CHALMERS
UNIVERSITY OF TECHNOLOGY

SSY235 - Decision Making for Autonomous System

TIAGo tutorials (MoveIt!)

Assignment - 5

ID-Number 9508224756

Fikri Farhan Witjaksono fikrif@student.chalmers.se

Ásgeir Barkarson basgeir@student.chalmers.se

Moritz Benno Reuss benno@student.chalmers.se

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1 Planning in joint space

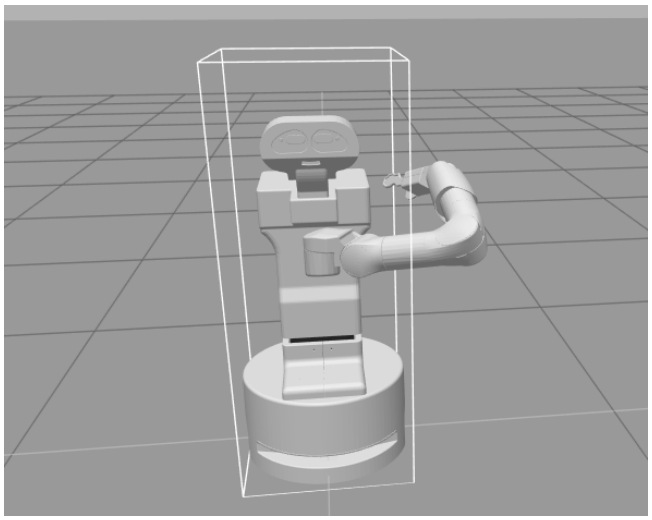

Figure 1: Result of simulation

After doing the tutorial, robot arm is doing the forward kinematics which moved it to the sideline in the joint space as planned. This is as intended by the tutorial. We don't need to add anything. Trying to change the coordinate of the joint space planning, we will have the result of simulation as follows.

```
user:~$ rosrun tiago_moveit_tutorial plan_arm_torso_fk  0 2.7 1.5 -2.1 2.0 1.0 -2.8 0
```

Figure 2: Coordinate modification

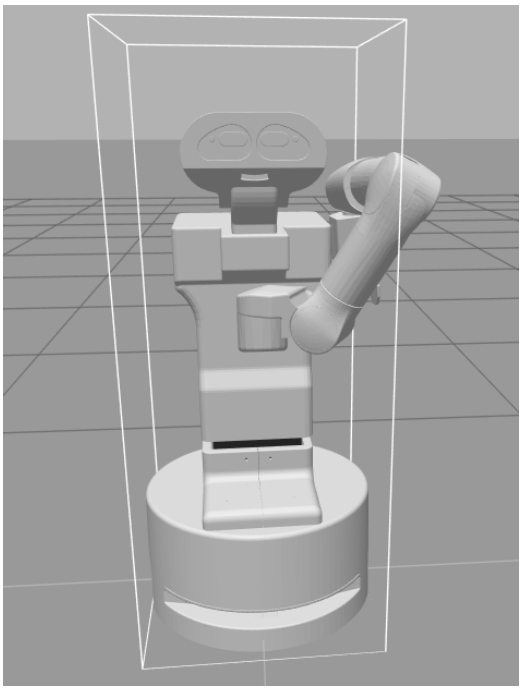

Figure 3: Result of simulation modified

2 Planning in cartesian space

After doing the tutorial, robot arm is doing the inverse kinematics which moved the tip joint to the ground in the cartesian space as planned. This is as intended by the tutorial. We don't need to add anything. Trying to change the coordinate of the cartesian space planning, we will have the result of simulation as follows.

