IoT Based Smart Wearable Device for Women Safety Using GPS And GSM

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Abstract—**Ensuring the safety of women has become a critical concern in modern society due to the increasing number of crimes and emergency situations. This paper presents the design and implementation of an IoT-based smart wearable device for women's safety using GPS and GSM technologies. The proposed system is developed using an Arduino microcontroller integrated with a GPS module for real-time location tracking and a GSM module for emergency communication. In critical situations, the user can activate a panic switch, which triggers the system to send an alert message along with the user's geographical coordinates to predefined contacts. Simultaneously, a buzzer is activated to draw nearby attention, and an LCD module displays system status information. The device is compact, cost-effective, and user-friendly, making it suitable for daily use. Unlike existing solutions that depend on smartphones or internet connectivity, the proposed system ensures reliable communication through GSM networks. This work demonstrates an efficient and practical approach to enhancing personal safety, and it can be further extended with advanced IoT features such as mobile application integration and real-time monitoring systems.**

Keywords: Women Safety, Internet of Things (IoT), Arduino, GPS Module, GSM Module, Wearable Device, Emergency Alert System, Real-Time Tracking.

I. INTRODUCTION

In recent years, the issue of women's safety has emerged as a major social concern due to the increasing number of crimes such as harassment, assault, and other emergency situations. Despite advancements in technology and communication systems, many women still feel unsafe while travelling alone or working in isolated environments. Therefore, there is a growing need for an efficient, reliable, and easy-to-use safety system that can provide immediate assistance during critical situations.

With the rapid development of the Internet of Things (IoT), smart and connected devices have enabled real-time monitoring, tracking, and communication. IoT-based systems are widely used in various applications such as healthcare, transportation, and security. Leveraging this technology, a smart wearable safety device can be developed to enhance personal security and provide quick emergency response.

This paper presents an IoT-based smart wearable device for women's safety using GPS and GSM technologies. The system is designed around an Arduino microcontroller, which acts as the central processing unit. The GPS module is used to obtain the real-time location of the user, while the GSM module is responsible for sending alert messages to predefined emergency contacts. In case of danger, the user can activate the device through a panic switch, which immediately triggers the transmission of location details via SMS. Additionally, a buzzer is activated to attract nearby attention, and an LCD display provides system status information.

Compared to existing safety solutions such as mobile applications and helpline services, the proposed system offers a more reliable and faster response mechanism, as it does not depend on internet connectivity or complex user interactions. The device is compact, cost-effective, and easy to operate, making it suitable for everyday use.

The main objective of this work is to design and develop a practical and efficient wearable safety system that enhances women's security and provides confidence in both public and private environments. The proposed solution can be further extended with advanced features such as mobile application integration, cloud-based monitoring, and additional sensors for improved functionality.

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II. REVIEW LITERATURE SURVEY

Recent advancements in women's safety systems have focused on the integration of embedded systems and Internet of Things (IoT) technologies to provide real-time monitoring and emergency response. Traditional safety approaches such as helpline numbers, mobile applications, and manual alert systems are widely used; however, they suffer from limitations such as dependency on user interaction, internet connectivity, and delayed response time during emergencies [1].

To overcome these limitations, several researchers have proposed wearable safety devices using embedded systems. These systems enable users to trigger alerts instantly through panic buttons or sensors. Although such systems improve response time, some of them depend on smartphone connectivity, which may not always be reliable in critical situations [2].

In recent years, IoT-based safety systems have gained significant attention. These systems integrate microcontrollers with GPS and communication modules to provide real-time location tracking and alert transmission. Some research works utilize Raspberry Pi along with cameras and image processing techniques for threat detection and monitoring. While these approaches offer advanced features such as video recording and facial recognition, they increase system complexity, cost, and power consumption [3].

Alternatively, GPS and GSM-based safety devices have been widely adopted due to their simplicity, reliability, and independence from internet connectivity. These systems can send SMS alerts along with location coordinates to predefined contacts during emergencies. Research studies have shown that GSM-based communication ensures reliable message delivery even in remote areas with limited internet access.

Furthermore, wearable devices integrated with sensors such as panic switches, buzzers, and health monitoring modules have been proposed to enhance personal security. These systems provide immediate alert generation and attract nearby attention during critical situations.

