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Safe Guard Smart Bangle: A Wearable Emergency Panic and Health Monitoring System for Women

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Abstract: Women's safety and health monitoring have become critical challenges due to the increasing incidence of harassment and sudden medical emergencies. This paper presents Safe Guard Smart Bangle, an IoT-based wearable emergency system that integrates a panic alert mechanism with on-demand health monitoring. The system is developed using an arduinoUno microcontroller and incorporates an emergency panic button, NEO-6M GPS module, ESP8266 Wi-Fi module, heart rate (pulse) sensor, LM35 temperature sensor, and a buzzer. When the panic button is pressed, the buzzer generates an audible alert to notify nearby individuals, while the system simultaneously acquires the user's real-time location along with heart rate and body temperature data. The collected information is transmitted to an IoT cloud platform for monitoring and storage, and an emergency alert message containing the location and health parameters is sent to a Telegram Safe Guard Bot. The proposed wearable device is compact, cost-effective, and energy-efficient, making it suitable for use in both urban and rural environments, and demonstrates the effectiveness of IoT-enabled wearable systems in enhancing emergency response for women's safety and health support.

Keywords: Women's Safety, Wearable Devices, Internet of Things (IoT), Emergency Panic Button, GPS Tracking, Health Monitoring.

I. INTRODUCTION

Women's safety and health have become critical concerns worldwide, particularly in countries like India, where incidents of harassment, assault, domestic violence, and other emergencies continue to rise . Such situations create fear and insecurity among women and often limit their freedom to travel independently for education, employment, and other daily activities . Although governments and organizations have implemented preventive measures and legal frameworks, there is still no permanent technological solution that can provide timely assistance during emergencies while also monitoring the user's health condition.

Wearable devices combined with Internet of Things (IoT) technology offer a promising approach to address these challenges. IoT-enabled wearable systems can provide continuous monitoring, rapid alert generation, and real-time transmission of critical information without relying on smartphones, which may be inaccessible during stressful situations. While many existing safety solutions focus primarily on location tracking or alert mechanisms, they often neglect the inclusion of health monitoring, which can provide vital information such as heart rate and body temperature during emergencies.

To overcome these limitations, this paper proposes the Safe Guard Smart Bangle, an IoT-based wearable system

designed specifically for women. The device integrates an emergency panic button, GPS module (NEO-6M), Wi-Fi module (ESP8266), heart rate sensor (SEN-11574), temperature sensor (LM35), and a buzzer within a compact, discreet bangle. When the panic button is pressed, the system immediately triggers a loud audible alert to notify nearby people while simultaneously collecting the user's real-time location and health parameters. The collected data is transmitted to an IoT cloud platform for monitoring and storage, and an emergency alert message is sent to a Telegram Safe Guard Bot, enabling rapid remote response.

The Safe Guard Smart Bangle is compact, energy-efficient, and cost-effective, making it suitable for women in both urban and rural environments. By integrating panic-based activation, audible alerts, GPS tracking, IoT cloud connectivity, and on-demand health monitoring, the proposed system enhances emergency response and provides a reliable technological solution for improving women's safety and health during critical situations.

II. LITERATURE SURVEY

Chinnasamy, A., Donde, and Joshi proposed an integrated women's security system that focuses on safe route navigation and instant reporting to law enforcement authorities [1]. Their system emphasizes real-time assistance to women during emergencies through location-based services. The approach improves situational awareness and response time. However, it does not include wearable health monitoring or a compact ornament-style design.

Praveen and Kumar developed a wearable location tracking system using Artificial Intelligence and IoT, primarily aimed at disaster management applications [2]. The system enables real-time tracking and emergency communication in critical situations. Their work demonstrates the effectiveness of IoT-enabled wearables for safety purposes. Nevertheless, the solution is not specifically tailored for women's safety or health monitoring during emergencies.

A.S.L.R.L.S.A and Guruprasad presented an IoT-based smart school bus tracking and security system to ensure the safety of students [3]. The system continuously monitors vehicle location and enhances security through IoT communication. This work validates the reliability of real-time tracking and alert mechanisms. However, it is vehicle-centric and not designed for personal wearable emergency use.

HBKS et al. proposed a comprehensive women's safety system integrating GPS and GSM modules with automated alert and defense mechanisms [4]. The system aims to provide immediate assistance during threatening situations. It highlights the importance of rapid emergency communication and location sharing. The reliance on GSM communication and lack of IoT cloud integration limit scalability and flexibility.

Ranjeeth et al. developed a smart child safety wearable device designed to monitor location and provide emergency alerts using wireless communication technologies [10]. The system enables real-time tracking and improves safety through wearable-based alert mechanisms. It demonstrates the practicality of compact wearable devices for personal safety applications. However, the system is primarily focused on child safety and does not incorporate health monitoring features for emergency medical assessment.

