

ROS2 environment entity mechanical dog APP navigation

Quick use

1. Power on the mechanical dog

PI4 version steps:

Press the power switch on the side of the mechanical dog and wait for the mechanical dog to start up. And connect the robot dog's WiFi to the same LAN environment as the computer.



After the mechanical dog is started, the laser radar, imu, and mechanical dog joint status nodes have been automatically started.

If you find that you cannot obtain lidar and other data, please close the mechanical dog program and restart the chassis program.

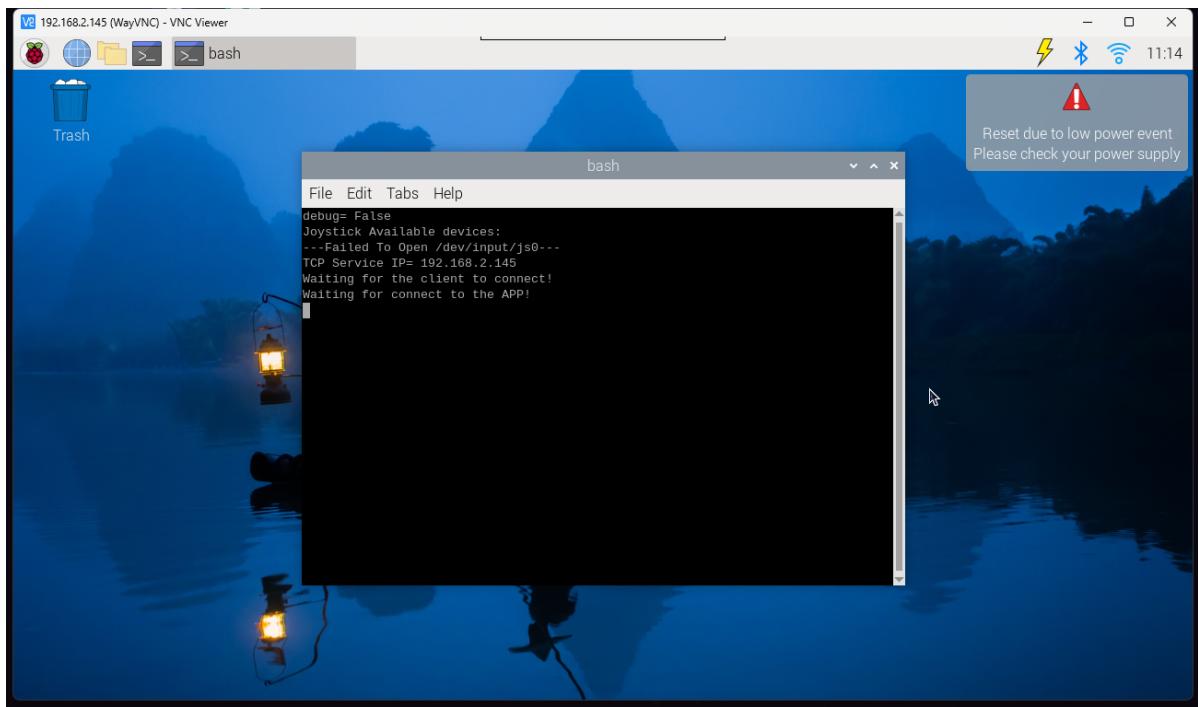
To close the large program, restart the chassis and modify the multi-level communication ID, please refer to the tutorial: 14. Radar mapping navigation\6. Obtaining the status of the physical mechanical dog in the ROS2 environment\Acquiring the real joint data of the mechanical dog in the ROS2 environment.pdf

PI5 version steps:

Press the power switch on the side of the mechanical dog and wait for the mechanical dog to start up. And connect the robot dog's WiFi to the same LAN environment as the computer.



After the mechanical dog is started, remotely connect to the mechanical dog through the IP address on the OLED.



Then `ctrl+c` closes the large program and enter the following command to enter docker:

```
./run_humble.sh
```

```
TCP Service IP= 192.168.2.145
Waiting for the client to connect!
Waiting for connect to the APP!
^CKeyboardInterrupt
2024-04-28T10:17:27Z
-----program end-----
pi@raspberrypi:~ $ ./run_humble.sh
access control disabled, clients can connect from any host
root@raspberrypi:/#
```

Then enter the following commands in the docker terminal to start the car radar, imu, and mechanical dog joint status nodes.

```
ros2 launch bringup Navigation Bringup.launch.py
```

```
root@raspberrypi: /
```

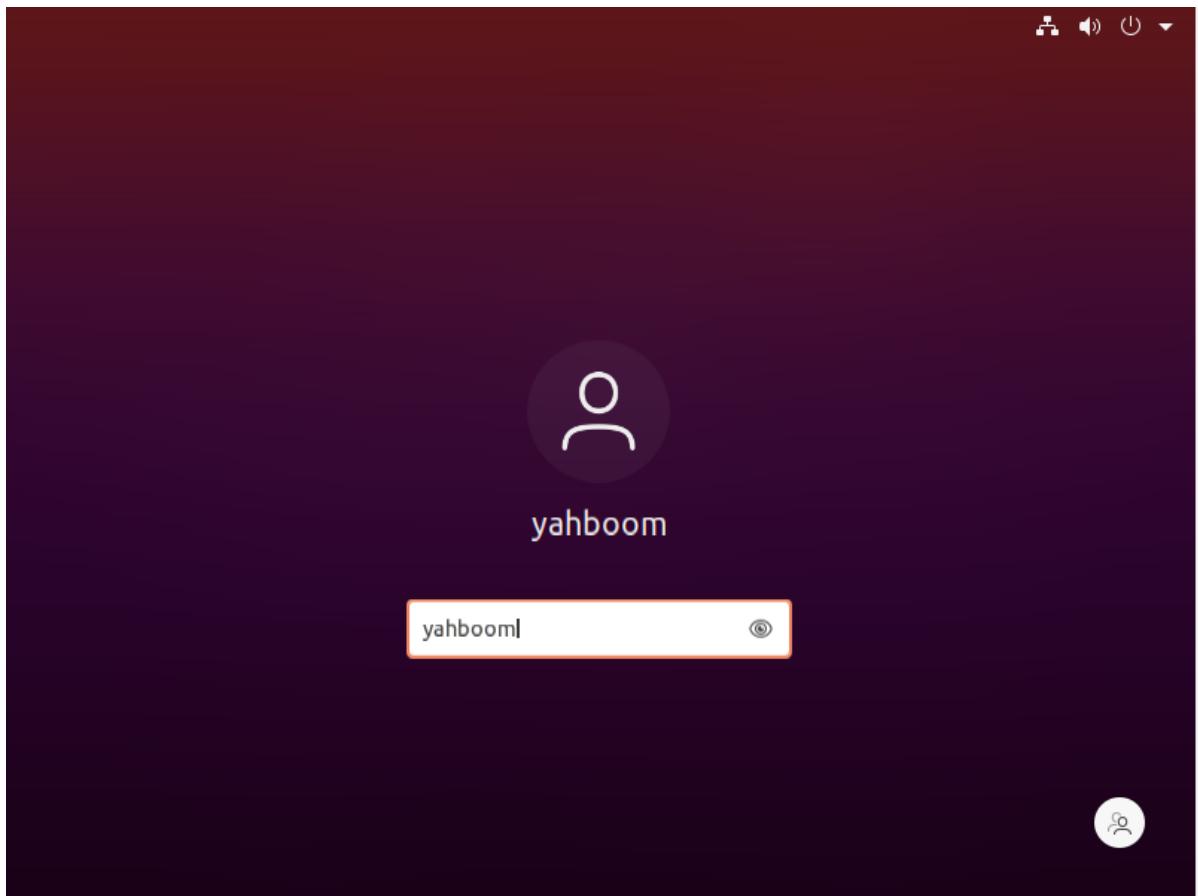
File Edit Tabs Help

```
at 0x7fff363522f0>
[yahboomcar_joint_state-3] [13.16, 45.61, 1.34, 10.1, 44.36, -1.09, 10.1, 51.85,
 2.55, 6.53, 51.22, -0.36]
[yahboomcar_joint_state-3] &&&&&&&&&&&&&&&&& 0.10927200317382812
[yahboomcar_joint_state-3] #####
[yahboomcar_joint_state-3] [-0.17585449218750002, -0.13996582031250002, -9.72702
63671875, -1.0365853658536586, -0.426829268292683, -0.6097560975609757, 0.010487
360583411322, -0.02726797640323639, 5.983139933268229]
[yahboomcar_joint_state-3] ***** <rclpy.timer.Timer object
at 0x7fff363522f0> *****
[yahboomcar_joint_state-3] [13.16, 45.61, 1.34, 10.1, 44.36, -1.09, 10.1, 51.85,
 2.55, 6.53, 51.22, -0.36]
[yahboomcar_joint_state-3] &&&&&&&&&&&&&&&& 0.10969948768615723
[yahboomcar_joint_state-3] #####
[yahboomcar_joint_state-3] [-0.14475097656250002, -0.131591796875, -9.7401855468
75, -1.0975609756097562, -0.3658536585365854, -0.6097560975609757, 0.01022947788
9007993, -0.02749979310565525, 5.983139933268229]
[yahboomcar_joint_state-3] ***** <rclpy.timer.Timer object
at 0x7fff363522f0> *****
[yahboomcar_joint_state-3] [13.16, 45.61, 1.34, 10.1, 44.36, -1.09, 10.1, 51.85,
 2.55, 6.53, 51.22, -0.36]
[yahboomcar_joint_state-3] &&&&&&&&&&&&&&&& 0.10920882225036621
[yahboomcar_joint_state-3] #####
```

