APP mapping navigation

1. Content Description

This course explains how to use the ROS Robot app to control a robot for mapping and navigation.

This section requires entering commands in the terminal. The terminal you open depends on your board type. This course uses a Raspberry Pi 5 as an example. For Raspberry Pi and Jetson Nano boards, you need to open a terminal on the host computer and enter the command to enter the Docker container. Once inside the Docker container, enter the commands mentioned in this section in the terminal. For instructions on entering the Docker container from the host computer, refer to **[01. Robot Configuration and Operation Guide] -- [5.Enter Docker (For JETSON Nano and RPi 5)]**.

For Orin boards, simply open the terminal and enter the commands mentioned in this section.

1.1. Preparation

You must first download the ROS Rotbot app on your phone. Android/iOS phone users, please scan the QR code to download the remote control software. iOS users can also search and download the ROSRobot map navigation app from the App Store.

The robot and phone must be on the same local area network, which can be achieved by connecting to the same Wi-Fi network.

2. App Map Creation

2.1. Program Startup

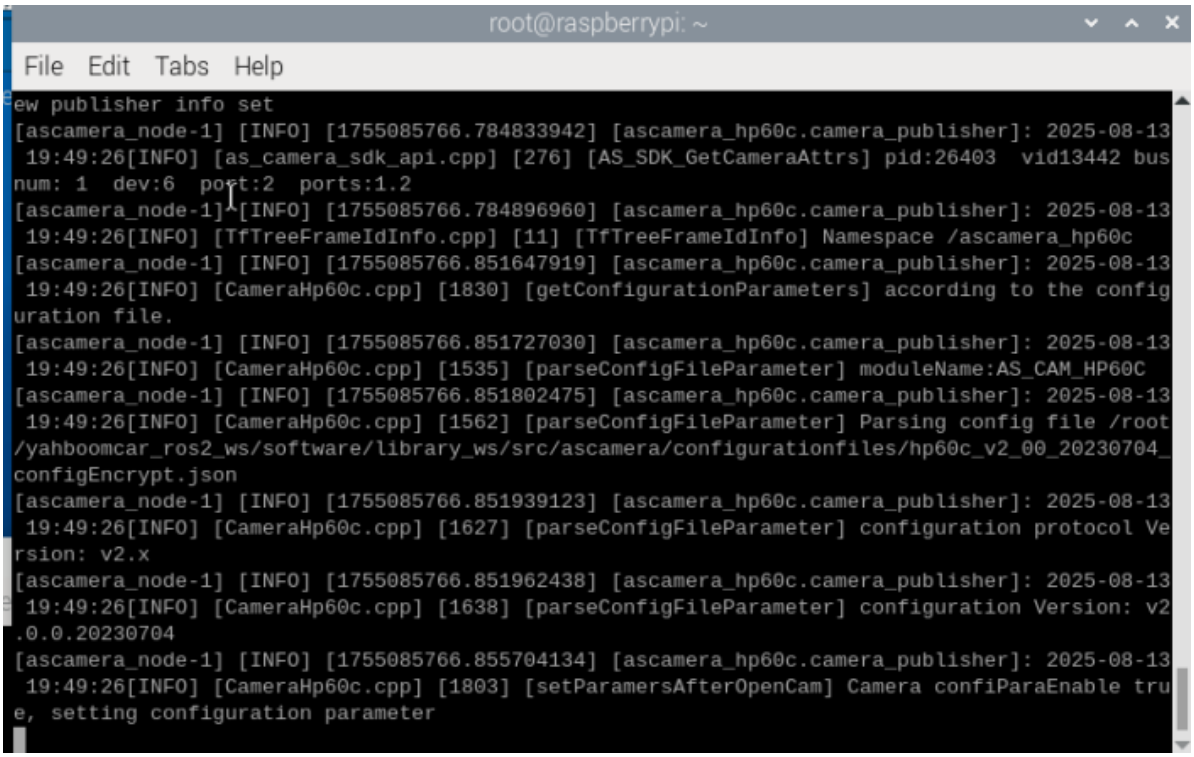
For the Raspberry Pi 5 controller, you must first enter the Docker container. For the Orin controller, this is not necessary.

Enter the Docker container (for steps, see [Docker Course] --- [4. Docker Startup Script]).

