Symphony Solutions

Midterm Presentation

Herui Chen & Izabella Rodrigues
with Larissa and Shayna

Our Team

Herui:

ITP Graduate Student

Bella:

Gallatin Undergraduate Student

Our Community Partner:
Larissa

Larissa has MS which is a disease where your immune system eats away at the protective coverings of your nerves. This causes a disruption in communication between your brain and body.

She is a music lover, DJ, and wife to Shayna.

Larissa’s Needs:

- Doing basic tasks with both hands like cutting and grabbing
- Keeping her left arm moving around to prevent atrophy

How Might We Statements:

- How do we restore the basic functions of Larissa's left arm and hand?

- How should we help Larissa perform actions such as grabbing and moving objects, with her remaining motor functions?

Background Research

1. What is MS
2. Literature Review
3. Competitive Analysis

1. What is Multiple Sclerosis

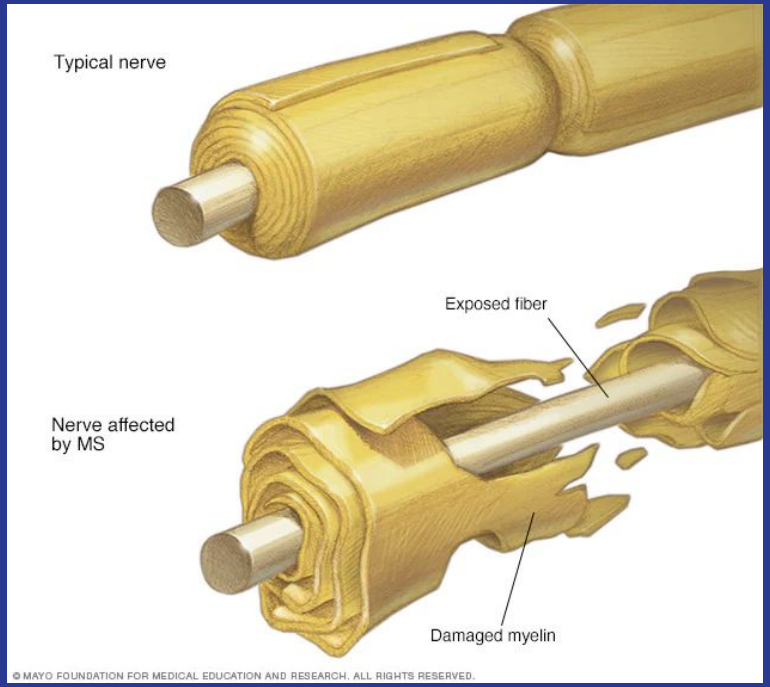
Cause and symptoms

1. What is MS

“Multiple sclerosis (MS) is a disease of the central nervous system.

When the nerves are damaged in this way, they can’t conduct electrical impulses to and from the brain.”

EMG isn’t the right solution



2. Literature Review

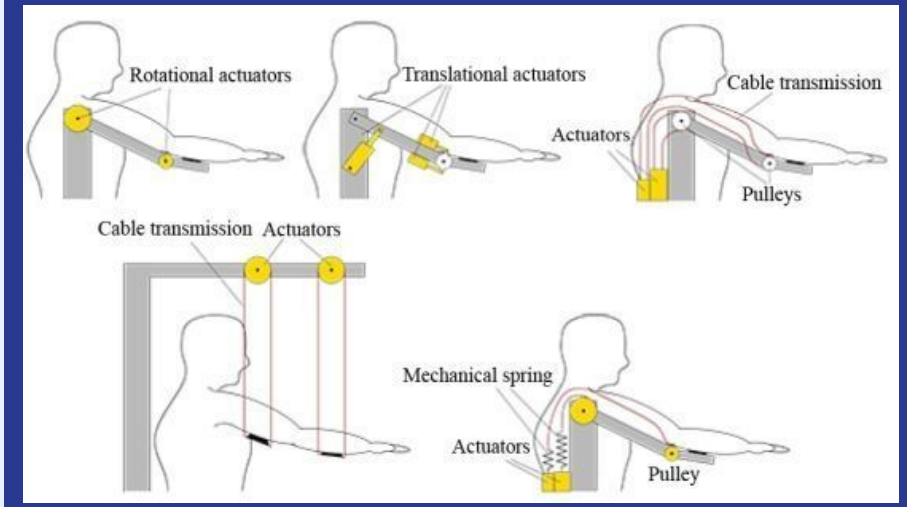
Precedent Research and Studies

2. Literature Review

Mechanically Actuated Exoskeletons

Actuated Arm Support Systems - This refers to a group of arm support systems that utilizes an actuator to assist the movement of the user's arm.

The paper provides an overview of different types of actuators used for arm support, and different design strategies that stems from them.



