iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** VI **Month of publication:** June 2026

DOI: https://doi.org/10.22214/ijraset.2026.83622

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VI June 2026- Available at www.ijraset.com

AI-Enabled IoT Health Monitoring System

Rishav Gupta[1], Uddeshya Rawat[2], Shobha[3], Subham Kumar[4], Sahil K Gupta[5]
Department of Computer Science, Tula's Institute, Dehradun

Abstract: This study outlines that how a health monitoring system based on IoT technology implemented using an ESP32 microcontroller. Unlike conventional techniques, this system captures real-time data by attaching low-cost sensors (i.e Max30100,Ds18b20) that measure heart pulse rate, blood oxygen concentration, and skin temperature. These physiological parameters are detected using MAX30102 and DS18B20 respectively. The data collected from the sensors is then transmitted wirelessly to the locally hosted Flask server for receiving and processing. This data is stored in a local database and can be viewed instantly using dashboard interfaces presented on browsers, which display live data along with historical data analysis. In addition to monitoring, this system predicts diseases using a disease prediction algorithm based on the physiological parameters captured from sensors. During evaluation, it was found that the developed system was able to capture data using sensors effectively, had minimum communication delays, and visualized the results effectively.

Index Terms: IoT, ESP32, Health Monitoring, MAX30102, DS18B20, Remote Healthcare, Real-Time Monitoring.

I. INTRODUCTION

Rapidly changing trends in the area of IoT have revolutionized numerous sectors; however, health care can be identified as one of those areas where the impact has been highly perceptible. IoT basically refers to the association of devices which are connected via sensors and software as well as communication means allowing continual exchange of data. As far as the requirement for affordable and efficient health care services goes, IoT has brought about a revolution in smart monitoring systems.

The traditional way of providing healthcare services involves regular visits to hospitals and clinics. This method does not take into account the possibility that there may be some symptoms indicating the emergence of an illness and continuous tracking of the patient's state. Those categories of people who are most at risk with regard to this negligence include elderly patients, those with chronic illnesses, and residents of rural locations without access to healthcare centers. Certain physiological characteristics of a human body should be monitored all the time, including heart rate, SpO2, and body temperature.

Modern technological advancements have seen the development of IoT-based monitoring systems which use biomedical sensors to obtain the vital statistics of patients and transmit them wirelessly to the computing system. The use of such a system enables healthcare experts to monitor the condition of their patients remotely without having to make frequent trips to the hospital, thus lowering costs and increasing efficiency. Previous works on these kinds of systems have proved the viability of such systems in healthcare. As an illustration, Wan et al. developed an IoT-cloud based health monitoring system wherein the collected data is sent directly to the cloud servers for constant remote monitoring, emphasizing scalability of data communication in healthcare applications. Similarly, Ramasamy et al. designed an IoT-based AI healthcare framework capable of predicting diseases using physiological data collected from biomedical sensors. This paper presents the design and implementation of health monitoring in real-time, where an ESP32 processor is used together with biomedical sensors. This application is able to track both heart rate and SpO_2 continuously using the MAX30102 biosensors, as well as body temperature using the DS18B20 sensor. The ESP32 processor acts as the central processing component while sending the sensor readings to a Flask back-end through wireless communication. The back-end could be located either locally or remotely (cloud), allowing access from any point and scalability for handling large amounts of collected health data. An informative web dashboard provides a graphical user interface for presenting the acquired data to the users. This approach focuses on continuous monitoring and low-latency data communication. In addition to monitoring of vital signs, this application incorporates a prediction engine which uses the gathered data for predicting possible health issues.

II. IOT FOR HEALTHCARE

IoT is influencing the mechanisms of automation and control of operations in different industrial sectors including healthcare. In cases where IoT technology is used for health surveillance, especially in remote and rural areas, it performs better compared to conventional modes of care delivery. With increasing medical expenses, especially in relation to chronic illnesses, patients bear huge costs. On the other hand, the aging of the populace has led to an increase in the demand for medical services and assisted living homes.

The application of IoT in the field of healthcare has been reflected in the use of wearables and smart apps that provide health services. Medical facilities are implementing the use of IoT-based technology in order to monitor the whereabouts of their personnel, patients, and medical equipment. Furthermore, with the emergence of e-healthcare using IoT technologies, doctors have access to patient information via smartphones to make treatment decisions as well as conduct monitoring.

In addition to minimizing visits to hospitals, remote monitoring enables rapid reactions during medical emergencies. Remote health monitoring services have proven valuable for the elderly and chronically ill individuals who require constant surveillance without being hospitalized. Wireless sensors and hardware components are used in practice to obtain and transmit physiological information. The microcontroller collects the physiological data, performs the necessary processing, and transmits it for real-time analysis. Since physiological data obtained by sensors may be available in various formats, an efficient database system becomes a necessity.

A successful implementation of IoT-based health monitoring should be able to monitor remotely and continuously via small wearable devices, have long-lasting battery power, be affordable by senior citizens and those suffering from chronic diseases, and provide a simple user interface.

