

PROGRESS REVIEW 7

16-682 MRSD Project 2 (Fall 2021)
Carnegie Mellon University

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Notes

- N/A

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1 Individual Progress

Description Since the start of the Fall 2021 semester, I have mainly been working to get the CoBorg running with full-integration capability on the Xavier Jetson AGX computer. In addition, I have been investigating different robot arm designs in the effort to fabricate a new robot arm that will enhance the task space capability of the CoBorg.

One of the first tasks started at the beginning of this semester was to set up Ubuntu 18.04 on a new Xavier Jetson AGX computer, bring in the most updated source code of the project, install dependencies, and successfully run the full integration pipeline off the AGX computer. Throughout this process, I gave the most support in installing and configuring the actuated manipulation subsystem's side of the source code as well as running the full integration pipeline off the AGX computer. The image shown below (see Figure 1.1) is a snapshot of a recorded video of the CoBorg arm actuating to Yuqing's detected hand location.

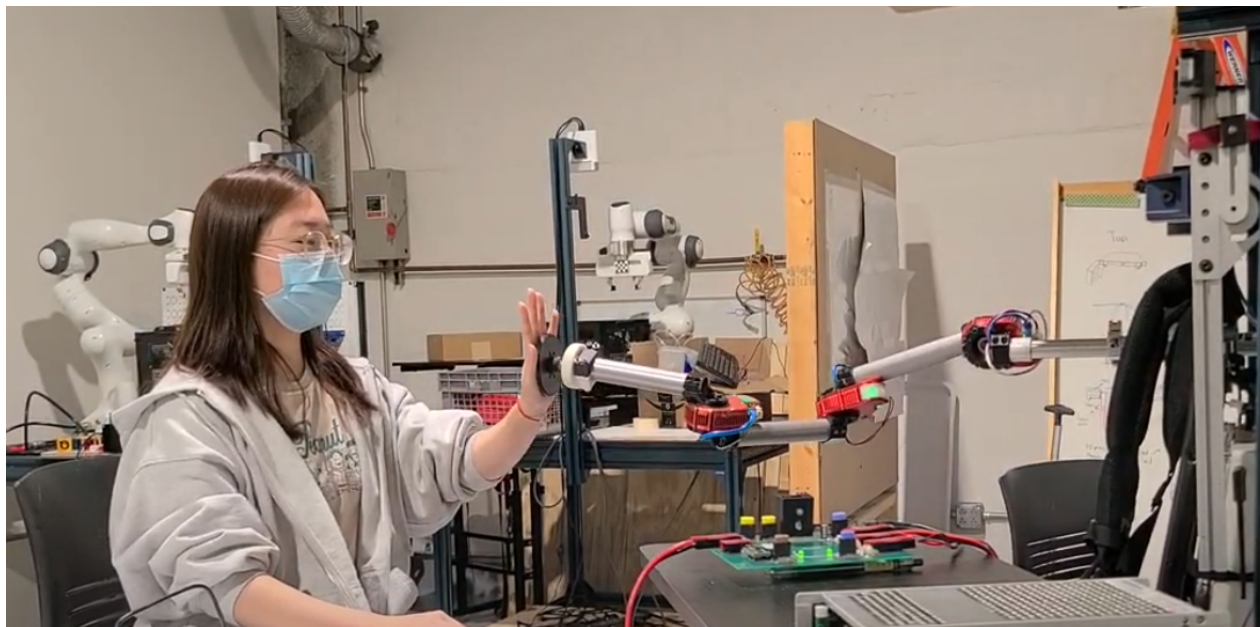
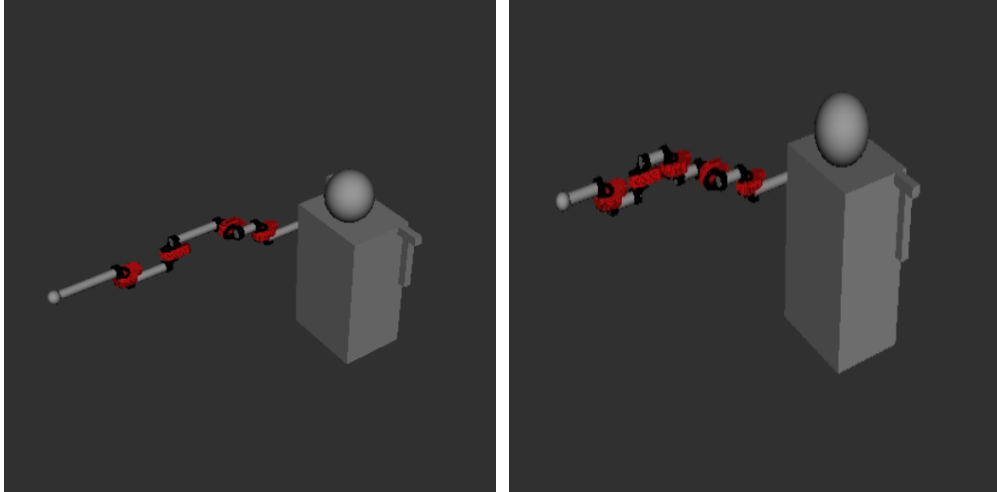


