7、ORB_ SLAM2 Octomap mapping

Octomap official website：http://octomap.github.io/

Octomap source code：https://github.com/OctoMap/octomap

octomap wiki：http://wiki.ros.org/octomap

octomap_server：http://wiki.ros.org/octomap_server

The operating environment and reference configurations for software and hardware are as follows:

- Reference model: ROSMASTER X3
- Robot hardware configuration: Arm series main control, Silan A1 LiDAR, AstraPro Plus depth camera
- Robot system: Ubuntu (version not required)+Docker (version 20.10.21 and above)
- PC virtual machine: Ubuntu (20.04)+ROS2 (Foxy)
- Usage scenario: Use on a relatively clean 2D plane

7.1、brief introduction

Octomap is a 3D map creation tool based on Octree, which can display complete 3D graphics including accessible areas and unmapped areas, and sensor data based on occupancy grid can be fused and updated in multiple measurements; Maps can provide multiple resolutions, data can be compressed, and storage is compact In fact, the code for octomap mainly consists of two modules: the 3D map creation tool octomap and the visualization tool octovis.
Compared to point clouds, it can save a lot of space. The map created by octomap is roughly like this: (different resolutions from left to right)

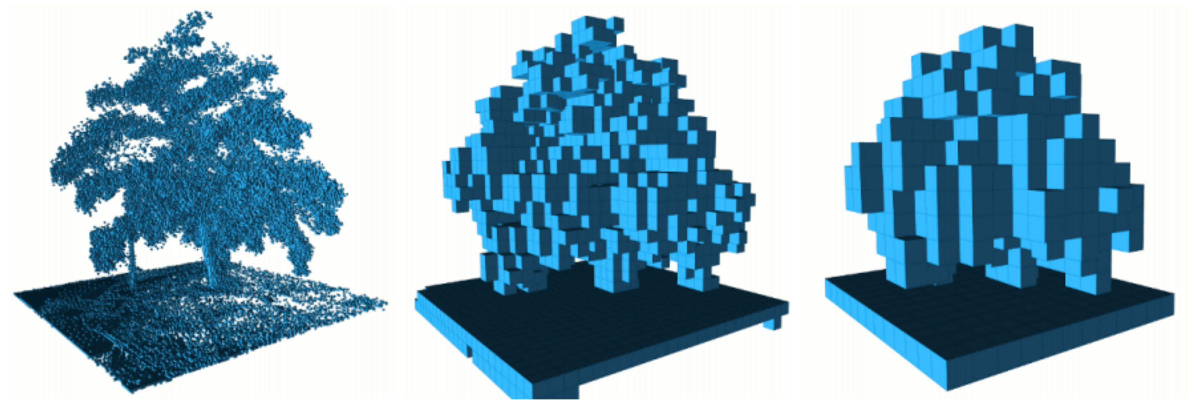


Fig. 3 By limiting the depth of a query, multiple resolutions of the same map can be obtained at any time. Occupied voxels are displayed in resolutions 0.08 m, 0.64 , and 1.28 m.

7.2、Camera based octomap mapping

Enter the Docker container, refer to **【Docker Course -5. Entering the Robot Docker Container】**, and execute the following launch file on the terminal:

