Automated Paralysis Patient Assistant Glove

Dr. Lija Arun[1*], Dr. Sumi M.[2], Meera[3], Anjana Krishnan[3], Keerthana B. Sivadas[3], Namitha Mohan[3]

[1]Assistant Professor, Electronics and Communication Engineering Department, NSS College of Engineering, Palakkad, India

[2]Associate Professor, Electronics and Communication Engineering Department, NSS College of Engineering, Palakkad, India

[3]Final year student, Electronics and Communication Engineering Department, NSS College of Engineering, Palakkad, India

*Corresponding author's e-mail: lijaarun@nssce.ac.in

doi: https://doi.org/10.21467/proceedings.160.34

ABSTRACT

The paper discusses the high incidence of paralysis in India and the challenges faced by individuals with mobility impairments. Paralysis is a condition where a person loses the ability to move a section of their body due to damage to the nervous system. Individuals with paralysis often require assistance in daily activities and may have difficulty communicating their needs effectively. The system aims to assist those who are partially paralysed or have other mobility impairments who have some mobility in their fingers or hands, through a wearable glove equipped with flex sensors, a voice processor, a speaker, and a GSM module. The glove enables patients to communicate their needs through voice commands and send text messages to their caregivers. The sensors in the glove detect the patient's movements, which are mapped to predetermined input data provided to the Arduino. Also, other sensors like temperature sensors and pulse sensors are embedded in the glove to monitor patients' health. This allows the patient to be self-sufficient and helps monitor their health efficiently even in the absence of a caregiver. The suggested method is straightforward and does not require sophisticated hardware setups or extensive software development.

Keywords: Flex sensors, voice processor, GSM module

1 Introduction

According to current statistics, paralysis affects about 10 to 20 people out of every 100,000 in India on an annual basis. Rural areas appear to be more involved, with an incidence rate of around 16-30 cases per 100,000 people. Paralysis is a significant public health issue in India that can significantly impact the lives of those affected and their families. It is caused by spinal cord injuries, strokes, or nervous system damage [5]. Depending on the amount of muscle mobility lost and the extent of the damage, paralysis may be partial or total and can be classified into several different types like monoplegia, hemiplegia, paraplegia etc. This project aims to help those people who are partially paralysed, have facial paralysis, limb paralysis, or have another mobility handicap. Paralysed and disabled people depend on others for their basic needs and survival.

The created system helps patients communicate their fundamental needs to the caregiver through voice commands and messages. Our prototype is a wearable glove with three embedded flex sensors that change resistance in response to the angular motion, allowing the patient's movements to be identified, mathematically evaluated, and mapped to predetermined input data provided to Arduino [3]. The GSM module will use text messages to send notifications to the caregivers' mobile phones, enabling the patient to be self-sufficient.

In this project, flex sensors are utilized instead of other sensor options such as Optical Linear Encoders (OLE), strain gauges, and potentiometers [2]. OLE (optical encoder) has limitations as it can only be used for measuring two angles: 0° and 90°. Meanwhile, strain gauges may become saturated when subjected to significant deflections, and potentiometers may not provide precise accuracy. Flex sensor overcomes these limitations. A flex sensor or bend sensor is a type of sensor that is designed to measure the amount of bending or deflection. It is attached to the surface and can be altered by bending the surface. The sensor has a fragile layer of copper metal plate on it, and its operation

Proceedings DOI: 10.21467/proceedings.160; Series: AIJR Proceedings; ISSN: 2582-3922; ISBN: 978-81-965621-9-9

is based on variations in sensor resistance and bending. The resistance of an object is influenced by the angle between the object and the flex sensor. However, one drawback of a flex sensor-based system is that it requires calibration every time the user wears the device [1].

2 Methodology and System Description

The sensor-based wearable glove uses finger gestures to generate voice alerts, SMS, and messages in liquid crystal display (LCD) [4]. The flex sensors, body temperature sensor and pulse sensor are used as inputs. The output from the flex sensor is sent to Arduino mega, which processes the signal and sends it to the voice processor. A body sensor is attached to the body, which continuously measures the body temperature and if it drops by a specified threshold, emergency buzzer alerts and messages will be given to the caretaker. The pulse sensor continuously monitors the patient's heartbeat and if it goes beyond a threshold value, alerts are provided to the caretaker.

