2020

Le Robot Marcheur

PROJECT ROBOTIQUE INDUSTRIELLE

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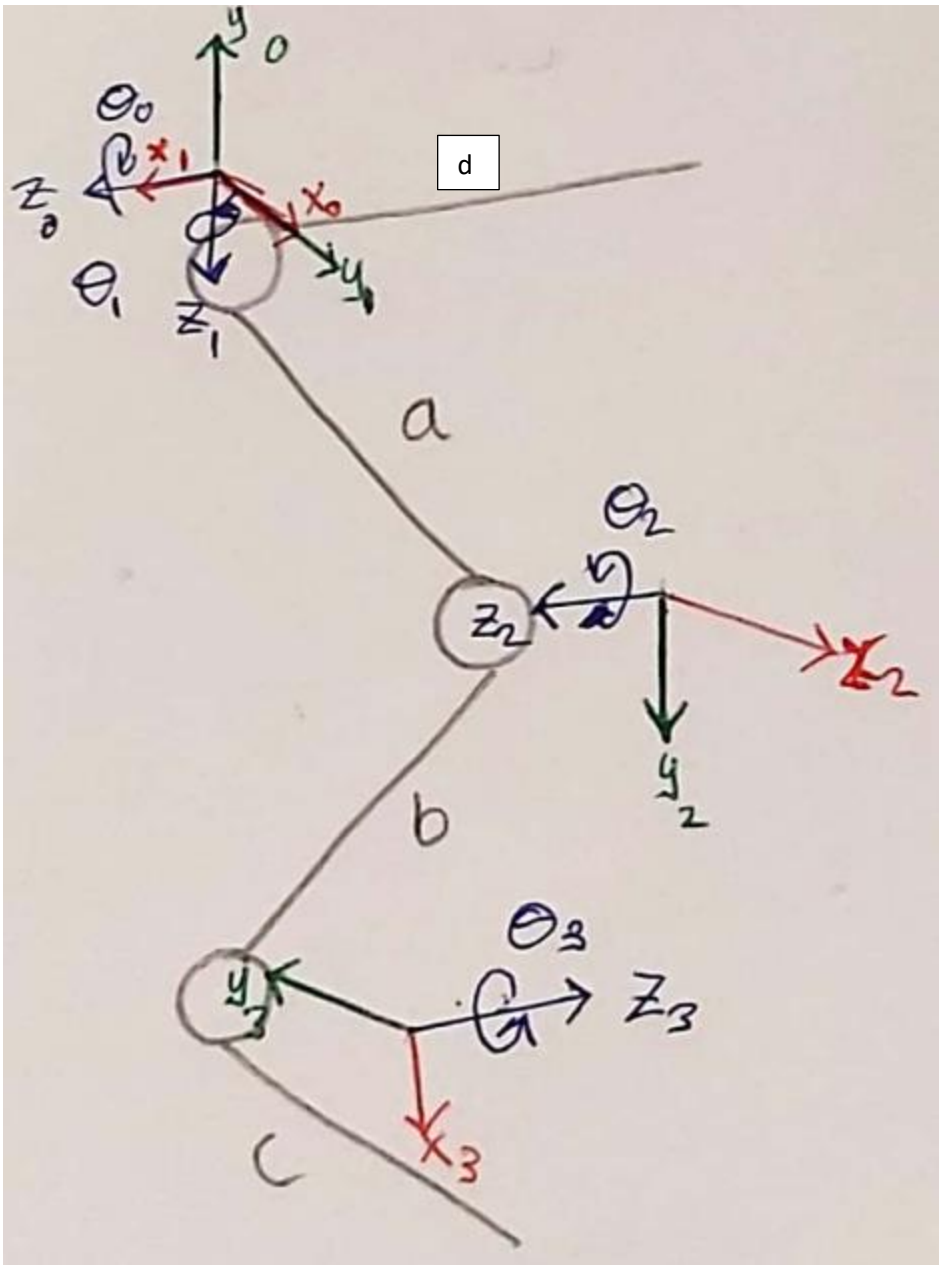
Partie 1 Conception d’une jambe

1. **Concevoir le schéma cinématique de la jambe de votre système.**



2. Indiquer les repères liés aux différents solides de votre système.

See in the picture above straight-line a, b, c and d. The circles are the revolute joint.