1、 Start camera code

```
ros2 launch astra_camera astro_pro_plus.launch.xml
```

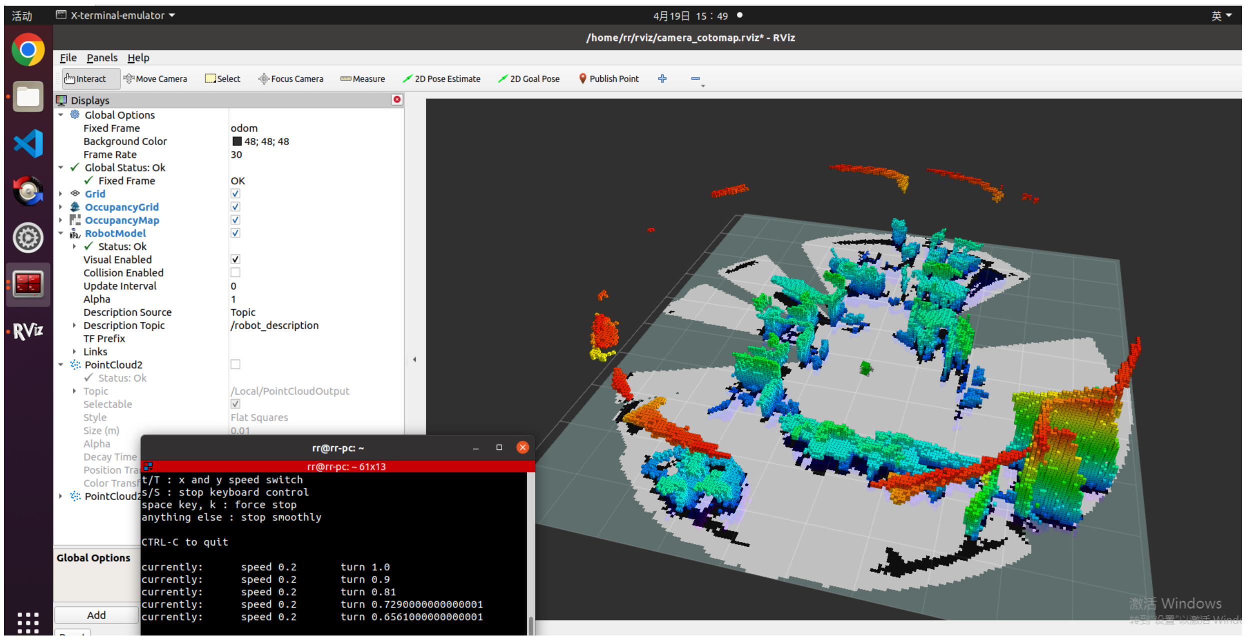
2、Start octomap_ Server mapping

```
ros2 launch yahboomcar_slam camera_octomap_launch.py
```

3、Enable rviz in Docker or Virtual Machine **[Recommended]**：

```
ros2 launch yahboomcar_slam display_octomap_launch.py
```

4、Using a remote control or keyboard to control the node to slowly move the machine to create a map, losing keyframes may cause the map to fail.



Global Options	
Fixed Frame	odom
Background Color	■ 48; 48; 48
Frame Rate	30
✓ Global Status: Ok	
✓ Fixed Frame	OK
Grid	✓
OccupancyGrid	✓
OccupancyMap	✓
RobotModel	✓
✓ Status: Ok	
Visual Enabled	✓
Collision Enabled	☐
Update Interval	0
Alpha	1
Description Source	Topic
Description Topic	/robot_description
TF Prefix	
Links	
PointCloud2	☐
✓ Status: Ok	
Topic	/Local/PointCloudOutput
Selectable	✓
Style	Flat Squares
Size (m)	0.01
Alpha	
Decay Time	
Position Tra	
Color Transf	
PointCloud2	

```
rr@rr-pc: ~
rr@rr-pc: ~ 61x13
t/T : x and y speed switch
s/S : stop keyboard control
space key, k : force stop
anything else : stop smoothly

CTRL-C to quit

currently:      speed 0.2       turn 1.0
currently:      speed 0.2       turn 0.9
currently:      speed 0.2       turn 0.81
currently:      speed 0.2       turn 0.7290000000000001
currently:      speed 0.2       turn 0.6561000000000001
```

