TASK 6: PROGRESS REVIEW 1

16-681 MRSD Project 1 (Spring 2021)
Carnegie Mellon University

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Notes

- N/A

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Contents

1 Individual Progress

Description Since the last ILR (i.e. Sensor and Motor Control Lab ILR), I have developed the pipeline between robot URDF model, as visualized through RViz, and the HEBI motors on the physical robot. A user is able to set a 3D goal pose on the robot URDF model in RViz and, once the path is planning executed, the robot arm will actuate accordingly to the designated 3D goal pose. This pipeline was demonstrated during the Progress Review 1 demo to Anjali Pemmaraju and John Dolan.

Though RViz should not be the focal point of actuating the robot arm in the end, it will solidify the data flow from publishing a 3D goal point to joint state actuation on the HEBI motors.

The figure below (see Figure 1.1) shows the robot URDF as seen through RViz. After designated a 3D goal pose and selecting the ”plan” option, end effector will plan a path from its initial state to the goal state. Executing the path will udpate the joint states of the motors and their accompanying tf frames.

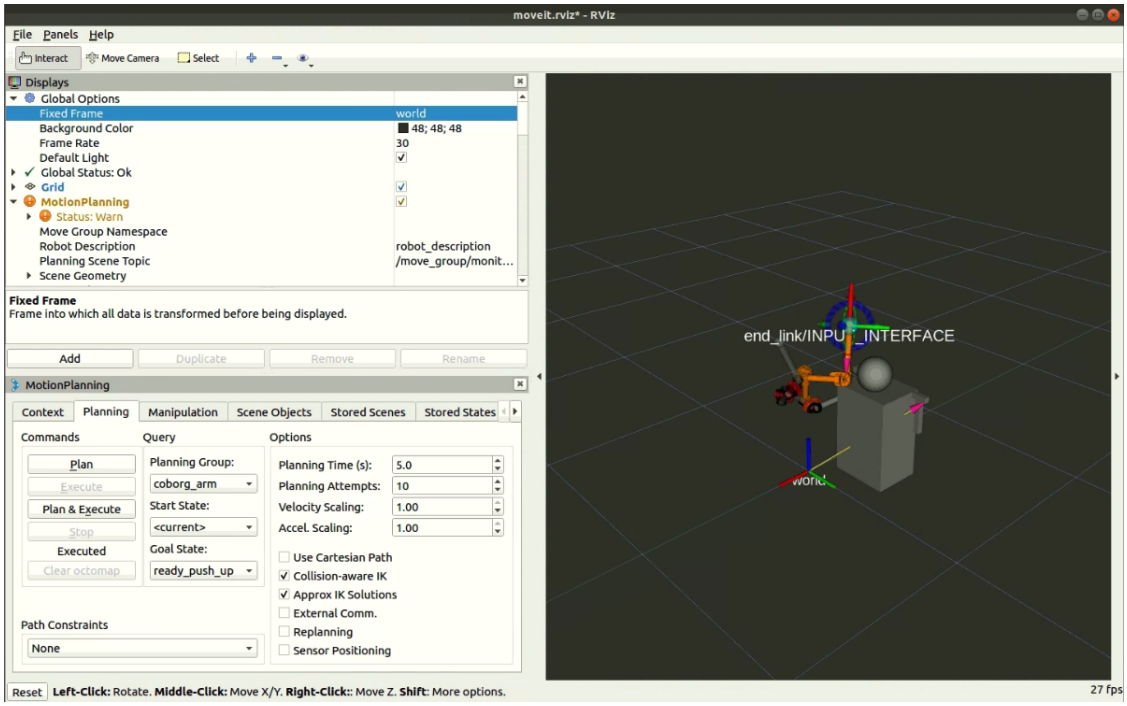

Figure 1.1: CoBorg URDF model executing a planned path as seen through RViz

The figure below (see Figure 1.2) shows the physical robot with annotations to where each of the three HEBI motors are. When MoveIt outputs the joint states of the motors through the /joint_states rostopic, the HEBI motors will actuate accordingly to the same 3D goal pose.