Based on the reviewed literature, it is evident that a combination of Arduino microcontroller, GPS module, GSM communication, and wearable design provides a low-cost, efficient, and reliable solution for women's safety. The proposed system builds upon these approaches to deliver a compact, user-friendly, and real-time emergency response system.

III. RESEARCH METHODOLOGY

The proposed system is designed to enhance women's safety by providing real-time location tracking and emergency alert communication using GPS, GSM, and an Arduino microcontroller. The methodology focuses on detecting emergency situations through user interaction and transmitting alerts instantly.

A. System Design

The system consists of an Arduino microcontroller connected to a GPS module, GSM module, panic switch, buzzer, and LCD display. The device is designed in a compact and wearable form, allowing users to carry it easily in daily life.

B. Data Acquisition

The GPS module continuously receives signals from satellites to determine the real-time location (latitude and longitude) of the user. This data is transmitted to the Arduino for further processing.

C. Data Processing

The Arduino processes the received GPS data and formats it into a readable message. The system continuously monitors the status of the panic switch. When the switch is pressed, it identifies the situation as an emergency and initiates the alert process.

D. Display Unit

An I2C LCD module is used to display real-time system information such as device status, GPS connectivity

E. Alert Mechanism

Once the emergency is detected, the Arduino activates the GSM module. The system sends an SMS containing the user's current location coordinates to predefined emergency contacts. Simultaneously, the buzzer is activated to attract nearby attention and provide immediate assistance.

IV. PROPOSED METHODOLOGY

The proposed system presents a smart and efficient solution for women's safety using IoT-based technologies. It is designed to provide real-time tracking and emergency alert communication without relying on internet connectivity.

In this system, the GPS module continuously tracks the user's location and sends the data to the Arduino microcontroller. The Arduino acts as the central processing unit, where the location data is analyzed and prepared for transmission.

A panic switch is provided as an input device. When the user presses the switch during an emergency, the system immediately activates the alert mechanism. The Arduino retrieves the latest GPS coordinates and sends them to the GSM module.

The GSM module transmits an SMS alert to predefined contacts, including family members or

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authorities. The message contains the exact location of the user, enabling quick response and assistance.

An LCD module displays system status messages such as “System Ready,” “GPS Connected,” and “SOS Sent,” providing real-time feedback. Additionally, a buzzer is activated to generate an audible alarm, helping to attract nearby people.

The system operates continuously and automatically, ensuring quick response without manual intervention. Its simple design, low cost, and reliability make it suitable for everyday use by women in various environments.

V. WORKING PRINCIPLE

The working principle of the proposed system is based on real-time location tracking and emergency alert transmission.

Initially, the GPS module continuously receives satellite signals and determines the user’s current location. This location data is sent to the Arduino microcontroller.

The system remains in monitoring mode until the panic switch is pressed. When the user activates the switch, the Arduino immediately reads the latest GPS coordinates.

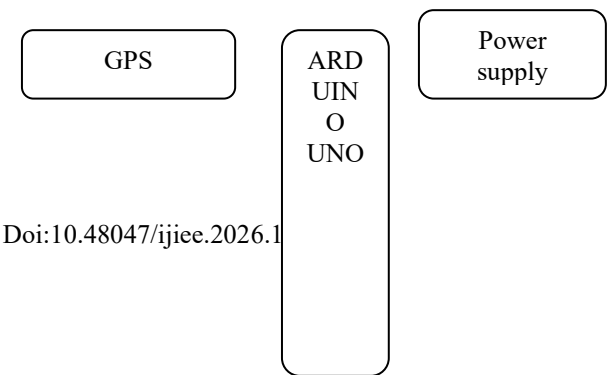
The microcontroller processes the location data and formats it into an SMS message. This message typically includes latitude, longitude, and a Google Maps link for easy tracking.

The GSM module is then activated to send the alert message to predefined contacts. At the same time, the buzzer is triggered to produce an audible alarm, alerting nearby people.

The LCD display shows confirmation messages such as “SOS Alert Sent,” ensuring that the user is aware of system operation.

