ROS Robot APP navigation

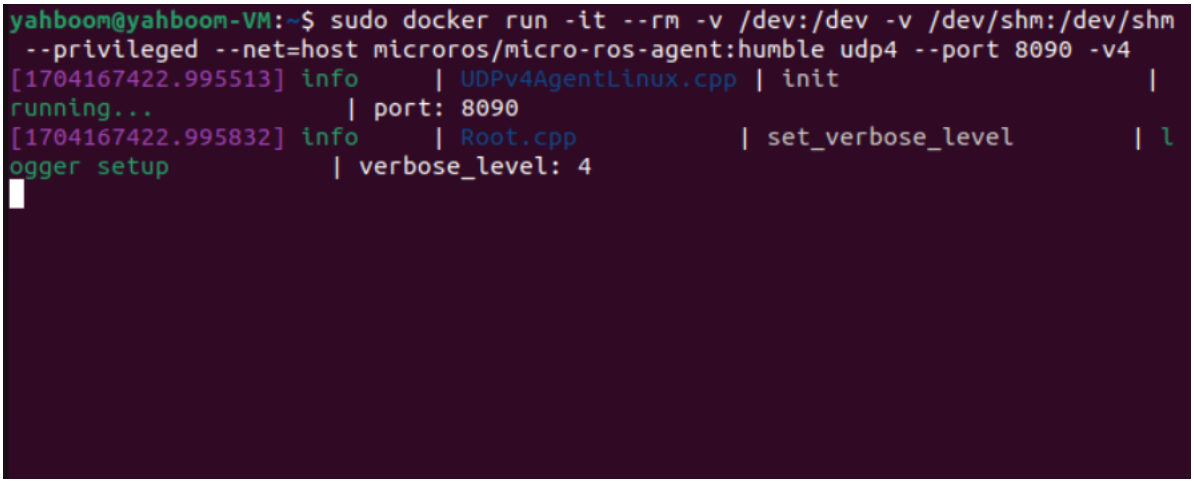
1、Program function specification

The car connects to the agent, runs the program, and the phone connects to the car through a network. Open the [ROS Robot] app downloaded on the mobile phone, enter the IP address of the car, select ROS2, and click Connect to connect the car. Select [Navigation], click [Set initialization point] on the App interface to set the start pose of the car, click [Set navigation point] on the App interface to set the target point of the car, and then the car will plan a path to move to this point.

2、Start and connect to the agent

Using the matching VM as an example, run the following command to start the agent，

```
#Car agency
sudo docker run -it --rm -v /dev:/dev -v /dev/shm:/dev/shm --privileged --
net=host microros/micro-ros-agent:humble udp4 --port 8090 -v4
#Camera agent (Start the agent and then turn on the car switch)
docker run -it --rm -v /dev:/dev -v /dev/shm:/dev/shm --privileged --net=host
microros/micro-ros-agent:humble udp4 --port 9999 -v4
```



