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Goal

Create a robot that can pick up an objects and place them in a line.

Process

Generally, in order for a robot to do this, we must consider orientation, inverse kinematics, and task space.

- Orientation: When the robot moves to pick up an object, we must consider the current state of the robot in relation to where we want the robot to go. This goes hand in hand with inverse kinematics.
- Inverse Kinematics: Our goal is to pick up and place objects. To do this, we must implement inverse kinematics twice for each object. When we calculate where the robot must be, we need to have some frame of reference.
- Task Space: For any robot, the workspace consists of the space that is within the robot's grasp. For this, we must think about the link lengths and feasible joint values. Since we are dealing with simulations and not physical robots, the joint values can be a full 360 degrees around each joint.

Results

There was some successes and some failures.

- Success: There are 3 main things that I wanted to implement. Namely, picking up an object, placing an object, and ensuring that everything is within the task space. In each of these categories I was successful.
- Failure: I wanted to have a working system using the spatial3r robot provided but was not able to fulfill this goal. However, I did manage to have everything working well for the planar2r robot. I believe this is due to a lack of experience with the ROS software as I spoke with another classmate who came across the same issues. I also tried to implement trajectory generation in order to have a smooth robot moving arm but was unsuccessful.

Sources

The main sources used were from the book, notes, lectures, and video. Essentially, everything utilized was provided by the professor, except for the Eigen and ROS documentation. Below are specific sources used:

- Forward kinematics notes: used to test whether my inverse kinematics functions were working properly.
- Inverse kinematics notes: used to help create inverse kinematics functions

- Tutorial 2, 3, 4 videos: these videos were paramount in helping me understand the ROS system. I used the planar2r material given and experimented in depth to have a better understanding of how ROS works.