Lidar guard

Note: The ROS_DOMAIN_ID of the Raspberry Pi needs to be consistent with that of the microROS control board. You can check [MicroROS Control Board Parameter Configuration] to set the microROS control board ROS_DOMAIN_ID. Check the tutorial [Connect MicroROS Agent] to determine whether the IDs are consistent.

1、Program function description

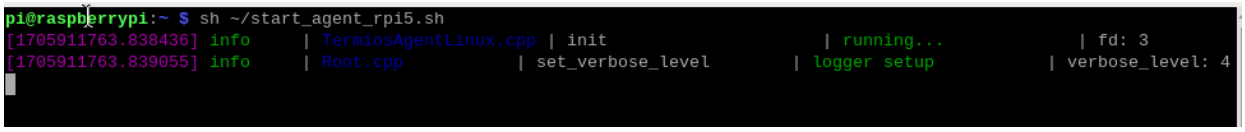
The car connects to the agent and runs the program. The radar on the car scans the nearest object within the set range and tracks the object through rotation. If the object is closer to the radar than the set distance, the buzzer on the car will Sounds as a warning. Parameters such as the radar detection range and obstacle avoidance detection distance can be adjusted through the dynamic parameter adjuster.

2、Query car information

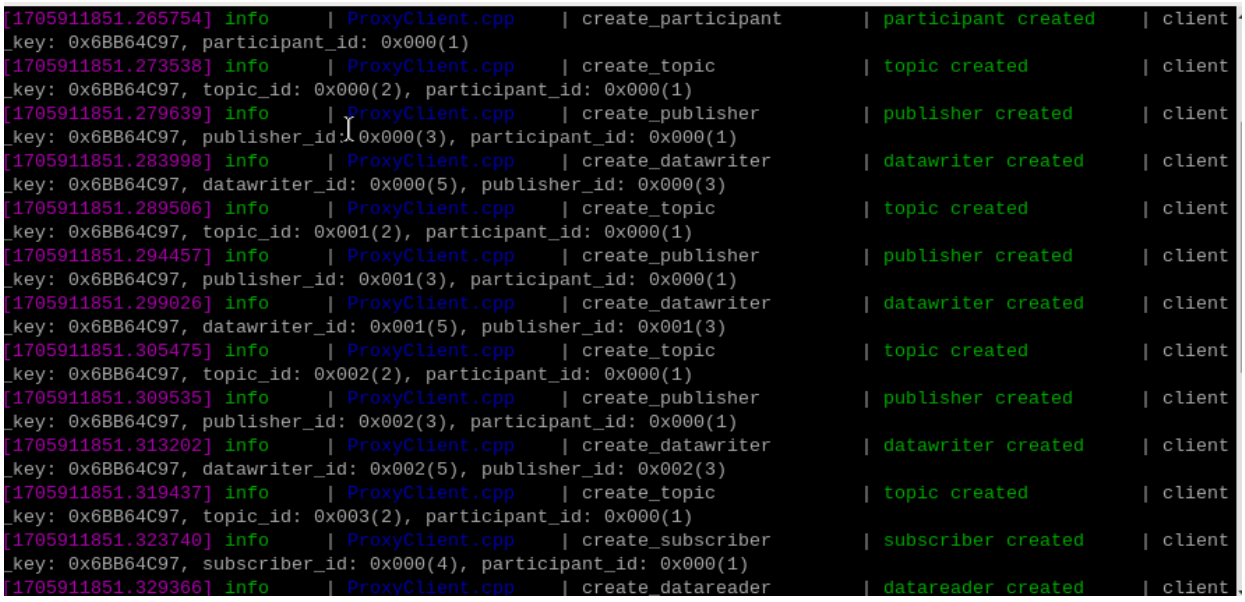
2.1、Start and connect to the agent

After the Raspberry Pi is successfully powered on, open the terminal and enter the following command to open the agent.

```
sh ~/start_agent_rpi5.sh
```



Press the reset button on the microROS control board and wait for the car to connect to the agent. The connection is successful as shown in the figure below.

