7. ORB_SLAM2 Octomap builds the map

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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 hardware and software reference configuration 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. Introduction

octomap is an octree-based 3D map creation tool that displays a complete 3D graphical representation of accessible and unmapped areas, and occupancy raster-based sensor data can be fused and updated over multiple measurements; the maps are available in multiple resolutions, and the data can be compressed and stored compactly. In fact, the octomap code consists of two main modules: the 3D map creation tool octomap and the visualization tool octovis.
Compared to a point cloud, it can save a lot of space. octomap creates maps that look like this: (from left to right are the different resolutions)

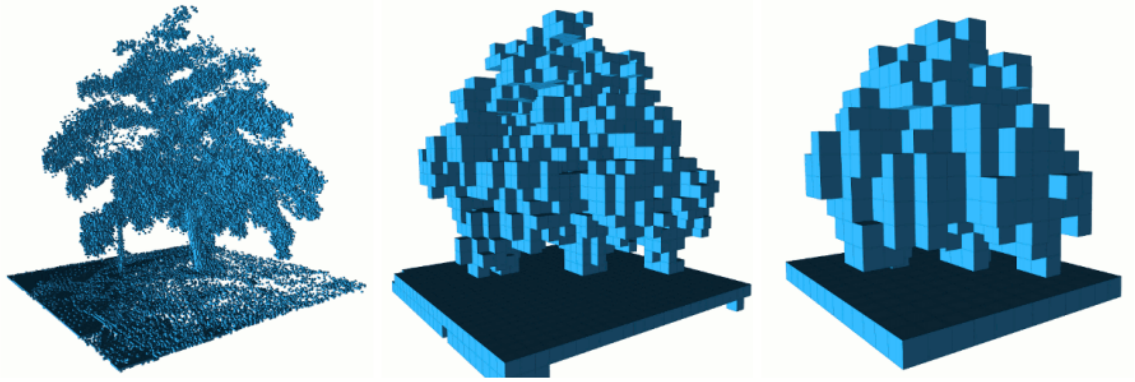


Fig. 3 By limiting the depth of a query, multiple resolutions of the same map can be obtained at any time. Occupied voxels are displayed in resolutions 0.08 m, 0.64 , and 1.28 m.

7.2 . Camera-based octomap build map

Into the docker container, see [docker course in ----- 5, into the robot docker container], sub-terminal execution of the following LAUNCH file:

1. Start the camera

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

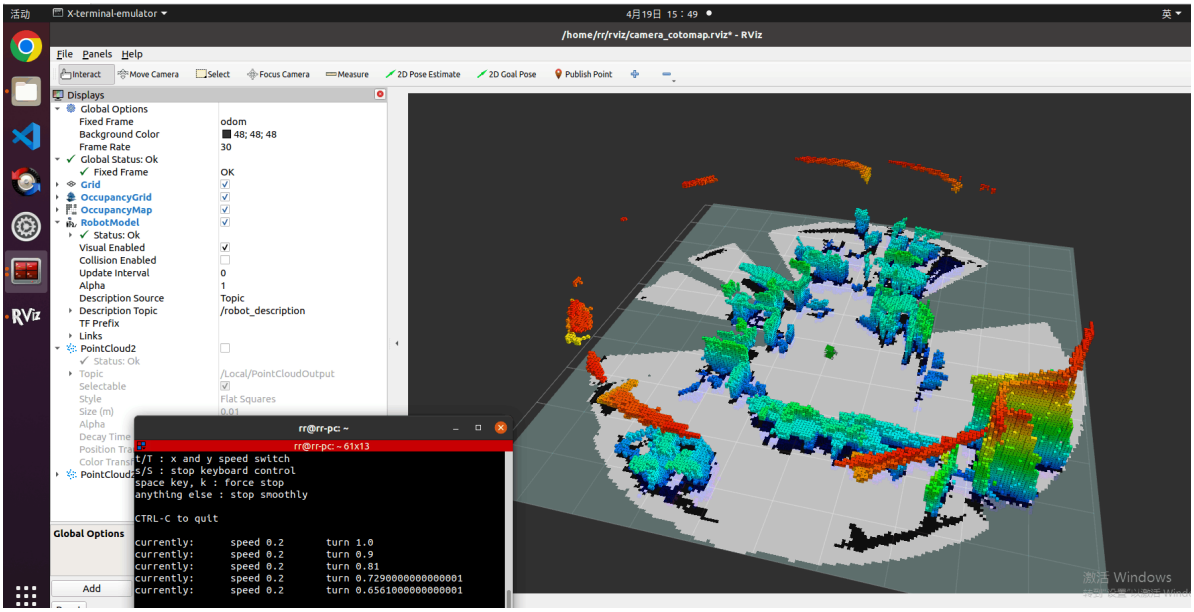
2. Start octomap_server to build the map

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

3. Enable rviz in docker or on the virtual machine side [recommended]:

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

4. Use the remote control or keyboard to control the nodes to move the machine slowly to build the map, the loss of key frames may lead to the failure of building the map.