3. **Déterminer la matrice de Denavit-Hartenberg.**

n	θ	α	r	d
1	180	90	0	0
2	θ_2	0	a	0
3	90	180	0	0

4. **Créer un package qui contiendra l'urdf de votre robot ainsi que les launchfile nécessaires à la visualisation des urdf.**

```
deeya@deeya-VirtualBox:~/catkin_ws$ cd src
deeya@deeya-VirtualBox:~/catkin_ws/src$ catkin_create_pkg urdf_quad rospy roscpp
 std_msgs
Created file urdf_quad/package.xml
Created file urdf_quad/CMakeLists.txt
Created folder urdf_quad/include/urdf_quad
Created folder urdf_quad/src
Successfully created files in /home/deeya/catkin_ws/src/urdf_quad. Please adjust
 the values in package.xml.
deeya@deeya-VirtualBox:~/catkin_ws/src$ ls
CMakeLists.txt    udm_hand_moveit_configs  udm_urdf
udm_hand_control  udm_leg                  urdf_quad
deeya@deeya-VirtualBox:~/catkin_ws/src$ cd urdf_quad
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ ls
CMakeLists.txt  include  package.xml  src
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ mkdir launch
```

```
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ ls
CMakeLists.txt  include  launch  package.xml  src
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ cd launch
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad/launch$ touch check_urdf.launch

deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad/launch$ ls
check_urdf.launch
```

Open ▾ | check_urdf.launch | ~/catkin_ws/src/urdf_quad/launch | Save

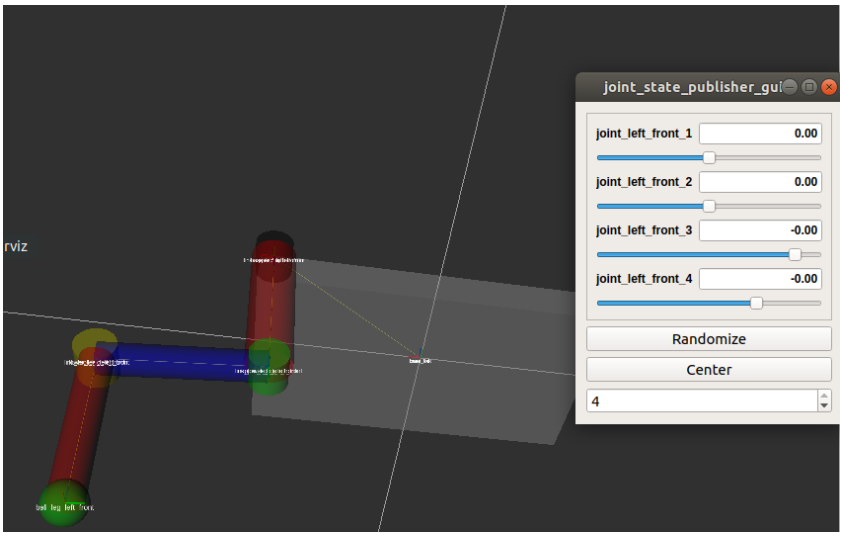
```
<launch>

  <arg name="model" default="$(find urdf_quad)/urdf/main.urdf"/>
  <param name="robot_description" command="$(find xacro)/xacro.py $(arg model)" />

  <!-- Combine joint values -->
  <node name="joint_state_publisher_gui" pkg="joint_state_publisher_gui"
type="joint_state_publisher_gui" />

  <!-- Send joint values -->
  <node name="robot_state_publisher" pkg="robot_state_publisher" type="robot_state_publisher" />

  <!-- Show in Rviz -->
  <node name="rviz" pkg="rviz" type="rviz" args="-d $(find urdf_quad)/rviz/urdf.rviz"/>

</launch>
```

