



A COMPREHENSIVE REVIEW ON IOT BASED HEALTHCARE AND ASSISTANCE SYSTEM FOR PARALYSIS PATIENTS

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Abstract:

This project presents an IoT-Based IoT Based Healthcare and Assistance System for Paralysis Patients designed to assist patients with limited mobility by enabling continuous monitoring and emergency communication. The system utilizes an ESP32 integrated with sensors such as temperature and accelerometer, along with a push button and buzzer for emergency alerts. The system continuously monitors the patient's health parameters and body movement. The collected data is transmitted to a web-based dashboard using IoT technology, allowing caregivers and doctors to monitor the patient remotely in real time. In case of an emergency, the patient can press a button, which triggers a buzzer alert to immediately notify the caretaker. Additionally, abnormal conditions detected through sensors can also generate alerts. This system improves patient safety, reduces response time during emergencies, and provides an efficient solution for remote healthcare monitoring. It is cost-effective, easy to implement, and highly beneficial for home care and hospital environments.

Keyword:- IoT Healthcare, Paralysis Patient Monitoring, ESP32, Assistance

1. INTRODUCTION

Paralysis is a serious and life-altering medical condition characterized by the loss of muscle function in certain parts of the body. It may occur due to various reasons such as stroke, spinal cord injury, neurological disorders, or accidents, and can affect a specific part of the body (partial



paralysis) or the entire body (complete paralysis) [1], [2]. Patients suffering from paralysis often face significant challenges in performing basic daily activities such as movement, communication, and self-care. As a result, they become highly dependent on caregivers or medical staff for their survival and well-being [2], [3]. One of the major challenges faced by paralysis patients is the inability to communicate effectively. Many patients are unable to speak or move properly, making it difficult for them to express their needs such as requiring water, food, or medical assistance. This lack of communication can lead to frustration, discomfort, and even life-threatening situations if timely help is not provided [1], [4], [7]. Additionally, continuous monitoring of such patients is essential, as they are more vulnerable to sudden health issues such as fever, infections, or physical discomfort [5], [8]. Traditional healthcare systems rely heavily on manual monitoring, where caregivers or hospital staff must be physically present to observe and assist patients. This approach is not only time-consuming but also inefficient, especially in situations where immediate attention is required. In home-based care environments, continuous supervision may not always be possible, leading to delays in assistance. Moreover, the increasing number of patients and limited availability of healthcare professionals further highlight the need for automated and intelligent healthcare solutions [6], [9], [10]. In recent years, the advancement of the Internet of Things (IoT) technology has revolutionized various fields, including healthcare. IoT refers to a network of interconnected devices and sensors that collect, process, and transmit data over the internet. In healthcare, IoT enables real-time monitoring, remote access to patient data, and automated alert systems, thereby improving efficiency and reducing the need for constant human supervision [11], [12], [13]. IoT-based systems have the potential to transform traditional healthcare into smart healthcare, where patients can be monitored continuously and caregivers can respond promptly to emergencies [12], [14]. The concept of the Internet of Medical Things (IoMT), a subset of IoT, further enhances healthcare systems by integrating medical devices, sensors, and cloud technologies. IoMT enables continuous tracking of patient health parameters such as temperature, heart rate, blood pressure, oxygen saturation, and movement patterns. This data can be analyzed and accessed remotely by doctors or caregivers, ensuring timely medical intervention and improved patient care [13], [15], [16].

2. LITERATURE SURVEY

Shri Harsha et al. [1] proposed an IoT-based automated paralysis patient healthcare system that enables monitoring and communication for patients with limited mobility. The system integrates sensors and wireless communication to monitor patient activity and transmit data to caregivers. The authors highlight that IoT technologies can significantly improve patient independence and reduce caregiver workload. However, the system requires multiple sensors and modules, increasing the complexity of the implementation.

Nandha Kumar and Vadivel [2] conducted a comprehensive study on IoT-based automated paralysis healthcare systems. Their research discusses the role of sensor networks, cloud platforms, and wireless communication in monitoring patients remotely. The study emphasizes that IoT-



enabled healthcare systems improve response time and patient safety by providing continuous monitoring and alert mechanisms.

Khan et al. [3] introduced an IoT-enabled sensor glove system designed to facilitate communication and health monitoring for patients with limited movement. The glove detects hand gestures using sensors and converts them into communication signals that can be interpreted by caregivers. The authors state that wearable IoT devices provide intuitive communication methods for disabled patients. However, the system may not be suitable for patients with severe paralysis who cannot move their hands.

