5. Robot URDF model

5.1. URDF overview

Function package reference path:

```
/home/yahboom/YBAMR-COBOT-EDU-
00001/src/yahboom_navrobo_description/scout_description/launch/display_scout_min
i_rviz.launch
```

5.1.1. Introduction

URDF, the full name of 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 line is a required XML field, describing the XML version information.

The second line describes the current robot name; all information about the current robot is contained in the [robot] tag.

5.1.2, Components

1), `link`, connecting rod, can be imagined as a human arm.

2), `joint`, joint, can be imagined as a human elbow.

Relationship between link and joint: two links are connected by joints.

5.1.3, links

1), Introduction

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

- Describe visual display, `<visual>` tag.
- Describe collision properties, `<collision>` tag.
- Describe physical inertia, `<inertial>` tag is not commonly used.

Links can also describe the size of the connecting rod (size)\color (color)\shape (shape)\inertial matrix (inertial matrix)\collision parameters (collision properties), etc. Each Link will become a coordinate system.

2), **Sample code:** /home/yahboom/YBAMR-COBOT-EDU-00001/src/yahboom_navrobo_description/scout_description/urdf/scout_mini.urdf.xacro ``xml

```
3) Tag introduction
```

```
- origin

describes the pose information; the `xyz` attribute describes the coordinate
position in the large environment, and the `rpy` attribute describes its own
posture.

- mess

describes the quality of `link`.

- inertia

Inertial reference system, due to the symmetry of the rotational inertia matrix,
only 6 upper triangular elements ixx, ixy, ixz, iyy, iyz, izz are needed as
attributes.

- geometry

The tag describes the shape; the main function of the `mesh` attribute is to load
the texture file, and the `filename` attribute is the file address of the texture
path. This tag also includes other tag descriptions:

```xml
<box size="1 2 3"/> <--!box box, the size attribute is used to describe the
length, width and height of the box. -->
<cylinder length="1.6" radius="0.5"/> <--!cylinder cylindrical, the `length`
attribute is used to describe the height of the cylinder, and the `radius`
attribute is used to describe the radius of the cylinder. -->
<sphere radius="1"/> <--!sphere spherical, the `radius` attribute is used to
describe the radius of the sphere. -->
```

- material

The tag describes the material; the `name` attribute is **required**, can be empty, and can be repeated. The `rgba` attribute in the [color] tag is used to describe red, green, blue, and transparency, separated by spaces. The color range is [0-1].

5.1.4, joints

1), Introduction

Describes the relationship between two joints, movement position and speed restrictions, kinematic and dynamic properties.

Joint types:

- fixed: Fixed joint. No movement is allowed, it acts as a connection.
- continuous: Rotary joint. It can rotate continuously without rotation angle restrictions.
- revolute: Rotary joint. Similar to continuous, it has rotation angle restrictions.
- prismatic: Sliding joint. Moves along a certain axis with position restrictions.
- floating: Suspended joint. It has six degrees of freedom, 3T3R.
- planar: Planar joint. It allows translation or rotation above the plane orthogonal to the plane.

2) Sample code
```

```
<!-- Laser Joint -->
<joint name="camera_joint" type="fixed">
<parent link="base_link"/>
<child link="camera_link"/>
<origin xyz="0.23 0 0.23" rpy="0 0 0"/>
</joint>
```

In the [joint] tag, the `name` attribute is a **required item**, describing the name of the joint, and is unique.

In the [joint] tag, the `type` attribute is filled in with the six major joint types.

3) Tag introduction

- origin

The sub-tag refers to the relative position of the rotation joint in the coordinate system of `parent`.

- parent, child

The `parent`, `child` sub-tags represent the two `link`s to be connected; `parent` is a reference object, and `child` rotates around `praent`.

- axis

The subtag indicates which axis (xyz) the `link` corresponding to `child` rotates around and the amount of rotation around the fixed axis.

- limit

The subtag is mainly used to limit `child`. The `lower` and `upper` attributes limit the range of rotation, the `effort` attribute limits the force range during the rotation. (positive and negative value, in Newton or N), and the `velocity` attribute limits the speed of rotation, in meters per second or m/s.

- mimic

Describes the relationship between this joint and existing joints.

- safety_controller

Describes the safety controller parameters. Protects the movement of robot joints.

5.2, URDF visualization

5.2.1, Startup

Stop the self-starting chassis service

```
sudo supervisorctl stop ChassisServer
```

Startup

```
roslaunch scout_description display_scout_mini_rviz.launch
```

5.2.2, Example image

The red axis is **X axis**; the green axis is **Y axis**; the blue axis is **Z axis**; the coordinate system formed by the three axes is called **base coordinate system**. Adjusting the [joint_state_publisher_gui] component can control the rotation of the wheel.