IoT-Based Healthcare Monitoring for Elderly and Paralyzed Patients: A Literature Review

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Abstract- **This research outlines the development of a low-cost, IoT-enabled health monitoring system specifically tailored for elderly and immobile patients who require continuous supervision within a home setting. The system employs the Arduino Uno as the core controller, interfacing with key biomedical sensors: the LM35 for accurate temperature tracking, the MPU6050 for detecting movement and orientation, and a pulse sensor to monitor heart rate. Sensor data is wirelessly transmitted via the ESP8266-01 Wi-Fi module to the ThingSpeak cloud platform, enabling remote, real-time visualization of patient vitals. This setup allows healthcare professionals and family members to monitor patients from any location using an internet-connected device. The prototype showcases the potential of integrating open-source hardware with IoT infrastructure to create scalable, remote health solutions. The system reduces dependency on in-person hospital visits while enhancing patient safety through immediate access to health data. With potential for further enhancements such as additional sensors and predictive analytics, the proposed design lays the groundwork for future smart healthcare systems.**

Index Terms- **IoT Health Monitoring, Arduino Uno, ESP8266-01, LM35 Temperature Sensor, MPU6050 Module, Heartbeat Sensor, ThingSpeak Cloud, Remote Patient Care, Elderly Monitoring.**

I. INTRODUCTION

The Internet of Things (IoT) has introduced new possibilities in modern medical care, particularly for elderly people and patients with mobility impairments. Many seniors face age-related conditions like chronic diseases and frequent falls, while paralyzed patients often need constant observation to stay safe at home. Unfortunately, hospitals and caregivers cannot monitor each patient continuously due to resource limitations and high demand [1]

IoT technologies provide an alternative way to extend healthcare outside of hospitals. By using affordable sensors, microcontrollers, and wireless communication, these systems gather important health information such as temperature, heart rate, and movement [5]. This data can be shared online with doctors or family members, allowing them to check the patient's condition from any location.

This research aims to develop a simple home-based system that uses an Arduino Uno board as its central unit. It connects to an LM35 sensor to record body temperature, an MPU6050 sensor to detect movement or possible falls, and a heartbeat sensor to track pulse rate. These readings are sent through an ESP8266 Wi-Fi module to the ThingSpeak platform, where authorized users can view real-time updates on a mobile phone or computer [9].

This paper reviews related studies on IoT health solutions for vulnerable patients and explains how the proposed system works based on the block diagram. It also discusses the main benefits, potential drawbacks, and ways such systems help people live independently while staying connected to their care network [1]. By closing the gap between home care and professional support, this design aims to reduce health risks and improve the quality of life for elderly and disabled individuals [15].

II. LITERATURE REVIEW

Researchers have widely explored the use of IoT technologies to monitor patient health at home, helping to bridge the gap between hospitals and remote care. Guizani and Guizani (2020) noted that using affordable temperature sensors such as the LM35, paired with microcontrollers like Arduino, can make home-based monitoring practical for elderly individuals who prefer to remain independent. Their findings highlight that accurate temperature readings are essential for early diagnosis and regular observation [1].

Najmurrokhman et al. (2021) demonstrated that the MPU6050 sensor, which combines an accelerometer and a gyroscope, is effective for detecting unexpected movement and falls among older patients. Their design confirmed that reliable fall detection can help caregivers act quickly,

making the inclusion of motion tracking sensors a critical safety measure in systems like the one presented here [2]. Jebane et al. (2021) focused on developing a simple system that measures pulse rate using an Arduino-compatible heartbeat sensor and sends the information wirelessly. They successfully showed how the ESP8266 Wi-Fi module can be used to upload patient data to an online platform, giving healthcare providers instant access to vital information from anywhere. This supports the idea of combining local data collection with cloud-based dashboards for better oversight [3].

Govindaraju et al. (2021) discussed how cloud tools such as ThingSpeak help visualize patient health data in clear, real-time graphs. Their contribution proves that accessible cloud services can be useful for both medical staff and families who wish to monitor patients without frequent hospital visits. This concept aligns well with the block diagram's cloud integration [4].

