International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 03 Issue: 04 April 2025
Page No: 1274-1279
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2025.0180

IOT Based Automated Paralysis Patient Healthcare System using Arduino and GSM

S. Frank Veronic[1], Dr.M.V. Rajee[2], Dr.M.V.R.S. Mani[3]
[1]UG-Mechatronics Engineering, Kamaraj College of Engineering and Technology, Virdhunagar, TamilNadu, India.
[2,3]Assistant Professor, Mechatronics Engineering, Kamaraj College of Engineering and Technology, Virdhunagar, TamilNadu, India
Email ID: *frankveronics.ug.21.ec@francisxavier.ac.com[1], rajee@francisxavier.ac.com[2] mani@francisxavier.ac.com[3]*

Abstract
The purpose of the Arduino and GSM-Powered Internet of Things-Based Automated Paralysis Patient Healthcare System is to monitor paralysis patients effectively and in real time. To improve patient care, this system combines wireless connectivity, sensor-based automation, and Internet of Things technology. It uses biomedical sensors to continuously monitor vital indications like body temperature, mobility activity, and heart rate. GSM modules are used to send the gathered data to caregivers and healthcare professionals. Patients can use voice commands or push buttons to convey distress signals thanks to the emergency alert system. An automated bed adjustment system also improves mobility and comfort. The system is inexpensive, energy-efficient, and simple to implement in both residential and medical settings. For improved medical insights, cloud integration guarantees remote access and historical data analysis.

Keywords: *IoT, Arduino, GSM, Paralysis Patient, Healthcare, Sensors, Remote Monitoring, Emergency Alert, Biomedical System, Automation.*

1. Introduction

A medical illness known as paralysis results in the loss of muscle function in a particular body region, frequently making people dependent on caregivers to carry out daily tasks. Communication and mobility are major obstacles for paralyzed patients, making effective dependable healthcare monitoring system necessary.In order to improve patient care, this project introduces [1-2] an Internet of Things-based Automated Paralysis Patient Healthcare System that makes use of Arduino and GSM technology. Using a variety of sensors, the system is intended to continuously monitor critical health factors like motion, body temperature, and heart rate. The device immediately notifies caretakers or medical professionals via GSM-based SMS notifications in the event of any aberrant readings or emergency scenarios. The system also has a patient aid feature that allows the user to ask for assistance with voice commands or basic gestures. Through a cloud-based platform, the integration of Internet of Things (IoT) technology guarantees remote monitoring and gives physicians and family members real-time health information. This system [3] seeks to improve the overall quality of life for paralysis patients, decrease reaction times during crises, and increase healthcare accessible by automating patient monitoring and communication.

2. Literature Review

The goal of Chouhan's project was to develop a reasonably priced wired interactive glove with precise gesture recognition.A computer running Octave or MATLAB might be linked to this glove. The glove used bend sensors, Hall Effect sensors, and an accelerometer to measure the hand's and fingers' orientation. As a means of error control, the gathered data was sent to [4] a computer via an automatic repetition request (ARQ). This system's main goal was to help people with disabilities by translating sign language into text messages that were easier to interpret. Likewise, a gesture

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 03 Issue: 04 April 2025
Page No: 1274-1279
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2025.0180