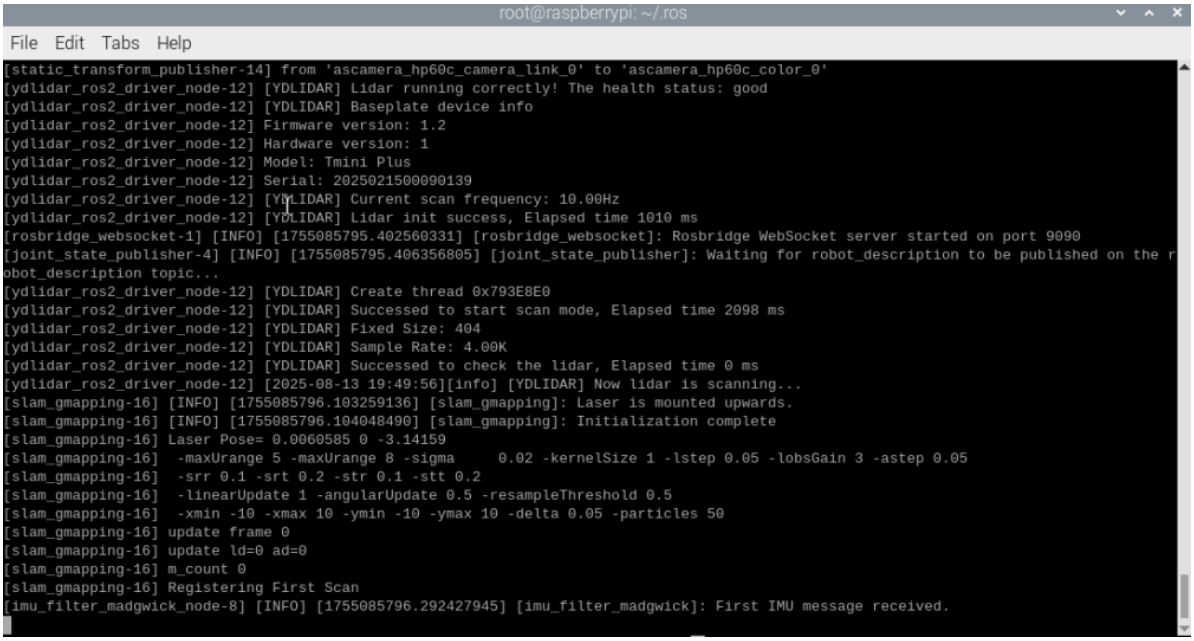
All the following commands must be executed from the Docker terminal within the same Docker container.**(For steps, see [Docker Course] --- [3. Docker Submission and Multi-Terminal Access]).**

Enter the following command on the Car terminal to start the Car app map creation.

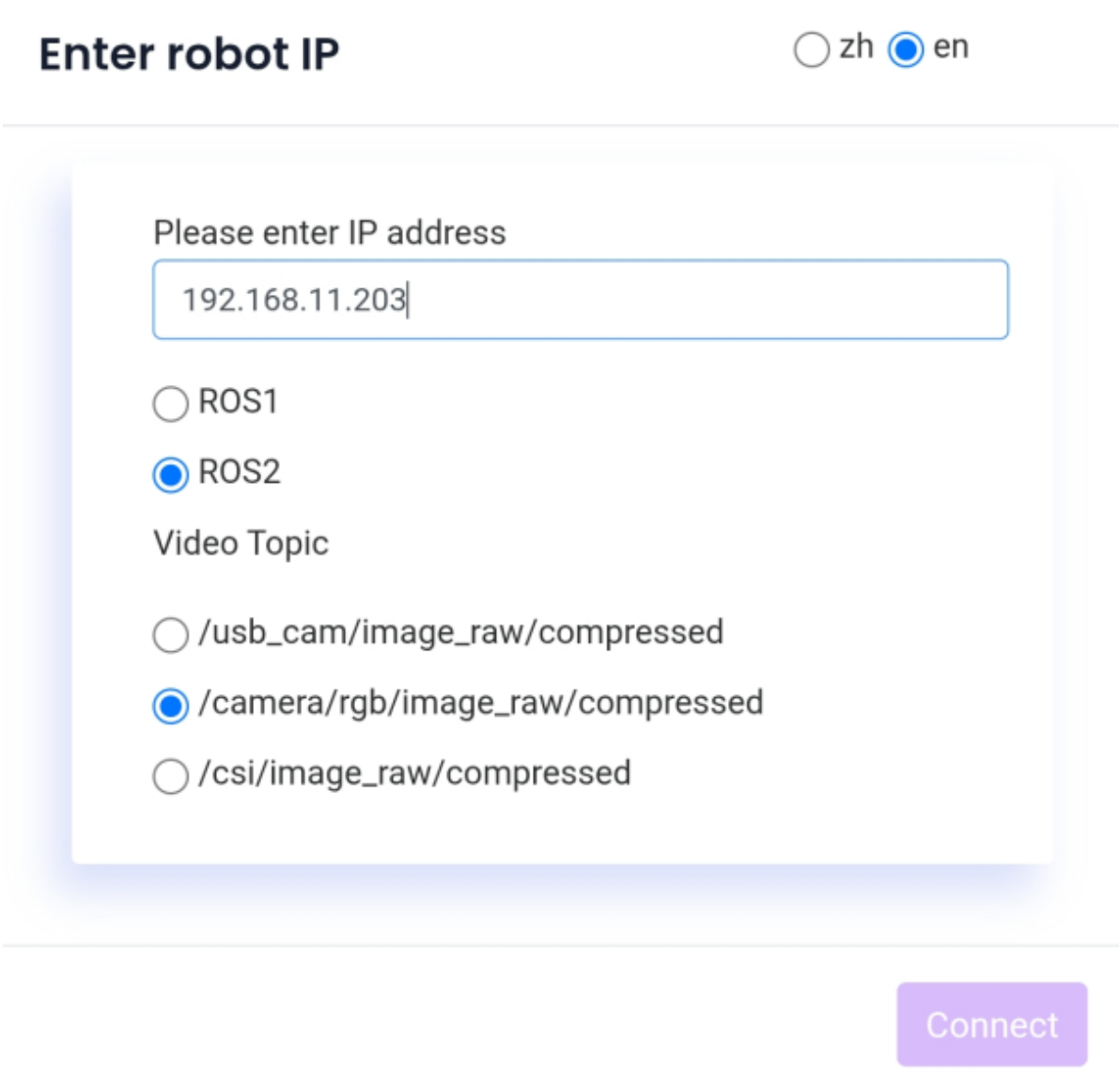
```
#Start the camera
#nuwa
ros2 launch yahboomcar_depth camera_app.launch.py
#usb
ros2 launch usb_cam camera.launch.py
```