III. EXISTING SYSTEM

Existing wearable safety systems mainly focus on real-time location tracking and emergency alert transmission using wireless communication technologies. These systems employ GPS modules to obtain precise location coordinates and transmit alerts to predefined contacts or monitoring interfaces during emergency situations. Wearable-based designs enhance portability and user convenience, making them suitable for applications such as child safety, disaster response, and personal security. The integration of wireless communication enables faster response and improves situational awareness for caregivers or authorities. However, most existing methods are limited to basic alert mechanisms and lack integrated health monitoring features such as heart rate or body temperature assessment. Furthermore, these systems generally do not support cloud-based data storage for maintaining location history and event logs. The absence of IoT cloud integration restricts scalability, real-time data visualization, and post-incident analysis. In addition, many existing devices are application-specific and not adaptable to women-centric safety requirements. These limitations indicate the need for an enhanced wearable safety system that combines location tracking, health monitoring, and IoT-based data management.

IV. PROPOSED SYSTEM

The proposed Safe Guard Smart Bangle is a wearable emergency panic and health monitoring system designed to enhance women's safety during critical situations. The system operates only when the emergency panic button is pressed, ensuring reduced power consumption and preventing unnecessary data transmission. It integrates an arduino Uno, GPS module (NEO-6M), ESP8266 Wi-Fi

module, heart rate sensor(SEN-11574), temperature sensor (LM35), panic button, and a buzzer into a compact wearable form.

Under normal conditions, the system remains in an idle state. When the user encounters a dangerous situation and presses the panic button, the device is immediately activated. The arduino Uno collects the current GPS coordinates, heart rate, and body temperature of the user. Simultaneously, the buzzer is triggered to produce an audible alert, helping to attract the attention of nearby people and provide immediate local assistance.

The collected location and health data are transmitted through the ESP8266 Wi-Fi module to an IoT cloud platform. From the cloud, an emergency alert message containing the live GPS location and health parameters is sent to the Telegram Bot, enabling remote monitoring and faster *response. This* mechanism ensures that emergency information reaches the monitoring platform instantly without dependence on GSM or predefined contacts.

The system also supports cloud-based data storage, allowing emergency data to be accessed later for analysis or investigation if required. Since the data transmission occurs only during emergency activation, the system achieves improved energy efficiency while maintaining reliability during critical situations.

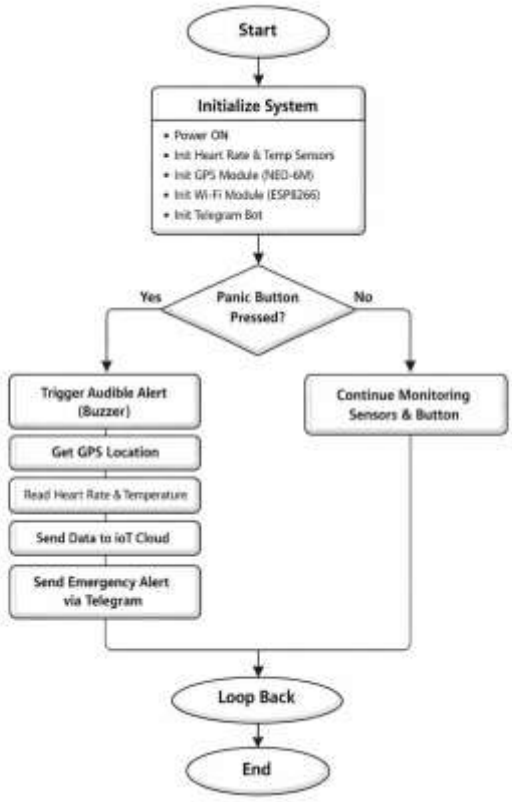

Fig.1. Proposed System Flowchart

In the above Fig.1.The operational flow of the proposed Safe Guard Smart Bangle begins with system initialization, where the device is powered on and the GPS module, heart rate sensor(SEN-11574), temperature sensor, Wi-Fi module, and alert interface are configured. The system continuously monitors the status of the panic button while remaining in a low-activity state under normal conditions. When the panic button is pressed, an audible alert is immediately triggered using a buzzer to attract nearby attention, followed by acquisition of the user's current GPS location and health parameters, including heart rate and body temperature. The collected data is then transmitted to the IoT cloud platform through the Wi-Fi module, and an emergency alert containing the location and health information is sent to the SafeGuard Telegram Bot for rapid response. After completing the alert transmission, the system returns to the monitoring state, ensuring continuous readiness for emergency situations with efficient power usage.

