Automated Paralysis Healthcare System

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Abstract—*This system aims to provide comprehensive care to individuals with paralysis, including symptom monitoring, medical treatment, and rehabilitation. The IoT-based system comprises interconnected devices, such as sensors, wearables, and mobile apps that communicate with one another and with healthcare providers. The system can track patients' vital signs, activity levels, and medication adherence, and provide immediate feedback to healthcare providers. Additionally, the system can aid with rehabilitation exercises, send reminders, and gather data on progress to enhance treatment outcomes. The system's intelligent analytics can also assist healthcare providers in detecting patterns in patient behavior and tailoring treatment plans more effectively. Overall, an IoT-based paralysis healthcare system has the potential to transform healthcare delivery by offering personalized, real-time care and monitoring to individuals with paralysis.*

Keywords—IOT, Paralysis, Rehabilitation, Tailoring Treatment.

I. INTRODUCTION

The emergence of the Internet of Things (IoT) has transformed various industries by connecting devices and generating real-time data. The healthcare industry has also been exploring the potential of IoT to improve patient care and outcomes. One promising area is the care of patients with paralysis. Paralysis is a debilitating condition that severely impacts a person's quality of life, and an IoT-based Paralysis Healthcare System can help monitor and manage the symptoms of paralysis, ultimately improving patient outcomes.

The primary purpose of this system is to provide comprehensive care to patients suffering from paralysis. The IoT-based Paralysis Healthcare System is designed to monitor and manage the symptoms of paralysis and provide real-time feedback to healthcare providers. The system can also assist with rehabilitation exercises, provide reminders, and collect data on progress, which can help improve treatment outcomes. The intelligent analytics of the system can also help healthcare providers in identifying patterns in the patient's behavior, allowing them to tailor treatment plans more effectively. The system is comprised of interconnected devices, including sensors, wearables, and mobile applications, that communicate with each other and healthcare providers.

The sensors and wearables can track vital signs, activity levels, and medication adherence, providing valuable insights to healthcare providers. The mobile application provides a user-friendly interface for patients to monitor their progress and receive personalized recommendations for exercises and rehabilitation. The data collected from these devices is stored in a secure cloud-based system, which can be accessed by healthcare providers for analysis and decision-making. The IoT-based Paralysis Healthcare System has numerous capabilities that can benefit patients and healthcare providers. For example, the system can monitor the patient's vital signs, activity levels, and medication adherence in real-time. This information can be used to identify potential health risks and intervene early.

The system can also provide personalized recommendations for rehabilitation exercises and send reminders to patients, ensuring that they stay on track with their treatment plans. The intelligent analytics of the system can also detect patterns in the patient's behavior, allowing healthcare providers to adjust treatment plans and improve outcomes. The IoT-based Paralysis Healthcare System has numerous benefits for patients, healthcare providers, and the healthcare system as a whole. For patients, the system provides personalized, real-time care and monitoring, which can improve treatment outcomes and enhance their quality of life. For healthcare providers, the system provides valuable insights into the patient's condition, enabling them to tailor treatment plans and interventions more effectively.

The system can also reduce the workload of healthcare providers by automating routine tasks and streamlining data management. Finally, the system can also reduce the overall cost of care by preventing complications and reducing hospital readmissions. In conclusion, the IoT-based Paralysis Healthcare System is a promising development in the care of patients suffering from paralysis. The system has the potential to transform healthcare delivery by providing personalized, real-time care and monitoring.

II. LITERATURE SURVEY

Chouhan aimed to design and implement an affordable wired interactive glove with high accuracy for gesture recognition, which can be interfaced with a computer running MATLAB or Octave. The glove uses bend sensors, Hall Effect sensors, and an accelerometer to map the orientation of the hand and fingers. The data is transmitted to a computer using automatic repeat request (ARQ) as an error controlling scheme. The system is intended for the differently abled section of the society to convert sign language into more understandable textual messages[1]. K. S. Abhishek proposed a gesture recognition glove based on charge-transfer touch sensors for translating the American Sign Language. The device is portable and uses low-cost hardware. The prototype can recognize gestures for the numbers 0 to 9 and the 26 English alphabets, A to Z, with an overall detection accuracy of over 92% based on 1080 trials. The goal of the proposed device is to bridge the communication gap between the hearing and speech impaired and the general public[2].