Key requirements for an effective IoT-based health monitoring system include:

- Real-time and continuous monitoring using wearable sensors
- Long battery life of devices
- Accessibility for elderly and chronic patients
- Simple and user-friendly interface

III. LITERATURE REVIEW

This part provides an overview of research carried out in recent times to demonstrate how the field of IoT-based health monitoring systems has evolved. It should be noted that the reviewed literature suggests many approaches to IoT-based health monitoring systems with differences being mostly associated with the system architecture, level of intelligence, and specific functions provided by each of them. For example, while the cloud-based architectures suggested by Affrose et al. and Al-Zidi et al. provide remote access and allow scaling of stored data, other types of architecture, such as one suggested by Farhan et al., use local servers, which is believed to result in lower latency and reduced dependence on cloud servers. Moreover, there is a significant distinction between intelligent approaches that involve using of machine learning techniques and artificial intelligence for predictive analysis and effective decision-making and non-intelligent ones that focus on providing real-time monitoring. Examples of the first type are Orpa et al. and Jegadeesan et al. studies, while Pawar et al. and Reddy et al. suggest the latter type of systems.

The paper by Thilakarathne et al. (2021) addressed the issue of AI-integrated IoT systems for health monitoring and wellbeing. Firstly, the researchers stressed that with new developments in IoT technologies, it became possible to have constant connectivity between the devices which facilitates real-time data transfer. Another major advantage of IoT technologies is their applicability in healthcare due to the usage of heterogeneous technologies which make it possible to have an intelligent decision-making process in healthcare. Moreover, the researchers touched upon the problem of huge volumes of information created with the help of IoT devices. In this regard, machine learning and AI were considered.

According to Jegadeesan et al. (2024), the development of an AI-based health care system through IoT technology and Wireless Body Area Networks (WBANs) was proposed in the study. In the paper, it was emphasized that the integration of AI and IoT-based WBAN systems helps monitor physiological parameters consistently, thereby ensuring timely and effective medical attention. Various challenges related to this topic were identified, including data privacy and security issues, legal concerns, data accuracy, and integration of different devices. For overcoming the mentioned obstacles, the authors recommended employing appropriate security measures, extensive testing, and ethical principles. The main aspects covered in the research include accurate detection of heartbeats for diagnosing heart conditions and the use of AI-based glucose level monitoring for diabetes care.

Chowdhury et al. (2024) proposed the use of IoT in developing an IoT-based wearable health monitor in conjunction with a medical emergency response system aimed at improving efficiency in healthcare. The system employs a set of sensors that includes MAX30100 and DS18B20 for collecting vital information related to the user's health status. The information is processed and transmitted by using the microcontroller and wireless communication modules to a cloud-based platform. The system provides information about the health status and automatically activates emergency response measures where there are irregularities detected. In order to test its effectiveness, the system was tested using simulators and an app. The importance of Wi-Fi communication in ensuring monitoring continuity and availability of data was emphasized.

An IoT enabled monitoring system was developed by Farhan et al. (2025), which monitors the vital signs of patients and environmental factors at the hospitals in real time. This research used an ESP32 microcontroller, which measured physiological parameters such as heart rate, oxygen saturation, body temperature, ECG signal, along with various environmental parameters such as temperature of the room, humidity, air quality, carbon monoxide concentration, and risk of fire hazards in the rooms. This research was different from other cloud-enabled systems as it had a local web server hosted on ESP32, which helped in visualizing the data collected in real time. The system had automation capability as it had actuators, which would activate on sensing changes, apart from manual alert using the buzzer. The experimental data were recorded on MS Excel and analysis of the ECG signal was done using MATLAB.

Pawar et al. (2024) introduced the concept of a health monitoring wearable gadget based on the ESP32 microcontroller, emphasizing the increasing relevance of telemedicine due to the pandemic. The researchers concentrated on a home health monitoring system that allows reducing reliance on frequent hospital visits and physical tests. In the developed system, heart rate and oxygen saturation are measured by the MAX30102 PPG sensor, and body temperature – by the DS18B20 temperature sensor. The OLED screen is used to monitor real-time data, and remote monitoring is provided via the Blynk online platform.

The IoT-based health monitoring system was introduced by Reddy et al. (2021) as a result of increased requirements for remote medical services caused by the pandemic of coronavirus. As can be seen from the paper, the authors pointed out the fact that due to contemporary living styles and hectic schedules, it is impossible to constantly monitor patients, especially elderly people who require constant care. To resolve this problem, the scientists have introduced an automatic IoT health monitoring system which is intended to perform continuous tracking of the patient's physiological parameters, including body temperature, pulse rate, blood oxygen saturation, and humidity.

The healthcare system developed by Orpa et al. (2022) was suggested on the basis of IoT technology that utilizes the ESP32 microcontroller embedded with the machine learning framework, which is suitable for non-contact remote patient monitoring. The system provides continuous monitoring and collection of vital health metrics like body temperature, heartbeat, and SpO_2. A machine learning algorithm called Light Gradient Boosting Machine is used to predict patient health conditions, and its efficiency reaches up to 91.12% accuracy. Besides, the developed system allows for collecting data via cloud computing and transferring it to health experts in real-time.

The IoT-enabled intelligent patient monitoring system was proposed by Shakir et al. (2024) to cope with the difficulties related to the busy lifestyle and the shortage of doctors per patients that are experienced in underdeveloped countries. In their paper, the authors emphasize the importance of ICT and IoMT as a new technological trend in healthcare. The system is efficient and convenient, involving biomedical sensors to monitor body temperature, heart rate, and blood oxygen saturation. Data transmission from sensors is achieved via an ESP32 microcontroller and a gateway. For real-time data representation, the system employs MQTT protocol, which helps visualize the data on an interactive dashboard.

