2、HD camera color tracking

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2.1、Introduction

The Transbot SE robot HD camera color tracking is capable of recognizing multiple colors at any time, automatically storing the currently recognized colors.

When controlling the car to follow the detected colors, we need to keep a certain distance from the object.

The color tracking of the Transbot SE robot can also realize the function of real-time HSV regulation. By adjusting the high and low thresholds of HSV, the interfering colors can be filtered out, so that the square can be identified ideally in a complex environment. If the color picking effect is not ideal At this time, we need to move the car to a different environment to calibrate it, so that we can recognize the color we need in a complex environment.

- **HSV**

H: 0 — 180

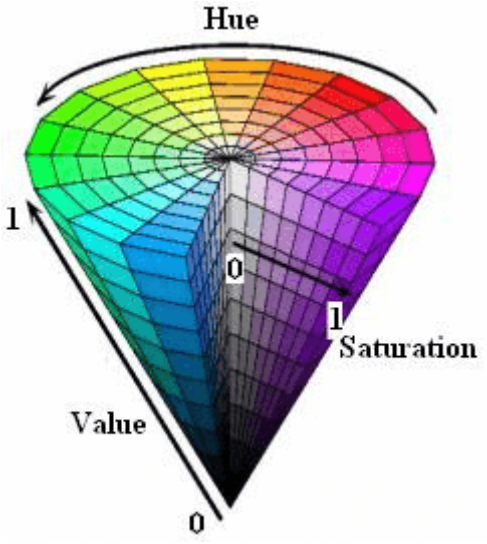
S: 0 — 255

V: 0 — 255

Part of the red is classified as the purple range here:

	black	gray	white	red		orange	yellow	green	verdant	blue	purple
hmin	0	0	0	0	156	11	26	35	78	100	125
hmax	180	180	180	10	180	25	34	77	99	124	155
smin	0	0	0	43		43	43	43	43	43	43
smax	255	43	30	255		255	255	255	255	255	255
vmin	0	46	221	46		46	46	46	46	46	46
vmax	46	220	255	255		255	255	255	255	255	255

- **HSV**
- **Lightness V**
    - **Saturation S**
- **Hue H**



2.2. Operation steps

Note: [R2] on the remote control handle has the [pause/start] function for all gameplays.

2.2.1. Start

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First start the underlying driver control, which can also be placed in other launch files. (robot side)

```
roslaunch transbot_bringup bringup.launch
```

Raspberry Pi 5

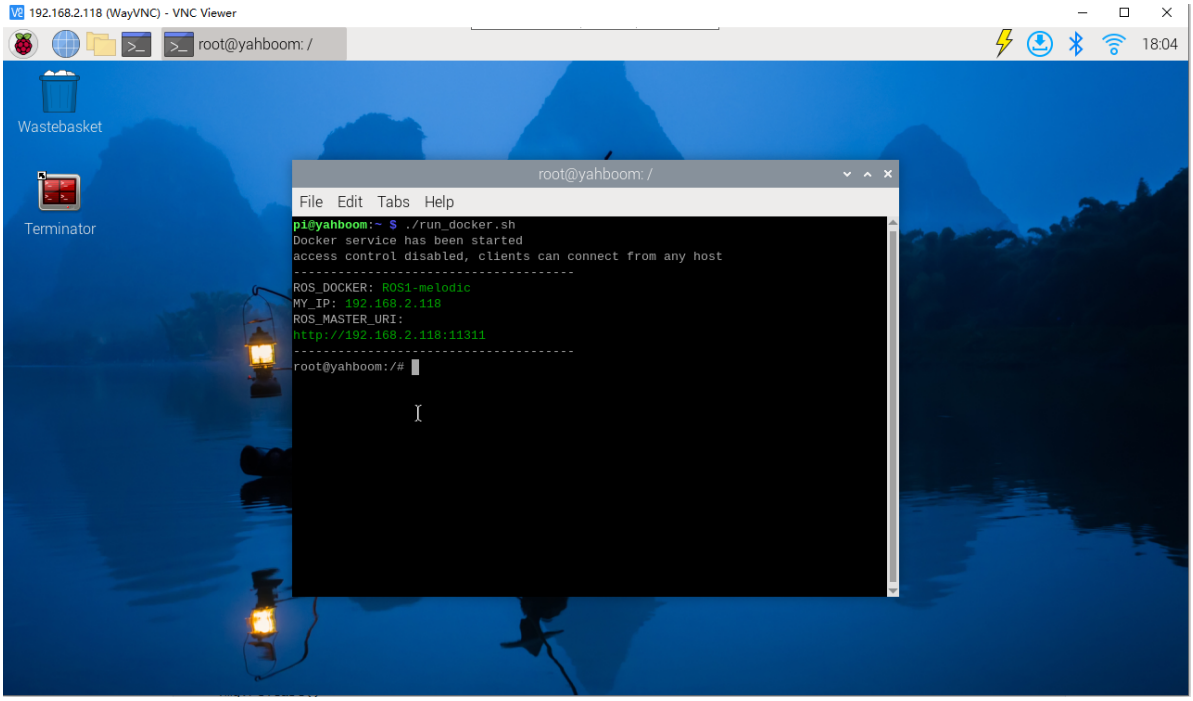
Before running, please confirm that the large program has been permanently closed