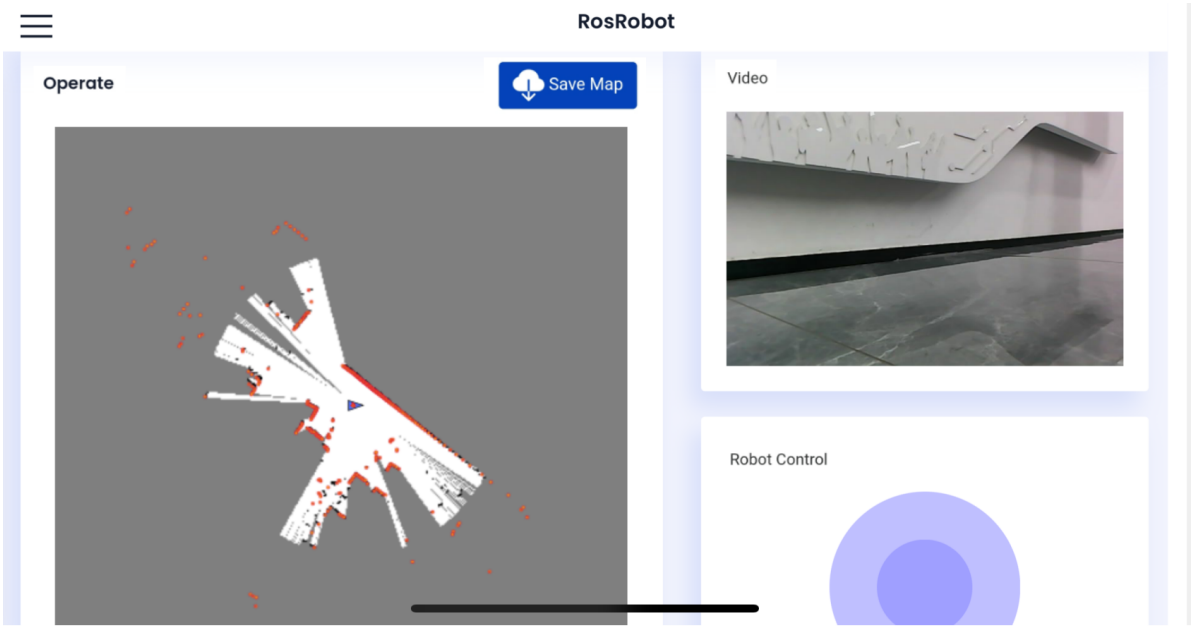

```
#Choose one of the two mapping algorithms
ros2 launch yahboomcar_nav map_gmapping_app_launch.xml
ros2 launch yahboomcar_nav map_cartographer_app_launch.xml
```