Fig.2. Block Diagram of Proposed System

Fig. 2. Block diagram of the Smart Bangle showing Arduino Uno interfacing with the NEO-6M GPS module, SOS button, heart rate sensor (SEN-11574), LM35 temperature sensor, and ESP8266 Wi-Fi module. The system transmits location and health data to Thing Speak and sends emergency notifications to a Telegram bot.

V. WORKING METHODOLOGY

Arduino Uno

Arduino Uno acts as the primary control unit of the Safe Guard Smart Bangle system. It interfaces with all hardware components including the NEO-6M GPS module, ESP8266 Wi-Fi module, SOS button, heart rate sensor (SEN-11574), LM35 temperature sensor, and buzzer. Arduino Uno processes sensor inputs, detects emergency conditions, and controls data transmission to the cloud platform. Its stable performance and ease of programming make it suitable for real-time safety and health monitoring applications.

NEO-6M GPS Module

The NEO-6M GPS module is used to obtain the real-time geographical location of the user. It receives signals from GPS satellites and computes accurate latitude and longitude coordinates. These coordinates are transmitted to arduino Uno via serial communication, enabling continuous location tracking during both normal and emergency situations.

ESP8266 Wi-Fi Module / NodeMCU

The ESP8266 Wi-Fi module (or NodeMCU) provides wireless internet connectivity to the system. It enables arduino Uno to upload GPS coordinates, health sensor data, and emergency alerts to the Thing Speak cloud platform through a mobile hotspot. This module supports real-time IoT communication and remote monitoring.

SOS (Panic) Button

The SOS button is a user-operated emergency switch integrated into the wearable bangle. When pressed, it sends a digital signal to arduino Uno indicating an emergency condition. This triggers alert generation, cloud data transmission, and activation of the buzzer.

Heart Rate Sensor (SEN-11574)

The heart rate sensor (SEN-11574) is used to measure the pulse rate of the user. It operates on the principle of photoplethysmography by detecting changes in blood flow through the fingertip or wrist. The sensor provides analog output corresponding to heart rate variations, which is processed by arduino Uno and transmitted to the Thing Speak cloud for monitoring.

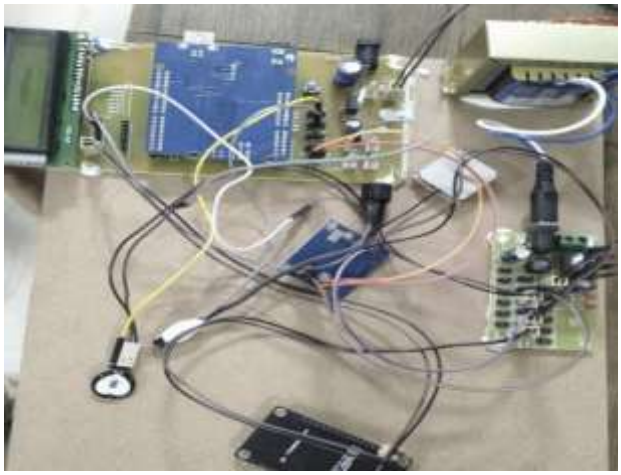

Fig.3. Connection of Proposed System

Temperature Sensor (LM35)

The LM35 temperature sensor is used to measure the body temperature of the user. It provides a linear analog voltage output proportional to temperature in degrees Celsius. arduino Uno reads this output and converts it into temperature values, which are uploaded to the Thing Speak cloud. This sensor enhances the health monitoring capability of the system.

Thing Speak Cloud Platform

Thing Speak is an IoT-based cloud platform used for real-time data storage, visualization, and analysis. It receives GPS location data, heart rate values, temperature readings, and SOS status from the device via the ESP8266 module. The platform displays data graphically and stores historical records for future reference.

Buzzer

The buzzer functions as an audible alert mechanism. When the SOS button is pressed, arduino Uno activates the buzzer to alert nearby people. This feature increases the chances of receiving immediate local assistance.

Power Supply Unit

A compact rechargeable battery supplies power to the arduino Uno and all connected modules. The power unit is designed to ensure uninterrupted operation while maintaining the wearable nature of the device.

The Smart Bangle integrates arduino Uno with the NEO-6M GPS module, ESP8266 Wi-Fi module, heart rate sensor (SEN-11574), and LM35 temperature sensor.
When powered ON, arduino Uno initializes all components and connects to the internet via the ESP8266 module. The GPS module provides real-time location, while the sensors continuously monitor heart rate and body temperature. All data is uploaded to the ThingSpeak cloud for monitoring. When the SOS button is pressed, the system triggers the buzzer, sends the critical location and health data to Thing Speak, and simultaneously sends an emergency notification to the Telegram bot, ensuring timely assistance and enhanced safety.

