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SAFETY BAND FOR PRENATAL CARE

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ABSTRACT

Maintaining maternal safety during pregnancy re quires uninterrupted observation of physiological conditions and immediate support during critical events. This work proposes a wearable prenatal safety band capable of continuously tracking essential health indicators while providing instant emergency notification. The system is implemented using an ESP32 microcontroller connected to sensors that monitor heart rate and body temperature. To support emergency response, a GPS unit is incorporated for real-time location identification, and a dedicated SOS switch enables user- initiated alerts. When sensor values exceed defined safety limits or when the SOS switch is activated, the device automatically transmits health information and current location details to registered contacts via the Telegram communication platform. Real-time system status and health data are displayed using an OLED screen. The developed wearable emphasizes simplicity, affordability, and mobility, making it suitable for deployment in rural and resource constrained environments and contributing to faster medical response and improved prenatal care delivery.

KEYWORDS: Maternal health Prenatal care Internet of Things Wearable device Health monitoring Emergency alert system.

INTRODUCTION

Maternal health remains a significant global challenge, particularly in developing and rural regions where access to medical facilities is limited [1]. During pregnancy, continuous physiological changes occur, and even minor deviations in vital parameters such as heart rate or body temperature can indicate serious health concerns that may affect both the mother and the unborn child if not detected early [2].

Conventional prenatal care primarily relies on periodic hospital visits, which are often insufficient for early detection of emergencies, especially in remote areas where delayed medical response further increases health risks [1]. Hence, there is a growing need for continuous and independent maternal health monitoring systems capable of real-time observation. Recent advancements in Internet of Things (IoT) and wearable technologies have enabled the development of smart healthcare solutions that support remote monitoring and instant communication [3]. I n this context, the proposed Safety Band for Prenatal Care provides continuous monitoring of vital parameters along with emergency alerts and location tracking, thereby reducing response time and improving maternal safety.

MATERIALS AND METHODS

The proposed system uses an ESP32 microcontroller integrated with a heart rate sensor, temperature sensor, GPS module, OLED display, and an SOS button, powered by a rechargeable lithium battery. Sensordata are continuously monitored and processed by the ESP32, and abnormal conditions trigger emergency alerts with real-time location sent to predefined contacts via Wi-Fi using a Telegram bot. The firmware is developed and deployed using the Arduino IDE, ensuring reliable data acquisition, communication, and alert generation [5].

Materials Used:

- **Microcontroller:** ESP32.
- **Temperature Sensor:** NTC thermistor.
- **Pulse sensor**
- **SOS Button**
- **Power Supply**
- **GPS tracker**
- **Software Tools:** Arduino IDE, embedded C

METHODOLOGY

The proposed Safety Band for Prenatal Care is developed as a compact IoT-enabled wearable system designed to serve maternal health continuously support rapid response during emergency situations. The operational methodology is structured around real-time sensing, local data evaluation, and wireless alert transmission.

Physiological parameters such as heart rate and body temperature are captured at regular

intervals using embedded wearable sensors. These sensors are directly interfaced with an ESP32 microcontroller, which serves as the primary control and processing unit. The collected sensor readings are analyzed locally by the controller and compared against predefined safety ranges to identify irregular health conditions. A GPS module is integrated into the wearable to determine the user's current geographical position during critical events. When monitored values exceed safe limits or when the user manually activates the SOS button, the system immediately initiates an emergency response routine. Alert notifications containing the user's health status and live location are trans mitted wirelessly to predefined contacts through the Telegram messaging platform. To enhance user awareness, an OLED display is incorporated to present live sensor readings and system alerts. The entire system is powered by a rechargeable lithium-ion battery, ensuring mobility and prolonged operation with optimized energy usage. This methodological framework enables early detection of potential risks, minimizes emergency response time, and strengthens prenatal healthcare through continuous and reliable monitoring.

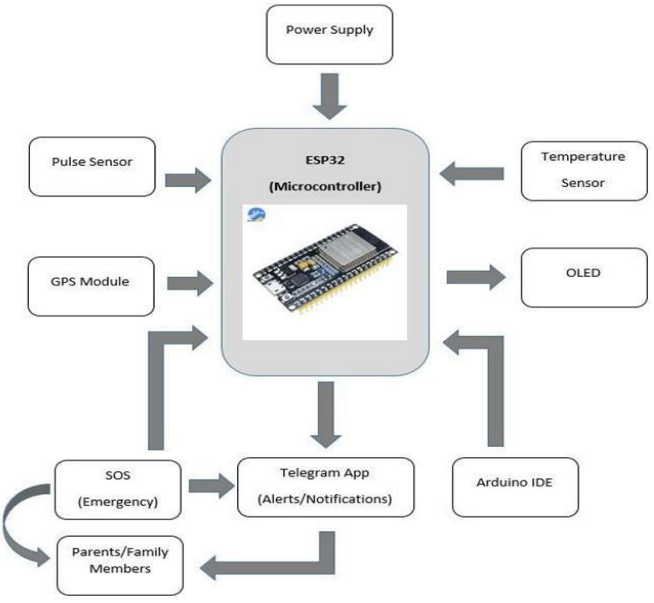

Figure 1. Block Diagram of proposed methodology

Table 1. Hardware Requirements

Sr. No.	Component	Specification
1	Microcontroller	ESP32
2	Temperature Sensor	NTC Thermistor
3	Pulse sensor	sen 11574
4	GPS tracker	GPS NEO-6M module
5	Power Supply	Regulated DC Source

RESULT AND DISCUSSION

The proposed Safety Band was evaluated using real-time sensor data. The system successfully monitored vital parameters such as heart rate, body temperature, and stress levels. Alerts were generated instantly whenever the measured values exceeded predefined thresholds or when the SOS button was pressed.

The observed results demonstrate that the system reliably detects abnormal conditions and transmits emergency notifications without delay. These outcomes confirm the effectiveness of the proposed solution in supporting timely medical intervention and improving maternal safety. Table I summarizes the observed results.

The system generated instant alerts when abnormal values were detected. The results indicate that the proposed safety band provides reliable monitoring and timely emergency notifications, thereby improving prenatal care.

Figure 2. Prototype of the proposed methodology

CONCLUSION

This project presented an IoT-enabled Safety Band for Pre- natal Care aimed at improving maternal health monitoring and emergency response. The wearable device continuously tracks vital parameters and provides real-time location information during emergencies. By utilizing an ESP32 microcontroller, GPS module, and Telegram-based communication, the system ensures timely delivery of critical health information to care- givers and medical personnel. Experimental evaluation demonstrates the reliability of the system in detecting abnormal conditions and generating instant alerts. The proposed solution is affordable, portable, and well-suited for deployment in rural and resource-constrained settings, contributing to enhanced maternal safety and improved prenatal care

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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