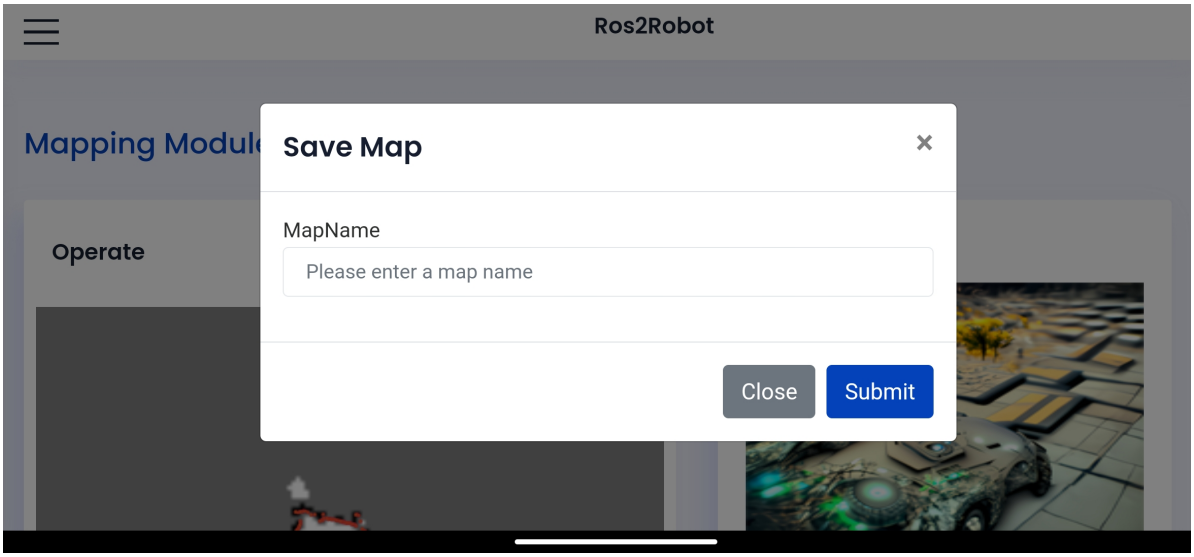
The mobile app displays the following image. Enter the car's IP address, using [zh] for Chinese and [en] for English. Select ROS2. In the Video Target area below, select /camera/rgb/image_raw/compressed. Finally, click [Connect].



After successfully connecting, the following display appears:

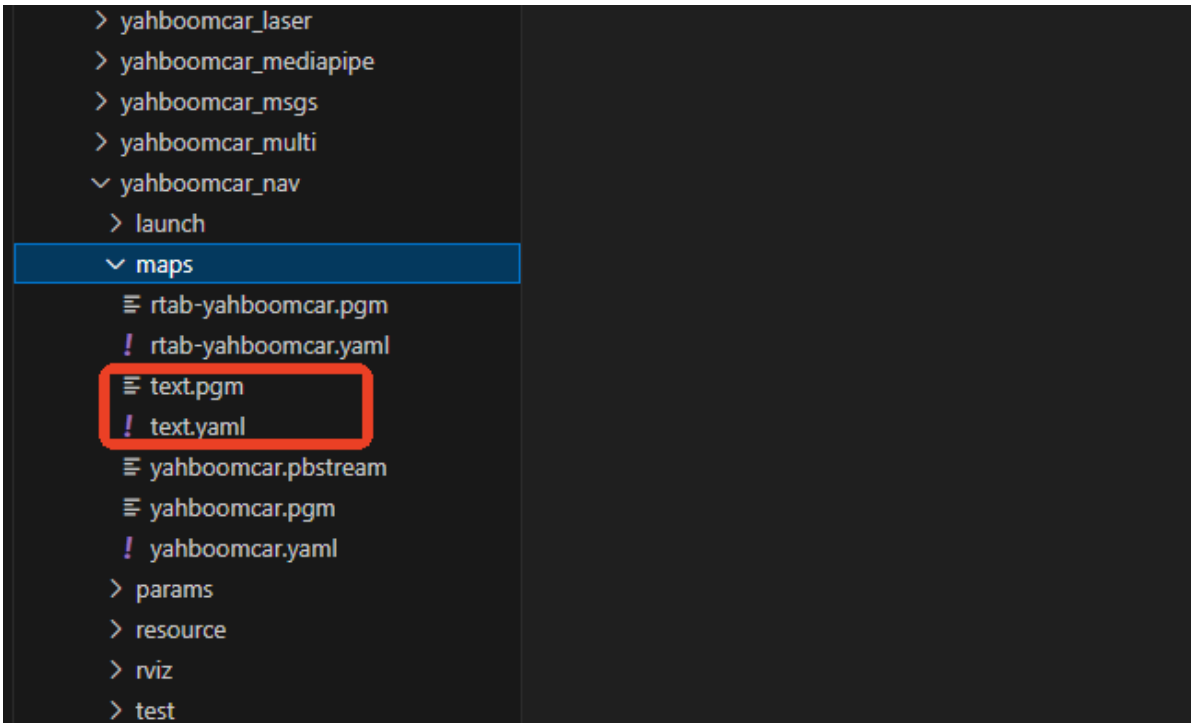


Use the wheel to slowly move the car around the area you want to map. Then click Save Map, enter a map name, and click Submit to save the map.