5. Créer l'urdf de votre robot avec une jambe et le base_link de votre robot.

```
deeya@deeya-VirtualBox:~/catkin_ws$ source devel/setup.bash
deeya@deeya-VirtualBox:~/catkin_ws$ roslaunch urdf_quad check_urdf.launch
... logging to /home/deeya/.ros/log/cba8dd10-047a-11eb-9877-080027eb1150/roslaunch-deeya-VirtualBox-2452.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

xacro.py is deprecated; please use xacro instead
started roslaunch server http://deeya-VirtualBox:35887/

SUMMARY
========

PARAMETERS
 * /robot_description: <?xml version="1....
 * /rosdistro: melodic
 * /rosversion: 1.14.9
```

```
deeya@deeya-VirtualBox:~/catkin_ws$ cd src/urdf_quad
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ ls
CMakeLists.txt  include  launch  package.xml  src
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ mkdir urdf
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ ls
CMakeLists.txt  include  launch  package.xml  src  urdf
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ cd urdf
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad/urdf$ touch main.urdf
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad/urdf$ ls
main.urdf
```

```
deeya@deeya-VirtualBox:~/catkin_ws$ catkin build
------------------------------------------------------------
Profile:                     default
Extending:          [cached] /opt/ros/melodic
Workspace:                   /home/deeya/catkin_ws
------------------------------------------------------------
Build Space:        [exists] /home/deeya/catkin_ws/build
Devel Space:        [exists] /home/deeya/catkin_ws/devel
Install Space:      [unused] /home/deeya/catkin_ws/install
Log Space:          [exists] /home/deeya/catkin_ws/logs
Source Space:       [exists] /home/deeya/catkin_ws/src
DESTDIR:            [unused] None
------------------------------------------------------------
Devel Space Layout:          linked
Install Space Layout:        None
------------------------------------------------------------
Additional CMake Args:       None
Additional Make Args:        None
Additional catkin Make Args: None
Internal Make Job Server:    True
Cache Job Environments:      False
------------------------------------------------------------
Whitelisted Packages:        None
Blacklisted Packages:        None
------------------------------------------------------------
Workspace configuration appears valid.
------------------------------------------------------------
[build] Found '5' packages in 0.0 seconds.
[build] Updating package table.
Starting  >>> udm_hand_control
Finished  <<< udm_hand_control                [ 0.5 seconds ]
Starting  >>> udm_leg
Finished  <<< udm_leg                         [ 0.4 seconds ]
Starting  >>> udm_urdf
Finished  <<< udm_urdf                        [ 0.3 seconds ]
Starting  >>> urdf_quad
Finished  <<< urdf_quad                       [ 5.0 seconds ]
Starting  >>> udm_hand_moveit_configs
Finished  <<< udm_hand_moveit_configs         [ 0.3 seconds ]
[build] Summary: All 5 packages succeeded!
[build]   Ignored:   None.
[build]   Warnings:  None.
[build]   Abandoned: None.
[build]   Failed:    None.
[build] Runtime: 6.7 seconds total.
[build] Note: Workspace packages have changed, please re-source setup files to use them.
```