2. Open the virtual machine

Note: The default virtual machine has been installed here.

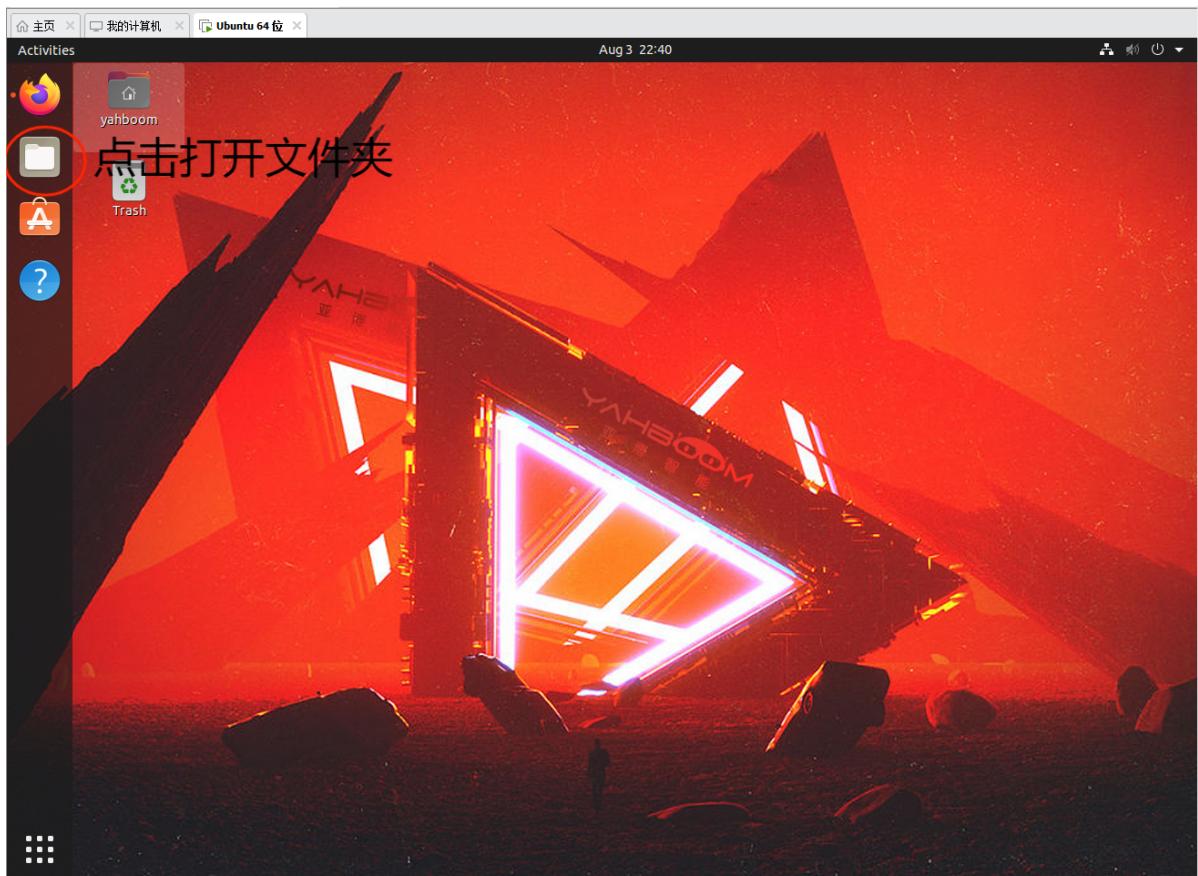
Open the virtual machine, enter the password: yahboom and press the Enter key to enter the system desktop.