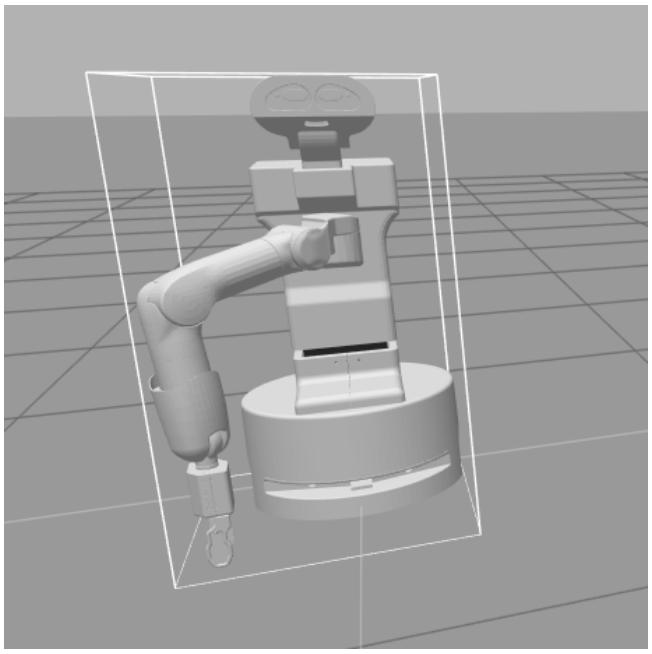

Figure 4: Result of simulation original

```
user:~$ rosrun tiago_moveit_tutorial plan_arm_torso_ik 0.4 -0.3 0.56 -0.011 5.57 0.08
```

Figure 5: Coordinate modification

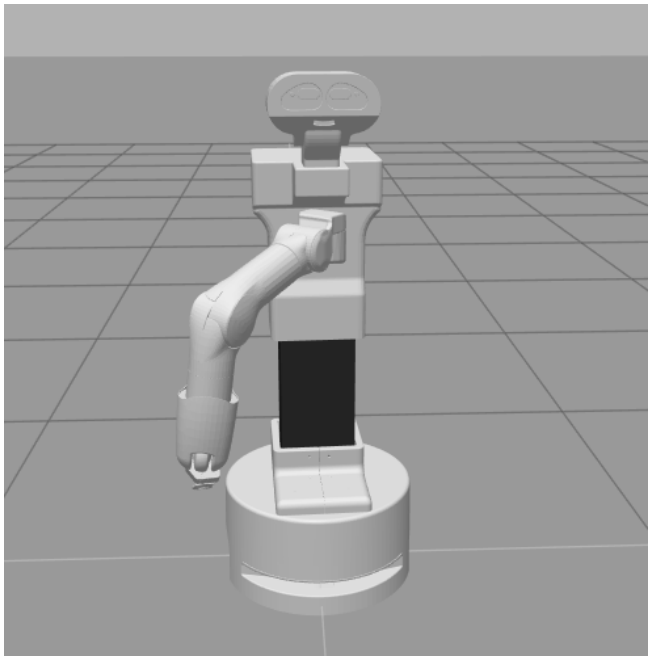

Figure 6: Result of simulation modified

3 Planning in cartesian space with TRAC-IK

After doing the tutorial, robot arm is doing the inverse kinematics which moved it to the ground in the cartesian space as planned. Before installing the TRAC-IK plugin, we will find an error shown in the shell in figure 7. Therefore, we decide to use the line from figure 8 which is used to update the before subsequently executing the line in figure 7. The final pose of the robot arm is as shown in figure 9. Moreover, doing small modification on the desired pose as shown in figure 10 will give us final pose as in figure 11.

```
user:~$ sudo apt-get install ros-$ROS_
```