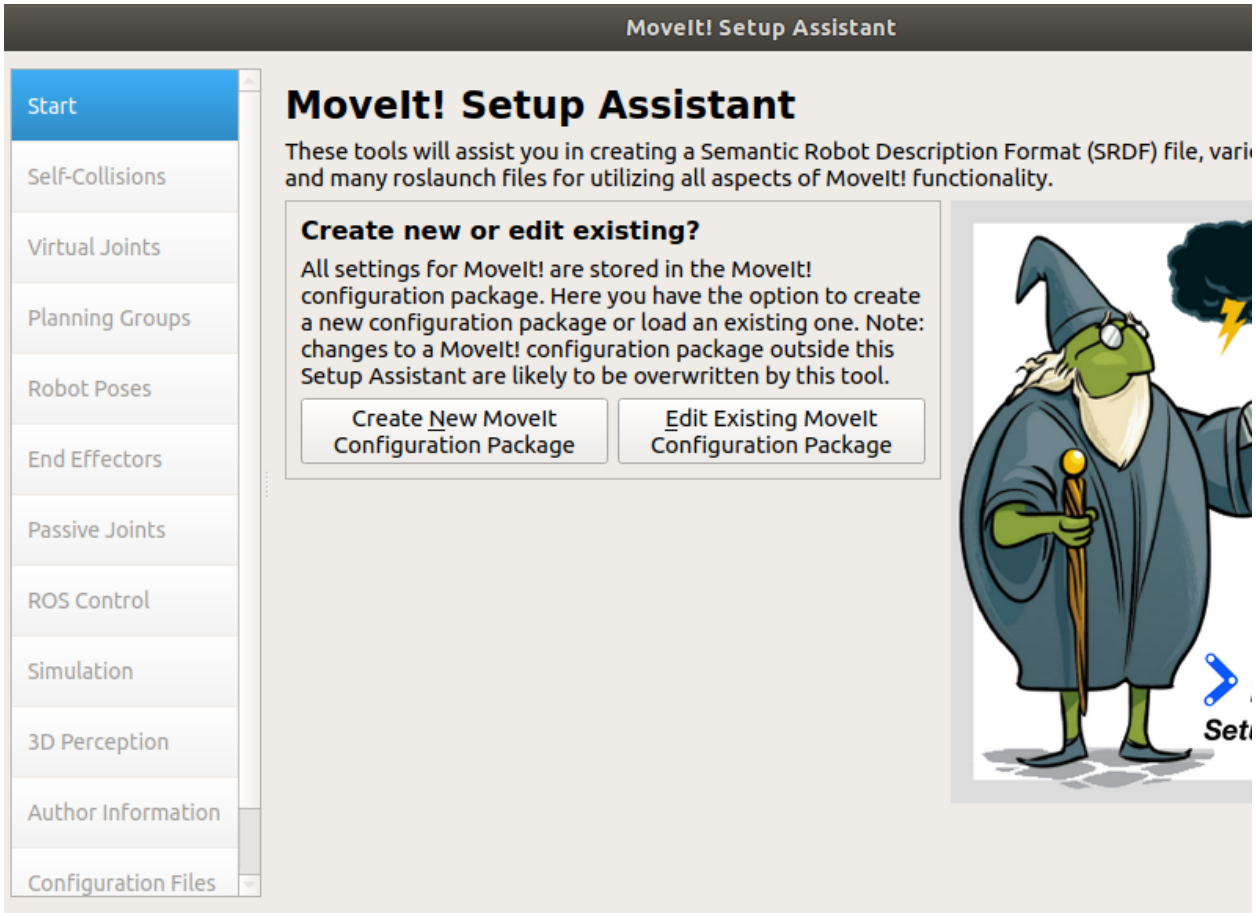


6. **Créer le package udm_project_moveitconfig avec le moveit assistant setup.**

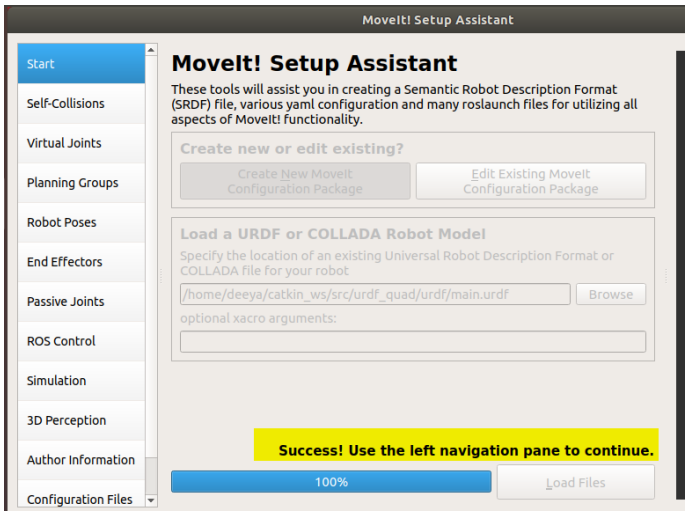
```
deeya@deeya-VirtualBox:~/catkin_ws$ roslaunch moveit_setup_assistant setup_assis
tant.launch
... logging to /home/deeya/.ros/log/f94acc24-0493-11eb-9877-080027eb1150/roslaun
ch-deeya-VirtualBox-5581.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://deeya-VirtualBox:32935/

SUMMARY
========
```

7. **Créer un package udm_project_control avec un noeud permettant de contrôler la jambe de manière directe, puis un autre noeud contrôlant la jambe de manière indirecte**.