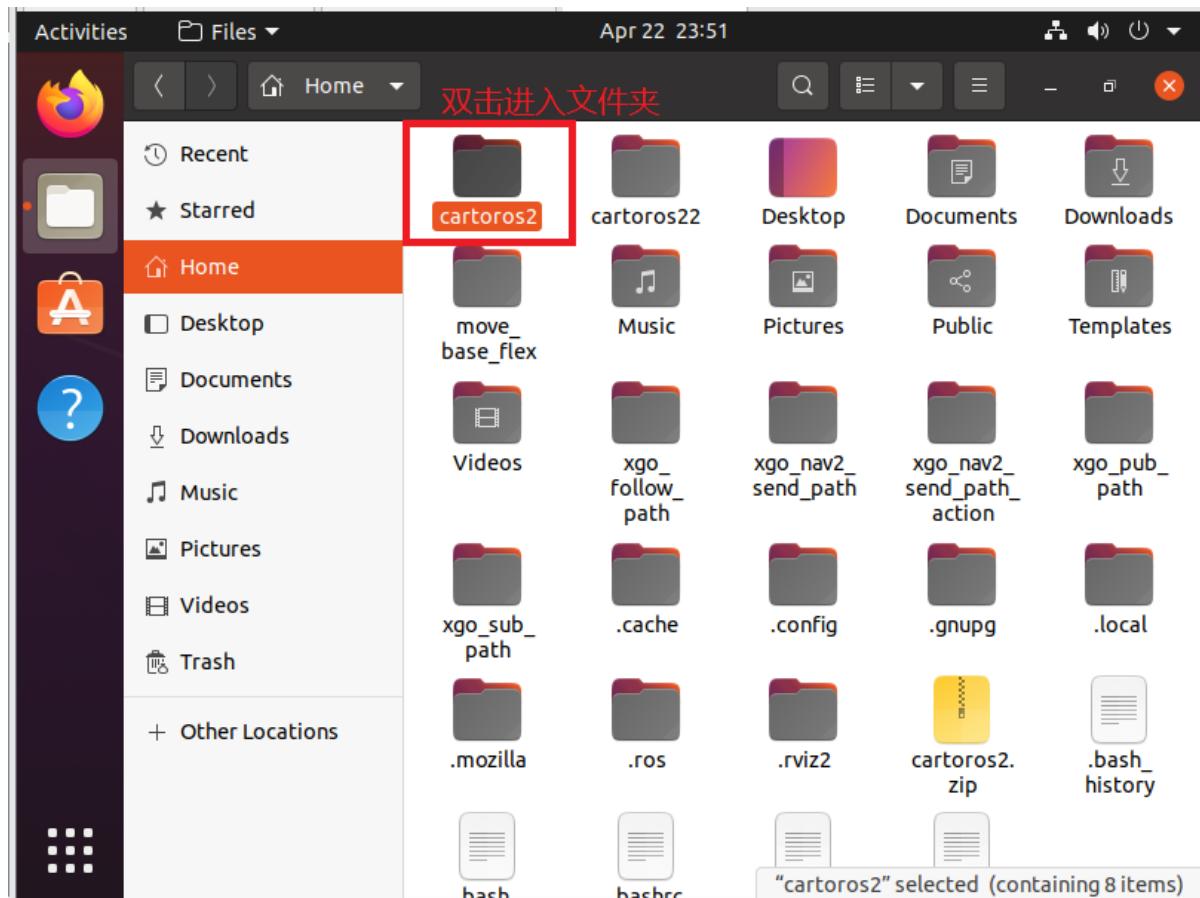
3. Start ROSBridge

The steps are the same for PI4 and PI5 versions:

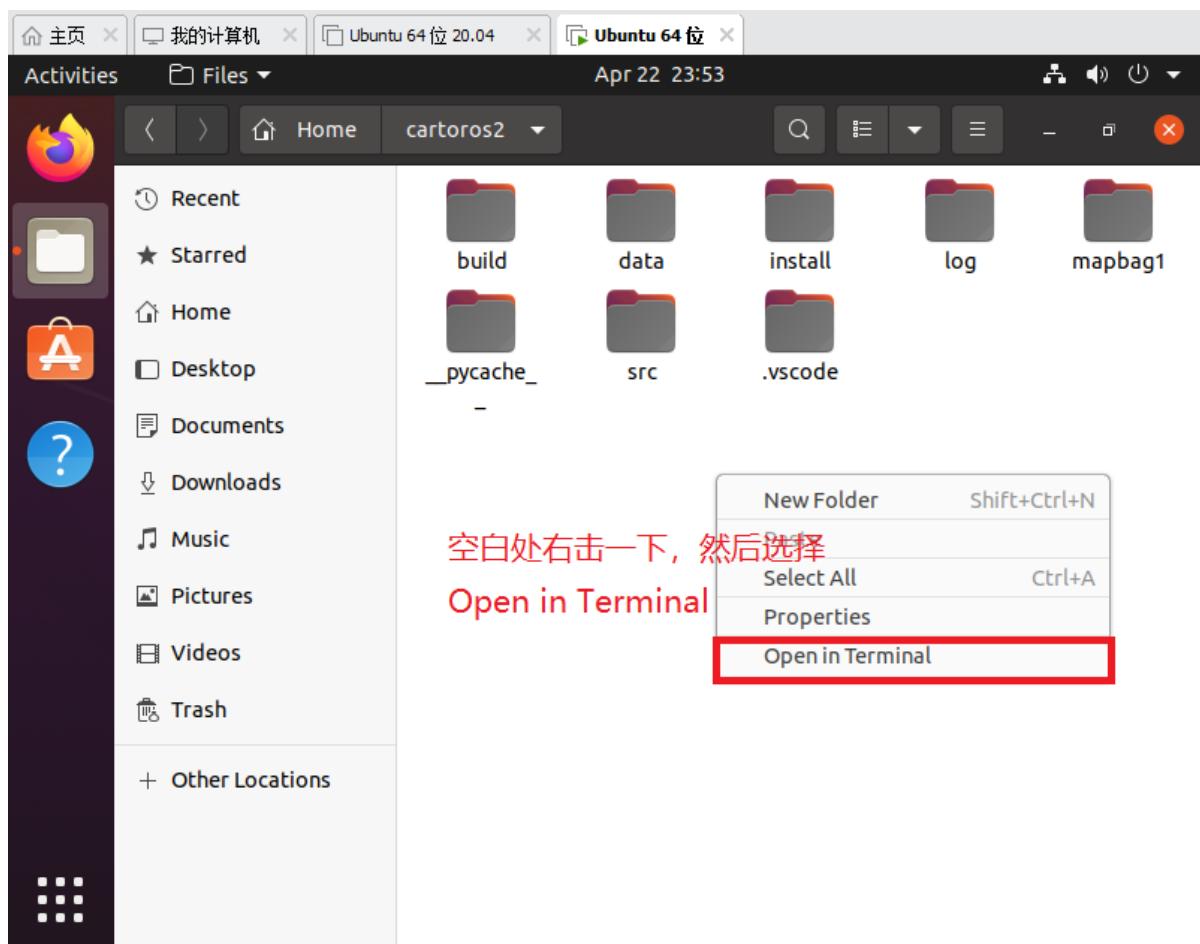
Enter the desktop system and open the folder.



