

ECE 4703

Mobile Autonomous Robots

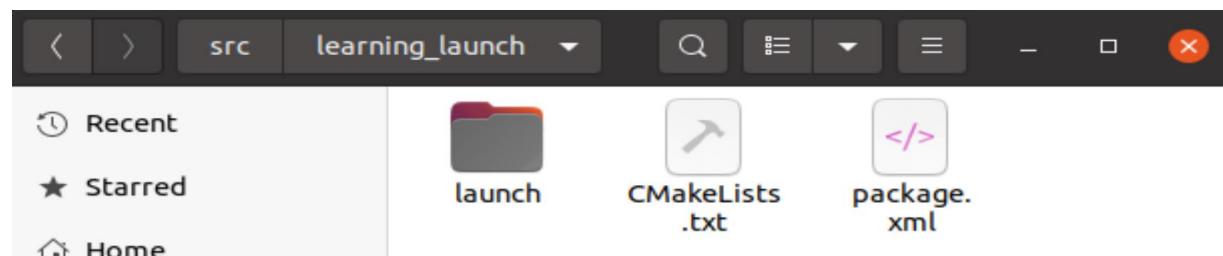
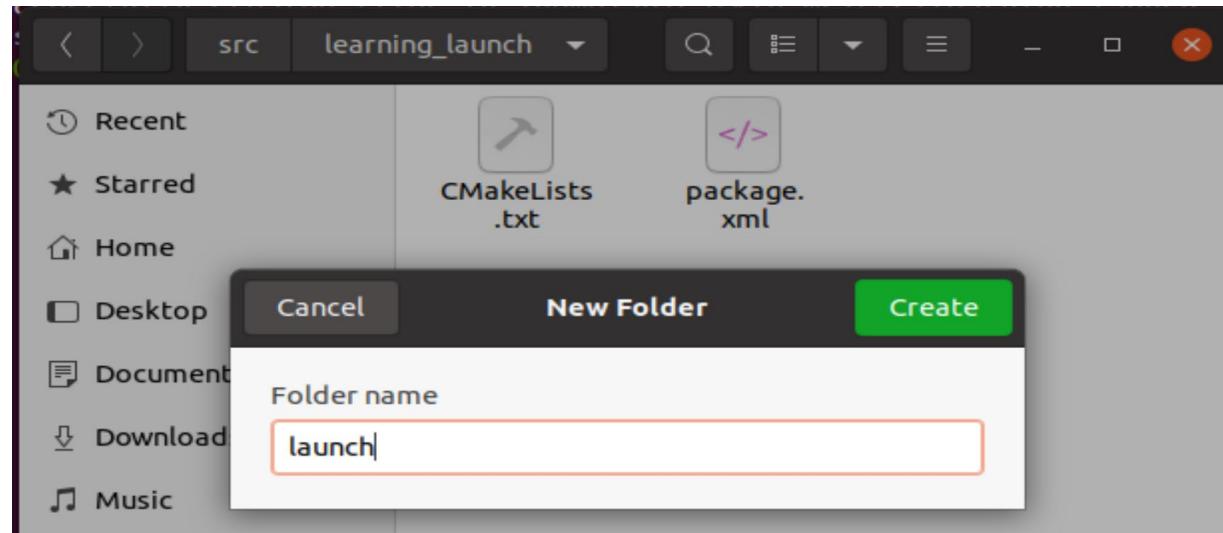
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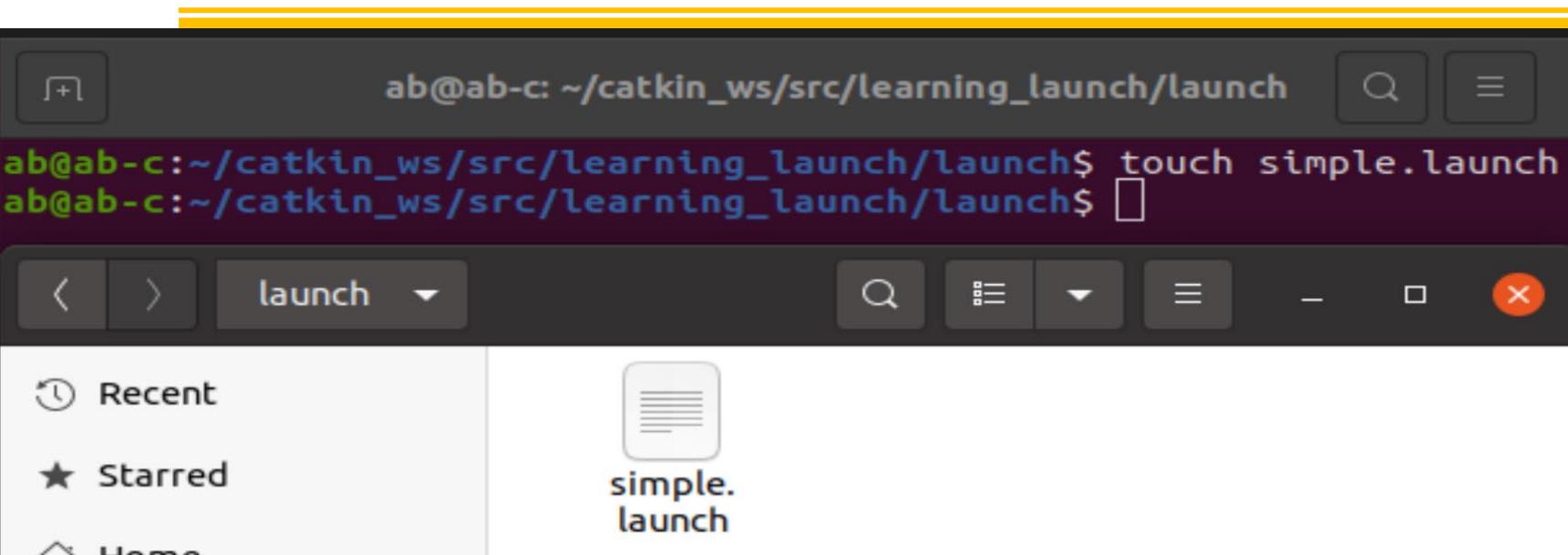
Lecture 14: Using roslaunch

Create Package

```
ab@ab-c:~/catkin_ws/src$ catkin_create_pkg learning_launch
```



Create simple.launch



The screenshot shows a code editor window with a dark theme. The title bar says "simple.launch" and the path "~/catkin_ws/src/le...". The editor contains the following XML code:

```
1 <launch>
2   <node pkg="learning_topic" type="person_subscriber"
3     name="talker" output="screen" />
4   <node pkg="learning_topic" type="person_publisher"
5     name="listener" output="screen" />
6 </launch>
```

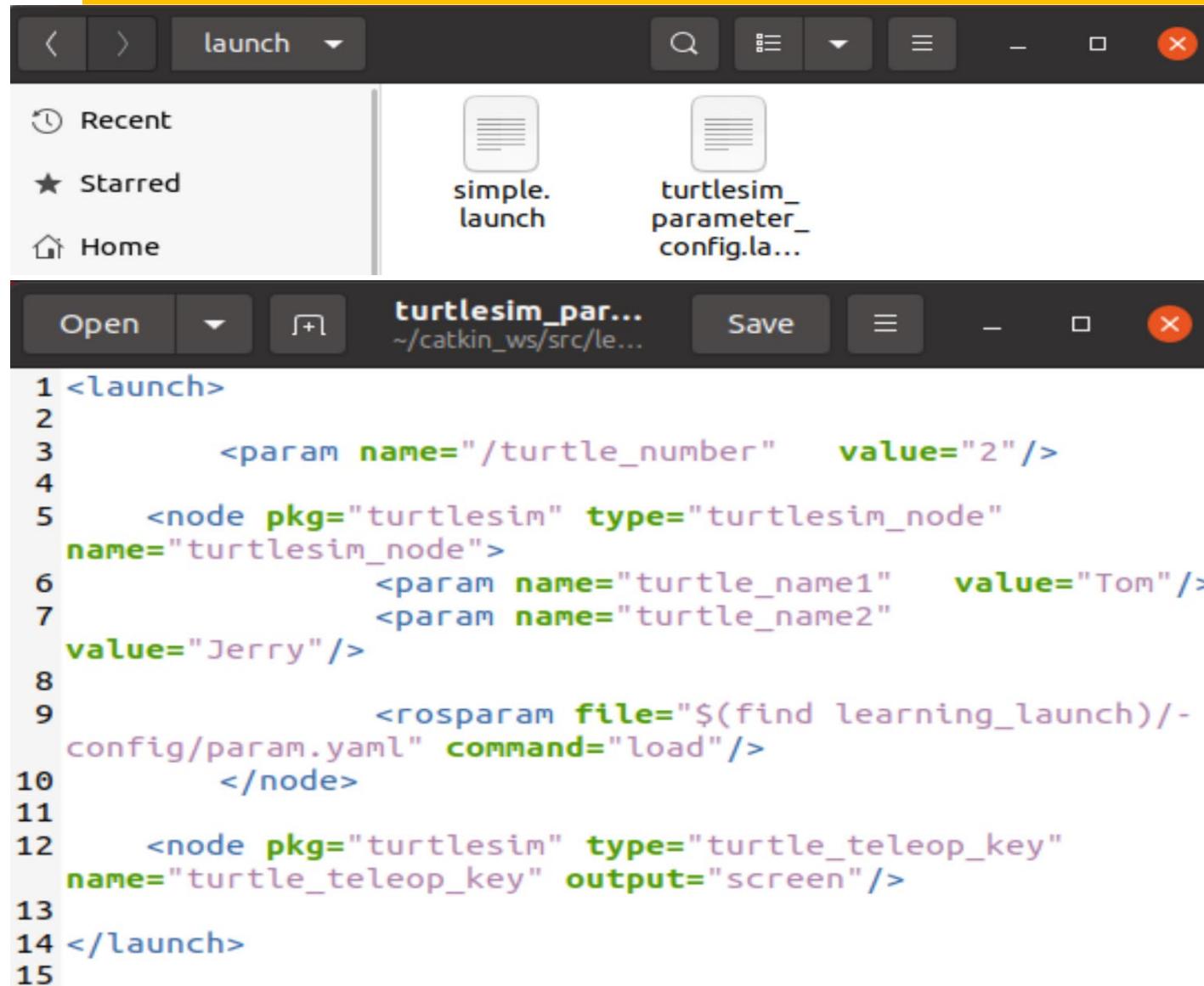
roslaunch

```
ab@ab-c:~/catkin_ws$ catkin_make
```

```
ab@ab-c:~/catkin_ws$ roslaunch learning_launch simple.launch
```

```
setting /run_id to 957a43f8-76de-11ee-a434-939a4530c802
process[rosout-1]: started with pid [5792]
started core service [/rosout]
process[talker-2]: started with pid [5795]
process[listener-3]: started with pid [5799]
[ INFO] [1698640887.689012058]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640888.692586907]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640888.694105623]: Subscribe Person Info: name:Tom age:18 sex:1
[ INFO] [1698640889.690449136]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640889.691436192]: Subscribe Person Info: name:Tom age:18 sex:1
[ INFO] [1698640890.690537244]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640890.692215885]: Subscribe Person Info: name:Tom age:18 sex:1
[ INFO] [1698640891.690382056]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640891.691659557]: Subscribe Person Info: name:Tom age:18 sex:1
[ INFO] [1698640892.692164907]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640892.694572404]: Subscribe Person Info: name:Tom age:18 sex:1
[ INFO] [1698640893.690037748]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640893.691335154]: Subscribe Person Info: name:Tom age:18 sex:1
[ INFO] [1698640894.689484017]: Publish Person Info: name:Tom age:18 sex:1
[ INFO] [1698640894.689971124]: Subscribe Person Info: name:Tom age:18 sex:1
```

