CS 4610/5335, Fall 2016: Directed Project

Due: 12/9/2016

1   Project Description

The final project should be an application of an algorithm (either taught in this class or otherwise) to some robotics problem of interest to you. I am providing several suggested projects below. You may choose to take one of these suggestions or you may propose a different project. However, if you elect to propose a different project, you must submit a project proposal by next Wedsnesday, 11/16. Projects may be implemented in OpenRAVE, Corke's Matlab robotics toolbox, ROS/Gazebo, or a different environment that you specify in your project proposal. Students may work alone or in pairs. Project teams with two people must tackle more challenging projects. Whereas I had originally planned to have students complete *two* directed projects in this class, I'm changing that to just one project now because it is so late in the semester. So, this one project will count for the full amount of the project grade (40% of your grade) in this course.

Project #1: Manipulating objects in OpenRAVE: In this project, you will write code to solve a version of the famous "blocks world" problem where the robot must stack objects in a particular order. Figure 1 shows the scenario. Your program should take as input a desired stack order, e.g. red on top of blue on top of green. It should perform the arm motions that would enable the robot to perform the corresponding stacking behavior starting from the object configuration that is given in CS5335.ENV.XML . You will need to implement a planner that reasons about how to move the objects in order to stack correctly. I suggest solving this problem using breadth first search or a similar algorithm (but you're free to use whatever you want). I think this project is suitable for a pair of two students, but feel free to tackle it alone if you prefer. Here are some resources that can help you with the project:
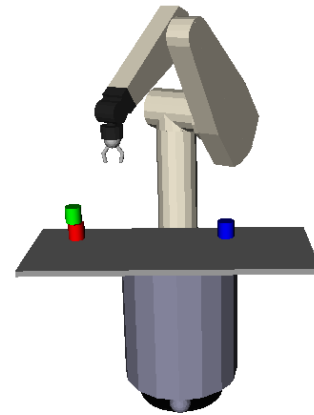
OpenRAVE install instructions: `https://github.com/ rdiankov/openrave/blob/master/docs/Tutorial%20for% 20Installing%20Openrave%20in%20Ubuntu-Ubuntu% 20Mate%2014.04.2%20x64.rst`

Figure 1: Scenario for project #1.

OpenRave example code: `http://openrave.org/docs/0.6.6/tutorials/openravepy_ examples/`

My example code for moving an object: `grasp_object_puma.py` and `puma_tabletop.env.xml` (packaged in this zip file).

Project #2: Path planning in OpenRAVE Use the same example code and XML file as in Project #1, but this time demonstrate using at least two of the built-in path planning functions in openrave. Create an environment with non-trivial obstacles and compare the ability of the path planners to find solutions from randomly selected start and end configurations. This could be one or two people depending upon how complex the scenarios are.

Project #3: Use Corke's Matlab robotics toolbox to implement PRM instead of RRT for the Puma 560 robot. This would be very similar to the RRT assignment in Homework 2 except that you would use the Puma 560 instead of the four link arm we used in Homework 2. Also, you should test your code using a more complex obstacle environment than we used in Homework 2 – please include at least three obstacles in the workspace of the robot.

Project #4: Something else for which submit a project proposal by 11/16.