Lata, P., et al. (2024) proposes a cloud IoT-based virtual health monitoring system which utilizes ESP8266 microcontroller for offering real-time remote healthcare service facility. The researchers suggest employing several biomedical sensors such as AD8232 to measure Electrocardiogram, DS18B20 to calculate body temperature, MAX30100/MAX30102 to determine the heart rate and SpO_2 level, BMP280 for measuring the respiration rate, and pulse sensor to estimate blood pressure. All the sensor readings get transmitted to the Arduino Cloud through Wi-Fi/Bluetooth in real time and stored securely. Thus, the authors focus on using high-level protocols to provide secured transmission of data since it may include personal medical information. Therefore, with the proposed virtual health monitoring system, healthcare specialists would be able to remotely monitor patients' vitals and timely diagnose possible abnormalities.

Al-Zidi, Nasser M., et al. (2021) provides a research paper which describes an IoT-based system for real-time remote monitoring of patients. It is used to solve the problems that arise in the field of medicine in rural or poor regions. This system employs a special wear device fitted with microcontrollers, Wi-Fi connection, and sensors to detect changes in the vital signs including body temperature, heart rate, and blood pressure. Data obtained from these measurements is uploaded to a cloud server. Doctors are able to view real-time and recorded data about patients via an Android app or web portal. Moreover, there is an alarm component within the system which raises the attention of healthcare workers in case of exceeding threshold values of vital signs.

Although much progress has been made in IoT-based health monitoring systems, a number of challenges continue to plague the current research in this area. Most available health monitoring systems tend to be either based on real-time monitoring or simple alerting mechanisms. Moreover, very few health monitoring systems integrate intelligence into their operations through prediction and decision making. In addition, most health monitoring systems are built to monitor only one individual at a time, and do not provide scalability in terms of monitoring multiple individuals simultaneously.

Data security, privacy and interoperability across different devices have not yet been extensively considered in available health monitoring systems. There are also no health monitoring systems that incorporate low cost hardware implementations and offer advanced functions such as AI health prediction, real-time emergency response and smart cloud/hybrid data management.

Table 1. Technologies used and key Features of recent works..

Author & Year	System Type	Technologies Used	Key Features	Limitations
Thilakarathne et al. (2021)	AI + IoT Monitoring	IoT, Machine Learning	Intelligent data analysis, decision support	No specific implementation model, high data complexity
Jegadeesan et al. (2024)	AI-enabled WBAN System	IoT, AI, WBAN, Cloud	Personalized monitoring, predictive analytics	Security, privacy, and integration challenges
Chowdhury et al. (2024)	Wearable IoT Device	MAX30100, DS18B20, Cloud	Emergency alerts, real-time monitoring	Limited intelligence (no AI prediction)
Farhan et al. (2025)	IoT + Environmental Monitoring	ESP32, Local Server	Real-time dashboard, environmental + health monitoring	No cloud scalability, limited remote access
Pawar et al. (2024)	Wearable ESP32 System	ESP32, MAX30102, Blynk	Low-cost, remote monitoring	No AI, limited advanced features
Reddy et al. (2021)	Basic IoT Monitoring	Sensors + Microcontroller	Continuous monitoring, simple architecture	Lacks intelligent decision-making, no scalability
Orpa et al. (2022)	IoT + ML Prediction System	ESP32, LightGBM, Cloud	Health prediction (91% accuracy), real-time data	Higher computational Complexity
Shakir et al. (2024)	IoT Smart Monitoring (IoMT)	ESP32, MQTT	Real-time dashboard, cost-effective	Limited analytics and prediction
Affrose et al.	Cloud-based IoT System	ESP8266, Arduino Cloud	Multi-sensor integration, secure data transmission	Dependence on cloud, latency issues
Al-Zidi et al.	Remote Patient Monitoring	IoT, Cloud, Mobile App	Real-time access, alert system	Limited AI integration

IV. PROPOSED METHOD

The suggested IoT-based architecture acts as a system for continuous collection and transmission of vital parameters of the patients. In order to measure the vital parameters such as heart rate, blood oxygenation level (SpO_2), and body temperature, biomedical sensors like MAX30102 and DS18B20 sensors are connected to the ESP32 microcontroller. The ESP32 collects the sensor data and filters it with simple filtering algorithms to make it more accurate before converting it to JSON format. Using its integrated Wi-Fi module, the ESP32 sends the collected data to the remote server over the HTTP protocol.

On the backend side, the system developed with the help of Flask framework collects, validates, and saves the data on the server into a database, which could be SQLite or PostgreSQL. There will also be RESTful APIs in order to access the data in real time or historical view. There will also be a web dashboard developed with the help of modern front end technologies for graphically showing the collected data and getting live updates in order to allow patients to monitor their health conditions remotely from any corner of the world.

A. *Role of Random Forest in the Proposed System*

In order to conduct intelligent analysis of health care, a Random Forest model of machine learning is embedded within the proposed system architecture. Training for the said model takes place using labeled data that contains physiological indicators like heart rate, SpO_2, and body temperature. In actual operation, the sensor data is passed through the model to predict potential diseases.

As compared to conventional methods of setting up thresholds for detecting certain diseases, the Random Forest model can consider multiple physiological indicators together and hence give more accurate predictions. Additionally, the use of the Random Forest model can help in detecting anomalies in physiological parameters.