The map is saved in:

```
~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_nav/maps
```



2.2. Launch Command Analysis

Code Path:

```
~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_nav/launch/map_gmapping_app_launch.xml
```

Using the map_gmapping_app_launch.xml file as an example, we will explain which launch files are launched. The map_gmapping_app_launch.xml file is as follows:

```
<launch>
    <arg name="use_rviz" default="false" />
    <include file="$(find-pkg-share
rosbridge_server)/launch/rosbridge_websocket_launch.xml"/>
    <node name="laserscan_to_point_publisher" pkg="laserscan_to_point_publisher"
exec="laserscan_to_point_publish"/>
    <include file="$(find-pkg-share
yahboomcar_nav)/launch/map_gmapping_launch.py">
        <arg name="use_rviz" value="$(var use_rviz)"/>
    </include>
    <include file="$(find-pkg-share
robot_pose_publisher_ros2)/launch/robot_pose_publisher_launch.py"/>
    <include file="$(find-pkg-share
yahboomcar_app_save_map)/yahboom_app_save_map.launch.py"/>
</launch>
```

rosbridge_websocket_launch.xml: Launches the rosbridge WebSocket server for ROS (Robot Operating System)

laserscan_to_point_publisher: Publishes radar point cloud data to the app

map_gmapping_launch: Gmapping mapping-related nodes

robot_pose_publisher_launch.py: Publishes vehicle position information

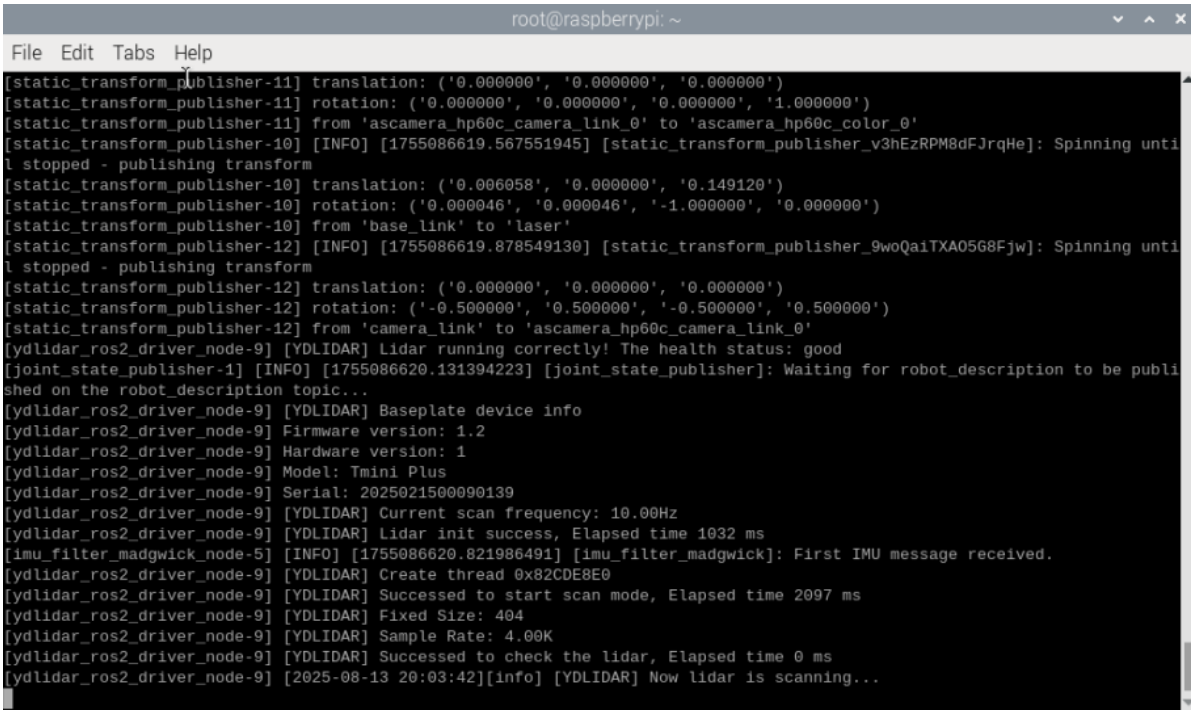
yahboom_app_save_map.launch.py: Saves the map node

