ROS Robot App建图

注：虚拟机需要与小车处在同一个局域网下，且ROS_DOMAIN_ID，需要一致，可以查看【使用前必看】来设置板子上的IP和ROS_DOMAIN_ID。

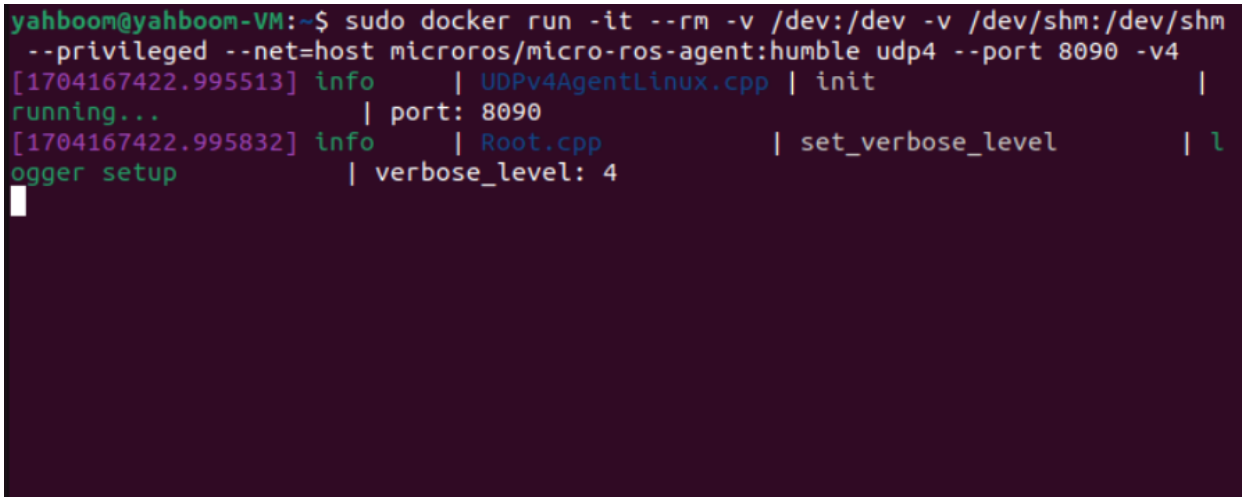
1、程序功能说明

小车连接上代理，运行程序，打开手机上下载的【ROS Robot】app，输入小车的IP地址，选择ROS2，点击连接，即可连接上小车。通过滑动界面的轮盘可以控制小车，缓慢控制小车走完建图的区域，最后点击保存地图，小车会保存当前建好的地图。

2、启动并连接代理

以配套虚拟机为例，输入以下指令启动代理（代理启动一次不关闭即可，无需重复启动），

```
#小车代理
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
#摄像头代理（先启动代理再打开小车开关）
docker run -it --rm -v /dev:/dev -v /dev/shm:/dev/shm --privileged --net=host
microros/micro-ros-agent:humble udp4 --port 9999 -v4
```



然后，打开小车开关，等待小车连接上代理，连接成功如下图所示，

```
[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、启动程序

首先启动小车处理底层数据程序，终端输入，

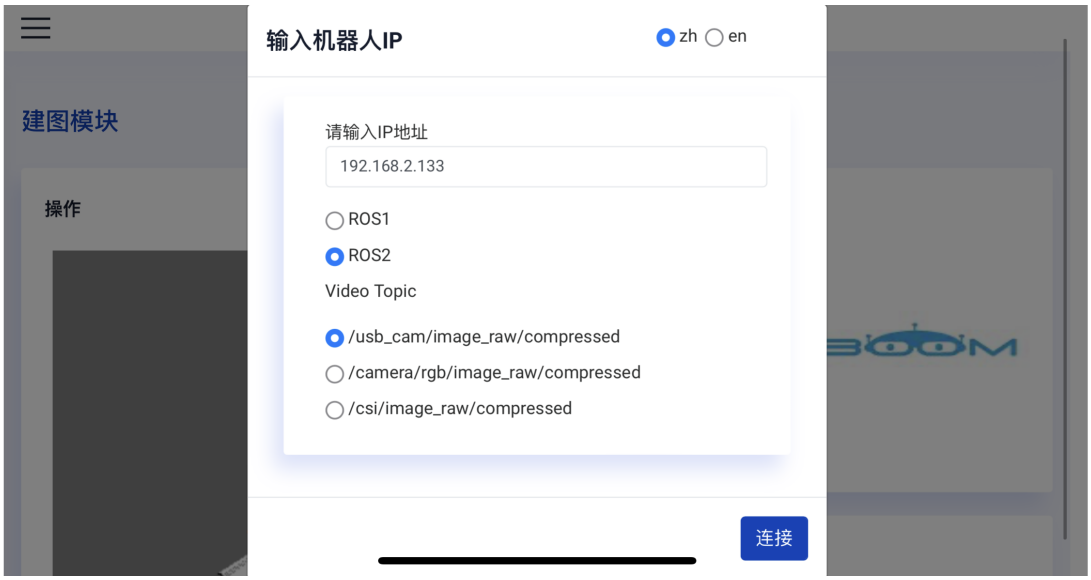
```
ros2 launch yahboomcar_bringup yahboomcar_bringup_launch.py
```