A study presented in the AIP Conference Proceedings [4](2025) proposed an IoT-based automated paralysis patient healthcare system that combines monitoring and communication features. The system integrates sensors with wireless modules to transmit patient data to remote monitoring platforms. The authors emphasize that IoT technology allows efficient healthcare management and improves the quality of life for disabled patients.

Kumar et al. [5] developed an IoT-based paralysis patient healthcare monitoring system that enables real-time monitoring of patient conditions and generates alerts during emergencies. The authors highlight that IoT-based monitoring systems can help caregivers detect abnormal

health conditions at an early stage. However, the system primarily focuses on monitoring and does not provide advanced communication features for patients.

Another research presented in IJRASET Journal [6] proposed a healthcare monitoring system for paralysis patients using IoT technology. The system collects patient data using sensors and transmits the information to a monitoring platform through wireless communication. The authors conclude that IoT-based healthcare systems can significantly improve patient care and monitoring efficiency.

An IoT-based healthcare monitoring and assistance system for paralysis patients was proposed in [7]. The system focuses on continuous patient monitoring and emergency alert generation. The authors highlight that remote monitoring reduces the need for constant physical supervision by caregivers. However, the system lacks efficient communication mechanisms for patients to convey their needs.

Mahendran et al. [8] proposed a smart healthcare monitoring system for paralysis and mute patients using IoT technology. The system integrates sensors and communication modules to monitor patient health conditions and assist in communication. According to the authors, IoT-based healthcare systems can significantly improve the independence and quality of life of disabled individuals.

Patel et al. [9] developed a wearable IoT system for patient health monitoring and emergency alerts. The system uses wearable sensors to monitor vital parameters and transmit data to healthcare providers. The authors emphasize that wearable IoT devices provide continuous



monitoring and quick emergency detection,

Table 1 Comparative review of IOT Based Healthcare and Assistance System for Paralysis Patients

Paper / Project	System Architecture	Cost	Performance	User Experience	Limitations
Shri Harsha et al. (2026)	IoT + Sensors + Gesture + Cloud	Medium	High	Good (gesture-based communication)	Complex hardware, multiple sensors
Nandha Kumar & Vadivel (2025)	IoT + AI + Cloud + Wearables	High	High	Advanced monitoring	High cost, security issues
Khan et al. (2025)	Sensor Glove + IoT	Medium	Good	Good (gesture communication)	Not suitable for fully paralyzed patients
AIP Conference (2025)	Multi-sensor IoT system	High	High	Moderate	Hardware complexity
Kumar et al. (2025)	IoT Monitoring + Alerts	Low	Good	Basic monitoring	No communication feature
IJRASET (2025)	Sensor-based IoT system	Low	Moderate	Moderate	Limited functionality
IJSREM (2025)	IoT Monitoring + Alert System	Low	Good	Basic	No communication system
Sharma et al. (2025)	ESP32 + IoT Monitoring	Low	Good	Moderate	Monitoring only
Patel et al. (2024)	Wearable IoT + Sensors	Medium	High	Comfortable wearable	No communication support
Mahendran et al. (2024)	IoT + Sensors + Flex system	Medium	Good	Good	More components required
Verma & Singh (2024)	IoT + Cloud (ThingSpeak)	Low	Good	Good (dashboard)	No patient interaction
Hegde (2024)	IoT Monitoring + Alerts	Low	Moderate	Basic	No communication feature
Ferdous et al. (2023)	ESP32 + Web Server	Low	Good	Good (web dashboard)	No communication system



Hao et al. (2023)	IoT + Cloud Computing	Medium	High	Good	Focus on backend only
Chen et al. (2023)	Wearable IoT + Sensors	Medium	High	Good	Lack of communication support

