially when the victim is incapacitated or separated from her mobile device. Furthermore, many existing solutions lack contextual awareness and do not provide Internet of Things (IoT) and Artificial Intelligence (AI) have enabled the design of smart systems capable of continuous monitoring, intelligent analysis, and autonomous decision-making. Physiological and behavioral indicators such as elevated heart rate, abnormal body movement, and voice stress naturally occur during threatening situations and can be detected using embedded sensors and machine learning techniques. Leveraging these indicators enables the development of proactive safety systems that can identify distress conditions without explicit user input.In this work, an **AI-powered proactive women's safety device** is proposed to overcome the limitations of conventional reactive systems. The proposed solution integrates physiological sensing, voice-based stress analysis, machine learning-driven threat detection, and standalone communication modules to ensure timely emergency response. The device is designed to operate independently of smartphones and automatically trigger alerts, capture evidence, and notify emergency contacts even when the user is unable to manually seek help.

II. LITERATURE SURVEY

The increasing concern for women's safety has led to the development of numerous technology-driven solutions that leverage the Internet of Things (IoT), wearable devices, and mobile communication technologies. Early approaches primarily focused on location tracking and manual alert mechanisms. However, recent research emphasizes automation, intelligent sensing, and real-time communication to improve response effectiveness.Pardhi *et al.* proposed a smart wearable system for women's security using IoT, integrating GPS and GSM modules to transmit emergency alerts and location information to registered contacts. The system provided real-time monitoring and multimedia capture; however, it relied on manual activation and Bluetooth connectivity, which limited its effectiveness during incapacitation scenarios. Similarly, Ebenezer *et al.* developed an IoT-based wristband incorporating physiological sensors, GPS tracking, and camera modulesfor live monitoring. While the system demonstrated improved portability and real-time surveillance, it faced challenges related to battery life, device size, and privacyconcerns.Asharani *et al.* presented a systematic literature review highlighting the role of IoT in women's safety applications. Their study analyzedvarious wearable and mobile-based safety solutions and identified key challenges such asfalse alarms from physiological sensors, dependence on user interaction, and connectivity issues.

Rajkumar *et al.* proposed an IoT-based women safety device capable of detecting abnormal sounds, vibrations, and physiological parameters to trigger automatic alerts. The system effectively reduced response time and included multimedia evidence capture; however, it relied heavily on GSM networks and lacked advanced mechanisms to differentiate between real emergencies and normal activities. Deshpande *et al.* introduced a human location tracking device using IoT and machine learning for fall detection and autonomous emergency alerting. Although the system demonstrated intelligent detection capabilities, it remained dependent on cloud infrastructure and continuous internet connectivity.Nandhini and Moorthi reviewed wearable safety devices for women and girl children, emphasizing the importance of portability, ease of use, and reliable communication. Their study proposed SMS-based alert systems to overcome internet dependency but highlighted the limitations of manual activation and limited sensor integration. Sampanna *et al.* conducted a comprehensive review of women safety devices, noting that many existing systems still require user intervention and lack proactive detection features, despite advancements in automation.

III. EXISTING SYSTEM

- Smartphone AppsDepend on the user's phone being charged, connected, and within reach.
- Simple Panic Buttons Are purely reactive, requiring manual activation, and send only a basic alert.
- Bluetooth-Enabled DevicesHave a limited operational range and are rendered useless if disconnected from the phone.

DISADVANTAGES:

- Systems fail if the user cannot manually trigger the alarm.
- Safety depends on phone availability and network conditions connectivity.
- Most systems do not capture location, photos, or audio evidence.
- They are ineffective when the user is unconscious or immobilized.

IV. PROPOSED SYSTEM

We propose an innovative, standalone safety device that directly addresses the failures of existing systems. Our solution is engineered around four central pillars: Intelligent Detection. A sophisticated AI model analyzes both voice stress and physiological data for highly accurate and nuanced distress detection. Proactive Alerting. The system automatically initiates an alert when danger is detected, removing the burden from the User. True independence with its own communication and GPS modules, the device operates anywhere, anytime,completely independent of a phone. Multi-Layered Response upon activation, it transmits location data, captures images of the surroundings, and sounds a powerful alarm to maximize safety and preserve evidence.

