6. Voice control multi-point navigation

The operating environment and software and hardware reference configuration are as follows:

- Reference model: ROSMASTER R2
- Robot hardware configuration: Arm series main control, Silan A1 lidar, AstraPro Plus depth camera
- Robot system: Ubuntu (no version 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

6.1. Function description

By interacting with the voice recognition module on ROSMASTER, voice control can be used to realize multi-point navigation in the established map;

Note: Before using the functions in this section, please first learn to use the [Lidar Series Courses ----- Mapping Navigation Function] module;

6.2. Preparation

This course requires the use of voice control equipment. Before running this course, you need to make the following preparations:

6.2.1. Bind the voice control device port in the host machine

Please refer to this chapter [1. Module Introduction and Port Binding Usage] for operation

6.2.2. Mount voice control device to docker container

When entering the docker container, you need to modify the script to enter the container and mount the voice control device in it:

Add this line to the [run_docker.sh] script:

```
--device=/dev/myspeech \ # Add this line
```

Others can be modified according to your own situation:

```
#!/bin/bash
xhost +

docker run -it \
--net=host \
--env="DISPLAY" \
--env="QT_X11_NO_MITSHM=1" \
-v /tmp/.X11-unix:/tmp/.X11-unix \
-v /home/jetson/temp:/root/yahboomcar_ros2_ws/temp \
-v /home/jetson/rosboard:/root/rosboard \
-v /home/jetson/maps:/root/maps \
-v /dev/bus/usb/001/010:/dev/bus/usb/001/010 \
-v /dev/bus/usb/001/011:/dev/bus/usb/001/011 \
--device=/dev/astradepth \
--device=/dev/astrauvc \
--device=/dev/video0 \
--device=/dev/myserial \
--device=/dev/rplidar \
--device=/dev/myspeech \ # Add this line
--device=/dev/input \
-p 9090:9090 \
-p 8888:8888 \
yahboomtechnology/ros-foxy:3.5.4 /bin/bash
```

6.3. Configure navigation points

1. Enter the container, see [Docker course ----- 5. Enter the robot's docker container], and execute the following commands on each terminal:

```
ros2 launch yahboomcar_nav laser_bringup_launch.py
```

2. Open the virtual machine, configure multi-machine communication, and then execute the following command to display the rviz node

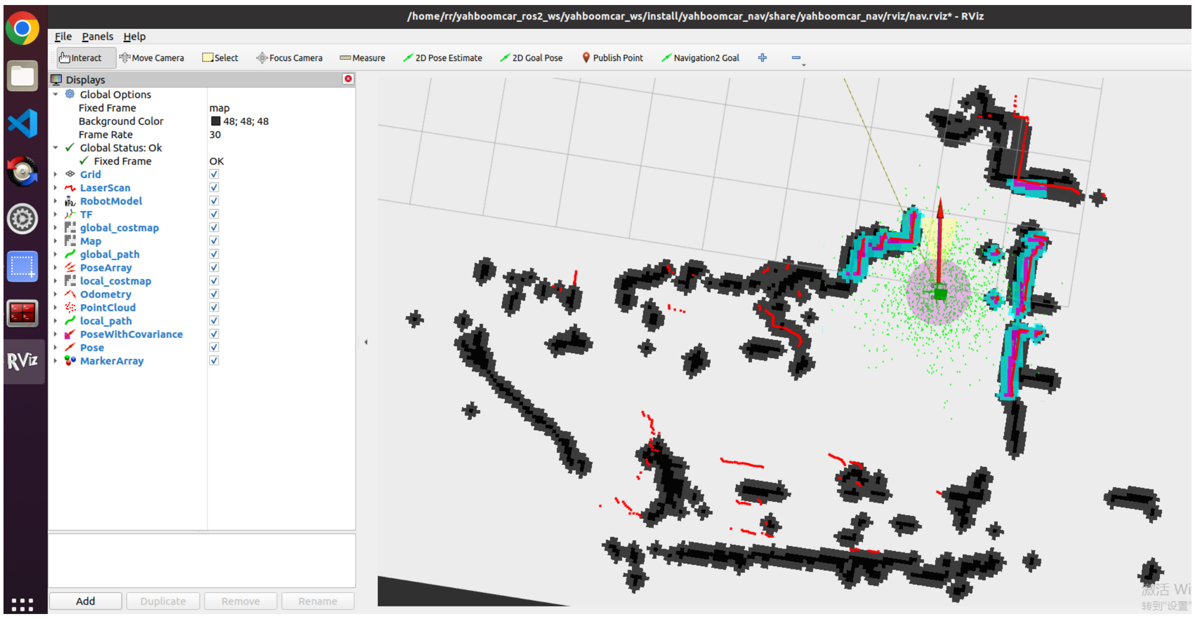
```
ros2 launch yahboomcar_nav display_nav_launch.py
```

