International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

IOT-ENABLED SMART HEALTHCARE SYSTEM

Dr.M.Arun[1], Naveen Kumar.S[2], Praveen Chidambaram.V[3], Sneha.S[4] and Vasanth.S[5]

[1]Associate Professor, Department of ECE, KGiSL Institute of Technology, India

[2,3,4,5]UG Students, Department of ECE, KGiSL Institute of Technology, India

Abstract

This paper is designed to revolutionize healthcare delivery by enabling real-time, remote monitoring of key health parameters. The system uses IoT-based sensors to continuously track vital signs like weight, body temperature, blood pressure, heart rate, and SpO_2. The data collected is transmitted wirelessly to healthcare providers via cloud technology, allowing doctors to monitor patients anywhere. This system is particularly beneficial for elderly, chronic, and rural patients who may struggle to access healthcare services regularly. By providing continuous monitoring, the system aids in the early detection of health issues, potentially preventing serious medical emergencies. It also generates instant alerts for abnormal readings, ensuring timely medical intervention. The system reduces the need for frequent hospital visits, saving both time and healthcare costs. Additionally, all patient data is securely stored in the cloud, providing long-term tracking and analysis for better treatment planning. The IoT-Enabled Smart Healthcare System is cost-effective, scalable, and user-friendly, making it a practical solution for both personal and clinical use. Ultimately, this system enhances healthcare accessibility, efficiency, and quality, enabling smarter, faster, and more connected healthcare services.

Keywords:

Internet of Things(Iot), MH-ET LIVE Heart Rate Sensor,DS18B20 Temperature Sensor,ESP32 microcontroller, SpO_2 levels

1. INTRODUCTION

The project is aimed at real-time health monitoring using IoT technology, focusing on tracking vital signs such as body temperature, heart rate, SpO_2 levels, and body weight. These health parameters are sensed through dedicated sensors and transmitted wirelessly to medical professionals via cloud platforms or mobile applications. The need for such a system has grown with the demand for remote healthcare and early diagnosis, especially in rural or high-risk areas. The MH-ET LIVE Heart Rate Sensor and DS18B20 Temperature Sensor provide accurate health readings. The ESP32 microcontroller reads the sensor data and transmits it using Wi-Fi/Bluetooth to a cloud dashboard. When abnormal readings are detected, alerts are automatically sent to caregivers or doctors, enabling immediate action. This system reduces the chances of manual errors, enhances patient monitoring, and helps in data-driven treatment decisions, especially in emergency or chronic cases. The system addresses the limitations of conventional manual health monitoring methods by offering automation, accuracy, and remote access capabilities. With the increasing global demand for telemedicine and remote patient monitoring, especially after recent global health crises, the necessity for reliable and non-intrusive health monitoring systems has grown substantially.

Additionally, the system allows for continuous data logging, enabling trend analysis and predictive insights using AI or machine learning algorithms in future iterations. Its modular design also makes it easily scalable and adaptable to monitor additional health parameters if needed. The integration of secure data transmission protocols ensures patient privacy and compliance with health data regulations. This approach not only improves individual healthcare outcomes but also strengthens public health infrastructure through timely, connected, and proactive medical responses.

2. LITERATURE SURVEY

The integration of IoT in healthcare has led to significant advancements in remote monitoring and smart diagnostics. A congestion-free routing mechanism was proposed to enhance Wireless Sensor Networks (WSNs) for smart healthcare, improving data delivery and network efficiency [1]. Güntner et al. developed breath sensors to enable real-time health monitoring, aiding in early diagnosis of respiratory conditions [2]. Kakria et al. designed a smartphone-based remote cardiac monitoring system, demonstrating the potential of mobile health (mHealth) technologies [3]. An ontology-based IoT framework was introduced for intelligent patient monitoring, supporting semantic interoperability and decision-making [4]. Another scalable green healthcare system combined cloud and IoT to improve energy efficiency and scalability [5]. Mao and Zhang optimized medical consultation services using AI and IoT, enhancing accessibility and responsiveness [6]. Bhuiyan et al. reviewed IoT-enabling technologies, highlighting challenges in standards, security, and market adoption [7]. Xue et al. studied smart healthcare development in China, emphasizing sustainable application systems [8]. Zhu et al. provided an overview of smart healthcare trends in the IoT era, identifying future directions [9]. Chen et al. proposed a zero-trust security model for 5 G-enabled healthcare systems to address growing cybersecurity threats [10].

