ROS Robot App mapping

Note: The ROS_DOMAIN_ID of the Raspberry Pi and the microROS control board need to be consistent. You can check **[MicroROS Control Board Parameter Configuration]** to set the microROS control board ROS_DOMAIN_ID. Check the tutorial **[Connect MicroROS Agent]** to determine whether the IDs are consistent.

1、Program function description

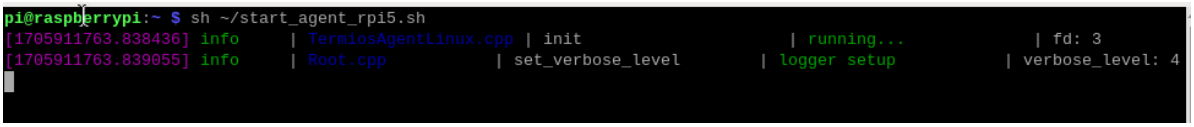
The car connects to the agent, runs the program, opens the [ROS Robot] app downloaded on the mobile phone, enters the IP address of the car, selects ROS2, and clicks connect to connect to the car. You can control the car by sliding the wheel on the interface, and slowly control the car to complete the mapped area. Finally, click Save Map, and the car will save the currently constructed map.

2、Query car information

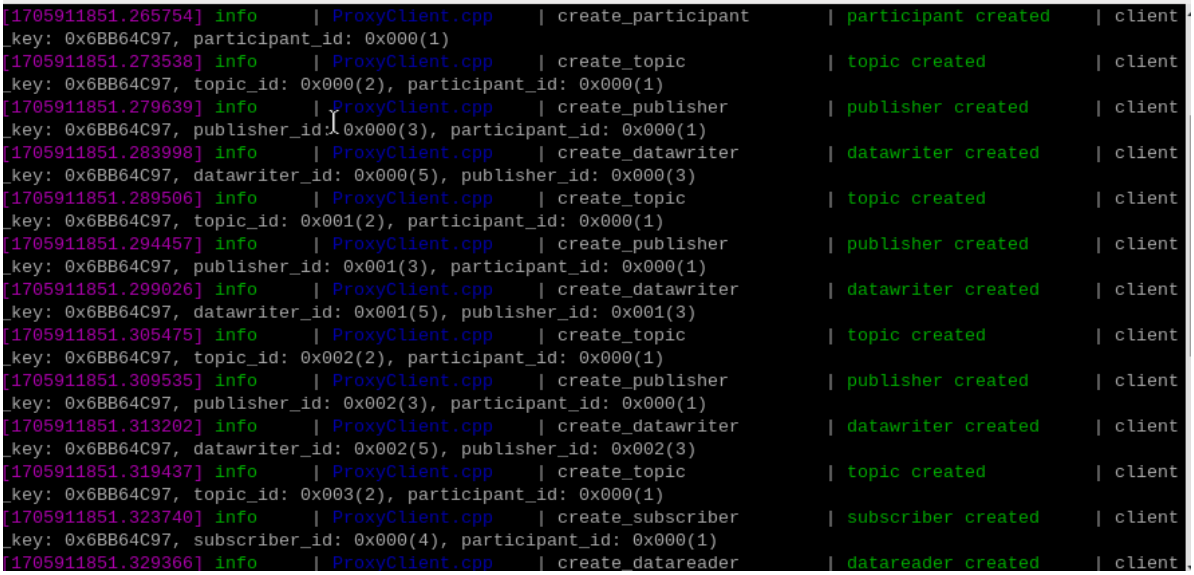
2.1、Start and connect to the agent

After the Raspberry Pi is successfully powered on, open the terminal and enter the following command to open the agent.

```
sh ~/start_agent_rpi5.sh
```



Press the reset button on the microROS control board and wait for the car to connect to the agent. The connection is successful as shown in the figure below.



