Rehab Robotics- Touch Trainer

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Touch Trainer

UCI Samueli School of Engineering

Background

The Center for Disease Control states that approximately 795,000 people suffer from a stroke each year thus making it the leading cause of long- term disability in the United States. When an individual suffers from a stroke, many lose somatosensation in one of their hands. This leads to a loss of the sense of touch (tactile sensation) and sense of movement of their limbs (proprioception). A patients loss of motor function typically affects the entire hand from fingers to wrist and results in much slower and weaker muscles in the arm. Additionally, patients can suffer from spasticity, or stiff, tight muscles that keep the affected hand clenched tight.

Problem and Solution

- Problem: Many rehabilitation facilities for stroke patients focus on assessments of movement and do not focus on the rehabilitation of somatosensation. This lack of focus is not beneficial to the patients and does not result in optimal recovery.
- Solution: Design a device that will focus on the rehabilitation of somatosensation in stroke patients while providing an affordable, portable, and convenient means for doing so.

Innovation

- Our design forces the patient to focus on their sense of touch while using the device
- Actuators will aid to decrease spasticity and vibration motors will increase somatosensation
- Portable stroke rehabilitation- they do not have to rely on accessibility to a facility

Design Criteria

- Compact and portable
- Battery operated
- Beneficial for all ages
- Engages and adapts to user's needs
- Variable difficulty
- Extremely durable
- Controlled movement of fingers between 1.5 cm and 3 cm to avoid strain to impaired hand

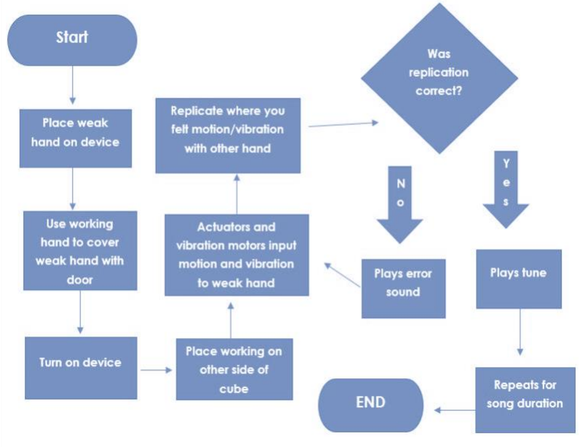
Goals and Objectives

- Improve sensation in impaired hand of stroke patients after 6 months of using the cube
- Manufacture a cube at maximum size of 10" x 12" x 18" that is battery operated
- Have session lengths increase until the user can play a full song
- Have fully developed pseudocode by November
- Use Solidworks and ANSYS for stress analysis
- Determine amount of force applied by hand

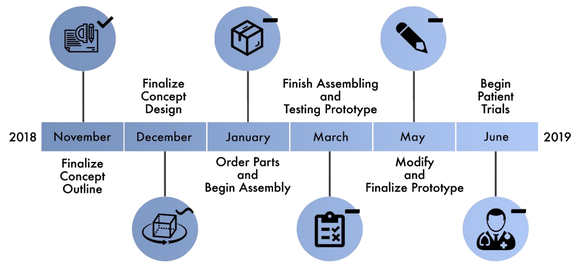
Subsystem Breakdown

Mechanical	User Interface	Code	Testing
Moving parts and overall design	How the user interacts	Control of the system	Range of tests to determine aspects of design
This includes how the fingers will be moving and vibrating.	Donning and doffing: how the user puts the device on and takes it off.	How the game works	Experiments to see how well the design is functioning
6 linear actuators 6 vibrational motors 6 buttons Connections to user interface	Comfortability User hand safety	Raspberry Pi Code of entire system - when actuators will move	"Monkey test" Collection of appropriate data

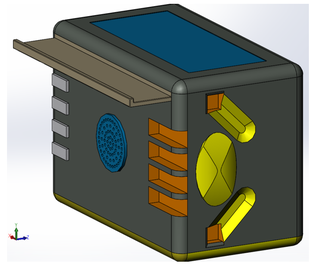
Game Operation

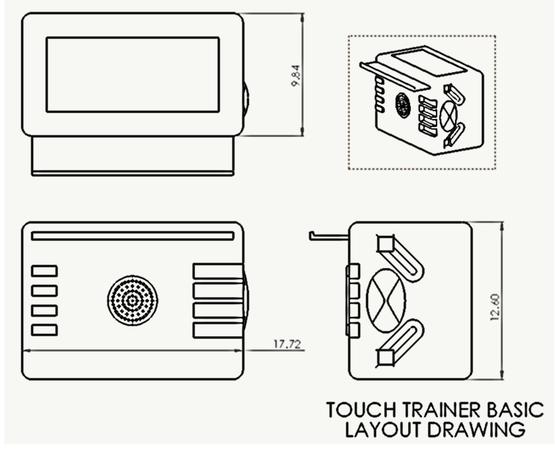


Current Progress



Current Progress





All dimensions in drawing are in inches

Progression:

- Pseudocode: Completed
- Solidworks design: Completion by Fall Quarter Week 10
- Finalization of engaging mechanics, internal components, materials, and user interface: In Progress

The Bigger Picture

- There is no portable somatosensation rehabilitation device available on the market for stroke patients
- This is the first of its kind and will become more beneficial over the 5 year developmental stage
- The cube will record data to make new breakthroughs in stroke rehabilitation
- If beneficial, it could help people worldwide

Resources

- Faculty Advisor: Dr. Reinkensmeyer
- Graduate Advisor: Quentin Sanders
- Medical Resources: Rancho Los Amigos National Rehabilitation Center

Team Specializations

Role	Teammate(s)
Pseudocode/Feedback and Music	Aiden & Eisah
Comfort/Ease of Use (Donning & Doffing) "User Interface"	Jenna, Lindsey, Michael & Yasmin
Mechanical Design	Lindsey, Michael, Eisah & Yasmin
Experimental Testing/Verification	Jenna & Yasmin
Recording/Scribe	Jenna

Budget

- Current budget estimate is around $1,000
- Funding is sourced from a grant given to Professor Reinkensmeyer

Next Steps

- Finalize external and internal components of device
- Begin prototyping
- Test efficiency of device
- Make necessary changes to the model and interface

Contact Information

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