3. Voice control color block transportation

3.1. Function Description

Through interaction with the voice module, the camera can recognize the color of the color block, accurately identify it, pick it up, and autonomously navigate to the point marked on the map, put down the color block, and finally autonomously navigate back to the origin for the next recognition.

3.2. Start

```
#Raspberry Pi 5 master needs to enter docker first, please perform this step
#If running the script into docker fails, please refer to ROS/07, Docker tutorial
~/run_docker.sh
```

3.2.1. Function package path

```
~/yahboomcar_ws/src/yahboomcar_voice_ctrl/
```

3.2.2. Start

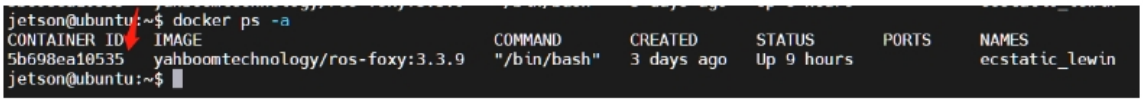
Note: **Multi-machine communication configuration** needs to be implemented between rosmaster X3Plus and the virtual machine. You can view the content of "**yahboomcar Course\06, Linux Operating System\04. Multi-machine Communication Configuration**" for configuration.

```
#rosmaster X3Plus launch
roslaunch yahboomcar_voice_ctrl voice_transport_base.launch
```

<PI5 needs to open another terminal to enter the same docker container

1. In the above steps, a docker container has been opened. You can open another terminal on the host (car) to view:

```
docker ps -a
```



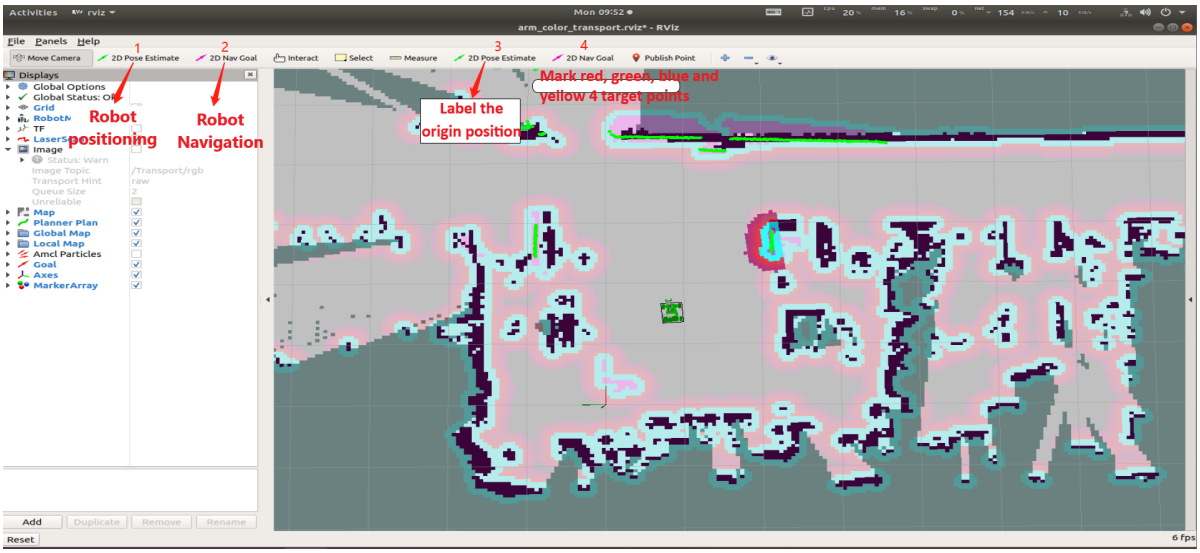
2. Now enter the docker container in the newly opened terminal:

```
docker exec -it 5b698ea10535 /bin/bash
```

After successfully entering the container, you can open countless terminals to enter the container.

```
python3
~/yahboomcar_ws/src/yahboomcar_voice_ctrl/scripts/voice_color_transport.py
#Virtual machine startup
roslaunch arm_color_transport transport_rviz.launch
```

Each tool annotation on the virtual machine rviz is as shown in the figure below,



