IoT BASED AI DRIVEN MATERNAL HEALTH MONITORING

Project Reference No.: *49S_BE_5943*

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Keywords:

Pregnancy Monitoring, Wearable Sensors, ESP32, Artificial Intelligence, ECG Sensor, Doppler Sensor, IoT, Real-Time Monitoring, Smart Healthcare, Wireless Communication

Introduction:

Pregnancy monitoring is important for the health and safety of both the mother and fetus. Traditional monitoring methods require frequent hospital visits, creating a need for smart and home-based healthcare solutions. This project proposes a wearable pregnancy monitoring system using sensors and the ESP32 to monitor parameters such as heart rate, fetal movement, uterine contractions, and body temperature. The collected data is transmitted through Wi-Fi/Bluetooth for real-time monitoring and analysis. By integrating IoT and AI technologies, the system aims to provide a non-invasive, low-cost, and user-friendly solution for continuous pregnancy monitoring and early detection of complications.

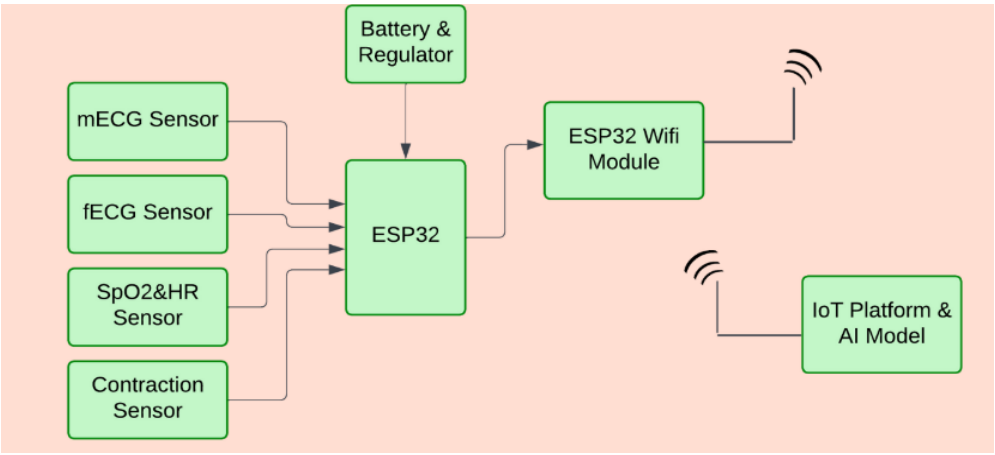

Figure 1: Block diagram of the proposed project.

Objectives:

1. To emphasize the critical role of continuous health monitoring in reducing maternal and fetal risks using various sensors for tracking physiological signals like ECG, uterine contractions, and fetal movements.
2. To study the key steps and technology for implementation of sensors in pregnancy monitoring to ensure accurate and effective health tracking for both the mother and fetus.

3. To illustrate the use of AI algorithms for early detection, smart diagnosis, and improved pregnancy outcomes.

Methodology:

1. Sensor Selection and Parameter Monitoring:
   Select appropriate sensors to monitor important maternal and fetal health parameters. ECG and FECG sensors or Doppler sensors are used to measure maternal and fetal heart rate. Pulse oximeter sensors monitor SpO_2 and heart rate. These sensors help in continuous and non-invasive pregnancy monitoring.
2. Wearable Device Development:
   Develop a wearable monitoring device in the form of a belt, patch, or wearable band by integrating the selected sensors with the ESP32. The device should be compact, lightweight, and comfortable for long-term use. A rechargeable and low-power battery system is included to support continuous monitoring.
3. Data Acquisition and Wireless Transmission:
   Collect real-time physiological data from the sensors using the ESP32 microcontroller. The collected data is transmitted wirelessly through Bluetooth or Wi-Fi to a smartphone or cloud-based platform.
4. Data Processing and AI Analysis:
   Process the acquired sensor data by removing noise and unwanted artifacts using signal processing techniques. Extract important features such as heart rate variability, contraction frequency, and fetal movement patterns. AI algorithms are then used to analyze trends and detect possible abnormalities or health risks.
5. User Interface Development:
   Develop a user-friendly mobile or web application for displaying real-time health data. The interface provides visual graphs, notifications, and alerts for abnormal conditions, helping pregnant women and healthcare providers monitor health status effectively.
6. Testing and Validation:
   Test the developed system for sensor accuracy, reliability, and user comfort. Compare the obtained results with hospital-grade monitoring systems to ensure consistency and proper functioning of the wearable device.
7. Deployment and Feedback:
   Deploy the wearable pregnancy monitoring system in home or clinical environments for practical usage. Collect feedback from users and healthcare professionals to improve system performance, usability, accuracy, and overall reliability.

Result and Conclusion:

In conclusion, the project presents a smart and wearable pregnancy monitoring system that combines IoT, wearable sensors, and AI technologies for effective maternal healthcare. By enabling continuous and remote monitoring, the system reduces the need for frequent hospital visits and supports early diagnosis of complications. The use of ESP32 ensures low power consumption, wireless connectivity, and efficient sensor integration, making the system cost-effective, portable, and suitable for future healthcare applications.

References:

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Future Scope:

The future scope of this project includes:

1. Integration of advanced AI algorithms for accurate prediction of pregnancy complications.
2. Addition of more biomedical sensors for monitoring parameters like blood pressure and stress levels.
3. Development of compact, comfortable, and low-power wearable devices for long-term use.
4. Integration with cloud and telemedicine platforms for remote healthcare monitoring.
5. Implementation of real-time emergency alert systems and improved data security.