Then double click on the cartoros2 folder



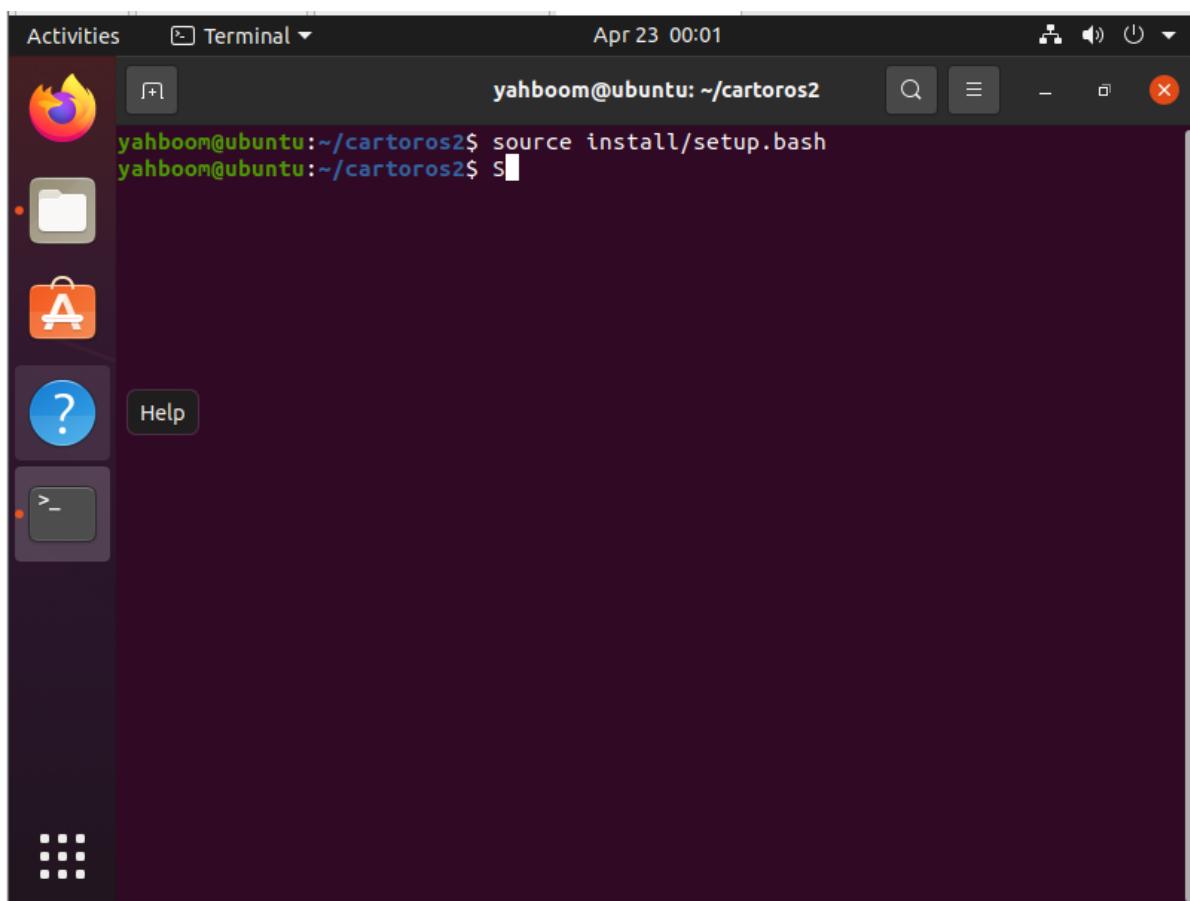
Then right-click in an empty space of the folder and select Open in Terminal



Then enter the following command in the terminal to activate the environment

```
source install/setup.bash
```

After completing the input, press the Enter key.



Then enter the following command and press Enter to start rosbridge

```
ros2 launch rosbridge_server rosbridge_websocket_launch.xml
```

A screenshot of a terminal window showing the execution of the command "ros2 launch rosbridge_server rosbridge_websocket_launch.xml". The terminal title bar says "Terminal" and the date "Apr 23 00:01". The user "yahboom" is at the prompt "yahboom@ubuntu: ~/cartoros2\$". The command is highlighted with a red underline. The terminal shows the output of the command, which includes log messages indicating the startup of the rosbridge WebSocket server on port 9090. The terminal window is dark-themed with light-colored text. A vertical scroll bar is visible on the right side of the terminal window.

4. Start navigation

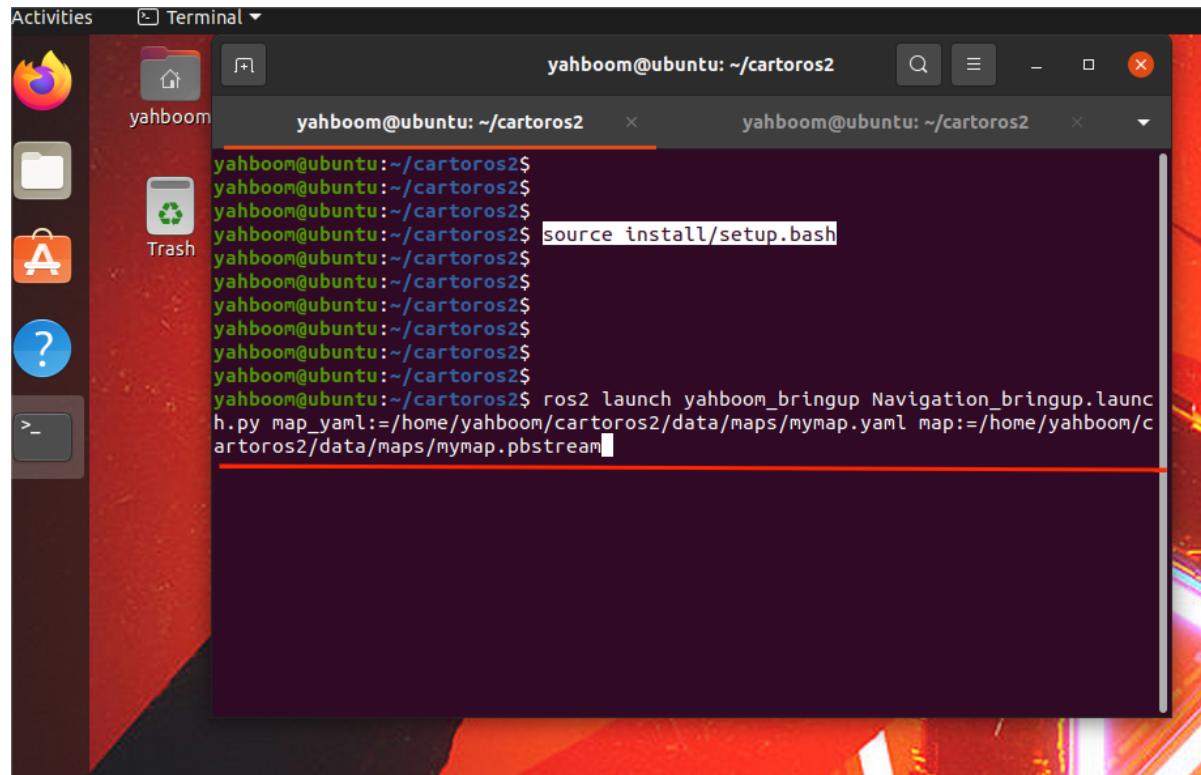
PI4 version steps:

Then press the shortcut key: ctrl + shift + t

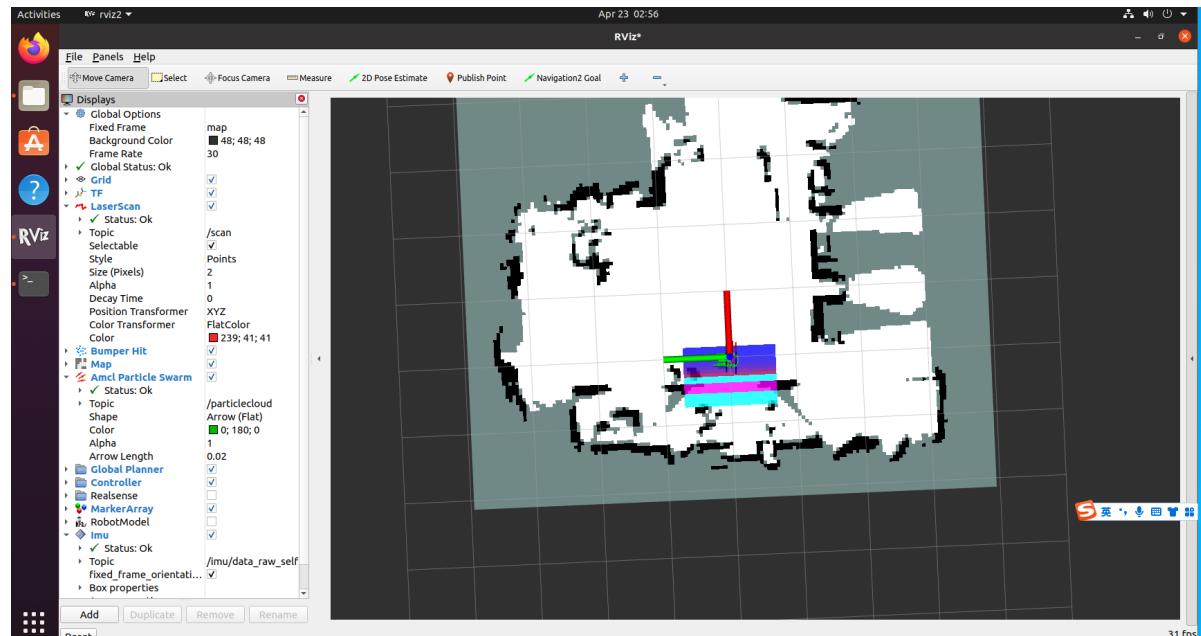
Enter the command in the newly opened terminal

```
source install/setup.bash

ros2 launch yahboom_bringup Navigation_bringup.launch.py
map_yaml:=/home/yahboom/cartoros2/data/maps/mymap.yaml
map:=/home/yahboom/cartoros2/data/maps/mymap.pbstream
```