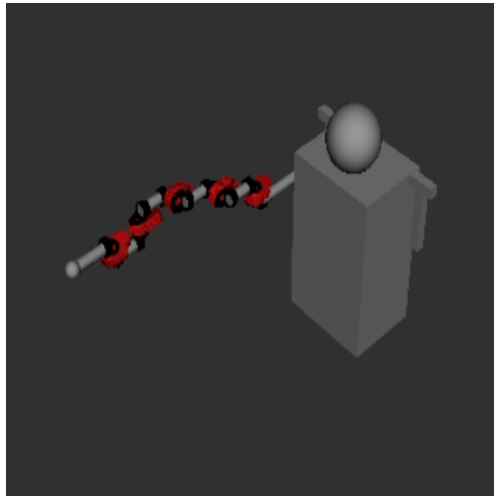
Figure 1.1: CoBorg end effector actuating to user's hands

In addition to getting the AGX computer up and running with the latest CoBorg source code, I was also investigating different robot arm designs that will have more than 3 degrees-of-freedom. There are three proposed robot arm designs. One design is a 4 degree-of-freedom arm and the other two designs are 5 degree-of-freedom arms at different configurations. The overall arm length of each design is around the same length as the original 3 degree-of-freedom arm. The URDF models of the three designs are shown in the figures below (see Figure 1.2). In addition these URDF models, cardboard replicas were also built in preparation of performing hands-on testing with these arms before concluding on a design for fabrication.



(a) 4 degree-of-freedom URDF arm

(b) 5 degree-of-freedom URDF arm, 3rd motor is Z-axis rotation



(c) 5 degree-of-freedom URDF arm, 3rd motor is Y-axis rotation

Figure 1.2: Proposal Robot Arm Designs, URDF Models

References

- N/A

2 Challenges

Description During the creation of these draft robot arm designs, it was a challenge to devise up designs that would meaningfully benefit from having added degrees-of-freedom. In the end, two main points were considered when creating these draft designs: added motors should rotate in an axis orthogonal to the origin and added motors should allow the robot arm end effector to move more freely along the horizontal plane.

As an upcoming challenge, I would need to collaborate closely with the vision subsystem team to ensure the new robot arm design will meet the task space requirements of the perception system. It is most likely the case that these designs will be tweaked so as to meet the new task space requirements that are also being built.

References

- N/A

3 Future Plans

Description In the next progress review meeting, I will continue working on testing the different robot arms with our developing task space requirements. From this work, I will also finalize the trade study of the different proposed robot arms and come to a conclusion on which arm to use. Final CAD design, bill-of-materials, and fabrication will begin shortly afterwards.

References

- N/A

4 Teamwork

Description The division of work between each member of the team are as follows:

- **Husam Wadi** Husam is the project manager of this team. He has updated our Trello kanban board and organized our team timeline. He has also led the CAD redesign for the CoBorg for this semester. From the redesign, he prototyped the new camera mounts and procured parts. He has worked with Gerry to evaluate the electrical system for potential redesign.
- **Jonathon Lord-Fonda** Jonathon is leading the integration between subsystems and project validation process. Jonathon has led the development of the task space requirements, devising up motivations and details of what is the defined task space that the robot arm and perception system ought to operate within. In addition, he has also created simulation code to test different URDF robot arm designs to his specified task space. Finally, he led the update of the Fall schedule, which was presented during the first project management presentation at the beginning of this semester.
- **Gerry D'Ascoli** Gerry is the lead for the voice subsystem. Since the start of the semester, he has tweaked the voice subsystem with improved key word recognition and added a timeout feature in between voice commands. In addition, he led the OS flash onto the Xavier Jetson AGX computer and installed all voice subsystem source code onto the computer. He has worked with Husam to evaluate the electrical system for potential redesign.
- **Yuqing Qin** Yuqing is leading the vision subsystem of the project. Yuqing has led the GPU configuration onto the Xavier Jetson AGX and installed the vision subsystem source code onto the computer. In addition, she optimized the perception pipeline and got rid of unnecessary ROS nodes in the pipeline. She has also worked to integrate the different subsystems to bring the CoBorg into its fully integrated state.

References

- N/A