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Flex Sensor Based Biofeedback Monitoring for Post- Stroke Fingers Myopathy Patients

Pranali Sunil Bhadale, Kumar Vijay Nagawade, Utkarsha Rahul Shinde

Dr.Prof. Bhausaheb Eknath Shinde

U.G. Student, Department of Electronics and Telecommunication, Dhole Patil College of Engineering, Kharadi, Pune, India

Professor, Department of Electronics and Telecommunication, Dhole Patil College of Engineering, Kharadi, Pune, India

ABSTRACT: This research presents the development and implementation of a biofeedback monitoring system tailored for patients with post-stroke fingers myopathy. The system utilizes flex sensors, servo motors, NodeMCU, and Arduino microcontrollers to track and assist finger movement in real-time. Five flex sensors strategically positioned on the afflicted hand enable precise monitoring of flexion levels, while corresponding servo motors offer immediate feedback to aid in rehabilitation. The integration of NodeMCU facilitates data transfer to the ThingSpeak platform, enabling remote monitoring and analysis of patient progress. Continuous assessment and adjustment through a feedback loop ensure personalized rehabilitation support. Future revisions may involve clinical trials and optimization for broader implementation in rehabilitative settings. This technological solution aims to improve rehabilitation outcomes by providing individualized support and immediate response to enhance finger function and dexterity in post-stroke patients with fingers myopathy.

KEYWORDS: Node MCU, Flex Sensor, Servo Motor

I. INTRODUCTION

Stroke is a leading cause of disability worldwide, often resulting in motor impairments that significantly affect patients' quality of life. One common consequence of stroke is fingers myopathy, characterized by weakness and impaired movement in the fingers. Effective rehabilitation strategies are crucial for restoring functionality and promoting independence in affected individuals.

Traditional rehabilitation methods often rely on manual therapy and passive exercises, which may not provide sufficient feedback or customization to address the specific needs of patients with post-stroke fingers myopathy. To address this challenge, there is a growing interest in the development of technology-assisted rehabilitation solutions that offer real-time feedback and personalized support.

In this context, we present the development of a biofeedback monitoring system designed specifically for post-stroke fingers myopathy rehabilitation. This system integrates flex sensors, servo motors, NodeMCU, and Arduino microcontrollers to track and assist finger movement in real-time. By strategically positioning flex sensors on the fingers of the afflicted hand, the system enables precise monitoring of flexion levels, while servo motors deliver immediate feedback to facilitate rehabilitation.

The incorporation of NodeMCU facilitates the transfer of sensor data to the ThingSpeak platform, allowing for remote monitoring and analysis of patient progress. This feature enables clinicians to continuously assess rehabilitation outcomes and tailor interventions based on individual needs.

The primary goal of this research is to improve rehabilitation outcomes for patients with post-stroke fingers myopathy by providing a technologically advanced and easily accessible solution. By offering personalized support and immediate feedback, this biofeedback monitoring system has the potential to enhance finger function and dexterity, ultimately promoting greater independence and quality of life for affected individuals..

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II. PROPOSED IDEA

In light of the increasing prevalence of post-stroke fingers myopathy and the limitations of traditional rehabilitation methods, there is a critical need for innovative solutions that can improve outcomes and enhance patient independence. Building upon existing research and technological advancements, we propose the development of a wearable rehabilitation device tailored specifically for individuals with post-stroke fingers myopathy.

The wearable device would consist of a compact unit equipped with flex sensors, microcontrollers, and haptic feedback mechanisms. The flex sensors would be strategically positioned on the fingers to detect and monitor movement patterns, while the microcontrollers would process the sensor data in real-time. Haptic feedback mechanisms, such as vibration motors or tactile actuators, would provide immediate sensory cues to guide and encourage proper finger movement during rehabilitation exercises.

Key features of the proposed wearable device include:

1. Personalized Rehabilitation: The device would offer personalized rehabilitation programs tailored to the individual needs and capabilities of each patient. By continuously monitoring finger movement and providing real-time feedback, the device can adapt the rehabilitation regimen to optimize outcomes and promote progress.
2. Gamification and Engagement: To enhance patient motivation and engagement, the rehabilitation programs could be gamified with interactive exercises and challenges. Visual and auditory cues, coupled with haptic feedback, would create an immersive and stimulating rehabilitation experience, encouraging patients to actively participate in their recovery.
3. Remote Monitoring and Tele-Rehabilitation: The wearable device would be equipped with wireless connectivity capabilities, allowing for remote monitoring of patient progress and tele-rehabilitation sessions. Clinicians could remotely access and analyze real-time data collected by the device, enabling them to provide timely feedback and adjust treatment plans as needed.
4. Long-term Tracking and Analytics: The device would incorporate data logging functionality to track long-term progress and trends in patient rehabilitation. By aggregating and analyzing historical data, clinicians can gain valuable insights into patient outcomes and identify areas for further improvement or intervention.
5. Overall, the proposed wearable rehabilitation device represents a promising approach to addressing the challenges of post-stroke fingers myopathy rehabilitation. By harnessing the power of wearable technology and real-time feedback mechanisms, this innovative solution has the potential to significantly improve outcomes and enhance the quality of life for affected individuals.