Then, open the car switch and wait for the car to connect to the agent. The connection is successful as shown in the figure below.

```
[1702630014.015846] info     | ProxyClient.cpp     | create_participant       | participant created     | client_key: 0x0B62A009, part
icipant_id: 0x000(1)
[1702630014.135363] info     | ProxyClient.cpp     | create_topic             | topic created           | client_key: 0x0B62A009, topi
c_id: 0x000(2), participant_id: 0x000(1)
[1702630014.223689] info     | ProxyClient.cpp     | create_publisher         | publisher created       | client_key: 0x0B62A009, publ
isher_id: 0x000(3), participant_id: 0x000(1)
[1702630014.415510] info     | ProxyClient.cpp     | create_datawriter        | datawriter created      | client_key: 0x0B62A009, data
writer_id: 0x000(5), publisher_id: 0x000(3)
[1702630014.428530] info     | ProxyClient.cpp     | create_topic             | topic created           | client_key: 0x0B62A009, topi
c_id: 0x001(2), participant_id: 0x000(1)
[1702630014.527190] info     | ProxyClient.cpp     | create_publisher         | publisher created       | client_key: 0x0B62A009, publ
isher_id: 0x001(3), participant_id: 0x000(1)
[1702630014.543889] info     | ProxyClient.cpp     | create_datawriter        | datawriter created      | client_key: 0x0B62A009, data
writer_id: 0x001(5), publisher_id: 0x001(3)
[1702630014.554490] info     | ProxyClient.cpp     | create_topic             | topic created           | client_key: 0x0B62A009, topi
c_id: 0x002(2), participant_id: 0x000(1)
[1702630014.737059] info     | ProxyClient.cpp     | create_publisher         | publisher created       | client_key: 0x0B62A009, publ
isher_id: 0x002(3), participant_id: 0x000(1)
[1702630014.755072] info     | ProxyClient.cpp     | create_datawriter        | datawriter created      | client_key: 0x0B62A009, data
writer_id: 0x002(5), publisher_id: 0x002(3)
[1702630014.818985] info     | ProxyClient.cpp     | create_topic             | topic created           | client_key: 0x0B62A009, topi
c_id: 0x003(2), participant_id: 0x000(1)
[1702630014.840001] info     | ProxyClient.cpp     | create_subscriber        | subscriber created      | client_key: 0x0B62A009, subs
criber_id: 0x000(4), participant_id: 0x000(1)
[1702630014.864010] info     | ProxyClient.cpp     | create_datareader        | datareader created      | client_key: 0x0B62A009, data
reader_id: 0x000(6), subscriber_id: 0x000(4)
[1702630014.959908] info     | ProxyClient.cpp     | create_topic             | topic created           | client_key: 0x0B62A009, topi
c_id: 0x004(2), participant_id: 0x000(1)
[1702630015.033537] info     | ProxyClient.cpp     | create_subscriber        | subscriber created      | client_key: 0x0B62A009, subs
criber_id: 0x001(4), participant_id: 0x000(1)
[1702630015.140350] info     | ProxyClient.cpp     | create_datareader        | datareader created      | client_key: 0x0B62A009, data
reader_id: 0x001(6), subscriber_id: 0x001(4)
[1702630015.158510] info     | ProxyClient.cpp     | create_topic             | topic created           | client_key: 0x0B62A009, topi
c_id: 0x005(2), participant_id: 0x000(1)
[1702630015.241039] info     | ProxyClient.cpp     | create_subscriber        | subscriber created      | client_key: 0x0B62A009, subs
criber_id: 0x002(4), participant_id: 0x000(1)
[1702630015.347393] info     | ProxyClient.cpp     | create_datareader        | datareader created      | client_key: 0x0B62A009, data
reader_id: 0x002(6), subscriber_id: 0x002(4)
```

3、Initiating program

First start the car to process the underlying data program, terminal input,

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

```
[INFO] [imu_filter_madgwick_node-1]: process started with pid [6638]
[INFO] [ekf_node-2]: process started with pid [6640]
[INFO] [static_transform_publisher-3]: process started with pid [6642]
[INFO] [joint_state_publisher-4]: process started with pid [6644]
[INFO] [robot_state_publisher-5]: process started with pid [6646]
[INFO] [static_transform_publisher-6]: process started with pid [6658]
[static_transform_publisher-3] [WARN] [1702865272.944043208] []: Old-style arguments are deprecated; see --help for new-style argume
nts
[static_transform_publisher-6] [WARN] [1702865272.984740987] []: Old-style arguments are deprecated; see --help for new-style argume
nts
[static_transform_publisher-3] [INFO] [1702865272.991857276] [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'
[static_transform_publisher-6] [INFO] [1702865273.005707993] [static_transform_publisher_JH06Gexf4GRodmgs]: 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'
[robot_state_publisher-5] [WARN] [1702865273.013202438] [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] [1702865273.013312806] [robot_state_publisher]: got segment base_link
[robot_state_publisher-5] [INFO] [1702865273.013516195] [robot_state_publisher]: got segment imu_link
[robot_state_publisher-5] [INFO] [1702865273.013524175] [robot_state_publisher]: got segment jq1_Link
[robot_state_publisher-5] [INFO] [1702865273.013528144] [robot_state_publisher]: got segment jq2_Link
[robot_state_publisher-5] [INFO] [1702865273.013531665] [robot_state_publisher]: got segment radar_Link
[robot_state_publisher-5] [INFO] [1702865273.013535185] [robot_state_publisher]: got segment yh_Link
[robot_state_publisher-5] [INFO] [1702865273.013538763] [robot_state_publisher]: got segment yq_Link
[robot_state_publisher-5] [INFO] [1702865273.013542135] [robot_state_publisher]: got segment zh_Link
[robot_state_publisher-5] [INFO] [1702865273.013545612] [robot_state_publisher]: got segment zq_Link
[imu_filter_madgwick_node-1] [INFO] [1702865273.030399479] [imu_filter]: Starting ImuFilter
[imu_filter_madgwick_node-1] [INFO] [1702865273.031826501] [imu_filter]: Using dt computed from message headers
[imu_filter_madgwick_node-1] [INFO] [1702865273.031858361] [imu_filter]: The gravity vector is kept in the IMU message.
[imu_filter_madgwick_node-1] [INFO] [1702865273.032488302] [imu_filter]: Imu filter gain set to 0.100000
[imu_filter_madgwick_node-1] [INFO] [1702865273.032525566] [imu_filter]: Gyro drift bias set to 0.000000
[imu_filter_madgwick_node-1] [INFO] [1702865273.032531441] [imu_filter]: Magnetometer bias values: 0.000000 0.000000 0.000000
[imu_filter_madgwick_node-1] [INFO] [1702865273.053298796] [imu_filter]: First IMU message received.
[joint_state_publisher-4] [INFO] [1702865273.282975810] [joint_state_publisher]: Waiting for robot_description to be published on th
e robot_description topic...
```

