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IOT BASED ADVANCE PATIENT HEALTH MONITORING SYSYEM

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Abstract

HealthGuard AI is an IoT based healthcare monitoring and emergency detection system developed using ESP32 microcontroller technology. The proposed system continuously monitors important health parameters such as heart rate, body temperature, body movement direction, and fall detection using integrated sensors including pulse sensor, DS18B20 temperature sensor, and MPU6050 accelerometer sensor. The collected sensor data is processed in real time and displayed on an OLED display module. The system also provides wireless monitoring through a web dashboard using WiFi connectivity. During emergency conditions such as abnormal body temperature or sudden fall detection, the system automatically activates a buzzer alarm and sends emergency notifications through Telegram API. This research work aims to improve patient safety, remote monitoring capability, elderly care support, and healthcare accessibility using low-cost IoT technology.

Keywords

ESP32, IoT, Healthcare Monitoring, Fall Detection, Pulse Sensor, Telegram Alert, Smart Healthcare, Embedded System

I. INTRODUCTION

The healthcare industry is rapidly adopting Internet of Things technology for smart monitoring applications. Real-time patient monitoring systems help in reducing medical emergencies and improving healthcare services. Traditional healthcare systems often require constant supervision by medical staff or caregivers, which can become difficult in remote areas and elderly care environments. Therefore, there is a growing demand for low-cost, portable, and intelligent monitoring systems.

HealthGuard AI is designed to solve these problems by integrating multiple sensors with an ESP32 microcontroller. The system monitors body temperature, heart rate, body movement, and fall conditions continuously. The system also provides remote access through WiFi-based web monitoring and Telegram emergency notifications. The proposed solution is efficient, affordable, and suitable for home healthcare, hospitals, and elderly patient monitoring applications.

II. OBJECTIVES

1. To design a smart healthcare monitoring system using ESP32.
2. To monitor body temperature using DS18B20 sensor.
3. To monitor heart rate using pulse sensor.
4. To detect body direction and fall conditions using MPU6050 sensor.
5. To provide real-time data monitoring using WiFi web dashboard.
6. To generate emergency alerts using Telegram API.
7. To improve patient safety and remote healthcare monitoring.

III. LITERATURE SURVEY

Several healthcare monitoring systems have been developed using IoT technology. Existing systems mainly focus on heart rate and temperature monitoring. However, many systems do not provide accurate fall detection and real-time emergency alert mechanisms. Research studies show that integrating accelerometer sensors and wireless communication can improve healthcare efficiency.

Various researchers have implemented wearable healthcare devices using Arduino and Raspberry Pi platforms. In this project, ESP32 is selected because of its built-in WiFi capability, high processing performance, and low power consumption. The integration of Telegram API and web dashboard provides advanced communication features compared to traditional monitoring systems.

IV. HARDWARE REQUIREMENTS

- ESP32 Microcontroller
- DS18B20 Temperature Sensor
- Pulse Sensor
- MPU6050 Accelerometer and Gyroscope
- OLED Display Module
- Buzzer
- Breadboard and Jumper Wires
- WiFi Network Connection
- USB Power Supply

V. SOFTWARE REQUIREMENTS

- Arduino IDE
- Embedded C++ Programming
- WiFi Library
- HTTPClient Library
- MPU6050 Library
- DallasTemperature Library

• Adafruit SSD1306 Library
• HTML and CSS for Web Dashboard
• Telegram Bot API

VI. SYSTEM ARCHITECTURE

The system architecture consists of ESP32 microcontroller connected with multiple sensors and output devices. The pulse sensor continuously measures heart rate values while the DS18B20 sensor measures body temperature. MPU6050 sensor monitors body direction and detects falls. The processed data is displayed on OLED display and transmitted through WiFi network. The emergency alert mechanism sends notifications to Telegram using internet connectivity. The web dashboard allows users to monitor live health data remotely.

VII. WORKING PRINCIPLE

The system starts by initializing all sensors, OLED display, and WiFi connection. Temperature data is collected using DS18B20 sensor and heart rate values are obtained using pulse sensor. The MPU6050 sensor measures acceleration values in different directions. If acceleration exceeds the predefined threshold, the system identifies a fall condition.

The ESP32 processes all sensor values and displays them on OLED screen. Simultaneously, the web server running on ESP32 sends live monitoring data through a browser dashboard. When emergency conditions such as high temperature or fall detection occur, the buzzer gets activated and Telegram notification is automatically sent to caregivers.

VIII. RESULTS AND DISCUSSION

The HealthGuard AI system was tested under different conditions to verify sensor performance and emergency detection accuracy. The pulse sensor successfully measured heart rate values in real time. The DS18B20 sensor provided stable and accurate body temperature readings. MPU6050 sensor effectively detected body movement and fall conditions.