Figure 7: Installing the TRAC-IK plugin

```
user:~$ sudo apt-get update
```

Figure 8: Error fix

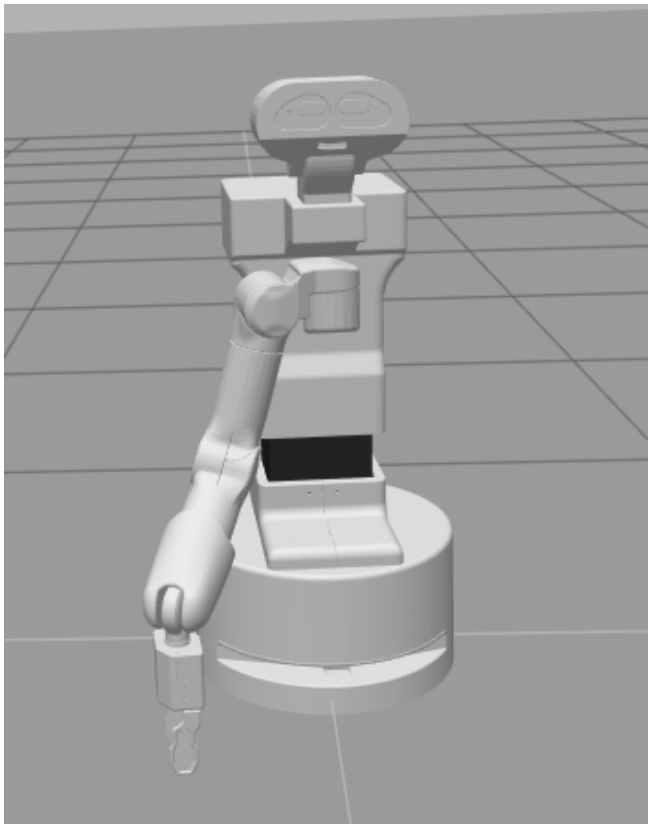

Figure 9: Final simulated pose original

```
user:~$ rosrun tiago_moveit_tutorial plan_arm_torso_ik 0.4 -0.3 0.66 -0.011, 1.57, 0.037
```

Figure 10: coordinate modification

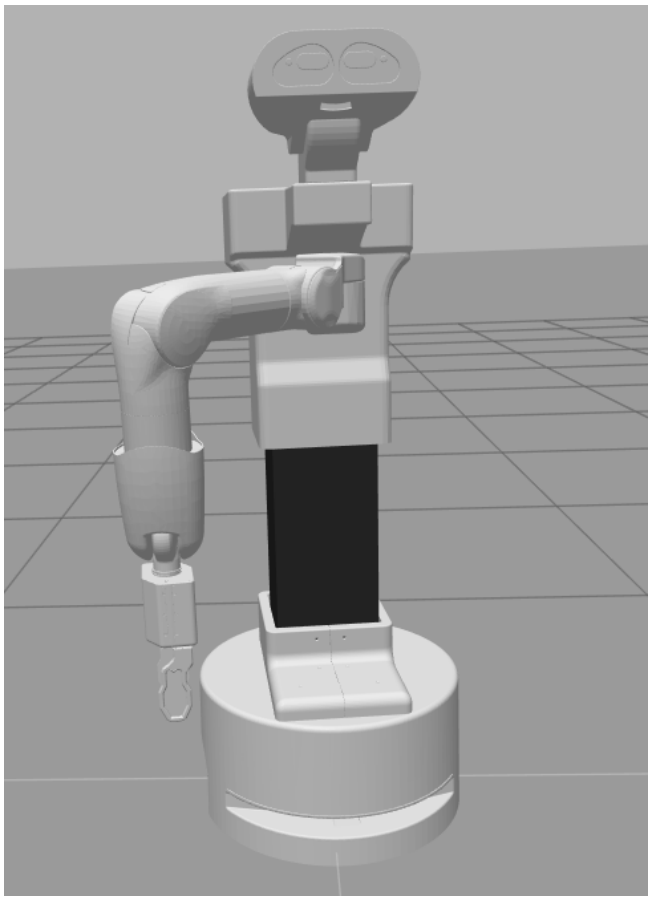

Figure 11: Final simulated pose modified

4 Planning with Octomap demo

In this tutorial, we used the octomap to maintain the 3D representation of the environment around the robot. After using the **head_look_around** command, we will have the 3D map as shown in figure 12 with the table is not visible, only the objects on the floor.

