

3.HD camera color tracking (robotic arm)

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3.1、 Introduction

The monocular color tracking (chassis) of the Transbot se robot can recognize multiple colors at any time and independently store the currently recognized color. The robot arm tracks the color up and down, and the car rotates left and right to track the color. When the color is far away from the car, it will actively follow.

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:

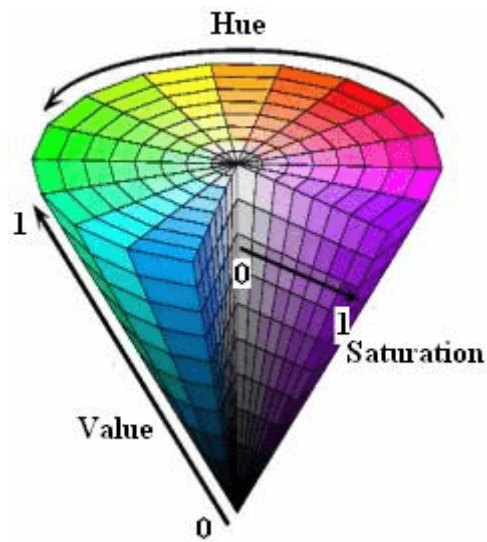
| | black | gray | white | red | | orange | yellow | green | verdant | blue | purple |
|------|-------|------|-------|-----|-----|--------|--------|-------|---------|------|--------|
| hmin | 0 | 0 | 0 | 0 | 156 | 11 | 26 | 35 | 78 | 100 | 125 |
| hmax | 180 | 180 | 180 | 10 | 180 | 25 | 34 | 77 | 99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

- **HSV**

- **Lightness V**

- **Saturation S**

- **Hue H**



3.2. Operation steps

Note: [R2] on the remote control handle has the [pause/start] function for all gameplays. Because an ordinary camera is used. The effect is affected by light.

3.2.1. Start

Start chassis drive control (robot side)

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```
roslaunch transbot_track TrackSrv.launch
```

Raspberry Pi 5

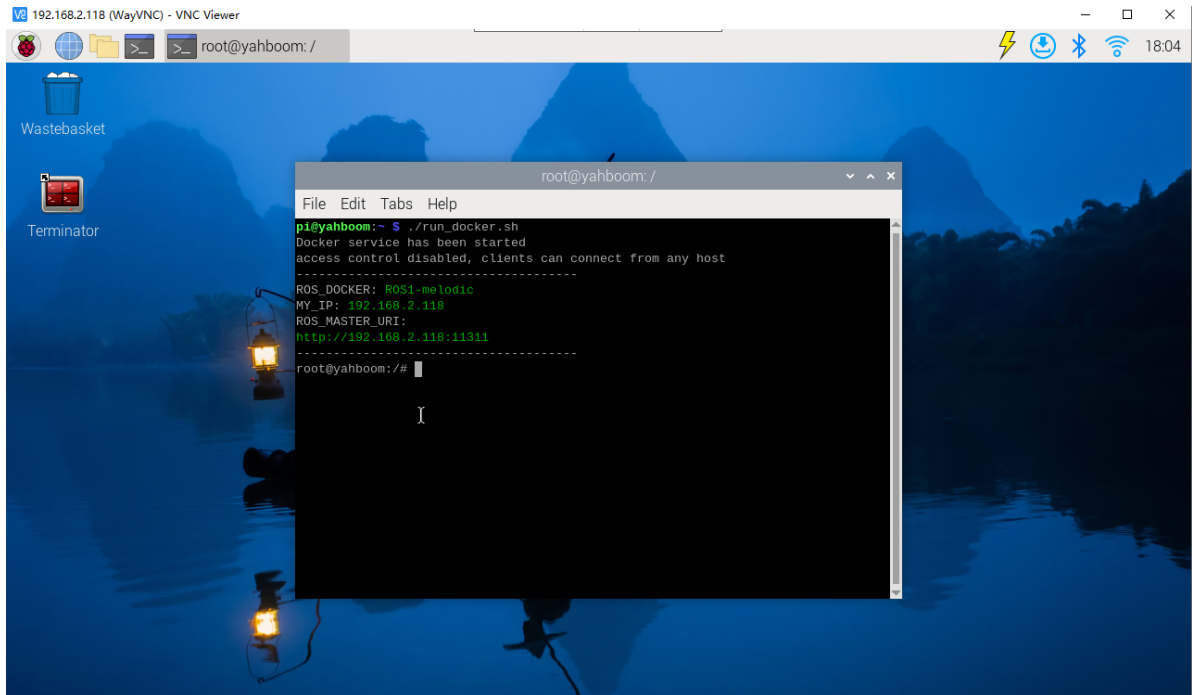
Before running, please confirm that the large program has been permanently closed

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 chassis drive control (robot side)

