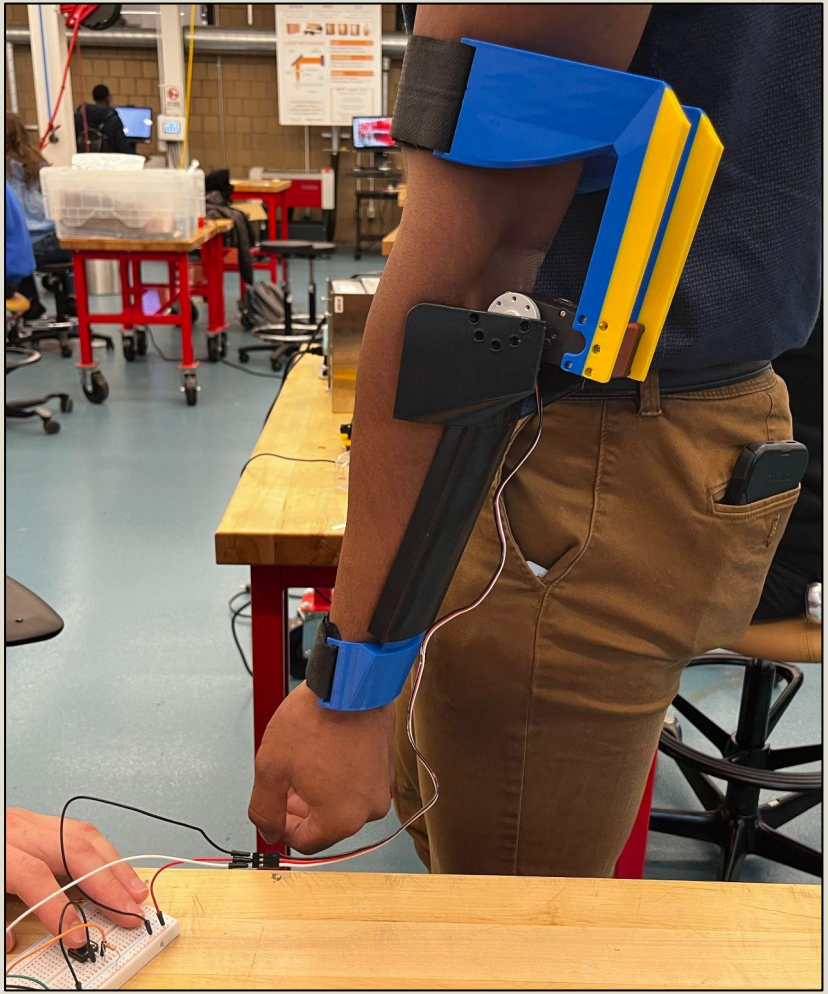
Elbow Extend-inator 3000

Thomas Bukosky, Angel Walker, Andre Cordova - FED101-N51 Professor Moon



Design Goal

The device aims to enhance mobility by providing additional power while allowing for a natural range of motion, improving functionality and accessibility for individuals in need of physical support.

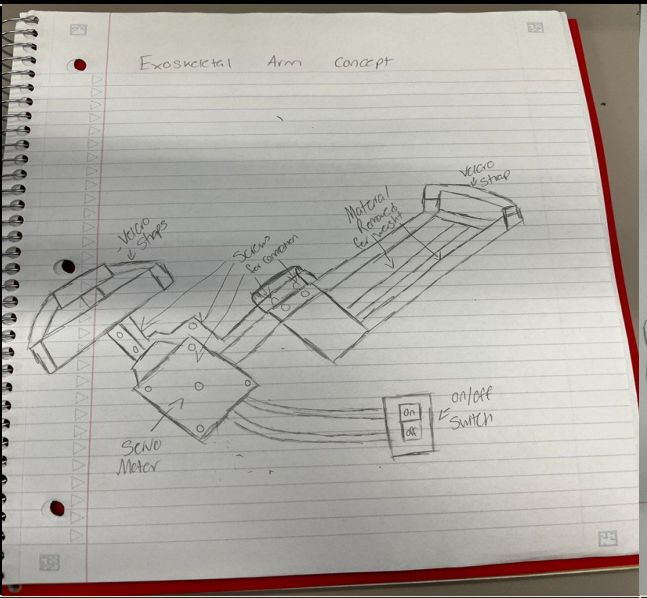
Design Requirements

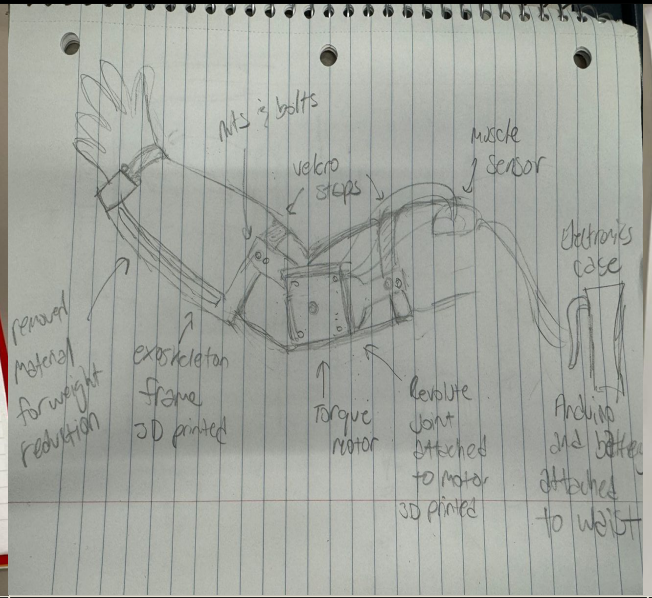
- Lightweight but Sturdy
- Adjustability
- Reliable
- Affordable
- Mechanism to actuate motor should be easily achievable by the user

