

# 7. URDF model

---

## 7. URDF model

[7.1 Program function description](#)

[7.2 Program code reference path](#)

[7.3. Program Startup](#)

[7.4 Introduction to URDF](#)

[7.4.1. link](#)

[7.4.2. joints](#)

## 7.1 Program function description

---

After running the relevant program on the **virtual machine** side, the URDF model file of the car can be displayed in rviz. The car end also contains relevant programs, but because there is no visual interface, rviz will not be started when running, but the tf transformation of chassis and sensor coordinate systems will still be released for subsequent functions.

## 7.2 Program code reference path

---

**Virtual machine** The location of the function source code is located in,

```
/home/yahboom/dev_ws/src/yahboomcar_rviz/launch/yahboomcar_urdf_launch.py
```

Where, the path of URDF model file is,

```
/home/yahboom/dev_ws/src/yahboomcar_rviz/urdf/yahboomcar.urdf
```

After SSH connection to **car** , the location of the relevant source code is located,

```
/userdata/yahboomcar_ws/src/yahboomcar_description/launch/description_launch.py
```

The path of the URDF model file is,,

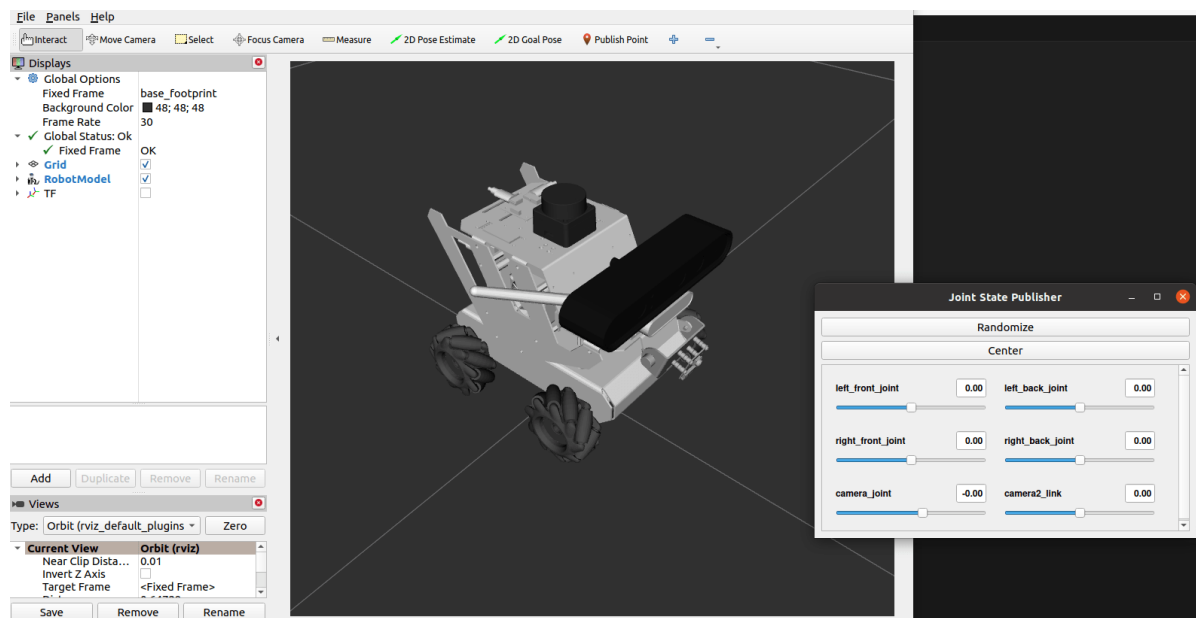
```
/userdata/yahboomcar_ws/src/yahboomcar_description/urdf/yahboomcar.urdf
```

## 7.3. Program Startup

---

In the VM terminal, enter,

```
ros2 launch yahboomcar_description display_launch.py
```

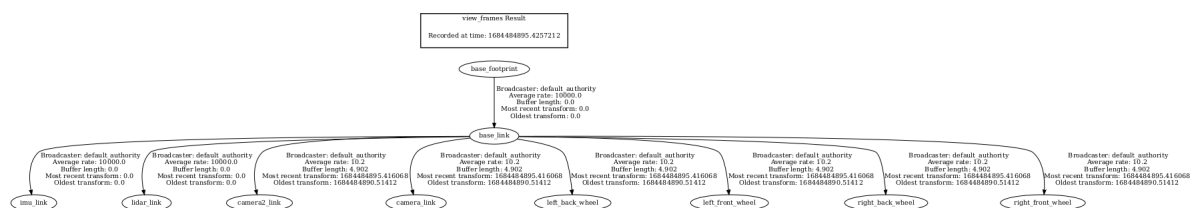


You can view TF tree, virtual machine terminal input,

```
ros2 run tf2_tools view_frames.py
```

A frame.pdf file will be generated in the terminal directory, and then we can open it with the following command,

```
evince frames.pdf
```



## 7.4 Introduction to URDF

URDF, full name Unified Robot Description Format, translated into Chinese as Unified Robot description format, is a robot model file described in xml format, similar to D-H parameters.

```
<?xml version="1.0" encoding="utf-8"?>
<robot name="yahboomcar">
</robot>
```

The first xml mandatory field describes the version information of the xml.