```
[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] [1702865272.991057276] [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...
```

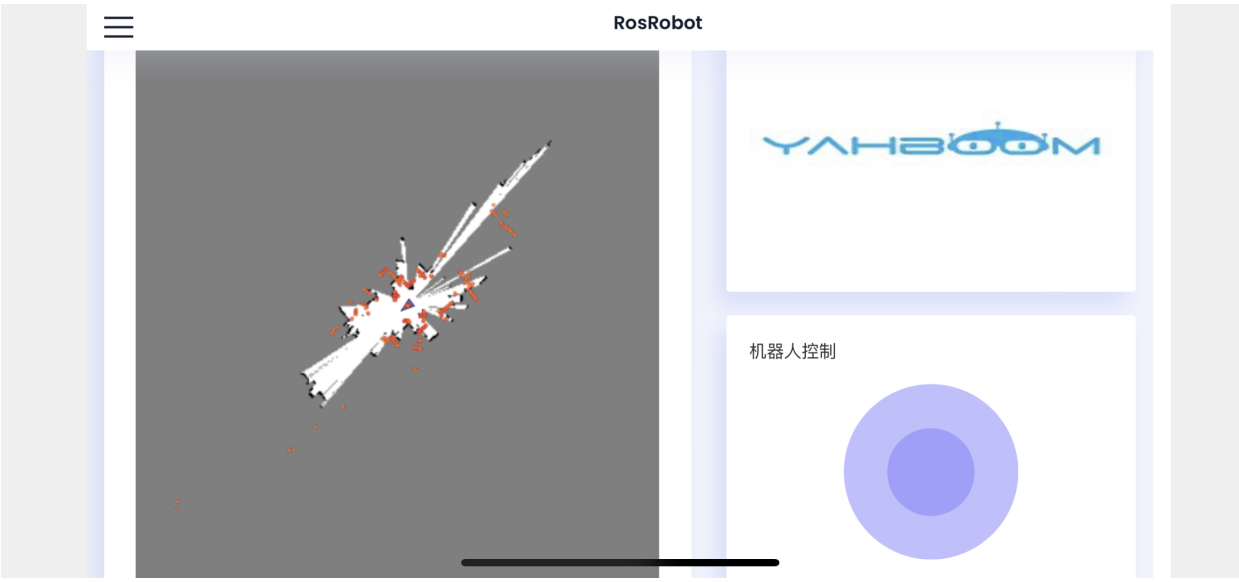
启动APP建图命令，终端输入，

