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Smart Exoskeleton Hand with Soft Electronics

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MULTI-DEPARTMENTAL

Smart Exoskeleton Hand with Soft Electronics

MULT 602 | Team members: Andrew Choi¹, Han Ha¹, Gabrielle Jones², Gregory Zobel² | Faculty adviser: Dr. Woon-Hong Yeo^{2,3}, Dr. Weijun Xiao¹ ¹Department of Electrical and Computer Engineering, ²Department of Mechanical and Nuclear Engineering, ³Center for Rehabilitation Science and Engineering

Background

- \succ Millions of people are affected by hand and wrist related injuries annually
- \succ During rehabilitation, these patients are unable to perform basic activities outside of the supervision of their physician
- \succ There is currently no known device aimed purely at performing basic movements without aiding in rehabilitation

Objectives

- \succ We aim to develop an electromechanical system paired with EMGs to provide extra strength and mobility where it lacks
- \succ We aim to track and display the EMG signals read by the electrodes and display them for ease of the patient



Design and Prototyping

> Prototype Development PQ12 100:1 Linear Actuator with 50N max and 10mm/s max speed Leading link of finger Giove attached at lingertips and palm plate for ease of use

> Confusion Matrix for Characterization





2.73345e-4 Max 2.46011e-4 2.15259e-4 1.84508e-4 1.53757e-4 1.23005e-4 9.22540e-5 6.15027e-5 3.07513e-5 0.00000e0 Mi

Software and Classification

> Program to train and perform real-time classification of the EMG signals written in C and Python > Applies software filters and algorithms to process signals > EMG training uses statistical analysis.





Thumb



Index

Circuit Design

- - 15048 9

-

Differential Input Pins

+9V, GND, -9Vpower supply



- via finger movements.

Future Plans

structural stability.









Closed



STONE DESIGN

EXPO 201

Middle





Pinky

signal threshold to output to Raspberry Pi



Differential Op Amps (Stage 1) Takes in two signals and calculates the difference and outputs one signal Op Amps (Stage 2) Amplifies signals obtained from stage 1 Output pins to Raspberry Op Amps (Stage 3) Amplifies signals and rectifies them using diodes Potentiometer • Op Amp (Stage 4) to adjust output Amplifies signals and smooths it to one

 \succ We successfully fabricated an exoskeleton glove via computational analysis and 3D printing. \succ In vivo test demonstrates real-time, multi-motion classifications

 \succ Design the ExoHand using the Eden by Stratasys for further