- step 1

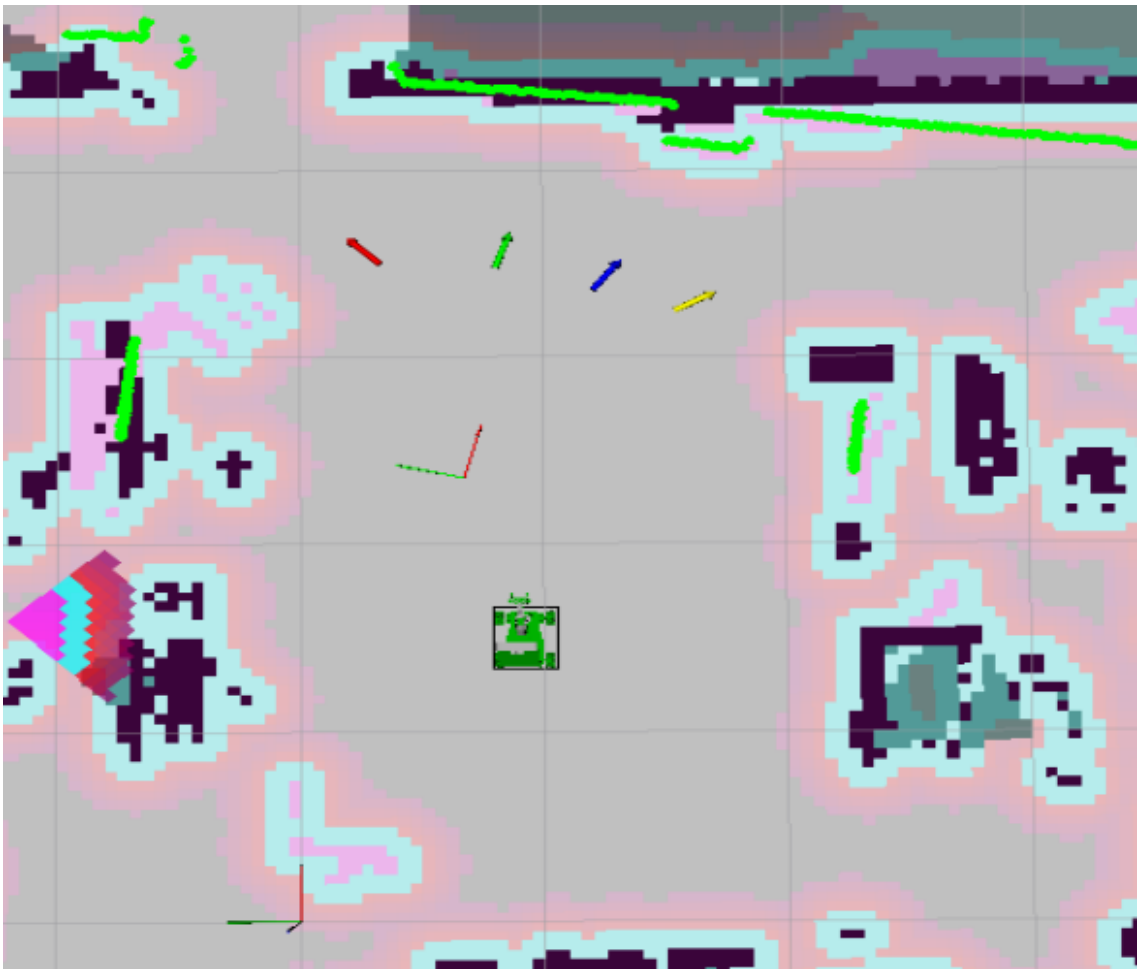
  In rviz, use tool 1 to calibrate and position the rosmaster

- Step 2

  In rviz, use 3 tools to mark the origin of rosmaster. This origin is the position where the car automatically returns after putting down the color block.

- Step 3

  In rviz, use the 4 tools to mark red, green, blue and yellow destinations on the map in sequence. After the rosmaster's robotic arm gripper picks up the color block, it will navigate to the destination corresponding to the color of the color block. It is best to put the four The points are marked in a row, and the front and back distance cannot be too far apart. Otherwise, when planning the path, you may hit the color block.



- Step 4

  Say "Hello, Xiaoya" to rosmaster, wake up the voice module, and then tell it to sort the colors, and then place the color block on the camera on the robotic arm, about 5-7cm away. After the camera recognizes the color block, it will After a beep, the recognition result will be broadcast; pass the color block to the gripper, and after another beep, the gripper will tighten the color block; then it will autonomously navigate to the position of the corresponding color, put down the color block, and finally return to the marked origin.

3.2.3. Launch file analysis

voice_transport_base.launch

```
    <!-- Load map || Load map -->
    <node name="map_server" pkg="map_server" type="map_server" args="$(find
yahboomcar_nav)/maps/$(arg map).yaml"/>
    <include file="$(find yahboomcar_nav)/launch/laser_bringup.launch"/>
    <!-- AMCL adaptive Monte Carlo positioning -->
    <include file="$(find yahboomcar_nav)/launch/library/amcl.launch"/>
    <!-- Navigation core component move_base -->
    <include file="$(find yahboomcar_nav)/launch/library/move_base.launch"/>
    <!-- web_video_server -->
    <node pkg="web_video_server" type="web_video_server" name="web_video_server"
output="screen"/>
    <node pkg="arm_color_transport" type="DrawMarker.py" name="draw_marker"
required="true" output="screen"/>
```

3.2.4. Core code voice_color_transport.py

- code path

```
~/yahboomcar/src/yahboomcar_voice_ctrl/scripts
```

- Core code analysis

  1). Import the corresponding library file

```
from transport_common import ROSNav #Navigation-related libraries
from Speech_Lib import Speech #Libraries related to speech recognition
broadcasting
```

  2), several important states

```
self.model = "Grip": After recognizing "color sorting", the init state
changes to the ready-to-catch state
self.model = "Grip_Target": Gripping state, after executing the gripping
state, it changes to Transport state
self.model = "Transport" state: transport color block state, it will change
to Grip_down state after reaching the destination
self.model = "Grip_down": Lower the paw and put down the color block. After
the action is completed, it will enter the comeback function, and then the
state will change to come_back
self.model = "come_back": Return to the original state. After returning,
reset all data and states.
```

  3), several important functions

```
get_color: Identify colors and increase the accuracy of color recognition by
adjusting HSV
Grip_Target: clip color block function
comeback: Return to origin function
Grip_down: lower claw function
buzzer_loop: prompter, buzzer function
```

- Program Description

  In the main function, after opening the camera and obtaining the camera data, the image data is passed into the process function, and then the mode status is judged in the process function, and then the corresponding function execution program is entered.

3.3. Program flow chart