3. METHODOLOGY

The methodology of the IoT-Enabled Smart Healthcare System involves the integration of various biomedical sensors to monitor vital health parameters such as body temperature, heart rate, blood pressure, SpO_2, and weight. These sensors are connected to a microcontroller, such as Arduino or NodeMCU, which collects real-time data from the patient. The collected data is then transmitted wirelessly via Wi-Fi or Bluetooth to a cloud-based server for remote access and storage. A secure cloud platform is used to ensure data privacy and accessibility by authorized healthcare professionals. A user-friendly web or mobile interface is developed to display the patient's health data

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

in real-time. Threshold values are set for each parameter, and alerts are generated automatically when abnormal readings are detected. The system is designed to be portable, scalable, and cost-effective for both personal and clinical use. Power management is considered to ensure uninterrupted monitoring, especially for wearable or mobile systems. Data analytics tools may be integrated to analyze long-term health trends for better diagnosis and treatment planning. The methodology includes regular calibration and validation of sensors to ensure data accuracy. Testing is conducted in simulated environments before deployment. Patient feedback and healthcare provider input are considered for iterative improvements. The entire system is designed with reliability, usability, and safety in mind. Security protocols are implemented to protect sensitive medical data from unauthorized access. Finally, the system aims to reduce hospital visits, improve health outcomes, and enhance accessibility to quality healthcare services.

4. EXISTING SYSTEM

The existing IoT-enabled healthcare systems primarily focus on remote health monitoring using various sensor-based technologies. These systems are designed to collect real-time physiological data such as heart rate, body temperature, blood pressure, SpO_2 levels, ECG, and body weight. Most existing systems employ microcontrollers like Arduino, Raspberry Pi, or ESP8266 to interface with biomedical sensors. The data collected is transmitted wirelessly through Bluetooth, Wi-Fi, or GSM modules to cloud platforms such as Firebase, AWS, or Thingspeak. These platforms allow storage, analysis, and visualization of patient data. Users and healthcare providers can access this information via mobile apps or web dashboards. In many cases, threshold levels are predefined, and alerts are triggered when the readings deviate from the normal range. SMS or app-based notifications are commonly used to inform doctors or caregivers. Existing systems often use wearable devices like smartwatches or patches for continuous tracking. Some solutions also include GPS tracking for patients with mobility concerns. Battery-powered systems are common but often lack optimized power management for longer operation. While these systems have improved accessibility and early diagnosis, many still lack robust data security and encryption measures. Additionally, most are not interoperable across healthcare platforms, limiting integration. Some systems are limited by short-range communication or require stable internet access, which can be challenging in rural areas. Moreover, AI-based predictive analytics is generally missing in most traditional systems. Despite these limitations, existing systems have laid a strong foundation for developing more advanced, scalable, and intelligent IoT healthcare solutions.

5. PROPOSED METHOD

The proposed IoT-enabled smart healthcare system is designed to provide continuous, real-time monitoring of patients' vital health parameters using advanced biomedical sensors. These sensors measure key indicators such as heart rate, body temperature, blood pressure, SpO_2, ECG, and body weight. A microcontroller (such as NodeMCU or Raspberry Pi) collects the data and transmits it wirelessly to a secure cloud platform using Wi-Fi or GSM. The data is stored, processed, and displayed through a user-friendly mobile or web application accessible to both patients and healthcare providers. The system sets threshold values for each parameter, and if any reading exceeds these limits, instant alerts are sent to the concerned medical personnel via SMS or in-app notifications. AI-based analytics is integrated to predict health abnormalities by learning from historical data trends, helping in early diagnosis and preventive care. The platform includes secure login, role-based access, and data encryption to ensure privacy and confidentiality. A low-power design ensures longer operation of wearable devices, while GPS integration can assist in tracking elderly or high-risk patients. The system is scalable and can be deployed in individual homes, hospitals, or rural clinics. Interoperability features enable easy integration with existing electronic health record (EHR) systems. Real-time dashboards provide visualizations of health metrics, trends, and alerts. Offline storage and later synchronization allow data to be captured even in low-connectivity areas. The system reduces the need for frequent hospital visits, minimizes emergency risks, and ensures timely medical response. Designed with modular architecture, it allows easy upgrades and maintenance. Ultimately, it promotes smarter, safer, and more accessible healthcare services.