```
roslaunch transbot_track Tracksrv.launch
```

method one

jetson motherboard/Raspberry Pi 4B

Start the monocular camera (robo not side)

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

Start monocular color tracking control (virtual machine)

```
roslaunch transbot_track Tracker.launch Videoswitch:=false tracker_type:=color
```

Raspberry Pi 5

Enter the same docker from multiple terminals

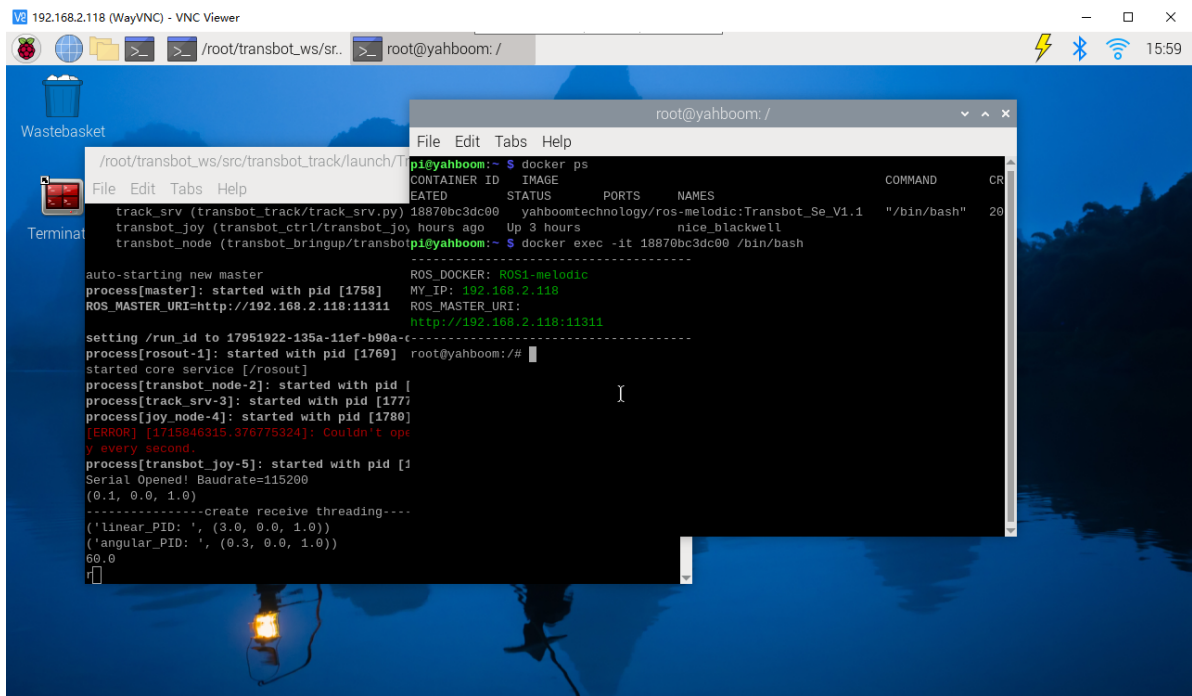
Keep the program of the previous docker terminal running and open a new terminal

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 (robnot side)

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

Start monocular color tracking control (virtual machine)

```
roslaunch transbot_track Tracker.launch Videoswitch:=false tracker_type:=color
```

Method 2

Note: [q] key to exit.

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(robot side)

```
roslaunch transbot_track 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
```


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). If the robotic arm blocks the camera, you can press the [r] key to reset the robotic arm.

[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.

3.2.3. Dynamic parameter debugging

Dynamic parameter debugging

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```
roslaunch rqt_reconfigure rqt_reconfigure
```