7.3、Based on orbslam and pointcloud_ Octomap mapping for mapping

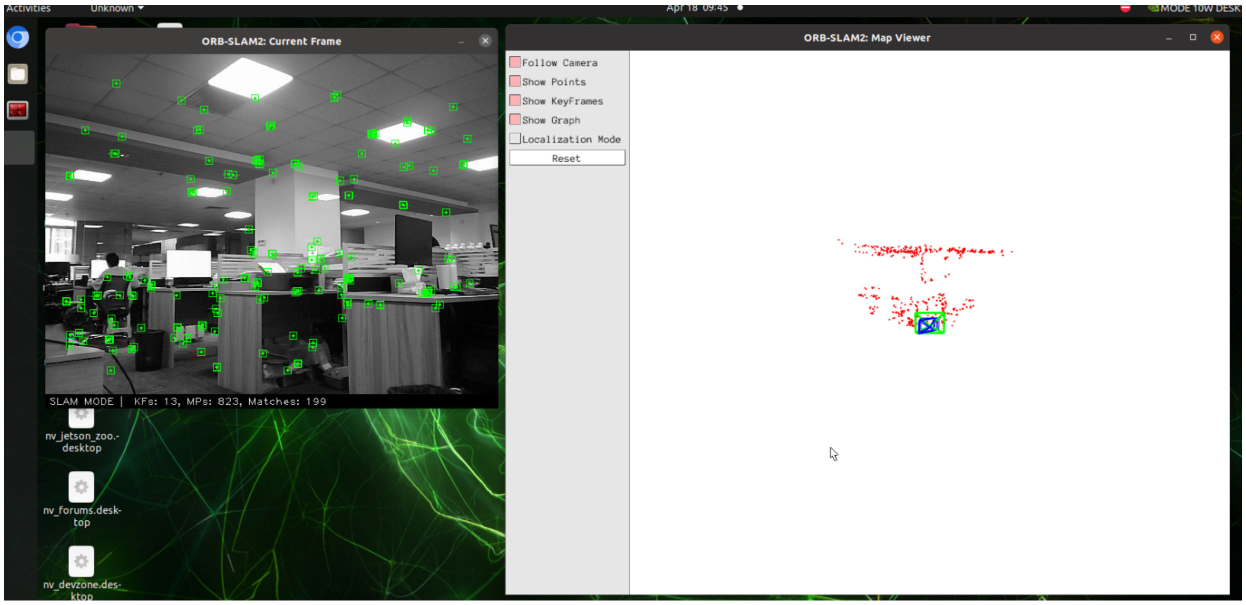
Enter the Docker container, refer to【**Docker Course -5. Entering the Docker Container for Robot**】, and execute the following launch file on each terminal:

1、 Start camera code

```
ros2 launch astra_camera astro_pro_plus.launch.xml
```

2、Launch orbslam to release camera pose, color and depth maps. Depending on the performance of different controllers, the waiting time here is approximately within 10 seconds

```
ros2 launch yahboomcar_slam orbslam_base_launch.py
```



```
SLAM MODE |  KFs: 13, MPs: 823, Matches: 199
```

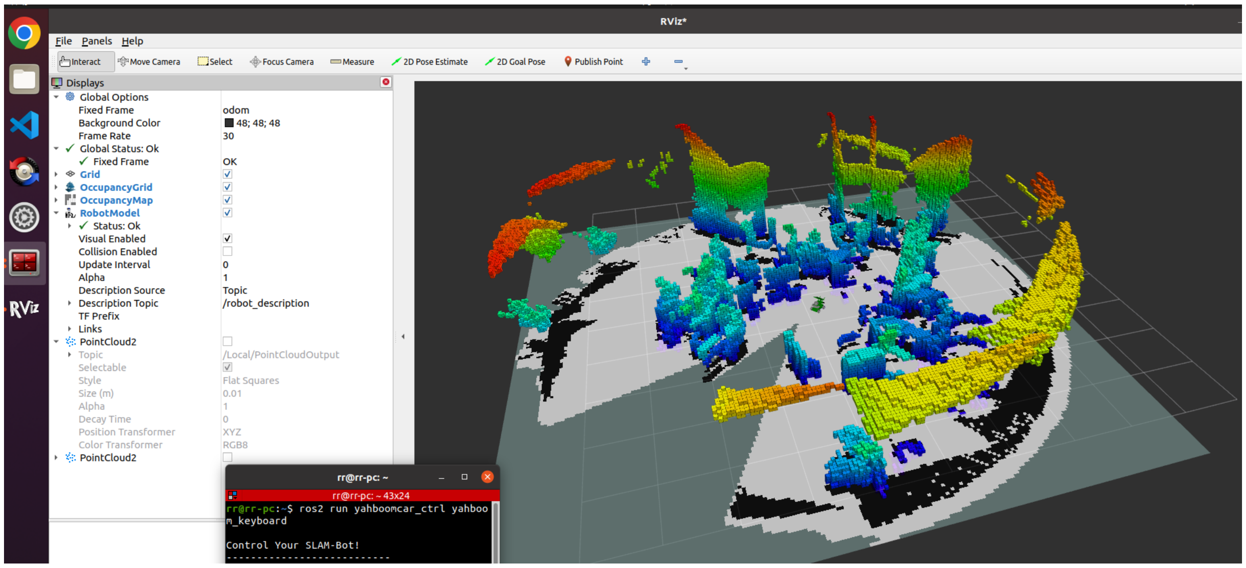
3、 Start octomap_ Server mapping

```
ros2 launch yahboomcar_slam orbslam_pcl_octomap_launch.py
```

