

# IOT Based Smart Assistance System for Paralysis Patient

A. Shayan Shaikh<sup>1</sup>, B. Jaydev Shelke<sup>2</sup>, C. Anushka Shinde<sup>3</sup>, D. Aditya Shinde<sup>4</sup>, E. Shantanu Sasane<sup>5</sup>,  
F. Umesh Chavan<sup>6</sup>

<sup>1,2,3,4,5,6</sup> *Department of Mechanical Engineering, VIT Pune, India*

**Abstract**—Since paralysis causes problems with moving, communicating and performing daily activities, new approaches have to be found to support patient independence. This paper proposes an Internet of Things (IoT)-based smart assistance system which has been designed to improve quality of life for individuals suffering with paralysis. The system makes use of wearable sensors, voice recognition, gesture motions to let users smoothly access their surroundings. By leveraging cloud computing and live data processing, the service quickly meets users' needs, allowing people to access home automation, emergency alerts and healthcare by just pressing a button.

Initial tests indicate that the solution could increase accessibility, decrease the need for care givers and allow people with paralysis to handle more everyday on their own. On going efforts will pay attention to boosting how the device responds, safeguarding the system and making it more valuable within areas that are advancing health care technology.

**Index Terms**—IoT-based assistance, Paralysis patient support, Wearable sensors, Voice recognition, Gesture control, Personalized user interface, Remote patient monitoring, Accessibility enhancement, Caregiver support, Real-time data processing, Healthcare monitoring.

## I. INTRODUCTION

It has been estimated that there are one billion individuals in the world who are living with disability problems that severely affect their day-to-day operations. One of the most undesirable out of such conditions is paralysis due to the restriction of the voluntary muscular activity and that in the vast majority of instances taming, patients are required to utilize the help of other people in performing the simplest actions, such as moving, communicating, and taking care of themselves. The spinal cord injuries, strokes, and neurological disorders are significant contributors to paralysis because they do not only

impair physical functioning negatively, but also lead to emotional pain and financial strain to the family.

The recent advances in Internet of Things (IoT) and sensor technologies have generated the prospect of new supportive solutions to contribute to the rise of the autonomy and quality of life. However, most of the available assistive technologies remain expensive, complex to implement or are not applicable to the severely handicapped. The traditional methods of control such as joystick, keyboards or voice activated controls do not work very well with upper-limb impaired individuals. Consequently, scientists are giving increased consideration to gesture-based systems that combine the IoT and flex sensor to allow communicating and controlling the environment with the lowest physical input.

The current generation of gesture recognition systems is based on flex sensors, initially designed and commercialized by Spectra Symbol and Flex point in the late 20th century. When integrated with microcontrollers and IoT device, these sensors can detect even the smallest motion of hands or fingers, which can be used to trigger functions such as appliance switching on or off, notifications or real menus of health measurements.

The researchers have made their contributions on this area by coming up with new designs. According to the paper IoT-Based Paralysis Patient Health Care System [1], the need of cheap and real-time monitoring of patients through Arduino, GSM, and cloud platform Blynk and Thing Speak is the issue. S. A. C. Aziz et al. [2] authors developed a gesture-based communication system using sensors of APDS-9960 and Arduino UNO to provide the alert to the caregiver in real-time, while R. Kishore Kanna et al. [3] developed an IoT-based smart glove equipped with flex sensors, accelerators, and pulse sensors and targeted at supporting paralyzed and hearing-impaired individuals. The combination of an option to observe

movements and a possibility to measure important vital parameters simultaneously were described in a publication in IEEE Xplore named Smart Assistive System of Paralysis Patients with Finger Flex Sensors, Eye Movement Detection and Vital Signal Monitoring [4]. Similarly, Y. D. Chincholkar and colleagues [5] developed a model of smart home automation that allowed them to control home appliances, such as lights and fans, with a minimum number of gestures. Wearable sensors have also been applied with fall detection and gesture control as other research has demonstrated to improve interaction between patients and their caregivers [6].

Overall, the literature review demonstrates that the tendency of conducting research on assistive technologies with low cost and user-friendliness is observed. Nevertheless, the majority of the existing systems are focused on individual functions such as gesture recognition or health monitoring. Thus, there was a need to introduce the solution that would encompass the gesticulation control, health monitoring, and the real-time communication in such a way that the paralyzed could become self-sufficient and reduce the amount of people who would need to stay with the caregivers.