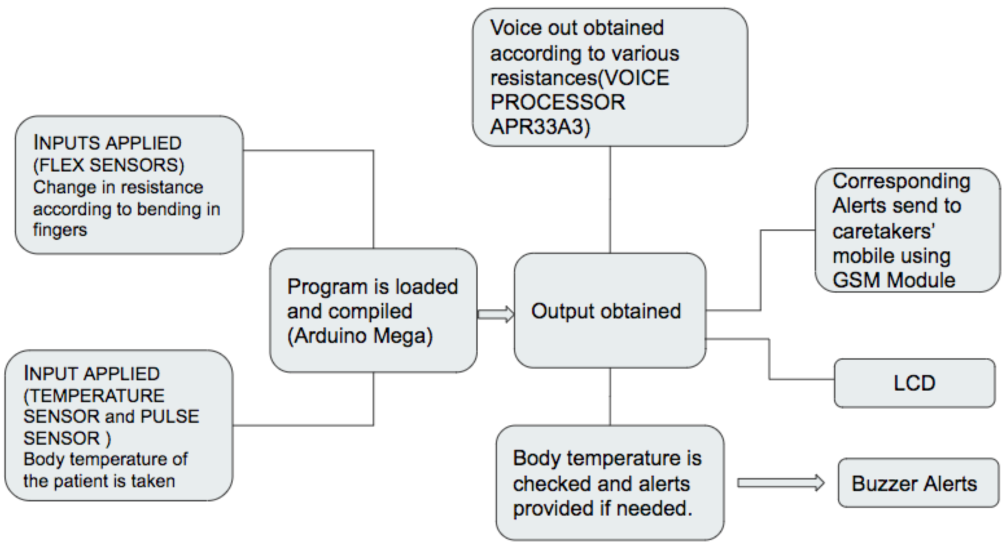

Figure 1: *Methodology*

The methodology of the system is as illustrated in the Fig.1.The glove has a flex integrated into it to detect hand motions and mount some sort of defence. The audio/video interface is designed to enable communication with the other party, and the caretaker's mobile can receive the message corresponding to the resistance value. The flex sensor is a sensor that monitors angular displacement, and the bent that developed between them may physically supply the angular displacement [6]. The resistance of a flex sensor changes in response to the length of the sensor and the degree of bending. This change in resistance is then used to map the extent of the bends or deflection. Mathematically, the change in resistance is mapped to a condition that suggests the patient's feeling or demand.

Here, we map each bending and combination bending of fingers to the patient's basic needs such as water requirement by the patient, food requirement, emergency etc.

The need/task to be done is converted to auditory speech with the help of voice processor aPR33A3, and through the speaker audio output is sent as a text to the caretaker's mobile. The LM35 temperature sensor uses a diode to monitor temperature as its primary operating mechanism. The voltage across the diode rises at a known rate as the temperature rises, and the linear scale factor governs how the LM35 sensor operates. The LM35 output voltage is VOUT, and the temperature is represented as VOUT = 10 mv/°C × T. If these values exceed the threshold value, the system is designed to produce an alarm/buzzer to alert the caretaker.

Proceedings DOI: 10.21467/proceedings.160
ISBN: 978-81-965621-9-9

Series: AIJR Proceedings
ISSN: 2582-3922

A pulse sensor comprises two surfaces: the first surface holds an LED ambient light sensor, while the second surface connects to the circuit responsible for noise cancellation and amplification. The LED is placed directly above a vein in the human body and begins emitting light once positioned. If the sensor detects blood flow, the ambient light sensor will detect more light due to the reflection of light from the blood flow, resulting in a slight variation in the acquired light that can be observed over time.