Create turtlesim_parameter_config.launch

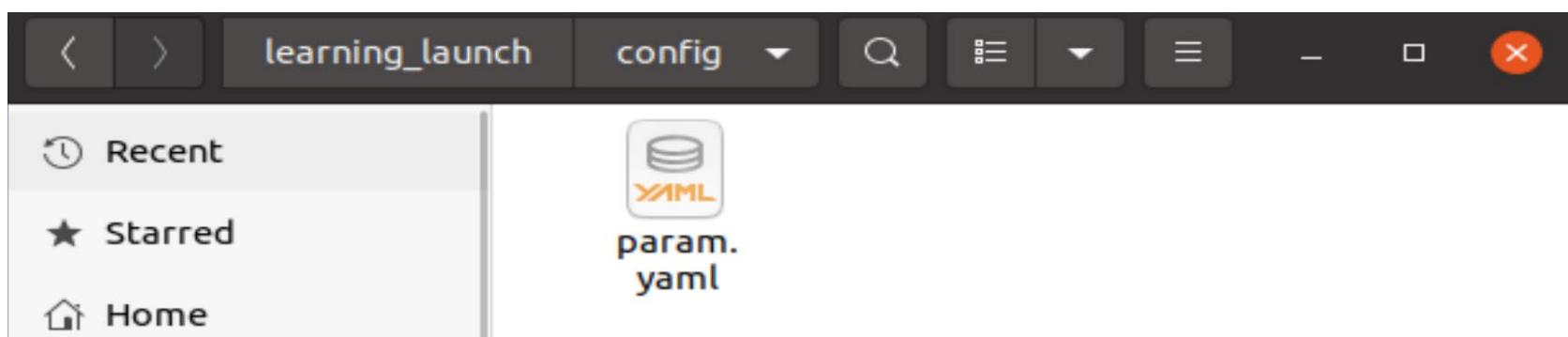
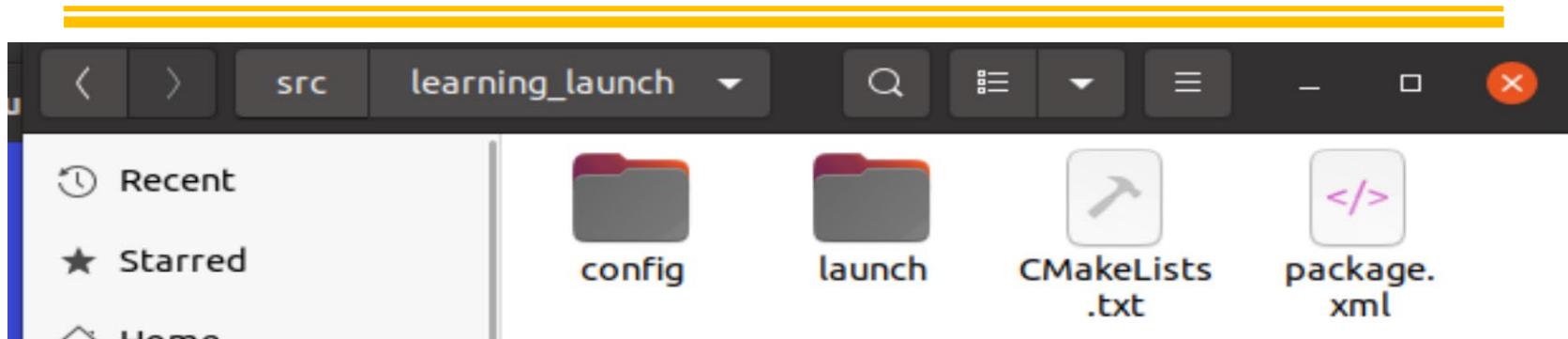


The image shows a code editor window with the following details:

- Title Bar:** The title bar displays "turtlesim_par..." and the path "~catkin_ws/src/le...".
- Toolbar:** The toolbar includes standard icons for Open, Save, and Close, along with other less common icons.
- Sidebar:** On the left, there is a sidebar with "Recent", "Starred", and "Home" sections, and two launch files listed: "simple.launch" and "turtlesim_parameter_config.la...".
- Code Area:** The main area contains the XML code for the launch file, numbered from 1 to 15. The code defines a launch configuration for the turtlesim node, setting parameters for turtle numbers, names, and loading a configuration file.

```
1 <launch>
2
3     <param name="/turtle_number" value="2"/>
4
5     <node pkg="turtlesim" type="turtlesim_node"
6         name="turtlesim_node">
7         <param name="turtle_name1" value="Tom"/>
8         <param name="turtle_name2"
9             value="Jerry"/>
10        <rosparam file="$(find learning_launch)/- config/param.yaml" command="load"/>
11    </node>
12
13    <node pkg="turtlesim" type="turtle_teleop_key"
14        name="turtle_teleop_key" output="screen"/>
15 </launch>
```

Create config

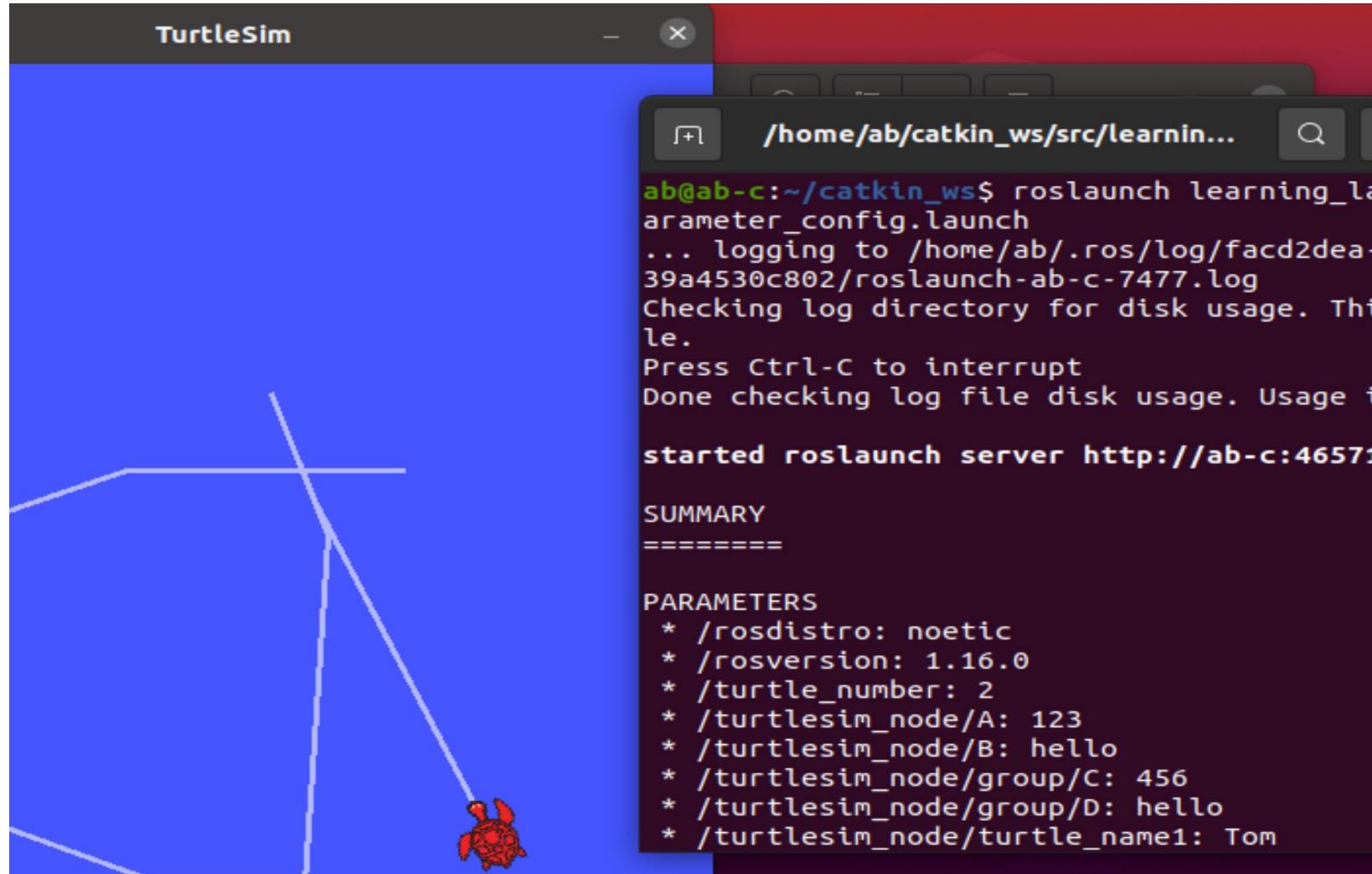


A screenshot of a code editor window showing the content of "param.yaml". The file path is indicated as "/catkin_ws/src/le...". The code is as follows:

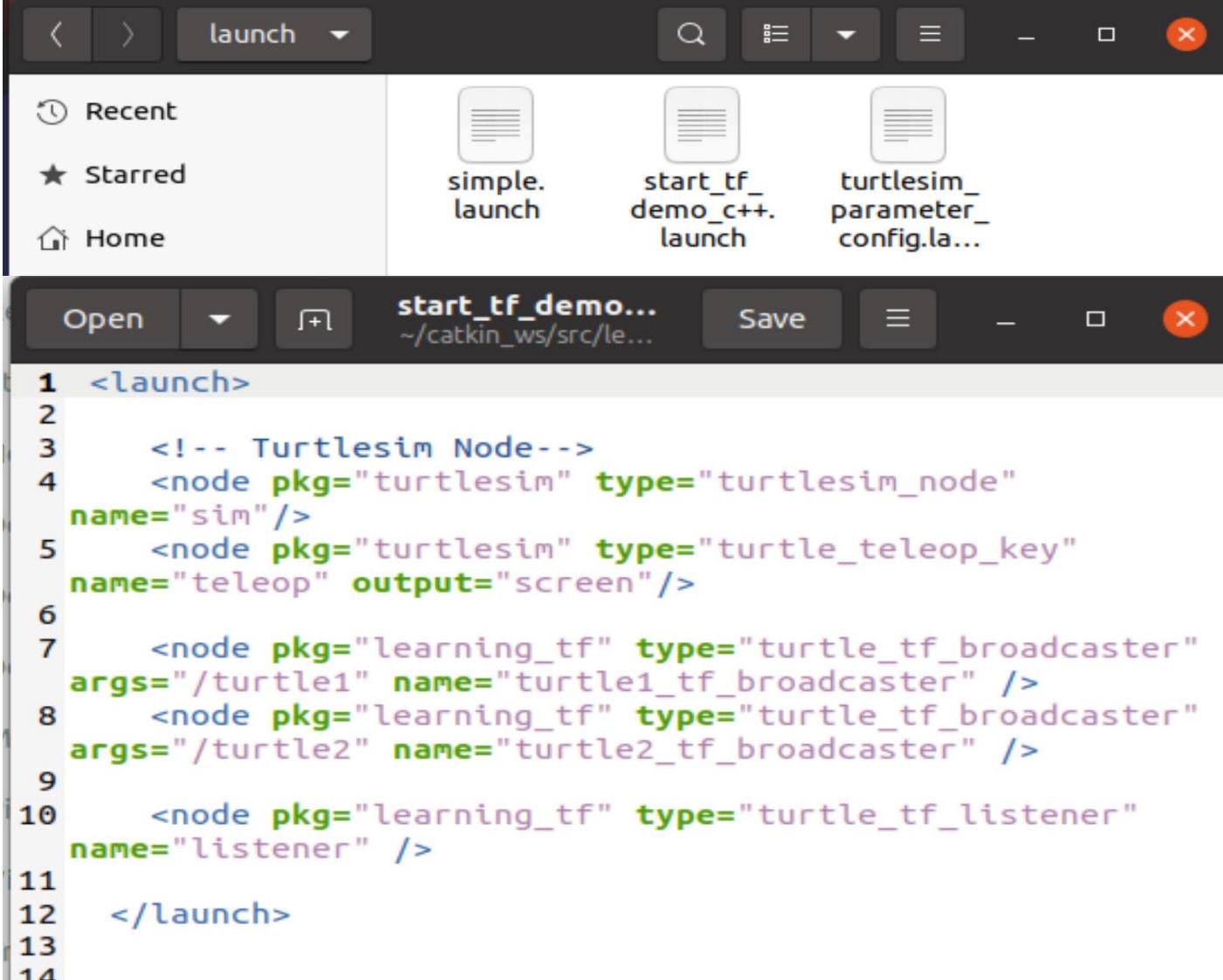
```
1 A: 123
2 B: "hello"
3
4 group:
5   C: 456
6   D: "hello"
```

roslaunch

```
ab@ab-c:~/catkin_ws$ rosrun learning.launch turtlesim_parameter_config.launch
```