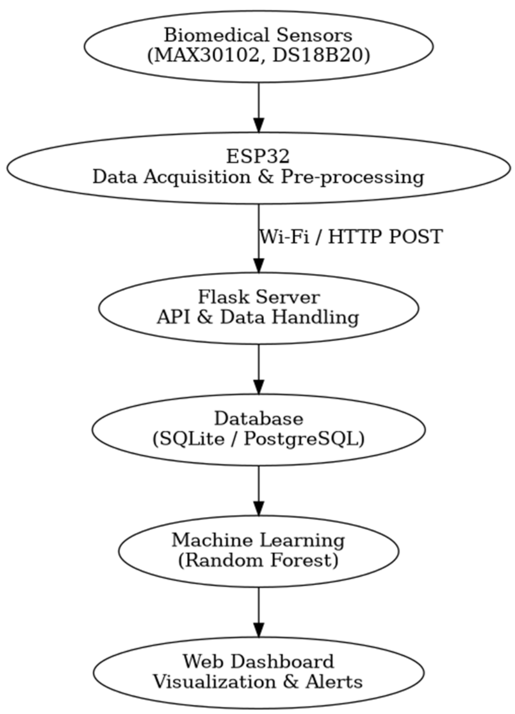
B. Comparison with Existing Systems

The proposed system provides an enhancement to the existing IoT-based healthcare monitoring techniques by offering real-time monitoring along with the ability to analyze the collected data intelligently. Though a number of other existing systems mainly emphasize on recording and visualization of physiological measurements, they do not have an advanced mechanism for prediction and decision making. However, the proposed system makes use of the Random Forest model, which helps in performing prediction and detection of anomalies. Moreover, whereas most of the existing systems restrict themselves to either recording data from one individual or simply storing it in the cloud, the proposed system is capable of performing these tasks along with providing a real-time dashboard interface.

Table 2. Comparison Table

Feature	Existing Systems	Proposed System (Your Project)
Monitoring	Real-time only	Real-time + intelligent monitoring
AI Integration	Limited or absent	Random Forest-based prediction
Data Analysis	Basic visualization	Pattern-based analysis + insights
Decision Making	Manual interpretation	Automatic prediction & anomaly detection
Scalability	Mostly single-patient	Scalable (multi-patient ready)
Architecture	IoT or Cloud only	IoT + Backend + AI + Dashboard
Cost vs Features	Either low-cost or advanced	Low-cost with advanced features

C. Working of the Proposed System



The suggested solution will act as an IoT-based healthcare monitoring system that would acquire, process, and analyze physiological parameters of patients in real time. Firstly, various biomedical sensors such as the MAX30102 and DS18B20 would be connected to the ESP32 microcontroller to acquire physiological parameters such as heart rate, SpO_2, and body temperature. Real-time data acquisition would take place through various biomedical sensors that capture physiological parameters of the patients. The gathered information is then processed by the ESP32.

In the edge layer, the ESP32 would be used for data preprocessing purposes. Various techniques will be implemented to filter out any interference that may lower the accuracy of collected information. The filtered information is then processed further using the ESP32, and data will be arranged in a JSON format.

The ESP32 makes use of its integrated Wi-Fi connectivity feature to send the data in formatted form to the backend server via HTTP POST request protocol. This will ensure the transmission of data from the sensor module to the backend server, resulting in immediate updating of data concerning the condition of the patient's vital signs.

On the server side, an application developed on the basis of the Flask framework accepts the data received and saves it to the database like SQLite and PostgreSQL. Besides, a RESTful API service is deployed for providing access to the data, both real-time and stored data.

In order to make intelligent monitoring of the patient's health possible, additional analysis of the obtained data will be conducted using an already trained machine learning algorithm known as Random Forest. By training this algorithm on labeled data sets of the healthcare sector, the algorithm will be able to analyze the received vital parameters and identify any abnormalities that may indicate health problems.

At last, the obtained data and the results of the algorithm will be visualized by means of a web-based dashboard developed utilizing the latest frontend solutions. In this way, the user will be able to observe real-time information about the vital signs and receive notifications if any abnormalities occur.

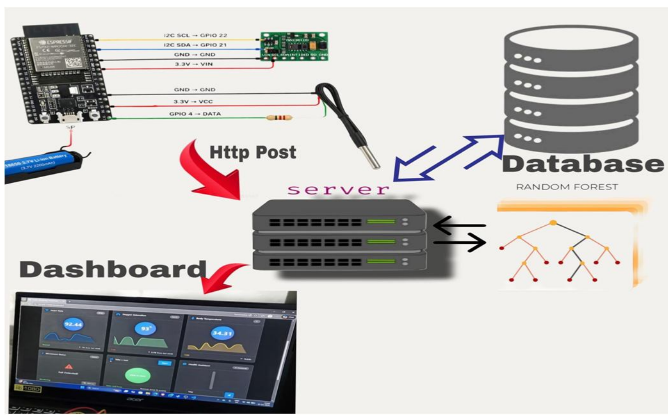


Figure 1. Network Connectivity

V. MATHEMATICAL MODELING AND SYSTEM PERFORMANCE EVALUATION

A. Heart Rate Estimation from PPG Signal

Heart rate calculation will be based on the output received from the PPG sensor, MAX30102. In the PPG sensor, the periodic detection of peaks associated with the heartbeat is made. To calculate the heart rate in BPM (beats per minute), we use the following formula:

$$HR(BPM) = \frac{60}{T_{peak}}$$

where T_peak represents the time difference between two peaks on the PPG graph in seconds. The above formula is used to calculate the heart rate immediately. The measured values are compared to those measured using the conventional instrument.

