Carnegie Mellon University

16-681

MRSD Project 1

Individual Lab Report 6
Team C - COBORG

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Sponsor:
Biorobotics Lab

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1. Individual Progress

For this time period, I primarily focused on creating the CAD design of the upgraded COBORG housing. This includes everything outside of the camping backpack frame. The main points of upgrade are the 80/20 extruded aluminum components. We decided to increase the rigidity of the frame by going from a square 1” by 1” channel to a rectangular 1” by 2” channel width. This allows us to easily tie the two channels together through the back of the frame, without the need for additional brackets.

I also designed seven new 3D printed components to assist in various aspects of the COBORG system. For our camera mounting, it was clear that we needed a component that allows rotation of the cameras in both the X axis and the Z axis. We could not find an off the shelf component that would accomplish this so I created a 3D printed assembly that allows these features to exist with our Depth and Tracking camera modules. I also created a 3D printed bracket to hold the battery packs, a bracket to hold the speakers to the 80/20 aluminum extruded frame, and a bracket assembly to hold our processing unit, the Nvidia Jetson Xavier AGX, to the rear mounting sheet.

The rear mounting sheet is a ¼ sheet of plastic that we will be press fitting in threaded inserts. These inserts will allow us to bolt in our electrical components to the rear of the frame.

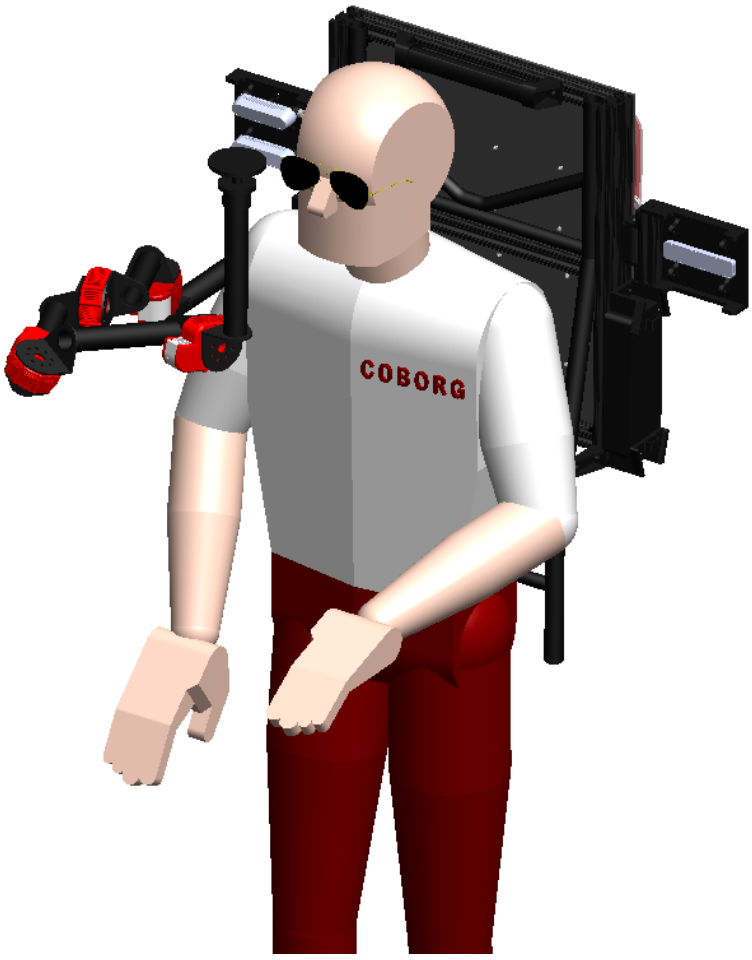

Figure 1. CAD Design

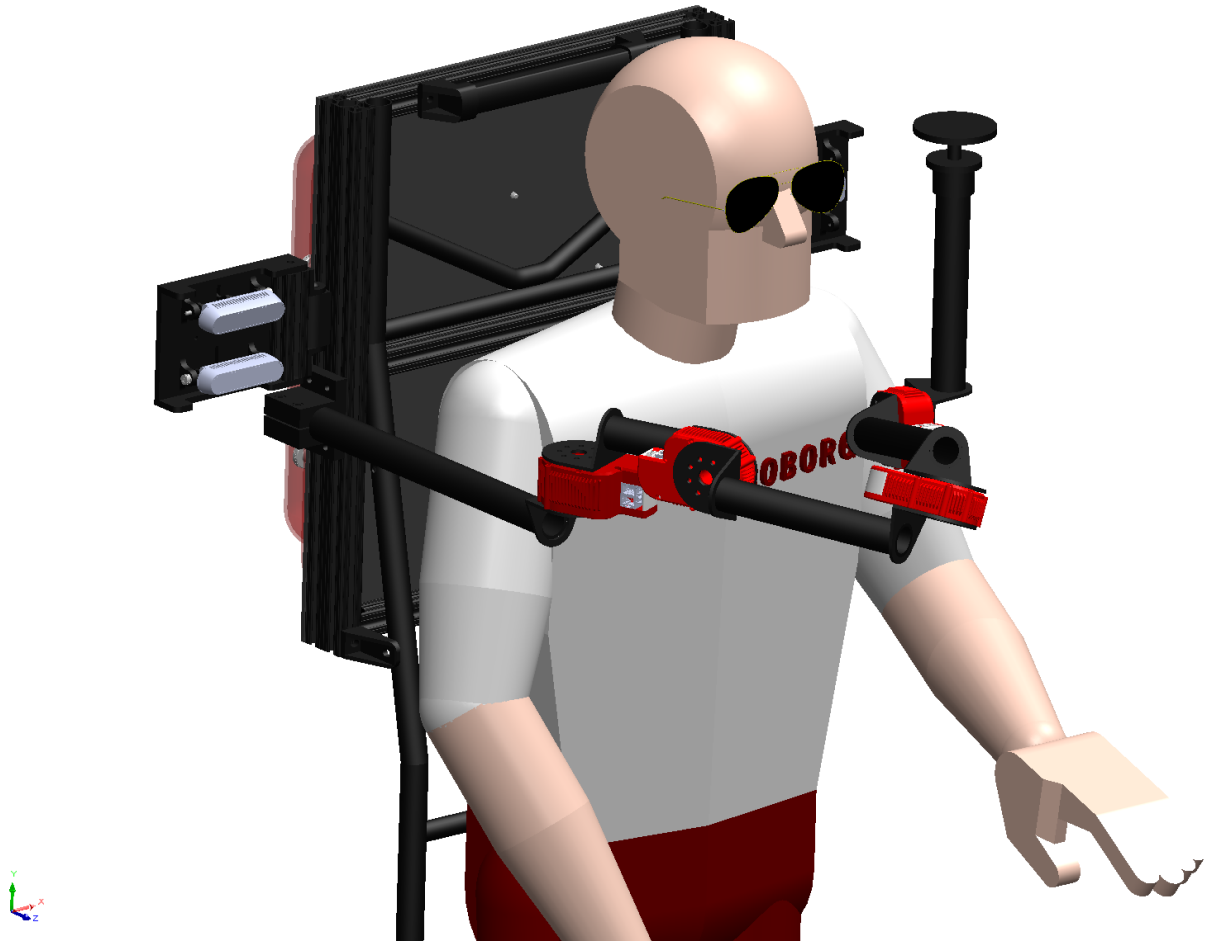

Figure 2. CAD Close Up Shot