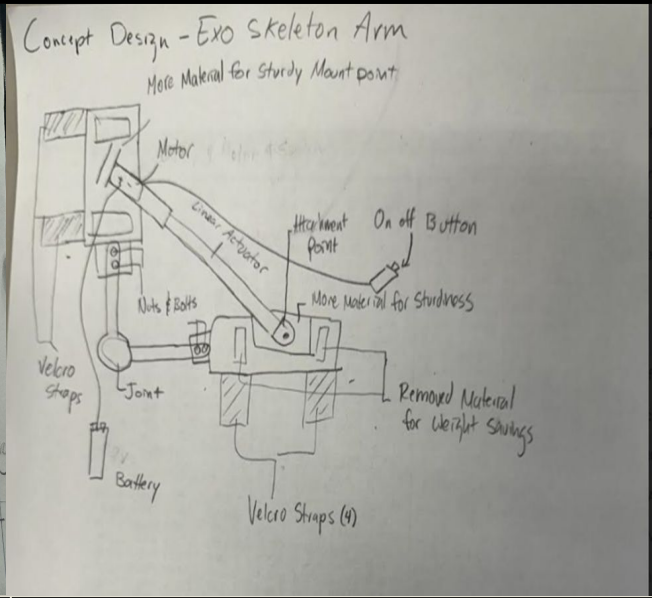
Design Constraints

- Natural range of motion
- Cannot be uncomfortable
- Heavy
- Expensive

Early Concepts







Concept 1

- This design utilizes a servo motor in combination with an on/off switch

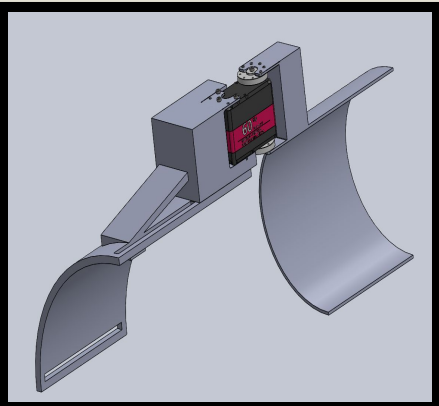
Concept 2

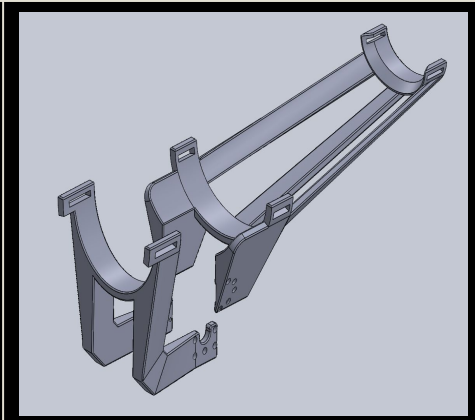
- This design also utilizes a servo motor, but the main difference is the muscle sensor used to activate the exoskeleton

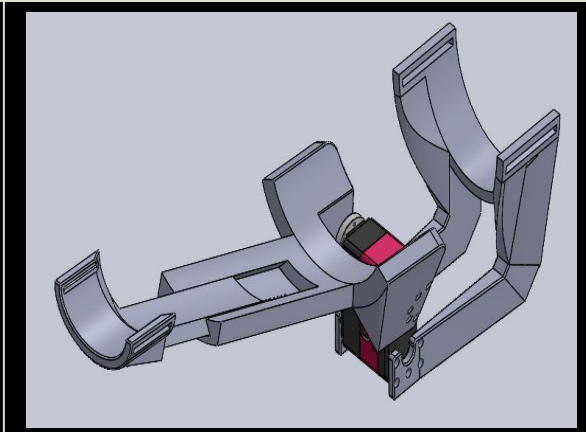
Concept 3

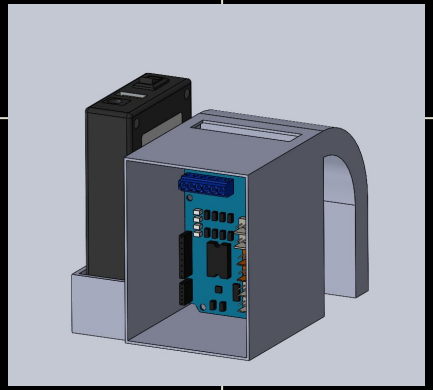
- This design differs from the previous two because it utilizes a linear actuator instead of a servo motor.