Raspberry Pi 5

Enter the same docker from multiple terminals

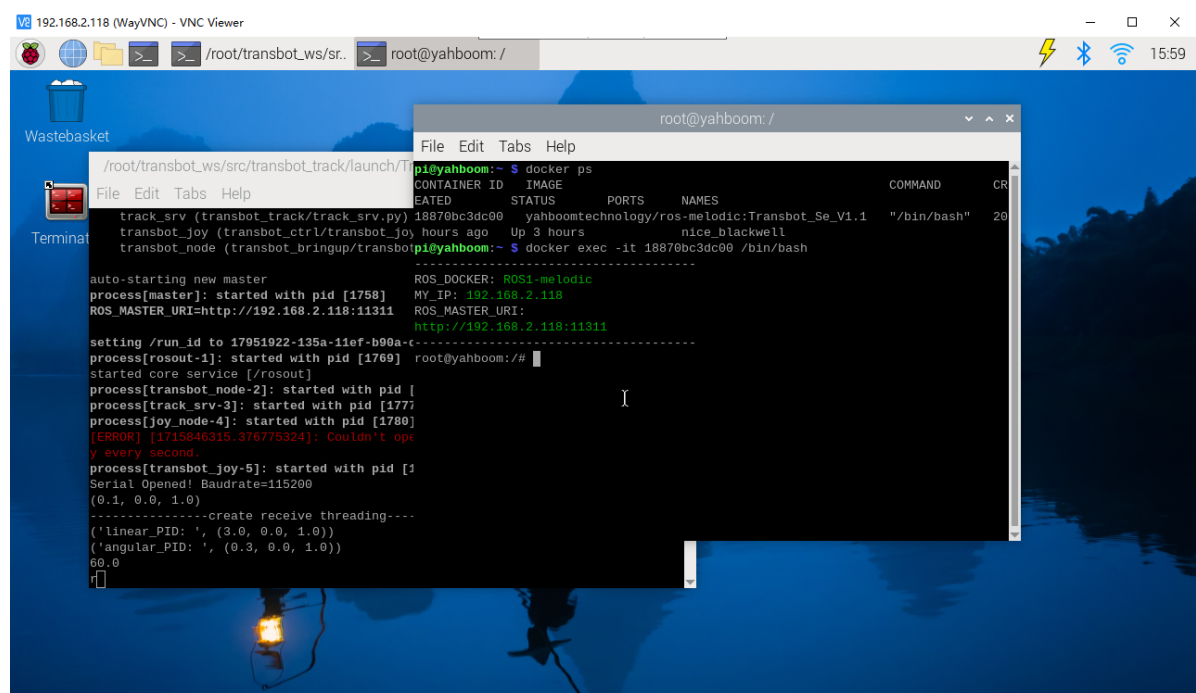
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