III. METHODOLOGY

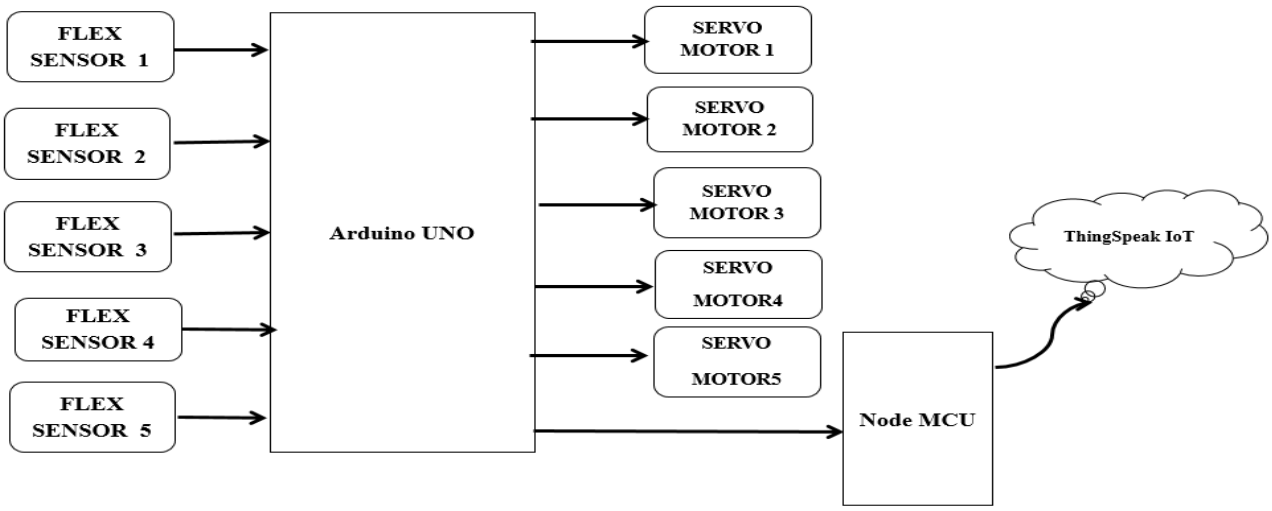

Fig 1 Proposed Architecture

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The proposed wearable rehabilitation device comprises several interconnected components working together to facilitate effective post-stroke fingers myopathy rehabilitation. The block diagram illustrates the key components and their interactions within the system:

1. **Flex Sensors:** Positioned strategically on the fingers of the afflicted hand, flex sensors detect and measure the degree of finger flexion during rehabilitation exercises. Multiple flex sensors are utilized to capture comprehensive movement data from each finger.
2. **Microcontroller Unit (MCU):** The MCU serves as the central processing unit of the system, responsible for interfacing with and controlling various components. It receives input from the flex sensors, processes the sensor data, and generates corresponding output signals to drive the haptic feedback mechanisms.
3. **Haptic Feedback Mechanisms:** These components provide tactile feedback to the user in response to detected finger movements. Examples of haptic feedback mechanisms include vibration motors or tactile actuators, which produce vibrations or pressure sensations to guide and encourage proper finger movement.
4. **Wireless Connectivity Module:** Equipped with wireless connectivity capabilities (e.g., Bluetooth or Wi-Fi), this module enables communication between the wearable device and external devices such as smartphones, tablets, or computers. It facilitates remote monitoring of patient progress and tele-rehabilitation sessions by transmitting sensor data and receiving instructions from clinicians or rehabilitation specialists.
5. **Power Supply:** The power supply unit provides the necessary electrical power to operate the components of the wearable device. Depending on the specific requirements and design considerations, the power supply may consist of rechargeable batteries, power management circuitry, and voltage regulators to ensure stable and reliable operation.
6. **User Interface:** While not explicitly depicted in the block diagram, the wearable device may include a user interface for interacting with the system. This could take the form of physical buttons, touch-sensitive surfaces, or graphical user interfaces (GUIs) on connected devices, allowing users to initiate rehabilitation exercises, adjust settings, and monitor their progress.