2. Literature Review

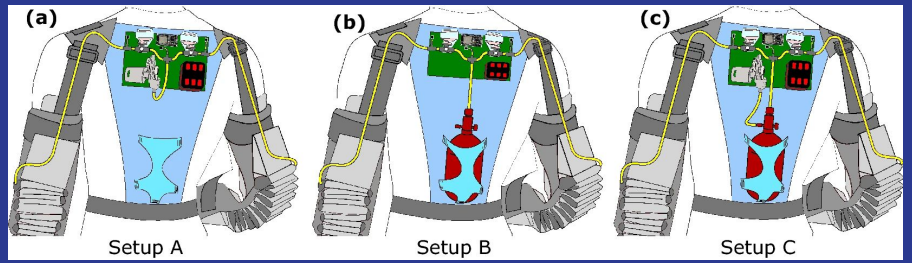
Soft Actuators / robotics

Positives:

- Force applied to the user can be variable
- More gentle and comfortable compared to mechanical solutions
- Relative Simplistic

Negatives:

- Poor durability and reliability: Repeated inflation and deflation will eventually cause structural failure.



2. Literature Review

Spring-loaded parallel mechanism

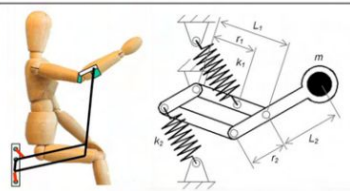
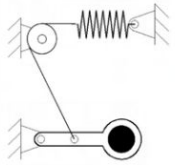
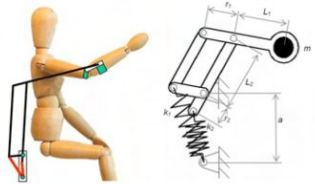
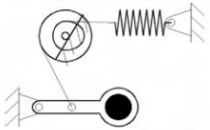
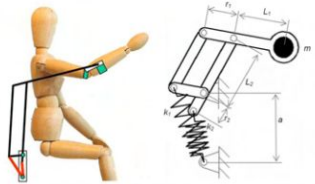
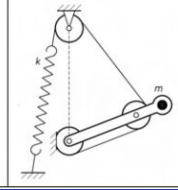
This design utilizes a mechanism to counteract the weight of the user's arm. This design has the following characteristics:

Positives:

- Reduction of operating effort (high balancing quality and low friction)
- Large range of motion

Negatives:

- Needs to be mounted on a static surface (e.g. a wheelchair). Not sure if a portable variant can exist.

	Kinematic architecture	Balancing principle	Picture	Error
Mark I				5% (*
Mark II				3% (#
Mark III				0,5%

3. Competitive Analysis

Existing Products

Rehabilitation Robotic Gloves

~$136

Pros: Cheap

Cons: Sketchy

Kinova Jaco Assistive Robotic Arm

~$50,000

Pros: Lightweight, compact

Cons: Fixed onto a wheelchair, expensive

Neomano

~$2,000

Pros: Lightweight, compact, portable

Cons: Ineffective according to reviews

MyoPro

~$86,000

Cons: EMG sensing (may not work on MS patients), expensive

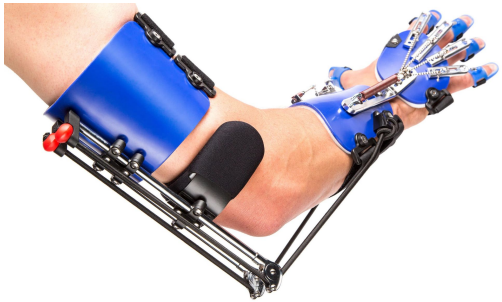
Pros: Restores function that Larissa wants.

SaeboReach

~$699

Cons: Not sure if Larissa has enough grip strength to use this device.

Pros: Relative affordable, opens her hand

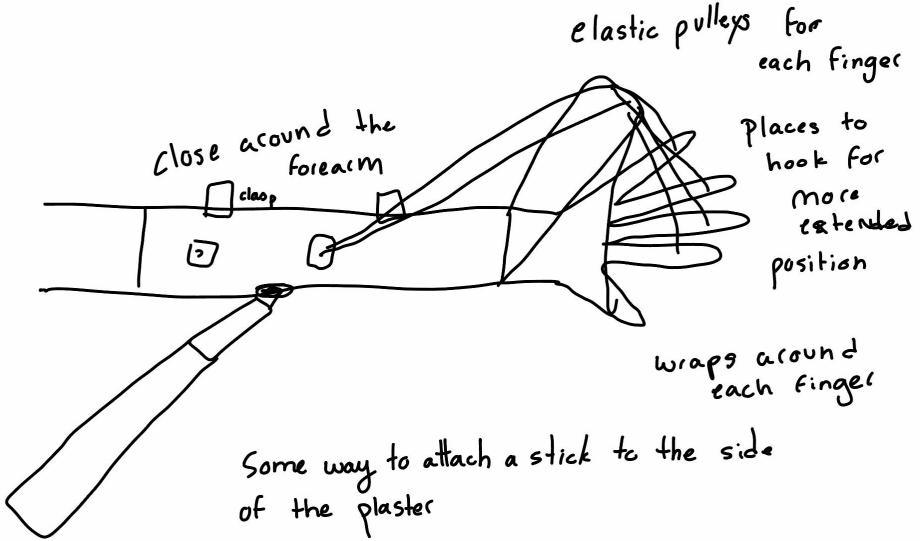


Summary of Meetings

- Monday October 2, 2023: First meeting as a group! We all got to meet each other, get to know one another and get an overview of the needs that Larissa has.