B. Blood Oxygen Saturation (SpO_2) Estimation

MAX30102 measures SpO_2 based on the ability of the blood to absorb red and infrared wavelengths of light. MAX30102 calculates the ratio of the pulsatile signal to the non-pulsatile signal for each wavelength. The ratio is denoted by R, where:

$$R = \frac{(AC_{red}/DC_{red})}{(AC_{IR}/DC_{IR})}$$

The oxygen saturation is then approximated using:

$$SpO_2 = 110 - 25 \times R$$

When AC stands for the pulsating signal and DC for the non-pulsing signal. This mode of measurement allows the continuous measurement of signals without causing any disturbance in the patient's blood stream. To ensure the accuracy of the result, the signal must be confirmed using clinical equipment. T_peak is referred to as the time difference between the two peaks in the PPG signal in terms of seconds. This is the method through which the heart rate can be instantly measured. The outcome will be compared with that of the clinical equipment.

C. Body Temperature Measurement
The body temperature can be determined through the DS18B20 sensor in order to obtain an accurate digital reading. In order to minimize the errors and ensure that there are no fluctuations in the readings, the following moving average is calculated:

$$T_{avg} = \frac{1}{N}\sum_{i=1}^{N} T_i$$

Here, T_i are the measured values, and N is the number of samples.

D. Latency of the System
Latency is an essential part of the implementation of the proposed real-time IoT-based healthcare application. The latency can be described by the following mathematical expression:

$$Latency = T_{received} - T_{sent}$$

where:
T_{sent} is the timestamp indicating when the ESP32 sends the data.
$T_{received}$ is the timestamp indicating when the server receives the data.

Ensuring that the latency remains low is critical to making sure that the application is efficient.

E. Accuracy and Error Measurement
To test the accuracy of our system, its results will be compared to those of regular medical devices. This is the formula used to calculate the percentage error:

$$Error(\%) = \frac{|\,Measured - Reference\,|}{Reference} \times 100$$

This value represents how much our design varies from clinically acceptable numbers.

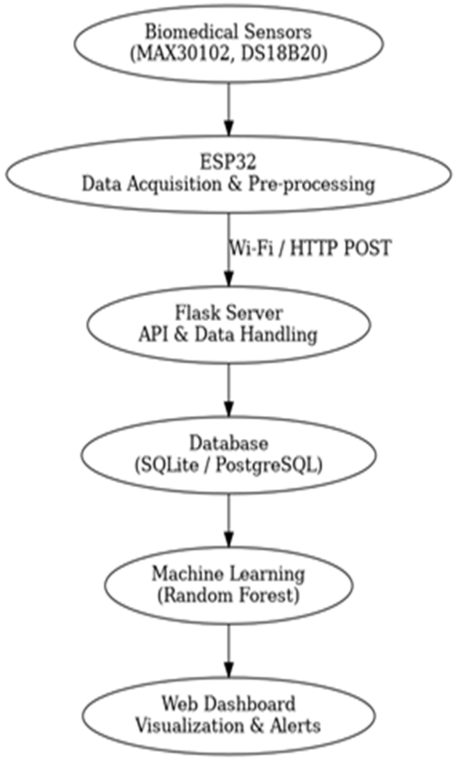
F. Data Transfer Speed
To measure the effectiveness of the IoT technology used in this system, we consider the following aspect of it:

$$Data\ Rate = \frac{Total\ Data\ Transmitted}{Time}$$

This measurement represents the effectiveness of the
ESP32-Flask system in handling data streams in real time.

VI. RESEARCH GAP
Despite considerable progress in the field of IoT based health care monitoring, a number of gaps still remain:
1) Very few economical devices can provide real-time operation with low latency capabilities.
2) The use of cloud technology causes major bottlenecks.
3) The absence of holistic integration of physiological and environmental monitoring.
4) No focus on designing light-weighted architecture.

Block Diagram of our working



 Step-by-Step Explanation

VII. SYSTEM ARCHITECTURE AND WORKING

The following are the working principles of the system we propose:

1) Data Acquisition Layer: The physiological data is collected from patients in real-time using biomedical sensors. The MAX30102 module is used to acquire heart rate and SpO2 information, whereas the DS18B20 sensor helps us obtain body temperature data.
2) Edge Processing using ESP32: The core processing unit ESP32 will read the outputs of the sensors, eliminate noise, and format data as JSON.
3) Data Transmission: Data from the sensor will be transferred to the backend via the Wi-Fi module on the ESP32 by sending an HTTP POST request.
4) Backend Processing: This step entails validation of data, processing of data, and storing processed data in a database. The backend plays an important role in running the application in the front end, whereby real-time updates can be made through the use of a web-based

Summary of Working Principle of the System
Sensor → ESP32 → Wi-Fi → Flask Server → Database → Machine Learning Model → Dashboard

Key Points to Be Highlighted in the Thesis
- Real-time data monitoring system
- ESP32 for intelligent pre-processing and HTTP for reducing latency
- Random Forest for making intelligent predictions
- Remote web dashboard for accessing information