V. BLOCK DIAGRAM

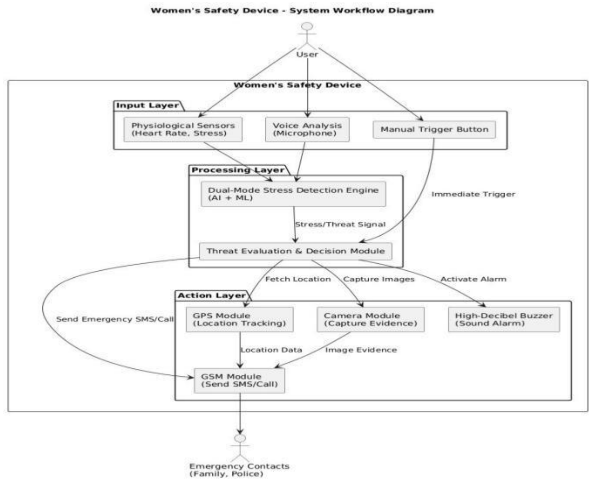

Fig1:BlockDiagram

VI. HARDWARE DESCRIPTION

ESP32-CAM: Used for real-time image capturing and video streaming to provide environmental evidence during an emergency.Microphone: Captures vocal input for stress detection through AI-based voice analysis.Stress Sensor: Monitors physiological signals (e.g., heart rate, skin response) to detect signs of distress. Buzzer.A high-decibel buzzer used as an alarm system to deter attackers and alert nearby people.Battery Pack Provides portable power supply, ensuring uninterrupted operation in mobile.GPS Module: Accurately tracks and transmits the user’s location during emergencies.ESP32: Serves as the core processing unit, handling sensor input, communication, and control of IoT functions.

A. GSMMODULE:

The**SIM900A**isareadilyavailable **GSM/GPRS module**,used in many mobile phones and PDA. The module can also be used for developing IOT (Internet of Things) and Embedded Applications. SIM900A may be a dual-band GSM/GPRS engine that works on frequencies EGSM900MHz and DCS 1800MHz. SIM900A options GPRSmulti- slot category 10/ class eight (optional) and supportsthe GPRS secret writing schemes CS-1, CS-2, CS-3 and CS-4.

B. GPSMODULE:

The NEO-6MV2could be a GPS (Global Positioning System) module and is employed for navigation. The module merely checks its location on earth and provides output knowledge that is meridian and latitude of its position.It is from a family of complete GPS receivers that includes the high performance u-blox half-dozen positioning engine. These versatile and value effective receivers supply varied property choices in an exceedingly miniature (16 x 12.2 x 2.4 mm) package The compact architecture, power and memory options make **NEO-6 modules** ideal for **battery operated mobile devices** with very strict cost and space constraints. Its Innovative design gives **NEO-6MV2** excellent navigation performance even in the most challenging environments.

VII. RESULTS

The AI-based women's safety device was subjected to simulated emergency conditions and its performance was evaluated. In everyday use, the system kept on monitoring the physiological parameters and the voice patterns continuously, and no wrong alerts were produced. The system, having been trained to recognize the situation, activated the emergency protocol after identifying the detected stress levels or distress-related voice patterns as a possible threat.The GPS unit, once activated, obtained the exact location of the user and sent the information to the emergency contacts that had been registered previously by means of the GSM module. The ESP32-CAM took pictures of the environment, thus offering visual proof, while the high-decibel sound was released to notify the people around and to scare off the attackers. Besides this, the manual SOS activation was also assessed and it produced an alert instantly.The findings validate that the system accomplishes efficiently the tasks of early distress detection, alert transmission, location tracking, and evidence capture all without the need of a smartphone.

VIII. CONCLUSION

The development of IoT-based women safety systems represents a significant advancement in addressing personal security challenges faced by women. The proposed system integrates multi-sensor monitoring, real-time location tracking, autonomous alert activation, and multimedia evidence collection to provide comprehensive protection. By leveraging IoT and AI technologies, it overcomes limitations of traditional devices that rely on manual activation and limited communication ranges. This approach not only enables timely intervention and improved emergency responses but also empowers women with a reliable, discreet, and user-friendly tool for personal safety. Future enhancements including enhanced connectivity, advanced sensor fusion, and broader community integration will further augur well for scalable deployment and societal impact.

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