

# AI-Driven Smart Wellness System for Continuous Health Surveillance

Dr. M J Anand<sup>1</sup>, Yashaswini B R<sup>2</sup>, Sohana M V<sup>3</sup>, Punyashree B<sup>4</sup> and Sindhushree G B<sup>5</sup>

<sup>1</sup>Department of Electronics and Communication, P. E. S College of Engineering, Mandya, India

Email<sup>1</sup>: [anandmj@pesce.ac.in](mailto:anandmj@pesce.ac.in)

<sup>2,3,4,5</sup>Department of Electronics and Communication, P. E. S College of Engineering, Mandya, India

Email<sup>2</sup>: [yashuyashaswini293@gmail.com](mailto:yashuyashaswini293@gmail.com)

Email<sup>3</sup>: [sohanamv2003@gmail.com](mailto:sohanamv2003@gmail.com)

Email<sup>4</sup>: [punyap814@gmail.com](mailto:punyap814@gmail.com)

Email<sup>5</sup>: [sindhusriqb@gmail.com](mailto:sindhusriqb@gmail.com)

\*\*\*\*\*

## Abstract:

The AI-Driven Smart Wellness System For Continuous Health Surveillance is an IoT-based solution that tracks vital signs such as heart rate, SpO<sub>2</sub>, ECG, temperature, and stress using sensors connected to Raspberry Pi . It integrates AI and machine learning models to analyze data, detect anomalies, and predict health risks like arrhythmia or fever. The processed data is stored in the cloud and displayed through a mobile or web dashboard, providing real-time alerts to doctors and caregivers. The proposed system offers a low-cost, efficient, and continuous health monitoring solution for patients, supporting preventive healthcare and early diagnosis.

*Keywords* — Artificial Intelligence (AI), Internet of Things (IoT), Continuous Health Monitoring, Predictive Healthcare.

\*\*\*\*\*

## 1. INTRODUCTION

Healthcare monitoring systems have become essential for continuous health observation and early detection of medical abnormalities. Traditional monitoring methods often require frequent hospital visits and constant supervision, making them costly and time-consuming. To address these challenges, the “AI-Driven Smart Wellness System For Continuous Health Surveillance” is developed using IoT technology and Raspberry Pi for real-time health monitoring. The system monitors vital parameters such as heart rate, SpO<sub>2</sub> level, and body temperature using MAX30102 and DS18B20 sensors. Sensor data is processed and displayed on an OLED display, while Telegram notifications are sent during abnormal conditions such as high temperature, low SpO<sub>2</sub>, or irregular heart rate. The proposed system is compact, portable, cost-effective, and suitable for remote patient

monitoring, elderly care, and preventive healthcare applications.

## 2. LITERATURE SURVEY

1. IoT Based Health Monitoring System Using Raspberry Pi
2. IoT-Based Patient Health Monitoring System Using NodeMCU
3. Implementation of IoT Based Patient Health Monitoring System Using ESP32 Web Server
4. Design and Development of SpO<sub>2</sub>, BPM, and Body Temperature Monitoring System
5. IoT-Based Patient Monitoring System Using Raspberry Pi
6. Smart Healthcare Monitoring System
7. Secure Health Monitoring Communication Systems Based on IoT

## 8. IoT-Based Smart Health Monitoring System: Design, Development and Implementation

### 3. PROBLEM ANALYSIS AND PROPOSED SOLUTION

#### 3.1 Problem Statement

Traditional healthcare monitoring systems require continuous manual supervision and frequent hospital visits, which can be inconvenient and costly. There is a need for a low-cost and real-time health monitoring system that continuously monitors vital parameters such as heart rate, SpO<sub>2</sub>, and body temperature. The proposed system uses Raspberry Pi and biomedical sensors to monitor health conditions and send alert notifications during abnormal situations.

#### 3.2 Objectives of The Project

1. Monitor heart rate (BPM), SpO<sub>2</sub>, and body temperature in real time.
2. Display live readings on an OLED display.
3. Process sensor data using Raspberry Pi.
4. Send Telegram alert notifications during abnormal health conditions.

#### 3.3 Methodology

The proposed Smart Health Monitoring System is designed to continuously monitor important health parameters such as heart rate (BPM), blood oxygen saturation (SpO<sub>2</sub>), and body temperature using Raspberry Pi and biomedical sensors.

The system uses the MAX30102 sensor for measuring heart rate and SpO<sub>2</sub> levels and the DS18B20 sensor for temperature monitoring. These sensors are connected to the Raspberry Pi through I2C and GPIO communication interfaces.