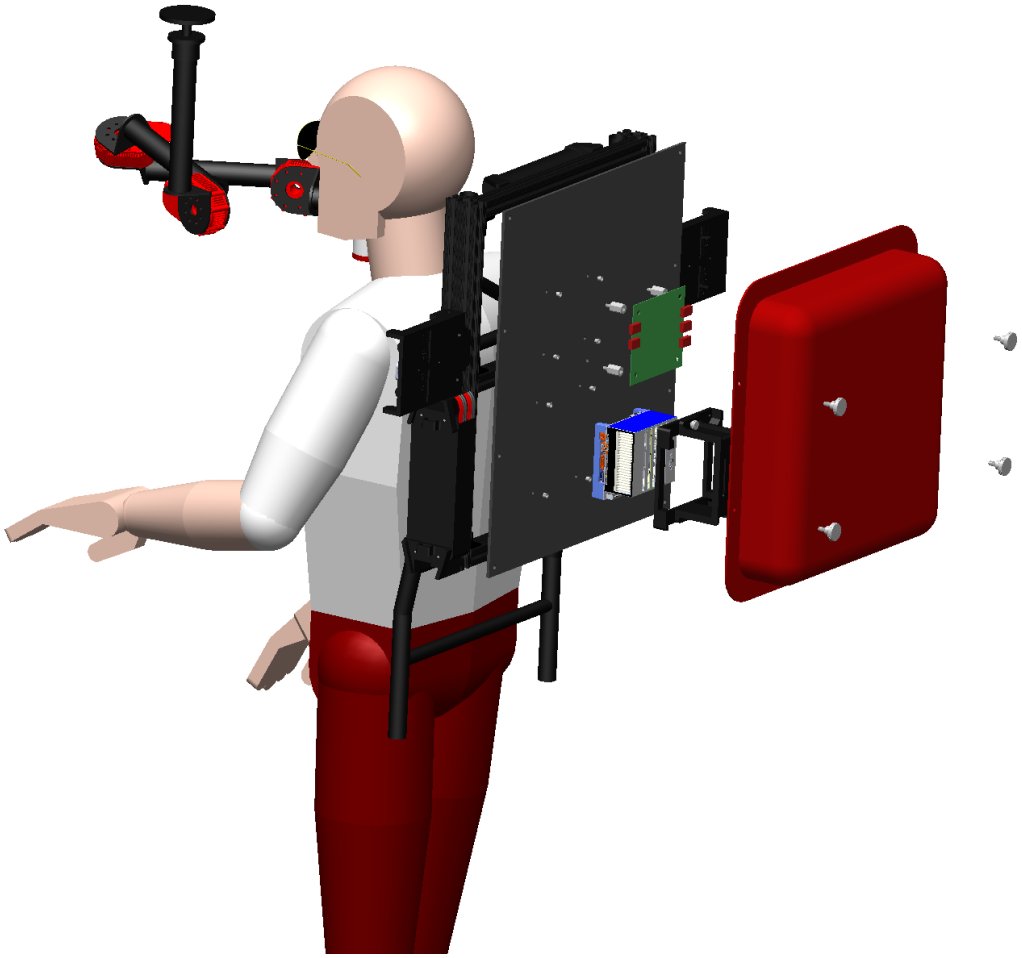

Figure 3. Exploded View

2. Challenges

A challenge that we are facing is that the depth camera we are using, the Intel D435i, only has a field of view of 50 degrees. This may not be enough to capture both hands in a fully integrated system. To account for this risk, I designed a 3D printed camera assembly that accommodates up to 3 cameras per side, and can be mounted on both sides of the operator.

Another challenge that I am facing is ensuring that all development is done on our Github repository. We have adopted some unfavorable habits of making local changes that are not tracked on the repository, then when it comes time to demonstrate functionality a person says "Oh that is not on the Github, but it's here locally." This introduces problems such as some team members using outdated code from another team member who made recent updates that are not reflected in the central repository. To combat this, I am enacting a strict weekly deletion of all local files to ensure that we recompile from Github regularly.

3. Teamwork

Below I detail the progress of the team as the project progresses:

- Jonathan Lord-Fonda:

  Jonathan is incharge of integration and validation testing, and this semester he will also work on the "Smart Manipulation" subsystem. He wrote task space requirements for the COBORG, created a program to check the mechanical work space against the task space, and helped update the Fall integration timeline.

- Gerry D'Ascoli:

  Gerry has been the technical lead for our electronic hardware components and the voice subsystem. This semester, he will be working on the "Smart Manipulation" subsystem and introduce advanced methods of stabilization to the COBORG robot arm. He worked on getting all of the code base transferred from the Zotac x86 platform to the Xavier arm64 computer. He also performed updates on the voice recognition system to improve performance and reduce false positives.

- Feng Xiang:

  Feng is incharge of the motion subsystem of the Coborg. In this period he installed and configured actuation manipulation nodes into the Xavier Jetson. Then he created URDFs or proposed robot arms and performed simulated SVD

testing through RViz, and finally he created arms out of cardboard in preparation of hands-on testing of task space of arms.

- Yuqing Qin

  Yuqing is the vision subsystem lead for the COBORG project. She migrated the vision subsystem from the Zotac x86 platform to the Xavier arm64 platform. She also integrated subsystems together, cleaned up the vision nodes, and optimized the vision pipeline for extracting 3D position.

4. Plans

We plan on really focusing on creating the parts from the CAD model in the upcoming progress review. We also want to have tangible progress towards upgrading our current robot arm to be able to fully articulate in the task space defined. To do this, we must define exactly what our task space is, and then work on the arm to meet our requirements. We also need to do thorough testing with the mounting positions of the camera, to ensure that we have sufficient view of our task space.

My personal plans are to iterate on the CAD model through the 3D printed files I create, integrate the hardware into the new COBORG platform, and get started on updating our main node that interacts with all other parts of the system. We want to have one unified setup for the Fall Validation Demonstration (FVD).