4、Enable rviz in Docker or Virtual Machine **[Recommended]**:

```
ros2 launch yahboomcar_slam display_octomap_launch.py
```

5、Using a remote control or keyboard to control the node to slowly move the machine to create a map, losing keyframes may cause the map to fail.



Global Options	
Fixed Frame	odom
Background Color	■ 48; 48; 48
Frame Rate	30
✓ Global Status: Ok	
✓ Fixed Frame	OK
Grid	✓
OccupancyGrid	✓
OccupancyMap	✓
RobotModel	✓
✓ Status: Ok	
Visual Enabled	✓
Collision Enabled	☐
Update Interval	0
Alpha	1
Description Source	Topic
Description Topic	/robot_description
TF Prefix	
Links	
PointCloud2	☐
Topic	/Local/PointCloudOutput
Selectable	✓
Style	Flat Squares
Size (m)	0.01
Alpha	1
Decay Time	0
Position Transformer	XYZ
Color Transformer	RGB8
PointCloud2	☐

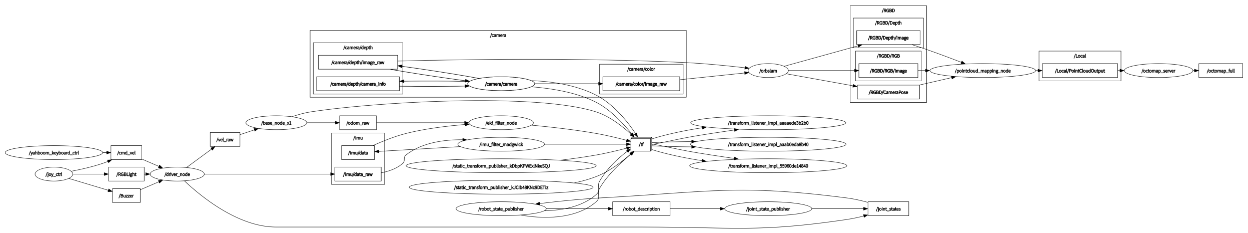
```
rr@rr-pc: ~ 43x24
rr@rr-pc:~$ ros2 run yahboomcar_ctrl yahboo
m_keyboard

Control Your SLAM-Bot!
---------------------------
```