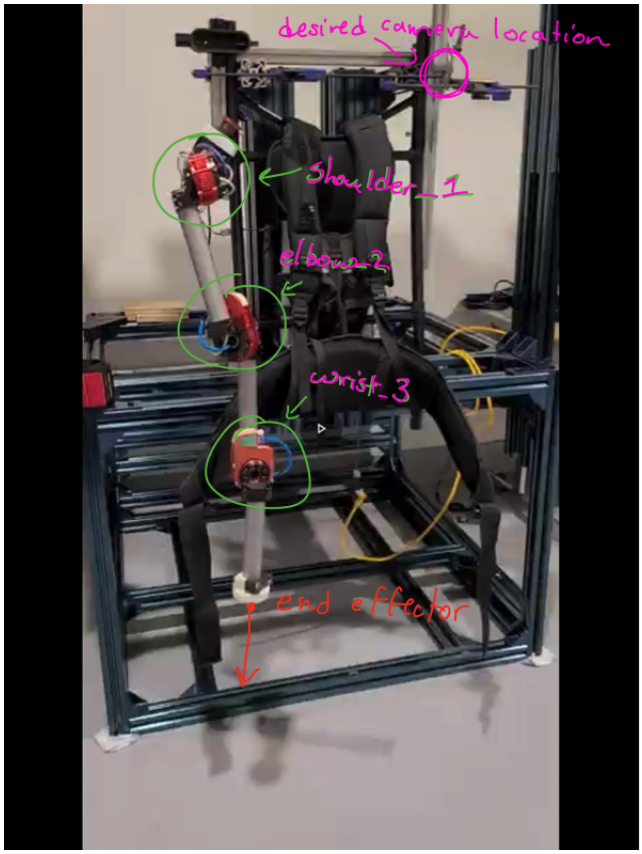

Figure 1.2: CoBorg picture showcasing motor names and locations

References

- HEBI C++ API ROS Integration

2 Challenges

Description The immediate challenges for me would be in developing the robot arm stabilization pipeline. Once the robot arm reaches the 3D goal pose, it must maintain that 3D position relative to the global origin point as defined by the T265 localization and SLAM camera.

Developing this pipeline would entail tying the frames of the T265 camera with the frame of the robot URDF model. This can be done through the ”tf” package in ROS. The challenge is to develop a stabilization system that is both responsive and robust enough so movements of the robot will output a quick 3D goal adjustment to the robot end effector. To fail at either of the two criteria would mean a robot arm that is unable to maintain control of a part in 3D space within a set amount of time, which is an important quality with must achieve on the robot.

References

- N/A

3 Future Plans

Description My next task for the next progress review is to tie the T265 and D435i cameras with the robot URDF model. Once the two are tied together, then I should be able to visualize the robot URDF's movements relative with the global frame of the T265 camera. In addition, I will integrate point cloud data from the D435i with the frame of the robot URDF. This means that depth data as seen through the D435i will be relative to the robot URDF. This integration will be visualized through RViz.

References

- N/A

4 Teamwork

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

- **Husam Wadi**

  Husam's primary role is project/program manager. In addition to managing the schedule, sprint tasks, and overall vision of the product, he is also floating between subsystems to check on the progress of each subsystem and providing assistance and re-assigning tasks as necessary. As of this ILR submission, he has provided feedback and assistance to the vision and actuated manipulation subsystems, providing clarification and focus when overcoming the given challenges. He also helped organize the team's lab space and built the testing structure of the robot.

- **Jonathon Lord-Fonda**

  Jonathon is leading the integration between the subsystems and validation of the project. As of this ILR submission, he has been updating the high level ROS node map of the robot, describing the data flow and pipelines between subsystems. In addition to writing the main state node for the robot, he also helped organize the team's lab space and built the testing structure of the robot. He also worked on the PCB assignment with Gerry and Yuqing.

- **Gerry D'Ascoli**

  Gerry is leading the voice subsystem of the project. As of this ILR, he has developed the voice program to listen to voice commands and output appropriate command signals. The voice system is based off of PocketSphinx, and Gerry has made progress in configuring and developing the voice framework to fit the workflow of the CoBorg. He also worked on the PCB assignment with Jonathon and Yuqing. He also helped organize the team's lab space and built the testing structure of the robot

- **Yuqing Qin**

  Yuqing is leading the vision subsystem of the project. As of this ILR, she has integrated a pre-trained YOLOv4 model with the Intel Realsense cameras to detect human hands at varying angles and hand configurations. She has also improved the performance of the hand-tracking program to be capable of running in real-time. She has also made progress in the 3D goal setter node of the subsystem, which translates information from the D435 camera to output a 3D goal pose that the actuated manipulation subsystem can use to move the robot arm. She also helped organize the team's lab space and built the testing structure of the robot

References

- N/A