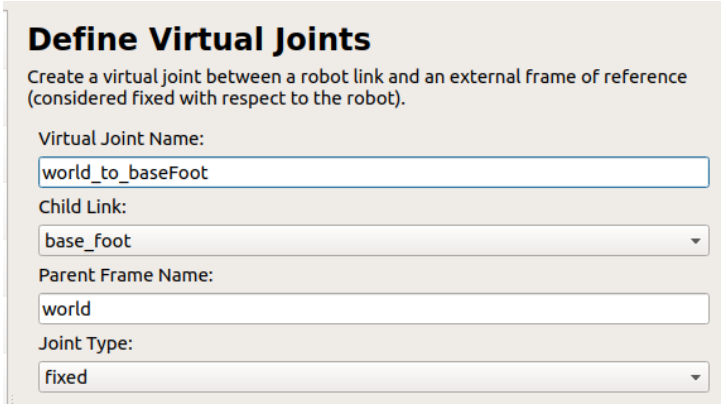
1. Click on create New and browse your urdf file



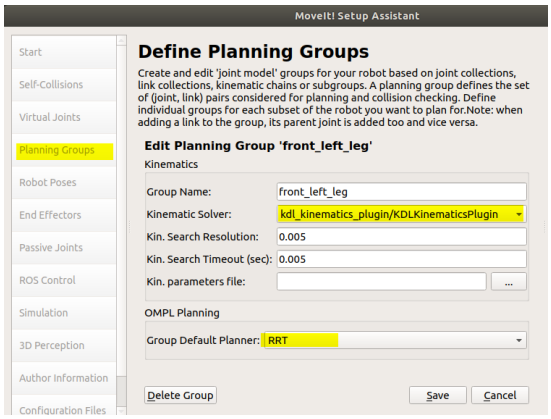
2. Click on load.

