



DESIGN AND IMPLEMENTATION OF IOT BASED HEALTHCARE AND ASSISTANCE SYSTEM FOR PARALYSIS PATIENTS

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Abstract:

Paralysis patients often face difficulty in communicating their needs and require continuous monitoring. This project presents an IoT-based Paralysis Patient Healthcare System that enables real-time health monitoring and communication assistance using sensor-based technology. The system is built using an ESP32 microcontroller, which collects data from a temperature sensor and an accelerometer sensor. The temperature sensor continuously monitors the patient's body temperature, while the accelerometer detects the direction and pattern of body movements. Based on the data from the accelerometer sensor, the system interprets different movement directions and translates them into meaningful messages (such as need help, need water, or emergency) displayed on a web-based dashboard. This allows paralysis patients to communicate their basic needs with minimal movement. The ESP32 transmits all sensor data to a cloud platform, enabling caregivers to monitor the patient remotely. In addition, the system can generate alerts if abnormal temperature or unusual movement is detected, ensuring timely medical attention. The proposed solution is cost-effective, user-friendly, and efficient, making it suitable for both home care and hospital environments. This system enhances patient independence, improves communication, and ensures better healthcare support through IoT technology.

Keyword: paralysis patient, IoT, real time monitoring, emergency alert system



1. INTRODUCTION

Paralysis is a condition that can substantially reduce an individual's ability to control body movements and perform routine activities independently. Depending on the underlying cause and severity, it may affect a limited region of the body or involve multiple parts of the body. Conditions such as stroke, spinal cord injury, neurological disorders, and traumatic accidents are among the major causes associated with paralysis. The resulting physical limitations can create difficulties in mobility, self-care, and interaction with caregivers, increasing the need for continuous assistance and support [1], [2]. Continuous monitoring is another important requirement in paralysis patient care. Conventional monitoring generally depends on caregivers or medical staff being physically present, which can be difficult to maintain continuously, especially in home-care environments. Delayed observation may result in delayed assistance during abnormal conditions or emergencies. Therefore, an automated system capable of monitoring patients and providing timely information to caregivers can improve the efficiency of patient care [4], [5], [6]. The development of Internet of Things (IoT) technology has enabled healthcare devices and sensors to collect and transmit patient information in real time. IoT-based healthcare systems can support remote monitoring, automatic data transmission, and emergency notifications. The Internet of Medical Things (IoMT) further extends these capabilities by connecting medical sensors with web or cloud-based platforms for remote access to patient information [6], [7]. However, many existing systems mainly concentrate on health-parameter monitoring and emergency alerts, while providing limited support for simple patient communication. Some solutions also involve complex hardware or higher implementation costs, which can reduce their suitability for patients with severe physical limitations and home-care applications [4]–[6]. Therefore, this work proposes a low-cost IoT-Based Paralysis Patient Healthcare System that integrates real-time health monitoring, movement-based communication, emergency alerts, and a Django-based web dashboard. The proposed system is designed to provide remote patient information to caregivers while offering a simple mechanism for patients to communicate their needs, thereby improving patient safety and reducing dependence on continuous physical supervision.

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.

AIP Conference [4] 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.

IJRASET [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.

IJSREM [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, but they do not provide communication support for paralysis patients.

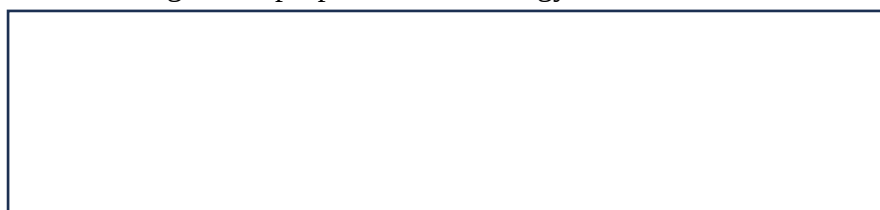


Table 1 A Comparative Review of IOT Based Healthcare and Assistance System for Paralysis Patients

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

3. PROPOSED METHODOLOGY

Figure 1 shows block diagram of proposed methodology



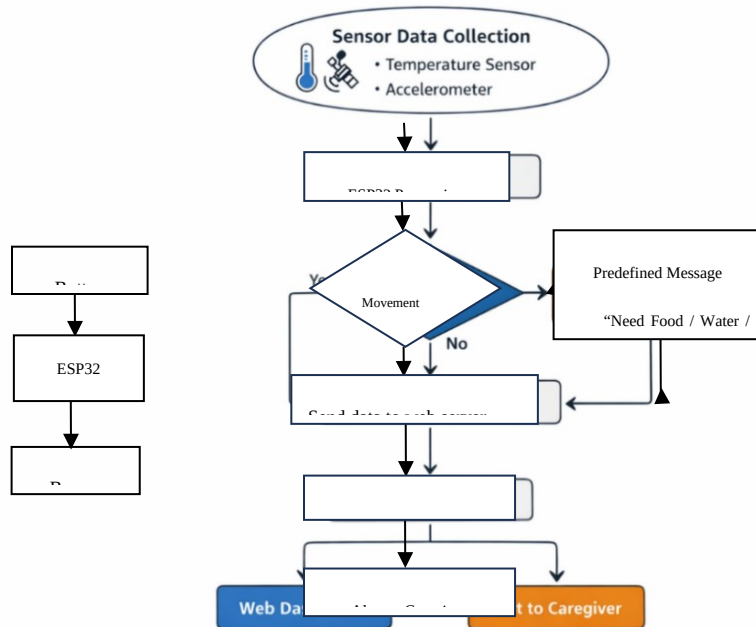


Figure 1 Block Diagram of Proposed System

The proposed system is designed to monitor the health condition of a paralysis patient and enable communication through movement detection using IoT technology. The working methodology is explained step-by-step as follows:

1. Data Collection

- A temperature sensor measures the patient's body temperature continuously.
- An accelerometer sensor detects the direction and pattern of the patient's movements (tilt, tilt left/right, up/down).