The OLED display provided clear monitoring output while the web dashboard enabled remote access through WiFi. Telegram notifications were received successfully during emergency events. The overall system demonstrated stable performance and reliable operation for healthcare monitoring applications.

IX. ADVANTAGES

• Real-time health monitoring
• Low-cost implementation
• Wireless communication support
• Remote healthcare monitoring
• Emergency notification system
• Portable and compact design
• Easy integration with IoT platforms
• Suitable for elderly care

X. APPLICATIONS

- Hospital patient monitoring
- Elderly care monitoring
- Home healthcare systems
- Remote patient observation
- Fitness monitoring systems
- Smart healthcare applications

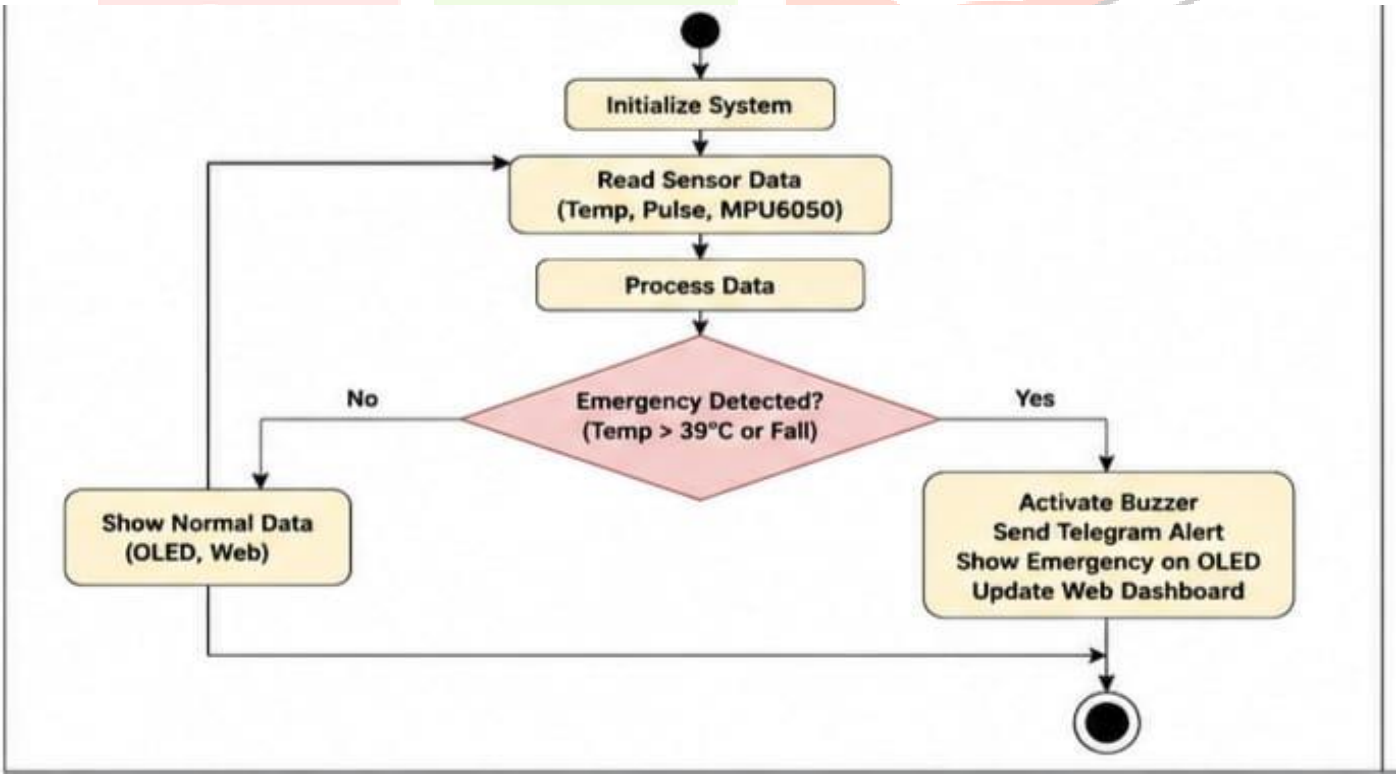
XI. FUTURE SCOPE

The future scope of this project includes integration with cloud storage and AI-based prediction systems. Mobile application support can be added for better user accessibility. GPS tracking functionality may also be implemented for location-based emergency services. Additional medical sensors such as ECG and blood oxygen sensors can improve healthcare analysis. Machine learning algorithms can further enhance prediction and emergency response capabilities.