Initially, the Raspberry Pi initializes all connected sensors and establishes communication with the OLED display module. The MAX30102 sensor continuously collects pulse and oxygen saturation data by using infrared and red LED optical sensing techniques. Simultaneously, the DS18B20 sensor measures body temperature in real time.

The acquired sensor data is processed using Python programs running on the Raspberry Pi. The processed values are displayed live on the OLED display for continuous monitoring. The system also checks whether the measured values exceed predefined threshold limits.

If any abnormal condition such as:

- high heart rate,
- low SpO<sub>2</sub> level, or
- high body temperature

is detected, the system automatically sends an alert notification to the user through the Telegram messaging platform using internet connectivity. The proposed methodology provides a low-cost, portable, and real-time healthcare monitoring solution that can be used for remote patient monitoring, elderly care, and emergency health alert systems.

#### 3.4 Block Diagram

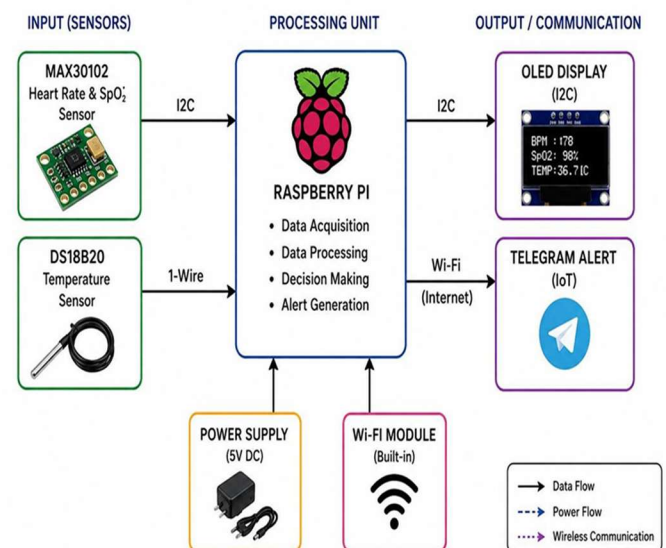


Figure 1: Block Diagram

The block diagram represents the architecture of the “AI-Driven Smart Wellness System For Continuous Health Surveillance”. The system consists of input sensors, a Raspberry Pi processing unit, and output and communication modules for real-time healthcare monitoring.

The input section includes the MAX30102 sensor and DS18B20 temperature sensor. The MAX30102 sensor measures heart rate and SpO<sub>2</sub> level using the I2C communication protocol, while the DS18B20 sensor measures body temperature using the 1-Wire protocol. These sensors continuously collect health data from the patient and send it to the Raspberry Pi.

The Raspberry Pi acts as the central processing unit of the system. It performs data acquisition, data processing, decision making, and alert generation using Python programs. The processed sensor values are displayed on the OLED display connected through I2C communication.

The system also includes an IoT-based Telegram alert mechanism. Whenever abnormal conditions such as high heart rate, low SpO<sub>2</sub> level, or high body temperature are detected, the Raspberry Pi sends alert notifications through the built-in Wi-Fi module using internet connectivity.

The entire system is powered using a 5V DC power supply. The proposed system provides a compact, portable, low-cost, and real-time healthcare monitoring solution suitable for remote patient monitoring and emergency healthcare applications.

### **3.5 Requirements**

#### **a) Hardware Requirements**

**Raspberry Pi 5 Model B** - The Raspberry Pi 5 Model B acts as the main processing unit of the system. It collects sensor data, processes it, and supports real-time health monitoring with built-in Wi-Fi and GPIO connectivity.

**MAX30102 – Heart Rate & SpO<sub>2</sub> Sensor**  
The MAX30102 sensor measures heart rate and blood oxygen saturation using infrared and red light sensing. It communicates with Raspberry Pi through the I2C protocol for real-time monitoring.

**DS18B20 – Digital Temperature Sensor**  
The DS18B20 sensor is used to measure body temperature accurately in real time. It

communicates using the one-wire protocol and supports continuous temperature monitoring.

**Power & Storage** - The Raspberry Pi is powered using a 5V, 3A official power adapter and stores data using a 32GB/64GB Micro SD card. These components ensure stable operation and data storage.