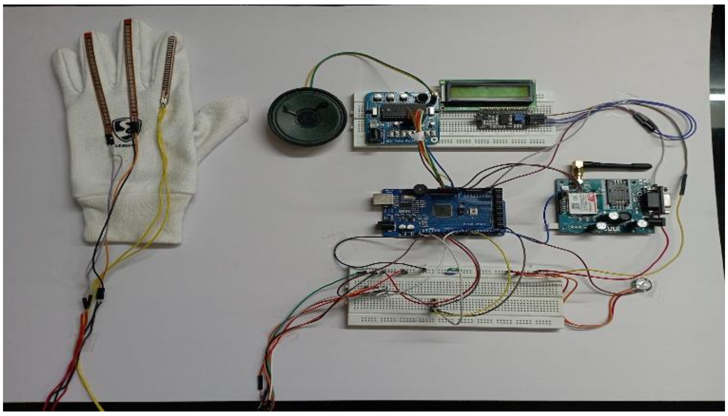

Figure 2: *Automated Paralysis Patient Assistant glove*

Fig.2 illustrates the proposed model consisting of Arduino-mega, apr33A3 voice processor, GSM 900A, flex sensor, gloves, LCD, and speaker. Its circuit diagram is depicted in Fig.3.

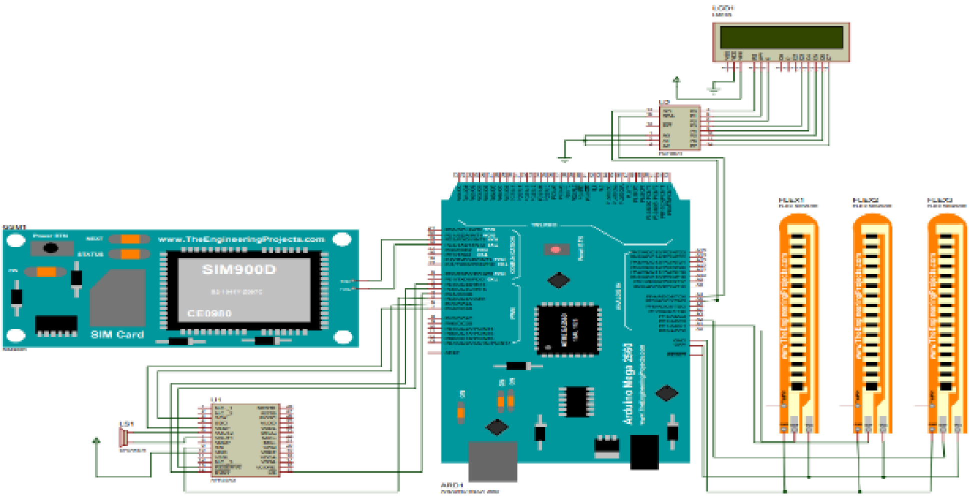

Figure 3: *Circuit Diagram*

3 Results and Conclusion

The model displays the patients' needs through LCD as depicted in Fig.4 and sends the corresponding messages to caretaker's mobile through GSM as illustrated in Fig. 5. The needs of the patient such as water, food requirements are also converted as auditory speech corresponding to the bending of the fingers.

The Proposed system is an implementation to help those with paralysis move their fingers. It enables patient monitoring and makes the work of caretakers easier and more efficient. The voice processor helps the caretaker to know the needs and requirements of the patient, while the GSM module sends text messages, and the health monitoring system provides health assistance in the absence of a doctor. This model makes the patient closer and helps them communicate easier with the caretaker.