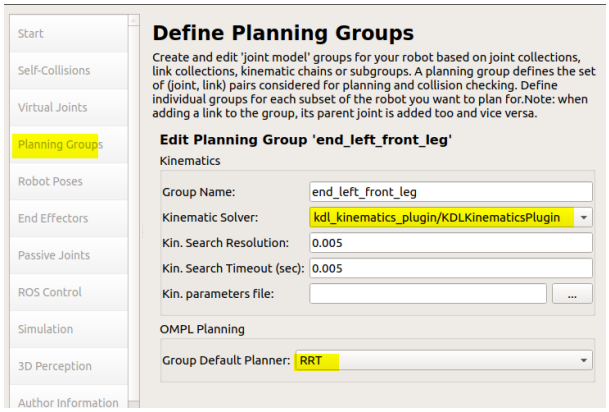


3. Add virtual joint

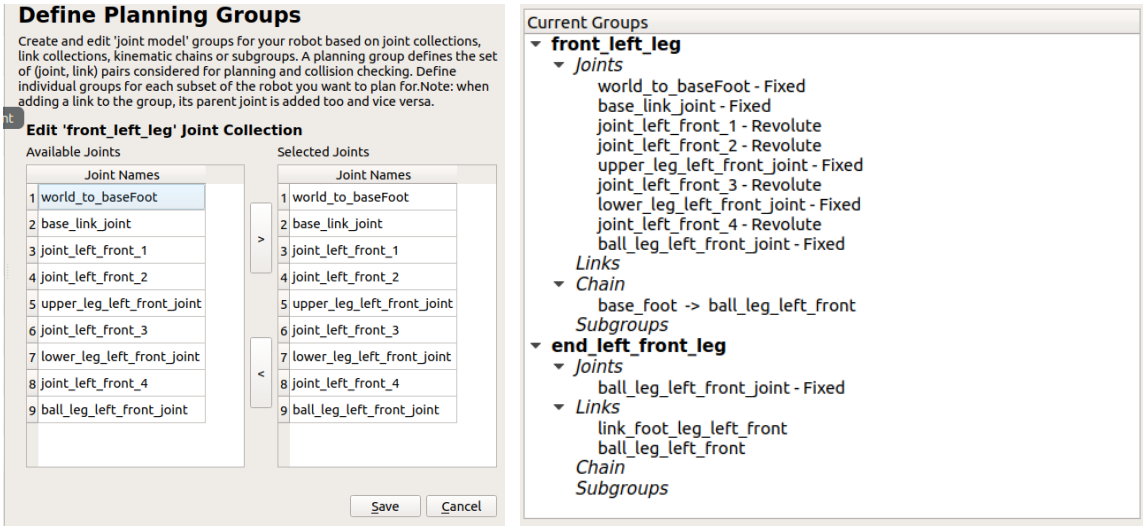


4. Click on planning groups.

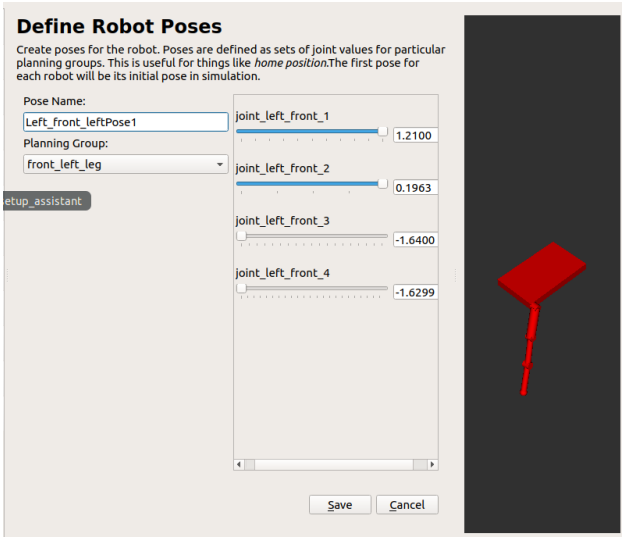




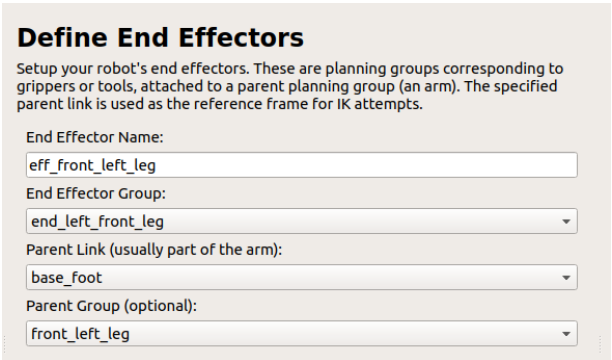
5. Click on add joints and select the joint.



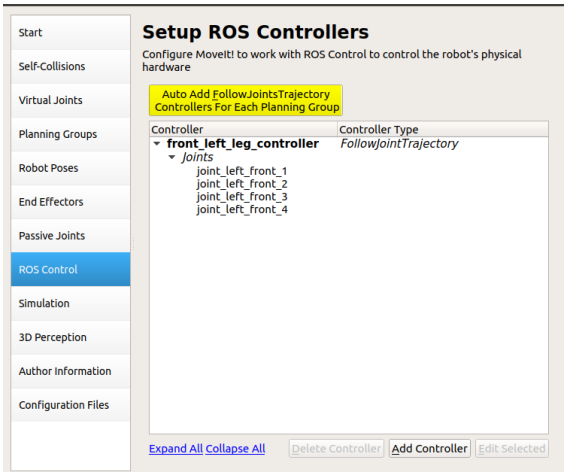
6. Add robot pose.



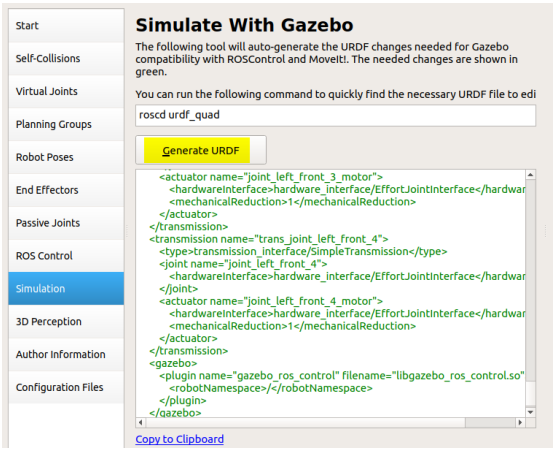
7. Add end effector.



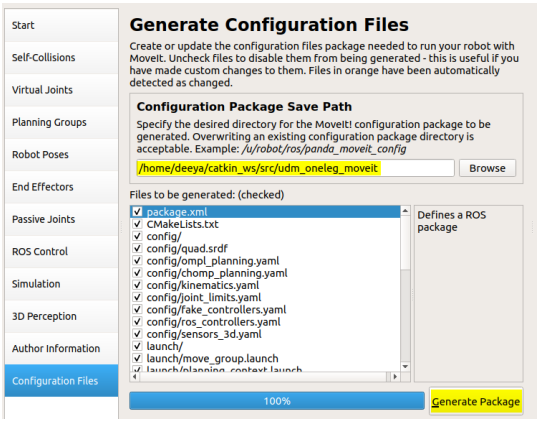
8. Click on ROS Control > auto Add followJointsTrajectory Controllers for each planning group.