Enter docker

Note: If there is a terminal that automatically starts docker, or there is a docker terminal that has been opened, you can directly enter the docker terminal to run the command, and there is no need to manually start docker

Start docker manually

```
./run_docker.sh
```



Start low-level driver control

```
roslaunch transbot_bringup bringup.launch
```

method one

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Start the monocular camera (robot side)

```
roslaunch usb_cam usb_cam-test.launch
```

Start monocular color tracking control (virtual machine)

```
roslaunch transbot_mono mono_tracker.launch VideoSwitch:=false
tracker_type:=color
```

Raspberry Pi 5

Enter the same docker from multiple terminals

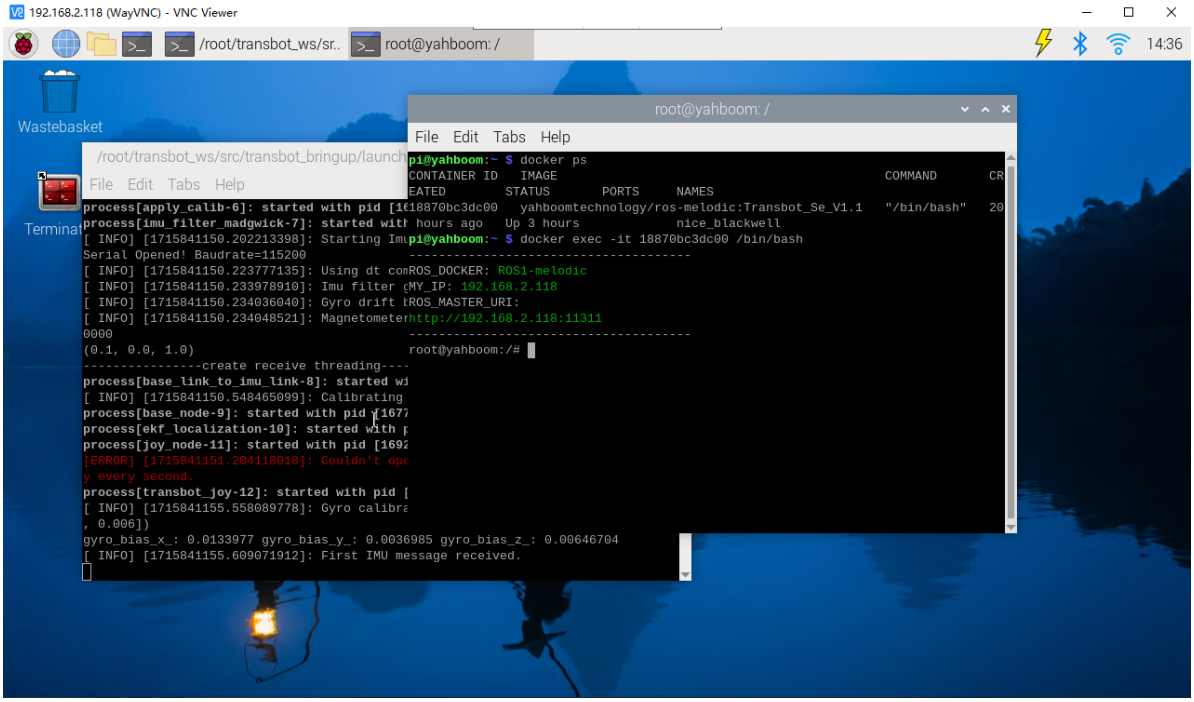
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

```
docker ps
```