2.2、Enter the car docker

Open another terminal and enter the following command to enter docker.

```
sh ros2_humble.sh
```

When the following interface appears, you have successfully entered docker. Now you can control the car through commands.

```
pi@raspberrypi:~ $ ./ros2_humble.sh
access control disabled, clients can connect from any host
Successful
MY_DOMAIN_ID: 20
```

3、starting program

First, start the car to process the underlying data program and enter the terminal.

```
ros2 launch yahboomcar_bringup yahboomcar_bringup_launch.py
```

```
[INFO] [imu_filter_madgwick_node-1]: process started with pid [6263]
[INFO] [ekf_node-2]: process started with pid [6265]
[INFO] [static_transform_publisher-3]: process started with pid [6267]
[INFO] [joint_state_publisher-4]: process started with pid [6269]
[INFO] [robot_state_publisher-5]: process started with pid [6271]
[INFO] [static_transform_publisher-6]: process started with pid [6286]
[static_transform_publisher-3] [WARN] [1706181650.342105372] []: Old-style arguments are deprecated; see --help for new-style arguments
[static_transform_publisher-3] [INFO] [1706181650.459314055] [base_link_to_base_imu]: Spinning until stopped - publishing transform
[static_transform_publisher-3] translation: ('-0.002999', '-0.003000', '0.031701')
[static_transform_publisher-3] rotation: ('0.000000', '0.000000', '0.000000', '1.000000')
[static_transform_publisher-3] from 'base_link' to 'imu_frame'
[imu_filter_madgwick_node-1] [INFO] [1706181650.478942143] [imu_filter]: Starting ImuFilter
[imu_filter_madgwick_node-1] [INFO] [1706181650.480114862] [imu_filter]: Using dt computed from message headers
[imu_filter_madgwick_node-1] [INFO] [1706181650.480197121] [imu_filter]: The gravity vector is kept in the IMU message.
[imu_filter_madgwick_node-1] [INFO] [1706181650.480631749] [imu_filter]: Imu filter gain set to 0.100000
[imu_filter_madgwick_node-1] [INFO] [1706181650.480707508] [imu_filter]: Gyro drift bias set to 0.000000
[imu_filter_madgwick_node-1] [INFO] [1706181650.480720249] [imu_filter]: Magnetometer bias values: 0.000000 0.000000 0.000000
[static_transform_publisher-6] [WARN] [1706181650.493533858] []: Old-style arguments are deprecated; see --help for new-style arguments
[robot_state_publisher-5] [WARN] [1706181650.639387954] [kdl_parser]: The root link base_link has an inertia specified in the URDF, but KDL does not support a root link with an inertia.  As a workaround, you can add an extra dummy link to your URDF.
[robot_state_publisher-5] [INFO] [1706181650.640061915] [robot_state_publisher]: got segment base_link
[robot_state_publisher-5] [INFO] [1706181650.640174267] [robot_state_publisher]: got segment imu_Link
[robot_state_publisher-5] [INFO] [1706181650.640191229] [robot_state_publisher]: got segment jq1_Link
[robot_state_publisher-5] [INFO] [1706181650.640201822] [robot_state_publisher]: got segment jq2_Link
[robot_state_publisher-5] [INFO] [1706181650.640211952] [robot_state_publisher]: got segment radar_Link
[robot_state_publisher-5] [INFO] [1706181650.640221211] [robot_state_publisher]: got segment yh_Link
[robot_state_publisher-5] [INFO] [1706181650.640229452] [robot_state_publisher]: got segment yq_Link
[robot_state_publisher-5] [INFO] [1706181650.640238470] [robot_state_publisher]: got segment zh_Link
[robot_state_publisher-5] [INFO] [1706181650.640246655] [robot_state_publisher]: got segment zq_Link
[imu_filter_madgwick_node-1] [INFO] [1706181650.655098332] [imu_filter]: First IMU message received.
[static_transform_publisher-6] [INFO] [1706181650.681177050] [static_transform_publisher_JarNTEa1OrW2k0Zb]: Spinning until stopped - publishing transform
[static_transform_publisher-6] translation: ('0.000000', '0.000000', '0.050000')
[static_transform_publisher-6] rotation: ('0.000000', '0.000000', '0.000000', '1.000000')
[static_transform_publisher-6] from 'base_footprint' to 'base_link'
[joint_state_publisher-4] [INFO] [1706181650.989117137] [joint_state_publisher]: Waiting for robot_description to be published on the robot_description topic...
```

Then, start rviz visual mapping. You need to enter the same docker terminal before entering this command. The steps are as follows:

Reopen a new terminal in the Raspberry Pi and enter the command,

```
docker ps -a
```

You can enter the same docker based on this ID number. Note that the ID number is different every time you enter the docker. Enter the command.