#### **b) Software Requirements**

**Python 3** - Main programming language used for developing the health monitoring system

**Raspberry Pi OS** - Operating system running on the Raspberry Pi

**max30102.py** - Python library used for interfacing with the MAX30102 pulse oximeter sensor

**hrcalc.py** - Library used for calculating Heart Rate (BPM) and SpO<sub>2</sub> values from sensor data

**smbus2** - Python library used for I2C communication between Raspberry Pi and sensors

**luma.oled** - Python library used for controlling the OLED display

**Pillow (PIL)** - Python imaging library used for creating and displaying text on OLED

**Requests** - Python library used for sending Telegram alert notifications through API

**Nano Editor** - Terminal-based text editor used for writing and editing Python programs

**SSH** - Secure Shell protocol used for remotely accessing the Raspberry Pi

**Telegram Bot API** - Used for sending real-time health alert notifications to users

**Git** - Version control and repository cloning tool used for downloading libraries and project files

i2c-tools - Linux utility used for detecting and verifying I2C sensor connections

Terminal / Command Line - Used for executing Python programs and system commands

#### 4. RESULTS AND DISCUSSIONS

The “AI-Driven Smart Wellness System For Continuous Health Surveillance” was successfully implemented for real-time monitoring of heart rate, SpO<sub>2</sub> level, and body temperature using Raspberry Pi, MAX30102, and DS18B20 sensors. The system continuously collected and processed sensor data and displayed the readings on the OLED display.

The MAX30102 sensor accurately measured heart rate and oxygen saturation, while the DS18B20 sensor provided stable temperature readings. The Telegram alert system successfully sent notifications whenever abnormal conditions such as high heart rate, low SpO<sub>2</sub> level, or high temperature were detected.

The project demonstrated a low-cost, compact, and efficient IoT-based healthcare monitoring solution suitable for remote patient monitoring and emergency healthcare applications. The system provided reliable real-time performance during testing and ensured continuous health observation. The integration of IoT technology improved remote accessibility and emergency response capability. The proposed system can be further enhanced by adding cloud storage, AI-based prediction, and additional biomedical sensors for advanced healthcare monitoring.

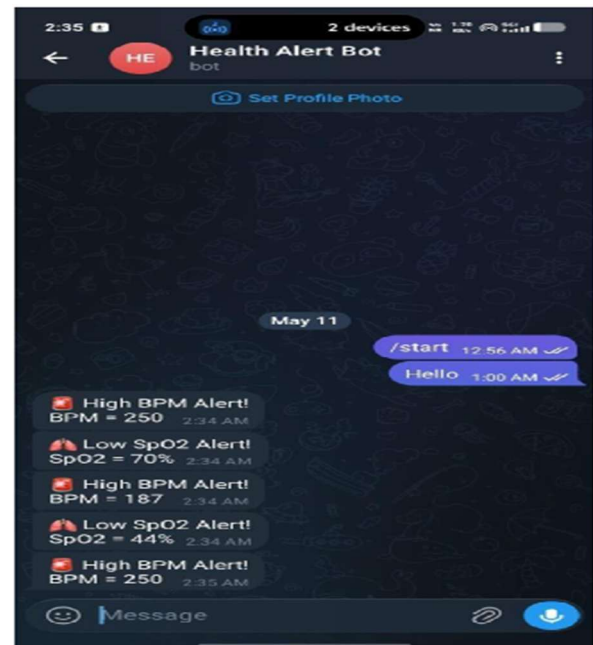
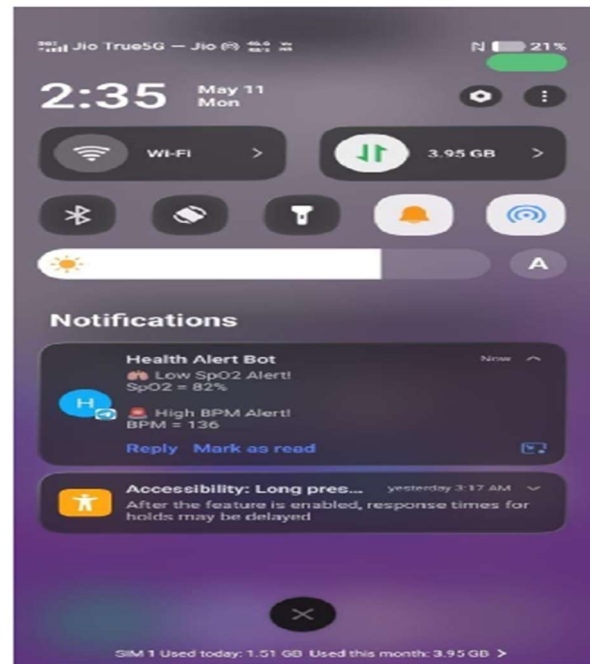