2. Data Processing (ESP32)

- The ESP32 microcontroller collects data from both sensors.
- It processes the accelerometer data to identify specific movement directions.
- Each movement direction is mapped to a predefined message (e.g., Need Help, Need Water, Emergency).

3. Data Transmission (IoT)

- The ESP32 uses built-in Wi-Fi to send sensor data to a cloud/server platform.
- Data is updated in real time for remote access.

4. Dashboard Display

- A web-based dashboard is developed to display:

- Patient temperature
- Movement-based messages
- When a specific movement is detected, the corresponding message is displayed instantly.

5. Remote Monitoring

- Caregivers or family members can monitor the patient's condition from anywhere using the dashboard.
- This reduces the need for continuous physical supervision.

4. RESULT AND DISCUSSION

Result: -

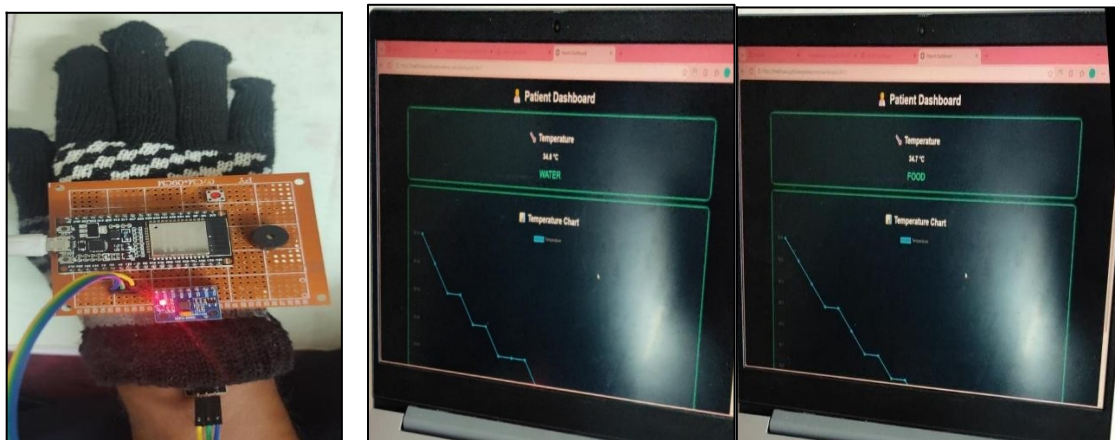


Figure 2 (A) Hardware Design And (B), (C) Software Design

Discussion: -

The experimental implementation shows that the developed system can combine patient monitoring and assistive functions within a single wearable platform. During testing, the ESP32 acquired temperature and motion data and transferred the information to the Django web interface through the network connection. The collected values could therefore be viewed remotely rather than relying only on direct observation of the patient. The MPU6050 provided the basis for the movement-based interaction feature. Predefined changes in hand orientation were used to trigger corresponding messages, allowing the patient to communicate selected requirements without relying on speech. This makes the interaction mechanism suitable for a prototype intended for patients with restricted communication abilities. The system also includes an emergency-alert function to support quicker caregiver response when assistance is required. From the software side, communication between the ESP32 and Django server was implemented through an HTTP API, allowing sensor information to be transferred to the web dashboard. The dashboard presents the received information in an accessible form, making it possible for a caregiver to observe the patient's status remotely. Overall, the experimental results demonstrate the feasibility of combining



sensor-based monitoring, movement-based communication, remote visualization, and emergency assistance in one low-cost prototype. Further testing with more patients, longer observation periods, and additional physiological sensors would be required to establish its performance under broader real-world conditions.

5. CONCLUSION

The prototype developed in this work integrates sensing, wireless communication, and assistive interaction into a compact healthcare platform for paralysis patients. During operation, the ESP32 acquires temperature and motion information from the connected sensors and transfers the collected data through Wi-Fi to the Django-based monitoring interface. This allows the caregiver to access patient information without being physically present near the patient. In addition to health monitoring, the system focuses on the communication difficulties commonly experienced by patients with restricted movement. The MPU6050 accelerometer is used to identify predefined movement patterns, which are then interpreted as corresponding requests or messages. This provides the patient with an alternative method of communicating basic requirements. An emergency mechanism is also incorporated to facilitate immediate notification when assistance is needed. The experimental implementation demonstrates that the proposed architecture can combine patient monitoring, remote data access, movement-based communication, and emergency assistance using relatively simple and economical hardware. The system is therefore suitable as a prototype for home-care and assisted-care applications. Although further validation with larger datasets and additional medical sensors is required, the developed platform provides a foundation for future improvements such as heart-rate and SpO₂ monitoring, mobile notifications, AI-based condition detection, and advanced assistive communication.

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