Start APP navigation command, terminal input,

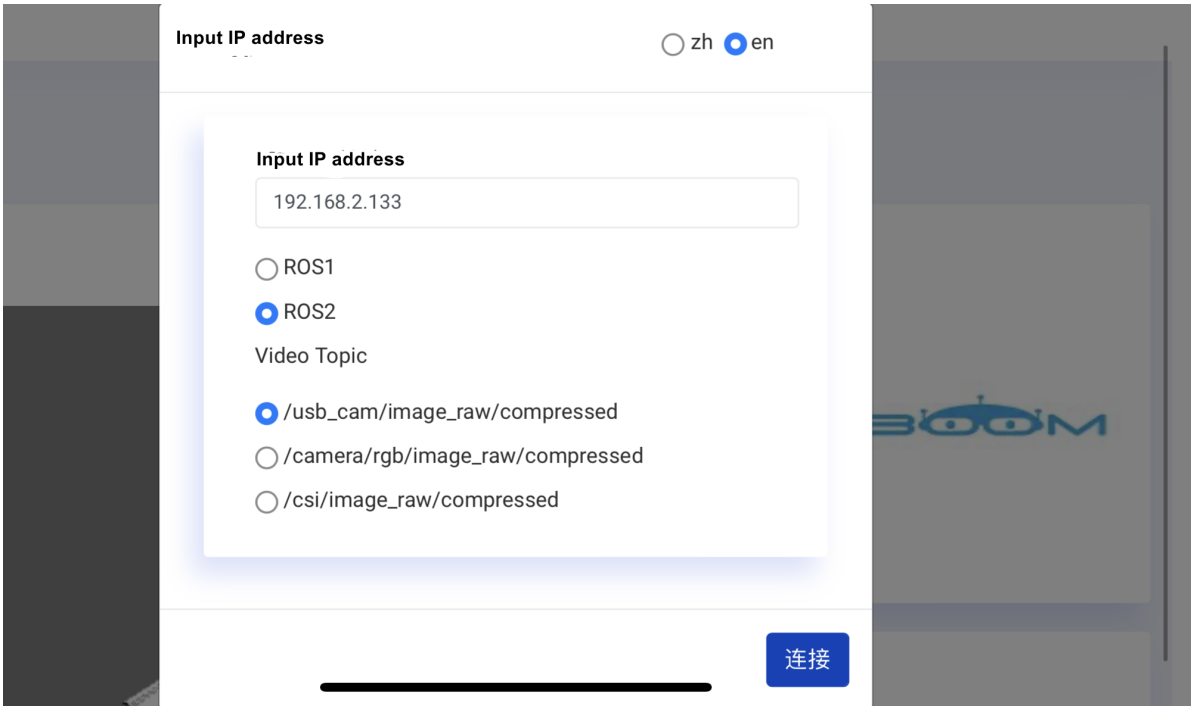
```
ros2 launch yahboomcar_nav navigation_dwb_app_launch.xml
maps:=/home/yahboom/yahboomcar_ws/src/yahboomcar_nav/maps/testaa.yaml
```