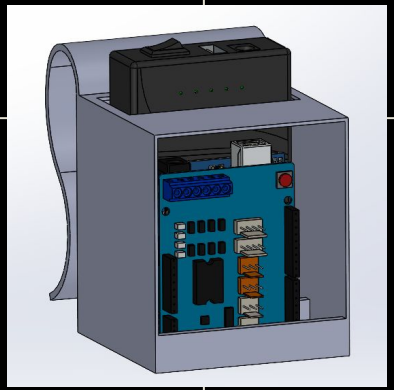
Early CAD Models



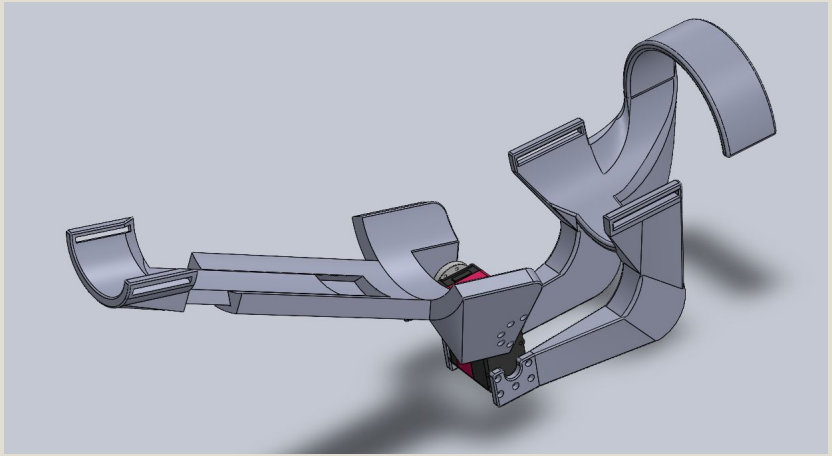




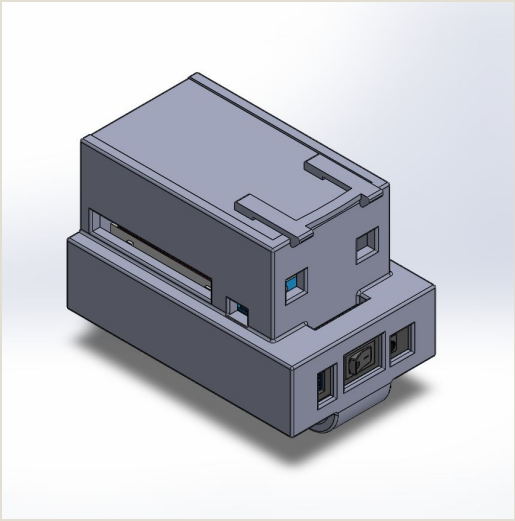




Final CAD Models

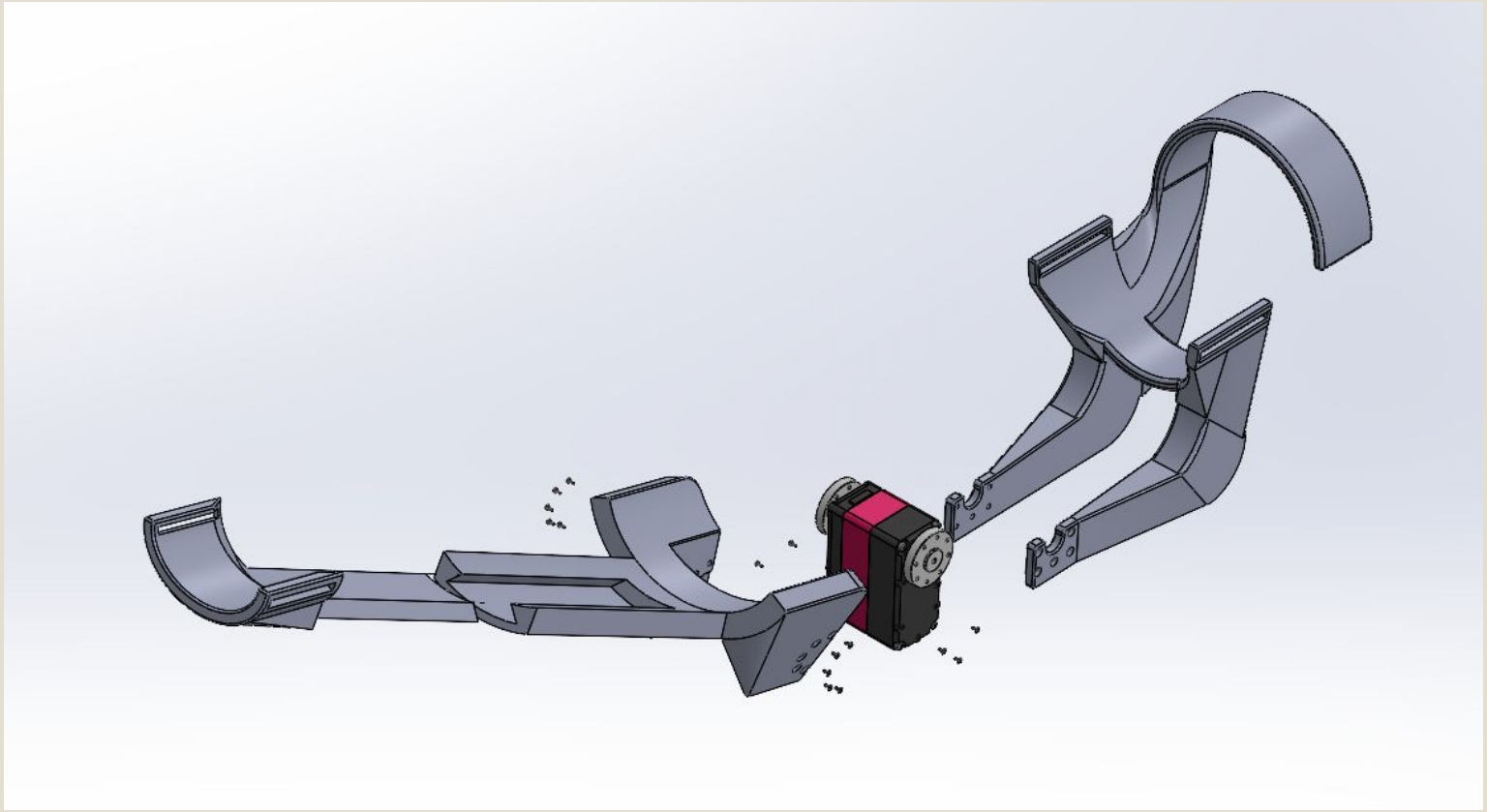


Improvements
- Support band for torque output from servo motor
- Increased thickness and added curved edges
- Padding



Improvements
- Electronic components all in one packaging
- Ease of access to parts
- Includes belt clip

Arm Assembly Exploded



Bill of Materials

Arduino Nano	$ 9.99
Servo Motor	$ 36.98
12v Rechargeable Battery	$ 32.99
Velcro Straps	$ 9.99
Muscle Sensor	$ 18.45
PETG	$ 6.23
9v Battery	$ 5.99
9v Connector	$ 1.27
Total	$ 121.89

Future Work

- Material
- Comfort
- Attachment Improvements
- Added degree of freedom
- Electronics optimization
- Improved range of assistance