3. Execute navigation node in docker container

```
ros2 launch yahboomcar_nav navigation_teb_launch.py
```

4. At this time, click [2D Pose Estimate] in the rviz interface of the virtual machine, then compare the pose of the car and mark an initial pose for the car on the map;

The display after marking is as follows:



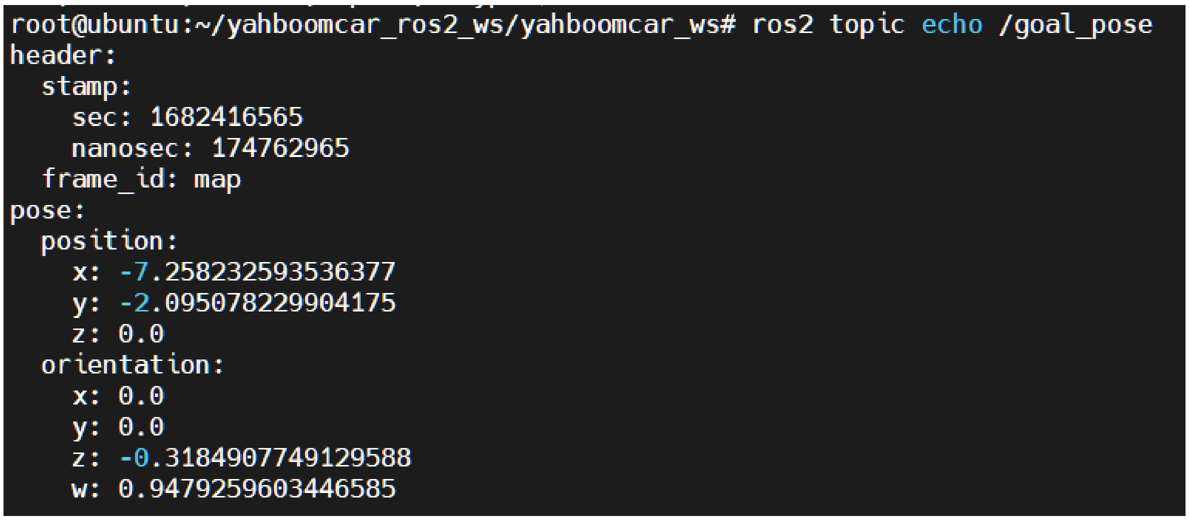
```
Global Options
  Fixed Frame        map
  Background Color   48; 48; 48
  Frame Rate         30
Global Status: Ok
  Fixed Frame        OK
```

5. Compare the overlap between the radar scanning point and the obstacle, and set the initial pose of the car multiple times until the radar scanning point and the obstacle roughly overlap;

6. Open another terminal to enter the docker container and execute

```
ros2 topic echo /goal_pose # Monitor /goal_pose topic
```

7. Click [2D Goal Pose] to set the first navigation target point. At this time, the car starts to navigate, and the monitored topic data will be received in step 6:

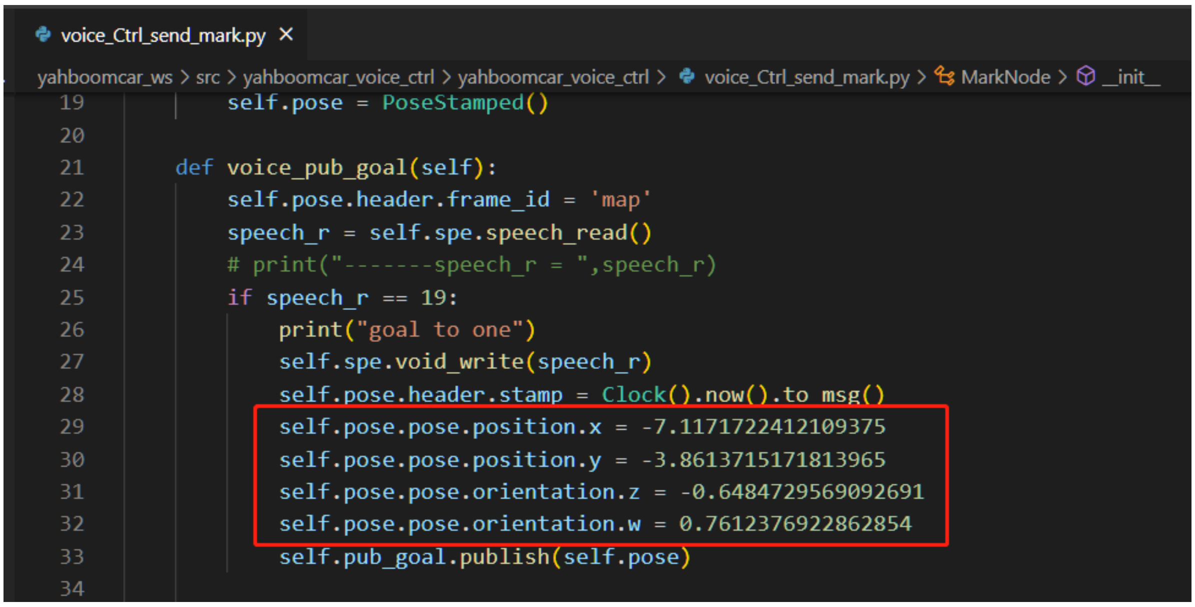


```
root@ubuntu:~/yahboomcar_ros2_ws/yahboomcar_ws# ros2 topic echo /goal_pose
header:
  stamp:
    sec: 1682416565
    nanosec: 174762965
  frame_id: map
pose:
  position:
    x: -7.258232593536377
    y: -2.095078229904175
    z: 0.0
  orientation:
    x: 0.0
    y: 0.0
    z: -0.3184907749129588
    w: 0.9479259603446585
```

8. Open the code at the following location:

```
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_voice_ctrl/yahboomcar_voic
e_ctrl/voice_Ctrl_send_mark.py
```

Modify the pose of the first navigation point to the one printed in step 7:


voice_Ctrl_send_mark.py
yahboomcar_ws > src > yahboomcar_voice_ctrl > yahboomcar_voice_ctrl > voice_Ctrl_send_mark.py > MarkNode > __init__

```
        self.pose = PoseStamped()

    def voice_pub_goal(self):
        self.pose.header.frame_id = 'map'
        speech_r = self.spe.speech_read()
        # print("-------speech_r = ",speech_r)
        if speech_r == 19:
            print("goal to one")
            self.spe.void_write(speech_r)
            self.pose.header.stamp = Clock().now().to_msg()
            self.pose.pose.position.x = -7.1171722412109375
            self.pose.pose.position.y = -3.8613715171813965
            self.pose.pose.orientation.z = -0.6484729569092691
            self.pose.pose.orientation.w = 0.7612376922862854
            self.pub_goal.publish(self.pose)
```

9. Use the same method to modify the poses of the other four navigation points. **After modifying voice_Ctrl_send_mark.py, you need to recompile the workspace.**

6.4. Use voice multi-point navigation

1. Enter the container, see [5. Enter the robot's docker container], and execute the following commands on the terminal:

```
ros2 launch yahboomcar_nav laser_bringup_launch.py
```

2. Open the virtual machine, configure multi-machine communication, and then execute the following command to display the rviz node