## II. METHODOLOGY

It is often difficult for people with movement or speech disabilities to do simple things each day. Through gestures and real-time health alerts, the Smart Glove System ensures people can communicate and receive things they require far more easily and reliably by using wireless technology. Since being able to experience suburban life matters to people, this technology tries to make itself as convenient and affordable as it can be. When used correctly, sensors can improve the way the device functions.

The Smart Glove System is based on detecting hand movements and measuring key health stats using many small sensors.

On every finger, a Flex Sensor is attached to detect whether it is bending or relaxing. If a user resists, the sensors turn the movement into a specific voltage, letting them perform movements with little effort. A MPU6050 sensor in the device detects yaw, pitch and roll so that it can tell gestures apart and react to hand movements. Using ongoing data, the Pulse Sensor can spot any stress, anxiety or health emergency in its

users. When the system finds irregular heartbeats, it alerts the doctors and nurses straight away. By monitoring your body temperature with the watch, you can tell right away if you start falling ill. The module quickly detects and responds to changes in position thanks to motion analysis from the MPU6050 if an emergency occurs. Information from the sensors is captured by the Arduino, checked in real-time and given to us as output that makes sense.

With gesture mapping, one can speak freely with friends. Now, patient-caregiver interaction is improving with the gesture-recognizing system. Gesture recognition has maximized the updated hand gesture motions suitable to Smart Glove. By inhaling another person's hand with the fingers, one shows the support gesture. The other two gestures may be one fast hand movement for hunger and thirst. Motion demands an outlandish move; it immediately sends a message, "Medical Emergency."

Upon every change, you'll get the latest update. Making sure, say, there are fewer problems and misunderstandings by notifying the staff. They have been finding diverse ways that people can message each other in this system. An unusual activity will immediately trigger an alarm to caregivers. Families will receive an early warning through the integration of the Blynk app, allowing them to resolve issues at home quickly and easily as they emerge. If app assistance cannot locate the Buzzer user, the Buzzer alert then acts to summon the intervention of nearby persons. Aiku indicates that the system is responding to your gestures.

Reliable Software Architecture for Accurate Processing  
The Smart Glove includes software that effectively structures, processes and moves data to facilitate the capture of gesture recognition data and alert notifications:-

- Built on the Arduino IDE to develop and administer the core programming that captures sensor data from the sensors and translate that into actionable commands.

- Embedded Libraries optimize data loading and data acquisition functions associated with either the sensors, communication module or displays to ensure suppleness throughout the system.

- The software also includes Proteus 8 Professional as a means to carry out virtual circuit analysis, assuring that the Smart Glove function under consideration

would work in practice before the hardware was soldered together.

- The Blynk App software integration effectively turns the caregiver's smartphone into the control mechanism to monitor the Smart Glove and see live sensor readings as well as system alerts if something required immediate action.

Considered Design for Comfort, Energy Efficient & Wearable As this system is intended for daily use over some time it was designed to be portable, stable and device low-power in usage:

- Custom-designed PCB equipment ensures the Smart Glove is compact and stable in assembly, and avoid a mish-mash of wire or big components to spoil the shape.

- Power consumption was also optimized to provide some usage before requiring an expensive battery replacement.

- The portable battery to power the Smart Glove ensures the device is both safe and safe to operate should the user wish to use the Smart Glove on the move, and - most importantly - with the freedom to communicate on their own terms.

Stringent Testing & Ongoing Validation :

Before being released to the public, all functions of the system will be tested or calibrated extensively to guarantee accuracy, consistency, reliability and efficiency:

- Gesture recognition tests understand whether hand movements result in the correct gestures.

- Sensor calibration and mapping understand the system can produce consistent output values for pulse, temperature, and fallibility detection.

- Finally, end-to-end validation will ensure that communication modules are reliable mechanisms for emergency alerts, and for triggering the intervention, variety of environmental conditions.

More than simply being a system to assist people with disabilities, the Smart Glove System is fundamentally, potentially a tool for empowering individuals by supporting independence, communication, and safety within ordinary moments of life. The system is an innovation which incorporates gesture-based interaction, health monitoring and remote notification, while minimizing reliance upon on-caregiver support, thus allowing the individual to more comfortably be able to express their needs.