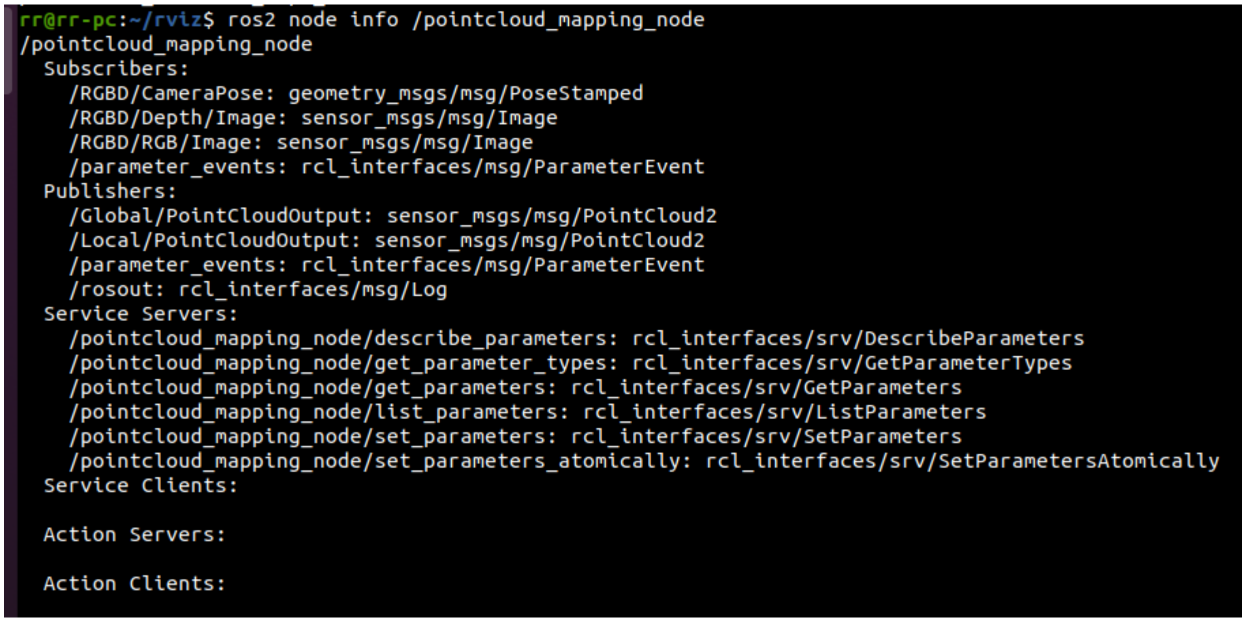
7.4、Node resolution

7.3.1、Display Calculation Chart

```
rqt_graph
```



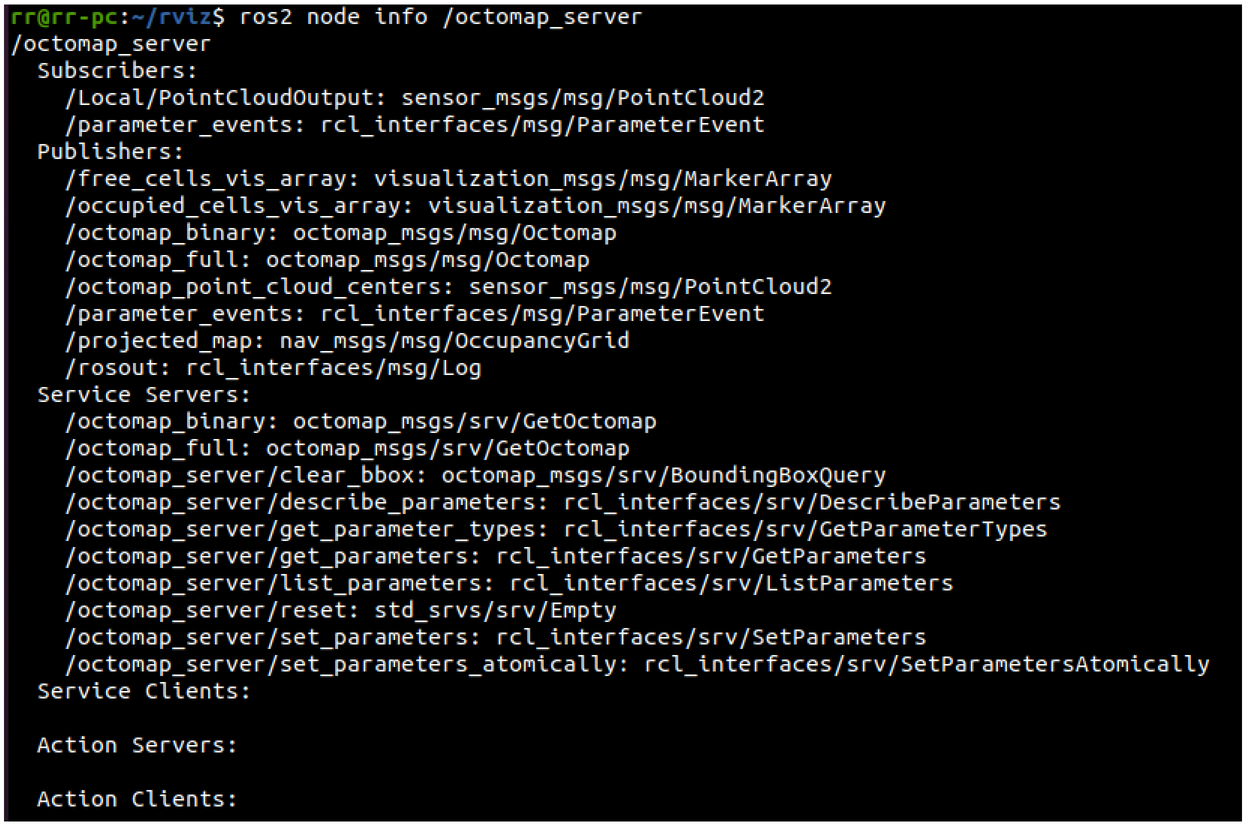
7.3.2、Details of each node



```
rr@rr-pc:~/rviz$ ros2 node info /pointcloud_mapping_node
/pointcloud_mapping_node
  Subscribers:
    /RGBD/CameraPose: geometry_msgs/msg/PoseStamped
    /RGBD/Depth/Image: sensor_msgs/msg/Image
    /RGBD/RGB/Image: sensor_msgs/msg/Image
    /parameter_events: rcl_interfaces/msg/ParameterEvent
  Publishers:
    /Global/PointCloudOutput: sensor_msgs/msg/PointCloud2
    /Local/PointCloudOutput: sensor_msgs/msg/PointCloud2
    /parameter_events: rcl_interfaces/msg/ParameterEvent
    /rosout: rcl_interfaces/msg/Log
  Service Servers:
    /pointcloud_mapping_node/describe_parameters: rcl_interfaces/srv/DescribeParameters
    /pointcloud_mapping_node/get_parameter_types: rcl_interfaces/srv/GetParameterTypes
    /pointcloud_mapping_node/get_parameters: rcl_interfaces/srv/GetParameters
    /pointcloud_mapping_node/list_parameters: rcl_interfaces/srv/ListParameters
    /pointcloud_mapping_node/set_parameters: rcl_interfaces/srv/SetParameters
    /pointcloud_mapping_node/set_parameters_atomically: rcl_interfaces/srv/SetParametersAtomically
  Service Clients:

  Action Servers:

  Action Clients:
```