Then press the Enter key to navigate.



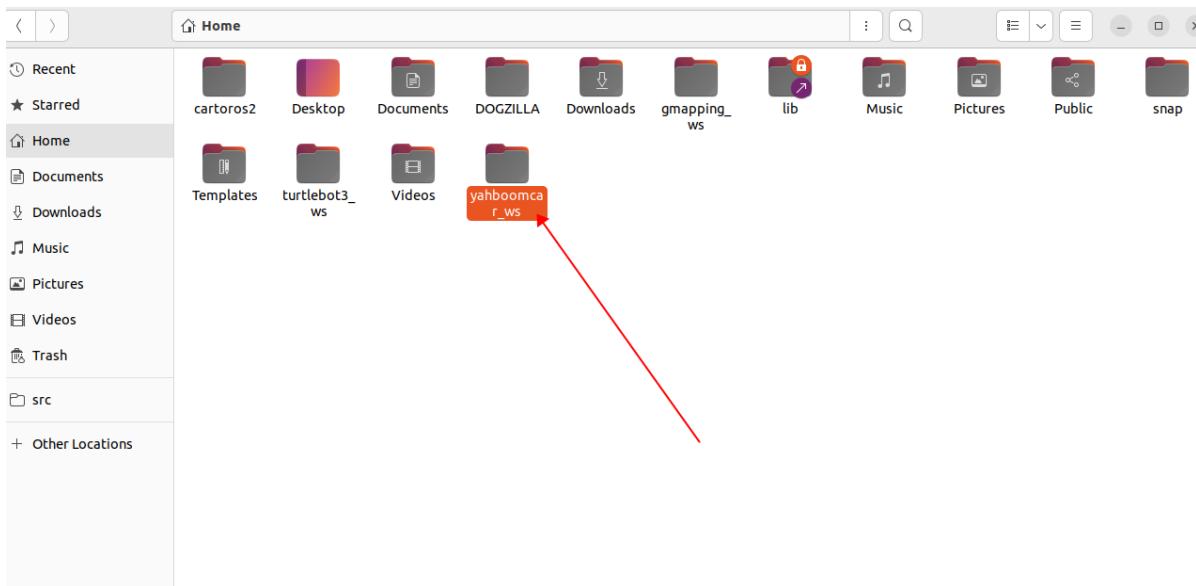
Press the Enter key, and the urdf of the mechanical dog is started.

P15 version steps:

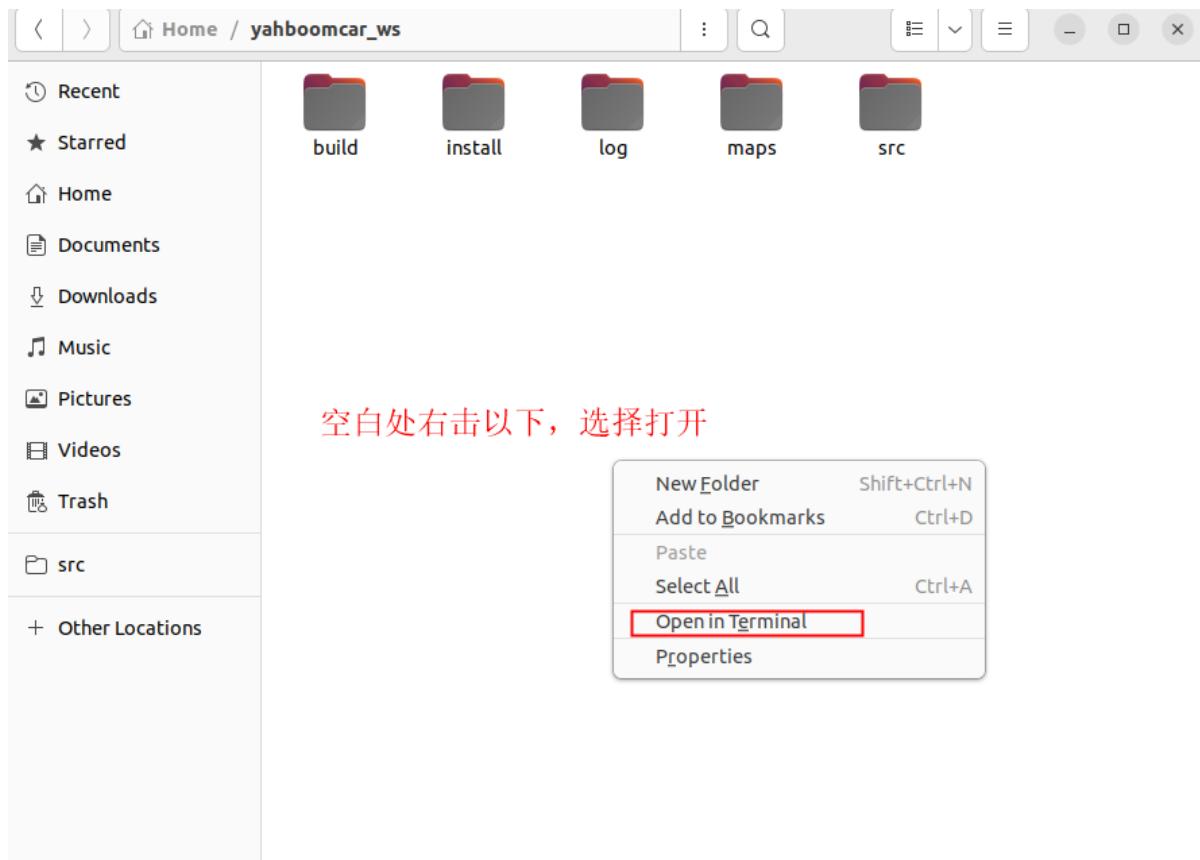
Enter the desktop system and open the folder.