Self Reflection

- Design
- Development
- Manufacturing
- Enjoyment
- Key Learnings

Off the shelf parts used

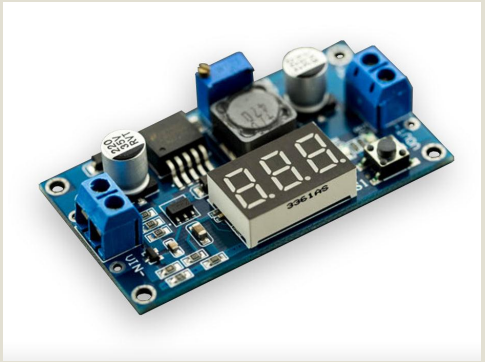
Servo Motor
- 80 kg cm torque
- 8.5 oz weight

Muscle Sensor

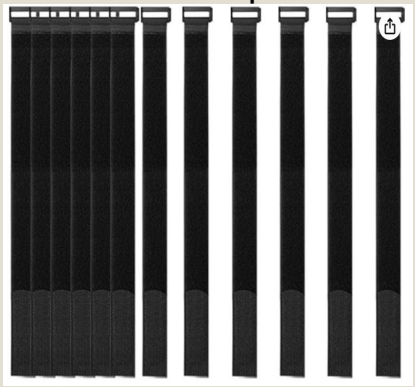
Talentcell 12v

Arduino Nano

Buck Converter



Velcro Straps

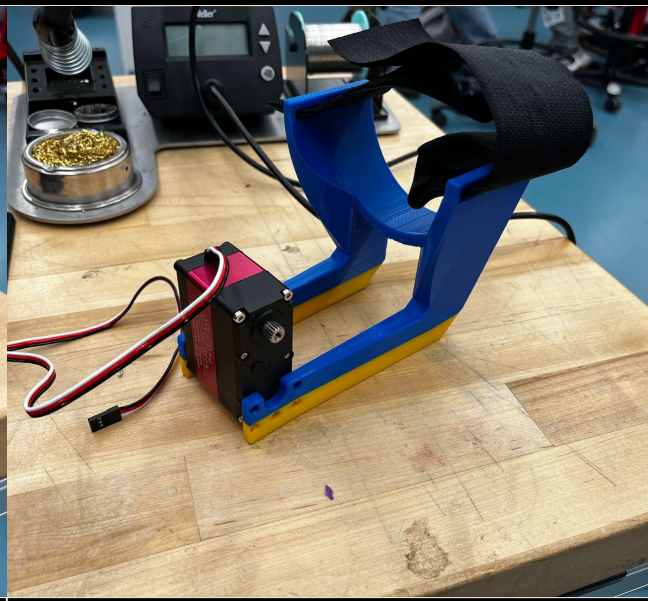


First Iteration - Stationary Arm

The main flaw with the initial design was that the slot for the Velcro strap wasn't wide enough.

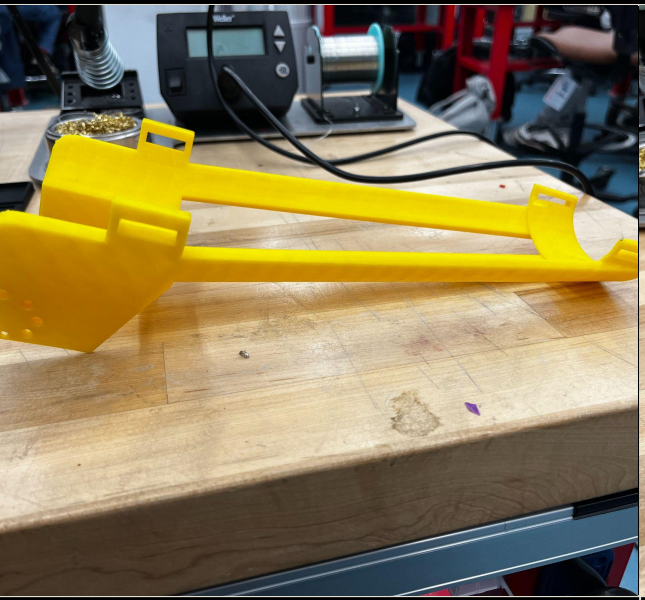
Second Iteration - Stationary Arm

The second iteration improved the flaw from the first iteration, but we still weren't satisfied with the way it was operating



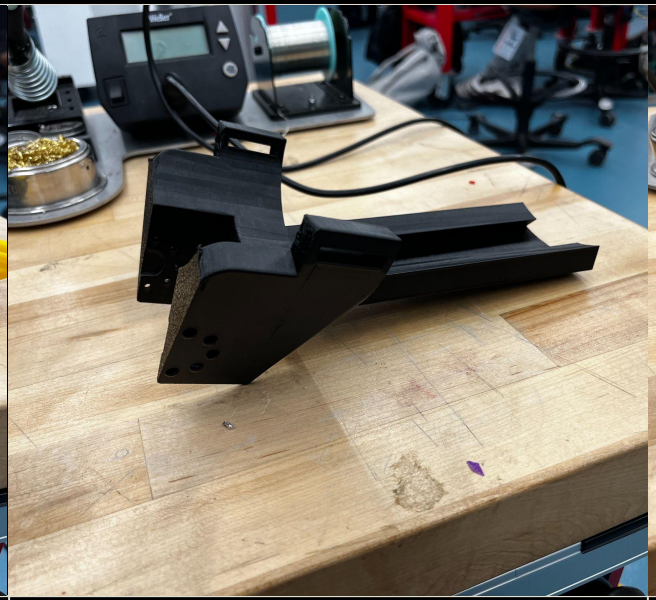
Final Iteration - Stationary Arm

The final iteration improved upon the flaws of the previous two, and the servo is now resting in the correct orientation