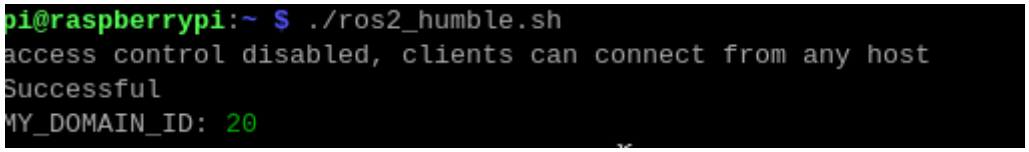


2.2、Enter the car docker

Open another terminal and enter the following command to enter docker.

```
sh ros2_humble.sh
```

When the following interface appears, you have successfully entered docker, and you can now control the car through commands.



3、starting program

Enter the following command in the terminal to start.

```
ros2 run yahboomcar_laser laser_Warning
```

```
root@raspberrypi:~/yahboomcar_ws# ros2 run yahboomcar_laser laser_Warning
improt done
init_pid:  0.1 0.0 0.1
init_pid:  3.0 0.0 5.0
start it
minDist:  1.839
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.838
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.838
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.839
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.839
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.84
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.838
minDistID:  -2.0000063878096133
no obstacles@
minDist:  1.838
minDistID:  -2.0000063878096133
no obstacles@
minDist:  1.839
minDistID:  -1.0000063955559801
no obstacles@
minDist:  1.837
minDistID:  -2.0000063878096133
no obstacles@
```

After the program is started, it will search for the nearest object within the radar scanning range, move the object slowly, and the car will follow the object through rotation.

As shown in the picture above, if the set range is not exceeded, [no obstacles@] will be printed. If an obstacle appears, [----------] will be printed and the buzzer will sound. You can set some parameters through the dynamic parameter adjuster and enter the following commands on the terminal.

```
ros2 run rqt_reconfigure rqt_reconfigure
```

Note: There may not be the above nodes when you first open it. You can see all nodes after clicking Refresh. The displayed laser_Warning is the node of the radar guard.

Description of the above parameters:

- LaserAngle：Radar detection angle
- ResponseDist：tracking distance
- Switch：Function enable switch

After modifying the above parameters, you need to click on the blank space to transfer the parameters into the program.

4、Code analysis

Source code reference path.

```
/root/yahboomcar_ws/src/yahboomcar_laser/yahboomcar_laser
```

laser_Warnning.py，The core code is as follows.

```
#Create a radar subscriber to subscribe to radar data and remote control data and a
speed publisher to publish speed data and a buzzer publisher to publish buzzer
control data.
self.sub_laser = self.create_subscription(LaserScan,"/scan",self.registerScan,1)
self.sub_JoyState = self.create_subscription(Bool,'/JoyState',
self.JoyStateCallback,1)
self.pub_vel = self.create_publisher(Twist,'/cmd_vel',1)
self.pub_Buzzer = self.create_publisher(UInt16,'/beep',1)
# Radar callback function: processes subscribed radar data
ranges = np.array(scan_data.ranges)
minDistList = []
minDistIDList = []
for i in range(len(ranges)):
    angle = (scan_data.angle_min + scan_data.angle_increment * i) * RAD2DEG
#Find the nearest object within the radar detection range according to the set radar
detection angle
if angle > 180: angle = angle - 360
if  abs(angle) < self.LaserAngle and ranges[i] > 0:
    minDistList.append(ranges[i])
```

```
        minDistIDList.append(angle)
    if len(minDistList) != 0:
        minDist = min(minDistList)
        minDistID = minDistIDList[minDistList.index(minDist)]
    else:
        return
    #Based on the position deviation from the tracking object, the angular velocity is
    calculated so that the front of the car is aligned with the object.
    angle_pid_compute = self.ang_pid.pid_compute(minDistID/48, 0)
    if abs(angle_pid_compute) < 0.1:
        velocity.angular.z = 0.0
    else:
        velocity.angular.z = angle_pid_compute
    self.pub_vel.publish(velocity)
    #Determine whether the radar detection distance of the smallest object is less than
    the set range, and then make a judgment whether the buzzer needs to sound.
    if minDist <= self.ResponseDist:
        print("---------------")
        b = UInt16()
        b.data = 1
        self.pub_Buzzer.publish(b)

    else:
        print("no obstacles@")
        b = UInt16()
        b.data = 0
        self.pub_Buzzer.publish(UInt16())
```