recognition glove for translating American Sign Language was proposed by K. S. Abhishek. The gadget was portable and reasonably priced, and it used charge-transfer touch sensors.The prototype could correctly identify movements for the 26 English alphabets, from A to Z, as well as the numerals 0 through 9. Based on 1080 testing, the device's remarkable detection accuracy of over 92% was designed to decrease the communication gap between the general public and people with hearing impairments. An inventive smart glove system that translates sign language into speech output was created by K. A. Bhaskaran.For precise gesture recognition, the glove uses an Inertial Measurement Unit (IMU) and flex sensors.To track the hand's movement in three dimensions, [5] a special State Estimation technique has been developed. The prototype's ability to translate Indian Sign Language into speech output was tested. The glove's main function is to convert sign language to speech, but it also has potential uses in robotics, gaming, and medicine.In a related endeavor, S. Patel developed software that could be used on mobile computers and translate Indian Sign Language into English speech. This innovation makes it easier for those with speech difficulties and the general public to communicate in both directions. The technology makes use of the device's built-in camera for gesture recognition and acquisition. The captured movements are processed by a number of algorithms, such as Contour Extraction, LargeBlob identification, Flood Fill, and the HSV model for skin color identification.Using cutting-edge gesture processing and voice analysis techniques, the system demonstrates a high degree of accuracy in identifying one-handed sign representations of standard alphabets (A-Z) and numeric values (0-9).
Preetham investigates the development of an automatic sign language recognition system in their study. Numerous previous studies have examined different approaches for sign language recognition. Making piezoresistive sensors using cheap packing materials, particularly velostat, [6] is one such technique. Finger bends can be detected by these flex sensors. The data obtained from these sensors is then interpreted using a machine learning technique known as Minimum Mean Square Error, which maps the input to a character set.. After identification, the character is transferred to an Android phone over Bluetooth and turned into voice. By matching hand configurations to sign language charts, the Hand Talk system generates a synthetic voice that accurately expresses the gestured words. Furthermore, this technology might be applied in a number of ways, including as a virtual keyboard, 3D mouse, or precise control system for robotic arms [7]

3. Proposed Method

The goal of the proposed Internet of Things (IoT)-based Automated Paralysis Patient Healthcare System, which uses Arduino and GSM, is to give patients with paralysis an effective, real-time health monitoring and emergency support solution. People who are paralyzed frequently struggle to move around, which makes it hard for them to express discomfort or call for assistance in an emergency. The system incorporates a number of biomedical sensors, such as a motion, temperature, and heart rate sensor, to continually monitor the patient's important health indicators in order to address this pressing issue. An Arduino microcontroller, the central processor of the system, processes the data gathered by various sensors, evaluating health parameters in real time and detecting any departures from typical values. The device automatically initiates an alert through a GSM module, delivering SMS notifications to registered caregivers, medical professionals, or family members in the event of an aberrant situation, such as an irregular heart rate, abrupt changes in body temperature, or prolonged immobility. This guarantees that medical care can be given right away, greatly speeding up reaction times in emergency circumstances. The system includes a patient support mechanism that enables people with limited or no mobility to communicate with caregivers using other means in addition to automated health monitoring. With the use of the system's gesture-based controls via an accelerometer, patients can set off warnings with simple, pre-programmed hand gestures. Voice command functionality ensures easycommunication without requiring physical effort by enabling those

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 03 Issue: 04 April 2025
Page No: 1274-1279
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2025.0180

who can talk to ask for help verbally. Additionally, a push-button emergency alarm system is integrated, allowing users to click a button to receive assistance right away. Additionally, by integrating the system with a cloud-based platform, physicians, caregivers, or family members can use computers or cellphones to save, access, and monitor real-time health data. Medical personnel may examine patient data and take proactive measures when necessary thanks to this remote access, which improves healthcare efficiency.Continuous health monitoring without the need for ongoing caregiver supervision is made possible by the integration of Internet of Things (IoT) technology, which guarantees seamless communication. Because of its user-friendly, scalable, and affordable design, this system can be used in both hospital and home healthcare settings. By giving paralysis patients autonomy and security, it not only improves their quality of life but also lessens the strain on caregivers by automating necessary monitoring duties. This intelligent healthcare system is a creative and dependable way to enhance the general health of patients with paralysis by guaranteeing prompt medical action, cutting down on emergency response times, and enhancing patient-caregiver communication. [8]

4. Hardware and Software Implementation

4.1. Hardware Implementation

The Arduino Uno Microcontroller, the system's central processing unit, gathers data from a variety of sensors and modules. In the event of an emergency, the patient can activate an alert by using the MPU6050 Accelerometer & Gyroscope to detect their movement and pre-programmed gestures. The patient's body temperature is tracked by the 10K NTC Thermistor Module, which triggers an alert system if it rises or falls abnormally. Real-time health information, including temperature, movement status, and emergency messages, is shown via an integrated 16x2 I2C LCD display. A Buzzer Module is incorporated into the alert systems to provide an auditory warning in the event of a critical condition. When abnormal conditions are identified, the SIM800L GSM Module sends SMS notifications to family members, caretakers, or medical professionals, enabling wireless communication. A 12V power source, a 5V converter, or a Li-ion battery with a step-down module to control voltage for various components are used to power the system. To ensure seamless data transfer, jumper wires are utilized to connect the various parts. (Figure 1) [9]