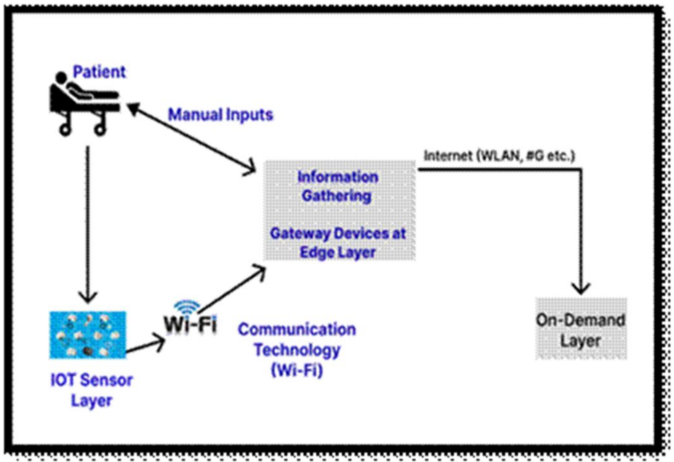


Figure.2:Data flow diagram

Table 3. Comparative Analysis of Heart Rate, SpO_2, and Temperature for Health Condition Assessment

Condition Pattern	Heart Rate (bpm)	SpO_2 (%)	Temperature (°C)	Possible Physiological Indication
Normal Condition	60–100	95–100	36.5–37.5	Stable physiological condition
Elevated Temperature with High Heart Rate	>100	≥95	>38	Possible infection or physiological stress
Low SpO_2 with High Heart Rate	>100	<94	Normal / High	Possible respiratory stress or reduced oxygen exchange
Low Heart Rate with Low SpO_2	<60	<94	Normal	Possible cardio-respiratory abnormality
High Temperature with Low SpO_2	>100	<94	>38	Possible severe physiological stress
High Heart Rate with Normal Temperature and SpO_2	>100	≥95	36.5–37.5	Possible stress, dehydration, or early physiological strain
Low SpO_2 with Normal Heart Rate	60–100	<94	36.5–37.5	Possible oxygen deficiency
High Temperature with Normal Heart Rate	60–100	≥95	>38	Mild fever or inflammatory response
Critical Low SpO_2 with High Heart Rate	>100	<90	Normal / High	Possible urgent respiratory abnormality
Very High Heart Rate with Low SpO_2 and High Temperature	>120	<94	>38	Possible severe systemic instability
Low Heart Rate with Low Temperature	<60	≥95	<35	Possible hypothermic condition
Irregular Heart Rate with Low SpO_2	Irregular	<94	Normal / High	Possible cardio-respiratory instability
High Heart Rate with Slightly Reduced SpO_2	>100	92–94	Normal / High	Possible early respiratory discomfort
Normal Heart Rate with High Temperature and Slightly Reduced SpO_2	60–100	92–94	>38	Possible infection affecting oxygen level

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VI June 2026- Available at www.ijraset.com

VIII. SYSTEM OVERVIEW

A. Objectives

- Development of a health monitoring system that measures body temperature, heart rate, ECG, blood pressure, etc.
- Development of a system that maintains patient records in a database to monitor changes over time.
- Analysis of the recorded sensor readings to gain an insight into the patient's health status.

System Block Diagram: The overall design of the IoT based health care system is presented in its block diagram (Figure 1). We have multiple sensors for vital signs which include body temp, heart rate, ECG, blood pressure, and also ambient humidity. These health care sensors collect data from the patient which is in turn collected by a microcontroller unit that does the data aggregation and processing. This data is put out to the cloud or server via an Internet communication module. At the server end data is processed and stored which in turn is put into a database. Also the patient's health info is made available in a user friendly format on a web app or dashboard which in turn allows doctors, family members, or caregivers to see the real time health status and historical trends.
Figure 1: Block diagram of the proposed IoT-based health monitoring system.

System Workflow: Figure 2 displays our system's workflow. At work, we see continuous collection of physiological data from the patient by the sensors, also at the same time the microcontroller is at work to analyze these inputs in real time. Should we detect at any point an abnormal variation in body temperature, heart rate or any other vital sign that we are monitoring, the system will set off an emergency alert (through SMS/email) to the doctor or care provider which in turn will inform them of the patient's health status. This immediate alert feature is what enables for prompt medical attention thus which in turn helps to lower the risk of serious health issues for the patient.