Enter the same docker and use the following 18870bc3dc00 to modify the ID displayed on the actual terminal.

```
docker exec -it 18870bc3dc00 /bin/bash
```



Start the monocular camera (robot side)

```
roslaunch usb_cam usb_cam-test.launch
```

Enter the same docker from multiple terminals

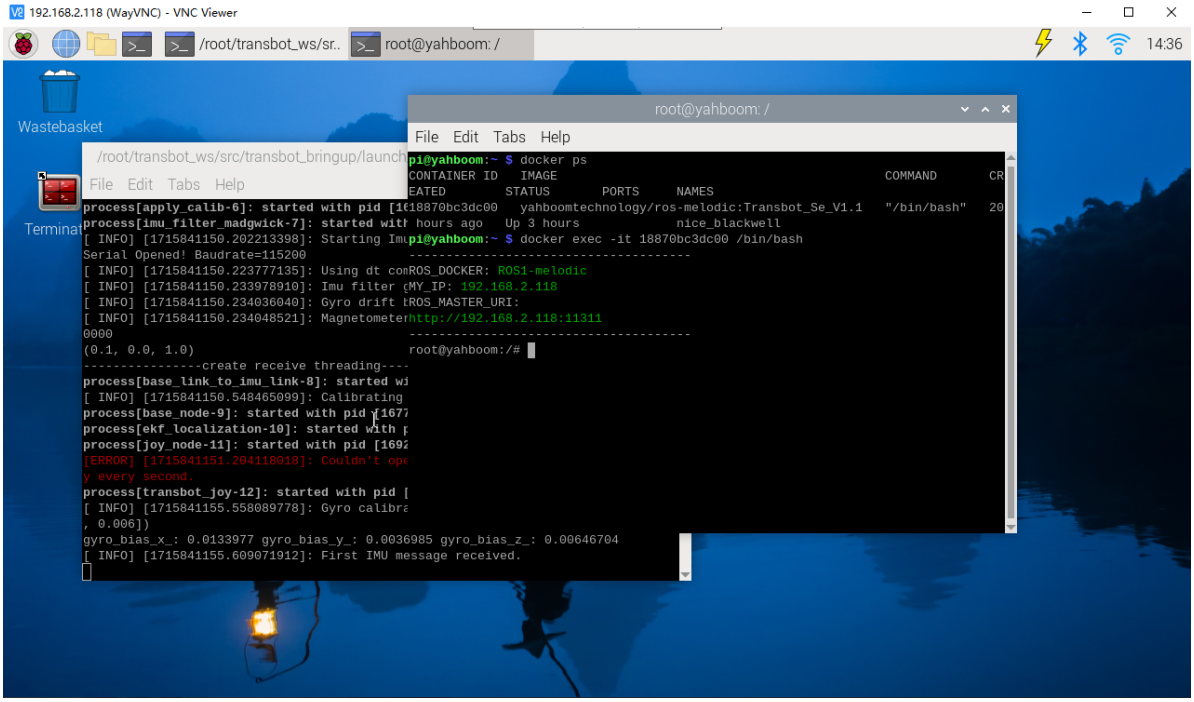
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

```
docker ps
```

Enter the same docker and use the following 18870bc3dc00 to modify the ID displayed on the actual terminal.

```
docker exec -it 18870bc3dc00 /bin/bash
```



Start monocular color tracking control (virtual machine)

```
roslaunch transbot_mono mono_tracker.launch VideoSwitch:=false
tracker_type:=color
```

Method 2

Note: [q] key to exit.

