CS 4610/5335, Fall 2017: Directed Project

Due: 12/9/2017

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. If you select Projects #4 or #5 (below), then you must submit a project proposal by 11/3. Project proposals should be half a page and should describe what you plan to do, the algorithms you intend to use, and the results you expect to get. 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 (except if you select Project #4 where you may work in a group of three). Project teams with two people must tackle more challenging projects.

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). Here are some resources that can help you with the project:
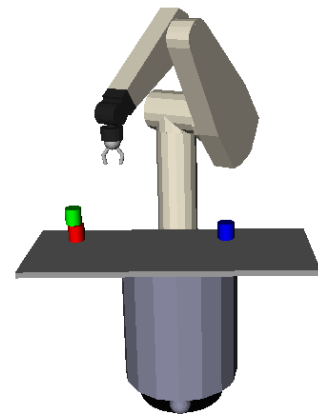

Figure 1: Scenario for project #1.

OpenRAVE install instructions: `https://github.com/ rdiankov/openrave/blob/master/docs/Tutorial%20for% 20Installing%20Openrave%20in%20Ubuntu-Ubuntu% 20Mate%2014.04.2%20x64.rst`

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

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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.

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: A project involving Baxter that would be implemented on the hardware in our lab. We don't have a particular project in mind here – this could be anything that can be deployed on Baxter. However, you would need to demonstrate the project in ROS/Gazebo by 11/15 prior to doing any work on the hardware (information on Gazebo models for Baxter here: `http://sdk.rethinkrobotics.com/wiki/Baxter_Simulator`). The 11/15 demonstration should completely show what the robot would do in real life. If you pursue this option, you should submit your half-page project proposal to us as soon as possible. For this option, we will allow students to work in teams of three people. During the hardware phase of the project (after 11/15), we expect that students would arrange time-slots with the TA when they will work on the Baxter hardware in our lab in 090 ISEC. For more information, please talk to me or the TA. If we get more interest than we can accomodate (we only have one robot!), then we will select at least two projects to go forward based on their performance on the 11/15 demonstration.

Project #5: Something else for which you submit a half-page project proposal by 11/3. You can do anything you want! But, the proposal needs to be submitted to us by 11/3 and approved shortly thereafter.