Figure 4: *Food Requirement of Patient displayed in LCD*

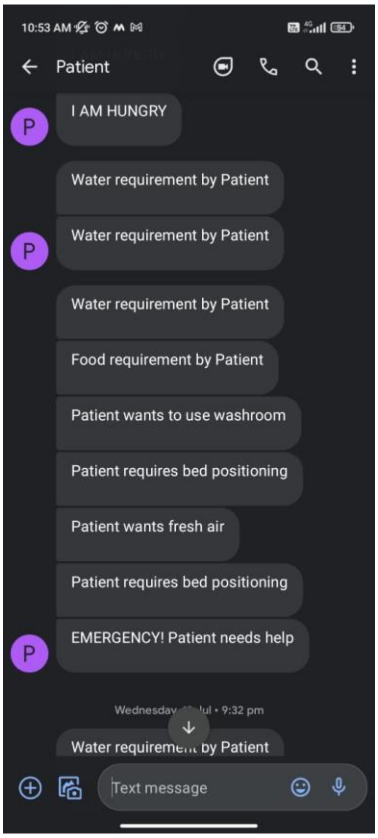

Figure 5: *Text messages received in care taker's phone through GSM*

4 Merits

In severe paralysis cases, the patient may have speech difficulties, which makes it challenging for him to interact with others and convey his requirements. Physically challenged people need specialized care from caregivers in order to live a normal life, and even at home, it is inconvenient for them to operate household items as they choose. Additionally, it is challenging to regularly check on the patient's health. This system makes it more convenient for the patients to communicate with their care takers even though they are not nearby. It makes them semi-independent, reduces the risk of the caretaker and also saves their time as they need not be always available with the patient. As a patient's body is fitted with a body temperature sensor, the concerned caretaker may not use a separate system to analyse and if in case of emergency, help can be provided more quickly.

Proceedings DOI: 10.21467/proceedings.160
ISBN: 978-81-965621-9-9

Series: AIJR Proceedings
ISSN: 2582-3922

5 Limitations

The designed model uses combinations of fingers to convey certain requirements of the patient, in certain cases it may be difficult for them to bend multiple fingers at same time, so more flex sensors can be used to overcome this. Accuracy of measurements can also be improved.

6 Future Scope

The system's performance can be enhanced by incorporating additional flex sensors, which can also allow for monitoring of additional health parameters like saline levels and ECG. This technology is not only beneficial for individuals with paralysis but also for the elderly. To make the system more patient-friendly, it may be equipped with basic home automation features such as the ability to control lights, fans, TVs, alarms, etc. Additionally, a system that allows for adjusting bed position and control switches via gesture control can also be developed.

7 Publisher's Note

AIJR remains neutral with regard to jurisdictional claims in institutional affiliations.

How to Cite

Arun *et al.* (2023). Automated Paralysis Patient Assistant Glove. *AIJR Proceedings*, 269-273. https://doi.org/10.21467/proceedings.160.34

References

[1] Kollu Jaya Lakshmi, Akshada Muneshwar, A Venkata Ratnam and Prakash Kodali-"Patient Assistance using Flex Sensor", - International Conference on Communication and Signal Processing, July 28 - 30, 2020.

[2] Ms Puja Dhepekar, Yashwant G. Adhav, "Wireless Robotic Hand for Remote Operations using Flex Sensor', International Conference on Automatic Control and Dynamic Optimization Techniques (ICACDOT), 2016.

[3] Vidya Sarode, K.RAlexRappai, VictorThomas, AkashDubey, ShashankShukla- "AUTOMATED PARALYSIS PATIENT HEALTH CARE SYSTEM"-International Research Journal of Engineering and Technology, Volume: 08 Issue: 05 — May 2021

[4] Kumara K R ,Ankita Kadam, Neha Rane, Shraddha Vernekar, Asma Gouda-" Sensor Based Wearable System to Assist Paralytic Patient with Continuous Health Monitoring"- International Journal on Future Revolution in Computer Science Communication Engineering, Volume: 4 Issue: 5.

[5] Udayashankar, A. R. Kowshik, S. Chandramouli and H. S. Prashanth,- " Assistance for the Paralyzed Using Eye Blink Detection"- Fourth International Conference on Digital Home, Guangzhou, 2012, pp. 104-108.

[6] AmbikaGujrati, KartigyaSingh, Khushboo, LovikaSora and Mrs.Ambikapathy-" Hand-talk Gloves with flex Sensors: A Review"- International Journal of Engineering Science Invention ISSN (Online),vol. 2, no. 4, pp. 43-46, 2013.