4.2. Software Implementation

The Arduino IDE is used to create the system's software, which uses C/C++ code to control physical components. The MPU6050 sensor, temperature sensor, and LCD display are initially initialized by the application to make sure they are operating correctly. The Arduino analyzes the data in real time while the sensor values are continuously tracked. The system sounds the buzzer and instructs the SIM800L GSM module to send an alert SMS to pre-specified contacts if any anomalies are detected, such as an abrupt stop in movement, an unusual temperature reading, or an emergency gesture. Certain patient actions, including tilting the head or moving a hand, can be mapped as emergency signals by the MPU6050 sensor, which is configured to recognize them. By programming the LCD display to update continuously with sensor readings, caregivers in close proximity can visually assess the patient's condition. AT commands are used to configure the GSM module so that text messages can be sent when necessary. IoT-based cloud integration can also be added to the system, allowing for internet-based remote monitoring. This system is an economical and effective way to care for patients with paralysis because it combines hardware and software to guarantee ongoing health monitoring, quick emergency response, and enhanced patient-caregiver communication. (Figure 2) [10]

4.3. Circuit Diagram Description

MPU 6050 to Arduino Uno, MPU6050 Pin to Arduino Uno Pin VCC 5V GND DND SCL A5(SCL) SDA A4(SDA) 10K NTC Thermistor Module to Arduino Uno, Thermistor Pin Arduino Uno Pin VCC 5V GND GND OUT - D10, Buzzer Module to Arduino Uno, Buzzer Pin Arduino Uno Pin, VCC 5V GND GND Signal D6 16*2 I2C LCD to Arduino Uno Pin VCC 5V GND GND SCL

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 03 Issue: 04 April 2025
Page No: 1274-1279
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2025.0180

A5(SCL) SDA A4 (SDA), SIM800L GSM Module to Arduino Uno, SIM800L Pin Arduino Uno Pin, VCC 4.2V(Use a step-down module if using 5V), GND GND TX RX (Pin 12) ,RX TX (Pin 13) , Power Supply, If using a Li-ion Battery use a 5V voltage regulator to power the Arduino and sensors,The SIM800L module operates on 4.2 V, so use a step-down module=e (like LM2596) if using a 5V source. [11]