9. Generate simulate with Gazebo.



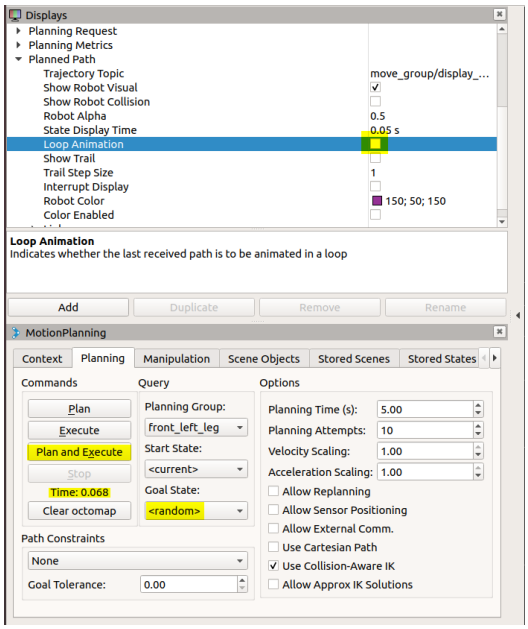
10. Generate the package file.

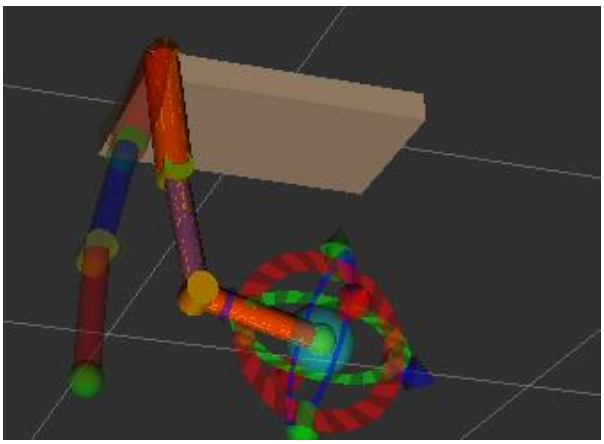


11. Launch demo.launch

```
deeya@deeya-VirtualBox:~/catkin_ws$ roslaunch udm_oneleg_moveit demo.launch
... logging to /home/deeya/.ros/log/8cd838da-04e6-11eb-9877-080027eb1150/roslaun
ch-deeya-VirtualBox-19610.log
```

12. Plan and execute.



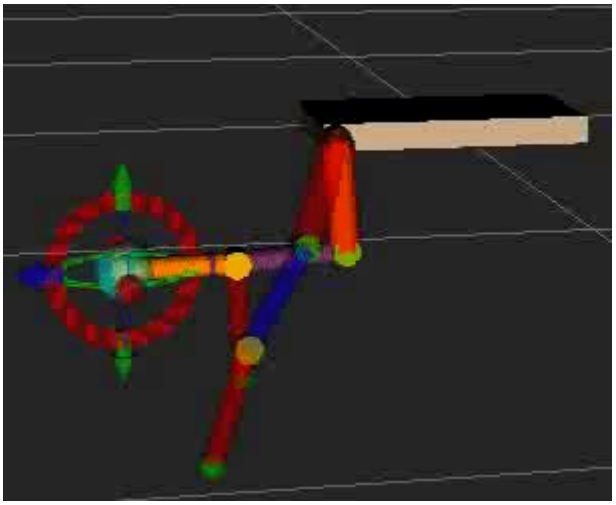


Direct movement :

1. Launch direct.launch

```
deeya@deeya-VirtualBox:~/catkin_ws$ roslaunch udm_project_control direct.launch
... logging to /home/deeya/.ros/log/f488b0b0-070a-11eb-b958-080027eb1150/roslaun
```

Click on image to see movement.