3. App Navigation

3.1. Program Startup

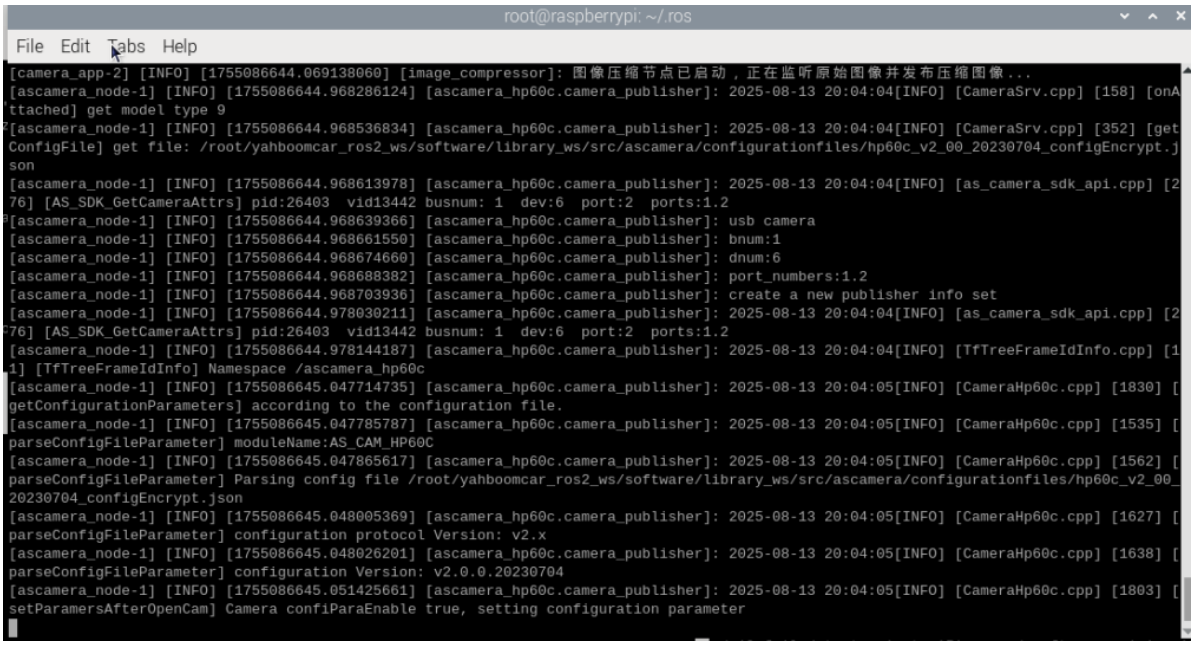
Enter the following command on the car terminal to start the car chassis and radar.

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



Enter the following command on the car terminal to start the camera.

```
#Start the camera
#nuwa
ros2 launch yahboomcar_depth camera_app.launch.py
#usb
ros2 launch usb_cam camera.launch.py
```



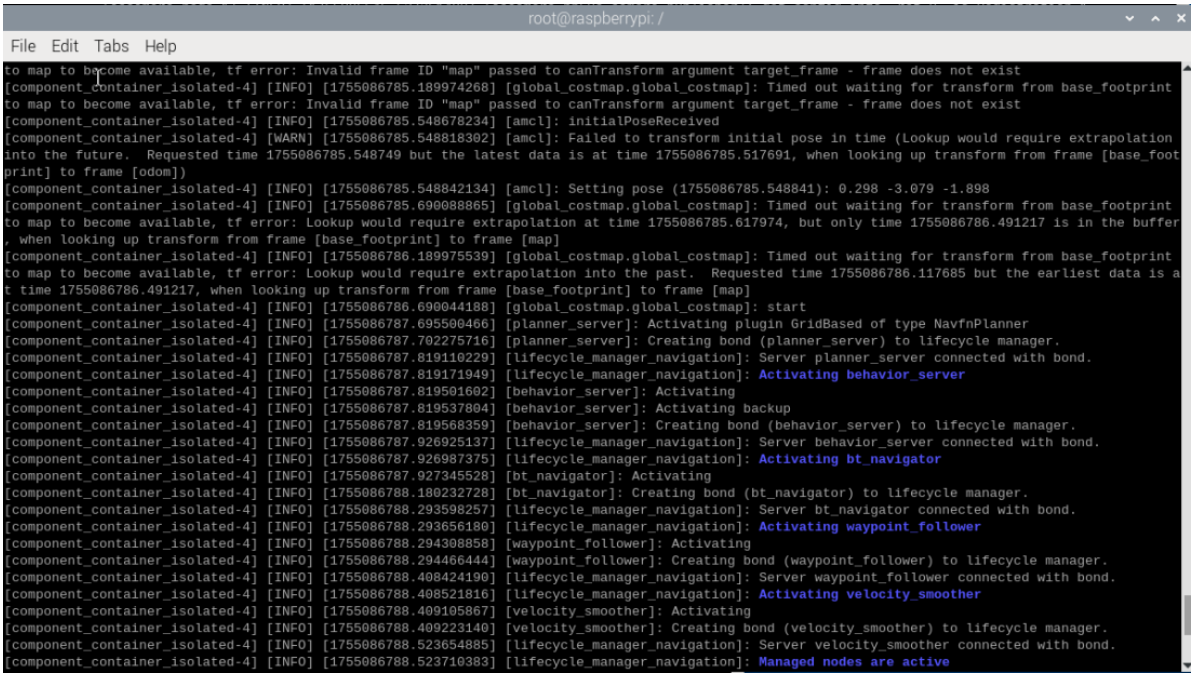
Enter the following command on the car terminal to launch the app navigation.

If you want to use fast relocalization navigation, you must first follow the tutorials [6. LiDAR - 7. Cartographer Mapping] to save a map in pbstream format and a map in yaml format.