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```
roslaunch transbot_mono mono_tracker.launch VideoSwitch:=true
tracker_type:=color
```

Raspberry Pi 5

Enter the same docker from multiple terminals

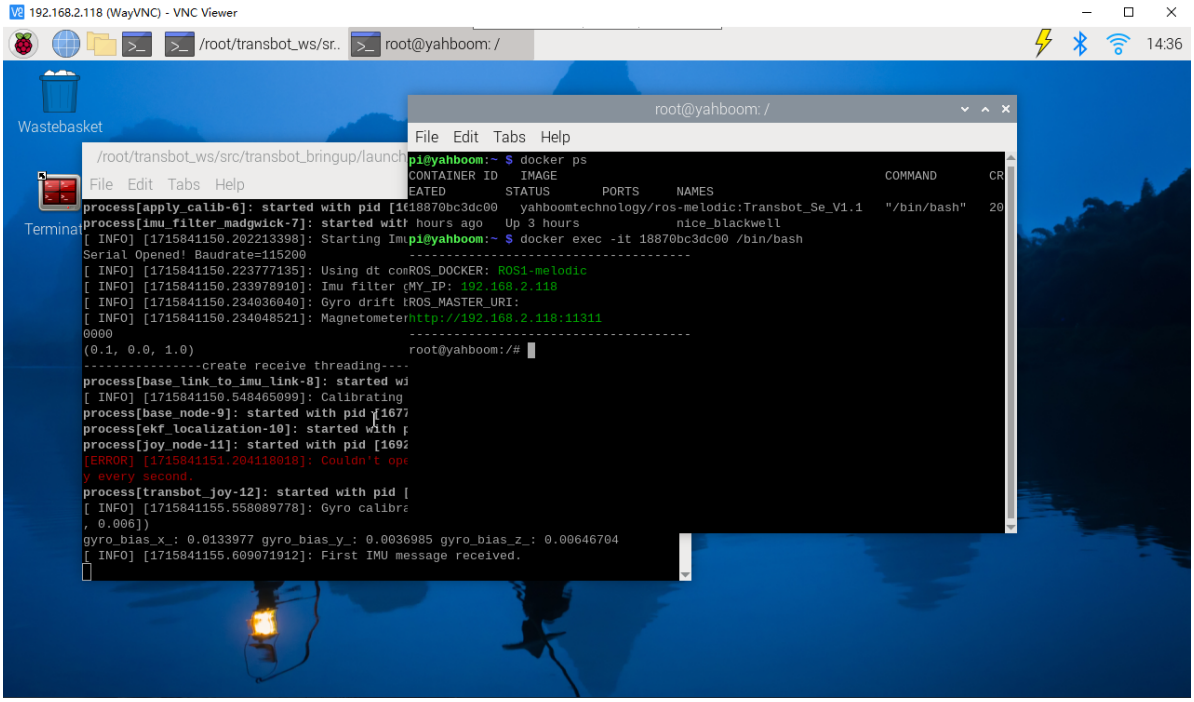
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

```
docker ps
```

Enter the same docker and use the following 18870bc3dc00 to modify the ID displayed on the actual terminal.