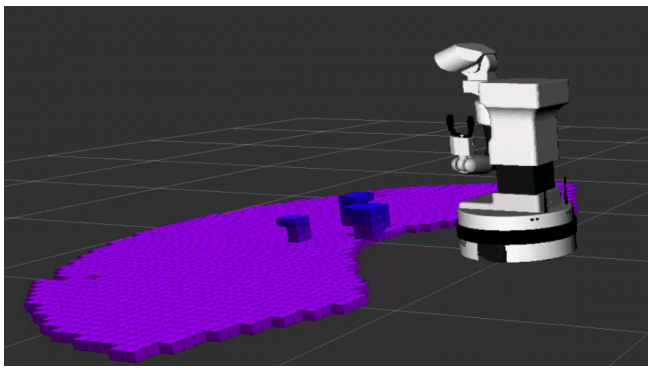

Figure 12: Using **head_look_around** original

By setting the gravity of **pringles.sdf**, **pringles2.sdf** and **coke_can_slim.sdf** to zero, we will get the following where the objects are floating on the invisible table.

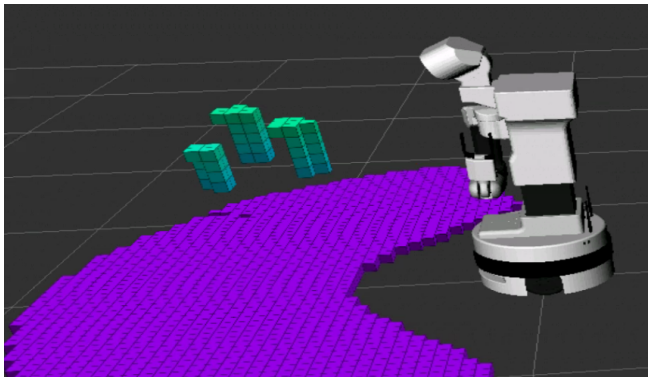

Figure 13: Using **head_look_around** modified 1

We have not found a fix for the invisible table problem so far.

5 Pick & Place demo

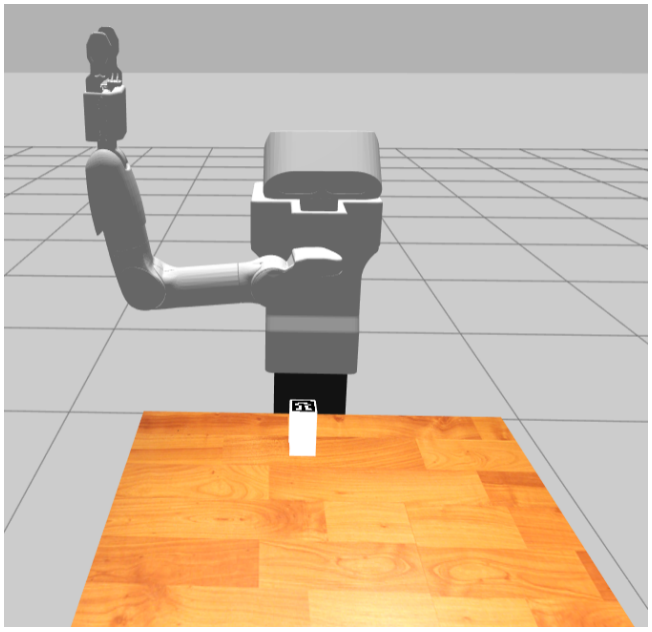

Figure 14: Result of demo (Gazebo)

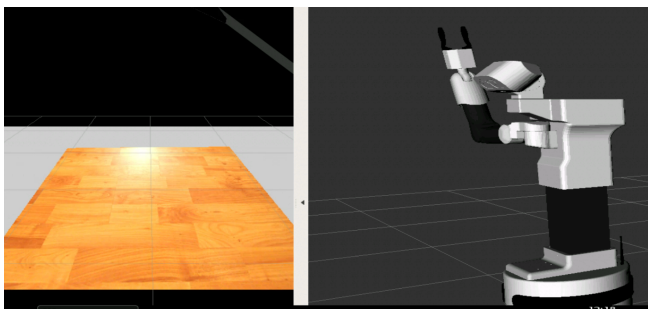

Figure 15: Result of demo (RViz)

Here, we cannot see the robot grasping the object as intended by the tutorial. The robot only moved its arm to get ready to grasp the object after moving its perception onto the object and stay like that doing nothing. We have not found any fix to this problem but we suspect that it is due to deficiency in the package.