Kassab et al. (2022) reviewed many projects where Arduino boards, Wi-Fi modules, and basic sensors were combined to monitor vital signs remotely. They emphasized that low-cost IoT solutions can ease pressure on hospitals while keeping families informed. This conclusion underlines the value of using proven modules and open-source tools to design systems that are easy to build and maintain [5].

Al-Emran et al. (2020) contributed a significant design that combined temperature and pulse sensors with a GSM module to send SMS alerts to caregivers when abnormal readings were detected. Their research shows that in areas where Wi-Fi may be unreliable, mobile network-based notifications can provide an effective backup channel for health alerts. This supports the broader idea that patient safety should be ensured through multiple data transmission options, as demonstrated by the ESP8266 Wi-Fi module in the proposed system [6].

Finally, Al-Janabi et al. (2022) conducted a thorough review of IoT-based patient monitoring frameworks that include multi-sensor setups and caregiver feedback loops. They emphasized the importance of cloud dashboards that display not only raw sensor data but also trend analytics for early warning signs. Their findings show that patients benefit when family members and doctors can interpret long-term health trends rather than just instant values. This insight reinforces the value of using platforms like ThingSpeak, which provide continuous data logging and visualization, as shown in this paper's block diagram [7].

Taken together, these studies confirm that combining temperature measurement, motion sensing, heart rate monitoring, wireless or mobile network transmission, and clear cloud dashboards is both practical and proven. Building on this established research, the proposed system aims to provide round-the-clock monitoring and timely alerts for elderly and paralyzed patients while supporting their comfort and independence at home.

III. COMPONENTS USED

The proposed system uses a combination of low-cost and easily available hardware components to build an effective IoT-based health monitoring framework for elderly and paralyzed patients. The main components are described below:

1. Arduino Uno Microcontroller

The Arduino Uno is an open-source microcontroller board based on the ATmega328P. It serves as the heart of the system, handling the collection, processing, and transmission of all sensor data.

2. LM35 Temperature Sensor

This analog sensor measures the patient's body temperature with high accuracy. It generates a voltage output directly proportional to the temperature in degrees Celsius, making it simple to interface with the Arduino.

3. MPU6050 Accelerometer and Gyroscope Module

The MPU6050 combines a three-axis accelerometer and a three-axis gyroscope in one compact module. It continuously monitors the patient's movement and orientation, helping to detect falls or abnormal body movements.

4. Heartbeat Sensor

This sensor measures the patient's pulse rate in beats per minute (BPM). It provides real-time heart rate data to detect irregularities that might need medical attention.

5. ESP8266-01 Wi-Fi Module

This module provides wireless connectivity for the system. It transmits the processed sensor data from the Arduino to a cloud platform via a Wi-Fi router, enabling remote monitoring.

6. ThingSpeak Cloud Platform

ThingSpeak is used as the IoT cloud service to store, analyze, and visualize health data uploaded from the sensors. It allows caregivers and medical staff to access real-time patient data remotely.

7. Wi-Fi Router

The router connects the ESP8266 Wi-Fi module to the internet, ensuring stable data transmission from the Arduino to the cloud.

8. Power Supply Unit

A regulated power supply converts the standard 230V AC input to 12V and 5V DC outputs, providing safe and stable power to all modules in the system.

IV. PROPOSED SYSTEM

The proposed IoT-based system is built to monitor the health status of elderly and paralyzed individuals who require constant supervision at home. At its core, the design uses an Arduino Uno board to connect various sensors and handle all data processing and transmission tasks [5].

The patient's temperature is measured continuously using an LM35 sensor, which is easy to calibrate and reliably provides output in Celsius. This information helps in detecting sudden changes in body temperature, such as fever, which can be risky for vulnerable patients [6].