```
docker exec -it 18870bc3dc00 /bin/bash
```




```
roslaunch transbot_mono mono_tracker.launch VideoSwitch:=true
tracker_type:=color
```

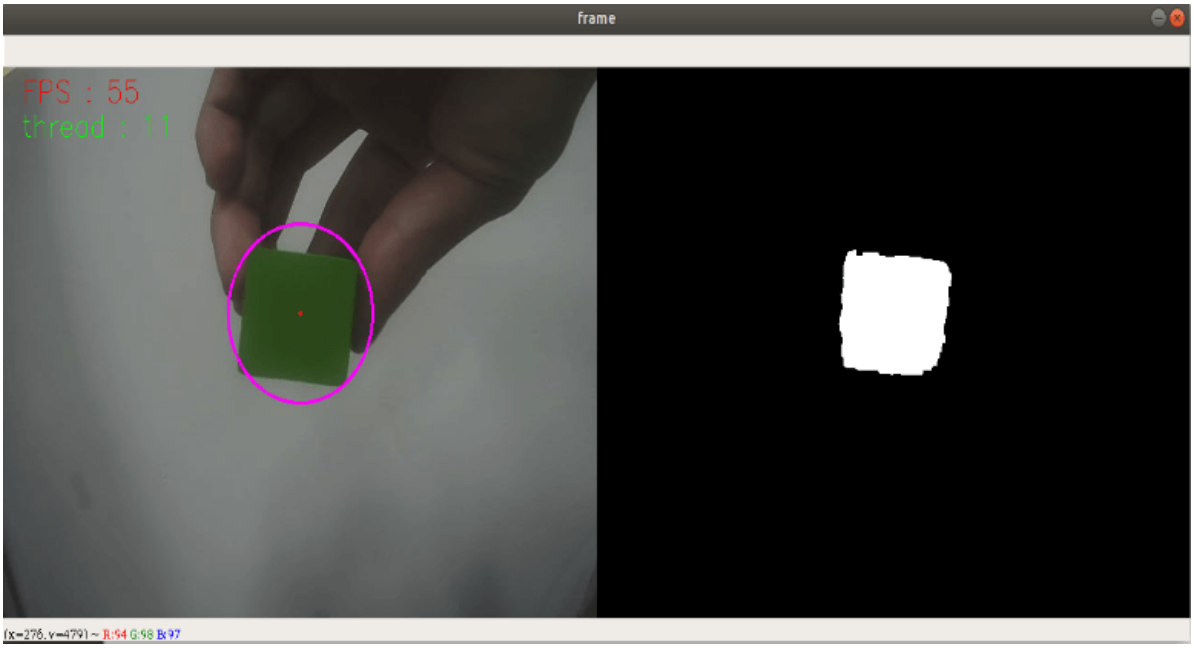
This method can only be started in the main control connected to the camera

- VideoSwitch parameter: whether to use the camera function package to launch; for example: to launch usb_cam-test.launch, this parameter must be set to true; otherwise, it is false.
- tracker_type parameter: Functional gameplay, select color tracking.

Set parameters according to needs, or modify the launch file directly, so there is no need to attach parameters when starting.

2.2.2. Identification

After startup, the system defaults to [Target Detection Mode], as shown below:



Keyboard key control:

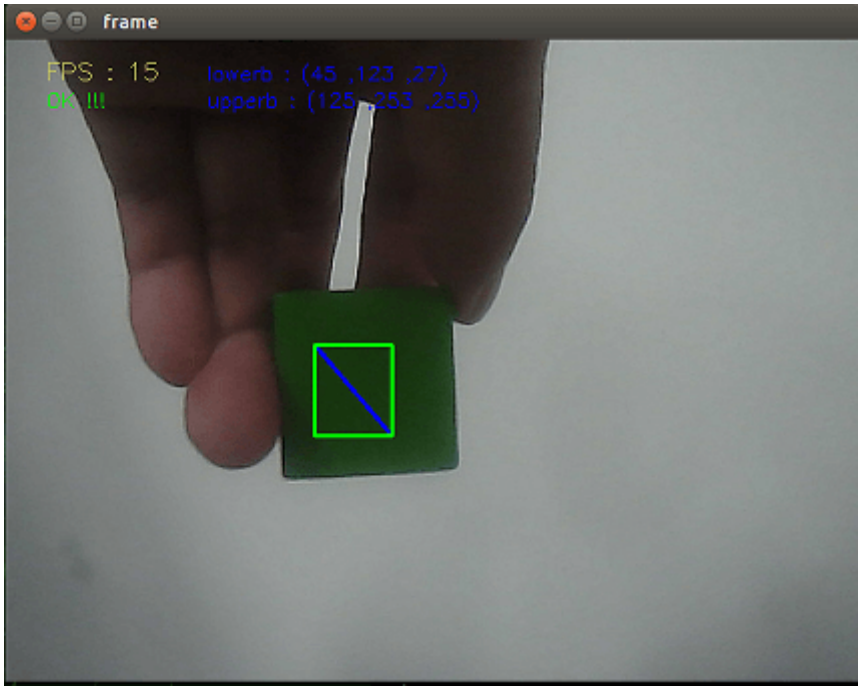
[r]: Color selection mode, you can use the mouse to select the area of the color to be recognized (cannot exceed the area range).

【i】: Target detection mode. The color image on the left (Color) and the binary image on the right (Binary).

[q]: Exit the program.

[Spacebar]: Color follow.

In the color selection mode, use the mouse to select the location of the color block, as shown in the figure below, and release it to start recognition.



2.2.3. Color calibration

Dynamic parameter tuning

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```
rosrun rqt_reconfigure rqt_reconfigure
```