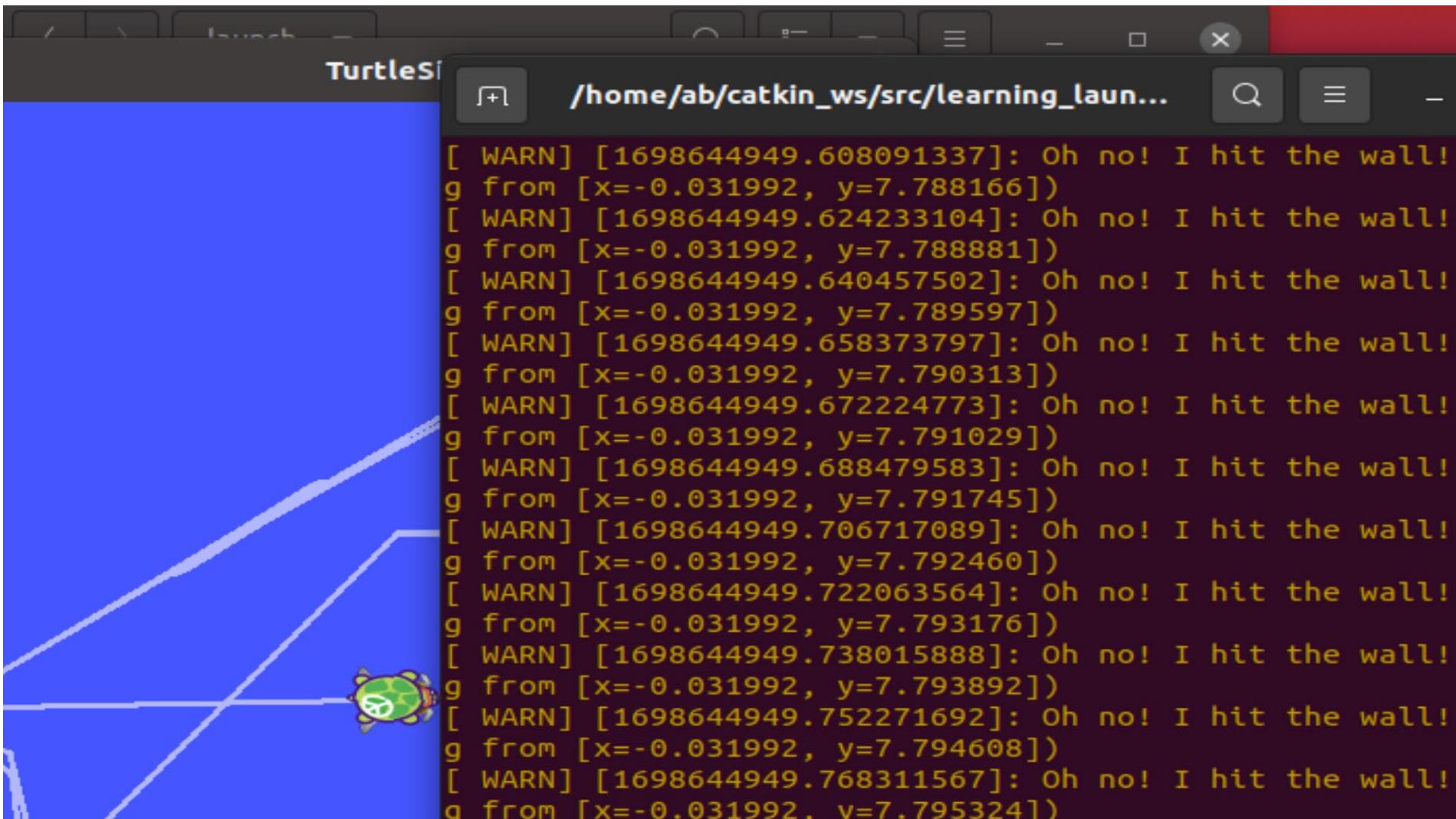
Create start_tf_demo_c++.launch



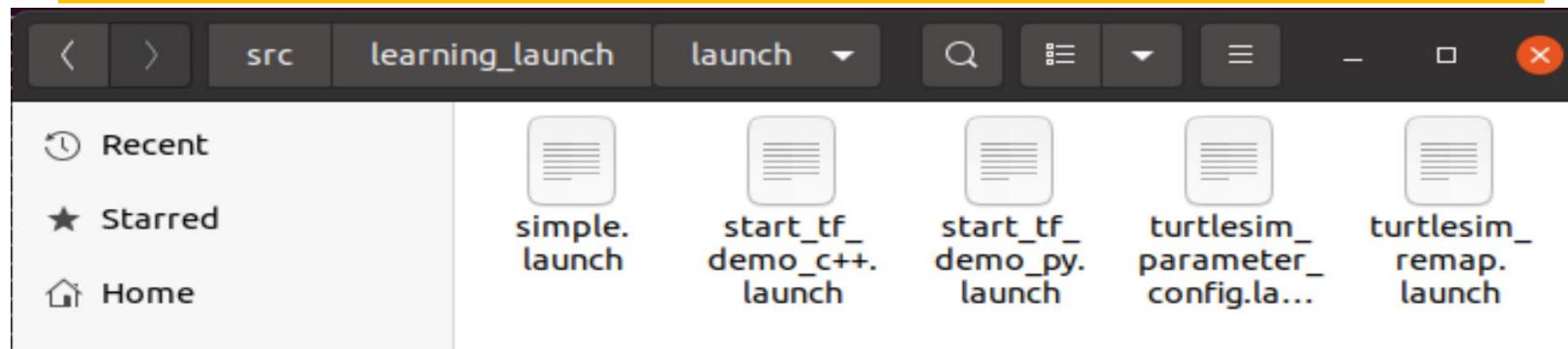
```
1 <launch>
2
3     <!-- TurtleSim Node-->
4     <node pkg="turtlesim" type="turtlesim_node"
5         name="sim"/>
6     <node pkg="turtlesim" type="turtle_teleop_key"
7         name="teleop" output="screen"/>
8
9     <node pkg="learning_tf" type="turtle_tf_broadcaster"
10        args="/turtle1" name="turtle1_tf_broadcaster" />
11     <node pkg="learning_tf" type="turtle_tf_broadcaster"
12        args="/turtle2" name="turtle2_tf_broadcaster" />
13
14     <node pkg="learning_tf" type="turtle_tf_listener"
15         name="listener" />
16
17 </launch>
```

roslaunch

```
ab@ab-c:~$ rosrun learning.launch start_tf_demo_c++.launch
```



Create start_tf_demo_c++.launch



A screenshot of a code editor showing the content of 'turtlesim_remap.launch'. The code defines a launch configuration with a node named 'turtlesim_node' from the 'turtlesim' package. It includes a 'simple.launch' file via an include statement and a remap for the 'cmd_vel' topic.

```
1 <launch>
2
3     <include file="$(find learning_launch)/launch/
4 simple.launch" />
5
6     <node pkg="turtlesim" type="turtlesim_node"
7         name="turtlesim_node">
8             <remap from="/turtle1/cmd_vel" to="/-
9 cmd_vel"/>
10        </node>
11
12 </launch>
```

roslaunch

```
ab@ab-c:~$ roslaunch learning_launch turtlesim_remap.launch
```



Lecture 15: Unified Robot Description Format (URDF)

Webcam

Enable Webcam in VirtualBox VM

VirtualBox 7.0.12 Oracle VM VirtualBox Extension Pack

- ↗ All supported platforms

Support VirtualBox RDP, disk encryption, NVMe and PXE boot for Intel cards. See [this chapter](#) from the [User Manual](#) for an introduction to this Extension Pack. The Extension Pack binaries are released under the [VirtualBox Personal Use and Evaluation License \(PUEL\)](#). *Please install the same version extension pack as your installed version of VirtualBox.*

```
ab@ab-c:~$ sudo apt-get install ros-noetic-usb-cam
```

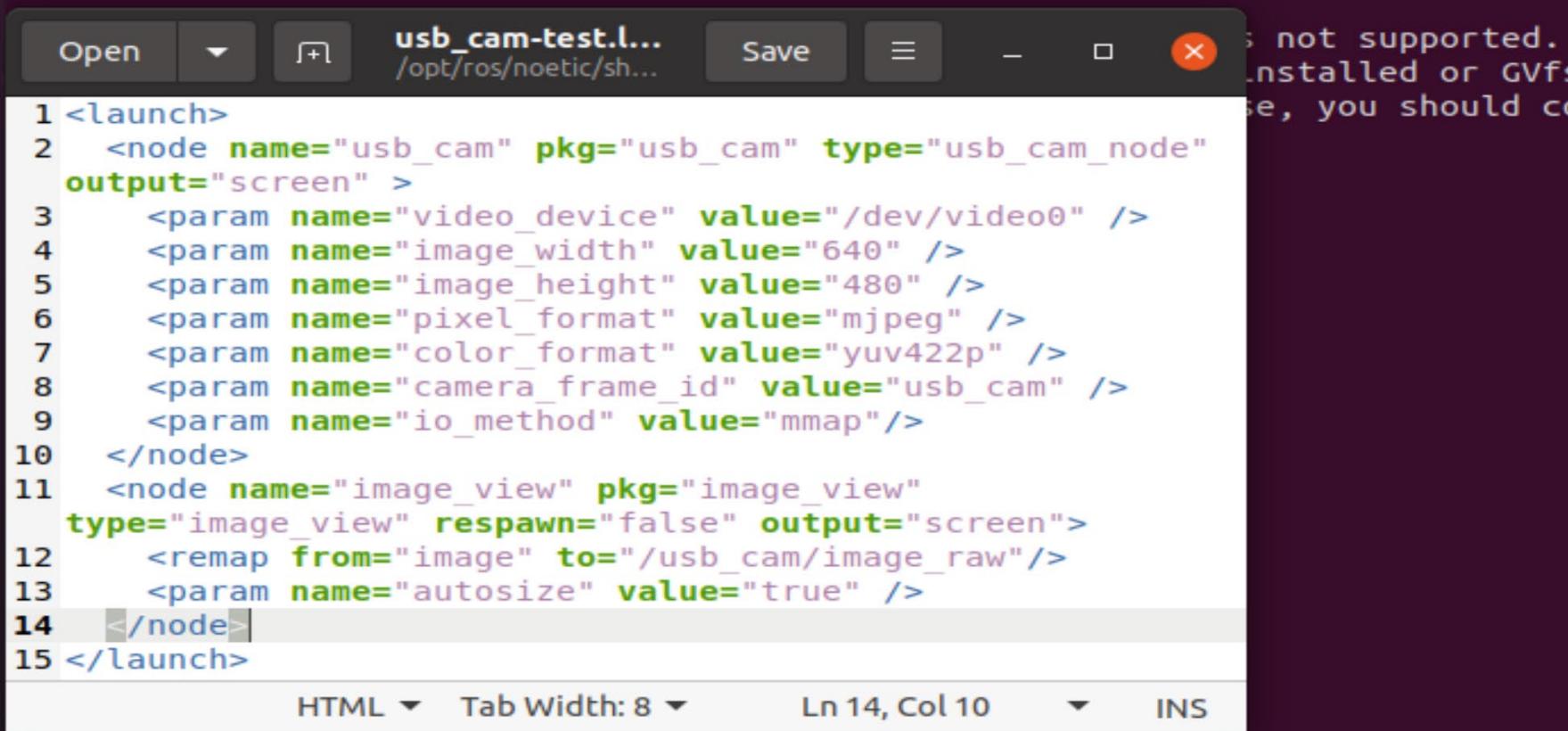
```
ab@ab-c:~$ sudo apt-get install ros-noetic-image-view
```

```
ab@ab-c:~$ roslaunch usb_cam usb_cam-test.launch
```

```
ab@ab-c:~$ rqt_image_view
```

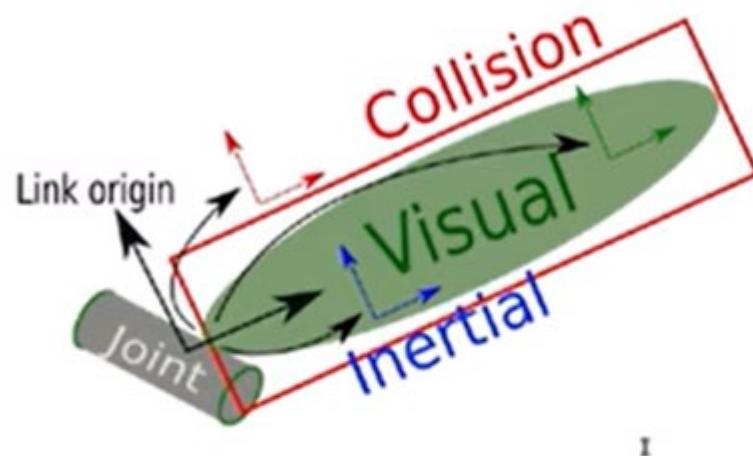
usb_cam-test.launch

```
ab@ab-c:~$ roscd usb_cam
ab@ab-c:/opt/ros/noetic/share/usb_cam$ cd launch
ab@ab-c:/opt/ros/noetic/share/usb_cam/launch$ sudo gedit usb_cam-test.launch
[sudo] password for ab:
```



```
1 <launch>
2   <node name="usb_cam" pkg="usb_cam" type="usb_cam_node"
3     output="screen" >
4     <param name="video_device" value="/dev/video0" />
5     <param name="image_width" value="640" />
6     <param name="image_height" value="480" />
7     <param name="pixel_format" value="mjpeg" />
8     <param name="color_format" value="yuv422p" />
9     <param name="camera_frame_id" value="usb_cam" />
10    <param name="io_method" value="mmap"/>
11  </node>
12  <node name="image_view" pkg="image_view"
13    type="image_view" respawn="false" output="screen">
14    <remap from="image" to="/usb_cam/image_raw"/>
15    <param name="autosize" value="true" />
16  </node>
17 </launch>
```