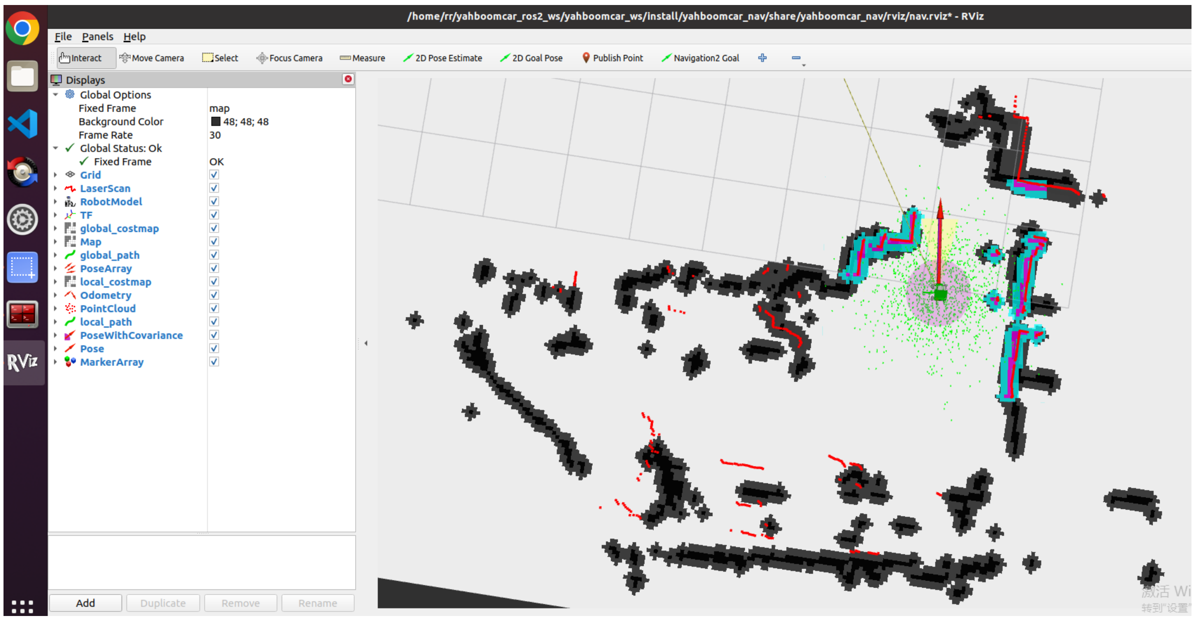
```
ros2 launch yahboomcar_nav display_nav_launch.py
```

3. Execute navigation node in docker container

```
ros2 launch yahboomcar_nav navigation_teb_launch.py
```

4. At this time, click [2D Pose Estimate] in the rviz interface of the virtual machine, then compare the pose of the car and mark an initial pose for the car on the map;

The display after marking is as follows:



/home/rr/yahboomcar_ros2_ws/yahboomcar_ws/install/yahboomcar_nav/share/yahboomcar_nav/rviz/nav.rviz* - RViz

Global Options	
Fixed Frame	map
Background Color	48; 48; 48
Frame Rate	30
Global Status: Ok	
Fixed Frame	OK

5. Compare the overlap between the radar scanning point and the obstacle, and set the initial pose of the car multiple times until the radar scanning point and the obstacle roughly overlap;

6. Open another terminal and enter the docker container, and execute to enable the voice control navigation node.

```
ros2 run yahboomcar_voice_ctrl voice_Ctrl_send_mark
```

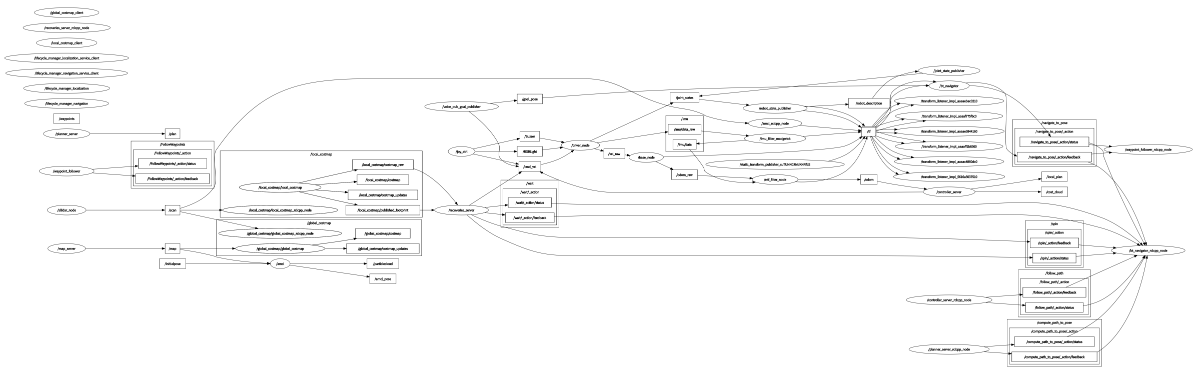
7. Say "Hello, Xiaoya" to the voice module on the car. Wake up the voice module. After hearing the voice module feedback "at", continue to say "Navigate to No. 1"; the voice module will feedback "Okay" , "Going to position 1", and at the same time, the car starts to navigate to position 1. Navigation in other locations can be used in the same way. Please refer to the following table for voice control function words:

Function words	Speech recognition module results	Voice broadcast content
Navigate to location 1	19	OK, heading to location 1
Navigate to location 2	20	OK, heading to location 2
Navigate to No. 3	21	OK, heading to No. 3
Navigate to No. 4	32	OK, heading to No. 4
Return to origin	33	OK, returning to origin

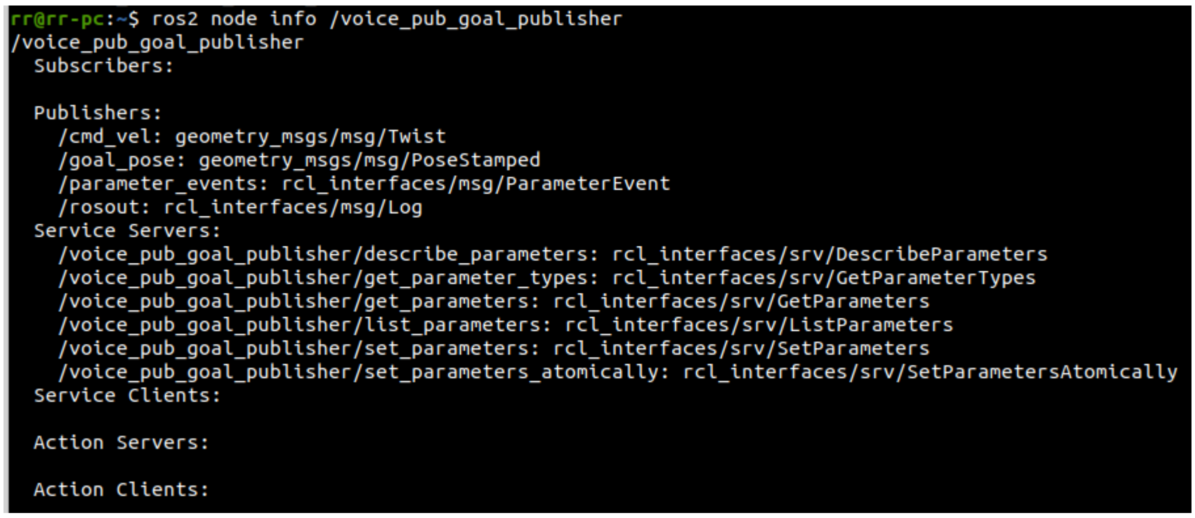
6.5. Node analysis

6.5.1. Display calculation graph

```
rqt_graph
```



6.5.2. Voice control node details



```
rr@rr-pc:~$ ros2 node info /voice_pub_goal_publisher
/voice_pub_goal_publisher
  Subscribers:

  Publishers:
    /cmd_vel: geometry_msgs/msg/Twist
    /goal_pose: geometry_msgs/msg/PoseStamped
    /parameter_events: rcl_interfaces/msg/ParameterEvent
    /rosout: rcl_interfaces/msg/Log
  Service Servers:
    /voice_pub_goal_publisher/describe_parameters: rcl_interfaces/srv/DescribeParameters
    /voice_pub_goal_publisher/get_parameter_types: rcl_interfaces/srv/GetParameterTypes
    /voice_pub_goal_publisher/get_parameters: rcl_interfaces/srv/GetParameters
    /voice_pub_goal_publisher/list_parameters: rcl_interfaces/srv/ListParameters
    /voice_pub_goal_publisher/set_parameters: rcl_interfaces/srv/SetParameters
    /voice_pub_goal_publisher/set_parameters_atomically: rcl_interfaces/srv/SetParametersAtomically
  Service Clients:

  Action Servers:

  Action Clients:
```