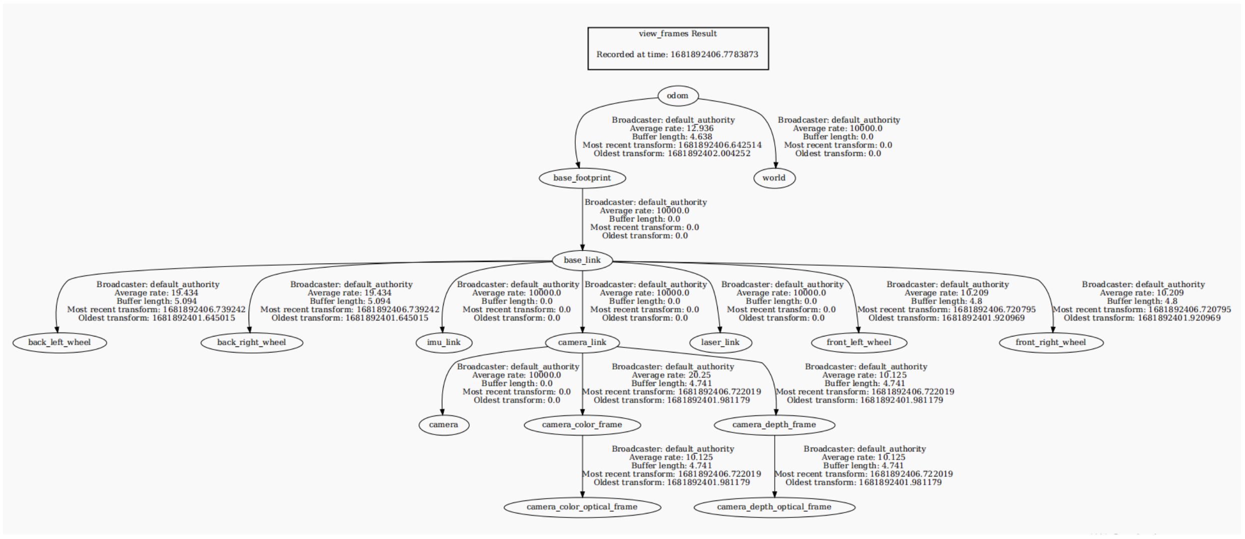
```
rr@rr-pc:~/rviz$ ros2 node info /octomap_server
/octomap_server
  Subscribers:
    /Local/PointCloudOutput: sensor_msgs/msg/PointCloud2
    /parameter_events: rcl_interfaces/msg/ParameterEvent
  Publishers:
    /free_cells_vis_array: visualization_msgs/msg/MarkerArray
    /occupied_cells_vis_array: visualization_msgs/msg/MarkerArray
    /octomap_binary: octomap_msgs/msg/Octomap
    /octomap_full: octomap_msgs/msg/Octomap
    /octomap_point_cloud_centers: sensor_msgs/msg/PointCloud2
    /parameter_events: rcl_interfaces/msg/ParameterEvent
    /projected_map: nav_msgs/msg/OccupancyGrid
    /rosout: rcl_interfaces/msg/Log
  Service Servers:
    /octomap_binary: octomap_msgs/srv/GetOctomap
    /octomap_full: octomap_msgs/srv/GetOctomap
    /octomap_server/clear_bbox: octomap_msgs/srv/BoundingBoxQuery
    /octomap_server/describe_parameters: rcl_interfaces/srv/DescribeParameters
    /octomap_server/get_parameter_types: rcl_interfaces/srv/GetParameterTypes
    /octomap_server/get_parameters: rcl_interfaces/srv/GetParameters
    /octomap_server/list_parameters: rcl_interfaces/srv/ListParameters
    /octomap_server/reset: std_srvs/srv/Empty
    /octomap_server/set_parameters: rcl_interfaces/srv/SetParameters
    /octomap_server/set_parameters_atomically: rcl_interfaces/srv/SetParametersAtomically
  Service Clients:

  Action Servers:

  Action Clients:
```