VI. RESULTS AND DISCUSSION

The proposed Smart Bangle was implemented and tested to evaluate real-time tracking, health monitoring, and emergency alert functionality. The NEO-6M GPS module provided accurate latitude and longitude coordinates, which were successfully uploaded to the ThingSpeak cloud via the ESP8266 Wi-Fi module. The heart rate sensor (SEN-11574) and LM35 temperature sensor delivered stable and consistent readings, allowing continuous health monitoring.

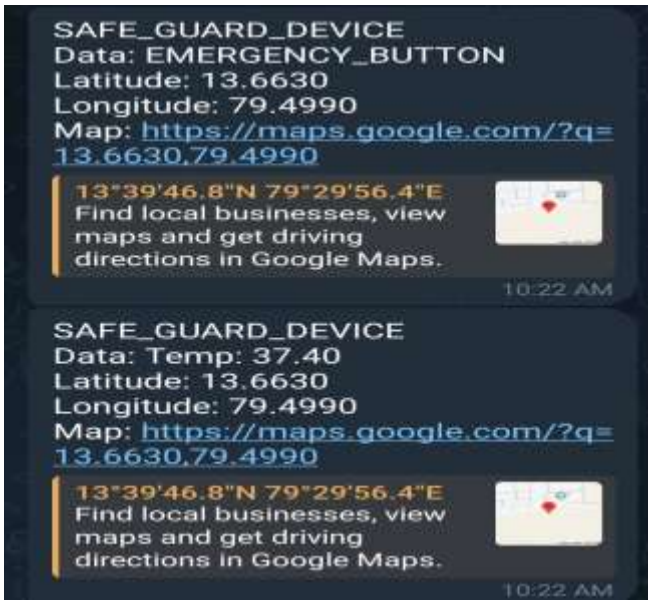

Fig.4(a) Alert Notification of Temperature with location

Fig.4(b) Alert Notification of Heart rate

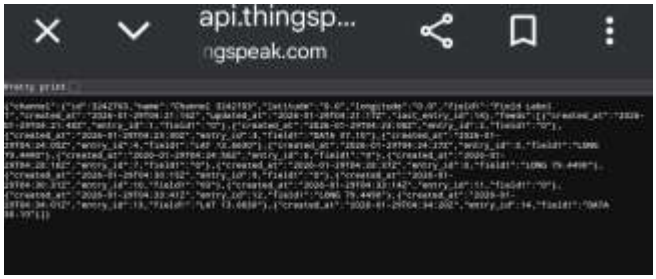

Fig.4(c). Data stored in Thinkspeak

When the SOS button was pressed, the buzzer was activated immediately, and the system transmitted critical location and health data to the Thing Speak cloud. Simultaneously, an emergency notification was sent to the Telegram bot, enabling instant remote awareness. The cloud interface allowed viewing both real-time and historical data, confirming the device's effectiveness in emergency situations.

Overall, the results demonstrate that the Smart Bangle provides a reliable, wearable solution for women's safety, integrating location tracking, health monitoring, and real-time emergency notifications. The system is cost-effective, portable, and user-friendly, making it suitable for daily use while ensuring prompt response during emergencies.

VII. CONCLUSION

The Safe Guard Smart Bangle presents a reliable, wearable solution that integrates women's safety and health monitoring in a single device. By combining arduino Uno, NEO-6M GPS, ESP8266 Wi-Fi, heart rate sensor (SEN-11574), and LM35 temperature sensor, the system provides real-time location tracking, physiological monitoring, and instant emergency alerts via ThingSpeak and Telegram notifications. The SOS button enables immediate response during critical situations, while the buzzer alerts nearby individuals, ensuring both local and remote assistance. Experimental results confirm that the device is accurate, responsive, and user-friendly, demonstrating its potential as an effective tool for enhancing women's safety and well-being. This project highlights the practical application of IoT and wearable technology in creating compact, cost-effective, and life-saving solutions for real-world emergencies.

VIII. FUTURE SCOPE

For future enhancements, the system can be upgraded with features such as automatic fall detection, integration with mobile applications for improved interface, advanced health sensors for detecting abnormal heart rhythms or stress levels, and multi-platform notifications to authorities or emergency contacts. Incorporating GPS and GSM redundancy can improve reliability in areas with weak internet connectivity, while miniaturization and ergonomic design can further increase wearability and comfort for daily use. Such improvements can make the Smart Bangle a comprehensive solution for women's safety and health monitoring, contributing to increased empowerment and reduced response time during emergencies.

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