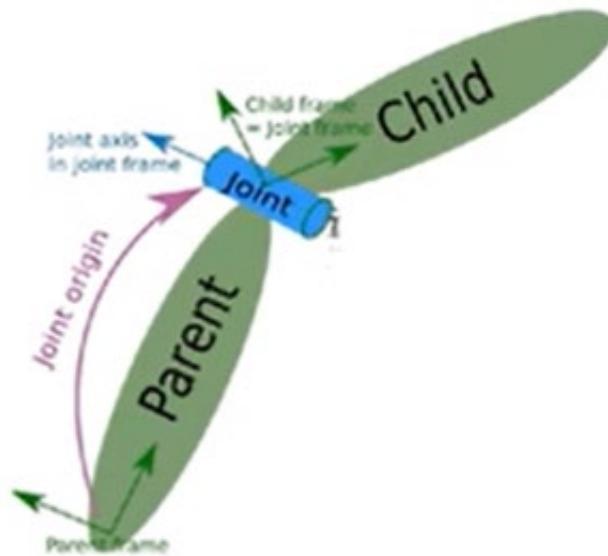
Link



I

```
<link name="<link name>">
    <inertial> . . . . . </inertial>
    <visual> . . . . . </visual>
    <collision> . . . . . </collision>
</link>
```

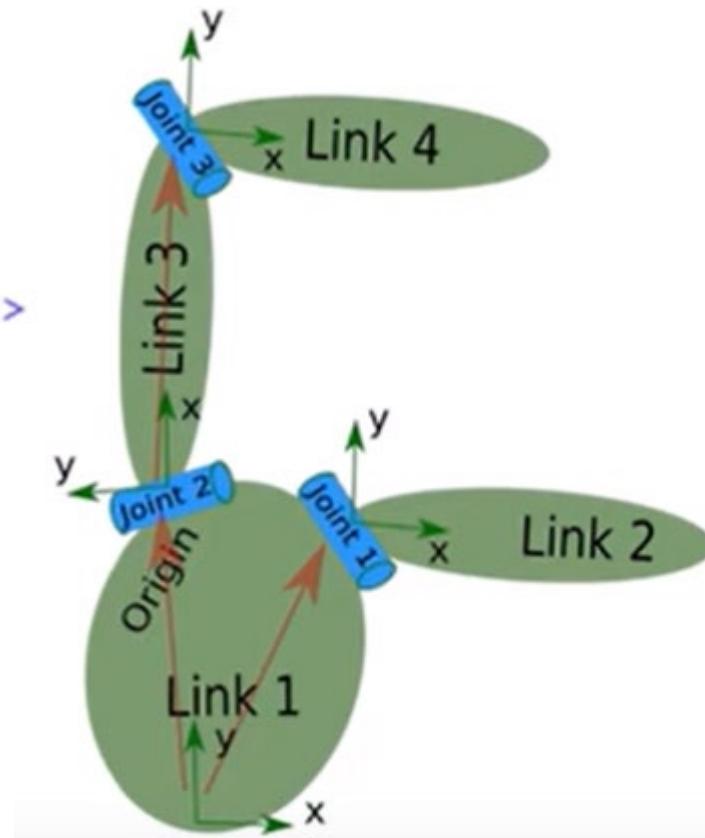
Joint



```
<joint name="<name of the joint>" type = "<joint type>">
    <parent link="parent_link" />
    <child link="child_link" />
    <calibration .... />
    <dynamics damping .... />
    <limit effort .... />
    ....
</joint>
```

Robot

```
<joint name="<name of the joint>" type = "<joint type>">  
  <parent link="parent_link" />  
  <child link="child_link" />  
  <calibration .... />  
  <dynamics damping .... />  
  <limit effort .... />  
  ....  
</joint>  
  
<robot name="<name of the robot>">  
  <link> ..... </link>  
  <link> ..... </link>  
  .  
  <joint> ..... </joint>  
  <joint> ..... </joint>  
</robot>
```



Create Robot Package

```
ab@ab-c: ~/catkin_ws/src$ catkin_create_pkg mbot_description urdf xacro  
Created file mbot_description/package.xml  
Created file mbot_description/CMakeLists.txt  
Successfully created files in /home/ab/catkin_ws/src/mbot_description. Please a  
djust the values in package.xml.  
ab@ab-c:~/catkin_ws/src$
```

The terminal window shows the command `catkin_create_pkg mbot_description urdf xacro` being run, which creates `package.xml`, `CMakeLists.txt`, and other files in the `mbot_description` directory.

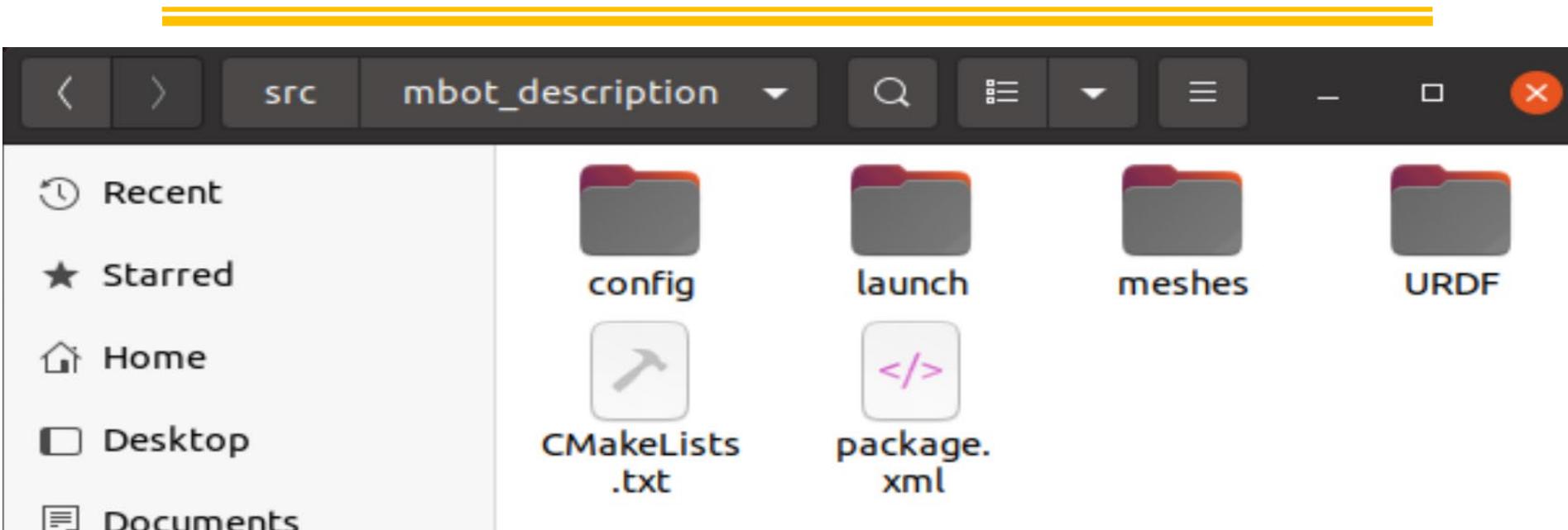
The file explorer shows the following files and folders in the `src` directory:

- Recent
- Starred
- Home
- Desktop
- Documents
- `learning_launch`
- `learning_parameter`
- `learning_service`
- `learning_tf`
- `learning_topic`
- `mbot_description`
- `.vscode`
- `CMakeLists.txt` (with a lock icon)

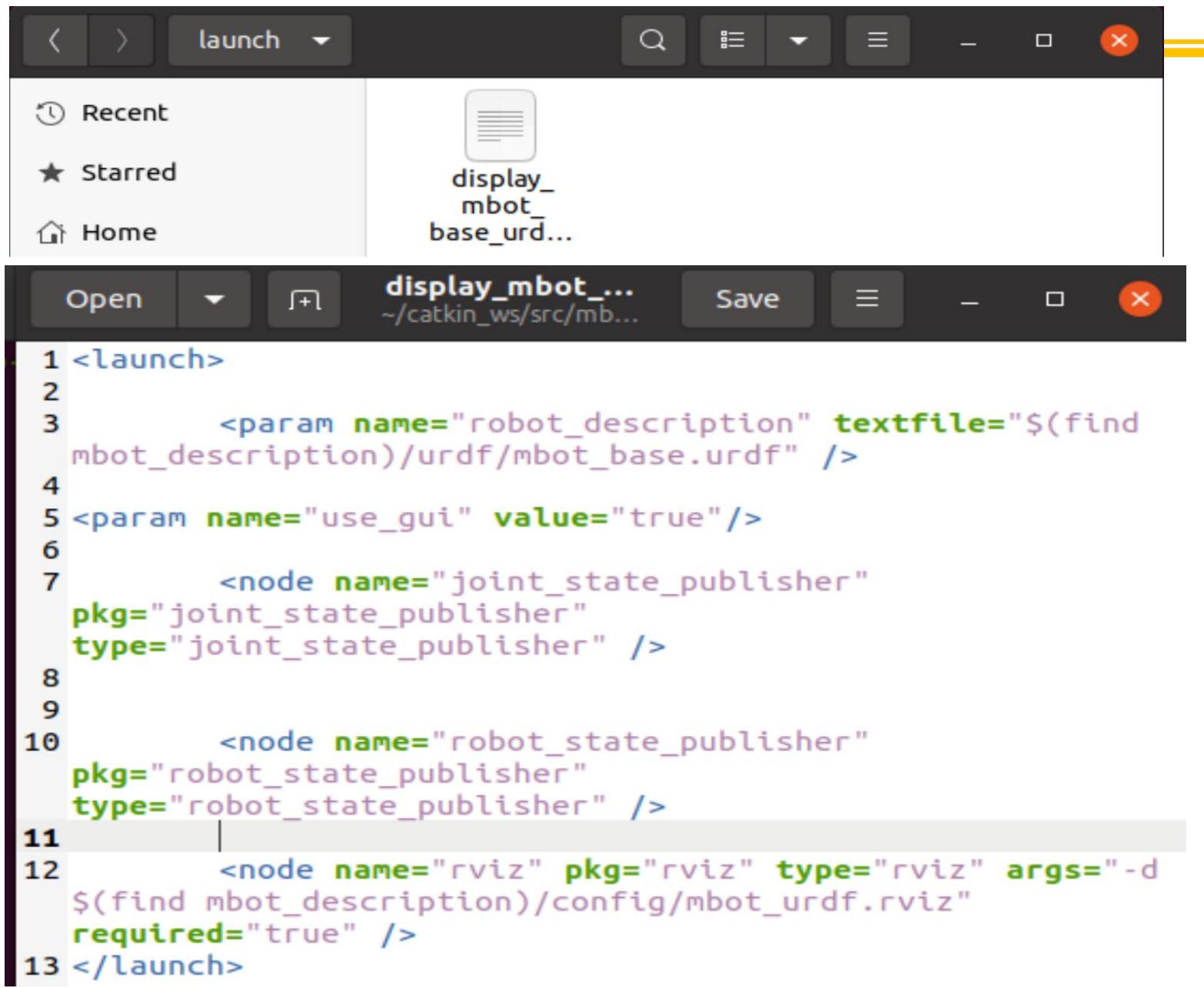
The file explorer shows the following files in the `mbot_description` directory:

- Recent
- Starred
- Home
- `CMakeLists.txt`
- `package.xml`

Create New Folders



Create display_mbot_base_urdf.launch

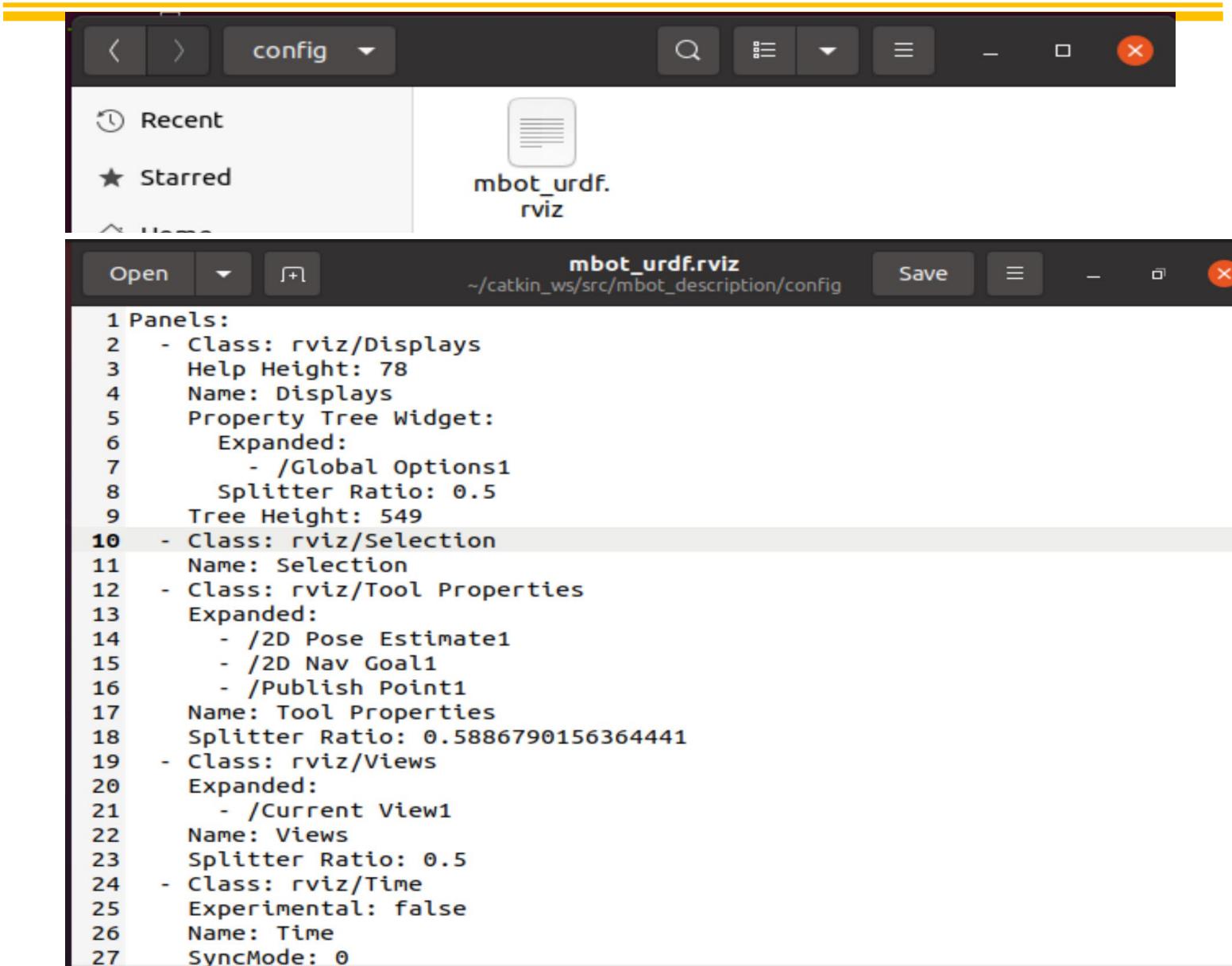


The screenshot shows a code editor window with the following details:

- Title Bar:** The title bar says "display_mbot_base_urdf.launch".
- File Path:** The path is shown as "~/catkin_ws/src/mb...".
- Recent and Starred:** On the left, there are links for "Recent", "Starred", and "Home".
- Content Area:** The main area contains the XML code for the launch file.
- Code Content:**

```
1 <launch>
2
3     <param name="robot_description" textfile="$(find
4         mbot_description)/urdf/mbot_base.urdf" />
5
6     <param name="use_gui" value="true" />
7
8     <node name="joint_state_publisher"
9         pkg="joint_state_publisher"
10        type="joint_state_publisher" />
11
12     <node name="robot_state_publisher"
13         pkg="robot_state_publisher"
14        type="robot_state_publisher" />
15
16     <node name="rviz" pkg="rviz" type="rviz" args="-d
17         $(find mbot_description)/config/mbot_urdf.rviz"
18         required="true" />
19
20 </launch>
```

Create mbot_urdf.rviz



The screenshot shows a window titled "mbot_urdf.rviz" with a dark-themed interface. The top bar includes buttons for navigation, search, and configuration, along with standard window controls. On the left, there's a sidebar with "Recent" and "Starred" sections. The main area displays the configuration XML code.

```
1 Panels:
2   - Class: rviz/Displays
3     Help Height: 78
4     Name: Displays
5     Property Tree Widget:
6       Expanded:
7         - /Global Options1
8         Splitter Ratio: 0.5
9         Tree Height: 549
10    - Class: rviz/Selection
11      Name: Selection
12    - Class: rviz/Tool Properties
13      Expanded:
14        - /2D Pose Estimate1
15        - /2D Nav Goal1
16        - /Publish Point1
17      Name: Tool Properties
18      Splitter Ratio: 0.5886790156364441
19    - Class: rviz/Views
20      Expanded:
21        - /Current View1
22      Name: Views
23      Splitter Ratio: 0.5
24    - Class: rviz/Time
25      Experimental: false
26      Name: Time
27      SyncMode: 0
```

Create mbot_urdf.rviz

```
28     SyncSource: ""
29 Preferences:
30   PromptSaveOnExit: true
31 Toolbars:
32   toolButtonStyle: 2
33 Visualization Manager:
34   Class: ""
35   Displays:
36     - Alpha: 0.5
37     Cell Size: 1
38     Class: rviz/Grid
39     Color: 160; 160; 164
40     Enabled: true
41     Line Style:
42       Line Width: 0.029999999329447746
43       Value: Lines
44     Name: Grid
45     Normal Cell Count: 0
46     Offset:
47       X: 0
48       Y: 0
49       Z: 0
50     Plane: XY
51     Plane Cell Count: 10
```

Create mbot_urdf.rviz

```
52      Reference Frame: <Fixed Frame>
53      Value: true
54      - Alpha: 1
55      Class: rviz/RobotModel
56      Collision Enabled: false
57      Enabled: true
58      Links:
59          All Links Enabled: true
60          Expand Joint Details: false
61          Expand Link Details: false
62          Expand Tree: false
63          Link Tree Style: Links in Alphabetic Order
64          back_caster_link:
65              Alpha: 1
66              Show Axes: false
67              Show Trail: false
68              Value: true
69          base_link:
70              Alpha: 1
71              Show Axes: false
72              Show Trail: false
73              Value: true
74          front_caster_link:
75              Alpha: 1
```

Create mbot_urdf.rviz

```
76      Show Axes: false
77      Show Trail: false
78      Value: true
79      left_wheel_link:
80          Alpha: 1
81          Show Axes: false
82          Show Trail: false
83          Value: true
84      right_wheel_link:
85          Alpha: 1
86          Show Axes: false
87          Show Trail: false
88          Value: true
89      Name: RobotModel
90      Robot Description: robot_description
91      TF Prefix: ""
92      Update Interval: 0
93      Value: true
94      Visual Enabled: true
95      Enabled: true
96      Global Options:
97          Background Color: 48; 48; 48
98          Default Light: true
99          Fixed Frame: base_link
```

Create mbot_urdf.rviz

```
100      Frame Rate: 30
101      Name: root
102      Tools:
103          - Class: rviz/Interact
104              Hide Inactive Objects: true
105          - Class: rviz/MoveCamera
106          - Class: rviz>Select
107          - Class: rviz/FocusCamera
108          - Class: rviz/Measure
109          - Class: rviz/SetInitialPose
110              Theta std deviation: 0.2617993950843811
111              Topic: /initialpose
112                  X std deviation: 0.5
113                  Y std deviation: 0.5
114          - Class: rviz/SetGoal
115              Topic: /move_base_simple/goal
116          - Class: rviz/PublishPoint
117              Single click: true
118                  Topic: /clicked_point
119      Value: true
120      Views:
121          Current:
122              Class: rviz/Orbit
123                  Distance: 1.3435935974121094
```

Create mbot_urdf.rviz

```
124      Enable Stereo Rendering:  
125          Stereo Eye Separation: 0.05999999865889549  
126          Stereo Focal Distance: 1  
127          Swap Stereo Eyes: false  
128          Value: false  
129      Focal Point:  
130          X: -0.038951627910137177  
131          Y: 0.013132067397236824  
132          Z: 0.0370001420378685  
133      Focal Shape Fixed Size: true  
134      Focal Shape Size: 0.05000000074505806  
135      Invert Z Axis: false  
136      Name: Current View  
137      Near Clip Distance: 0.009999999776482582  
138      Pitch: 0.425398051738739  
139      Target Frame: <Fixed Frame>  
140      Value: Orbit (rviz)  
141      Yaw: 0.6003987789154053  
142      Saved: ~  
143 Window Geometry:  
144      Displays:  
145          collapsed: false  
146          Height: 846  
147          Hide Left Dock: false
```

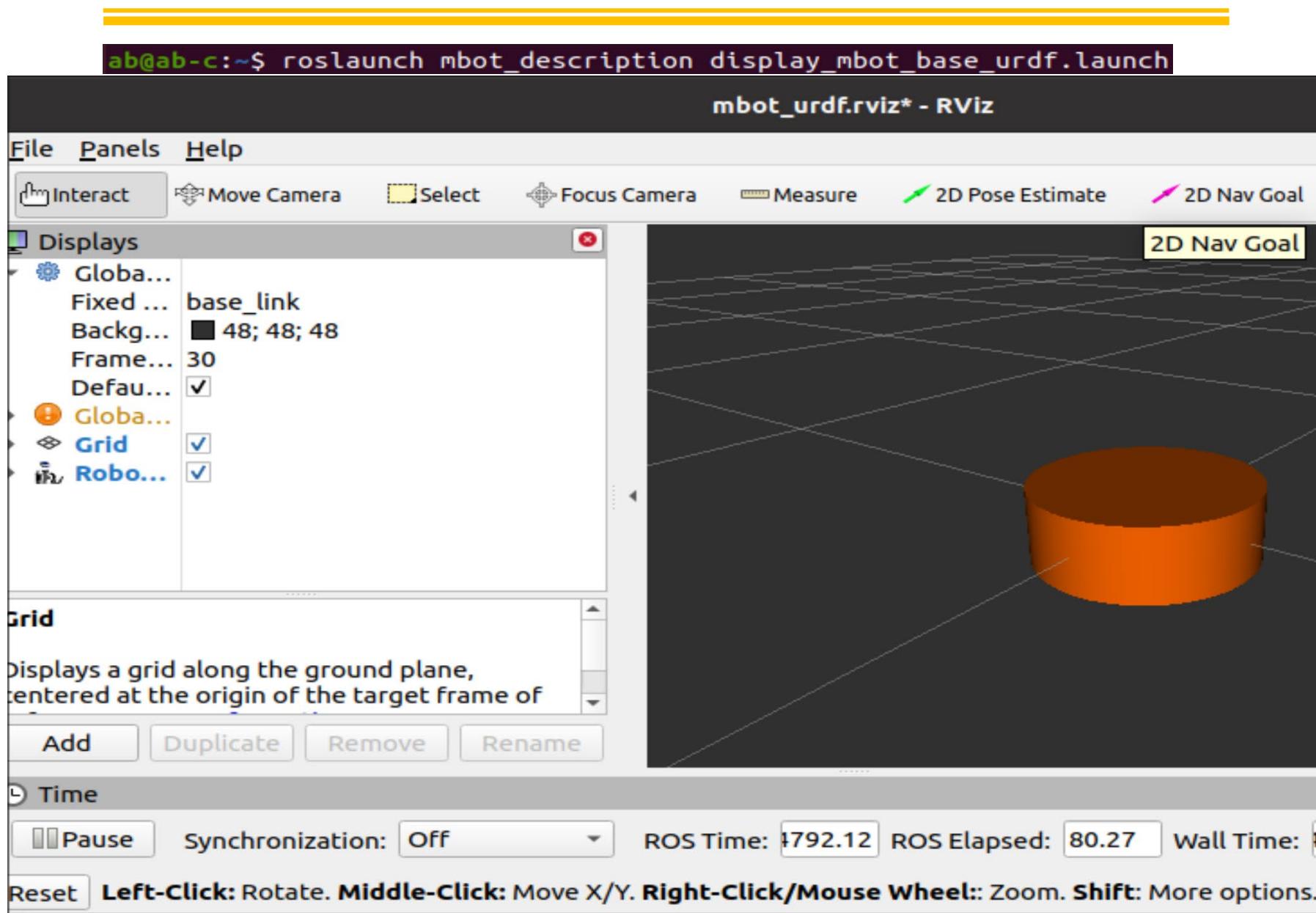
Create mbot_urdf.rviz

```
148 Hide Right Dock: true
149 QMainWindow State:
000000ff00000000fd000000040000000000000000213000002b0fc0200000008fb000000120053
150 Selection:
151     collapsed: false
152 Time:
153     collapsed: false
154 Tool Properties:
155     collapsed: false
156 Views:
157     collapsed: true
158 Width: 1200
159 X: 363
160 Y: 85
```