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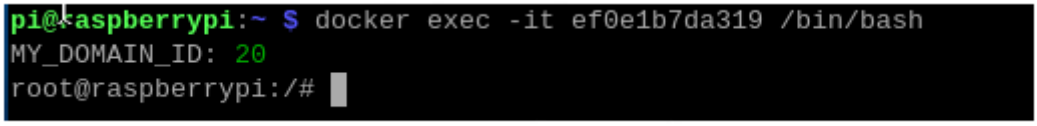
```
docker exec -it ef0e1b7da319 /bin/bash
```



When this screen appears, we have entered the same docker. Then start mapping,

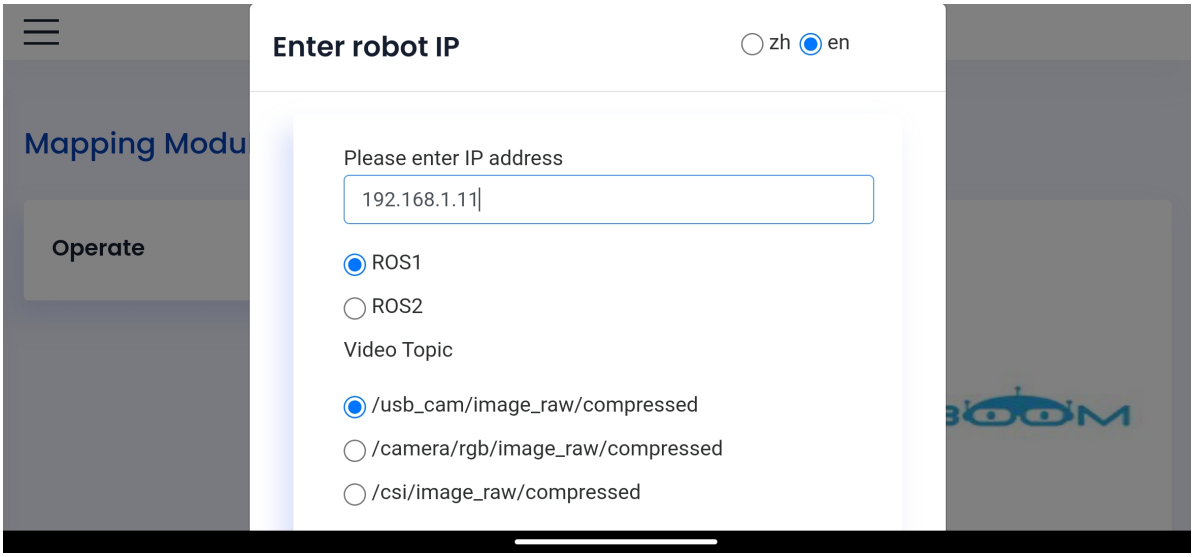
```
#Choose one of the following drawings
ros2 launch yahboomcar_nav map_gmapping_app_launch.xml
ros2 launch yahboomcar_nav map_cartographer_app_launch.xml
```

Start the camera screen..**(You need to enter the same docker terminal as above)**,