K. A. Bhaskaran developed a smart glove system that can convert sign language to speech output. The glove is embedded with flex sensors and an Inertial Measurement Unit (IMU) to recognize gestures. A novel method of State Estimation has been developed to track the motion of the hand in three-dimensional space. The prototype was tested for its feasibility in converting Indian Sign Language to voice output. Although the glove is primarily intended for sign language to speech conversion, it can also be used in gaming, robotics, and medical fields[3]. S. Patel created software that runs on a mobile computing device to translate Indian Sign Language into English speech, thus enabling duplex communication between the vocally impaired and the general public. The system uses gesture recognition and acquisition via an intrinsic mobile camera. The acquired gesture is processed using algorithms like HSV model (skin color detection), LargeBlob Detection, Flood Fill, and Contour Extraction. The system can recognize one-handed sign representation of the standard alphabets (A-Z) and numeric values (0-9) with high approximation of gesture process and speech analysis[4].

C. Preetham discusses the attempts to develop an automatic sign language recognition system. Various works have been carried out previously on various sign language recognition techniques. They use low-cost packaging material (velostat) for making piezoresistive sensors. These flex sensors detect a bend in fingers, and the data is mapped to a character set using a Minimum Mean Square Error machine learning algorithm. The recognized character is transmitted via Bluetooth to an Android phone, which performs a text-to-speech conversion. The technology, called Hand Talk, compares hand configurations with sign language charts to generate artificial speech that articulates the gestured words. This technology also has further applications as a 3D mouse, virtual keyboard, and control for precision control of robotic arms[5].

III. PROBLEM STATEMENT

Due to paralysis, patients are not able to move their body parts, and also it is very difficult for them to talk with other people for their need for help. When in need, hand movements will pass on the information to the caretakers. Hence our project will help them to convey their messages to doctors or family members. This project is the solution to the problem because the message is conveyed with the least effort of the finger movement. This project can also be extended for an instance of an emergency. Here we propose a smart speaking system that helps them in conveying the message to regular people using hand motions or gestures

IV. PROPOSED WORK

The proposed work is an IoT-based Paralysis Healthcare System that aims to enhance the quality of life of people with paralysis by providing them with assistive technology and real-time health monitoring. The system is composed of three main components: a wearable device, a mobile application, and a cloud server.

The wearable device is intended to be worn on the user's wrist and will collect real-time data on various health parameters, such as heart rate, blood pressure, oxygen saturation, and body temperature. Additionally, it will contain sensors that can identify movements and provide information on the user's posture, balance, and gait.

The mobile application will be the user interface for the system and will allow users to access their health data, view notifications and alerts, and manage various features of the wearable device. The application will also include features such as medication reminders and emergency assistance.

The cloud server will store the user's health data and perform real-time analysis of the data to detect any abnormalities or potential health issues. The server will also be used to provide remote access to healthcare professionals who can monitor the user's health and help as needed.

Our hardware proposed system works the bending of the user fingers. The working of the device is shown by holding in the fingers of the mobile hand. The user now just needs to bend the flux the device in a particular angle to convey a message. Bending the flux sensor, the device in different directions conveys a different message. In this way the Automated Paralysis Patient Healthcare System truly automates the care taking ability of the patient which ensures a timely attention to the patient and thus for a good health of the patient.

In this project we propose a Sign Language Glove which will assist those people who are suffering for any kind of speech defect to communicate through gestures i.e. with the help of single handed sign language the user will make gestures of alphabets. The glove will record all the gestures made by the user and then it will translate these gestures into visual form as well as in audio form.

In summary, the proposed IoT-based Paralysis Healthcare System intends to enhance the lives of individuals with paralysis by providing them with real-time health monitoring, assistive technology, and remote access to healthcare professionals.

V. IMPLEMENTATION

Software

An IoT-based Paralysis Healthcare System can be implemented using MIT App Inventor, LabVIEW, and ThingSpeak. The system includes a wearable device, a mobile application, a cloud server, and a LabVIEW interface. The wearable device collects real-time health data using sensors for monitoring heart rate, blood pressure, oxygen saturation, body temperature, movement, posture, balance, and gait. The device sends the data to the cloud server via ThingSpeak.

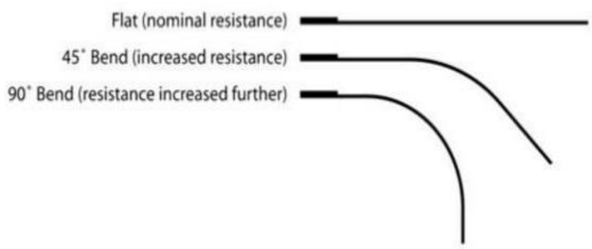

Fig 1: Flex sensor

The mobile application, built using MIT App Inventor, serves as the user interface and enables users to view their health data, receive alerts and notifications, and control various features of the wearable device, such as medication reminders and emergency assistance.

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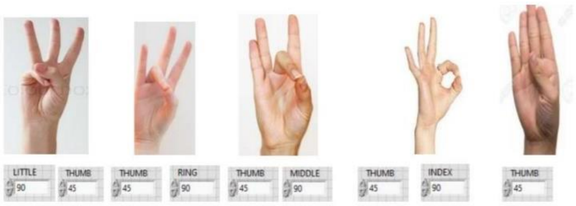


(a) (b) (c) (d) (e)

Fig 2: a) The gesture to ask for food. B) The gesture to ask for medicines c) The gesture to use the restroom d) The gesture to ask to go out e) The gesture for an emergency

The cloud server is implemented using ThingSpeak, which allows for real-time data storage and analysis. The server receives the health data from the wearable device and provides remote access to healthcare professionals for monitoring and assistance. It also performs real-time analysis of the data to identify any abnormalities or potential health issues.

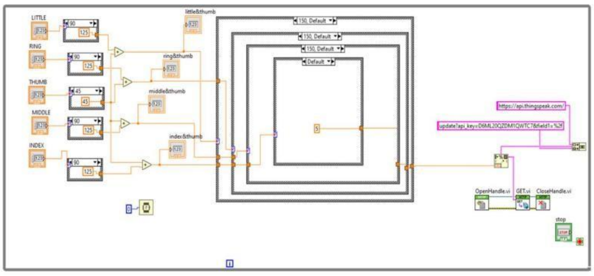


Fig 3: LabVIEW circuit

The LabVIEW interface provides additional features for healthcare professionals, including real-time monitoring of the user's health data and tools for data analysis and visualization. In summary, the implementation of an IoT-based Paralysis Healthcare System using MIT App Inventor, LabVIEW, and ThingSpeak can provide a comprehensive and effective solution for real-time health monitoring and assistance for individuals with paralysis.

Fig 4: The Input given to the LabVIEW in the form of degrees

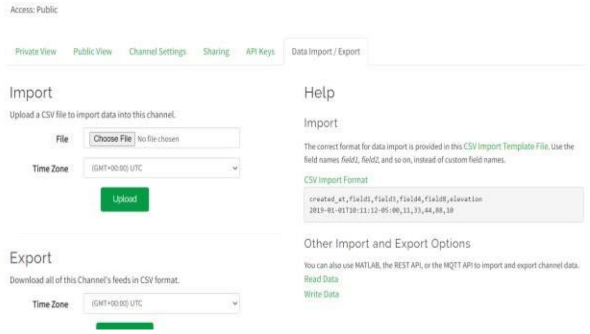


Fig 5: Exporting the csv file

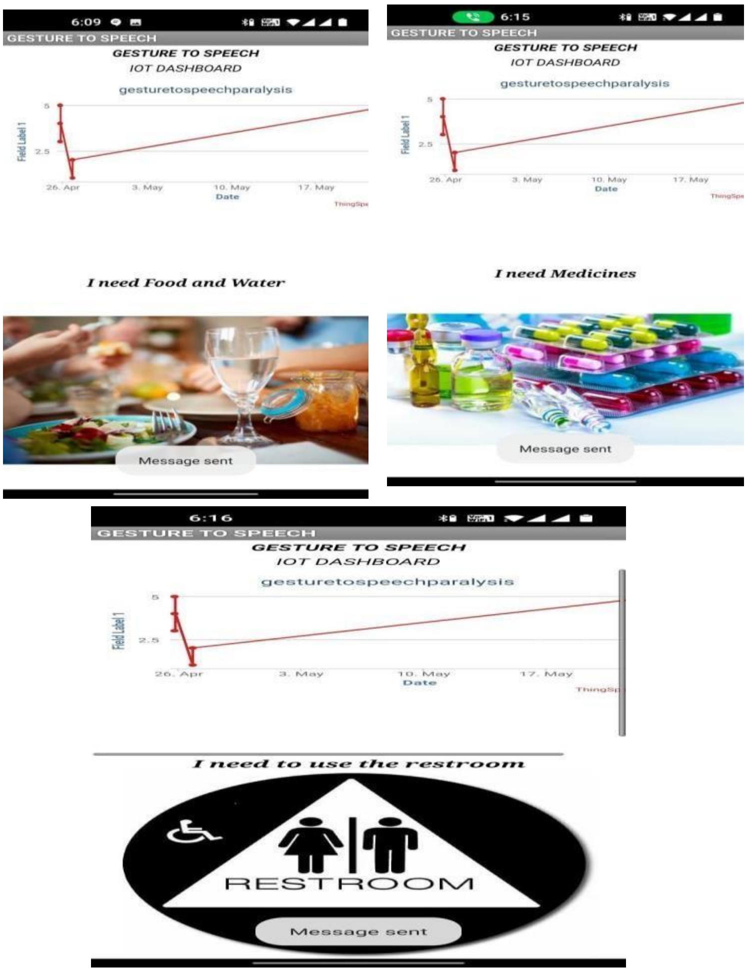


Fig 6: Results for Software implementation

Hardware

Fig 7: Block Diagram

Components Used:

- Arduino mega2560
- GSM
- GPRS
- Speaker
- Temperature sensor
- ECG sensor
- ECG cable
- Accelerometer
- Voice module
- LCD
- Flux sensors
- Hand glove
- Power supply

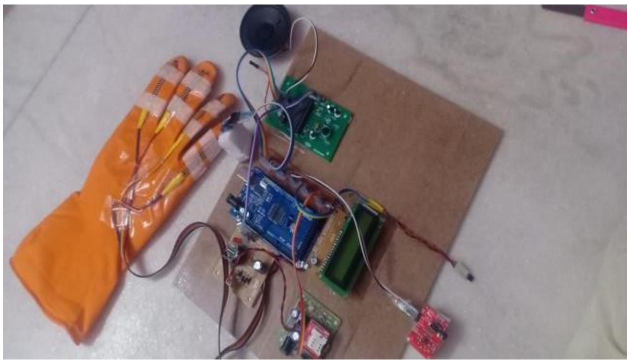
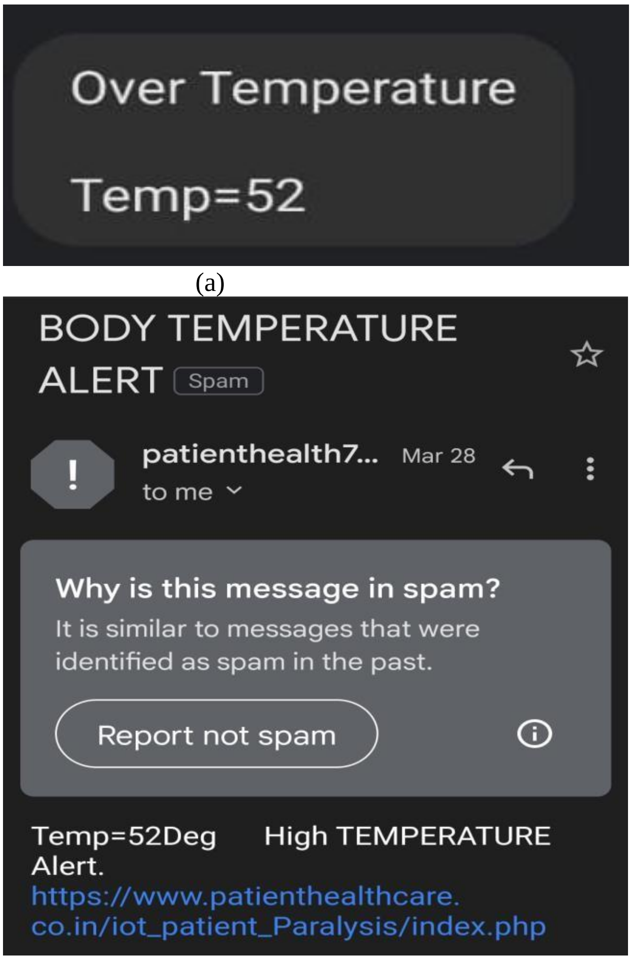


Fig 8: Hardware experimental setup

Working:

As we see the hardware setup, we connected all the flux sensors to the ADC pins of the Arduino. LCD is connected to 2,3,4,5,6,7 and the speaker to 8,9,10,11,12 pins of the Arduino. When we give the power supply, it checks for all the necessary conditions for the device to start off like the GSM and GPRS and the voice module. We send the data of the temperature, ECG and accelerometer to a server with the help of a sim card. The output of the flux sensors is recorded in voice module and the output will be sent to speaker which gives a voice alert.

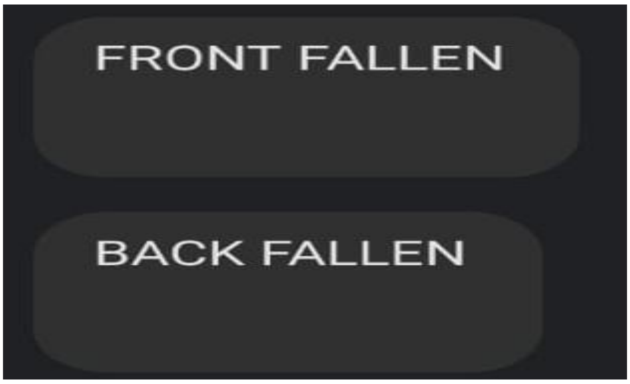
Firstly, we will find the room temperature of the patient with the help of the temperature sensor. It detects the room temperature around the patient and its data will be sent to the server. If the temperature is greater than 50, the data gets recorded in the server and an SMS alert and an E-mail alert will be sent to the registered mobile number and e-mail respectively.



(b)

Fig 9: (a) SMS Alert, (b) E-Mail Alert

Now we will detect the body fall of the patient. According to the angles we provide to the accelerometer, it detects that the patient is in normal condition or if the patient has fallen from the bed. If the patient has fallen down this device detects which side the patient has fell, that is, right fall or left fall or front fall or back fall. So, this data will also be sent to the server and also an SMS alert and an E-mail alert is sent to the registered mobile number and e-mail respectively.



(a)

(b)

(c)

(d)

Fig 10: (a) SMS Alert of Patient Front and Back fall, (b) (c) SMS Alert of Patient Left and Right fall
(d)E-Mail alert of Patient fall

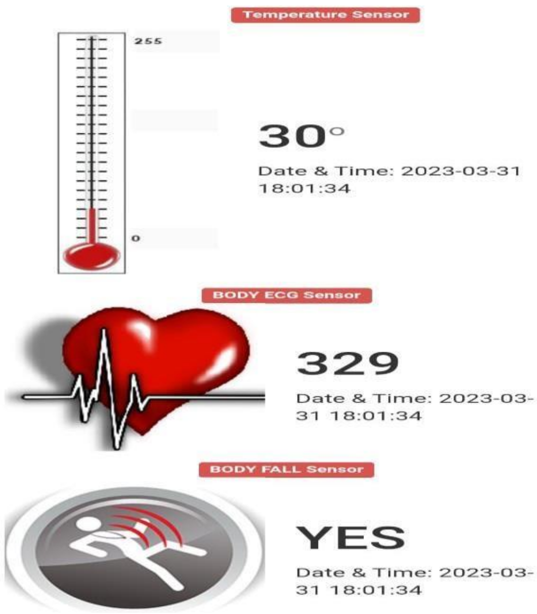


Fig 11: Output of webpage

Now we will know what the patient exactly needs with the help of a hand glove to which we attached the flux sensors which will work like human fingers. So, when we bend the index finger, the device will let us know that the patient needs water. It will display water on the LCD screen and give voice alert through the speaker. It will also send an SMS alert to the registered mobile number like “I need Water”.

Fig 12: Bending index finger

In the same way, when we bend the middle finger, we will know that the patient needs food. Food will be displayed on the LCD screen and give voice alert through the speaker. SMS alert will be sent to the registered mobile number like “I need Food”.

Fig 13: Bending middle finger

In the same way, when we bend the ring finger, we will know that the patient needs fresh air. Fresh air will be displayed on the LCD screen and give voice alert through the speaker. SMS alert will be sent to the registered mobile number like “I want Fresh air”.

Fig 14: bending ring finger

In the same way, when we bend the little finger, we will know that the patient needs to go to washroom. Washroom will be displayed on the LCD screen and give voice alert through the speaker. SMS alert will be sent to the registered mobile number like "I want to go Washroom.".


Fig 15: bending little finger

In the same way, when we bend index finger and middle finger, we will know that the patient needs help. Help will be displayed on the LCD screen and give voice alert through the speaker. SMS alert will be sent to the registered mobile number like "Plz Help me".


Fig 16: bending index and middle finger

And if no finger is bent, it just displays Normal fingers on the LCD.

VI. RESULTS

IoT based Paralysis Healthcare System aims to improve the quality of life for individuals with paralysis by providing real-time health monitoring and assistive technology. By collecting and analysing health data, the system can identify any abnormalities or potential health issues, which can be addressed promptly by healthcare professionals. The system also provides remote access to healthcare professionals for monitoring and assistance.

The main aim of the project was the development of automated paralysis patient healthcare system using GSM. Paralysis patients need to be taken care almost for 24 hours and they need someone beside them all the time to be taken care of. So based on the gesture they can convey the message to the caretaker and the output is the digital format. Based on the gestures the output is digitalized.

Overall, the system can help individuals with paralysis manage their health more effectively and improve their quality of life.

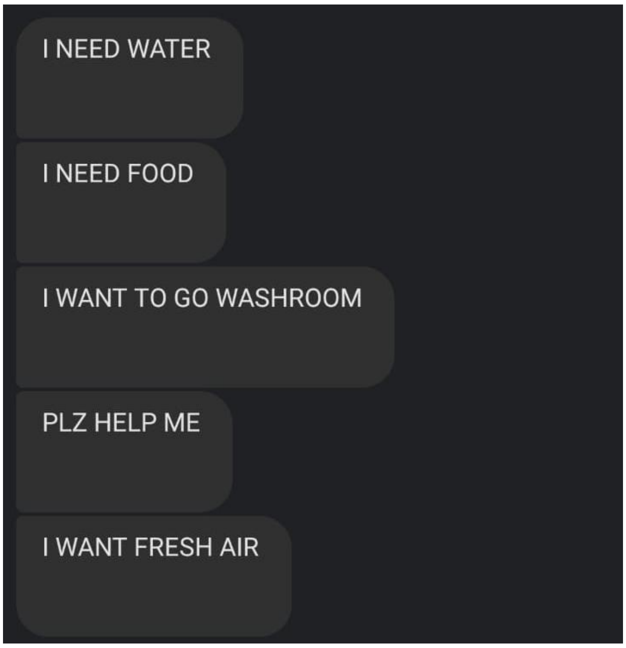


Fig 17: SMS Alert of the gestures

VII. EXSITING SYSTEM VS PROPOSED SYSTEM

Although there are numerous procedures in place to keep an eye on paralysed patients' health, there aren't many that concentrate on communication. However, this approach fills the communication gap between the patient and others, enables the paralysed patient to release stress by disclosing their thoughts, and encourages them as much as possible. Additionally, this system is practical and affordable enough to purchase without incurring excessive debt. People who are paralysed find it difficult to communicate with carers in a way that satisfies their needs since they are unable to effectively convey their worries and requirements. To help disabled persons get through this barrier, we created a GSM-based paralysis patient healthcare system. In this suggested method, the paraplegic patient uses a glove to communicate with the carer. The GSM module transmits a message to the preprogramed caregiver phone numbers when the patient's hand is tilted. We want to integrate this method into desktop screens and an Android app for remote monitoring in the future. The proposed approach allows for the evaluation of hospital doctors' performance, as well as the true treatment of patients and the saving of their lives. The love fit of making the patient aware of a healthy lifestyle is also initiated by this proposed system.

VIII. CONCLUSIONS

Though there already exists a several systems to monitor the paralyzed patient's health, there are not many systems that focuses on communication of them. But this system bridges the gap between the patient and others via communication and helps the paralyzed patient to relieve their stress by revealing their thoughts and help them to motivate as much as possible. And this system is cheap enough to afford without much debt and is also useful.

IX. APPLICATIONS

This is mainly used in home automation patients and in old age homes.

X. FUTURE WORK

Some potential future work for an IOT based Paralysis Healthcare System could include:

1. Integration with machine learning algorithms: By integrating machine learning algorithms, the system can learn from the user's data and make predictions about their health, alerting them or their healthcare provider if an anomaly is detected.

2. Integration with other medical devices: The system could be expanded to work with other medical devices, such as smart beds, wheelchairs, and other wearables, to provide even more comprehensive health monitoring and assistance.

3. Development of more advanced sensors: Future versions of the wearable device could include more advanced sensors, such as EEG sensors for monitoring brain activity or pressure sensors for detecting pressure sores, to provide even more detailed and accurate health data.

4. Expansion to more conditions: While the system is designed specifically for individuals with paralysis, it could be adapted to work with other conditions, such as Parkinson's disease or multiple sclerosis, to provide real-time health monitoring and assistance for individuals with those conditions as well.
5. Integration with telemedicine: The system could be integrated with telemedicine technology, allowing for remote consultations with healthcare professionals, and providing patients with access to medical advice and support without having to leave their homes.
6. In future, the system can be made smart and efficient by making the goggle wireless for eyeblink detection. It can be made by using Bluetooth and Wi-Fi technology. So as to make system efficient and secure as well as easy to handle. Also, for constant patient monitoring some indications for security can be added like light indicators.
7. Instead of using GSM module monitor patient’s parameters on mobile in case of if patient is in hospital. So, it becomes useful in hospitals for continuous monitoring of body parameters on doctors mobile or main mobile of hospital ward.
8. According to the availability of sensors or development in biomedical trend more parameter can be sensed and monitored which will drastically improve the efficiency of the wireless monitoring system in biomedical field.

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