DESIGN AND STUDY OF SMART CUP FOR MONITORING HAND ACTIVITY OF STROKE PATIENT

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Introduction:

- A **stroke** is a medical condition in which poor blood flow to the brain causes cell death. There are two main types of stroke: ischemic, due to lack of blood flow, and hemorrhagic, due to bleeding.
- Both cause parts of the brain to stop functioning properly.
- Stroke symptoms typically start suddenly, over seconds to minutes, and in most cases do not progress further.
- The symptoms depend on the area of the brain affected.
- Stroke is one of the leading causes of death and disability in India.
- The estimated adjusted prevalence rate of stroke range, **84-262/100,000 in rural and 334-424/100,0000 in urban areas**
- Life expectancy in India has recently increased to over 60 years of age leading to an increase in age-related, non-communicable diseases including stroke;- making stroke India's fourth leading cause of death and fifth leading cause of disability
- Early treatment and rehabilitation after a stroke can improve recovery and many people regain a lot of abilities.
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- The most common types of disability after stroke are changes to speech, learning and understanding, and weakness or paralysis on one side of the body.
- Hence a system that accurately measures the angle displacement and muscle imbalance is developed in this project.
- Using accelerometer provides angle along the 3 axis and is displayed in terms of row ,pitch and yaw axis.
- Angular rotation of the hand is computed using gyroscope sensors

Objectives:

- The biofeedback device described seems to be a promising solution for addressing the shaking hands experienced by stroke patients when lifting a glass. By using sensors to measure three-axis angles through a gyroscope and accelerometer, the device can provide real-time readings that monitor muscle imbalance. This allows stroke patients to see their improvement through deflection angular momentum, which can serve as a motivational tool for performing their prescribed exercises.
- Furthermore, the biofeedback system can also be valuable for doctors in monitoring the progress of stroke patients. By observing the readings provided by the device, doctors can gain insights into the patient's muscle imbalances and the effectiveness of their prescribed exercises. This information can help doctors make informed decisions and adjustments to the treatment plan, including the prescription of medications if necessary.
- Overall, the biofeedback device offers a dual benefit by motivating stroke patients to engage in their exercises and providing doctors with valuable data for monitoring and prescribing appropriate treatments. It has the potential to improve the rehabilitation process and enhance the overall quality of life for stroke patients.

Methodology:

- 1.Connecting MPU6050 to NodeMCU: Connect the SDA and SCL pins of the MPU6050 to the corresponding pins on the NodeMCU, following the I2C protocol.
- 2. Setting up Libraries in Arduino IDE : Install the necessary libraries for the MPU6050 sensor, the OLED display, and any additional libraries required for the buzzer.
- 3. Initializing and Configuring MPU6050:Initialize the MPU6050 sensor in your code. Configure the sensor to provide accelerometer and gyroscope data.
- 4. Reading Sensor Data : Use the sensor library functions to read accelerometer and gyroscope data from the MPU6050.
- 5. Calculating Angular Momentum : Implement mathematical formulas and algorithms to calculate angular momentum based on the accelerometer and gyroscope readings.
- 6. Displaying Results on OLED : Code the NodeMCU to display calculated angular momentum on the OLED display. Display the number of lifts made by the patient on the OLED screen.
- 7. Disorderliness Monitoring: Define thresholds for disorderly motion based on angular momentum. Implement conditional statements to check if the hand's angular momentum meets disorderliness criteria. Display appropriate messages on the OLED screen if disorderliness criteria are met.

- 8. Adding Buzzer for Critical Deflection: Integrate a buzzer into the circuit. Set a threshold for critical deflection. Activate the buzzer if the angular momentum exceeds the critical threshold. Optionally, turn on a red LED for a visual warning.
- 9. Uploading Code to NodeMCU: Upload the completed code to the NodeMCU board using the Arduino IDE.
- 10. Observing the Output : Monitor the OLED display for calculated angular momentum and lift count. Check for warning messages in case of disorderly motion. Pay attention to the buzzer and LED to detect critical deflections.

Conclusion and Future Scope:

- A normative dataset for orientation of holding will be created based on non-disabled performance characterizing hand trajectory, hand velocity, and grip aperture features for reach-grasp and transport-release segments of the movements.
- These features verified that the tasks challenged a variety of motor control strategies, and these unique movement characteristics were reflected in the quantitative results while being highly consistent within-performers.
- In addition to the low within-participant and between-participant variability for these complex tasks, a repeatability analysis showed that this novel assessment approach has good between-session repeatability.

  Future scope can indeed extend to tremor analysis. By incorporating tremor analysis into the system, it could be expanded to monitor and assess conditions such as Parkinson's disease or essential tremor