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Enter the same docker from multiple terminals

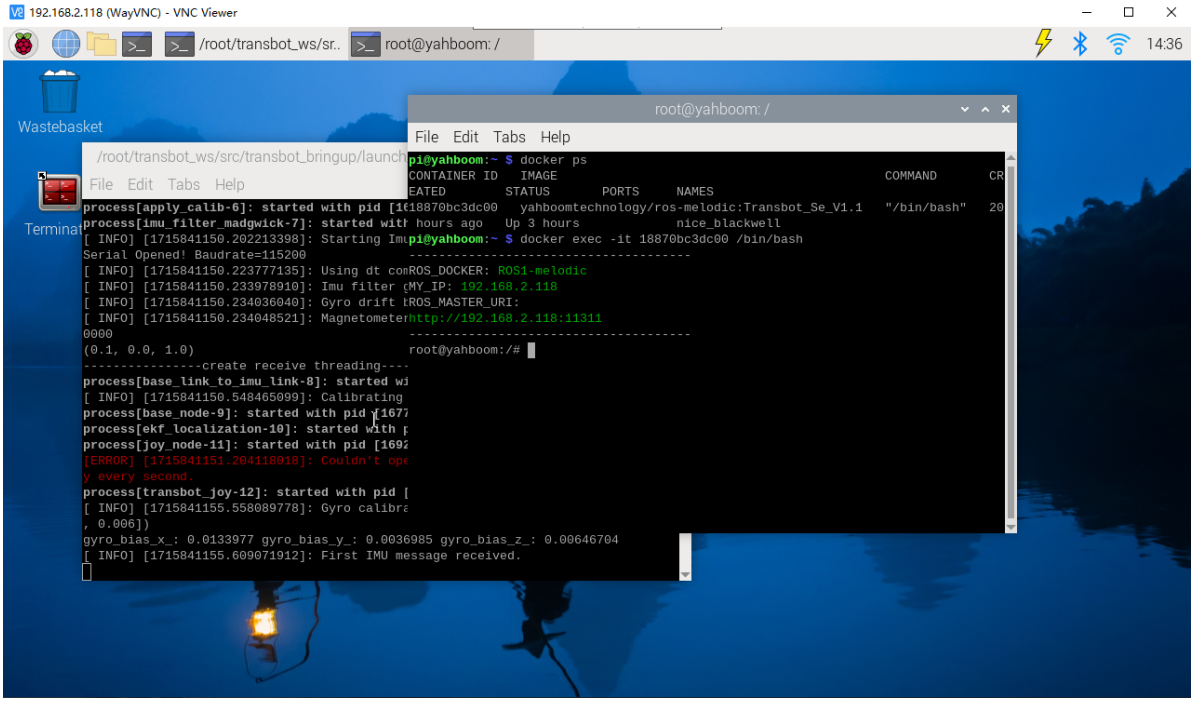
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