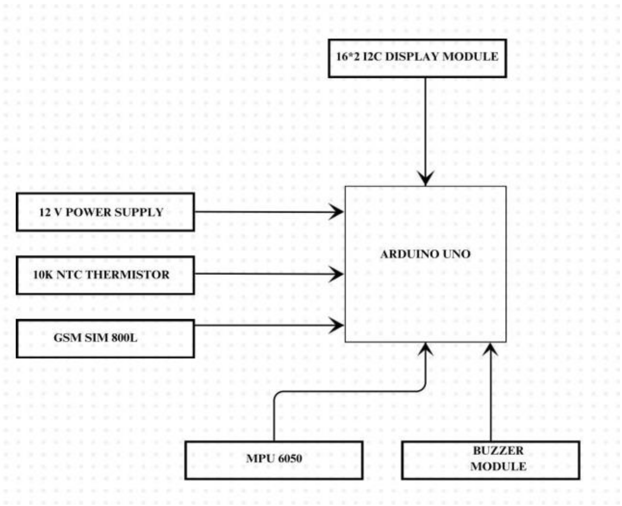

Figure 1 Hardware Block Diagram of Proposed Method

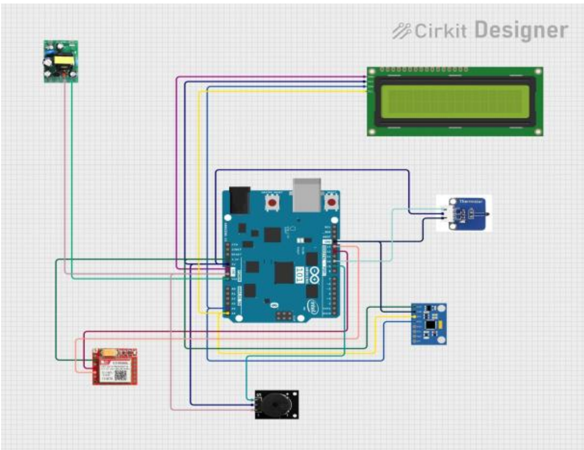

Figure 2 Hardware Circuit Diagram of Proposed Method

Result and Discussion

The IoT-Based Automated Paralysis Patient Healthcare System, built using Arduino and GSM, successfully exhibits real-time health monitoring and emergency alert systems for paralyzed patients. The system efficiently collects data from several sensors, such as the MPU6050 Accelerometer & Gyroscope, which recognizes patient motions and predetermined gestures, and the 10K NTC Thermistor Module, which continuously monitors body temperature. The Arduino Uno Microcontroller interprets these sensor readings and shows real-time data on a 16x2 I2C LCD Display, allowing caretakers nearby to check the patient's health status at any moment. One of the system's most important functions is its emergency alert mechanism, which uses abnormal conditions, such as a high fever or prolonged immobility, to trigger the Buzzer Module for local alerts and prompt the SIM800L GSM Module to send an SMS notification to registered caregivers, doctors, or family members. The system was tested in a variety of circumstances, including normal conditions, abnormal health parameter fluctuations, and emergency gesture activation, and it responded well in all cases by producing alerts and sending notifications on time. One of the most notable findings during testing was the MPU6050 sensor's precision and reliability in detecting movement. The technology recognized specific patient gestures, such as tilting or shaking, and translated them into emergency alerts. However, slight discrepancies in sensor calibration were observed, necessitating fine-tuning of threshold levels to reduce false alerts. The temperature sensor module delivered reliable readings, allowing the diagnosis of fever-like circumstances, and the response time for generating an alert was within acceptable limits. The LCD display worked properly, regularly updating the health metrics and offering good visibility of the data. The GSM module worked well, generating SMS notifications within a few seconds of detecting an aberrant situation, ensuring prompt responses from caretakers. The system's power supply mechanism, which included a 12V power source, a 5V converter, and a Li-ion battery with a step-down module, assured reliable operation and made the system suitable for both home and hospital use. The battery backup option improves portability and provides uninterrupted operation during power interruptions. One issue observed was intermittent network delays in SMS transmission, which depended on the strength of the GSM signal. This might be solved by incorporating IoT-based cloud services for speedier remote monitoring.Overall, the designed system has proven to be a cost-effective, dependable, and user-friendly healthcare solution for paralysis patients. It effectively decreases reliance on caregivers by enabling automated health monitoring and quick emergency response. The use of IoT technology increases the system's potential by allowing for remote patient monitoring, which can be enhanced in future advancements. The results demonstrate the system's effectiveness in improving the quality of life for paralysis patients by providing timely medical intervention and ongoing healthcare support. [12]

Conclusion

The IoT-Based Automated Paralysis Patient Healthcare System with Arduino and GSM effectively delivers a dependable and real-time health monitoring solution for paralysis patients. The system continuously monitors important health metrics and recognizes emergency situations by integrating sensors such as the MPU6050 accelerometer and gyroscope and the 10K NTC thermistor module. The acquired data is processed by the Arduino Uno microcontroller, which then updates the 16x2 I2C LCD display in real time. In the event of aberrant readings or an emergency, the system activates an alert through the buzzer module and sends SMS notifications to caretakers or medical experts via the SIM800L GSM module.The system runs effectively on a 12V power source, a 5V adapter, or a Li-ion battery, ensuring consistent performance in a variety of scenarios. This method improves the quality of life for paralysis patients by lowering reliance on caregivers, delivering rapid emergency response, and increasing patient safety. Cloud-based monitoring and AI-powered health analysis could be added in the future to increase efficiency and accessibility. [13]