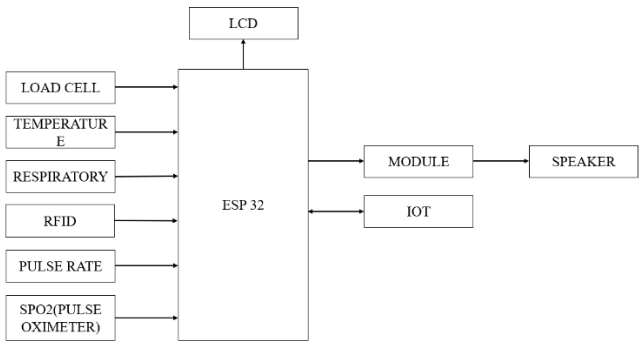

Figure 5.1 Block Diagram

6. RESULTS AND DISCUSSIONS

This chapter discusses the successful implementation and performance of the IoT-Enabled Smart Healthcare System. The system accurately monitored and transmitted real-time health data such as weight, temperature, blood pressure, heart rate, and SpO_2 to healthcare providers. It generated timely alerts for abnormal readings, enabling quicker medical response. The results show improved healthcare accessibility, efficiency, and patient safety.

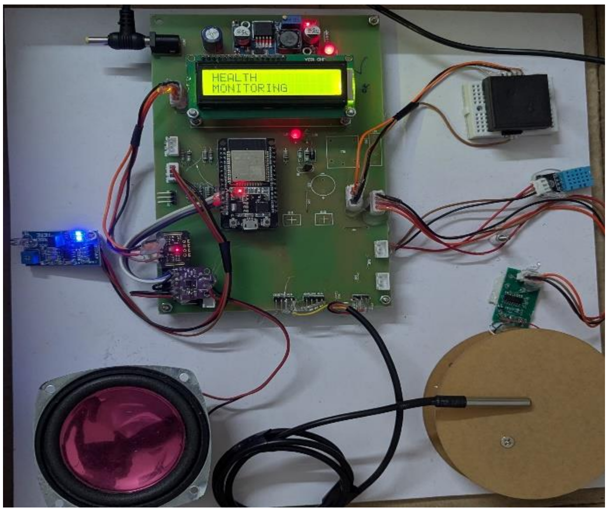

Figure 6.1 Healthcare System

The system successfully recognized patient identity using the RFID reader, accurately retrieving and displaying personal details such as name, age, and address, along with generating a unique token number.

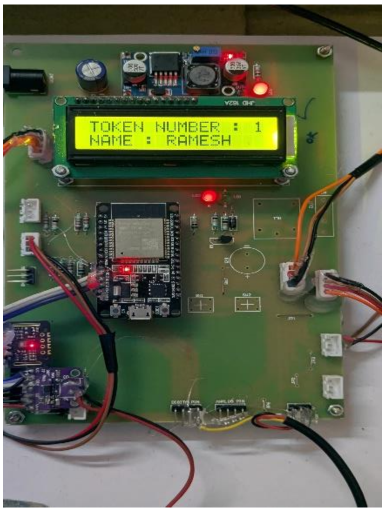

Figure 6.2 Gathering patients' information

The speech module effectively guided patients through the health check process by announcing steps like "weight check," "temperature check," "pressure check," and "pulse check," enhancing user interaction and accessibility.

Each health parameter was read accurately as the user followed the voice prompts and placed their hand or body in the correct position for sensor readings. The values were displayed on the screen after every check, ensuring transparency and ease of understanding for the user.

Figure 6.3 Displaying patients' information

At the end of the procedure, when the same RFID tag was scanned again, all data was securely stored, and the final token was generated and transmitted to the doctor via the IoT-based communication system. Each patient's data are also seen in the Blynk IoT application.

In cases where abnormal health values were detected, the system reliably generated an emergency token, prioritizing such patients for immediate attention. The results demonstrate that the system is user-friendly, responsive, and suitable for both regular monitoring and emergency detection.