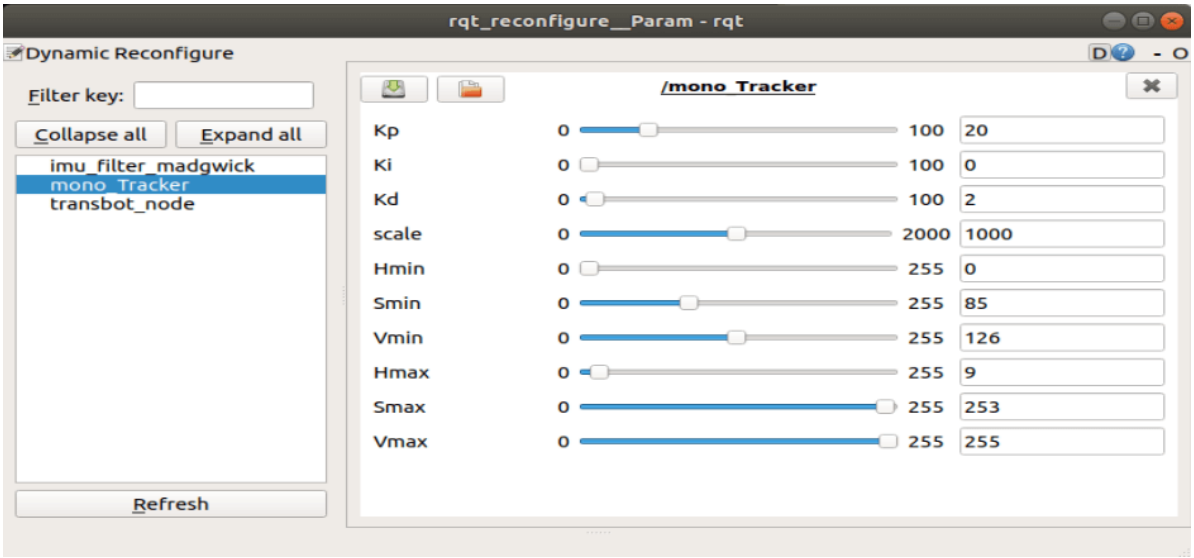
```
docker ps
```

Enter the same docker and use the following 18870bc3dc00 to modify the ID displayed on the actual terminal.

```
docker exec -it 18870bc3dc00 /bin/bash
```




```
rosrun rqt_reconfigure rqt_reconfigure
```



Select the [mono_Tracker] node. Generally, you only need to adjust [Hmin], [Smin], [Vmin], and [Hmax]. These four parameters can be easily identified. The slide bar is always in a dragging state and data will not be transferred to the system until it is released; you can also select a row and then slide the mouse wheel.

Parameter analysis:

[Kp], [Ki], [Kd]: PID control during car driving.

[scale]: PID scaling.

2.2.4. Color following

After identifying that there is no problem, click the [space bar] on the keyboard to execute the color following program.

- Node view

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```
rqt_graph
```

Raspberry Pi 5

Enter the same docker from multiple terminals

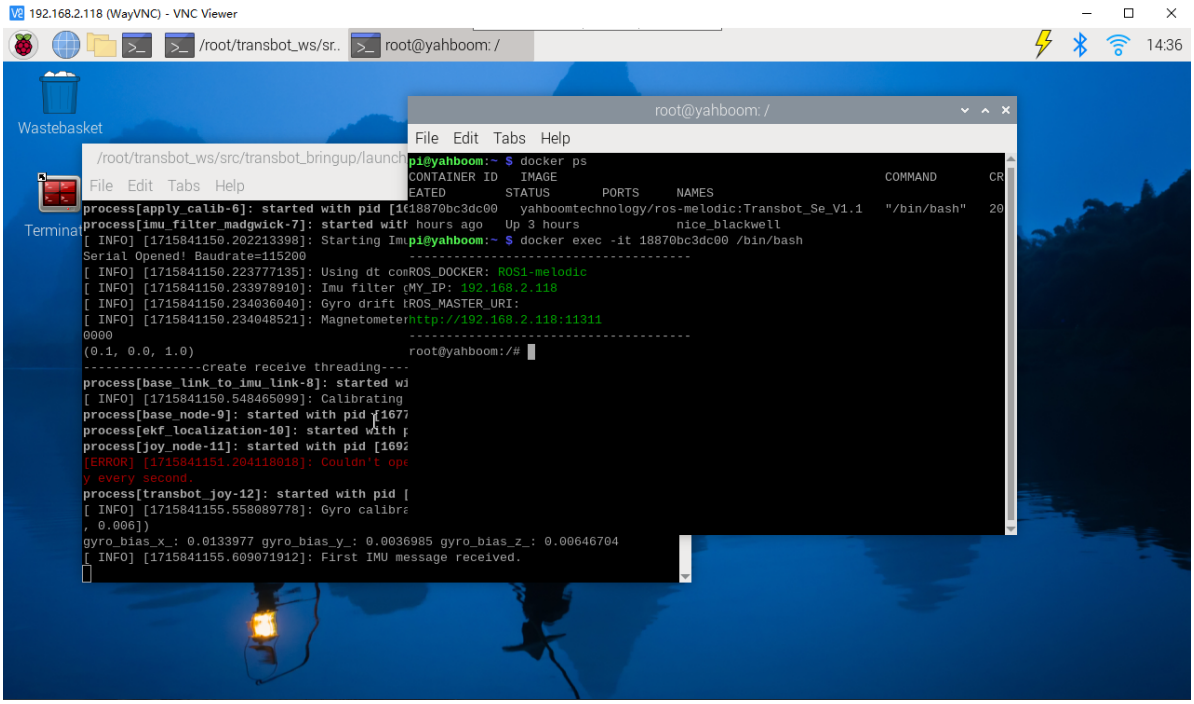
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