Double-click to open the yahboomcar_ws folder



Then right-click in an empty space of the folder and select Open in Terminal



Then enter the following command in the terminal to activate the environment

```
source install/setup.bash
```

After completing the input, press Enter.

```
yahboom@yahboom-virtual-machine:~/yahboomcar_ws$ source install/setup.bash
yahboom@yahboom-virtual-machine:~/yahboomcar_ws$
```

Then enter the command to start the relocation function

```
ros2 launch yahboom_dog_cartographer localization_imu_odom.launch.py
load_state_filename:=/home/yahboom/yahboomcar_ws/maps/mymap.pbstream
```

```
[+]- yahboom@yahboom-virtual-machine: ~/yahboomcar_ws
```

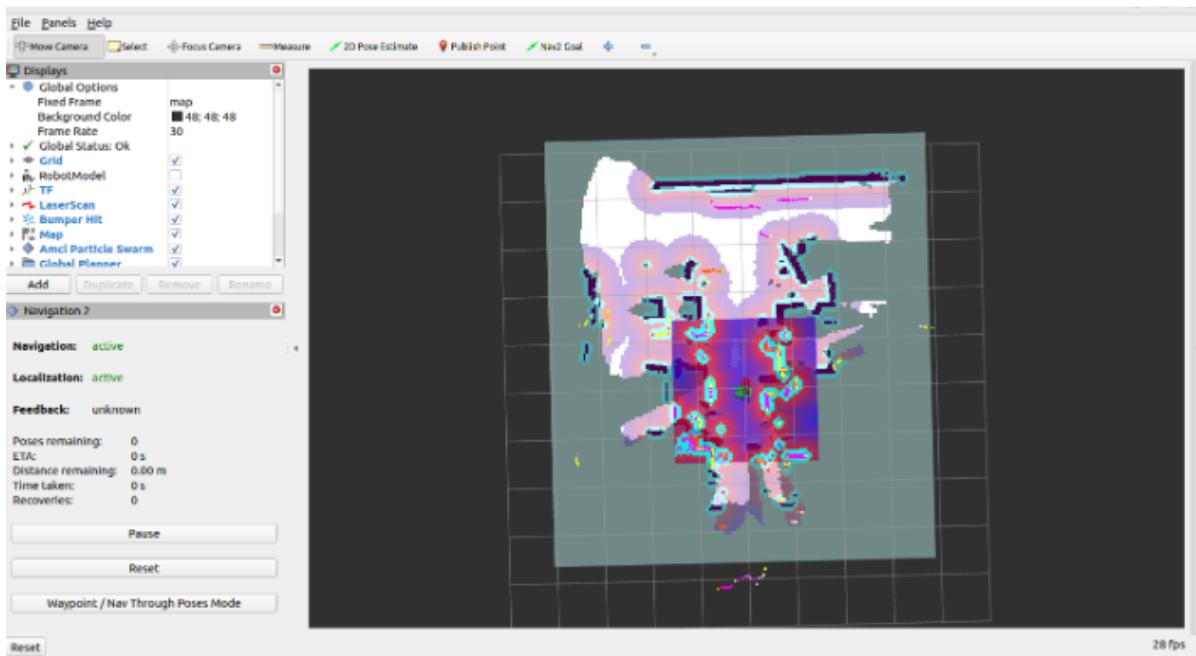
```
/share/cartographer/configuration_files/trajectory_builder_2d.lua' for 'trajectory_builder_2d.lua'.
[cartographer_node-1] [INFO] [1714300732.505165702] [cartographer logger]: I0428
18:38:52.000000 6171 configuration_file_resolver.cc:41] Found '/opt/ros/humble
/share/cartographer/configuration_files/trajectory_builder_3d.lua' for 'trajectory_builder_3d.lua'.
[cartographer_node-1] [INFO] [1714300732.505199532] [cartographer logger]: I0428
18:38:52.000000 6171 configuration_file_resolver.cc:41] Found '/opt/ros/humble
/share/cartographer/configuration_files/trajectory_builder_3d.lua' for 'trajectory_builder_3d.lua'.
[cartographer_node-1] [INFO] [1714300732.557136750] [cartographer logger]: I0428
18:38:52.000000 6171 map_builder_bridge.cpp:117] Loading saved state '/home/yahboom/yahboomcar_ws/maps/mymap.pbstream'...
[cartographer_node-1] [INFO] [1714300732.625084345] [cartographer logger]: I0428
18:38:52.000000 6171 map_builder_bridge.cpp:136] Added trajectory with ID '1'.
[cartographer_node-1] [INFO] [1714300732.691241270] [cartographer logger]: I0428
18:38:52.000000 6171 ordered_multi_queue.cc:172] All sensor data for trajectory 1 is available starting at '638498975326548929'.
[cartographer_node-1] [INFO] [1714300732.691513274] [cartographer logger]: I0428
18:38:52.000000 6171 local_trajectory_builder_2d.cc:135] Extrapolator is still
initializing.
[cartographer_node-1] [INFO] [1714300732.892889455] [cartographer logger]: I0428
18:38:52.000000 6171 pose_graph_2d.cc:148] Inserted submap (1, 0).
```

Repeat the above steps to open the terminal, reopen a terminal and enter navigation commands.

```
ros2 launch yahboom_dog_navigation2 navigation2.launch.py use_sim_time:=False
map:=/home/yahboom/yahboomcar_ws/maps/mymap.yaml
```

```
yahboom@yahboom-virtual-machine:~/yahboomcar_ws$ source install/setup.bash
yahboom@yahboom-virtual-machine:~/yahboomcar_ws$ ros2 launch yahboom_dog_navigation2 navigation2.launch.py use_sim_time:=False map:=/home/yahboom/yahboomcar_ws/maps/mymap.yaml
```

Then press the Enter key to navigate. (**Because the mechanical dog itself does not provide odom, we need to position the mechanical dog at the coordinate origin when constructing the map**)



5. APP controls the mechanical dog to walk and navigate

The steps are the same for PI4 and PI5 versions:

Click on the terminal and press the shortcut key: **ctrl + shift + t**

Enter the command in the terminal to start the point cloud publishing node:

```
source install/setup.bash
ros2 run laserscan_to_point_publisher laserscan_to_point_publisher
```

```
yahboom@ubuntu:~/cartoros2$ source install/setup.bash
yahboom@ubuntu:~/cartoros2$ ros2 run laserscan_to_point_publisher laserscan_to_point_publisher
```

Click on the terminal and press the shortcut key: **ctrl + shift + t**

Enter the command in the terminal to start the positioning publishing node:

```
source install/setup.bash
ros2 launch robot_pose_publisher_ross2 robot_pose_publisher_launch.py
```

```
yahboom@ubuntu:~/cartoros2$  
yahboom@ubuntu:~/cartoros2$  
yahboom@ubuntu:~/cartoros2$ source install/setup.bash  
yahboom@ubuntu:~/cartoros2$  
yahboom@ubuntu:~/cartoros2$  
yahboom@ubuntu:~/cartoros2$ ros2 launch robot_pose_publisher_ross2  
--print-description  
robot_pose_publisher_launch.py  
-s  
--show-all-subprocesses-output  
--show-args  
--show-arguments  
-n  
--noninteractive  
-p  
--print  
yahboom@ubuntu:~/cartoros2$ ros2 launch robot_pose_publisher_ross2 robot_pose_publisher_launch.py
```

启动定位节点

6. Camera display

PI4 version steps:

Click on the terminal and press the shortcut key: **ctrl + shift + t**

Enter the command in the terminal to remotely connect to the robot dog. Currently, the robot dog and the virtual machine are in the same LAN. The IP of the robot dog is: 192.168.2.79. In actual operation, it depends on the specific IP address of your own robot dog.

```
ssh -p 22 pi@192.168.2.79
```