7.3. octomap build map based on orbslam and pointcloud_mapping

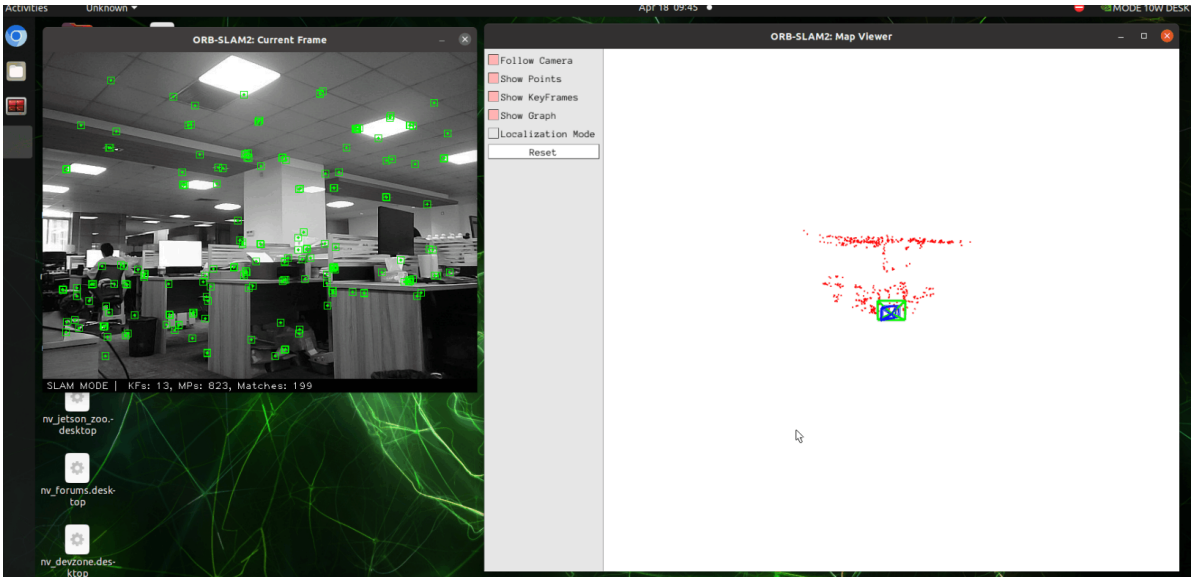
Into the docker container, see [docker course in ----- 5, into the docker container of the robot], sub-terminal execution of the following LAUNCH file:

1. Start the camera

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

2. Start orbslam to publish the camera position as well as the color and depth maps, depending on the performance of different masters, the waiting time here is about 10s

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



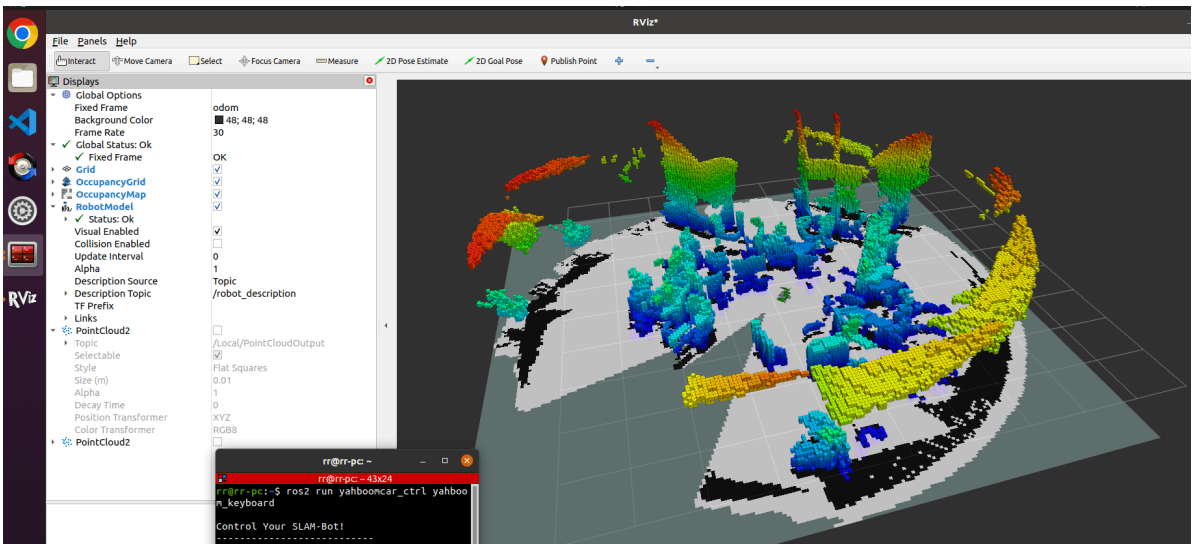
3. Start octomap_server to build the map

