5. Voice control color tracking

Raspberry Pi PI5 master controller needs to check this step, Orin master controller does not need it

Before running this program, it is necessary to bind the port number of the voice board and the port number of the ROS extension board on the host computer; When entering the docker, you need to mount the voice board to recognize the voice board in the docker.

5.1. Function description

Voice control robot open and close tracking red/blue/green/yellow color function. The R2 button on the handle can cancel/enable this function at any time.

5.2. Steps

5.2.1. Function package path

Raspberry Pi PI5 master control needs to enter the docker container first, Orin master control does not need to enter,

The location of the function source code is located

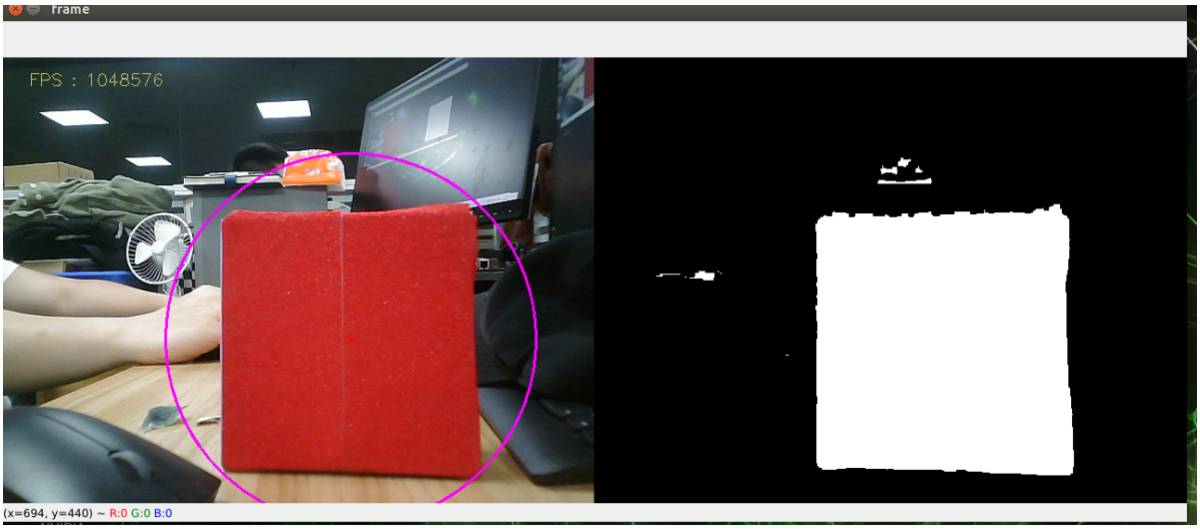
```
~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_voice_ctrl/yahboomcar_voic
e_ctrl/Voice_Ctrl_colorTracker.py
~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_voice_ctrl/yahboomcar_voic
e_ctrl/Voice_Ctrl_colorHSV.py
```

5.2.2. Start

according to the actual vehicle type and radar type, terminal input

```
#orin master starts the depth camera first, pi5 master does not need to start
ros2 launch astra_camera astro_pro_plus.launch.xml
```

```
#Start handle controls
ros2 run yahboomcar_ctrl yahboom_joy_X3
ros2 run joy joy_node
#Start voice-controlled color tracking
ros2 run yahboomcar_voice_ctrl Voice_Ctrl_colorHSV
ros2 run yahboomcar_voice_ctrl Voice_Ctrl_colorTracker
#Start rosmaster
ros2 run yahboomcar_voice_ctrl Voice_Ctrl_Mcnamu_driver_X3
#Start the depth camera and get the depth image. The pi5 master controller needs
to be started, and the orin master controller does not need to be started again.
ros2 launch astra_camera astra.launch.xml
```



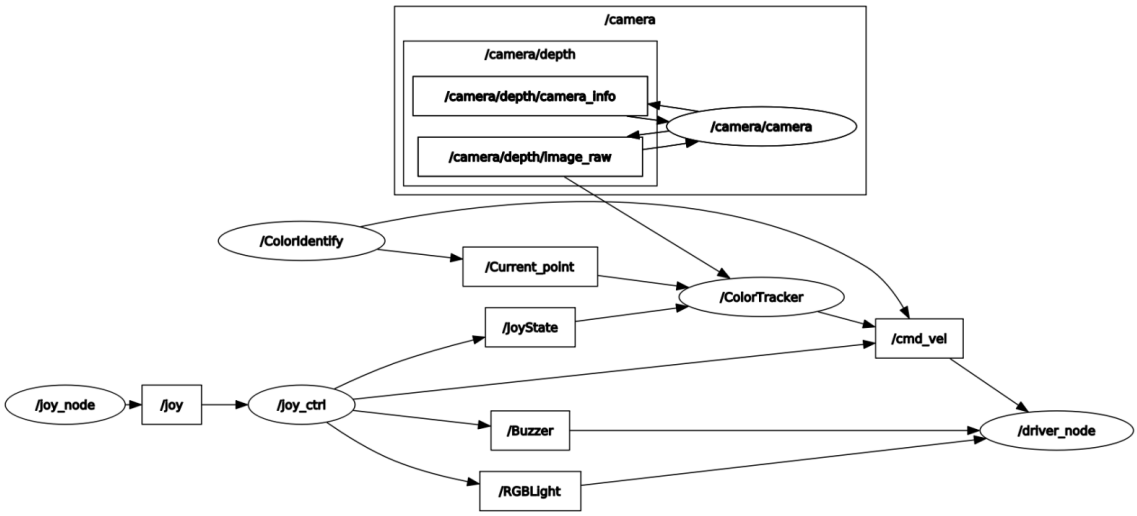
(***Take tracking red for example***)

1. After the above program is run, we say "Hi Yahboom" to wake up the voice module, until it replies "Hi, i'm here", indicating that the module has been woken up.
2. We can say "red following" and it will reply "OK, I found the red ".
3. Next, we press the R2 key on handle, then ROSMASTER starts following red object.
4. If you want to cancel this color tracking function, say "stop following", it replies "OK, it has been stoped". ROSMASTER will cancel this function.
5. When the robot is moving, you can pause the robot by pressing the R2 key on handle again.