Load map parameters:
maps:=/home/yahboom/yahboomcar_ws/src/yahboomcar_nav/maps/testaa.yaml（Replaceable target map)

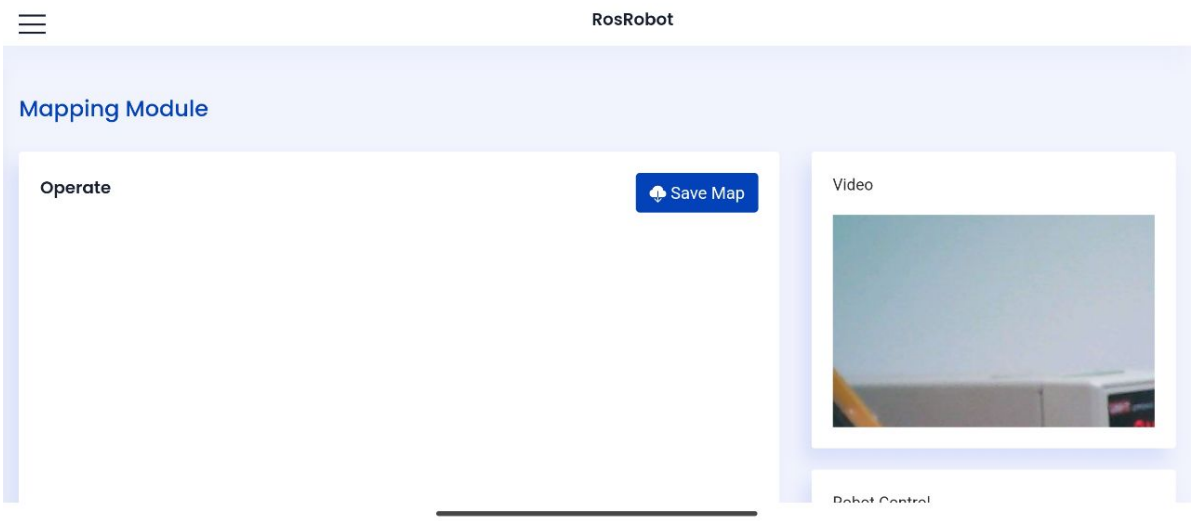
Start the camera display command, terminal input,

```
# Make the camera steering level
ros2 run yahboom_esp32_mediapipe control_servo
# Start ESP32 camera
ros2 run yahboom_esp32_camera sub_img
```

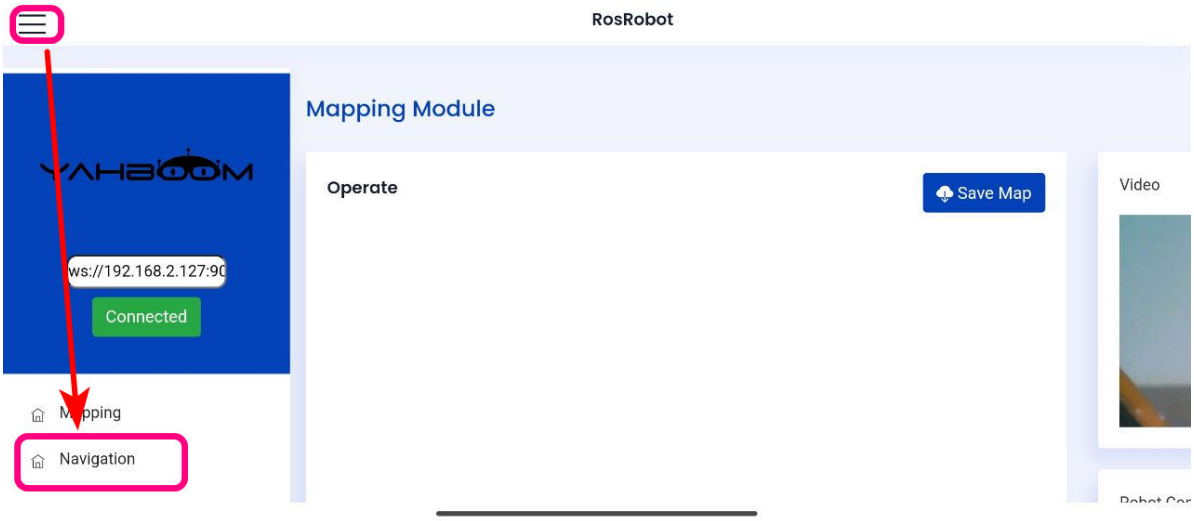
The mobile APP shows the following picture. Enter the IP address of the car, 【zh】 indicates Chinese, 【en】 indicates English; Select ROS2 and Video Tpoic: /usb_cam/image_raw/compressed, then click Connect.



