Robot Autonomy Homework 0

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Python Sorting Functions

All the three sorting functions are in the file **python_tutorial.py** and the output is printed in the format mentioned in the Homework Problem set.

OpenRave Functions

1. move_straight

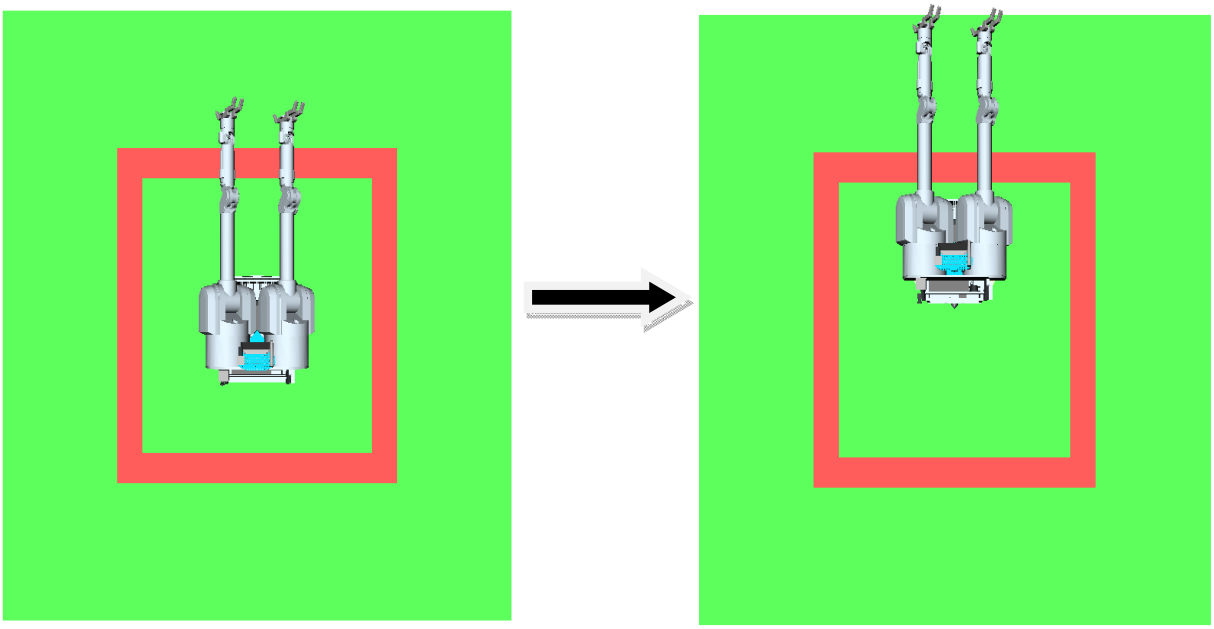
a) Code:

with self.env:

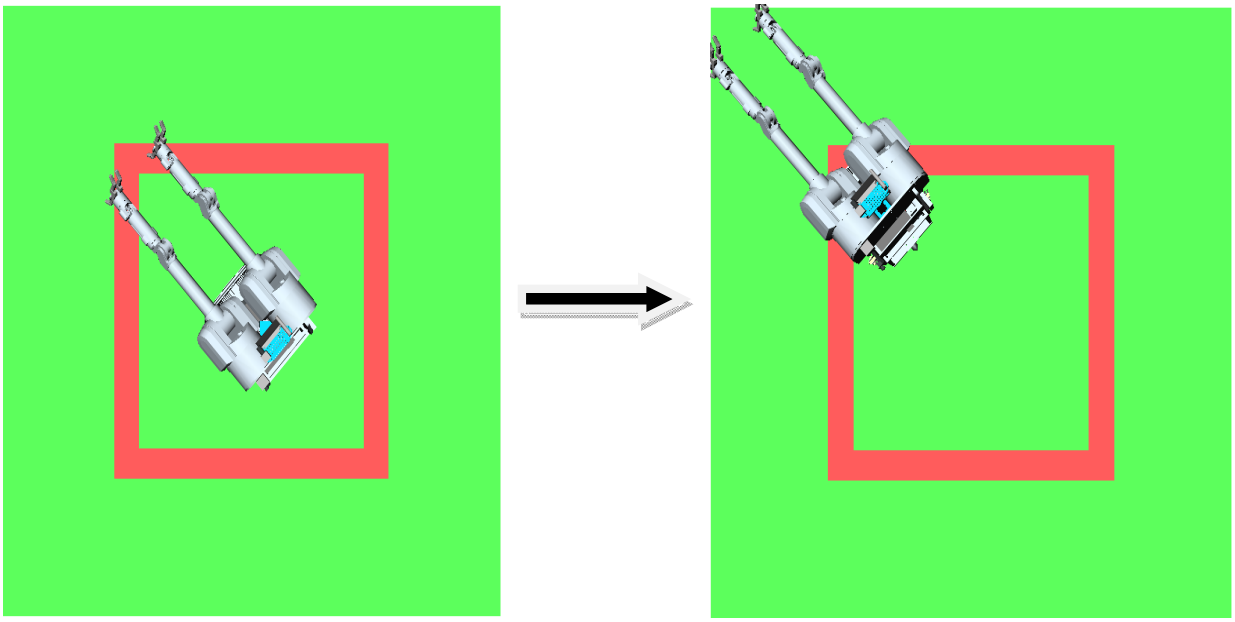
```
T1 = self.robot.GetTransform() # Get the current Transform
T2 = openravepy.axisAngleFromRotationMatrix(T1[0:3,0:3]) # Get current axis angle
T1[0,3] = dist*np.cos(T2[2]) # Distance moved in X-direction
T1[1,3] = dist*np.sin(T2[2]) # Distance moved in Y-direction
self.robot.SetTransform(T1) # Setting the new transform
```

b) Images:

1.



2.



2. rotate_by

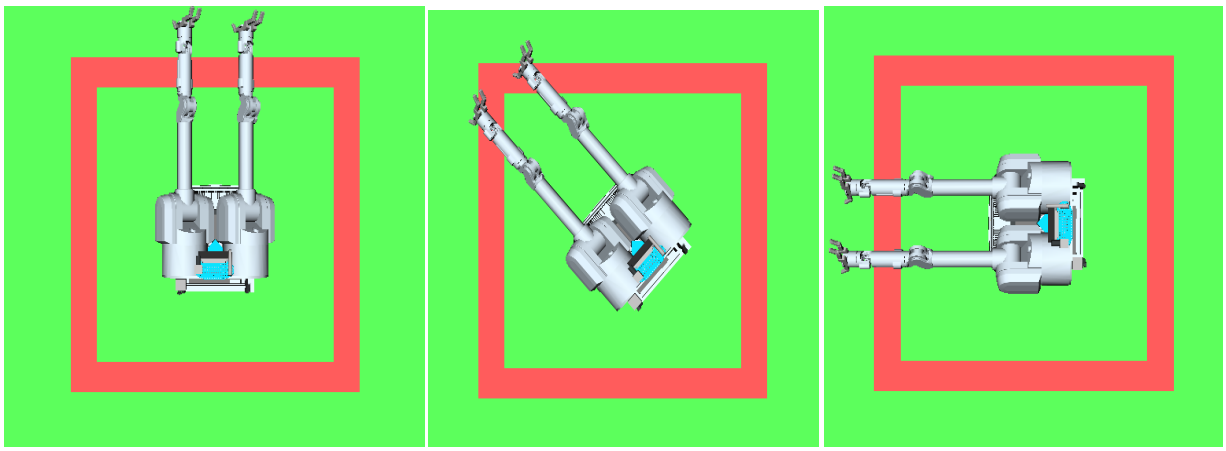
a) Code:

T = openravepy.matrixFromAxisAngle([0,0,ang]) # Get the transformation matrix

with self.env:

self.robot.SetTransform(np.dot(T,self.robot.GetTransform())) # Applying the new #transformation

b) Images:

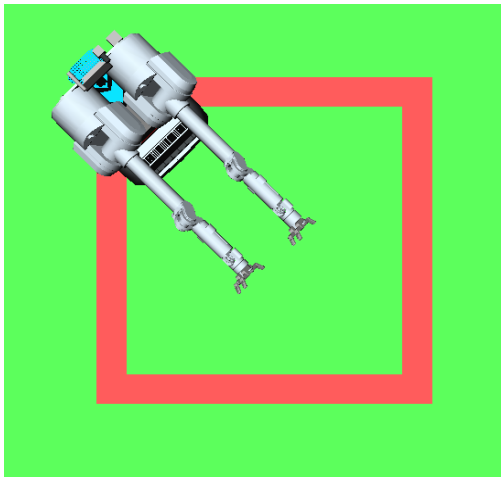


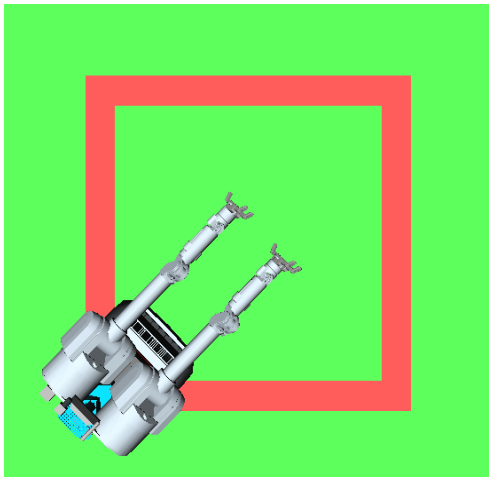
3. go_around_square

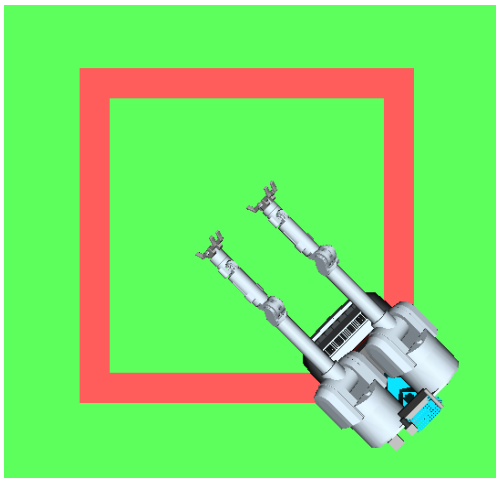
a) Code:

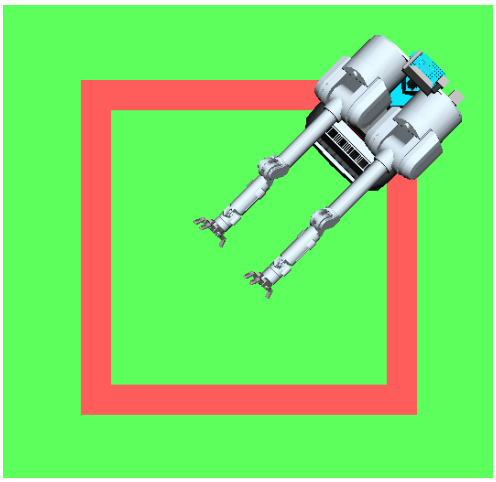
```
# set the robot back to the initialize position after
with self.env:
    self.robot.SetTransform(np.identity(4));
    self.rotate_by(np.pi/4)
    self.move_straight(-np.sqrt(2))
    time.sleep(3)
    self.rotate_by(np.pi/2)
    time.sleep(3)
    self.rotate_by(np.pi/2)
    time.sleep(3)
    self.rotate_by(np.pi/2)
```

b) Images:









4. figure_out_DOFS:

a) Code:

```
### Joints
with self.env:
    Joint = self.robot.GetJoints()
    print 'Name of all the Joints: [',
    for i in xrange(0,len(Joint)):
        print Joint[i].GetName(),
    print ']'
###
### Indices
print 'Indices of Right Arm: ',list([0,1,2,3])
print 'Indices of Right Hand: ',list([4,5,6,7,8,9,10,11])
print 'Indices of Left Arm: ',list([12,13,14,15])
print 'Indices of Left Hand: ',list([16,17,18,19,20,21,22])
print 'Indices of Head: ',list([23,24])
###
```

b) Name of Joints and Index Ranges (Note: Considering wrist and fingers as part of hand and elbows, shoulder as part of arm):

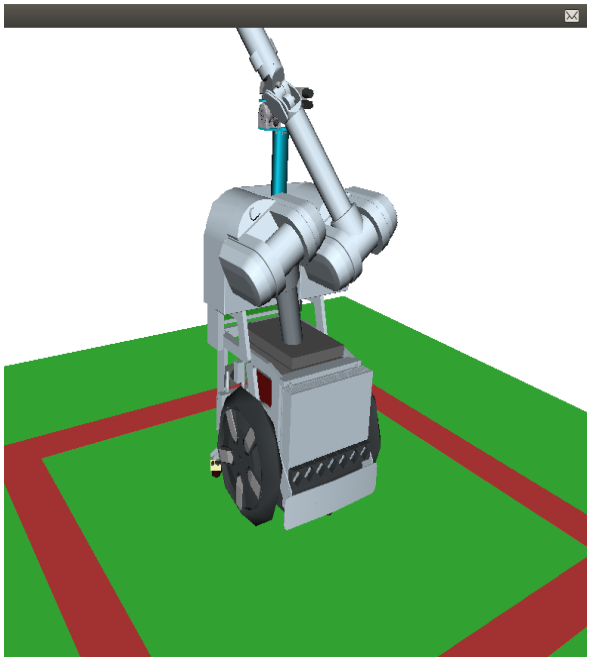
```
Name of all the Joints: [ R_Shoulder_Yaw R_Shoulder_Pitch R_Shoulder_Roll R_Elbo
w R_Wrist_Yaw R_Wrist_Pitch R_Wrist_Roll RJF1 RJF2 RJF3 RJF4 L_Shoulder_Yaw L_Sh
oulder_Pitch L_Shoulder_Roll L_Elbow L_Wrist_Yaw L_Wrist_Pitch L_Wrist_Roll LJF1
 LJF2 LJF3 LJF4 Joint_Pan Joint_Tilt ]
Indices of Right Arm:  [0, 1, 2, 3]
Indices of Right Hand:  [4, 5, 6, 7, 8, 9, 10, 11]
Indices of Left Arm:  [12, 13, 14, 15]
Indices of Left Hand:  [16, 17, 18, 19, 20, 21, 22]
Indices of Head:  [23, 24]
```

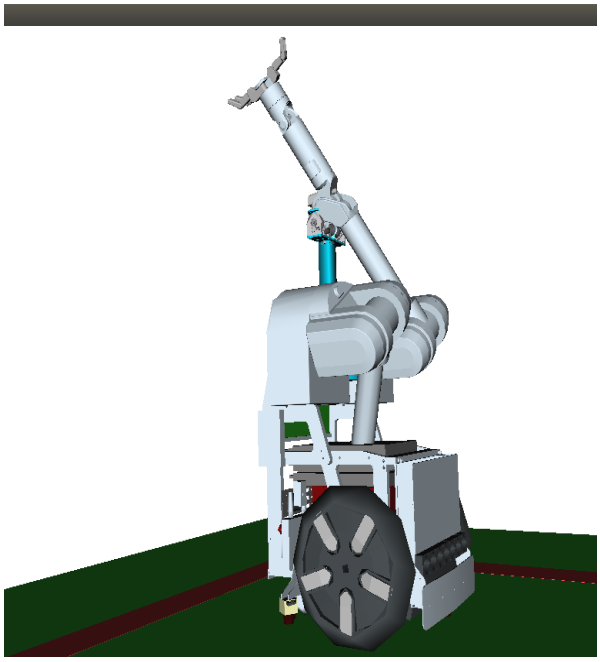
5. put_in_self_collision:

a) Code:

```
DOFValues = self.robot.GetDOFValues() # Get current DOF values
DOFValues[1]  = -3 # Modify one of them so that there is self collision
DOFValues[12]  = 3 # Modify another value
Indices = xrange(0,len(DOFValues))
with self.env:
        self.robot.SetDOFValues(DOFValues,Indices,checklimits = False) # Set the new DOF
#values and set checklimits = False
```

b) Images:



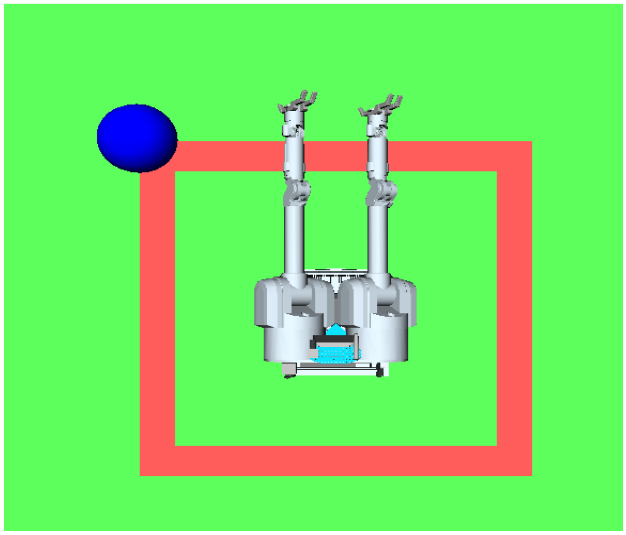


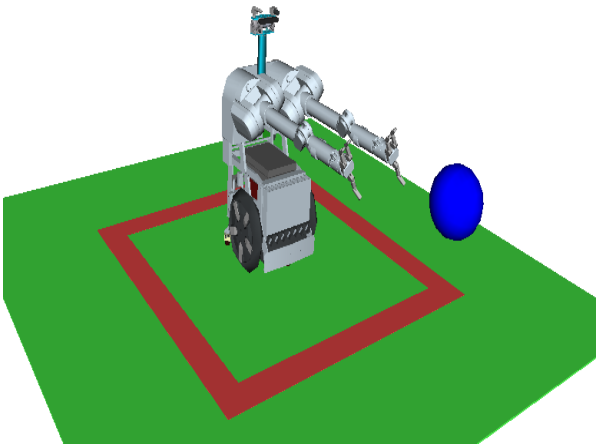
6. Adding a Sphere

a) Code:

```
<KinBody name="sphere1">
    <Body type="static">
        <Translation>1 1 0.5</Translation>
        <Geom type="sphere">
            <Radius>0.2</Radius>
            <diffuseColor>0 0 1</diffuseColor>
            <ambientColor>0 0 1</ambientColor>
        </Geom>
    </Body>
</KinBody>
```

b) Images:





Time taken for this homework:

1. The first two python sorting functions did not take much time but for the third sorting function, I had to spend some time to figure it out. In total, Python sorting functions took around 1 hour.

2. OpenRave part of the assignment took some time. As this was the first time I was using OpenRave, I had to go through the documentation of OpenRave and spend some time to get familiar with it. Then, I started with the assignment. In total, it must have taken around 1 day to finish the OpenRave Assignment.

Locking the environment:

To lock the environment, I have used ***with self.env*** in all the functions which locks the environment in python.