However, this system is more than a piece of assistive technology. This is innovative and a step towards

inclusive design supporting the dignity, agency and accessibility of individuals deserving the ability to communicate on their terms.

1. Human-computer interaction & gaming — data gloves, controllers and gesture interfaces (early notable use: commercial and hobbyist gloves).

2. Wearables & biomechanics — measuring joint angles, joint range-of-motion (goniometry) for gait/hand kinematics.

3. Medical & rehabilitation — wearable gloves and sensor sleeves for monitoring finger/hand movement, remote assessment of post-stroke rehabilitation, and feedback during therapeutic exercises.

4. Prosthetics & assistive devices — as simple, low-cost controllers (e.g., glove → prosthetic finger motion mapping) or to supply intent signals where myoelectric signals are unavailable.

5. Robotics & soft-robot sensing — joint/bending detection for soft actuators and exosuits.

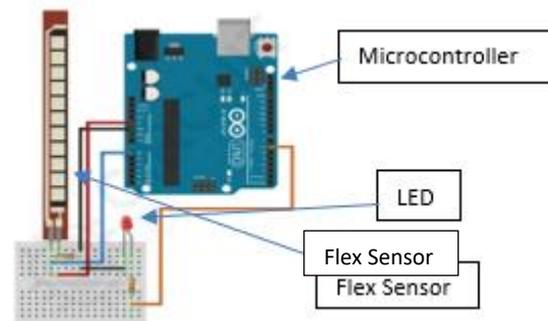


Figure 1. Basic Circuit Diagram

A flex sensor is a low-cost, easy-to-use variable resistor that is designed to measure the amount of deflection it experiences when bent. The sensor's resistance is lowest when it's flat on the surface, increases when we bend it slowly and reaches it's maximum when it's at a 90-degree angle.

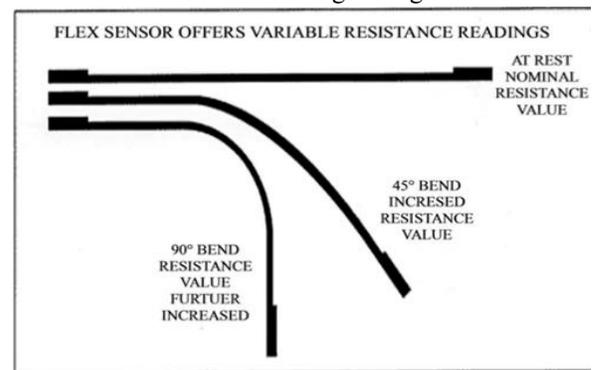


Figure 2. Variation of Resistance of Flex Sensor

Flex sensors are popular because they are used in many different applications like game controllers, data gloves, motion trackers, and even in biomedical devices to register static and dynamic postures. So, in today's project, we will learn all about flex sensors, how it works, and how you can interface them with an Arduino.

### III. RESULTS

Picture a world that is free from communication barriers, where technology will be able to make the connection between spoken language and gestures. This vision led to the smart hand glove—a device created to recognize hand movements and translate them into sign language characters. It already has the features to demonstrate how improving accessibility is achievable; we have an initial prototype that consists of only two flex sensors that are stitched into the glove fabric.

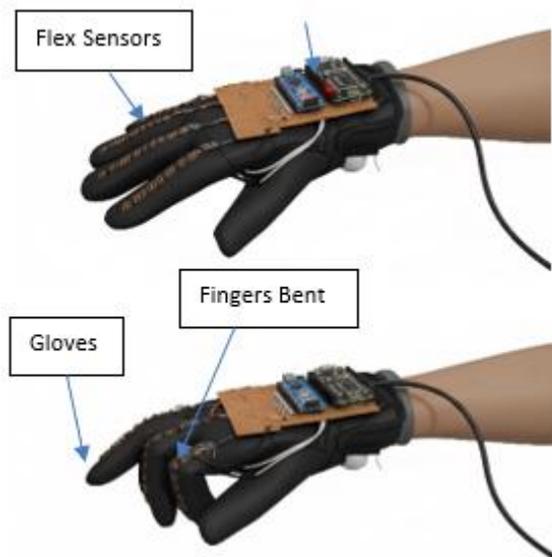


Figure 3. Prototype Version

The magic happens when the user moves fingers, bend or straighten them. The flex sensors detect flexibility which results in change in resistance. All of the changes are converted to voltage. An Arduino microcontroller as shown in Fig 1 reads the voltage which is produced by bending or straightening the fingers and then translates it into corresponding characters A, B, C, D, and E. The system is basic however, the structure allows it to accurately represent finger movement, including recognized voltage

thresholds for gestures generated at the pre-established values.