5.2.3. Topic graph

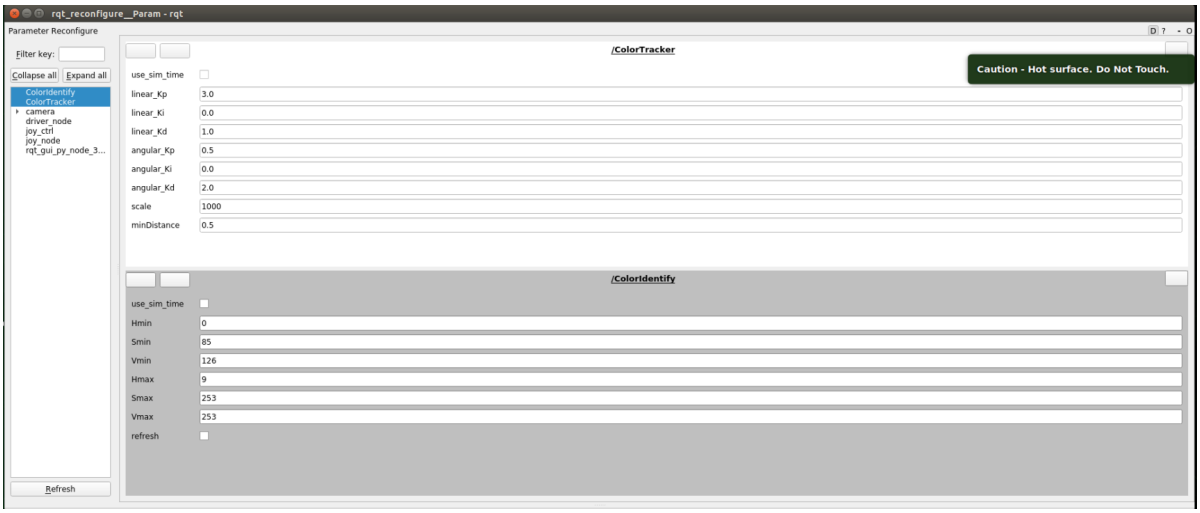
Docker terminal input

```
ros2 run rqt_graph rqt_graph
```



Dynamic parameter adjusters are also available

```
ros2 run rqt_reconfigure rqt_reconfigure
```



Modified parameter:

- colorHSV is mainly responsible for image processing and can adjust the value of HSV
- colorTracker is mainly responsible for calculating speed, adjustable speed and distance related parameters

colorHSV	colorTraker
Hmin	linear_Kp
Smin	linear_Ki
Vmin	linear_Kd
Hmax	angular_Kp
Smax	angular_Ki
Vmax	angular_Kd
refresh	minDistance

Notes: The camera is very sensitive to light, and if it is in a different lighting environment, it will cause inaccurate color recognition. So we need to re-calibrate the colors for red, green, yellow, and blue according to the current lighting environment.

5.3. Code analysis

5.3.1. colorHSV

This part mainly analyzes voice instructions, as well as image processing, and finally publishes the center coordinates

```
#Define a publisher，Publish the center coordinates of the detected object
self.pub_position = self.create_publisher(Position,"/Current_point", 10)
#Import the voice driver library
from Speech_Lib import Speech
#Create a voice control object
self.spe = Speech()
#The following is to obtain instructions to judge the recognition results，load
the corresponding HSV value
command_result = self.spe.speech_read()
self.spe.void_write(command_result)
if command_result == 73 :
self.model = "color_follow_line"
print("tracker red")
self.hsv_range =  [(0, 175, 149), (180, 253, 255)]
#process image，calculate the center coordinates of the detected object，enter
execute function，publishing center coordinate
rgb_img, binary, self.circle = self.color.object_follow(rgb_img, self.hsv_range)
if self.circle[2] != 0: threading.Thread(
                target=self.execute, args=(self.circle[0], self.circle[1],
self.circle[2])).start()
if self.point_pose[0] != 0 and self.point_pose[1] != 0: threading.Thread(
                target=self.execute, args=(self.point_pose[0],
self.point_pose[1], self.point_pose[2])).start()
```

5.3.2. colorTracker

This part receives the topic data and depth data of the center coordinates, then calculate the speed and publish it to the rosmaster

```
#Define a subscriber，subscribe to depth information
self.sub_depth = self.create_subscription(Image,"/camera/depth/image_raw",
self.depth_img_Callback, 1)
#Define a subscriber，subscribe to center coordinate information
self.sub_position =
self.create_subscription(Position,"/Current_point",self.positionCallback,1)
#callback function
def positionCallback(self, msg)#Gets the center coordinate value
def depth_img_Callback(self, msg) #Get depth information
#Pass in the X-value of the center coordinate and the depth information，then
calculated speed publish to the rosmaster
def execute(self, point_x, dist)
```

5.4. Voice module communication protocol

function word	Speech Recognition Module Results	Voice broadcast content
yellow following	72	OK, I found the yellow
red following	73	OK, I found the red
green following	74	OK, I found the green
follow this color	75	OK, I found this color
stop following	76	OK, it has been stoped