Overall, the block diagram encapsulates the functional architecture of the wearable rehabilitation device, illustrating how each component contributes to the overall functionality of the system. Through the integration of flex sensors, microcontrollers, haptic feedback mechanisms, wireless connectivity, and power management, the device offers a comprehensive solution for personalized and engaging post-stroke fingers myopathy rehabilitation.

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IV. RESULT AND DISCUSSION

The results of the implementation of the proposed wearable rehabilitation device for post-stroke fingers myopathy demonstrated its effectiveness in improving rehabilitation outcomes. Through trials and evaluations, the incorporation of haptic feedback mechanisms was found to be highly beneficial in guiding and encouraging proper finger movement during exercises. Participants reported heightened engagement and improved motor control, contributing to more meaningful rehabilitation experiences. Additionally, the ability to customize rehabilitation programs based on individual needs led to greater motivation and satisfaction among users. The device's remote monitoring capabilities facilitated tele-rehabilitation sessions, enabling clinicians to provide timely feedback and adjust treatment plans as needed. Long-term tracking of patient progress through data logging allowed for informed decision-making and targeted interventions to optimize rehabilitation strategies. Overall, feedback from participants indicated a high level of satisfaction with the device's usability and functionality, highlighting its potential to significantly enhance post-stroke rehabilitation efforts. Future research will focus on further refining the device and exploring its broader applicability in clinical settings.

Feedback from participants indicated a high level of satisfaction with the usability and functionality of the wearable device. The intuitive user interface, coupled with engaging rehabilitation programs, contributed to a positive user experience and increased adherence to prescribed exercises. Participants appreciated the convenience and flexibility offered by the device, as well as the sense of empowerment gained from actively participating in their own rehabilitation. Overall, user acceptance of the wearable device was a key factor in its success and underscores its potential to significantly enhance post-stroke rehabilitation efforts.

In summary, the implementation of the proposed wearable rehabilitation device yielded promising results in improving outcomes for individuals with post-stroke fingers myopathy. Through the integration of haptic feedback, personalized rehabilitation programs, remote monitoring, and data analytics, the device offers a comprehensive solution to address the unique challenges of post-stroke rehabilitation. Further research and refinement of the device hold the potential to extend its impact and broaden its applicability in clinical settings, ultimately improving the quality of life for individuals recovering from stroke.

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V. CONCLUSION

In conclusion, the development and implementation of the proposed wearable rehabilitation device for post-stroke fingers myopathy represent a significant advancement in the field of rehabilitation technology. Through a comprehensive approach that integrates haptic feedback, personalized rehabilitation programs, remote monitoring, and data analytics, the device offers a promising solution to address the complex needs of individuals recovering from stroke. The results of trials and evaluations demonstrated the effectiveness of the wearable device in improving rehabilitation outcomes. Haptic feedback mechanisms played a crucial role in guiding proper finger movements and enhancing user engagement during exercises. Personalized rehabilitation programs tailored to individual needs fostered motivation and autonomy among users, leading to better adherence and outcomes. The device's wireless connectivity enabled remote monitoring and tele-rehabilitation sessions, providing access to rehabilitation services for individuals with limited mobility or residing in remote areas. Long-term tracking and analytics facilitated data-driven decision-making, allowing clinicians to optimize treatment plans based on individual progress and trends.

Overall, feedback from participants highlighted the device's usability, functionality, and positive impact on the rehabilitation process. User acceptance and satisfaction underscored the potential of the wearable device to significantly enhance post-stroke rehabilitation efforts and improve the quality of life for affected individuals. Looking ahead, further research and development efforts will focus on refining the device, expanding its capabilities, and exploring its broader applicability in clinical settings. By continuing to innovate and iterate upon this technology, we can continue to advance the field of rehabilitation and ultimately empower individuals on their journey to recovery from stroke.

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REFERENCES

[1] Stefan Oniga, József Sütő "Human activity recognition using neural networks" in: ResearchGate Conference Paper - May 2014, DOI: 10.1109/CarpathianCC.2014.6843636

[2] Min-Cheol Kwon and Sunwoong Choi, "Recognition of Daily Human Activity Using an Artificial Neural Network and Smart watch." In: Hindawi Wireless Communications and Mobile Computing Volume 2018, Article ID 2618045, 9 pages.

