Robotics and Automation – Arm Exoskeleton

Final Demonstration Summary

Colin Cipolla

Dylan Kurz

Jordan Finger

Michael George

Michael Marchica

2022-2023

NORTHERN ARIZONA UNIVERSITY | College of Engineering, Informatics, and Applied Sciences

Project Sponsor: W.L. Gore

Faculty Advisor: Dr. Zachary Lerner

Instructor: Armin Eilaghi

Summary:

The final prototype for Project 11 Robotic Arm Exoskeleton currently includes 4 of the 6 main components of the final design: the shoulder plate, the hinge, the pulley, and the arm cuff (Figure 1, 2, and 3). These components are how the prototype will be attached to the user and transmit assistance to the user from the motors. The current prototype is wearable and durable enough that the team can move its components which visualizes how the prototype operates at its current state. The prototype has been made entirely out of PLA which makes most parts durable for now except for one; the shoulder lever. It's one of the smallest and thinnest parts of the design that has the highest potential to break. The team plans to print this part out of a stronger material such as Carbon Fiber or Onyx because of their high tensile stress and flexibility.

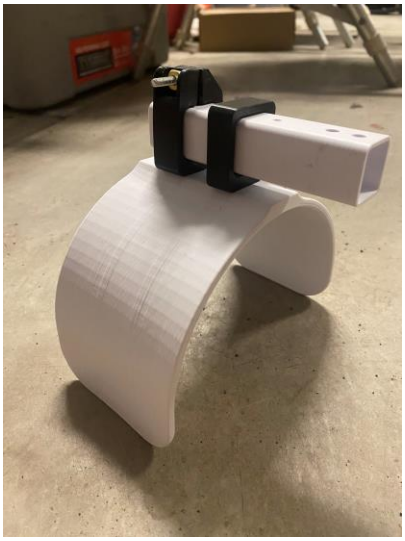

Figure 1: Arm Cuff

Figure 2: Prototype Assembly

Figure 3: Shoulder Plate, Hinge, and Pulley

The plan moving forward for the team is to flesh out the prototype over the winter break and have a final design ready by January 5th, 2023. The biggest issue with the current design is that it does not allow for an adequate range of motion in the frontal region. To fix this issue the team is planning on creating a ball and socket like joint at the shoulder, to mimic the actual joint of a human shoulder. This will allow for increased movement and flexibility. The team is planning to go through multiple iterations of this ball and socket joint design to try and get the most efficient and effective prototype. Another issue the team was facing with the current prototype was the lack of stability when raising the arm in any direction. To combat this the team wants to implement a rock climbing like harness system to the exoskeleton, this way the harness will go through the legs of the user and support the system from underneath. In addition to the leg harness there will be a harness that travels along the collarbone and upper chest to stabilize the system at the top. With both harnesses there should be little to no unwanted movement or sliding issues. One thing that the team must keep in mind when redesigning is to ensure that the system will still be able to connect and interface with the elbow exoskeleton system that Dr. Lerner already has. In conclusion, the main goal moving forward is to redesign the hinge joint and create a better stabilization system over the winter break, to allow the team a step ahead when the spring semester begins.

Appendix:

CAD Model of the Prototype