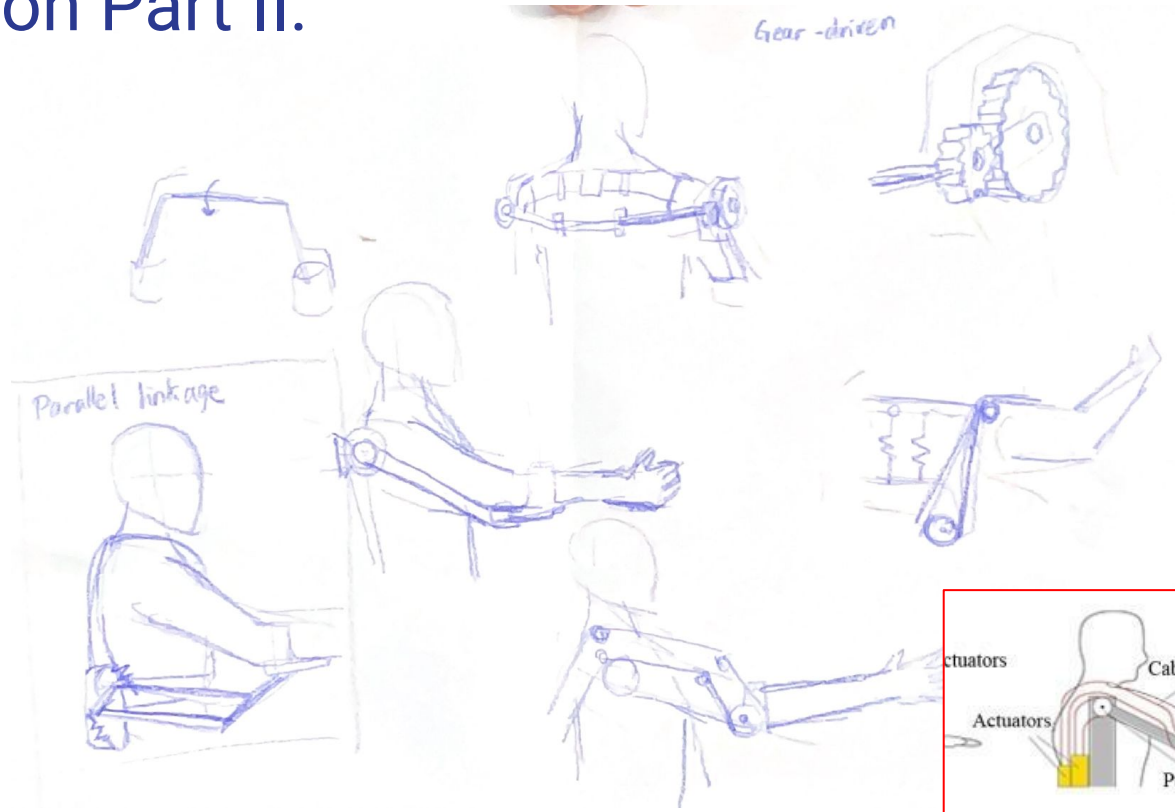
- Sunday October 22, 2023: Second team meeting. Herui and Bella presented weeks worth of research of soft robotics, clinical research in Chicago area, robotic arms, and rehabilitation devices. Entire group came to a conclusion about what the semester project and assistive device will be.

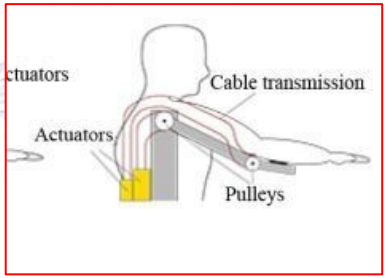
Planned Solution Part I:



Planned Solution Part II:

- Provide left arm support
- Move left arm support using right arm easily
- Purely mechanically powered mechanisms (springs, pulleys, gears, etc)





Timeline


OCTOBER 2023
SUN MON TUE WED THU FRI SAT
1
2 1st Meeting
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Research
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Research
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Research
22 2nd Meeting
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NOVEMBER 2023
SUN MON TUE WED THU FRI SAT
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7 Lo Fidelity Prototype
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21 Prototype on Proof of Concept
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DECEMBER 2023
SUN MON TUE WED THU FRI SAT
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5 Form Factor Prototype
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final alterations
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making object
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14
Public access
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19 Final Prototype
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cardboard prototyping
very basic operatus
tests out basic design principles
+ work on clasping around the arm and being secure
+ finding best materials
trial + error, how can we improve the device

Summary of Our Goals

1. Build Prototype
2. Finish Model
3. Continue external research for movement related technology
4. Find a way for this device to be open access.