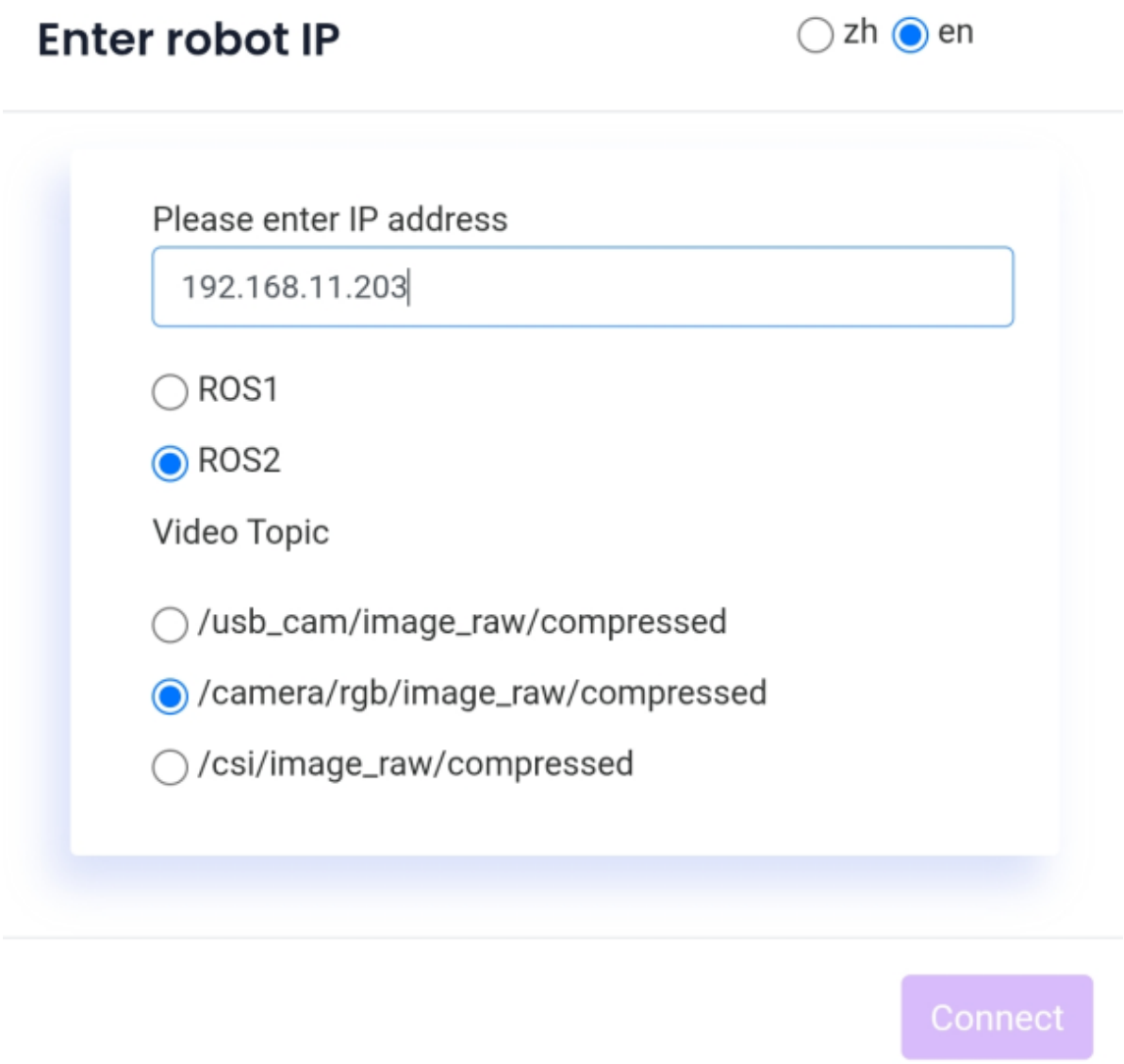
```
# Navigation: Choose one of the two options
#1. Normal positioning and navigation
ros2 launch yahboomcar_nav navigation_teb_app_launch.xml

#2. Fast relocalization and navigation
#2.1 Positioning
ros2 launch yahboomcar_nav localization_imu_odom.launch.py ••use_rviz:=false
load_state_filename:=/root/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_nav/m
aps/yahboomcar.pbstream
#2.2Navigation
ros2 launch yahboomcar_nav navigation_cartodwb_app_launch.xml
maps:=/root/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_nav/maps/yahboomcar.
yaml
```