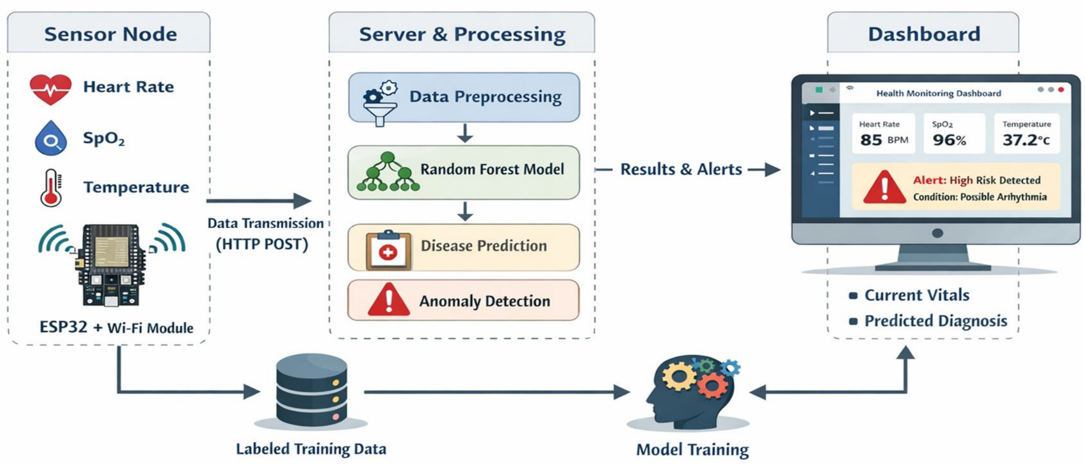


Figure 3. System Workflow

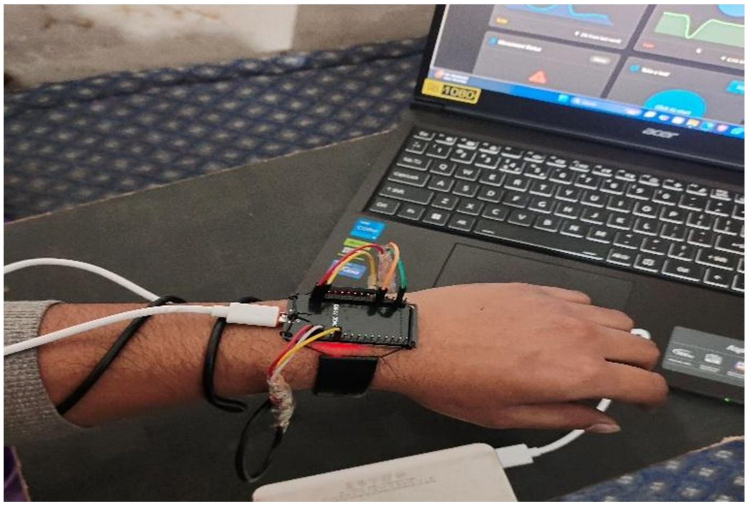


Figure 4. Prototype Image

IX. CONCLUSION

This project reports the development and operation of an AI enabled IoT health care monitoring system which we built using low cost and easily accessible components. We used sensors, ESP32 microcontroller, and wireless technology in the design which in turn enable us to collect and transmit vital signs like heart rate, SpO2, and temperature in real time. Also we incorporated a Random Forest machine learning model into the system for intelligent data analysis which in turn enables us to predict diseases and to detect anomalies.

The present system reports on how we have seen great progress in embedded systems, low cost sensors, and internet connectivity which in turn has made remote health monitoring a practical and scalable option. We also present our web dashboard which in time continuously displays patient vitals and at the same time enables timely decision making and remote supervision. Also as a whole our proposed solution is very much put forth to improve the state of patient care, which is very true in the case of the elderly and chronically ill patients that benefit from a continuous health surveillance. In the future as we see ourselves adding in cloud storage, alert systems, and multi- patient support the system will turn into a strong platform for smart healthcare and will be an asset in preventative medicine and broad scale health services.

REFERENCES

[1] N. N. Thilakarathne, W. D. M. Priyashan, and C. P. Premarathna, “Artificial intelligence - enabled IoT for health and wellbeing monitoring,” in 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT), 2021, pp. 01–07.

[2] S. Jegadeesan, P. Prasanth, P. Pradeep, P. P. Kumar, and B. Rahul, “AI-enabled efficient health monitoring system using IoT-based WBAN,” in 2024 4th Asian Conference on Innovation in Technology (ASIANCON), 2024, pp. 1–6.

[3] S. Chowdhury et al., “An IoT-based wearable healthcare monitoring device and medical emergency response system,” in 2024 IEEE Students Conference on Engineering and Systems (SCES), 2024, vol. 10, pp. 1–5.

[4] S. Farhan, P. Das, and S. Shabab, “IoT-based health monitoring system for real-time vital signs and hospital room conditions tracking,” in 2025 International Conference on Quantum Photonics, Artificial Intelligence, and Networking (QPAIN), 2025, pp. 1–6.

[5] M. Pawar, S. Rusia, S. Tijare, A. Gadpalliwar, M. Ashtekar, and R. Pichkate, “Development of health monitoring wearable device using ESP32,” in 2024 International Conference on Inventive Computation Technologies (ICICT), 2024, pp. 2007–2012.

[6] D. L. Reddy, M. R. Naik, and D. Srikar, “Health monitoring system based on IoT,” in 2021 5th International Conference on Trends in Electronics and Informatics (ICOEI), 2021, pp. 468–472.

[7] T. H. Orpa, A. Ahnaf, T. B. Ovi, and M. I. Rizu, “An IoT based healthcare solution with ESP32 using machine learning model,” in 2022 4th International Conference on Sustainable Technologies for Industry 4.0 (STI), 2022, pp. 1–6.

[8] M. Shakir, A. Arshad, M. O. Tariq, U. Sadiq, and U. Shabbir, “Development of IoT based smart system and data acquisition for patient monitoring,” in 2024 International Conference on Engineering and Emerging Technologies (ICEET), 2024, pp. 1–6.

[9] Lata, P., et al. "An Effective Investigation on Health Cloud Based IoT Based Virtual Health Monitoring System." 2024 9th International Conference on Communication and Electronics Systems (ICCES). IEEE, 2024.