The second line describes the current robot name; All information about the current robot is contained in the [Robot] TAB.

Components:

- link, the link, you can think of it as a human arm
- joint, think of it as a human elbow joint

link and joint relationship: Two links are connected by joints, imagine an arm with a lower arm (link) and a larger arm (link) connected by an elbow joint.

## 7.4.1. link

### 1) Introduction

In the URDF descriptive language, link is used to describe physical properties,

- Describes visual displays, `tags`.
- Describes collision properties, `tag`.
- Describes physical inertia. The `tag` is not commonly used.

Links can also describe the link size, color, shape, inertial matrix, collision properties, each Link becomes a coordinate system.

### 2) Sample code (yahboomcar.urdf)

```
<link
  name="base_link">
  <inertial>
    <origin
      xyz="0.00747327885898614 -0.000703137401396085 0.00844632750789007"
      rpy="0 0 0" />
    <mass
      value="0.472828691870721" />
    <inertia
      ixx="0.00023735992797554"
      ixy="1.96687462104139E-07"
      ixz="4.09403791310172E-05"
      iyy="0.000480258948998206"
      iyz="2.77544074265144E-07"
      izz="0.000585619745886075" />
    </inertial>
    <visual>
      <origin
        xyz="0 0 0"
        rpy="0 0 0" />
      <geometry>
        <mesh
          filename="package://yahboomcar_rviz/meshes/base_link.STL" />
        </geometry>
        <material
          name="">
            <color
              rgba="1 1 1 1" />
            </color>
          </material>
        </visual>
      <collision>
        <origin
          xyz="0 0 0"
          rpy="0 0 0" />
        <geometry>
          <mesh
            filename="package://yahboomcar_rviz/meshes/base_link.STL" />
          </geometry>
        </collision>
      </link>
```

### 3) Label introduction

- origin

Describes pose information; The xyz attribute describes its coordinate position in the larger environment, and the rpy attribute describes its attitude.

- mess

It describes the quality of the link.

- inertia

The inertial reference frame, due to the symmetry of the rotational inertia matrix, requires only six upper triangular elements *ixx*, *ixy*, *ixz*, *iyy*, *iyz*, *izz* as properties.

- geometry

The label describes the shape; The main function of mesh properties is to load texture files, filename attribute texture path file address.

```
<box size="1 2 3"/> #box箱体, 通过size属性描述盒装的长宽高。#box, using the size attribute to describe the length, width and height of the box.
<cylinder length="1.6" radius="0.5"/> #cylinder圆状, 通过`length`属性描述圆柱的高度, `radius`属性描述圆柱的半径。#cylinder cylindrical, the height of the cylinder is described through the 'length' attribute, and the 'radius' attribute describes the radius of the cylinder.
<sphere radius="1"/> #sphere球状, 通过`radius`属性描述球的半径。#sphere The radius of the sphere is described by the 'radius' attribute.
```

- material

The label describes the material; The name attribute is **mandatory field**, can be empty, can be repeated. Red, green, blue, and transparency are described by the rgba attribute in the [color] tag, separated by a space. The color range is [0-1].

## 7.4.2. joints

### 1) Introduction

Describe the relationship between two joints, motion position and speed limits, kinematic and dynamic properties.

Joint type:

- fixed: fixed the joint. No movement allowed. It acts as a connection.
- continuous: rotates the joint. Can continue to rotate, there is no rotation Angle limit.
- revolute: Rotates the joint. Similar to continuous, there is a restriction on rotation Angle.
- prismatic: sliding joint. Move along an axis, with a position limitation.
- floating: Floating joints. Six degrees of freedom, 3T3R.
- planar: planar joint. Allow translations or rotations above plane orthogonality.

### 2) Sample code (yahboomcar.urdf)

```
<joint
  name="left_front_joint"
  type="continuous">
  <origin
    xyz="0.06 0.08361 -0.03295"
    rpy="0 0 0" />
  <parent
```

```

    link="base_link" />
  <child
    link="left_front_wheel" />
  <axis
    xyz="0 1 0" />
  <limit
    lower="0"
    upper="0"
    effort="0"
    velocity="0" />
</joint>

```

The name attribute in the [joint] tag is **required** , describes the name of the joint, and is unique. In the [joint]tag, the type attribute corresponds to six types of joints.

### 3) Label introduction

- origin

The child label refers to the relative position of the rotary joint in the coordinate system of the parent.

- parent, child

parent, child Indicates the two links to be connected. The parent is the reference, and the child rotates around the parent.

- axis

The child label indicates which axis (xyz) the child's corresponding link rotates around and the amount of rotation about the fixed axis.

- limit

child tags are primarily restricted to children. The lower and upper attributes limit the range of rotation radians, and the effort attribute limits the range of forces in the rotation process. The velocity property limits the speed of rotation in meters per second or m/s (plus or minus value, in cows or N).

- mimic

Describe the relationship between the joint and existing joints.

- safety\_controller

Describes security controller parameters. Protect the movement of the robot joints.