Figure 2: Health Bot alerting system in mobile through telegram

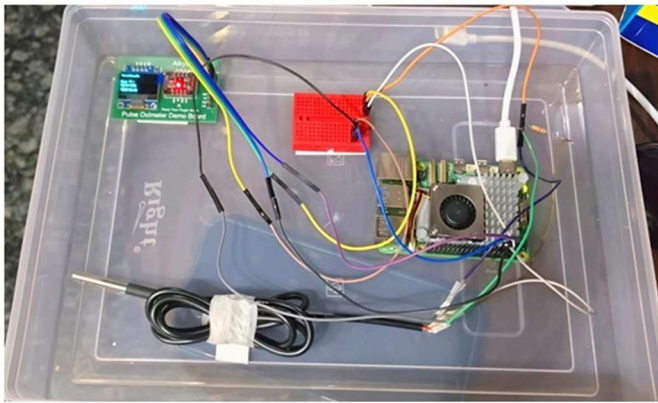


Figure 3: Hardware setup

## 5. CONCLUSION

The “AI-Driven Smart Wellness System For Continuous Health Surveillance” developed using Raspberry Pi successfully monitors important health parameters such as heart rate, SpO<sub>2</sub> level, and body temperature in real time. The system integrates the MAX30102 sensor, DS18B20 temperature sensor, and OLED display to continuously acquire and display health data efficiently. The Raspberry Pi processes the sensor data and provides Telegram alert notifications during abnormal health conditions, improving remote healthcare monitoring and emergency response capability.

The proposed system is low-cost, portable, reliable, and suitable for real-time patient monitoring, elderly care, and home healthcare applications. In future, the system can be enhanced by integrating cloud storage, mobile applications, AI-based health prediction, wearable devices, and additional biomedical sensors for advanced healthcare monitoring and smart medical applications.

## ACKNOWLEDGMENT

We express our sincere gratitude to our guide and faculty members for their valuable guidance and support throughout this project.

We thank our institution for providing the necessary resources and facilities.

We also acknowledge the contributors and developers of the tools and technologies used, especially Michael Shell and others for the IEEE LaTeX style files.

Recognition is also given to the contributors and developers of the tools and technologies used in this project, whose efforts simplified the implementation process.

Finally, we are thankful to our family for their constant encouragement.

## REFERENCES

- [1] Gupta, P., Chouhan, A. V., Wajeed, M. A., Tiwari, S., Bist, A. S., & Puri, S. C. (2023). Prediction of health monitoring with deep learning using edge computing. *Measurement: Sensors*, 25, 100604.
- [2] A Review on Edge AI for Low-Latency Health Monitoring in Wearable IoT Devices: Challenges and Future Directions — Channar, N. A., Koondhar, M. Y., Shaikh, S., Issani, F. N., Dahri, N. N., Maher, Z. A., & Ghulam, A. (2025). *Spectrum of Engineering Sciences*.
- [3] Hennebelle, A., Dieng, Q., Ismail, L., & Buyya, R. (2025). *Smart Edge: Smart Healthcare End-to End Integrated Edge and Cloud Computing System for Diabetes Prediction Enabled by Ensemble Machine Learning*. arXiv.
- [4] Hennebelle, A., Materwala, H., & Ismail, L. (2023). *Health Edge: A Machine Learning- Based Smart Healthcare Framework for Prediction of Type 2 Diabetes in an Integrated IoT, Edge, and Cloud Computing System*. arXiv.
- [5] Tuli, S., Basumatary, N., Gill, S. S., Kahani, M., Arya, R. C., W ander, G. S., & Buyya, R. (2019). *HealthFog: An Ensemble Deep Learning based Smart Healthcare System for Automatic Diagnosis of Heart Diseases in Integrated IoT and Fog Computing Environments*. arXiv.
- [6] Rathi, V. K., Rajput, N. K., Grover, B. A., Tiwari, P., Jaiswal, A. K., & Hossain, M. S. (2021). An edge AI-enabled IoT healthcare monitoring system for smart cities. *Computers & Electrical Engineering*, 96(Pt B), 107524.
- [7] Sahoo, S., Borthakur, P., Baruah, N., & Chutia, B. P. (2021). IoT and Machine Learning Based Health Monitoring and Heart Attack Prediction System. *Journal of Physics: Conference Series*, 1950.
- [8] Artificial Intelligence Based Anomaly Detection in Patient Health Monitoring Using Ensemble Learning Methods — Ajitha, P. (2024). *IACIDS 2023*.