

Robotic Exoskeleton for Neuromuscular Rehabilitation and Exercise (Fourth Generation)

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Abstract

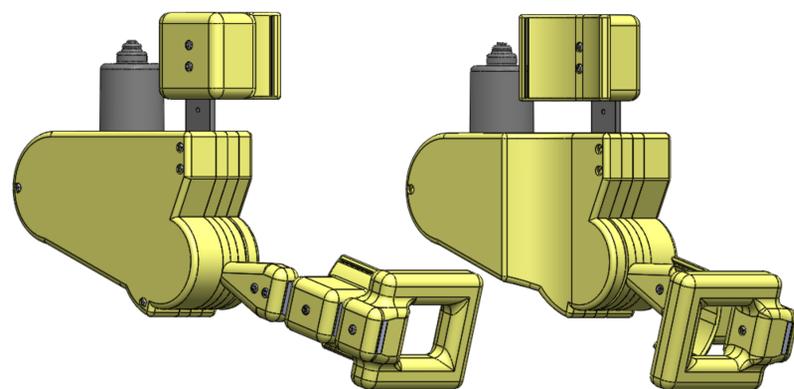
With an increase in the number of stroke patients comes the need for a more efficient method of rehabilitation. This project involves the redesign and enhancement of a non-invasive exoskeleton used for rehabilitation and exercise. The device allows for flexion and extension cycles of the elbow, increasing the user's neuroplasticity.

Brain cells are then able to regenerate and redevelop the neuromuscular system in the affected region.



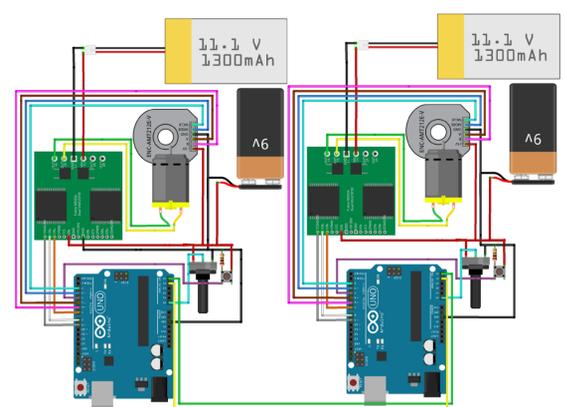
Introduction

The purpose of this project is to design an external apparatus to assist patients with neuromotor impairments as they progress through their rehabilitation.

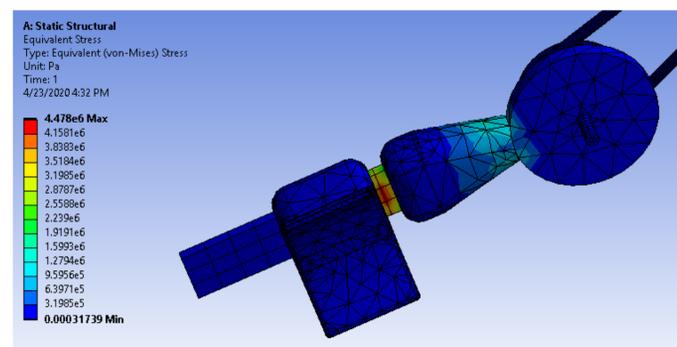


Methods and Materials

The frame of the exoskeleton is made of aluminum and 3D printed polylactic acid. The electrical configuration is comprised of two mirrored circuits. Each circuit includes an ATmega328P microcontroller, a motor driver, a capacitive modular encoder, a DC motor, and two power sources. The system is controlled by an Arduino Uno programmed using the Arduino Integrated Development Environment (IDE).



Results



Discussion

The physical exoskeleton was tested to ensure user safety. Using Ansys software, a 9-lb force was applied to the inside of the forearm cuff to simulate the stress put on the exoskeleton during use. The resulting stresses were found using mesh analysis.

Conclusions

The fourth generation of the robotic exoskeleton for neuromuscular rehabilitation and exercise will improve the lives of patients suffering from the decreased motor ability. The design is optimized to ensure a sustainable and cost-efficient apparatus that puts the needs of the consumer at the forefront.

Acknowledgements

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The design team would also like to thank the students involved in the three previous generations of the exoskeleton.