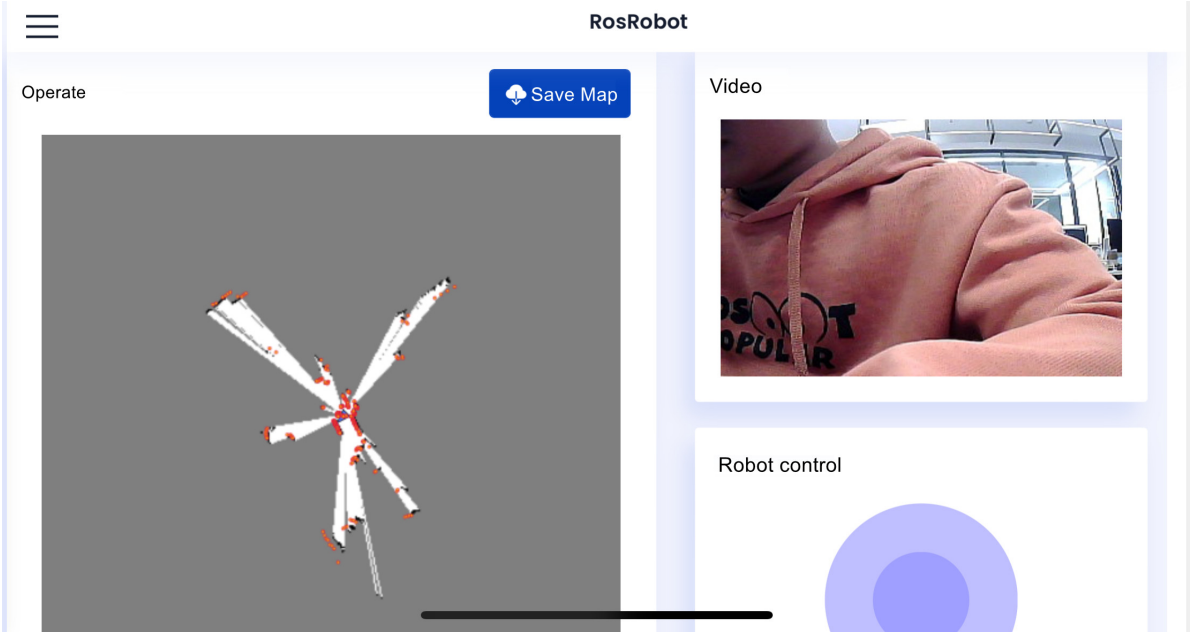
```
ros2 launch usb_cam camera.launch.py
```

```
root@raspberrypi:~# ros2 launch usb_cam camera.launch.py
[INFO] [launch]: All log files can be found below /root/.ros/log/2024-01-25-10-33-16-478075-raspberrypi-558
[INFO] [launch]: Default logging verbosity is set to INFO
[INFO] [usb_cam_node_exe-1]: process started with pid [559]
[usb_cam_node_exe-1] [INFO] [1706178798.300109580] [camera1]: camera_name value: test_camera
[usb_cam_node_exe-1] [WARN] [1706178798.301320740] [camera1]: framerate: 30.000000
[usb_cam_node_exe-1] [INFO] [1706178798.331489959] [camera1]: camera calibration URL: package://usb_cam/config/camera_info.yaml
[usb_cam_node_exe-1] [INFO] [1706178798.333964944] [camera1]: Starting 'test_camera' (/dev/video0) at 320x240 via mmap (mjpeg2rgb) at 30 FPS
[usb_cam_node_exe-1] [swscaler @ 0x55564a91f270] No accelerated colorspace conversion found from yuv422p to rgb24.
[usb_cam_node_exe-1] This device supports the following formats:
[usb_cam_node_exe-1]     Motion-JPEG 1920 x 1080 (30 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 640 x 480 (120 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 640 x 480 (90 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 640 x 480 (60 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 640 x 480 (30 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 1280 x 720 (60 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 1280 x 720 (30 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 1024 x 768 (30 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 800 x 600 (60 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 1280 x 1024 (30 Hz)
[usb_cam_node_exe-1]     Motion-JPEG 320 x 240 (120 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 1920 x 1080 (6 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 640 x 480 (30 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 1280 x 720 (9 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 1024 x 768 (6 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 800 x 600 (20 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 1280 x 1024 (6 Hz)
[usb_cam_node_exe-1]     YUYV 4:2:2 320 x 240 (30 Hz)
[usb_cam_node_exe-1] unknown control 'white_balance_temperature_auto'
[usb_cam_node_exe-1]
[usb_cam_node_exe-1] [INFO] [1706178798.499334881] [camera1]: Setting 'white_balance_temperature_auto' to 1
[usb_cam_node_exe-1] [INFO] [1706178798.499433620] [camera1]: Setting 'exposure_auto' to 3
[usb_cam_node_exe-1] unknown control 'exposure_auto'
[usb_cam_node_exe-1]
[usb_cam_node_exe-1] [INFO] [1706178798.505503067] [camera1]: Setting 'focus_auto' to 0
[usb_cam_node_exe-1] unknown control 'focus_auto'
[usb_cam_node_exe-1]
[usb_cam_node_exe-1] [INFO] [1706178798.648586676] [camera1]: Timer triggering every 33 ms
```