Press Enter and enter yes, then enter the login password of the mechanical dog: **yahboom**

```
yahboom@ubuntu:~/cartoros2$  
yahboom@ubuntu:~/cartoros2$ ssh -p 22 pi@192.168.2.79 远程登陆机械狗  
The authenticity of host '192.168.2.79 (192.168.2.79)' can't be established.  
ECDSA key fingerprint is SHA256:nnxe1N28ulZhcJSY+k9fLYh8oUcgfN9xKAeZbLvz79o.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
Warning: Permanently added '192.168.2.79' (ECDSA) to the list of known hosts.  
pi@192.168.2.79's password:  
Welcome to Ubuntu 20.04.4 LTS (GNU/Linux 5.4.0-1089-raspi aarch64)  
  
 * Documentation:  https://help.ubuntu.com  
 * Management:    https://landscape.canonical.com  
 * Support:       https://ubuntu.com/advantage  
  
 System information as of Wed 05 Jul 2023 08:06:45 PM CST  
  
 System load: 1.47 Temperature: 80.3 C  
 Usage of /: 43.3% of 58.22GB Processes: 265  
 Memory usage: 17% Users logged in: 1
```

Then enter the command to start the camera in the terminal:

```
ros2 launch usb_cam demo.launch.py
```

```
pi@yahboom:~$ ros2 launch usb_cam demo_launch.py 启动相机节点
[INFO] [launch]: All log files can be found below /home/pi/.ros/log/2023-07-05-2
0-13-03-911670-yahboom-89445
[INFO] [launch]: Default logging verbosity is set to INFO
'opt/ros/foxy/share/usb_cam/config/params.yaml'
[INFO] [usb_cam_node_exe-1]: process started with pid [89529]
[usb_cam_node_exe-1] [INFO] [1688559184.442941567] [usb_cam]: camera_name value:
test_camera
[usb_cam_node_exe-1] [WARN] [1688559184.443275107] [usb_cam]: framerate: 30.0000
00
[usb_cam_node_exe-1] [INFO] [1688559184.461739301] [usb_cam]: camera calibration
_URL: package://usb_cam/config/camera_info.yaml
[usb_cam_node_exe-1] [INFO] [1688559184.464124605] [usb_cam]: Starting 'test_c
amera' (/dev/video0) at 640x480 via mmap (mjpeg2rgb) at 30 FPS
[usb_cam_node_exe-1] [swscaler @ 0xaaaaf30867f0] No accelerated colorspace conve
rsion found from yuv422p to rgb24.
[usb_cam_node_exe-1] [INFO] [1688559184.545634240] [usb_cam]: This devices suppr
```

PI5 version steps:

Open a terminal in the virtual machine, enter the IP on the mechanical dog, and log in remotely. The example IP here is 192.168.2.145.

```
ssh -p 22 pi@192.168.2.145
```

Press Enter and enter yes, then enter the login password of the mechanical dog: yahboom

```
yahboom@yahboom-virtual-machine:~$ ssh -p 22 pi@192.168.2.145
pi@192.168.2.145's password:
Linux raspberrypi 6.6.20+rpt-rpi-2712 #1 SMP PREEMPT Debian 1:6.6.20-1+rpt1 (202
4-03-07) aarch64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sun Apr 28 08:36:44 2024
pi@raspberrypi:~ $ █
```

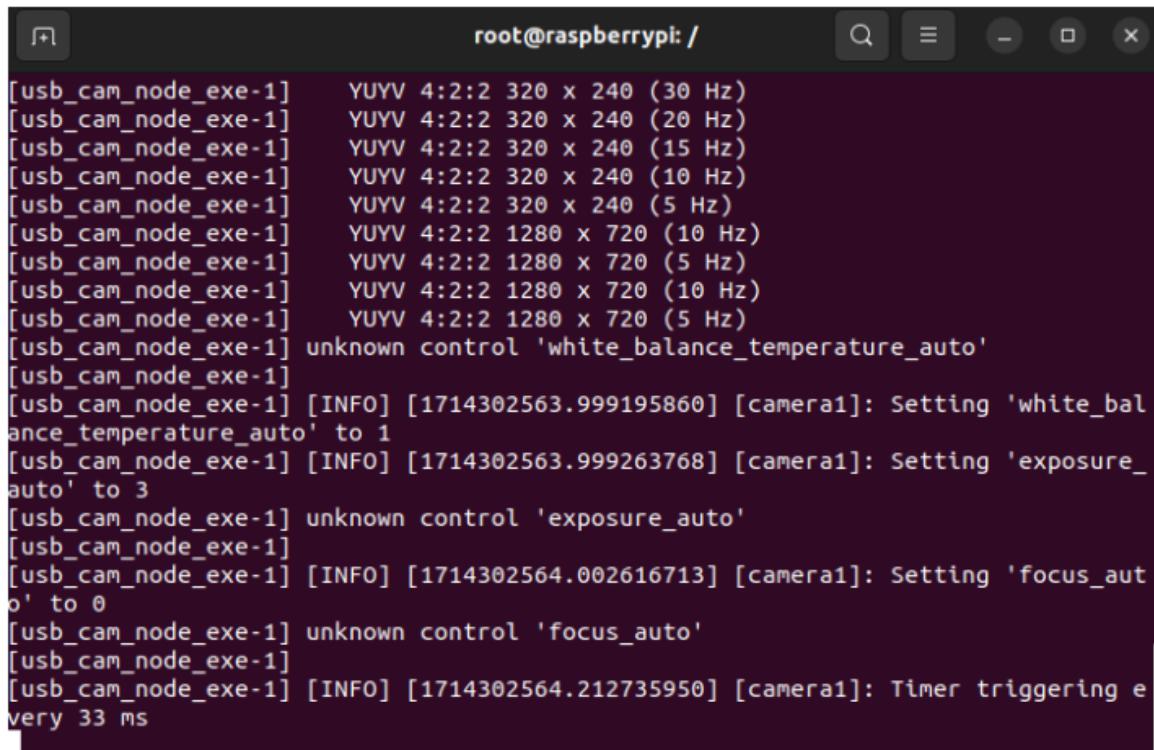
Then enter docker ps to view the current ID, and then enter the command to enter the same docker

```
docker ps
docker exec -it (id)/bin/bash
```

```
pi@raspberrypi:~ $ docker ps
CONTAINER ID   IMAGE                               COMMAND      CREATED
 STATUS        PORTS     NAMES
5029cf9a6f99   yahboomtechnology/ros-humble:3.0   "/bin/bash"   50 minutes ago
   Up 50 minutes          loving_black
pi@raspberrypi:~ $ docker exec -it 5029 /bin/bash
root@raspberrypi:/#
```

Then enter the command to start the camera in the terminal:

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



A terminal window titled 'root@raspberrypi: /' displaying log output from a ROS node. The logs show various camera settings being configured, including frame rates (30, 20, 15, 10, 5 Hz) and resolutions (320x240, 1280x720). It also shows attempts to set controls like 'white_balance_temperature_auto' and 'exposure_auto' to specific values (1, 3), and 'focus_auto' to 0. A timer is triggered every 33 ms.

```
[usb_cam_node_exe-1] YUYV 4:2:2 320 x 240 (30 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 320 x 240 (20 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 320 x 240 (15 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 320 x 240 (10 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 320 x 240 (5 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 1280 x 720 (10 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 1280 x 720 (5 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 1280 x 720 (10 Hz)
[usb_cam_node_exe-1] YUYV 4:2:2 1280 x 720 (5 Hz)
[usb_cam_node_exe-1] unknown control 'white_balance_temperature_auto'
[usb_cam_node_exe-1]
[usb_cam_node_exe-1] [INFO] [1714302563.999195860] [camera1]: Setting 'white_balance_temperature_auto' to 1
[usb_cam_node_exe-1] [INFO] [1714302563.999263768] [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] [1714302564.002616713] [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] [1714302564.212735950] [camera1]: Timer triggering every 33 ms
```