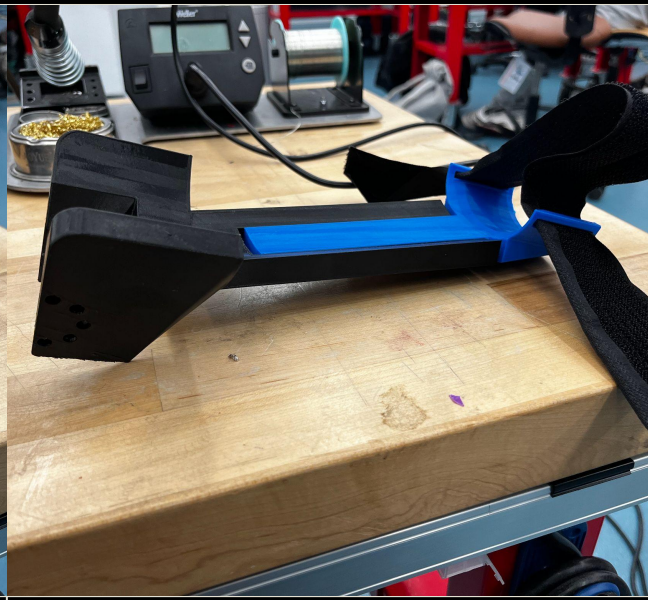
First Iteration - Receiving Arm

The main design flaw with this design is firstly that the slots for the straps are too small. With this design the rotation point was also not able to adjust to the user's elbow.



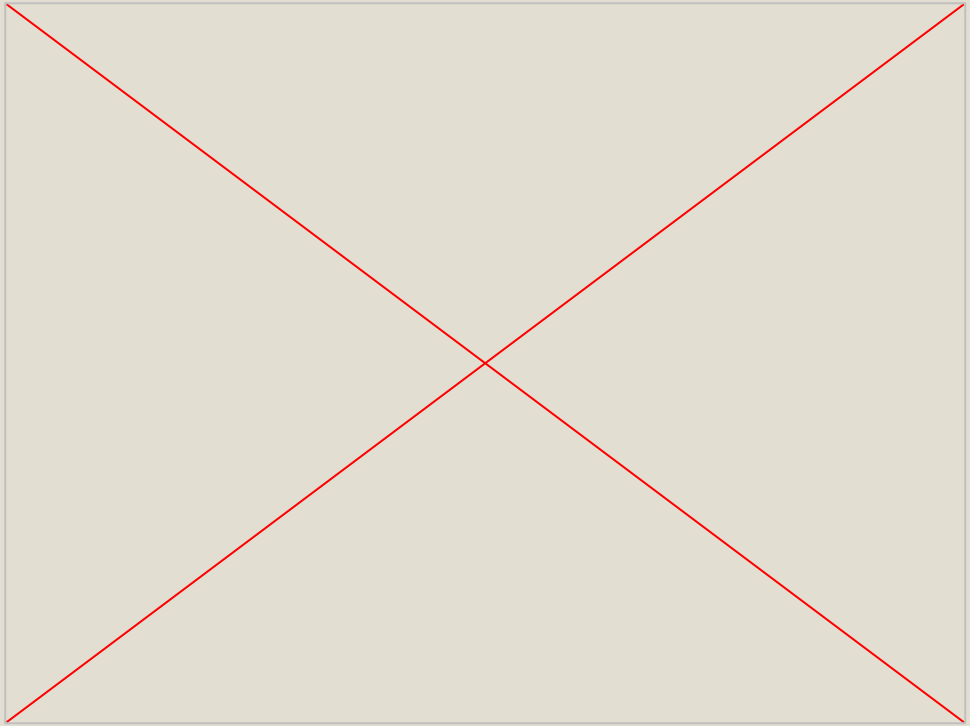
Second Iteration - Receiving Arm

This iteration doesn't really have any major flaws, however, some adjustments were needed for the device to operate as intended.



Final Iteration - Receiving Arm

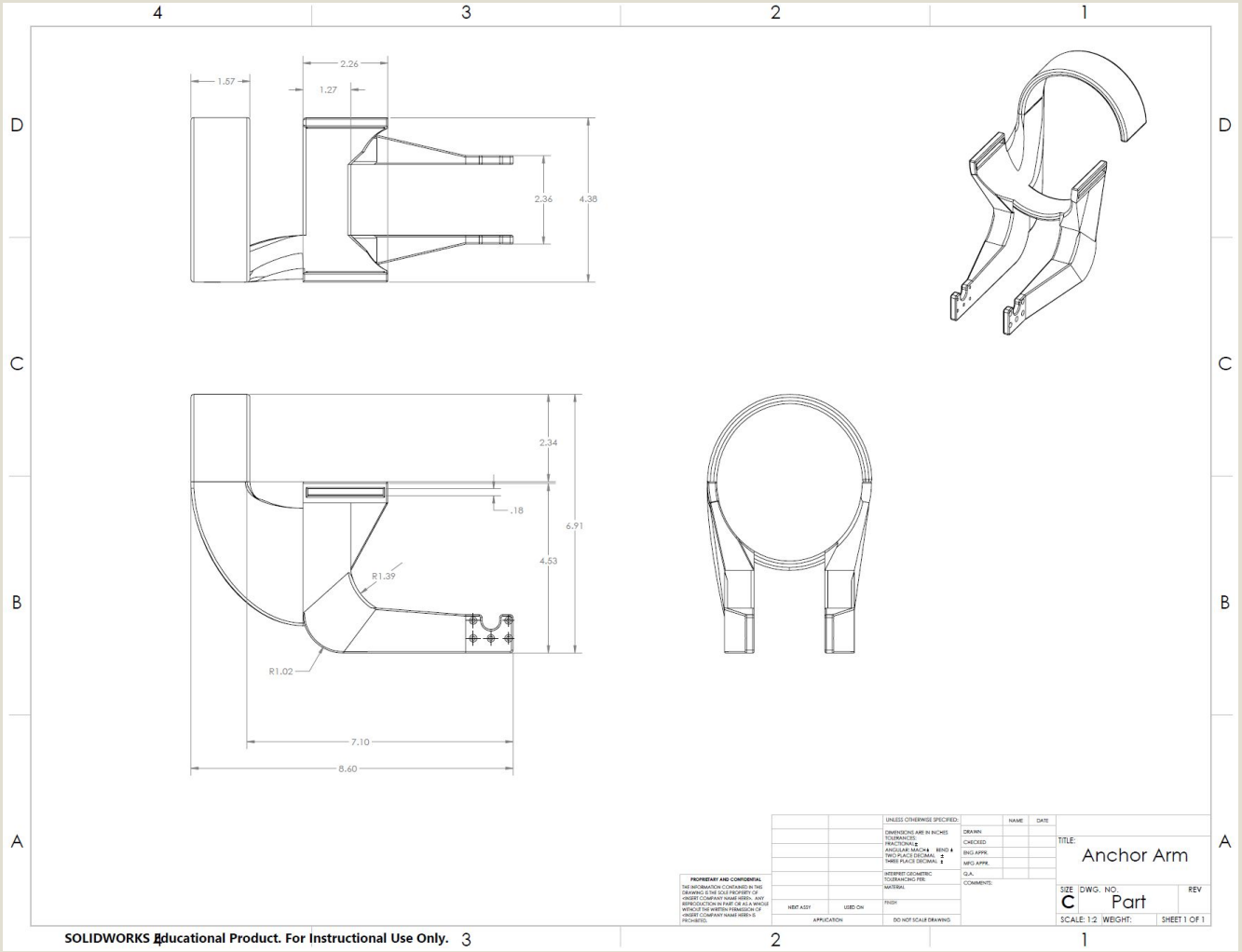
The final iteration solves all of the previously mentioned problems. The rotation point is now adjustable to the user, and the device fits better on the arm.