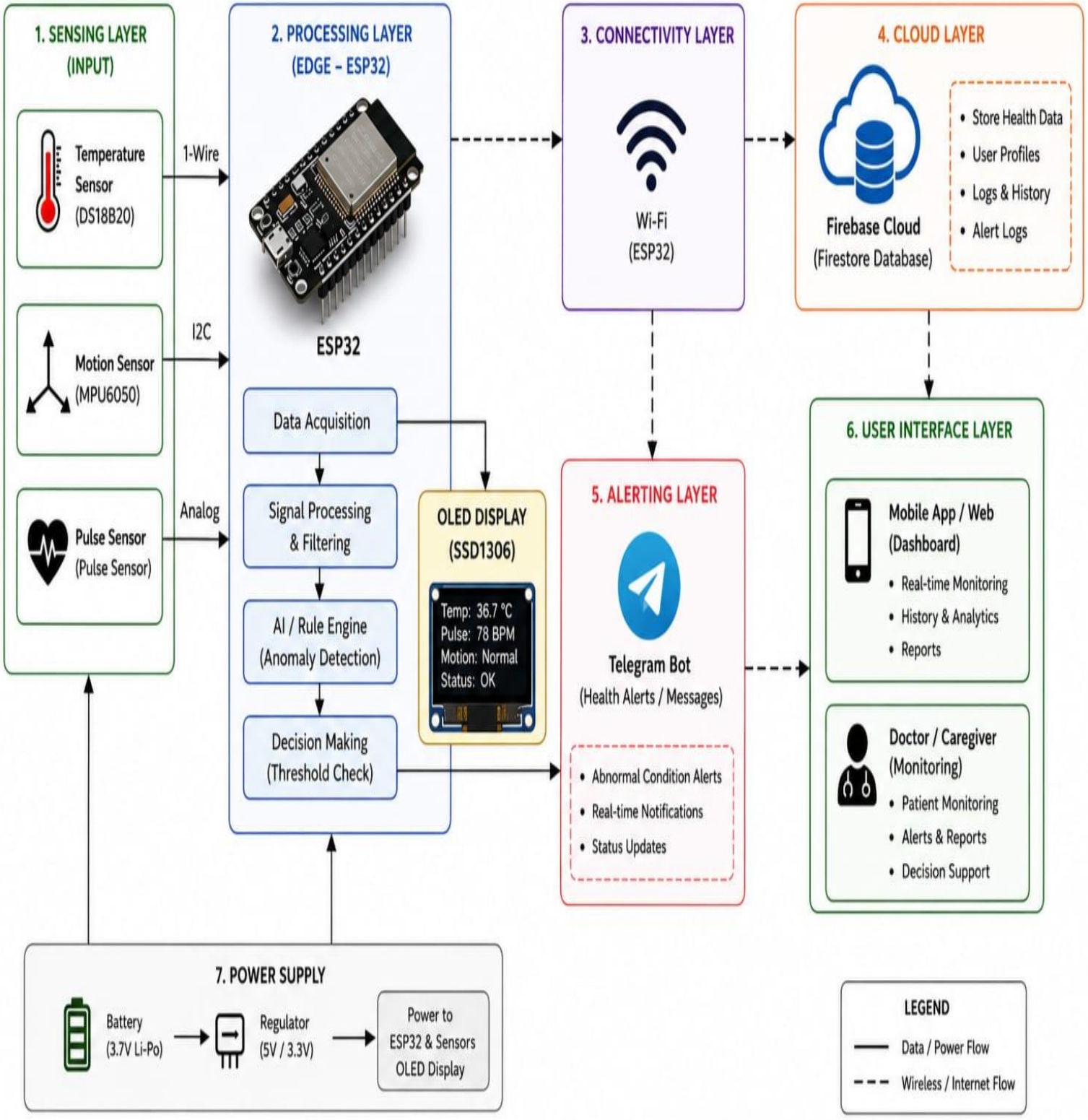
XII. CONCLUSION

HealthGuard AI is a reliable and efficient smart healthcare monitoring system developed using ESP32 and IoT technology. The system successfully monitors heart rate, temperature, body movement, and fall conditions in real time. Emergency alerts are transmitted through Telegram notifications, improving patient safety and caregiver response time. The proposed solution is affordable, portable, and suitable for healthcare applications in hospitals, homes, and elderly care environments.

XIII. ACTIVITY DIGRAM



XIV. SYSTEM ARCHITECTURE DIAGRAM



XV. SENSOR SPECIFICATION TABLE

Component	Function	Technology	Purpose
ESP32	Main Controller	WiFi MCU	Data Processing
Pulse Sensor	Heart Rate	Analog Sensor	Pulse Monitoring
DS18B20	Temperature	Digital Sensor	Body Temperature
MPU6050	Motion Detection	Accelerometer	Fall Detection
OLED Display	Output Display	SSD1306	Data Visualization
Buzzer	Alarm System	Electronic Output	Emergency Alert

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