References

[1]. V. Annepu, D. R. Sona, C. V. Ravikumar, K. Bagadi, M. Alibakhshikenari, A. A. Althuwayb, B. Alali, C. S. Virdee, G. Pau, I. Dayoub, C. H. See, and F. Falcone, “Review on Unmanned Aerial Vehicle Assisted Sensor Node Localization in Wireless Networks:Soft Computing Approaches,” IEEE Access, vol. 10, pp. 132875-132894, December 2022.
[2]. V. Annepu, A. Rajesh and K. Bagadi, “Radial basis function-based node localization for unmanned aerial vehicle-assisted 5G wireless sensor networks,” Neu. Comp. and Appl., vol. 33, pp. 12333-12346, March 2021.
[3]. M. N. Mohammed, M. Alfiras, S. Al-Zubaidi, O. I. Al-Sanjary, E. Yusuf and M. Abdulrazaq, "2019 Novel Coronavirus Disease (Covid-19): Toward a Novel Design for Smart Waste Management Robot,"2022 IEEE 18th International Colloquium on Signal Processing & Applications (CSPA), Selangor, Malaysia, 2022, pp. 74-78, doi: 10.1109/CSPA55076.2022.9781999.
[4]. Mohammed, M. N., Hazairin, N. A., Arif, A. S., Al-Zubaidi, S., Alkawaz, M. H., Sairah, A. K., ... & Yusuf, E. (2021, August). 2019 novel coronavirus disease (covid-19): Toward a novel design for disinfection robot to combat coronavirus (covid-19) using iot based technology. In 2021 IEEE 12th Control and System Graduate Research Colloquium (ICSGRC) (pp. 211-216). IEEE.
[5]. K. P. Bagadi, V. Annepu, and S. Das, “Recent trends in multiuser detection techniques for SDMA–OFDM communication system,” Phy. Comm., vol. 20, pp. 93–108, September 2016.
[6]. N. K. Vaegae, K. K. Pulluri, K. Bagadi, and O. O. Oyerinde, “Design of an Efficient Distracted Driver Detection System: Deep Learning Approaches,” IEEE Access, vol. 10, pp. 116087-116097, November 2022.
[7]. S. F. Desyansah, M. N. Mohammed, S. Al-Zubaidi, H. Syamsudin, I. Abdullah and E. Yusuf, "Bradykinesia Detection System Using IoT Based Health Care System for Parkinson’s Disease Patient," 2021 IEEE International Conference on Automatic Control & Intelligent Systems (I2CACIS), Shah Alam, Malaysia, 2021, pp. 329-333, doi:10.1109/ I2CACIS52118.2021.9495885.

[8]. N. Seedat, V. Aharonson and Y. Hamzany, "Automated and interpretable m-health discrimination of vocal cord pathology enabled by machine learning," 2020 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE), Gold Coast,

[9]. Australia, 2020, pp. 1-6, doi: 10.1109/CSDE50874.2020.9411529.

[10]. Mohammed, M. N., Desyansah, S. F., Al-Zubaidi, S., & Yusuf, E. (2020, February). An internet of things-based smart homes and healthcare monitoring and management system. In Journal of physics: conference series (Vol. 1450, No. 1, p. 012079). IOP Publishing.

[11]. B. Kim, S. Kim, M. Lee, H. Chang, E. Park, and T. Han, "Application of an Internet of Medical Things (IoMT) to Communications in a Hospital Environment," App. Sci., vol. 12, p. 12042, November 2022.

[12]. M. N. Mohammed, Halim Syamsudin, Mnel A H Abdelgnei, Dharshini Subramaniam, Mohamad Amirul Aznil Mohd Taib, Nurhasliza Hashim et al., "Toward A Novel Design For Mechanical Ventilator System To Support Novel Coronavirus (Covid-19) Infected Patients Using Iot Based Technology", 2021 IEEE International Conference on Automatic Control and Intelligent Systems (I2CACIS 2021), 26th June 2021.

[13]. N. R. Challa, and K. Bagadi, "Design of Large Scale MU-MIMO System with Joint Precoding and Detection Schemes for Beyond 5G Wireless Networks," Wir. Per. Comm., vol. 121, pp. 1627–1646, July 2021.