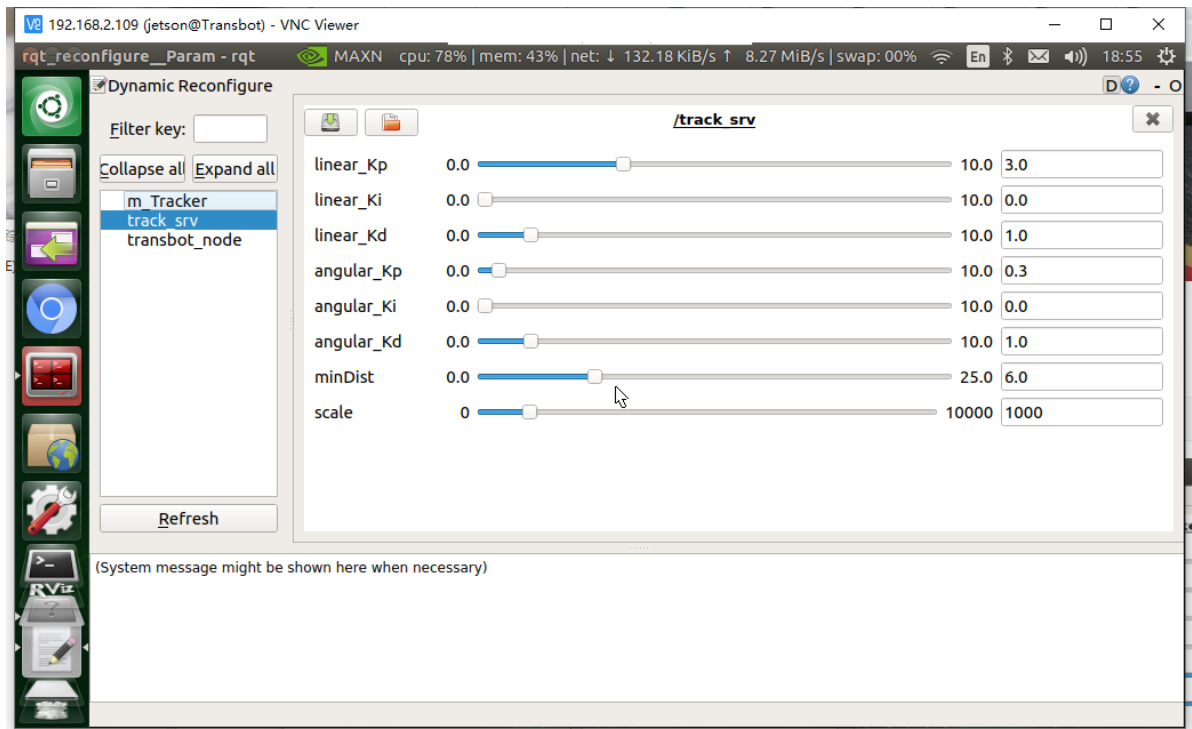
```
docker ps
```

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

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



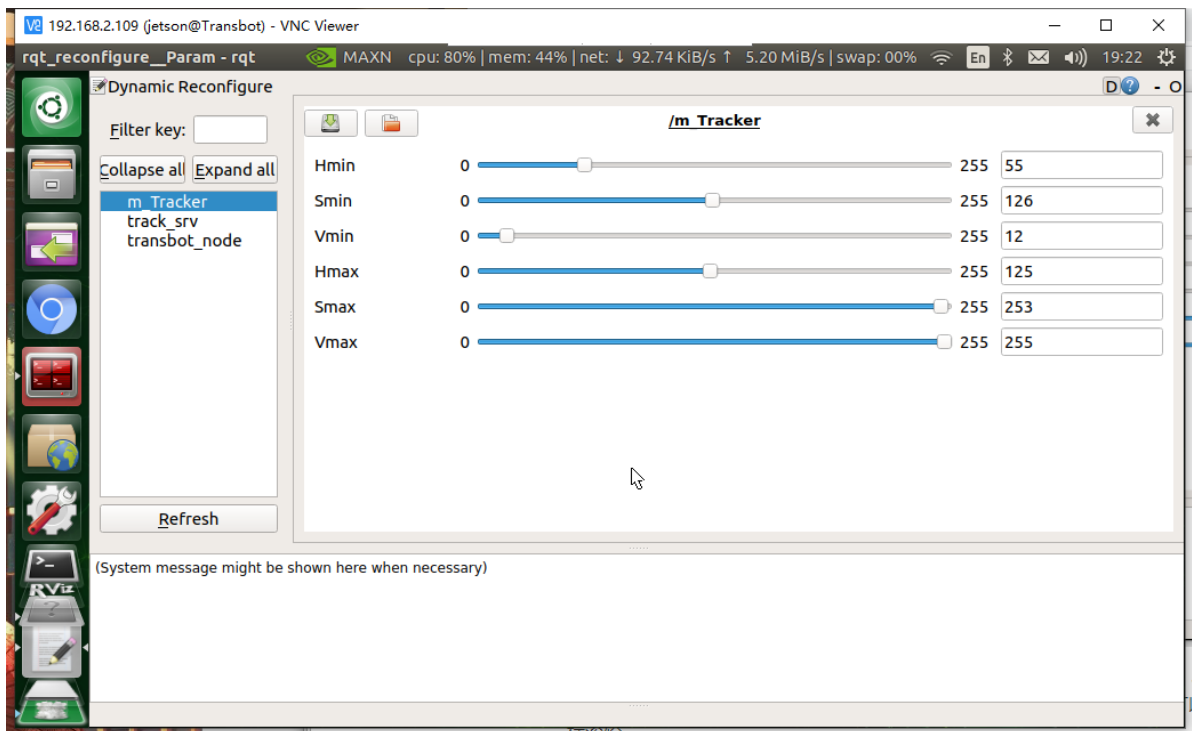

```
roslaunch rqt_reconfigure rqt_reconfigure
```



