ME 410 Robotics

Project #4, Manipulator for Pick and Place, due on 11/30 via email
For team projects, please ensure all team members are contributing to the project. There could potentially be a written peer review.

1   Overview

This project is on programming a robot to sort colored items into bins using pick and place operations. Here is an example of a manipulator doing a pick and place operation
https://youtu.be/eQ7OBg1ENeE?t=46.

We will use the UR5 manipulator for this project in CoppeliaSim
https://www.universal-robots.com/products/ur5-robot/. You can watch some applications of this manipulator by clicking on this YouTube search link:
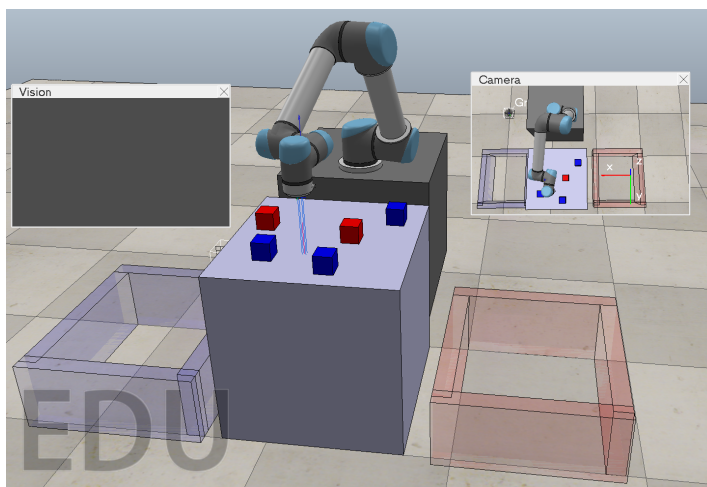https://www.youtube.com/results?search_query=ur5+manipulator+applications.

Figure 1: CoppeliaSim scene for UR5 pick and place

Understanding the file given to you

I have provided the file *ur5_pick_place.ttt*. The scene is shown in Fig. 1. There are blue and red boxes on the table. Your goal is to put the blue boxes in the blue bin and red boxes in the red bin one at a time.

The end-effector of the UR5 is fitted with a force connector, a proximity sensor, and a vision sensor. The UR5 is already set in the inverse kinematic mode such that the end-effector follows a reference dummy. The UR5 is programmed with a simple Finite State Machine that picks one box at a time and drops it at a certain location. Note that it is OK to drop the boxes in the red or blue bin instead of placing gently on the ground. I will only check to see if the box lands in the respective bin.

Feel free to reuse this code or write your own code.

2 Grading (100 points as given below)

Demonstrate the robot can pick and place the red boxes in the red bin and blue boxes in the blue bin. The pick and place can be done in any order. That is, you do not require to put the red boxes first and then the blue boxes.

1. 30 **points** For identifying correct location to move the box using the vision sensor.

2. 30 **points** For ensuring that the motion is continuous visually. That is, you need to specify a trajectory between pick and intermediate points (if any) to the final placement location.

3. 30 **points** Overall logic including the final outcome of blue boxes being placed in the blue bin and red boxes being placed in the red bin.

4. 10 **points** Your final submission will be via email. Please include these three things: (1) video recording (either as an attachment or as a YouTube link), (2) CoppeliaSim file *ur5_pick_place_initials_of_group.ttt*. Please put all names as a comment inside the Lua script, preferably in the beginning. (3) Include the names of all people who worked on the project. Mail everything to pranav@uic.edu.

(Optional) Partial Grade: Alternately, you can get partial grade of 50 points if you put all boxes in a single bin. You would not need to use the vision sensor in this case. For each step identified above you will get half the points, 15, 15, 15, and 5, which sums to 50 points. You can take this option if you think you do not have enough time to do the project with vision sensor.