```
#以下建图二选一
ros2 launch yahboomcar_nav map_gmapping_app_launch.xml
ros2 launch yahboomcar_nav map_cartographer_app_launch.xml
#使摄像头舵机水平
ros2 run yahboom_esp32_mediapipe control_servo
#启动ESP32 摄像头
ros2 run yahboom_esp32_camera sub_img
```

手机APP显示如下图，输入小车的IP地址，【zh】表示中文，【en】表示英文；选择ROS2，下边的Video Tpoic选择/usb_cam/image_raw/compressed，最后点击【连接】



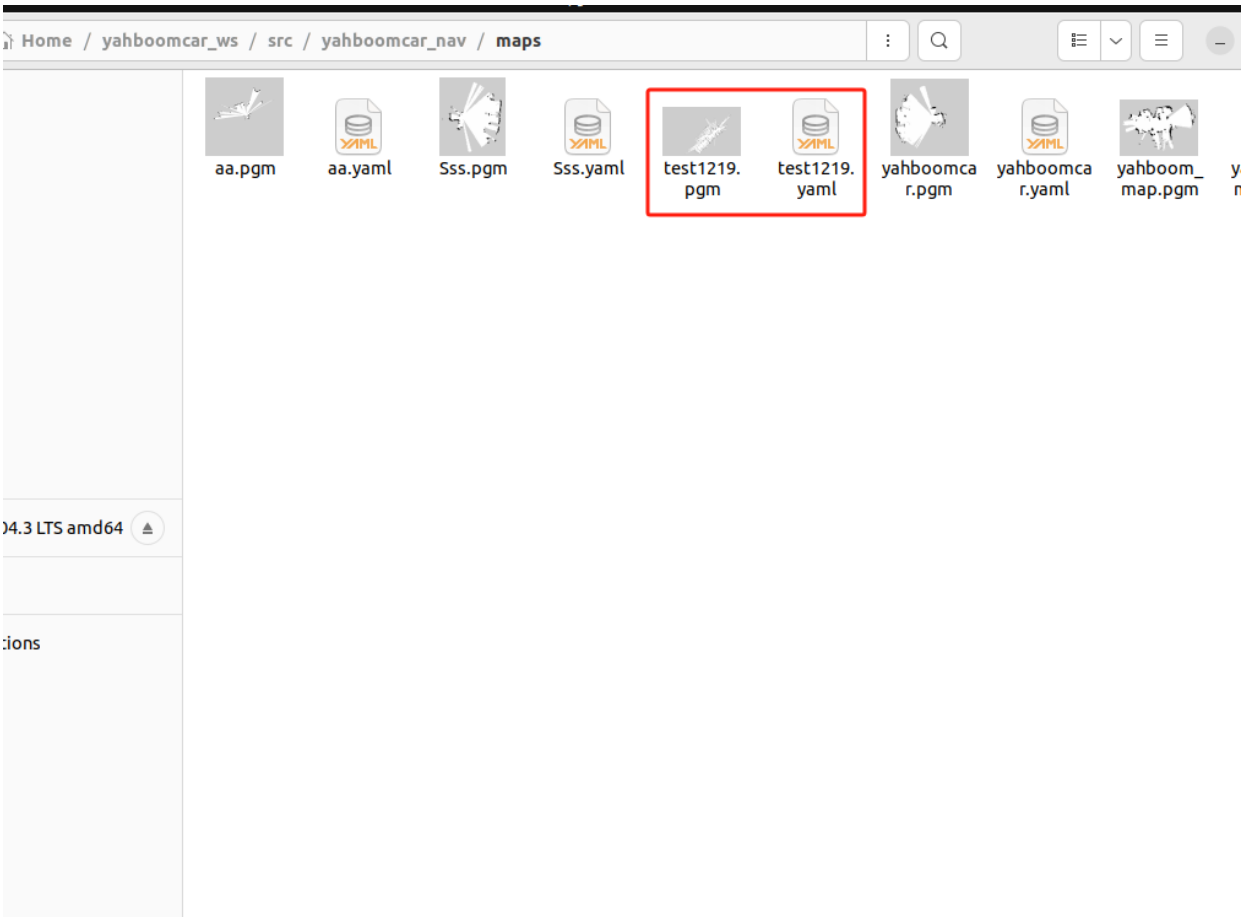
成功连接上后，显示如下，



通过滑动轮盘控制小车缓慢移动走完需要建图的区域，然后点击保存地图，输入地图名字点击提交，即可保存地图

地图保存的位置是，

```
/home/yahboom/yahboomcar_ws/src/yahboomcar_nav/maps
```



4、代码解析

这里说明下开启APP建图的launch文件，以gmapping建图为例，

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>
```

这里运行了以下几个launch文件和节点Node：

- rosbridge_websocket_launch.xml：开启rosbridge服务相关节点，启动后，可以通过网络连接到ROS
- laserscan_to_point_publisher：把雷达的点云转换发布到APP上进行可视化
- map_gmapping_launch.py：gmapping建图程序
- robot_pose_publisher_launch.py：小车位姿发布程序，小车位姿在APP进行可视化
- yahboom_app_save_map.launch.py：保存地图的程序