Researchers developed rigorous tests to validate its effectiveness and simulating variations in hand placement. The results were quite good, each gesture produced different voltages with precise letter recognitions without really interfering with other sensors. For example, when one sensor did not move and the subsequent sensor had a voltage of 0.68V, it gave the proper display of the letter "C." These experiments and test cases supported the capability for glove to capture physical movements and return consistent digital outputs.

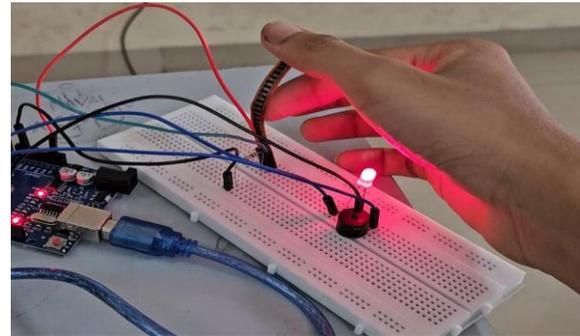


Figure 4. Above system represents simple alert system. When the finger is bent, it triggers both LED and a buzzer.

While the first iteration is limited to only five characters, the significance of the analysis is what matters most. This shows that even with a simple design, the glove can contribute to relatable communications for patients dependent on signing. The system works properly, but it will develop like any other emerging technology.

Next iterations will seek to expand the glove's functionality to achieve its potential. The glove with incorporate superior features, as the components are already available. This future work will include an MPU6050 sensor to detect the orientation of the hand, thus allowing for more complex movements to be detected. The future glove will also include pulse and temperature sensors for real-time monitoring. I would focus mainly on expanding the character set and have it document the whole full alphabet in sign language. Also research machine learning algorithms as it will give the computer more intelligent capabilities in recognizing.

Ultimately, this project is more than technology as innovation; it leverages technology to empower inclusion. After all, if individuals have tools that

enable communication and access to the world, it is easier to imagine a world in the future where no voice is lost, whether spoken or gestured.

#### IV. CONCLUSION

Imagine a world in which communication and independence don't hold a barrier for individuals with speech, mobility impairment, or hearing. Vision behind developing this glove was the same—a wearable device that translates hand gestures into meaningful digital outputs that allows individuals to communicate without any hindrance.

The glove consists of flex sensors and analyses the movement of fingers, interpreting them as sign language or custom command inputs. These types of user gestures can display text outputs, send messages, or even control smart appliances. The device is more than a communication device; it is also a health monitoring and safety device, allowing the monitoring of pulse rate, body movement or a body fall even.

This provides a simple solution to a complex problem. It is light-weight, inexpensive. Confused and distant individuals with various disabilities can now interact with the surrounding environment while being independently able to communicate with family members, friends, and society. This is more than a wearable device, it shows empowerment.

As we continue visioning enhancements, the glove will become even more flexible. In future such gloves could potentially utilize new wireless protocols as replacement items for the GSM modules. The gesture detection could integrate accelerometer and gyroscope technology and help the health sector in such a way no one could have imagined of. Further, we hope to see it improving the ability to see complex movements.

In the end, this isn't just about progress but it is about inclusiveness. It is about creating and utilising a platform for technology for smarter healthcare, and to create a kind, gentle world where technology works with humanity in the best possible manner every individual dreams by.

#### V. FUTURE SCOPE

The smart glove system described in this dissertation is an assistive technology for people with speech, hearing, or mobility disabilities that allows them to communicate via gestures and track their health.

Currently, the glove supports a limited range of gesture recognition for sign language, but there are many possibilities for expanding its capacity through future work.

