PROGRESS REVIEW 9

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

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Notes

- N/A

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Contents

1 Individual Progress

Description Since the last progress review, I have been collaborating with Yuqing and Gerry to implement the new vision upgrade subsystem and implement the stabilization / obstacle avoidance features to the actuated manipulation subsystem, respectively. Even though there there are continued lead time delays with the team's hardware materials, progress is still being made in upgrading the current CoBorg framework with updated vision and actuated manipulation designs. As such, I have also been working on reconfiguring the MoveIt robot model to reflect the new hardware design changes.

The new vision upgrade involves the installation of two Intel Realsense D435i cameras and new mounting designs to install those two cameras and the Intel T265 camera onto the CoBorg robot. I have been working with Yuqing on calibrating the mounting location and field-of-views of the D435i cameras in order to see the user's hands across our defined task space. Once a useable mounting configuration is decided, Yuqing and I took measurements of the location and orientation of the two D435i and T265 cameras. We configured those measurements as ROS *TF* frames and visualized them through RViz (see Figure 1.1). Those new frame locations and orientations are subject to change, and will require further calibration in the future.

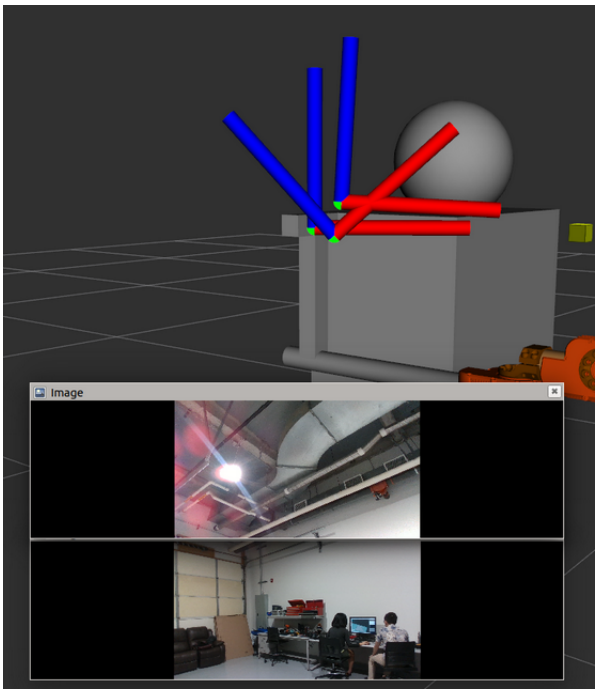

Figure 1.1: TF frames of three Intel Realsense cameras as seen through RViz.

With the upgraded actuated manipulation subsystem coming soon, I have been working with Gerry on building the code and testing the obstacle avoidance and goal stabilization / resolved rate features onto the CoBorg. As presented in this progress review meeting, the obstacle avoidance feature is functional on the current configuration of the CoBorg, and we demonstrated that the robot arm can navigate a path around the user's arm. The obstacle avoidance feature is implemented in MoveIt via the Octomap plug-in within MoveIt. Depth information from one of the two D435i cameras feeds into the obstacle avoidance pipeline, and depth points below a specific distance threshold are converted to 3D voxels, as shown in RViz. The robot arm will consider these 3D voxels as obstacles when planning its path to a 3D goal point.

With the newly configured robot arm, I have been working on calibrating the URDF robot model to fit the current hardware configuration of the CoBorg robot. This entails verifying measurements of the motors

and linkage lengths are consistent between the actual robot arm and the URDF model. When the rest of the team's hardware components are delivered and the new framework of the robot is built, I will need to recalibrate the URDF model and robot arm further to ensure both are accurately modeled.

References

- N/A

2 Challenges

Description The main challenge faced throughout this time was the prolonged time to measure and configure the new *tf* frames and tweaking the robot URDF model. As the project is progressing, the robot model and its various configurations will continue to be changed and tweaked in order to match the new designs of the various subsystems. It is evident that there ought to be several methods to automate this process, one of which Husam is working on.

References

- N/A

3 Future Plans

Description By the next progress review, I will have finalized the goal stabilization / resolved rate code with Gerry into a functional state for testing. In addition, I will also be working on tweaking the obstacle avoidance feature with Gerry to improve the performance and perhaps run more complex testing cases. I will continue to work with Yuqing to implement the new 2 D435i vision design onto the CoBorg robot and perform some functional testing and examine use cases. By next progress review, I will continue to calibrate the robot model as the new hardware framework is built.

References

- N/A

4 Teamwork

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

- **Husam Wadi** Husam is the project manager of this team. He led the fabrication and assembly of the new carbon fiber arm design as seen in this progress review meeting. In addition, he started investigating a plug-in method to convert SOLIDWORKS designs to URDF formatted files. Implementing this method would speed up the process of tweaking and reconfiguring the robot model in the future.
- **Jonathan Lord-Fonda** Jonathon is leading the integration between subsystems and project validation process. He started the debugging process of the smart manipulation code, and continues to debug and test the code to bring it into a functional state to test on the CoBorg robot. In addition, he continues to work with the other subsystems to ensure quality integration and testing is being performed.
- **Gerry D'Ascoli** Gerry is the lead for the voice subsystem. He is leading the goal stabilization / resolved rate and obstacle avoidance features of the CoBorg. This includes programming, implementation, and testing on the CoBorg arm.
- **Yuqing Qin** Yuqing is leading the vision subsystem of the project. She is leading the vision system upgrade on the CoBorg. This includes configuring the new design through ROS and unit testing the new vision pipeline to ensure expected functions. She is also working on installation and configuring the cameras on the CoBorg robot.

References

- N/A