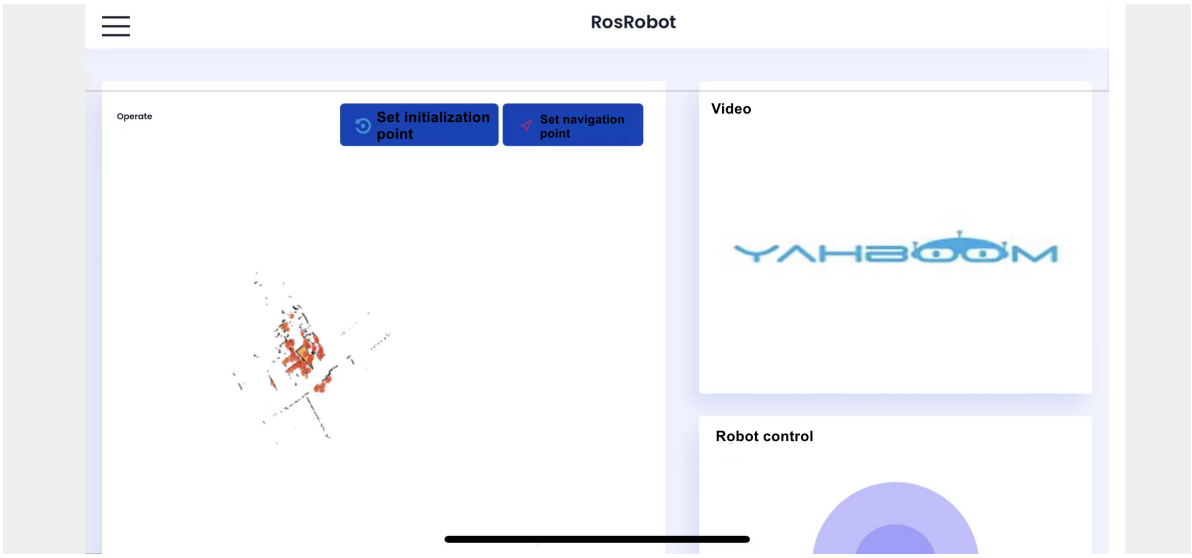
After the connection is successful, the following information is displayed,



Select the navigation interface as shown in the following figure,



Then, combined with the actual pose of the car, click [Set initialization point] to give the car an initial target point, and the area scanned by the radar roughly coincides with the actual obstacle, indicating that the pose is accurate. As shown in the following picture,



Then, click [Set navigation point], give the car a destination, the car will plan a path and move to the destination according to the path。

4、Code parsing

This section describes the launch file for APP navigation,

navigation_dwb_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/navigation_dwb_launch.py"/>
    <include file="$(find-pkg-share
robot_pose_publisher_ros2)/launch/robot_pose_publisher_launch.py"/>
</launch>
```

The following launch files and Node nodes are run:

- rosbridge_websocket_launch.xml：Start the nodes related to rosbridge service and connect to ROS through the network
- laserscan_to_point_publisher：Publish the radar point cloud conversion to the APP for visualization
- navigation_dwb_launch.py：Navigation program
- robot_pose_publisher_launch.py：Car position and posture release program, car position and posture visualization in the APP