ROS: Motion planning with dual manipulator system

The objective of this lab is to learn how ROS MoveIt! can be used for different planning groups and how to integrate different robots into a single system.

Setting up your computer

Open terminal window.

Clone your git repository to your home folder:

```
$ git clone <URL for your personal repository <yourname>-rtech>
```

Use `ls` to confirm that ***<yourname>-rtech*** has been downloaded to your home folder**.**

Motion planning with two Yaskawa SIA5D manipulators

In this section you are going to:

1) Describe a Xacro-file that combines two robot models.
2) Set up MoveIt! configuration package that enables motion planning for each manipulator independently and for simultaneous dual manipulation.
3) Test motion planning in RViz.

First you need to create a description for the dual manipulator system using a Xacro-file. It is practical to create a separate ROS package for that, *e.g.*, `dual_manipulator_support`. In the Xacro-file, describe a setup with two SIA5D robot manipulators placed on a box-shaped platform within 1 m distance from each other (e.g., Figure 1).

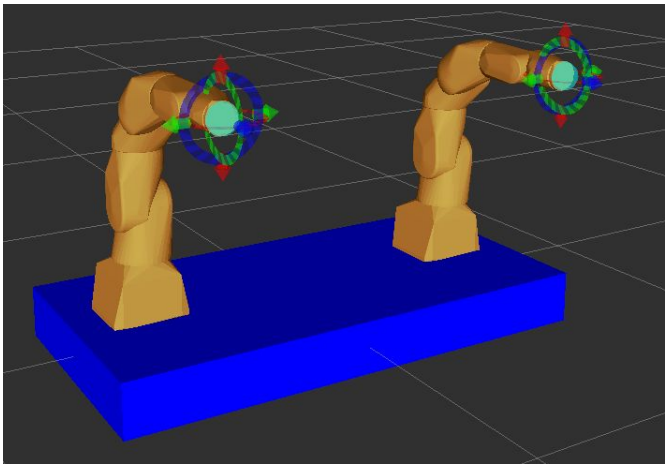

Figure 1. *Two Yaskawa SIA5D robot manipulators on a solid platform.*

Next, create a new MoveIt! configuration package (e.g., `dual_sia5_moveit_config`) for the dual manipulator system. Define 3 different planning groups: *first_manipulator*, *second_manipulator*, *dual_manipulator*. Let *dual_manipulator* contain the other two.

By using RViz and MotionPlanning GUI, test that you can plan and execute for all three planning groups.

>>> Show the result to your lab instructor! <<<

Dual manipulation with Yaskawa SIA5D and Universal Robots UR5

In this section you are going to:

1) Download ROS-Industrial support packages for Universal Robots and replace one SIA5D manipulator with UR5 manipulator in the previously created dual manipulation setup (Figure 2).
2) Set up MoveIt! configuration package that enables motion planning for each manipulator independently and for simultaneous dual manipulation.
3) Test motion planning in RViz.

Create a new Xacro-file where you replace one of the manipulators with Universal Robots UR5 industrial robot, e.g., Figure 2.

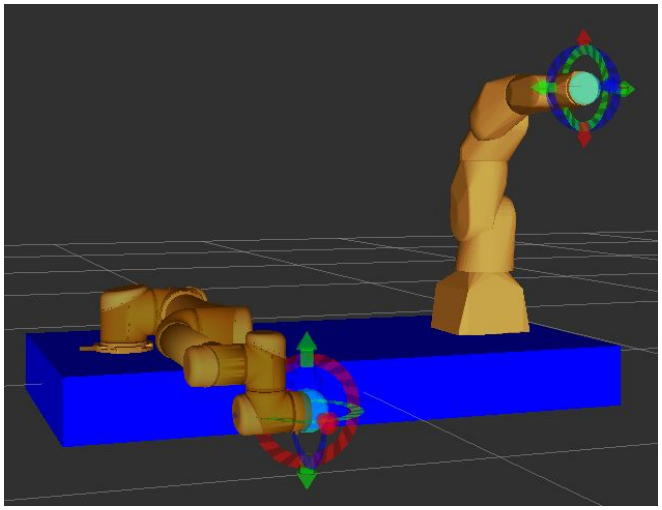

Figure 2. *Dual manipulator system with UR5 and SIA5D mounted on a solid platform.*

Generate a MoveIt! configuration package (e.g., `dual_manipulator_moveit_config`) for the new dual robot setup and test motion planning for individual manipulators as well as dual manipulation.

>>> Show the result to your lab instructor! <<<

CLEAN UP YOUR WORKSPACE

NB! Before you leave the lab, make sure you have pushed all the files in your catkin workspace to your git cloud service.

In terminal, `cd` to **<yourname>-rtech**

Type

```
git config user.email "youremail@example.com"
```

Type

```
git status
```

You should now see all the new and modified files in red.

Prepare the relevant files for the commit.

```
git add file_name_in_red1 file_name_in_red2
```

When you now type

```
git status
```

you should see all the added files in green. You are now ready to commit changes. Type

```
git commit –m "Insert a brief explanation"
```

Your changes have now been committed but not yet uploaded to the cloud. To upload your files, type

```
git push
```

In your web browser, **verify that all the files** have been uploaded to the **<yourname>-rtech** repository.

Delete the **<yourname>-rtech** folder and any other files you created from the lab's computer.