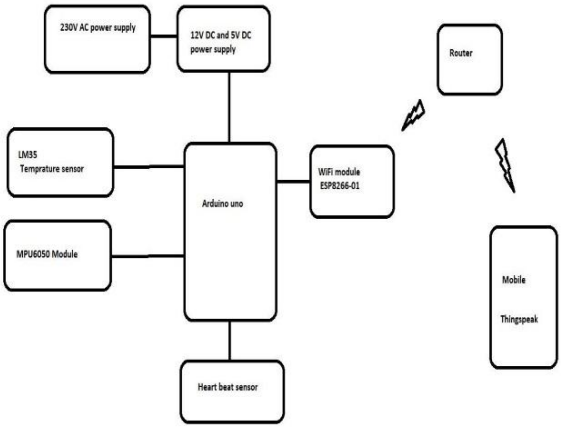
For motion tracking, an MPU6050 module combines an accelerometer and gyroscope to sense movement and orientation. By analyzing these readings, the system can identify abnormal actions or accidental falls, helping caregivers respond promptly [2].

A heartbeat sensor is also included to track the pulse rate. Its output is processed by the Arduino, which calculates beats per minute and stores this information as part of the patient's health data [4].

To send the collected readings to a remote location, the design uses an ESP8266-01 module that connects through Wi-Fi. This module ensures the data reaches a secure online platform without the need for physical cables. The ThingSpeak service is used to store the incoming sensor values and show them in a clear graphical format [4],[7]. Doctors, nurses, or family members can log in to this platform through their phones or computers to see the latest updates about the patient's condition.

A router provides the Internet link needed for wireless transmission, and a regulated power supply converts the AC mains to stable DC voltages for the Arduino and its connected modules [5].

By combining open-source hardware, reliable sensors, and a simple cloud dashboard, the proposed system creates an affordable way to watch over patients at home. It reduces the need for repeated hospital visits and ensures quick help is available when abnormal readings appear.



V. FUTURE SCOPE

This IoT-based health monitoring system has strong potential for future expansion and real-world deployment. One key improvement would be the inclusion of additional medical sensors—such as those for oxygen saturation (SpO_2), ECG signals, or blood pressure—to offer a broader and more detailed view of a patient's condition [14], [15]. This would greatly benefit individuals with chronic illnesses who require more extensive monitoring.

Incorporating machine learning algorithms could enable the system to detect abnormal patterns in health data, allowing early alerts before a serious issue arises [10], [11]. This shift from reactive to predictive care would improve outcomes and reduce emergency risks.

To improve accessibility, especially in rural areas with poor internet, the system could be enhanced with GSM or mobile network modules to send alerts via SMS [9], [12]. Furthermore, linking the system to mobile apps can offer real-time updates and remote configuration, making it more user-friendly.

In larger settings like hospitals or elder care centers, multiple units could be connected to a single monitoring dashboard, allowing centralized tracking of many patients [8], [13]. Overall, these enhancements would make the system smarter, more reliable, and suitable for a wider range of healthcare environments.

VI. CONCLUSION

This project demonstrates a cost-effective and intelligent health monitoring solution, specifically designed for elderly and physically dependent individuals requiring constant observation within their homes. The system is built around the Arduino Uno microcontroller, which

gathers input from key biomedical sensors such as the LM35 (for body temperature), MPU6050 (for movement detection), and a pulse sensor (for heart rate) [12].

Once collected, this health data is wirelessly transmitted via the ESP8266-01 Wi-Fi module to the ThingSpeak cloud service, allowing authorized caregivers and healthcare professionals to monitor real-time patient status remotely through internet-enabled devices [11], [13].

The proposed model emphasizes the potential of combining open-source platforms and low-cost electronics to deliver dependable remote healthcare support [9], [15]. It reduces the need for physical check-ups while increasing patient safety through early alerts in case of irregular health conditions [14].

Looking forward, the system offers opportunities for enhancement by integrating additional biomedical sensors such as SpO_2 or ECG modules, enabling comprehensive tracking of a patient's condition [14]. Furthermore, incorporating machine learning algorithms can enable predictive analysis, helping caregivers anticipate potential health issues before they become critical [10], [11]. This scalable approach sets a solid foundation for building intelligent healthcare infrastructure that supports both home and clinical environments [8], [13]

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