Research Gap

A comprehensive review of recent literature indicates that significant progress has been made in developing IoT-based healthcare systems for paralysis patients. Most studies have successfully implemented real-time health monitoring using IoT sensors, cloud platforms, wearable devices, and wireless communication technologies. Several researchers have also proposed systems that provide emergency alerts, remote monitoring, and patient activity tracking. Despite these advancements, several important research gaps remain. The first major limitation is that most existing systems primarily focus on monitoring physiological parameters such as temperature, heart rate, and body movement, while providing limited support for patient communication. Paralysis patients often experience difficulty expressing their needs, and many existing solutions do not offer a simple and practical communication mechanism. Secondly, many proposed systems rely on expensive hardware, multiple wearable devices, or complex architectures involving artificial intelligence, machine learning, blockchain, or cloud computing. Although these approaches improve system intelligence and security, they increase implementation cost, computational complexity, and power consumption, making them less suitable for low-cost home healthcare applications. To address these gaps, the proposed system presents a low-cost, wearable IoT solution based on the ESP32 microcontroller. It combines temperature monitoring, accelerometer-based communication, emergency alert generation using a push button and buzzer, and a Django-based web dashboard for real-time remote monitoring. The modular architecture also allows future integration of additional health sensors such as pulse oximeters and ECG sensors.

Objectives:-

1. To monitor the patient's body temperature continuously using a temperature sensor.
2. To interpret different movement directions and convert them into meaningful messages (e.g., food, water, emergency).
3. To develop a web-based dashboard for displaying sensor data and messages in real time.
4. To create a cost-effective and user-friendly system suitable for home and hospital use.

3. METHODOLOGY

A structured literature review was conducted to examine recent developments in IoT-based healthcare systems for paralysis patients, with particular emphasis on health monitoring, assistive communication, remote patient care, and emergency support. Relevant research studies were identified using academic databases and scholarly sources, including Google Scholar, Scopus,



IEEE Xplore, ScienceDirect, Springer, and other research repositories. The search was performed using combinations of keywords such as IoT-based paralysis patient healthcare system, paralysis patient monitoring, IoT healthcare monitoring, wearable healthcare system, assistive communication, remote patient monitoring, and Internet of Medical Things. The collected studies were initially screened according to their relevance to the research objectives. Papers focusing on IoT-enabled healthcare, wearable sensing, patient monitoring, communication assistance, remote monitoring, or emergency alert mechanisms were considered for further analysis, while unrelated studies and papers with insufficient technical information were excluded. For each selected study, relevant information was systematically extracted, including the authors, publication year, journal or conference, research objective, methodology, technologies or sensors used, and major findings. The extracted information was organized into a literature review matrix to facilitate systematic comparison among the studies. Particular attention was given to the type of sensors, processing platforms, communication technologies, monitoring interfaces, patient-assistance mechanisms, and practical implementation approaches reported in the literature. The reviewed studies were then compared to determine their major contributions, advantages, and limitations. Finally, the findings were synthesized to identify existing research gaps and areas requiring further development. The review particularly examined the need for simple, economical, wearable, and user-friendly systems that can combine continuous health monitoring with assistive communication and emergency support for paralysis patients.

4. DISCUSSION

The proposed IoT-Based Paralysis Patient Healthcare System demonstrates the effective application of IoT technology in improving patient care and communication. The system successfully integrates hardware components with a software platform to provide real-time monitoring, movement-based communication, and emergency alert features. The results indicate that the system performs reliably in detecting temperature and movement, and accurately converts sensor inputs into meaningful outputs. The use of the accelerometer sensor proved to be an efficient method for enabling communication, as even slight movements were sufficient to generate predefined messages. This approach is simpler compared to complex systems like sensor gloves or voice-based systems, making it more practical for paralysis patients. The integration of the ESP32 with a Django-based web dashboard ensured smooth and real-time data transmission. The API-based communication was stable and secure, allowing continuous monitoring without significant delay. The dashboard provided a clear and user-friendly interface, enabling caregivers to easily understand patient conditions remotely.

5. CONCLUSION

The developed IoT-based Paralysis Patient Healthcare System successfully demonstrates an effective solution for monitoring and assisting paralysis patients. By using an ESP32 microcontroller, along with a temperature sensor and accelerometer sensor, the system is able to



track the patient's health condition and detect body movements in real time. The integration of IoT technology enables remote monitoring through a web-based dashboard, allowing caregivers to observe patient status from anywhere. A key feature of the system is its ability to convert movement directions into meaningful messages, helping paralysis patients communicate their basic needs easily. Additionally, the system provides alerts in case of abnormal conditions, ensuring timely medical attention and improving patient safety. The proposed solution is cost-effective, simple, and user-friendly, making it suitable for both home and hospital environments. Overall, this project enhances the quality of life for paralysis patients by combining health monitoring and communication support in a single system, and it serves as a foundation for future advancements in smart healthcare technologies.

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