3.2.3.1. Following distance setting

The distance value defaults to 150. If you want to modify the following distance, you can change the distance value in line 258 of the `~/transbot_ws/src/transbot_track/scripts/Tracker.py` file.

3.2.3.2. Color calibration



Select the [m_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.

3.2.4. Color following

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

- Node view

jetson motherboard/Raspberry Pi 4B

```
rqt_graph
```

Raspberry Pi 5

Enter the same docker from multiple terminals

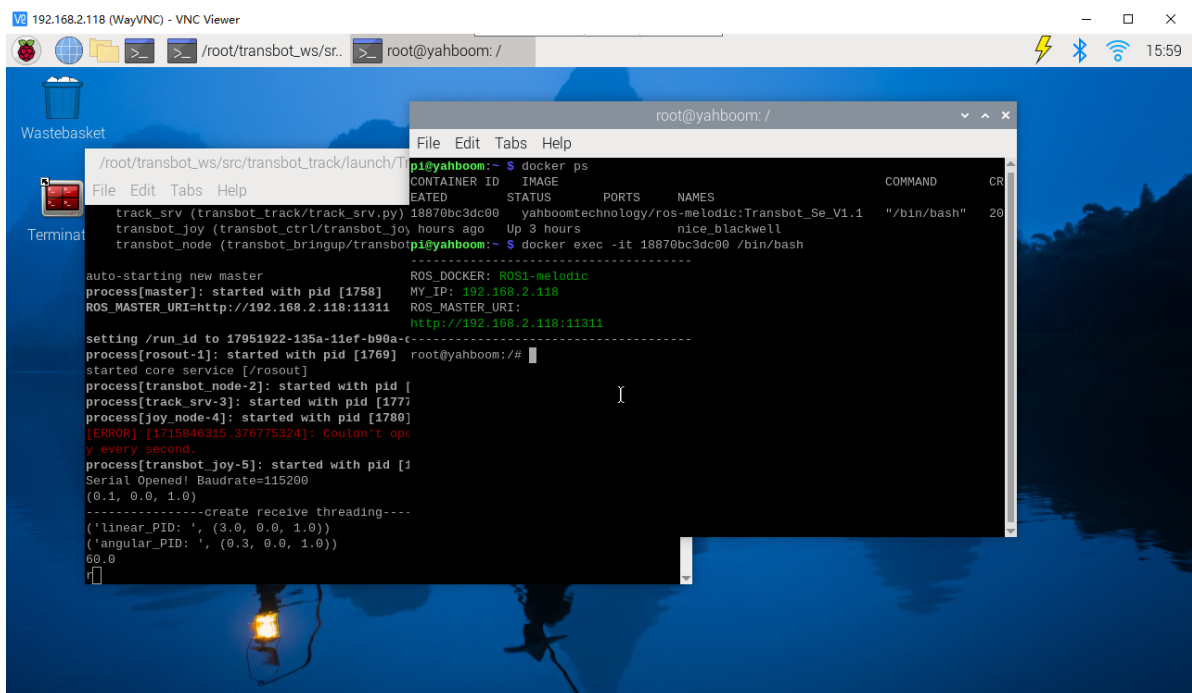
Keep the program of the previous docker terminal running and open a new terminal