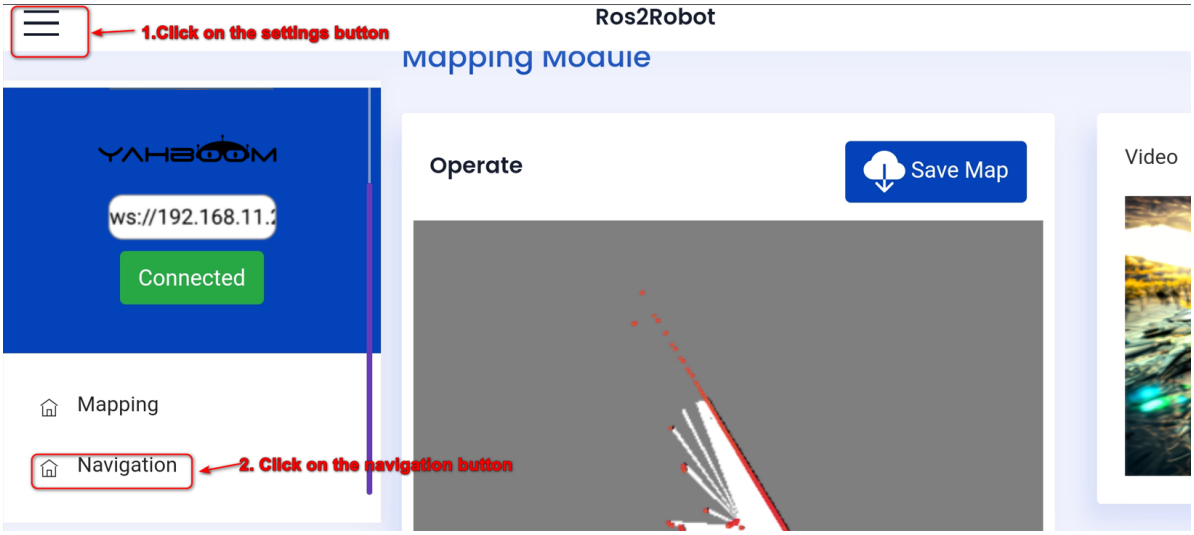
Take standard positioning navigation as an example.



The mobile app will display the following image. Enter the car's IP address, using [zh] for Chinese and [en] for English. Select ROS2 and select /camera/rgb in the VideoTpoic field at the bottom. Finally, click [Connect].

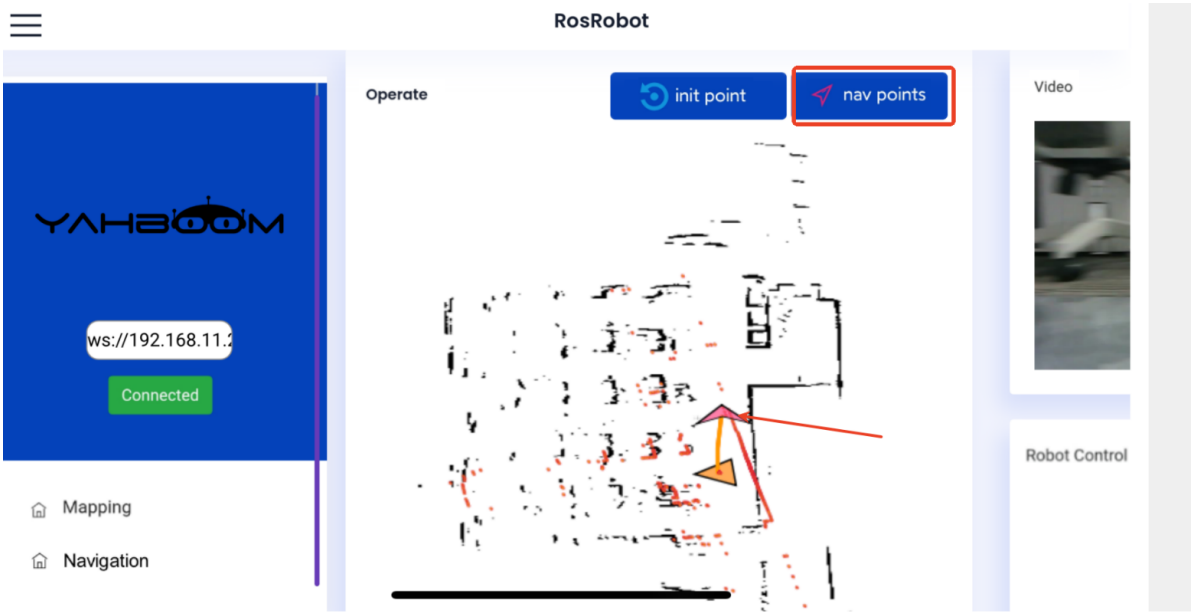


After successfully connecting, select the navigation interface, as shown below.



Then, based on the actual position of the robot, click [Set Initialization Point] to set an initial target point for the robot. If the radar scan area roughly overlaps with the actual obstacle, the position is accurate. As shown in the image below,

Then, click [Set Navigation Point] and give the car a destination. The car will then map a route and follow it to the destination. As shown in the image below,



3.2. Instruction Analysis

Code Path:

```
~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_nav/launch/navigation_teb_app_
launch.xml
```

Using the navigation_teb_app_launch.xml file as an example, we will explain which launch files are launched. The navigation_teb_app_launch.xml file is as follows:

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

rosbridge_websocket_launch.xml: Launches the rosbridge WebSocket server for ROS (Robot Operating System)

laserscan_to_point_publisher: Publishes radar point cloud data to the app

robot_pose_publisher_launch.py: Publishes vehicle position information

app_send_goal: Publishes navigation target topic to the app

navigation_teb_launch.py: Navigation-related programs for Navi2