7.3.3、TF transformation

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


view_frames Result
Recorded at time: 1681892406.7783873
odom
Broadcaster: default_authority
Average rate: 12.936
Buffer length: 4.638
Most recent transform: 1681892406.642514
Oldest transform: 1681892402.004252
Broadcaster: default_authority
Average rate: 10000.0
Buffer length: 0.0
Most recent transform: 0.0
Oldest transform: 0.0
base_footprint
world
Broadcaster: default_authority
Average rate: 10000.0
Buffer length: 0.0
Most recent transform: 0.0
Oldest transform: 0.0
base_link
Broadcaster: default_authority
Average rate: 19.434
Buffer length: 5.094
Most recent transform: 1681892406.739242
Oldest transform: 1681892401.645015
Broadcaster: default_authority
Average rate: 19.434
Buffer length: 5.094
Most recent transform: 1681892406.739242
Oldest transform: 1681892401.645015
Broadcaster: default_authority
Average rate: 10000.0
Buffer length: 0.0
Most recent transform: 0.0
Oldest transform: 0.0
Broadcaster: default_authority
Average rate: 10000.0
Buffer length: 0.0
Most recent transform: 0.0
Oldest transform: 0.0
Broadcaster: default_authority
Average rate: 10000.0
Buffer length: 0.0
Most recent transform: 0.0
Oldest transform: 0.0
Broadcaster: default_authority
Average rate: 10.209
Buffer length: 4.8
Most recent transform: 1681892406.720795
Oldest transform: 1681892401.920969
Broadcaster: default_authority
Average rate: 10.209
Buffer length: 4.8
Most recent transform: 1681892406.720795
Oldest transform: 1681892401.920969
back_left_wheel
back_right_wheel
imu_link
camera_link
laser_link
front_left_wheel
front_right_wheel
Broadcaster: default_authority
Average rate: 10000.0
Buffer length: 0.0
Most recent transform: 0.0
Oldest transform: 0.0
Broadcaster: default_authority
Average rate: 20.25
Buffer length: 4.741
Most recent transform: 1681892406.722019
Oldest transform: 1681892401.981179
Broadcaster: default_authority
Average rate: 10.125
Buffer length: 4.741
Most recent transform: 1681892406.722019
Oldest transform: 1681892401.981179
camera
camera_color_frame
camera_depth_frame
Broadcaster: default_authority
Average rate: 10.125
Buffer length: 4.741
Most recent transform: 1681892406.722019
Oldest transform: 1681892401.981179
Broadcaster: default_authority
Average rate: 10.125
Buffer length: 4.741
Most recent transform: 1681892406.722019
Oldest transform: 1681892401.981179
camera_color_optical_frame
camera_depth_optical_frame