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

4. Enable rviz in docker or on the virtual machine side [recommended]:

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

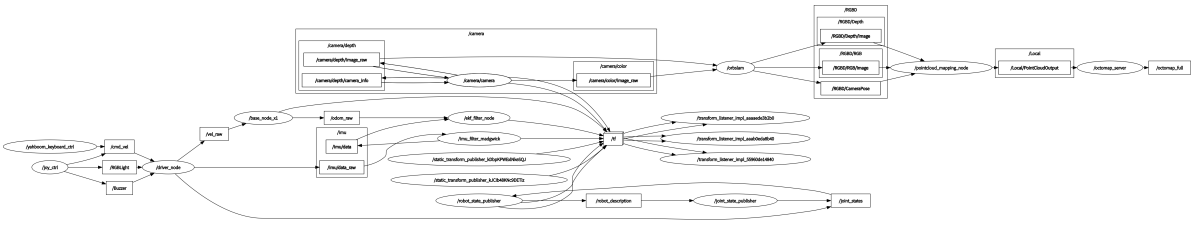
5. Use the remote control or keyboard to control the nodes to move the machine slowly to build the map, the loss of key frames may lead to the failure of building the map.



7.4. Node resolution

7.3.1. Displaying computational graphs

```
rqt_graph
```



7.3.2. Details of nodes

```
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:
```

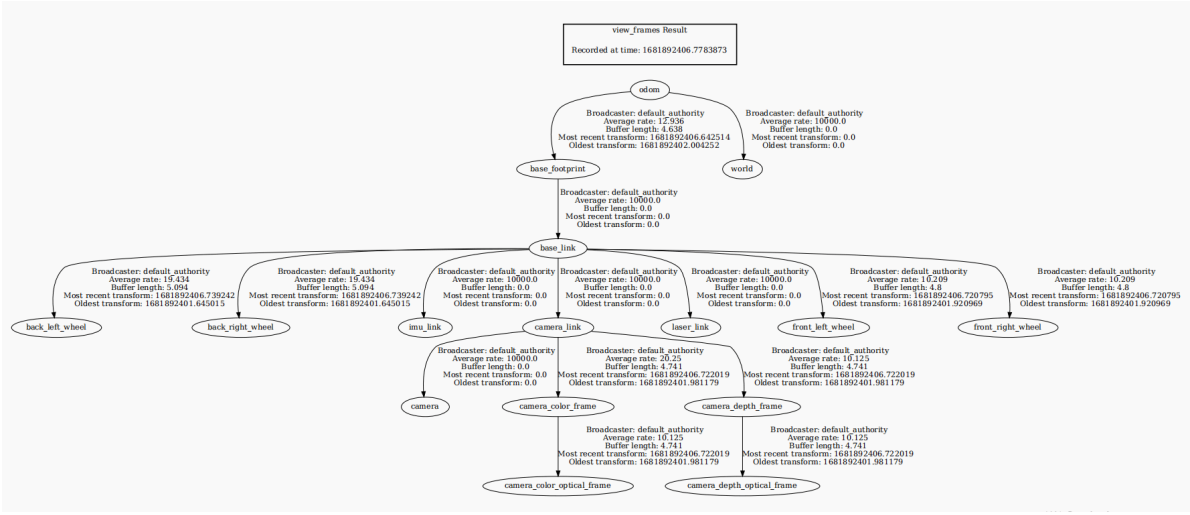
```
rr@rr-pc:~/rviz$ ros2 node info /octomap_server
/octomap_server
  Subscribers:
    /Local/PointCloudOutput: sensor_msgs/msg/PointCloud2
    /parameter_events: rcl_interfaces/msg/ParameterEvent
  Publishers:
    /free_cells_vis_array: visualization_msgs/msg/MarkerArray
    /occupied_cells_vis_array: 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 transformations

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


view_frames Result
Recorded at time: 1681892406.7783873
odom
Broadcaster: default_authority
Average rate: 17.936
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: 16.209
Buffer length: 4.8
Most recent transform: 1681892406.720795
Oldest transform: 1681892401.920969
Broadcaster: default_authority
Average rate: 16.209
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