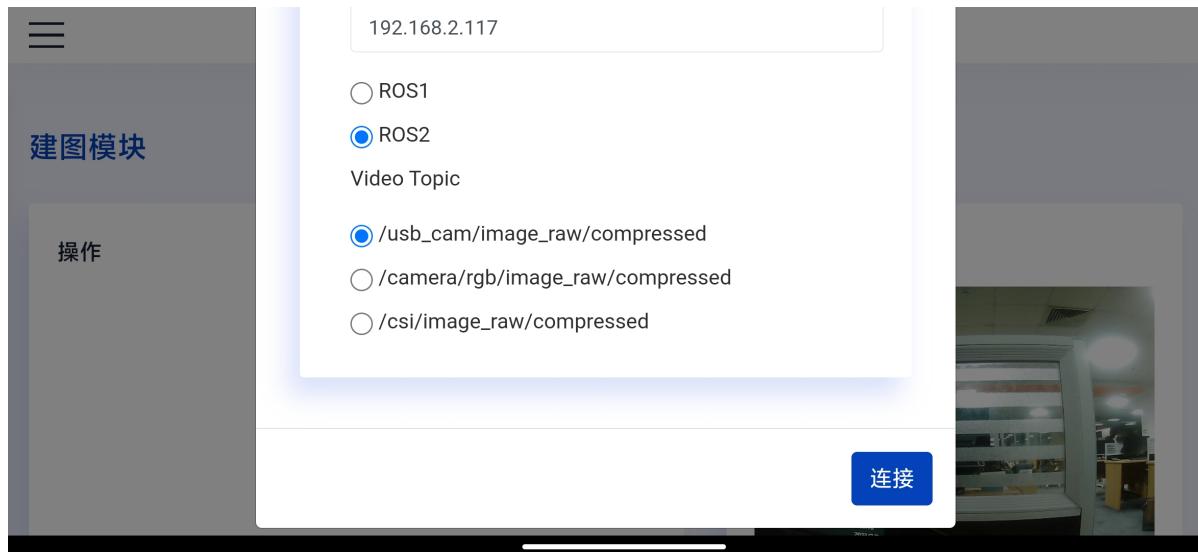
7. APP display

Open the mobile APP ROS Robot



Enter the IP address of the virtual machine. Take the current virtual machine IP as 192.168.2.117 as an example. At the same time, select the camera topic of the mechanical dog as /usb_cam/imge_raw/compress and select ros2.

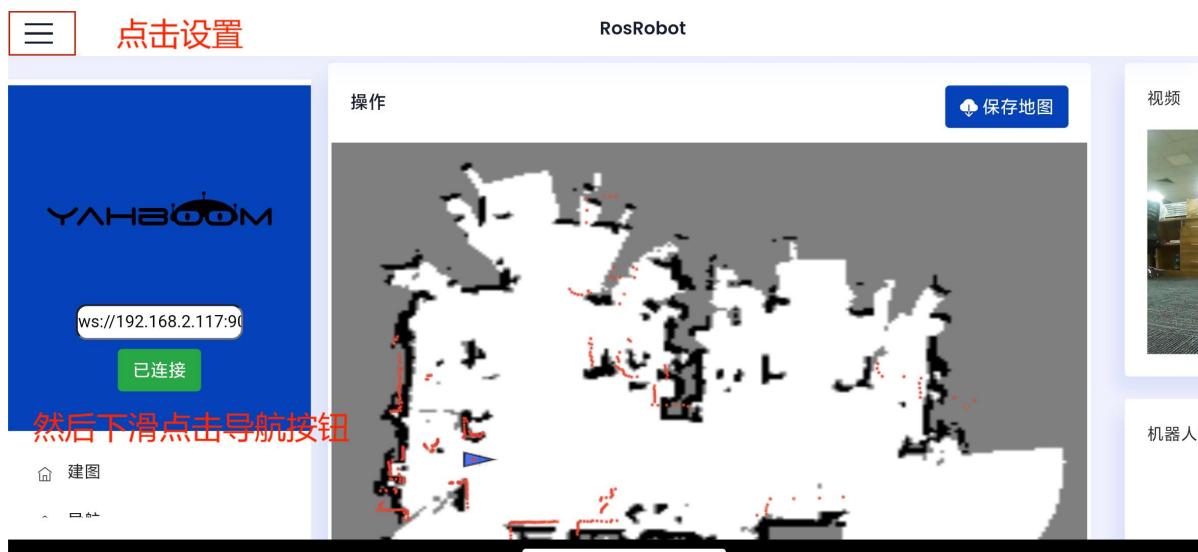
Then swipe down and click Connect.



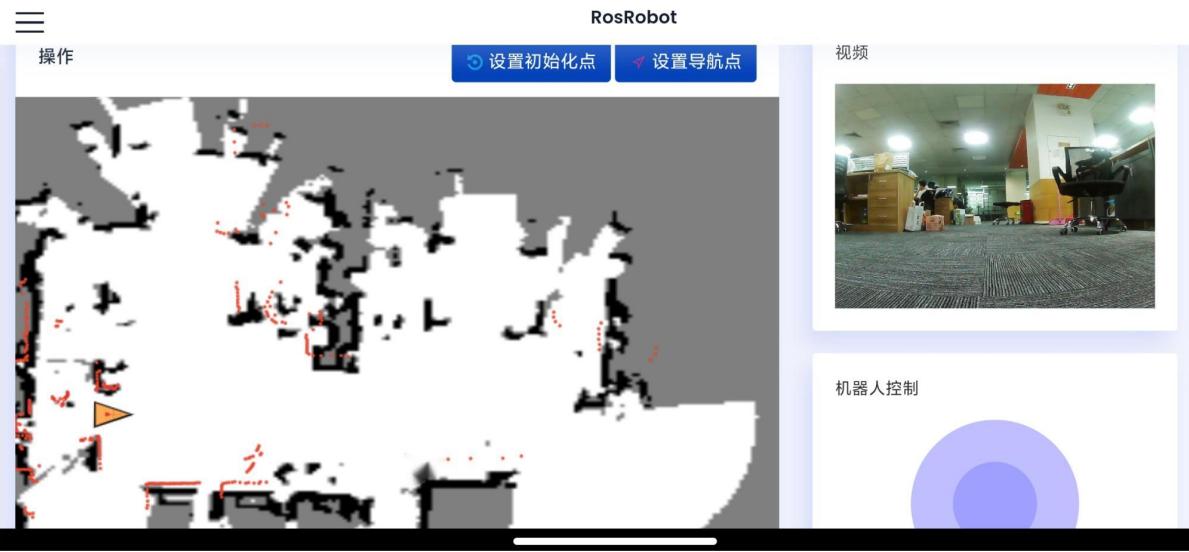
After entering the map interface, you can see the map scanned by the radar and the camera image.



Click the Settings button and slide down the pop-up interface to click the Navigation button.



The picture below shows the screen of entering navigation mode.



Then click on a target point on the subway, and the mechanical dog can navigate normally. The yellow line is the navigation path.