Enter the following command

```
docker ps
```

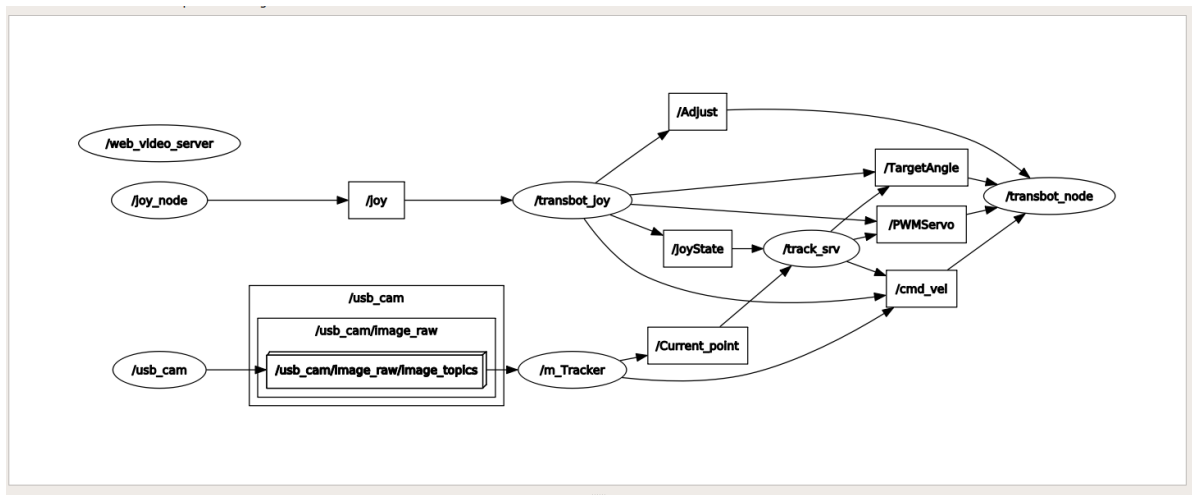
Enter the same docker and use the following 18870bc3dc00 to modify the ID displayed on the actual terminal.

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



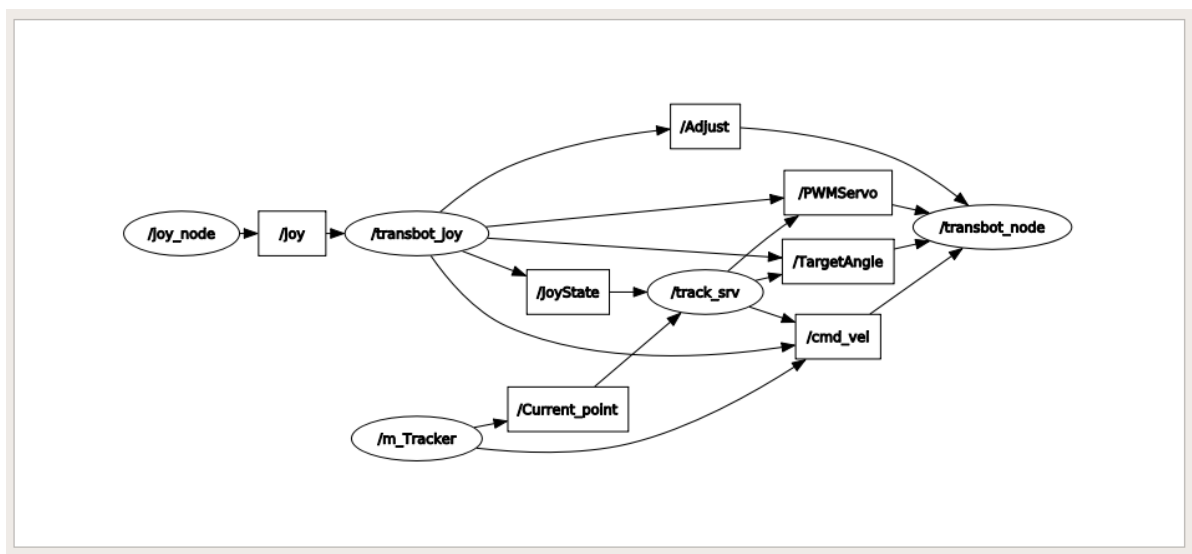
```
rqt_graph
```

- When starting method 1, node [m_Tracker]



Subscribe to image topics; publish topics on gimbal servo, robotic arm, and chassis drive

- When starting method 2, node [m_Tracker]



Publish topics on gimbal servos, robotic arms, and chassis drives.