Autonomous driving line patrol

Note: The VM and ROS-wifi image transfer module must be consistent with the microROS control board ROS_DOMAIN_ID and set the value to 20. You can check [MicroROS control board Parameter configuration] to set the microROS control board ROS_DOMAIN_ID. Check the tutorial Connecting to MicroROS Agents to see if the ids are the same.

1、Program function specification

After the program starts, adjust the pitch Angle of the camera, move the camera down, so that the camera can see the line, then click the image window, press the r key to enter the color selection mode; Then in the area of the line in the screen, frame the color of the line that needs to be toured, and the processed image will be automatically loaded after releasing the mouse; Finally, press the space bar to enable the line patrol function. In the process of running, the car will stop and the buzzer will sound when encountering obstacles.

2、Program code reference path

After entering the docker container, the location of the feature source code is located，

```
/home/yahboom/yahboomcar_ws/src/yahboom_esp32ai_car/yahboom_esp32ai_car/follow_line.py
```

3、Program initiation

3.1、Start command

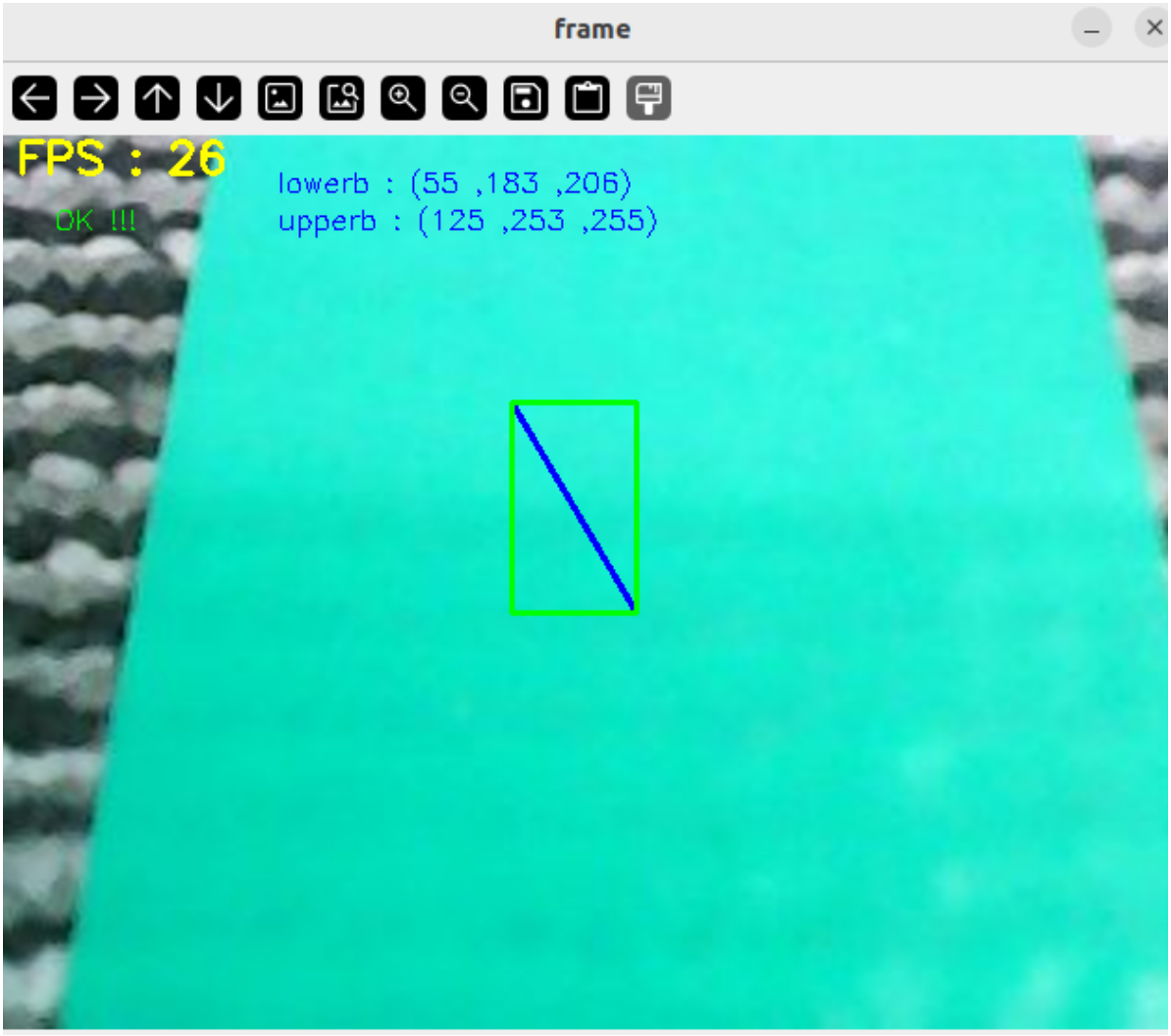
After entering the docker container, terminal type,

```
ros2 run yahboom_esp32ai_car follow_line
```

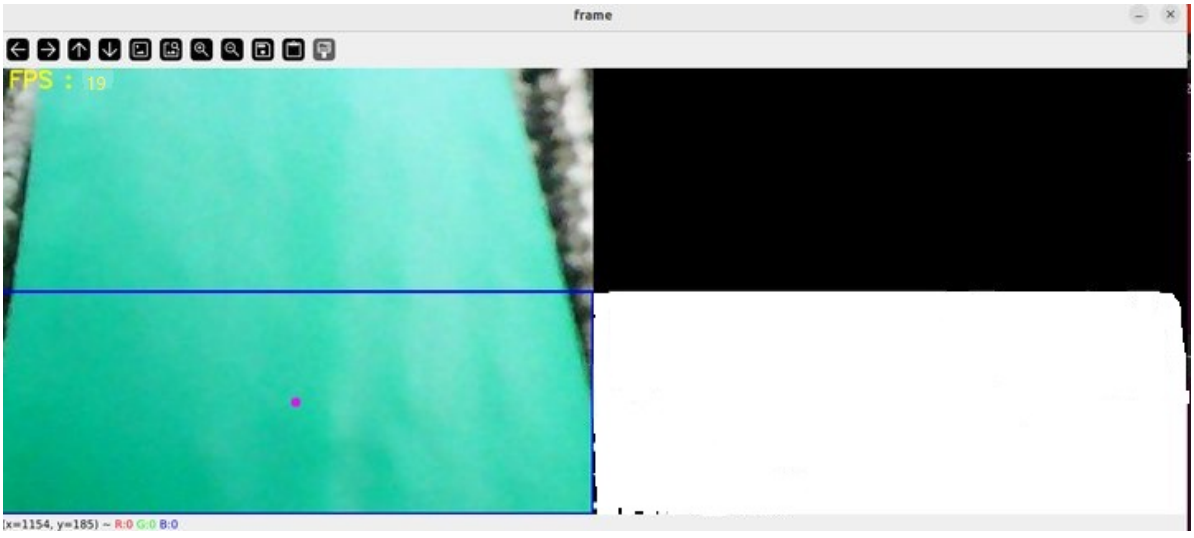
If the Angle of the camera is not at this Angle, please press CTRL+C to end the program and run again, this is because the network delay causes the Angle of sending the steering gear to lose packets

If the camera picture image appears upside down, you need to see **3. Camera picture correction (must see)** document itself correction, the experiment is no longer described.

Take the green line as an example,



After pressing the r key, select the blue line area as shown in the figure above, and release the mouse after selecting.

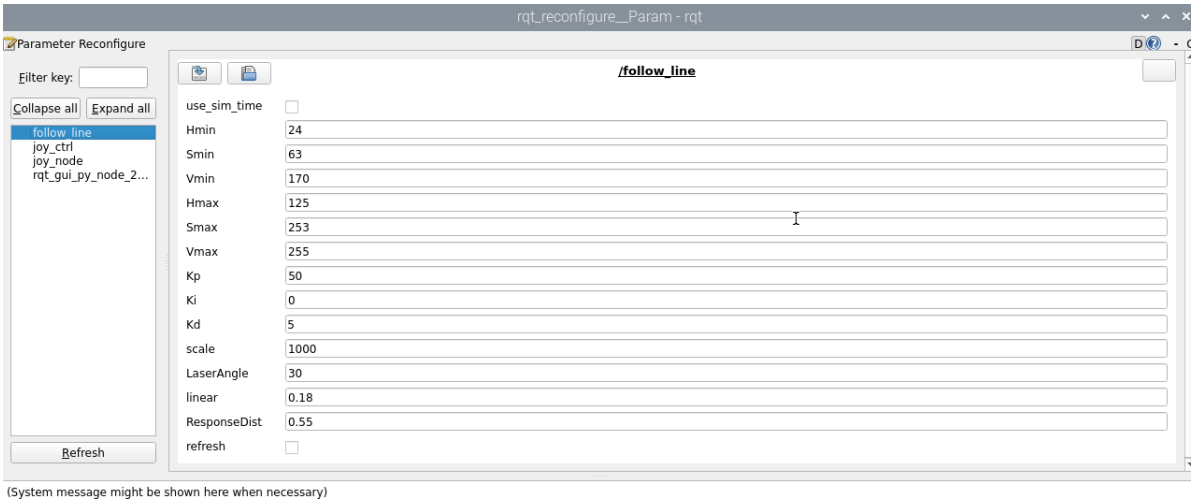


As shown above, the processed image shown on the right shows the green line. **Because the pixel of the camera is only 200W, put the line in the middle of the image as much as possible**, and then press the space bar to calculate the speed, and the car patrol line automatic driving.

3.2、Dynamic parameter regulation

Relevant parameters can be adjusted through dynamic parameterizers, and docker terminal input,

```
ros2 run rqt_reconfigure rqt_reconfigure
```



Adjustable parameters are,

argument	Instructions
Kp	The p-value of PID
Ki	The i-value of PID
Kd	The d-value of PID
scale	PID adjusts the proportional coefficient
LaserAngle	Radar detects angles
linear	Magnitude of linear velocity
ResponseDist	Obstacle avoidance detection distance
refresh	Refresh parameter button

4、Core code

Let's start with the principle of the patrol, through

- Calculate the offset between the center coordinates of the line and the center of the image,
- Calculate the value of the angular velocity based on the offset of the coordinates,
- Release speed drive dolly.

Calculate the center coordinates,

```
#Calculate the hsv value
rgb_img, self.hsv_range = self.color.Roi_hsv(rgb_img, self.Roi_init)
rgb_img, binary, self.circle = self.color.line_follow(rgb_img, self.hsv_range)
```

Calculate the value of the angular velocity,

```
[z_Pid, _] = self.PID_controller.update([(point_x - 320)*1.0/16, 0])
```