Date	Token No	Weight	Pulse	Sp02	Temperature	Patient's Details
2025-04-26	1	350	78	98	96	N:RAMESH A:20 G:MALE TOKEN NUMBER : 1
2025-04-26	2	430	80	99	97	N:MANI A:25 G:MALE TOKEN NUMBER :2
2025-04-26	3	600	88	95	103	N:ARUN A:25 G:MALE EMERGENCY TOKEN NUMBER : 3

Table 6.4 Patient information

7. CONCLUSION

In conclusion, the IoT-Enabled Smart Healthcare System provides an effective and reliable solution for real-time health monitoring using IoT technology. It successfully measures vital parameters such as weight, temperature, blood pressure, heart rate, and SpO_2 with accuracy. The system ensures remote accessibility of patient data through cloud connectivity, allowing doctors to monitor health conditions anytime, anywhere. It reduces the dependency on frequent hospital visits, saving time and reducing healthcare costs. Timely alerts for abnormal readings enhance patient safety and enable quick medical intervention. The project also supports long-term data storage for future health analysis. Its user-friendly design and scalability make it suitable for both home and clinical environments. This system bridges the gap between patients and healthcare providers, especially in remote areas. It promotes preventive healthcare by enabling early detection of health issues. Overall, the project contributes to a smarter, more efficient, and connected healthcare ecosystem

8. REFERENCE

1) "Congestion Free Routing Mechanism for IoT-enabled Wireless Sensor Networks for Smart Healthcare Applications"vol.27,Nov 2020,Access.2020.2987433.
2) A.T. Güntner, S. Abegg, K. Königstein, P. A. Gerber, A. Schmidt-Trucksäss , and S. E. Pratsinis , "Breath sensors for health monitoring," ACS Sensors, vol. 4, no. 2, pp. 268–280, 2019.
3) P. Kakria, N. K. Tripathi, and P. Kitipawang, "A real-time health monitoring system for remote cardiac patients using smartphone and wearable sensors," Int. J. Telemed. Appl., vol. 2015, 2015. Furkh Zeshan , Muhammad hamid , Adnan Ahmad ,Muhammad Imran Babar,,Fahima Hajjej , Mahmood Ashraf,"An IoT-Enabled Ontology-Based Intelligent Healthcare Framework for Remote Patient Monitoring" vol.11,Nov 2023,Access.2023.3332708.
4) Md. Motaharul Islam, Zaheed Ahmed Bhuiyan, "An Integrated Scalable Framework for Cloud and IoT Based Green Healthcare System" vol.11,Nov 2023,Access.2023.3250849.
5) Prasenjit Chanak, Indrajit Banerjee, "Congestion Free Routing Mechanism for IoT enabled Wireless Sensor Networks for Smart Healthcare Applications" IEEE Access ,April 2020,Access.2020.2987433.
6) Y. Mao and L. Zhang, ''Optimization of the medical service consultation system based on the artificial intelligence of the Internet of Things,'' IEEE Access, vol. 9, pp. 98261–98274, 2021.
7) M. N. Bhuiyan, M. M. Rahman, M. M. Billah, and D. Saha, ''Internet of Things (IoT): A review of its enabling technologies in healthcare applications, standards protocols, security, and market opportunities,'' IEEE Internet Things J., vol. 8, no. 13, pp. 10474–10498, Jul. 2021.
8) X. Xue, Y. Zeng, Y. Zhang, S. Lee, and Z. Yan, ''A study on an application system for the sustainable development of smart healthcare in China,''IEEE Access, vol. 9, pp. 111960–111974, 2021.
9) H. Zhu, C. K. Wu, C. H. Koo, Y. T. Tsang, Y. Liu, H. R. Chi, and K.-F. Tsang, ''Smart healthcare in the Era of Internet-of-Things,'' in IEEE Access. Electron. Mag., vol. 8, no. 5, pp. 26–30, 1, Sep. 2019.
10) B. Chen, S. Qiao, J. Zhao, D. Liu, X. Shi, M. Lyu, H. Chen, H. Lu,and Y. Zhai, ''A security awareness and protection system for 5G smart healthcare based on zero-trust architecture,'' IEEE Internet Things J., vol. 8, no. 13, pp. 10248–10263, Jul. 2023