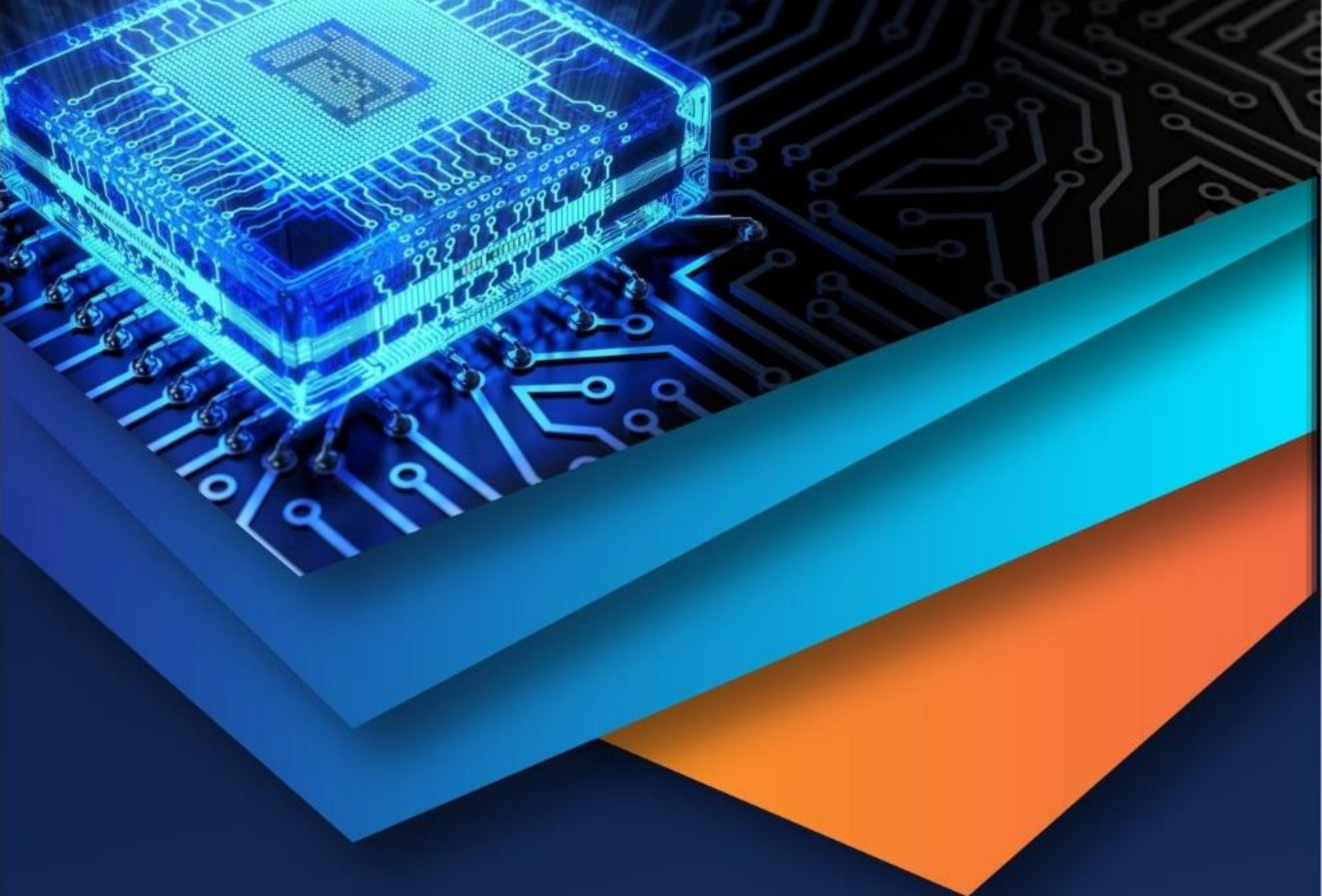
[10] Al-Zidi, Nasser M., et al. "Smart system for real-time remote patient monitoring based on internet of things." 2021 2nd International Conference on Computational Methods in Science & Technology (ICCMST). IEEE, 2021.

[11] J. Wan, M. A. A. H. Al-awlaqi, M. Li, M. O’Grady, X. Gu, J. Wang, and N. Cao, “Wearable IoT enabled real-time health monitoring system,” EURASIP Journal on Wireless Communications and Networking, vol. 2018, no. 1, pp. 1–10, 2018, doi: 10.1186/s13638-018-1308-x.

[12] L. K. Ramasamy, F. Khan, M. Shah, B. V. V. S. Prasad, C. Iwendi, and C. Biamba, “Secure smart wearable computing through artificial intelligence-enabled Internet of Things and cyber-physical systems for health monitoring,” Sensors, vol. 22, no. 3, p. 1076, 2022, doi: 10.3390/s22031076.

[13] M. Alshamrani, “IoT and artificial intelligence implementations for remote healthcare monitoring systems: A survey,” Journal of King Saud University – Computer and Information Sciences, vol. 34, no. 7, pp. 4687–4701, 2022, doi: 10.1016/j.jksuci.2021.06.005.

[14] Y. Qian and K. L. Siau, “Advances in IoT, AI, and sensor-based technologies for disease treatment, health promotion, successful ageing, and ageing well,” Sensors, vol. 25, no. 6207, 2025, doi: 10.3390/s25196207.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY