Next Generation Assistive System for Paralysis Patients

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Abstract - Paralytic people in most cases are not able to convey their needs as they are neither able to speak properly nor do they convey through sign language due to loss in control by their brain. To solve such issues, simple, transportable, and accurate assistive technology will probably be developed. Stroke is the major cause of paralysis, which affects almost 33.7% of the population with paralysis. But there is no system to monitor the patient's health and daily needs. In this high-speed world, it is not possible to constantly take care of their near ones who need their help. In this way the Automated Paralysis Patient Care 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. The glove with sensors and microcontroller is the major focus. The micro-controller identifies certain finger bending using sensors attached to gloves and converts sensor output data into text and audio It has the capacity to assess biological indicators like heart rate and temperature as a patient monitoring device. The system will be put into place with the intention of enhancing the quality of life for people with disabilities and providing additional assistance in bridging the communication gap.

***Key Words*:** Paralysis patient, Care taker, Microcontroller, Flex Sensor, Temperature, Heart rate, Real time monitoring.

1.INTRODUCTION

There are many people with paralysis, injuries or lost part of their bodies, as a result, they can't even perform their daily activities. There are some existing systems for individual comforts. But our project will help to monitor the overall need of the patients. Our project has the potential to empower paralyzed patients, enhance health outcomes, and improve overall quality of life easy communication with care takers. The potential impact of our project is far-reaching, promising to revolutionize the way assistive care is delivered and improving the lives of individuals living with paralysis. Through continued research and innovation, the smart assistive system represents a significant step towards a more inclusive and supportive environment for all.

The smart glove is embedded with flex sensors that can detect specific finger bend, which are then interpreted and converted into predefined messages, allowing patients with limited speech or mobility to communicate effectively. In addition to its communication features, the glove is equipped with sensors to monitor vital health parameters such as pulse rate and body temperature. This dual functionality is enhanced by the integration of Internet of Things (IoT) technology, enabling real-time data transmission to caregivers for timely response and intervention. The system is designed with affordability and user-friendliness in mind, making it accessible to a broad range of users, including those in low-resource settings. Overall, the smart glove offers a practical and efficient solution for improving the quality of life and care of individuals living with paralysis.

2. LITERATURE SURVEY

A large number of assistive tools have been developed over the years, ranging from traditional devices like wheelchairs to advanced robotics for rehabilitation purposes. Wearable devices have become increasingly popular, integrating features to support mobility, communication, and health monitoring. Smart gloves have

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been an area of interest, especially for their ability to bridge communication gaps. For example, research by M. Liu et al. (2020) highlighted the use of flex sensors for detecting finger bending, showcasing their potential in translating physical gestures into electronic signals.

IoT technology facilitates real-time data transmission, ensuring seamless interaction between patients and caregivers. Studies such as P. Singh et al. (2022) have validated the efficacy of IoT in healthcare systems, emphasizing its role in remote monitoring and early intervention. Your integration of IoT for real-time health updates exemplifies this paradigm shift towards connected healthcare. our project proposes an intelligent glove capable of sensing finger bends using flex sensors and converting them into predefined messages for communication purposes.

This aspect builds upon previous works like T. Elahi et al. (2019), which explored gesture recognition for speech-impaired patients, demonstrating promising outcomes. Beyond communication, the inclusion of sensors for health monitoring (e.g., heart rate, body temperature) marks a significant leap forward, providing caregivers with timely insights into patient conditions.

3. METHODOLOGY

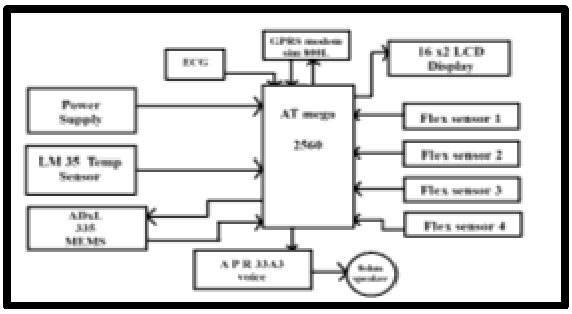

Fig. 3(a): block diagram of Next generation assistive system for paralysis patients

The methodology for developing a next-generation assistive system for paralysis patients involves integrating various components to monitor, alert, and assist the patient in real time. The system is built around the ATmega2560 microcontroller, which interfaces with sensors such as the LM35 temperature sensor, ADXL335 MEMS accelerometer, and flux sensor to collect data on the patient's health and movements.

The LM35 continuously monitors the patient's body temperature, sends an SMS using the GPRS SIM800L module. The flux sensor can be used to control assistive devices, by detecting proximity or force changes. The system communicates with the patient and caregivers through an LCD display, showing vital data like temperature and movement status, while the speaker provides audio alerts for emergencies. The SIM800L module enables remote monitoring by sending updates and alerts to caregivers via SMS. Once integrated, the system allows real-time feedback, emergency notifications, improving the patient's autonomy and care. Future improvements may include incorporating additional sensors, wireless communication, and mobile app integration for a more comprehensive health monitoring solution.

4. HARDWARE COMPONENTS

4.1 ATMega2560 Microcontroller

Fig. 4.1: ATMega2560 Microcontroller

The ATMega2560 is a powerful 8-bit AVR microcontroller. It takes supply of 5V and It receives input signals from sensors like flex sensor, temperature sensor fall detector and transmits output signals to LCD and speaker. It processes instructions from its program memory (Flash) and executes them sequentially or based on conditional logic, making decisions and controlling the flow of the system. With its digital and analog pins, the microcontroller serves as an interface between the real world and the system.

4.2. Multi power supply

Fig. 4.2: Multi power supply board

In our system we are using different sensors and other electronic components for different purposes and all these components need different levels of voltages such as APR33A3 needs 12V, AD8232 ECG sensor requires 3V and Flex sensor, LCD, microcontroller board etc. requires 5V so we are using a multi-power supply board. A multi-power supply board provides multiple voltage outputs from a single input source.

4.3 Flex sensors

Fig.4.3: Flex sensors

It is also sometimes called as bend sensor, The sensor acts more like a variable resistor, whose resistance changes based on how much it is bent so it is used to the signals of patient's needs like food, water, need fresh air and need to go washroom. Through these flex sensors the patient can communicate with their care taker.

4.4 LCD display

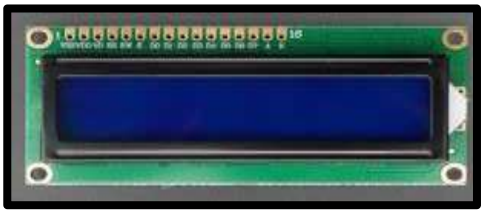

Fig.4.4: LCD display

In the next generation assistive system for paralysis patient the lcd display is used as output device that's gives output by displaying the heart rate body temperature and body fall detection and also the requirement of the patients like water, food, fresh air and need to go washroom. In the sense we are using the 16x2 liquid crystal display that gives the visual output of the system.

4.5 APR33A3

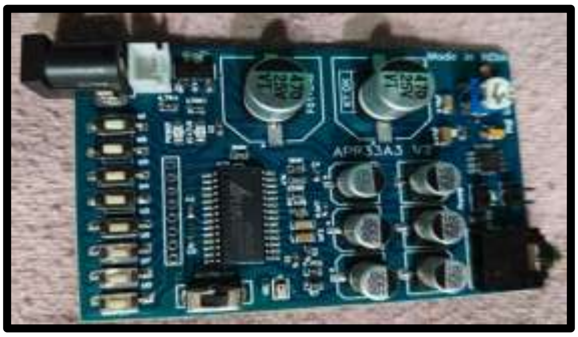

Fig.6.4: APR33A3

This chip is commonly used in applications like toys, alarms, and voice guidance systems. In our project the APR33A3 is used to record and play the audio of the comments like food, water and washroom through speaker. The APR33A3 voice record and playback module operates based on audio processing and memory storage principles. It uses a 16-bit digital audio processor to capture and process sound, converting analog audio signals into digital data for storage in its non-volatile flash memory.

5. WORKING PRINCIPLE

In next generation smart assistive system, the main component is the flex sensor where these sensors are placed on the patient's finger the flux takes the inputs of 5V from the power supply, the bending of the flex sensor changes the impedance and change in the impedance.

Flex sensors are attached to the gloves that should be wore by the patients, bending of flex sensor gives signal to Arduino and respective command is passed that the patient is needed.

The microcontroller ATMega2560 is the controller device that gets 5V supply from power supply and every component is controlled by microcontroller. Every component that are used in the smart assistive system is connected to the microcontroller.

Depending on the patient's needs, the system can control various needs like a water, food, washroom or fresh air using bending the fingers that makes patients easy to communicate with the caretakers.

In the starting phase the LCD display displays "Paralysis patient monitoring system". If the patient need food the 1st flex is bent and the LCD displays the message "The patients need food". And if the person requires water "the patient needs water" comment is displayed, and real time body temperature is detected by LM35 temperature sensor

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and heart rate is also monitored by AD8232 ECG sensor and real time data is displayed

Body fall detector is also attached to the patient if the fall is detected the sms is sent to the caretaker phone through GSM sim model "Body fall detected..." and the same message is displayed in LCD.

6. RESULTS

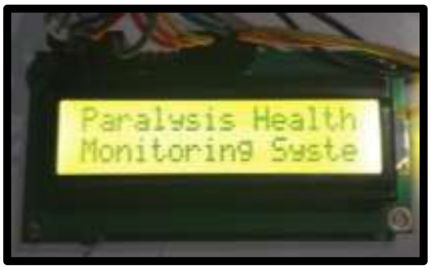

Fig.6.1: Displaying the health monitoring system

Fig.6.2: Displaying the more temperature

Fig.6.3: The heart rate of the patient

Fig.6.4: Displays the need of Water

Fig.6.5: SMS sent to the caretaker

The above figure shows the result of the next generation assistive system for paralysis patient. The result is obtained through LCD display, speaker and SMS is sent to the caretaker about the patient health condition. The above figure shows the starting display of the LCD display when the system is ON. The purpose of LCD display is to display the body temperature and heart rate of the patient and also the needs of the patient.

ADVANTAGES

- Depending on the patient's needs, the system can control various needs like a water, food, washroom or fresh air using bending the fingers.
- The speaker announces the required need of the patients that if they need water or food etc.
- The temperature sensor senses the body temperature of the patients and ECG regularly monitors the heart rate of the patients.

APPLICATIONS

- The next generation smart assistive system for paralysis patients is majorly applicable for medical fields.
- The patients suffering from stroke, spinal card injuries and other paralysis patients can use this system.
  - It is applicable for hospitals, house and old age homes.

7. CONCLUSION

The development of smart assistive systems for paralysis patients represents a significant technological breakthrough that aims to enhance the quality of life for individuals facing mobility challenges.

The Smart Assistive System for Paralysis Patients represents a significant help in healthcare and assistive technology, enabling individuals with paralysis by actively engage with their environment.

By including modern technologies such as Arduino, sensors, and IoT, these systems provide cost-effective, customizable, and adaptable solutions to the unique needs of patients offering personalized support and enhancing their daily living activities.

FUTURE SCOPE

- AI can predict patient needs based on behavioral patterns, making the system more proactive and adaptive.
- Smart assistants could detect stress, fatigue, or discomfort and provide alerts.
- The integration of artificial intelligence, brain-computer interfaces, and wearable technologies in the future will further enhance functionality, making the system more intuitive and adaptive.
- Data collected from patients could be stored and analyzed in the cloud, providing insights for personalized healthcare.
- Assistive systems could include diagnostic tools to monitor the progression of neurological conditions, providing timely interventions.

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