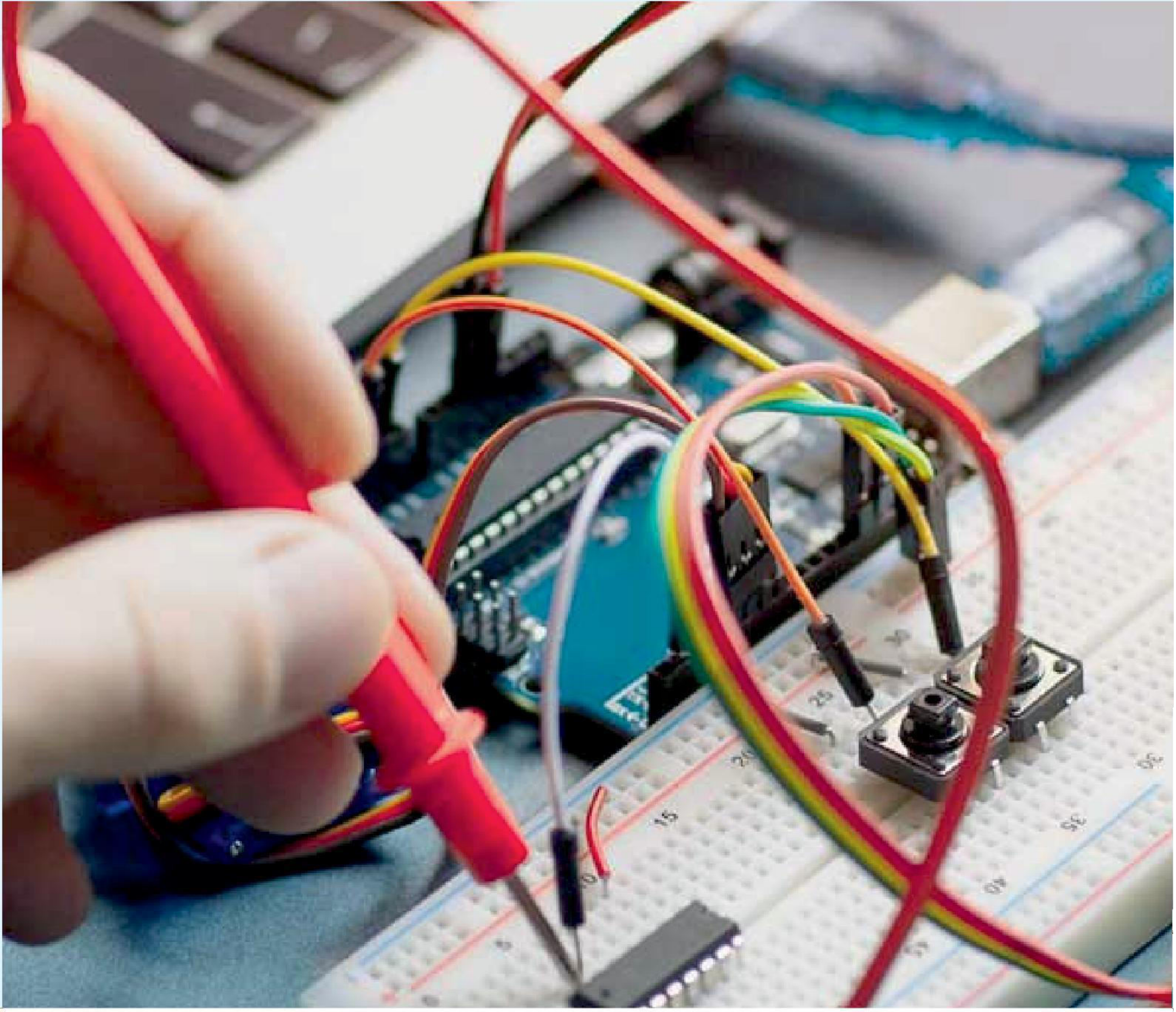
[3] Diego Castro, William Coral, Camilo Rodriguez, Jose Cabra and Julian Colorado, "Wearable-Based Human Activity Recognition Using an IoT Approach" in: J.Sensor and Actuator Networks 2017. DOI: 10.3390/jsan6040028.

[4] V.Padmanabhan, M.Sornalatha, "Hand gesture recognition and voice conversion system for dumb people" in: International Journal of Scientific & Engineering Research, Volume 5, Issue 5, May-2014 ISSN 2229-5518.

[5] U. Maurer, A. Smailagic, D.P. Siewiorek, M. Deisher, "Activity recognition and Monitoring Using Multiple Sensors on Different Body Positions" in: Proc. Of the International Workshop on Wearable and Implantable Body Sensor Netowrks (BSN'06) pp. 113–116 (2006).

[6] Li Wei and Shishir K. Shah,"Human Activity Recognition using Deep Neural Network with Contextual Information" in: VISIGRAPP 2017, DOI: 10.5220/0006099500340043.

[7] Theo Jourdan, Antoine Boutet, Carole Frindel, "Toward privacy in IoT mobile devices for activity recognition" in: MobiQuitous 2018 - 15th EAI International Conference on Mobile and Ubiquitous Systems: Computing, Networking and Services, Nov 2018, New York city, United States. pp.1-10.



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