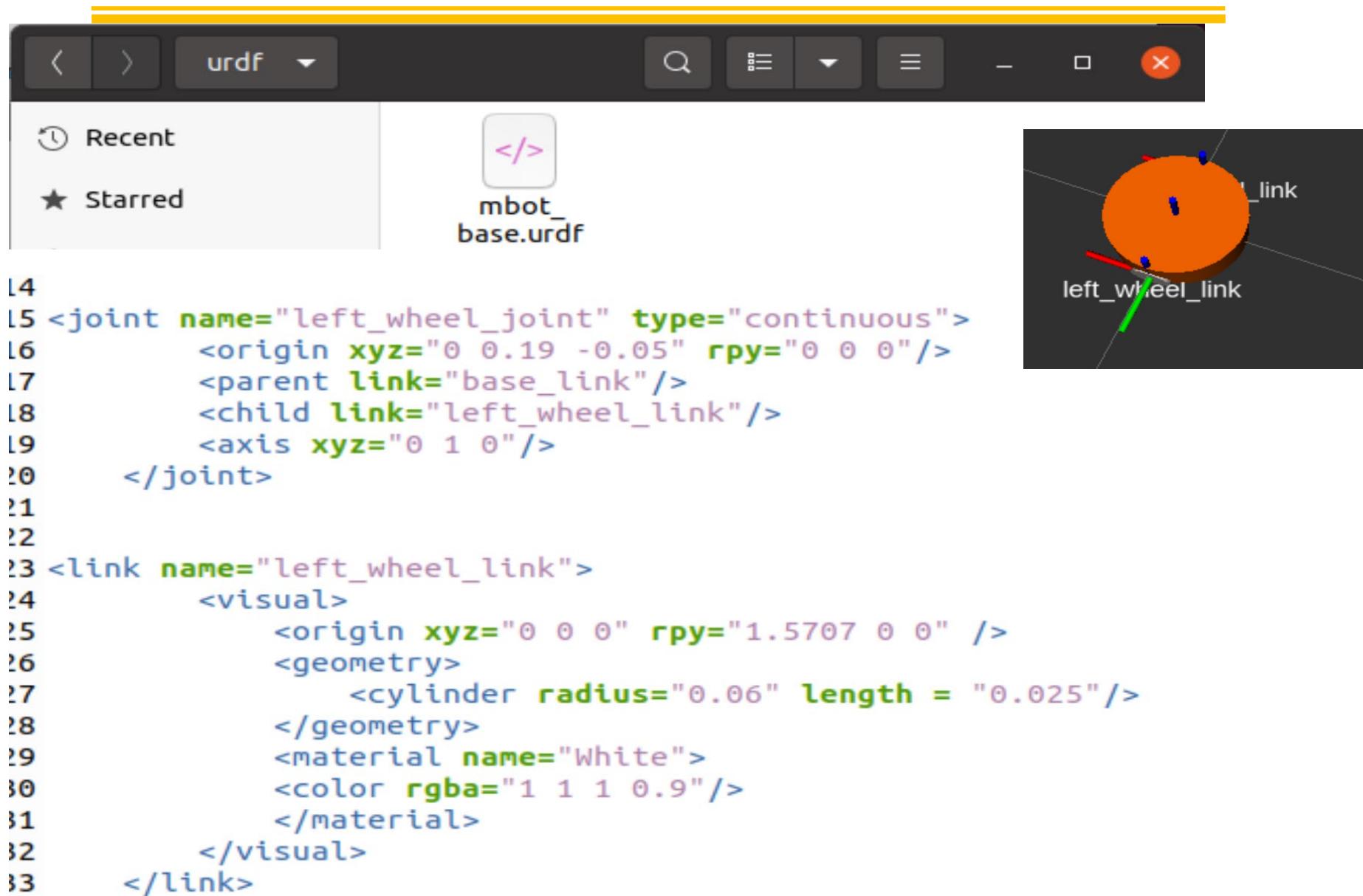
Create mbot_base.urdf

```
1 <?xml version="1.0" ?>
2 <robot name="mbot">
3
4     <link name="base_link">
5         <visual>
6             <origin xyz=" 0 0 0" rpy="0 0 0" />
7             <geometry>
8                 <cylinder length="0.16" radius="0.20" />
9             </geometry>
10            <material name="Yellow">
11                <color rgba="1 0.4 0 1"/>
12            </material>
13        </visual>
14    </link>
15
16
17 </robot>
```

roslaunch



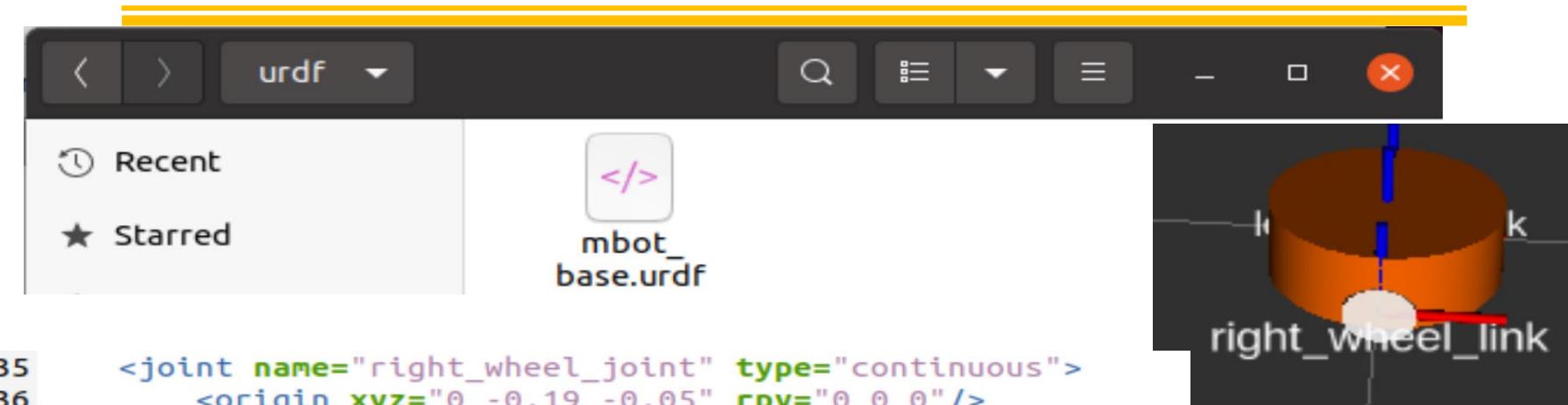
Create left wheel



The image shows a code editor window with the file `mbot_base.urdf` open. The code defines a continuous joint for the left wheel and its corresponding link. A 3D rendering of the robot base shows the left wheel link highlighted in green.

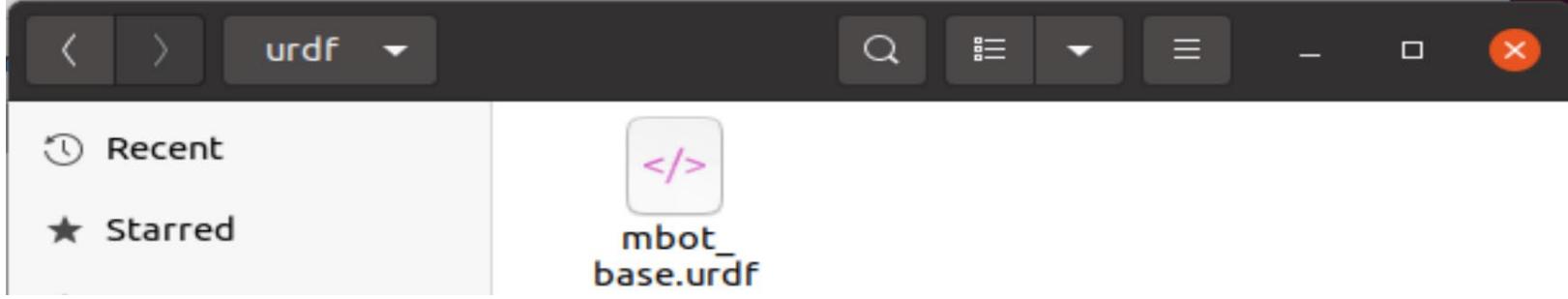
```
L4
L5 <joint name="left_wheel_joint" type="continuous">
L6   <origin xyz="0 0.19 -0.05" rpy="0 0 0"/>
L7   <parent link="base_link"/>
L8   <child link="left_wheel_link"/>
L9   <axis xyz="0 1 0"/>
L10 </joint>
L11
L12
L13 <link name="left_wheel_link">
L14   <visual>
L15     <origin xyz="0 0 0" rpy="1.5707 0 0" />
L16     <geometry>
L17       <cylinder radius="0.06" length = "0.025" />
L18     </geometry>
L19     <material name="White">
L20       <color rgba="1 1 1 0.9" />
L21     </material>
L22   </visual>
L23 </link>
```

Create right wheel

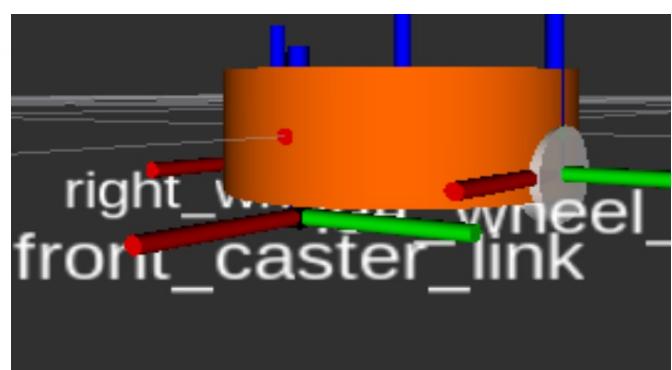


```
35 <joint name="right_wheel_joint" type="continuous">
36     <origin xyz="0 -0.19 -0.05" rpy="0 0 0"/>
37     <parent link="base_link"/>
38     <child link="right_wheel_link"/>
39     <axis xyz="0 1 0"/>
40 </joint>
41
42 <link name="right_wheel_link">
43     <visual>
44         <origin xyz="0 0 0" rpy="1.5707 0 0" />
45         <geometry>
46             <cylinder radius="0.06" length = "0.025"/>
47         </geometry>
48         <material name="White">
49             <color rgba="1 1 1 0.9"/>
50         </material>
51     </visual>
52 </link>
53
```

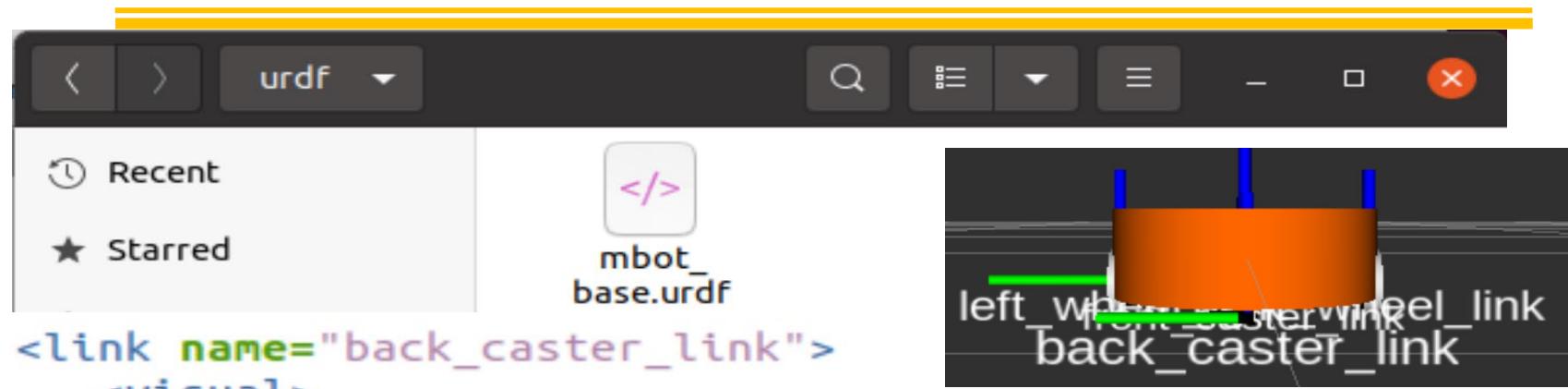
Create front caster



```
55 <joint name="front_caster_joint" type="continuous">
56   <origin xyz="0.18 0 -0.095" rpy="0 0 0"/>
57   <parent link="base_link"/>
58   <child link="front_caster_link"/>
59   <axis xyz="0 1 0"/>
60 </joint>
61
62 <link name="front_caster_link">
63   <visual>
64     <origin xyz="0 0 0" rpy="0 0 0"/>
65     <geometry>
66       <sphere radius="0.015" />
67     </geometry>
68     <material name="Black">
69       <color rgba="0 0 0 0.95"/>
70     </material>
71   </visual>
72 </link>
```