Conclusion

- Key learnings
  - Iterative design process, the process of going from a concept to CAD to prototype
- Future work
  - Design can be improved by consolidating electronics further, using higher quality materials, and improving the emg muscle sensor attachment longevity
- Final thoughts
  - Developed technical skills, problem solving skills, and time management
  - Allows for future innovations into mobility assistance technology

Drawings: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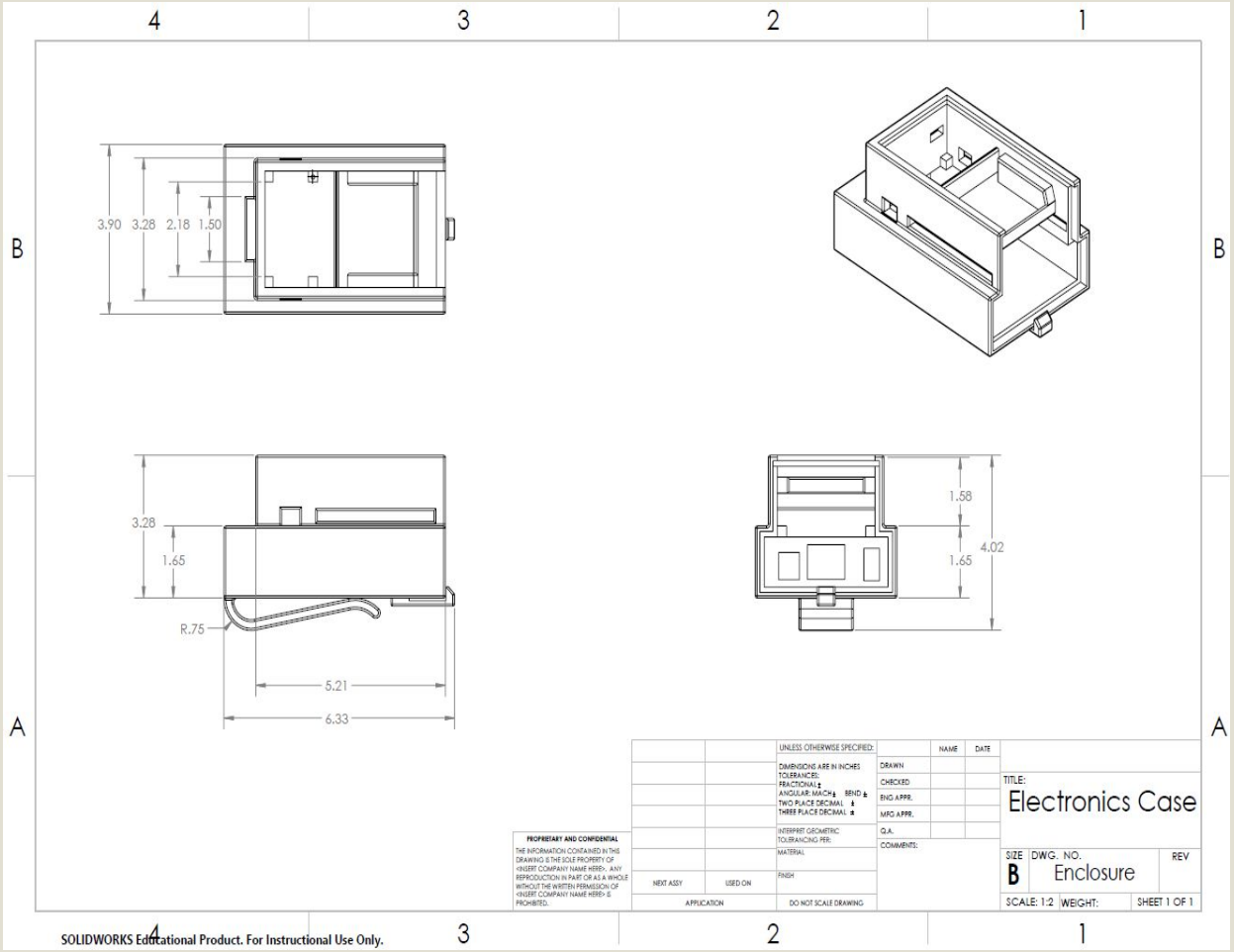
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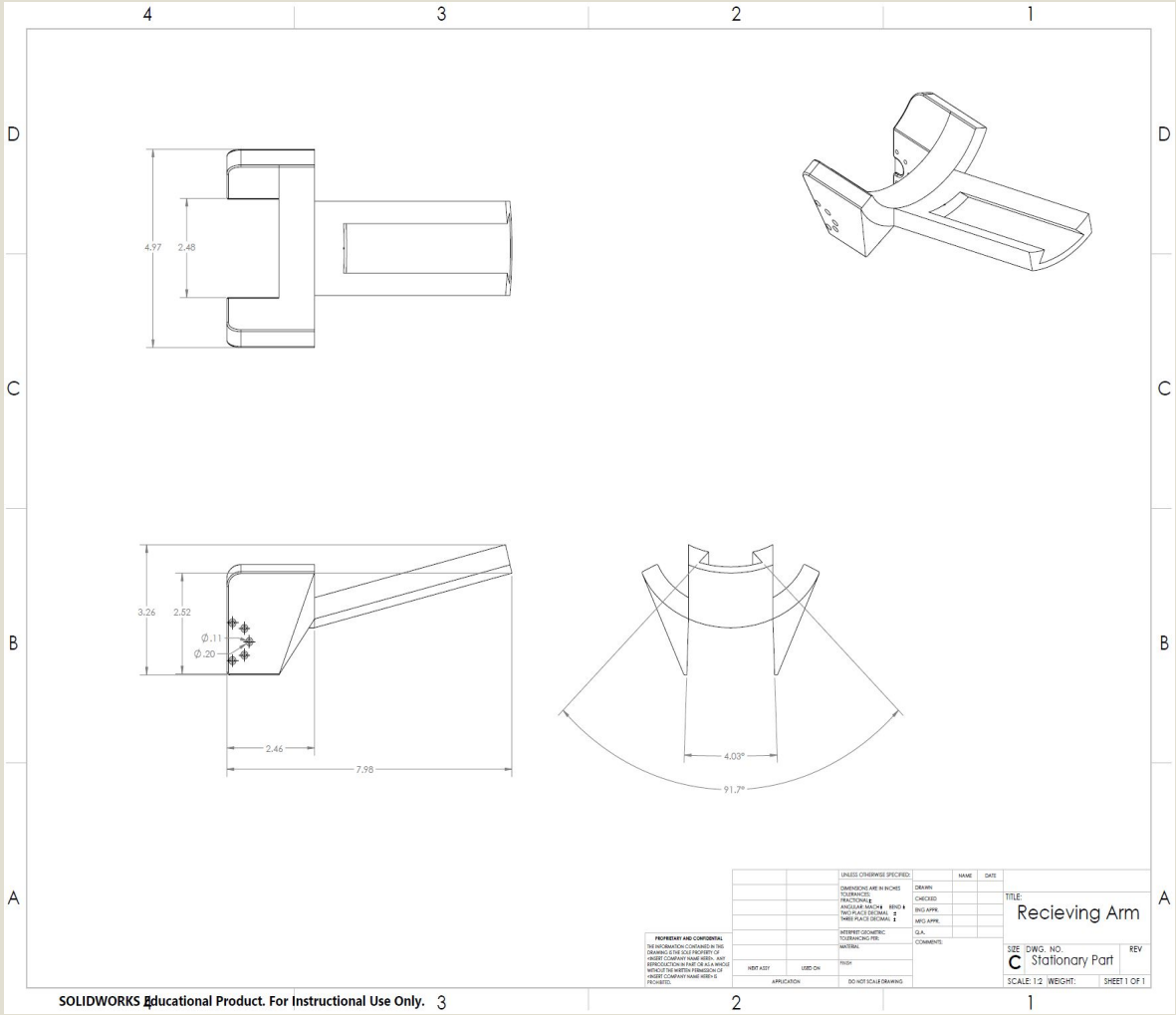