```
docker ps
```

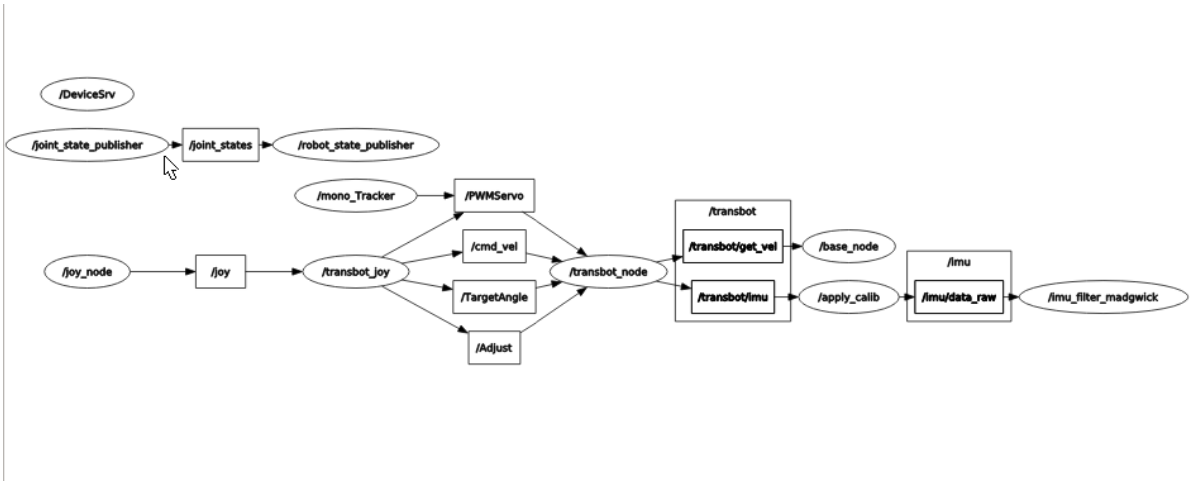
Enter the same docker and use the following 18870bc3dc00 to modify the ID displayed on the actual terminal.

```
docker exec -it 18870bc3dc00 /bin/bash
```



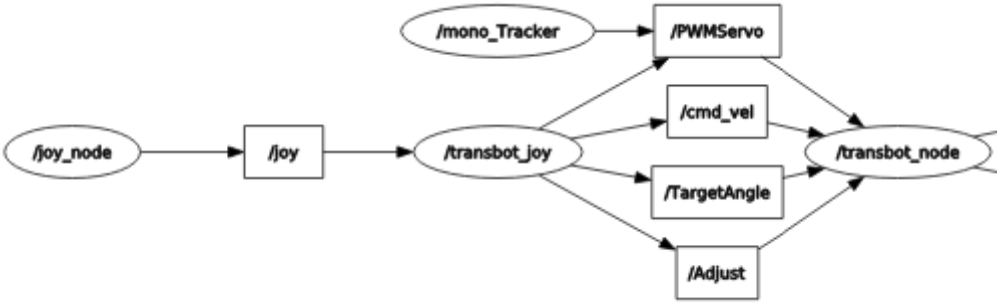

```
rqt_graph
```

- When starting method one, the node [mono_Tracker]



Subscribe to the image topic; publish the gimbal servo topic

- When starting method one, the node [mono_Tracker]



Post the gimbal servo topic and control the gimbal to follow.