Create back caster

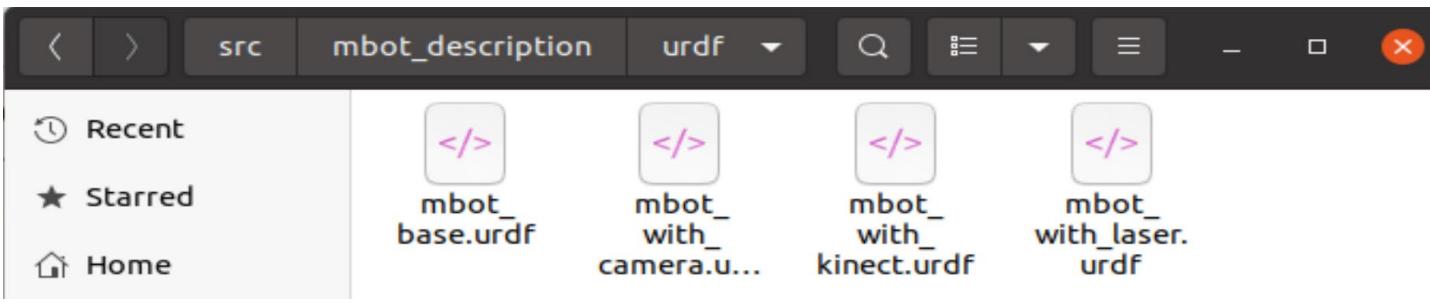


```
</>
mbot_
base.urdf

<link name="back_caster_link">
  <visual>
    <origin xyz="0 0 0" rpy="0 0 0"/>
    <geometry>
      <sphere radius="0.015" />
    </geometry>
    <material name="Black">
      <color rgba="0 0 0 0.95"/>
    </material>
  </visual>
</link>

<joint name="back_caster_joint" type="continuous">
  <origin xyz="-0.18 0 -0.095" rpy="0 0 0"/>
  <parent link="base_link"/>
  <child link="back_caster_link"/>
  <axis xyz="0 1 0"/>
</joint>
```

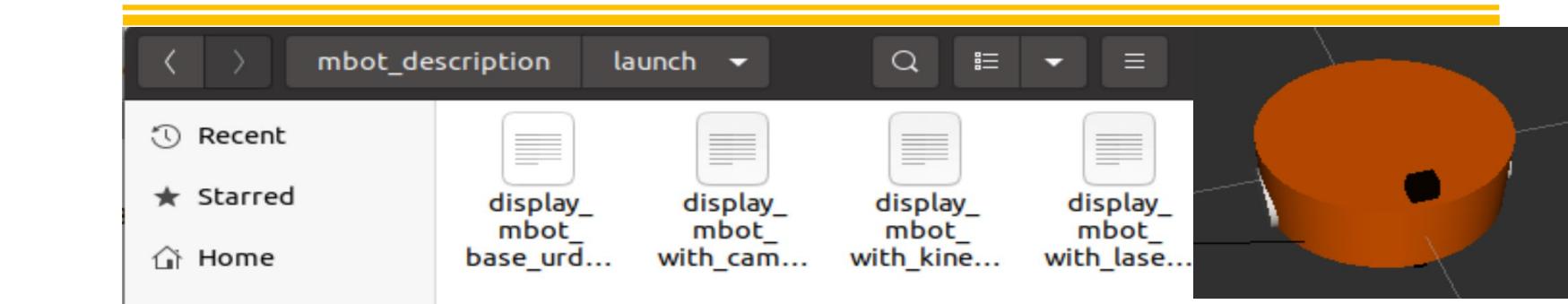
Create Camera



The screenshot shows a code editor interface with a dark theme. The top bar includes navigation icons (< >), a 'src' button, and tabs for 'mbot_description' and 'urdf'. Below the tabs are buttons for search, file operations, and close. On the left, a sidebar lists 'Recent' (empty), 'Starred' (empty), and 'Home' (empty). The main area displays a portion of an URDF XML file with line numbers 95 through 111. The code defines a camera link with a visual element and a fixed joint connecting it to the base link.

```
95     <link name="camera_link">
96         <visual>
97             <origin xyz="0 0 0" rpy="0 0 0"/>
98             <geometry>
99                 <box size="0.03 0.04 0.04" />
100            </geometry>
101            <material name="Black">
102                <color rgba="0 0 0 0.95"/>
103            </material>
104        </visual>
105    </link>
106
107 <joint name="camera_joint" type="fixed">
108     <origin xyz="0.17 0 0.10" rpy="0 0 0"/>
109     <parent link="base_link"/>
110     <child link="camera_link"/>
111 </joint>
```

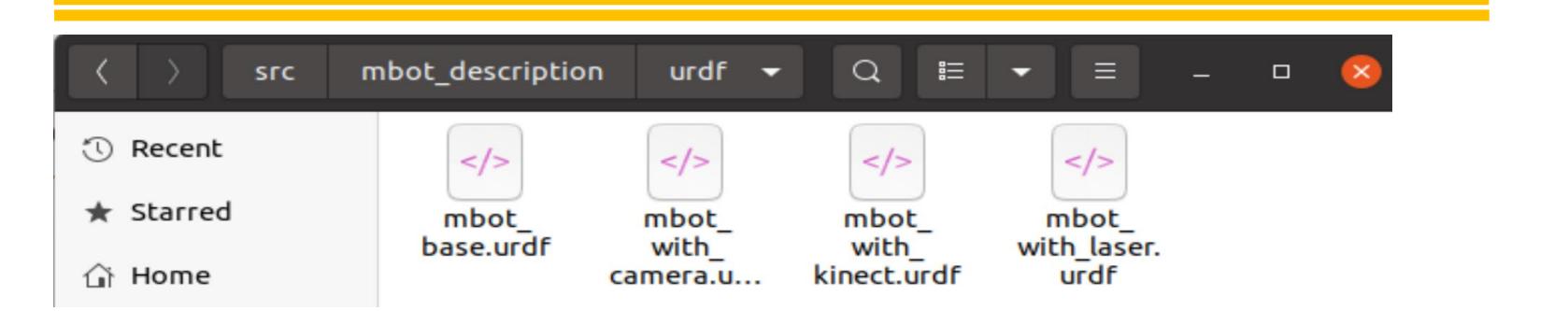
Create Camera



The screenshot shows a ROS workspace interface. At the top, there's a toolbar with icons for back, forward, search, and file operations. Below it is a sidebar with links for 'Recent', 'Starred', and 'Home'. The main area contains four URDF files: 'display_mbot_base_urdf...', 'display_mbot_with_camera...', 'display_mbot_with_kine...', and 'display_mbot_with_lase...'. To the right of these files is a 3D visualization of a red cylindrical robot base with a black circular hole at the bottom. The bottom part of the interface is a code editor with two tabs: 'mbot_with_camera.urdf' and '*display_mbot_with_camera_urdf.launch'. The code in the launch file is as follows:

```
1 <launch>
2
3     <param name="robot_description" textfile="$(find
4         mbot_description)/urdf/mbot_with_camera.urdf" />
5
6     <param name="use_gui" value="true"/>
7
8     <node name="joint_state_publisher"
9         pkg="joint_state_publisher" type="joint_state_publisher" />
10
11    <node name="robot_state_publisher"
12        pkg="robot_state_publisher" type="robot_state_publisher" />
13
14    <node name="rviz" pkg="rviz" type="rviz" args="-d $(find
15        mbot_description)/config/mbot_urdf.rviz" required="true" />
16
17 </launch>
```

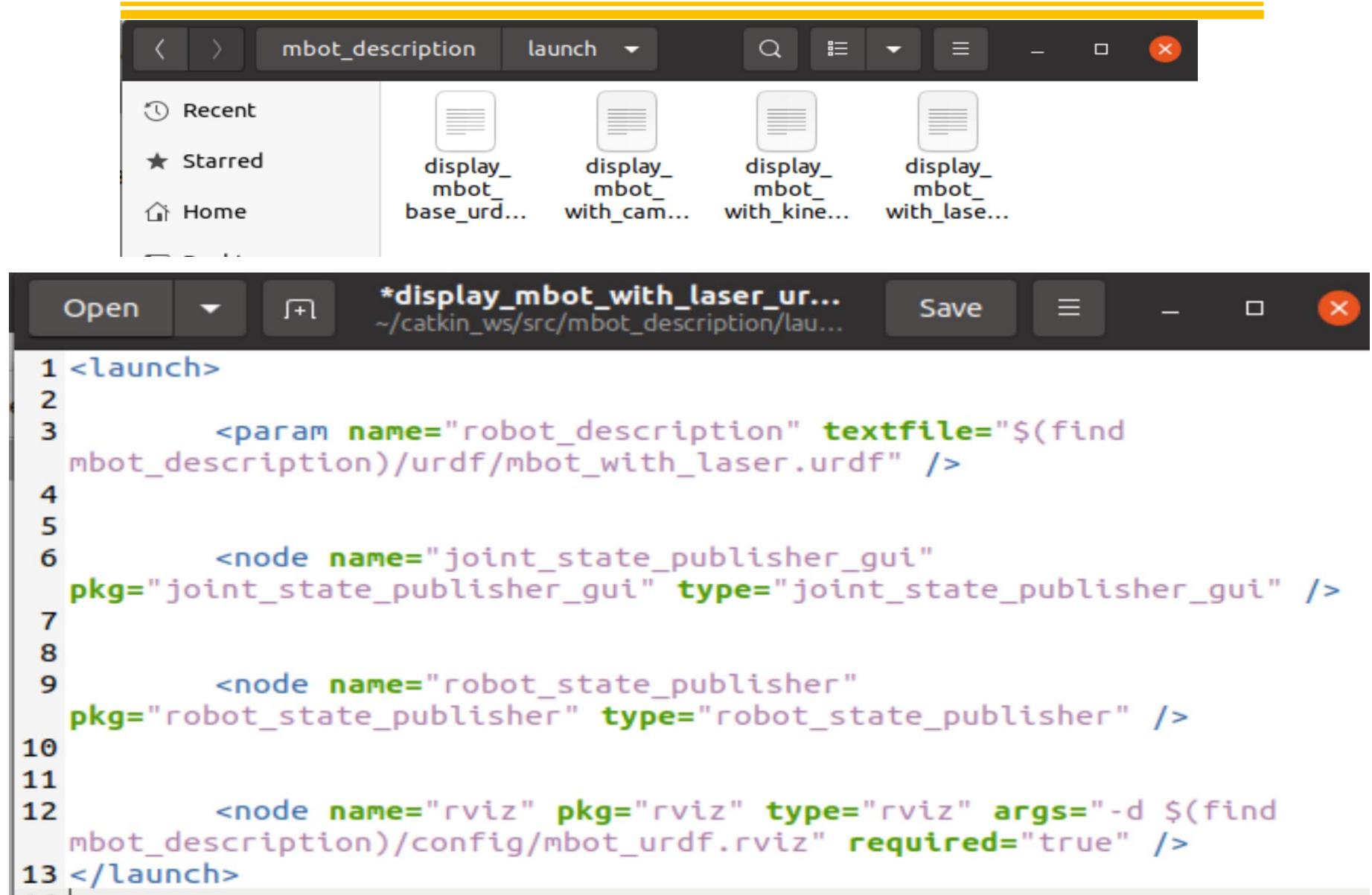
Create Laser



The screenshot shows a code editor interface with a dark theme. The title bar says "mbot_description" and "urdf". The left sidebar has icons for "Recent", "Starred", and "Home". Below the sidebar, there are four URDF files listed: "mbot_base.urdf", "mbot_with_camera.urdf", "mbot_with_kinect.urdf", and "mbot_with_laser.urdf". The main area displays the XML code for creating a laser link and joint.

```
94     <link name="laser_link">
95         <visual>
96             <origin xyz=" 0 0 0 " rpy="0 0 0" />
97             <geometry>
98                 <cylinder length="0.05"
99                   radius="0.05"/>
100            </geometry>
101            <material name="Black"/>
102        </visual>
103    </link>
104
105    <joint name="laser_joint" type="fixed">
106        <origin xyz="0 0 0.105" rpy="0 0 0"/>
107        <parent link="base_link"/>
108        <child link="laser_link"/>
109    </joint>
```

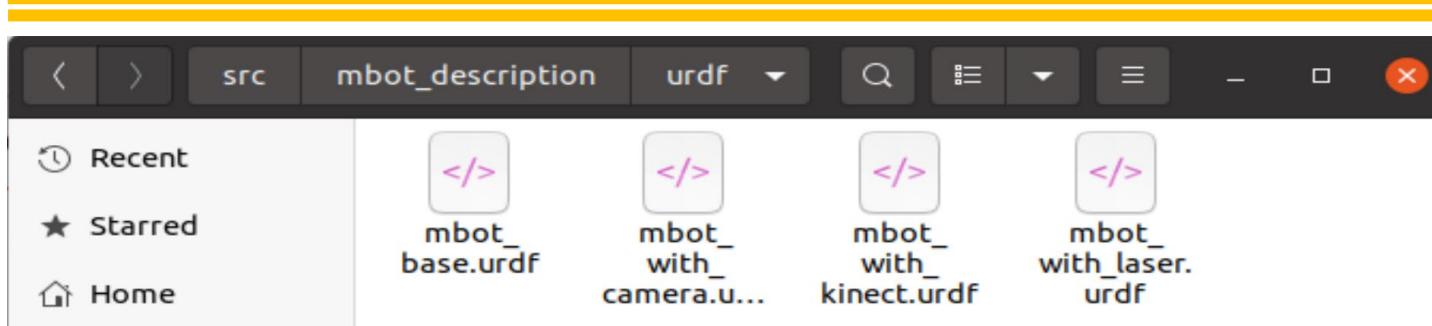
Create Laser



The screenshot shows a code editor interface with a dark theme. The title bar indicates the project is "mbot_description" and the file type is "launch". The left sidebar contains "Recent", "Starred", and "Home" items. The main area displays a launch configuration file:

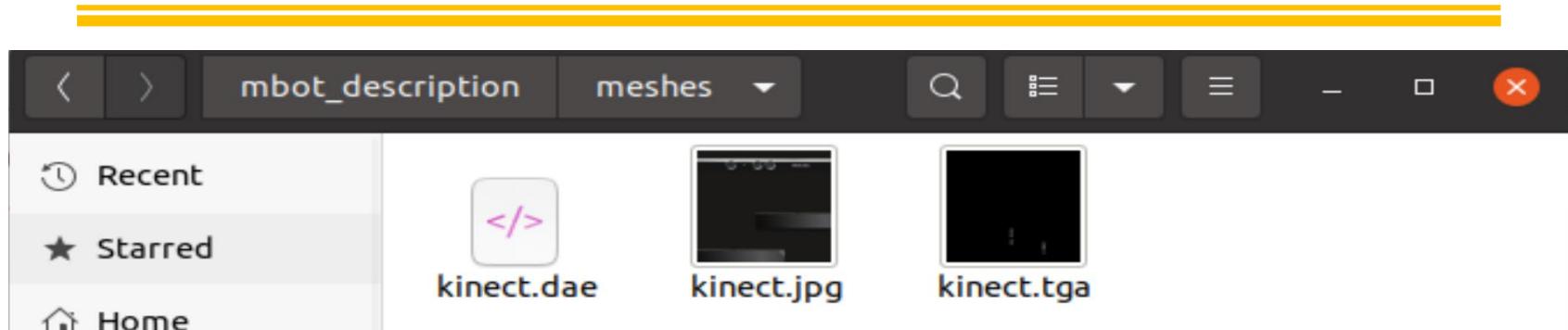
```
1 <launch>
2
3     <param name="robot_description" textfile="$(find
4         mbot_description)/urdf/mbot_with_laser.urdf" />
5
6     <node name="joint_state_publisher_gui"
7         pkg="joint_state_publisher_gui" type="joint_state_publisher_gui" />
8
9     <node name="robot_state_publisher"
10        pkg="robot_state_publisher" type="robot_state_publisher" />
11
12    <node name="rviz" pkg="rviz" type="rviz" args="-d $(find
13        mbot_description)/config/mbot_urdf.rviz" required="true" />
14 </launch>
```

Create Kinect

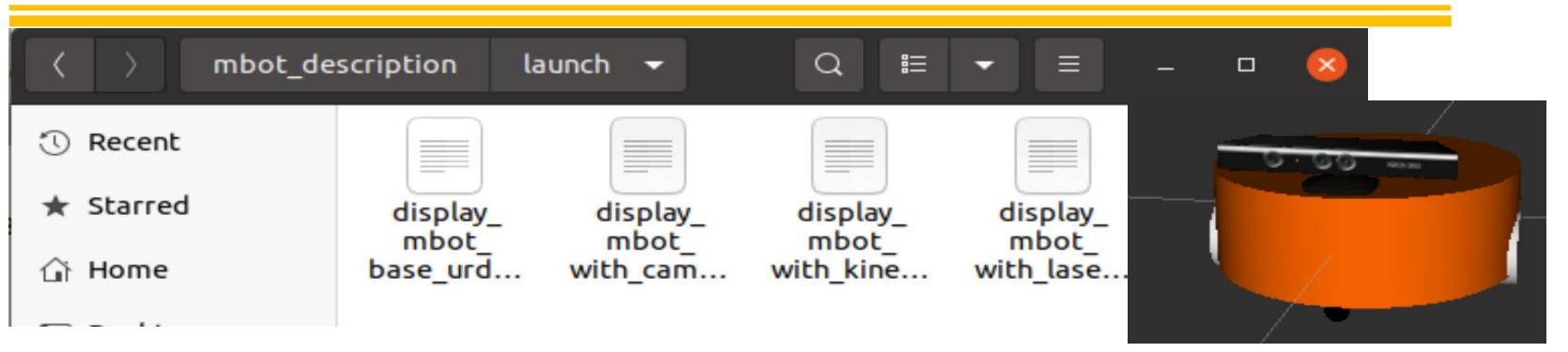


```
94     <link name="kinect_link">
95         <visual>
96             <origin xyz="0 0 0" rpy="0 0 1.5708"/>
97             <geometry>
98                 <mesh filename="package://mbot_description/meshes/-
  kinect.dae" />
99             </geometry>
100        </visual>
101    </link>
102
103    <joint name="kinect_joint" type="fixed">
104        <origin xyz="0.15 0 0.11" rpy="0 0 0"/>
105        <parent link="base_link"/>
106        <child link="kinect_link"/>
107    </joint>
108
109 </robot>
```

Create Kinect



Create Kinect



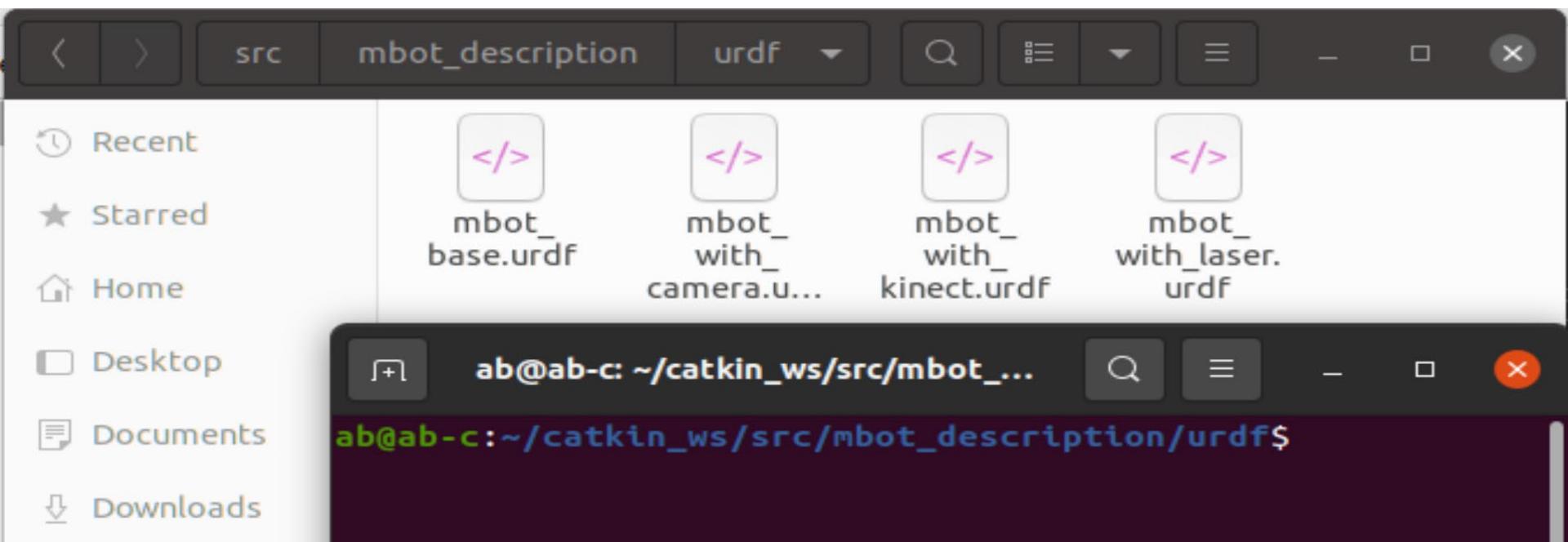
The screenshot shows a ROS workspace interface. The left sidebar contains 'Recent' (empty), 'Starred' (empty), and 'Home' (empty). The main area displays four URDF files: 'display_mbot_base_urdf', 'display_mbot_with_camera', 'display_mbot_with_kinect', and 'display_mbot_with_laser'. On the right, a 3D visualization of an orange Mbot robot with a black Kinect sensor mounted on top is shown in RViz.

The bottom part of the image shows the content of the 'display_mbot_with_kinect.launch' file:

```
1 <launch>
2
3     <param name="robot_description" textfile="$(find
mbot_description)/urdf/mbot_with_kinect.urdf" />
4
5
6     <node name="joint_state_publisher_gui"
pkg="joint_state_publisher_gui" type="joint_state_publisher_gui" />
7
8
9     <node name="robot_state_publisher"
pkg="robot_state_publisher" type="robot_state_publisher" />
10
11
12     <node name="rviz" pkg="rviz" type="rviz" args="-d $(find
mbot_description)/config/mbot_urdf.rviz" required="true" />
13 </launch>
```

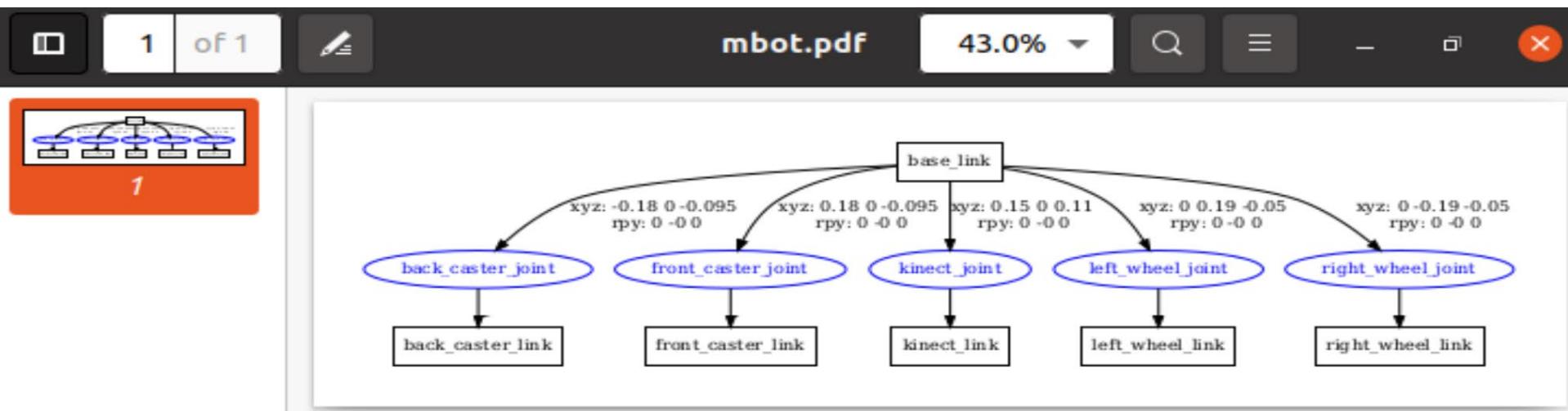
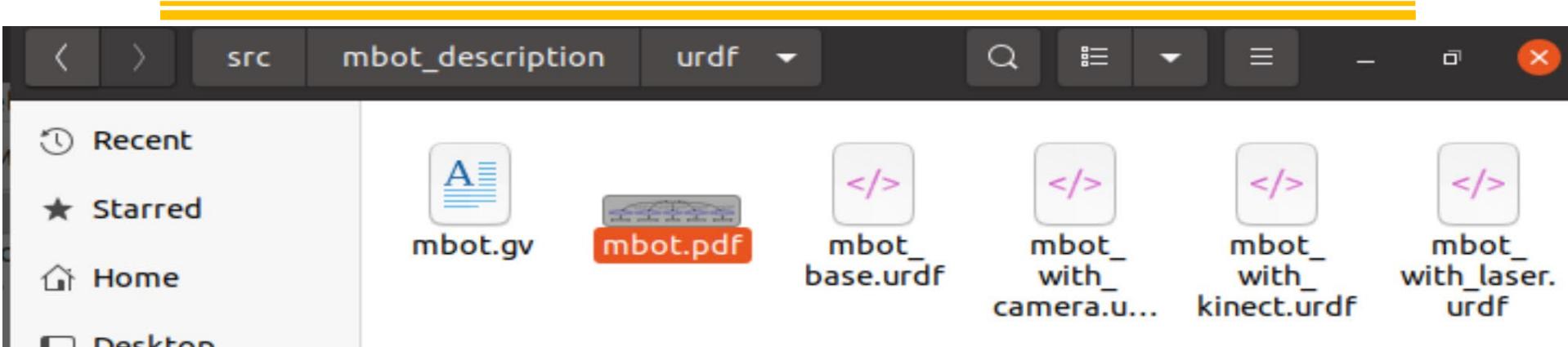
urdf_to_graphiz

```
ab@ab-c:~$ sudo apt install liburdfdom-tools
```



```
ab@ab-c:~/catkin_ws/src/mbot_description/urdf$ urdf_to_graphiz mbot_with_kinect.urdf
```

urdf_to_graphviz



Reference



✓ [Download link](#)

✓ Language:
English, Chinese, Japanese, Korean



"ROS Robot Programming"

A Handbook is written by TurtleBot3 Developers

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