2. Parameters used to call function

```
deeya@deeya-VirtualBox:~/catkin_ws$ rosservice call /direct_kin_service_front_left_leg "joint1:
 data: 0.7100
joint2:
 data: 0.0
joint3:
 data: 0.0
joint4:
 data: 0.0"
res:
  data: True
message:
  data: "Success"
```

Indirect movement :

1. Launch indirect.launch

```
deeya@deeya-VirtualBox:~/catkin_ws$ roslaunch udm_project_control indirect.launch
... logging to /home/deeya/.ros/log/7c0a8204-05ab-11eb-915d-080027eb1150/roslaunch-deeya-Virtual
Box-20854.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://deeya-VirtualBox:33451/

SUMMARY
========

PARAMETERS
 * /move_group_leg/group_name: front_left_leg
 * /rosdistro: melodic
 * /rosversion: 1.14.9
```

2. Parameters used to call function

```
deeya@deeya-VirtualBox:~/catkin_ws$ rosservice call /indirect_kin_service_front_left_leg "pose:
 orientation:
  w: 1
 position:
  x: 0.01
 position:
  y: 0.2
 position:
  z: -0.01"
res:
  data: True
message:
  data: "Success"
```

Annex

1. Error: forgot to add other dependencies.

Solution: delete package.xml and creating a new one.

```
CMakeLists.txt  udm_hand_control  udm_hand_moveit_configs  udm_leg  udm_urdf  urdf_quad
deeya@deeya-VirtualBox:~/catkin_ws/src$ cd urdf_quad
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ ls
CMakeLists.txt  include  package.xml  src
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ rm package.xml
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ ls
CMakeLists.txt  include  src
deeya@deeya-VirtualBox:~/catkin_ws/src/urdf_quad$ cd
deeya@deeya-VirtualBox:~$ cd catkin_ws/src
deeya@deeya-VirtualBox:~/catkin_ws/src$ catkin_create_pkg urdf_quad rospy roscpp urdf std_msgs ge
ometry_msgs sensor_msgs
```

```
Created file urdf_quad/package.xml
Created file urdf_quad/CMakeLists.txt
Created folder urdf_quad/include/urdf_quad
Created folder urdf_quad/src
Successfully created files in /home/deeya/catkin_ws/src/urdf_quad/urdf_quad. Please adjust the va
lues in package.xml.
```

2. Error: cannot launch node

```
ERROR: cannot launch node of type [udm_project_control/direct_kin_service.py]: C
annot locate node of type [direct_kin_service.py] in package [udm_project_contro
l]. Make sure file exists in package path and permission is set to executable (c
hmod +x)
```

Solution:

```
deeya@deeya-VirtualBox:~/catkin_ws/src/udm_project_control/src$ chmod +x direct_
kin_service.py
deeya@deeya-VirtualBox:~/catkin_ws/src/udm_project_control/src$ cd
deeya@deeya-VirtualBox:~$ cd catkin_ws
deeya@deeya-VirtualBox:~/catkin_ws$ roslaunch udm_project_control direct.launch
... logging to /home/deeya/.ros/log/2eeefb14-05a4-11eb-915d-080027eb1150/roslaun
ch-deeya-VirtualBox-6061.log
Checking log directory for disk usage. This may take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://deeya-VirtualBox:40543/

SUMMARY
========
```

3. Error: unable to communicate with master

```
deeya@deeya-VirtualBox:~/catkin_ws$ rosservice
call /direct_kin_service_front_left_leg "joint1
:
> data: 1.21
> joint:
>  data: 0.109
> joint:
>  data: 0.17
> joint:
>  data: -1.625"
ERROR: Unable to communicate with master!
```

Solution: Start roscore in other shell.

```
deeya@deeya-VirtualBox:~/catkin_ws$ roscore
... logging to /home/deeya/.ros/log/7c0a8204-05
ab-11eb-915d-080027eb1150/roslaunch-deeya-Virtu
alBox-6736.log
Checking log directory for disk usage. This may
 take a while.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1G
B.
```

Text Editor

4. Error: Robot model parameter not found

```
    move_group_leg (udm_project_control/direct_
kin_service.py)

ROS_MASTER_URI=http://localhost:11311

process[move_group_leg-1]: started with pid [81
64]
[ERROR] [1601756019.871804801]: Robot model par
ameter not found! Did you remap 'robot_descript
ion'?
Traceback (most recent call last):
  File "/home/deeya/catkin_ws/src/udm_project_c
ontrol/src/direct_kin_service.py", line 62, in
<module>
    groupService()
```

Solution: Add the following parameters