This process is repeated whenever the panic switch is activated, ensuring continuous and reliable emergency response. The system provides a fast, efficient, and automated safety solution.

VI. BLOCK DIAGRAM



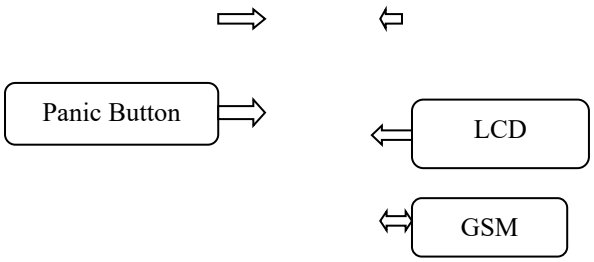


Fig. 6.2. Block Diagram

VII. RESULTS AND OUTCOMES

The proposed IoT-based wearable safety device was successfully designed and implemented. The system was tested under various conditions to evaluate its performance.

Fig. 1. The GPS module accurately captured real-time location data under normal outdoor conditions.The Arduino effectively processed the data and controlled all components.

Fig. 2. The GSM module successfully sent SMS alerts to predefined contacts within a few seconds of activation.The LCD displayed correct system status messages, improving user interaction.The buzzer provided an immediate audible alert during emergencies.

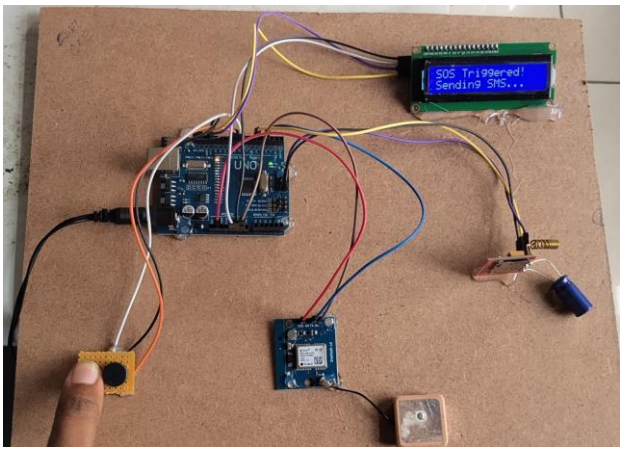


Fig. 7.1. Output1

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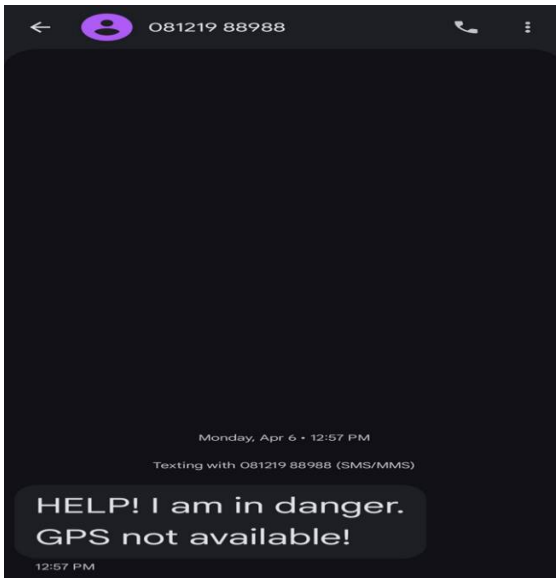

Fig. 7.2. Output2

The system demonstrated high reliability, fast response time, and ease of use. It significantly reduced the need for manual communication during emergencies and ensured quick assistance.

VIII.CONCLUSION

The IoT-based smart wearable device for women's safety was successfully developed using Arduino, GPS, and GSM technologies. The system effectively provides real-time location tracking and immediate alert communication during emergency situations.

The integration of GPS and GSM modules ensures accurate location sharing and reliable communication without internet dependency. The inclusion of a panic switch, buzzer, and LCD enhances usability and functionality.

The system proved to be cost-effective, portable, and user-friendly, making it suitable for daily use. It improves personal security and provides confidence to women in both public and private environments.

In conclusion, the proposed system offers a practical and efficient solution for women's safety. Future enhancements may include mobile application integration, cloud-based tracking, and additional sensors for health and motion detection.

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