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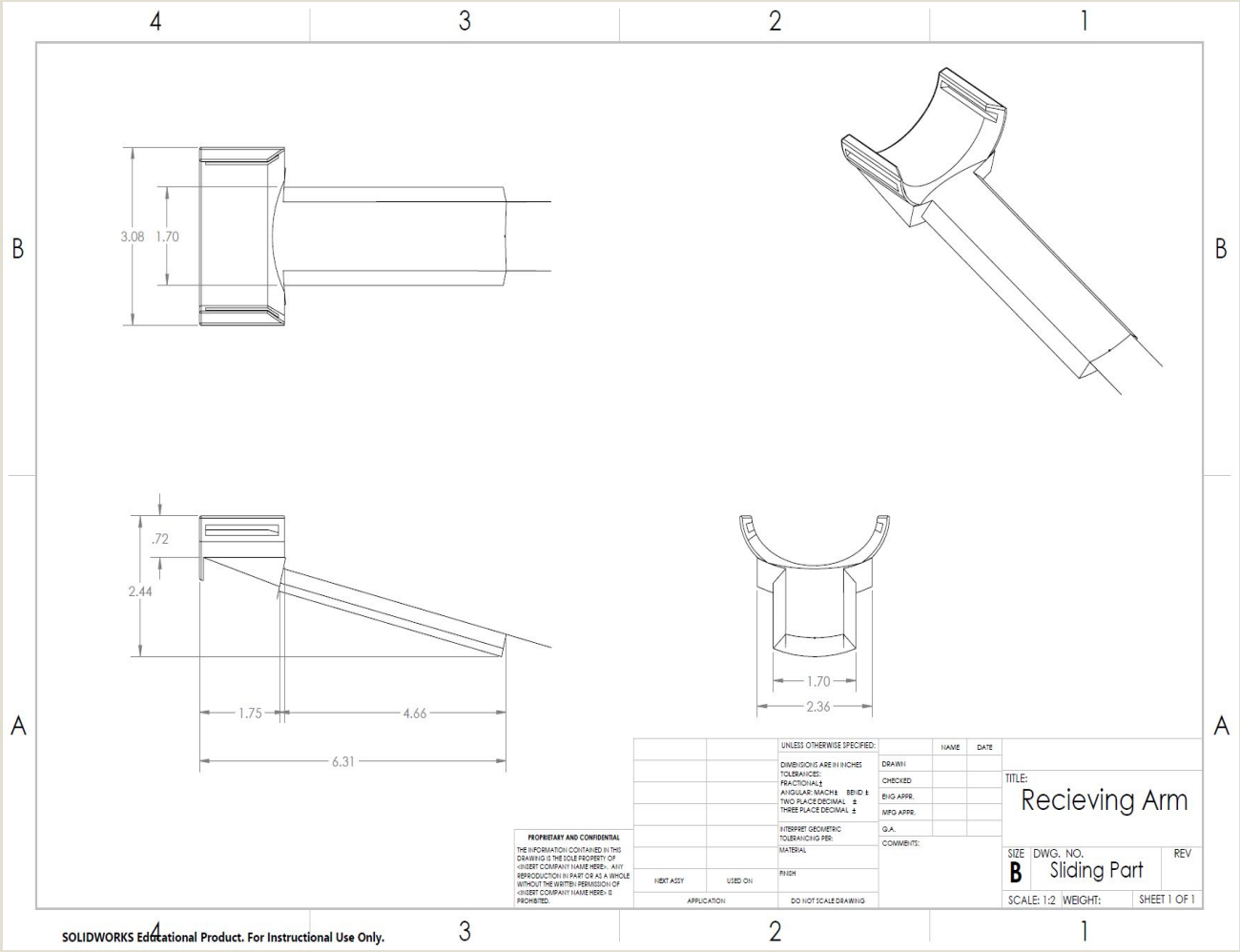
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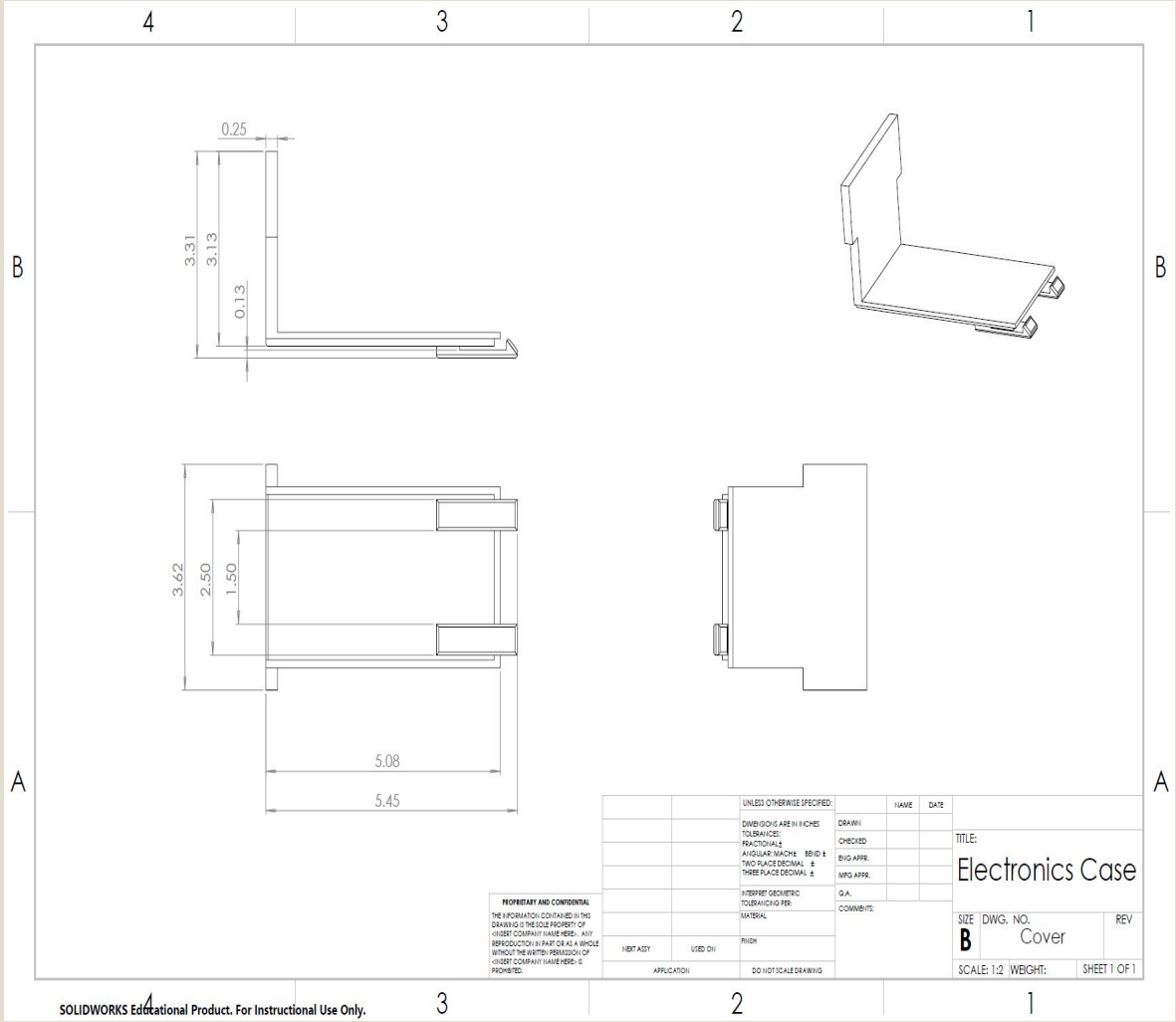
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Electronics Case
Cover
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