One potential area for improvement specific to sign language recognition would be to incorporate full alphabet recognition and basic phrases into the system. Adding additional flex sensors as well as IMUs in the fingertips would allow for advanced finger movements as well as grasping actions that could improve detection of dynamic gestures. In addition, adding a combination of sensors including pulse sensors, temperature sensors and more sophisticated IMUs or even accelerometers and gyros could allow for a more robust form of health monitoring and could provide alerts for falls or other degrading health conditions in real-time.

Improving the efficiency of communication with the smart glove system might also include replacing the current GSM modules with Wi-Fi, Bluetooth or LoRa in order to improve the user experience and make connectivity more accessible in different environments. I also believe that creating an application for a mobile companion to the smart glove could enhance the end-user experience even more and would allow access to supplementary data in real-time, a text-to-speech option for a non-verbal interaction or immediate alerts to caregivers and relatives if needed. Lastly, future work will include examining the accuracy of gesture recognition by indulging machine learning algorithms focused on CNNs or k-NN which would allow more adaptive and less rigid gesture recognition specifically tailored for the user. This type of incorporation could allow the system to accommodate multilingual speakers by adding a variable for audio feedback similar to TTS, especially including flexibility for thumb signs by other language speakers.

Minimizing the footprints of flexible printed circuit boards (PCBs) and lightweight batteries would help improve the wearability of firmware, while using physiotherapy in specific applications could also support tracking rehabilitation milestones. IoT stored in the cloud offers a life-long health history, and smart home automation could not only keep you aware but assist independently through gesture controlled appliances.

With consideration of all these enhancements, the smart glove system could evolve into an overall

assistive device that not only addresses barriers to effective communication, it can also facilitate access to safe health care, and ultimately independence for differently abled people.

## VI. ACKNOWLEDGMENT

We convey our sincere gratitude to Prof. Umesh Chavan for their invaluable guidance and support throughout the development of our project, "IoT Based Smart Assistance System for Paralysis Patient". Their encouragement has been instrumental in shaping our understanding and execution of this work. We deeply appreciate their mentorship, which has been pivotal in our academic and technical growth. This project aims to enhance the need for Smart assistance for Paralysis Patients

## REFERENCES

- [1] Here are references you can include in your research paper, based on relevant topics to your project:
- [2] IOT based Paralysis Patient Health Care System- Prashant Vaddodagi, Purushottam M J, Purushottam B K, Rajugouda M, Dr. B S Nanda D. Y. Goswami, F. Kreith, J. F. Kreider, Principles of Solar Engineering, 3rd ed., Taylor & Francis, 2015.
- [3] M. Vijay Kumar, K. Pandurangan and R. Vinu, "Automated Paralysis Patient Monitoring System," 2021 IEEE National Biomedical Engineering Conference (NBEC), Kuala Lumpur, Malaysia, 2021.
- [4] S. Sivanandam, A. A. Ajees, B. Kamesh and W. K. Samraj, "Supportive System for Hemiplegic Patients with Health Monitoring Capabilities," 2023 9th International Conference on Smart Structures and Systems (ICSSS), CHENNAI, India, 2023.
- [5] Development of automatic healthcare instruction system via movement gesture sensor for paralysis patient- S. A. C. Aziz, A. F. Kadmin, N. Rahim, W. H. W. Hassan, I. F. A. Aziz, M. S. Hamid, R. A. Hamzah.
- [6] Smart Assist System Module for Paralysed Patient Using IoT Application- R. Kishore Kanna, Nihar Ranjan Pradhan, Bhawani Sankar Panigrahi, Santi Swarup Basa, Sarita Mohanty.
- [7] Satyana, I. M. Y. D., Arifin, A., & Hermawan, N. (2023, July). Internet of Things-Based Telemonitoring System Design for Wrist Rehabilitation. In 2023 International Seminar on Intelligent Technology and Its Applications (ISITIA) (pp. 388-393). IEEE.
- [8] Kanna, R.K., Banappagoudar, S.B., Menezes, F.R., Sona, P.S. (2023). Patient Monitoring System for COVID Care Using Biosensor Application. In: Tomar, R.S., et al. Communication, Networks and Computing. CNC 2022. Communications in Computer and Information Science, vol 1893. Springer, Cham.
- [9] Deshpande, B. K., Ara, T., Budhiraja, S., & Gupta, A. (2023). An Intelligent Healthcare System for Quadriplegia Patients using Internet of Things and Machine Learning. International Neurology Journal, 27(4), 1-11.