Carnegie Mellon University

16-682

MRSD Project II

Individual Lab Report 8
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 designing the 4 degree of freedom (DOF) arm for the COBORG. This required purchasing the 1.25” outer diameter (OD) and 1.00” inner diameter (ID) carbon fiber tubing, the required fittings, and the epoxy adhesive to create the arm. The arm was cut under the instruction of Tim, the machine shop manager, who showed us how to cut the various lengths of the arm using a wet tile saw. After the 11”, 9”, 7.5” x 2, and 5” lengths were cut, we used the epoxy adhesive to attach the 1” metal tube to the stanchion fitting on the aluminum extruded cut frame. The finished product is shown below in *Figure 1:*

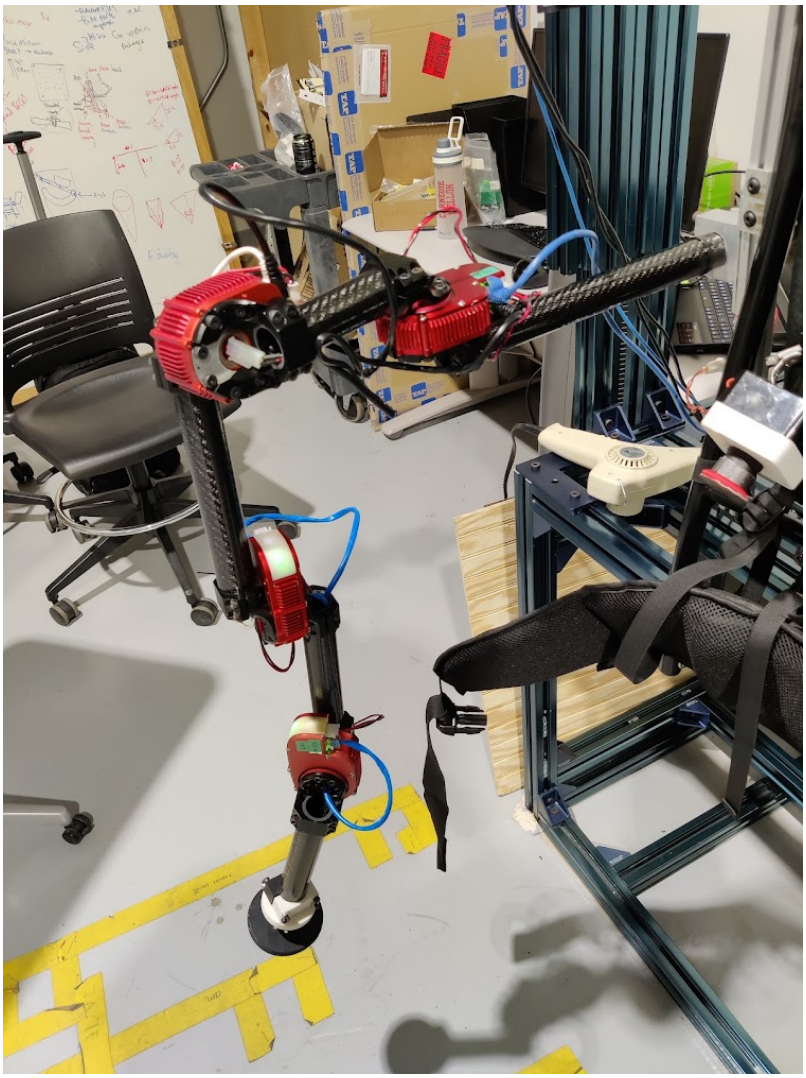

Figure 1. 4DOF Arm Carbon Fiber

I also worked on the Solidworks to URDF conversion in ROS. This is different from how we currently do our URDF, in that we currently specify our offsets and dimensions manually using measurements to the robot model. The idea is that we will generate the URDF directly from the CAD file using a plugin in Solidworks. This plugin can be found here.

2. Challenges

A challenge that we are facing is that the 8020 extruded aluminum parts we had ordered on 9/13/2021 have yet to arrive. We expected to have some hardware integration completed by this week, however our plans have been delayed until everything we ordered arrives. If the parts do not arrive by next week, we must move on to mitigate further risk.

This challenge has continued into this Progress Review, and at this point this challenge has become quite an outstanding risk. Fortunately, after weeks of contacting the 8020 support and seeing how we could mitigate this issue finally came to fruition. They shipped the parts on 10/13/2021 and provided us a tracking number for the UPS shipment. With the parts being over two weeks behind schedule, this has put us in quite a time crunch in which we have to integrate and validate the entire system in under a month.

The other challenge is that the Solidworks to URDF converter is a complex process that will require some setting up, and may break some of our components that are already functional. However this risk is worth taking, as we spent an entire day manually tweaking the URDF model instead of focusing on other deliverables for the project.

3. Teamwork

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

- Jonathan Lord-Fonda:

  For this time period, Jonathan set up a smart manipulation branch on Github and resolved merging issues. He also debugged smart manipulation code and discussed project aspects with various team members

- Gerry D'Ascoli:

  In this time period, Gerry initialized the goal stabilization code using resolved rate with Jason, which still needs testing and debugging before it can be integrated into the COBORG platform. He also tested object avoidance using object detection and further tuned parameters for object detection for improved performance.

- Feng Xiang:

  For this time period, Feng worked on vision upgrades with Yuqing to measure and implement new positions of realsense cameras. He also worked on goal stabilization code with Gerry. He is now currently implementing resolved rate code and testing on CoBorg. He also worked with Gerry on obstacle avoidance implementation on CoBorg, and calibrated the URDF robot model.

- Yuqing Qin

  Focused her work on the Vision node. This included working on the finalized vision upgrade, running a simple demo with two YOLO camera instances, and measuring the vision transforms with Jason to calibrate the URDF file.

4. Plans

For the next ILR, my plan is to finish the hardware integration, as this is the top priority. Once we have that complete, I will work on the updated E-stop design. This includes a pull cord mechanism instead of the current push button, and a relay that kills power to the motor on the "Stop Stop Stop" voice command. The final task planned for the next sprint is to convert the main node from an open loop state machine to a closed loop state machine. This will require feedback from the other nodes into the "/*state_input"* ROS topic. The main overall goals have stayed the same, as that the tasks I am assigned are tied to hardware delivery, which was pushed back by a Progress Review. The rest of the team is working in parallel to complete their software based tasks until my hardware items are no longer blocked.