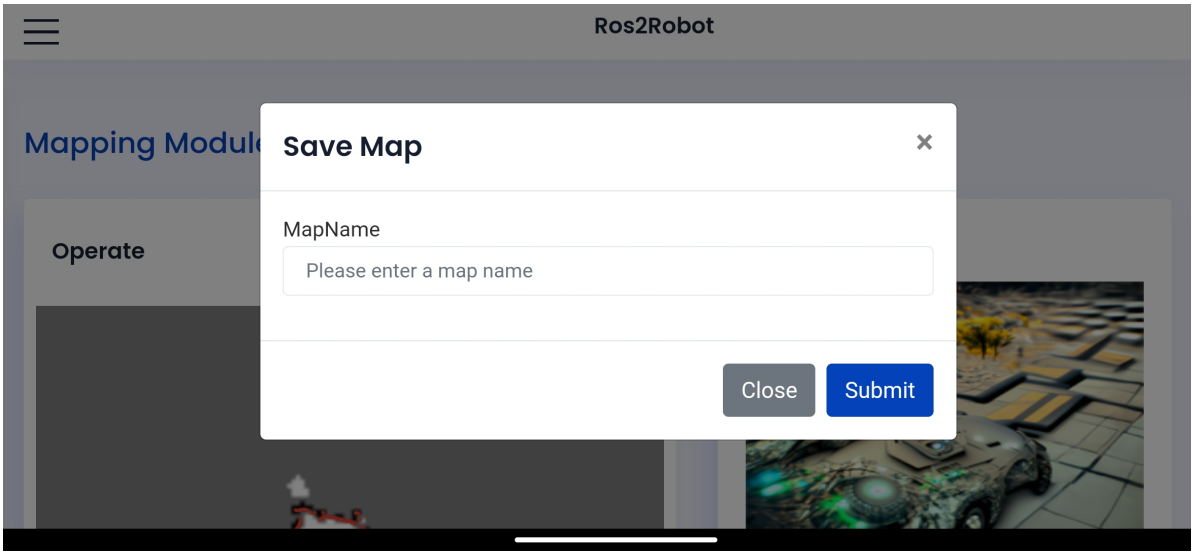
The mobile APP displays as shown below, enter the IP address of the car, **[zh]** means Chinese, **[en]** means English; select ROS2, select the first Video Tpoic below, and finally click [Connect]



After successful connection, the following is displayed:



Use the sliding wheel to control the car to move slowly through the area that needs to be mapped, then click to save the map, enter the map name and click submit to save the map.



The location where the map is saved is as follows.

```
/root/yahboomcar_ws/src/yahboomcar_nav/maps
```

4、Code analysis

Here is an explanation of the launch file that opens the APP mapping, taking gmapping mapping as an example.

map_gmapping_app_launch.xml

```
<launch>
    <include file="$(find-pkg-share
rosbridge_server)/launch/rosbridge_websocket_launch.xml"/>
    <node name="laserscan_to_point_publisher" pkg="laserscan_to_point_publisher"
exec="laserscan_to_point_publisher"/>
    <include file="$(find-pkg-share
yahboomcar_nav)/launch/map_gmapping_launch.py"/>
    <include file="$(find-pkg-share
robot_pose_publisher_ros2)/launch/robot_pose_publisher_launch.py"/>
    <include file="$(find-pkg-share
yahboom_app_save_map)/yahboom_app_save_map.launch.py"/>
</launch>
```

The following launch files and nodes are run here:

- rosbridge_websocket_launch.xml：Open the rosbridge service-related nodes. After starting, you can connect to ROS through the network.
- laserscan_to_point_publisher：Publish the radar point cloud conversion to the APP for visualization
- map_gmapping_launch.py：gmapping mapping program
- robot_pose_publisher_launch.py：Car pose publishing program, the car pose is visualized in the APP
- yahboom_app_save_map.launch.py：Program to save maps.