Lidar avoid

Note: The virtual machine needs to be in the same LAN as the car, and the ROS_DOMAIN_ID needs to be consistent. You can check [Must read before use] to set the IP and ROS_DOMAIN_ID on the board.

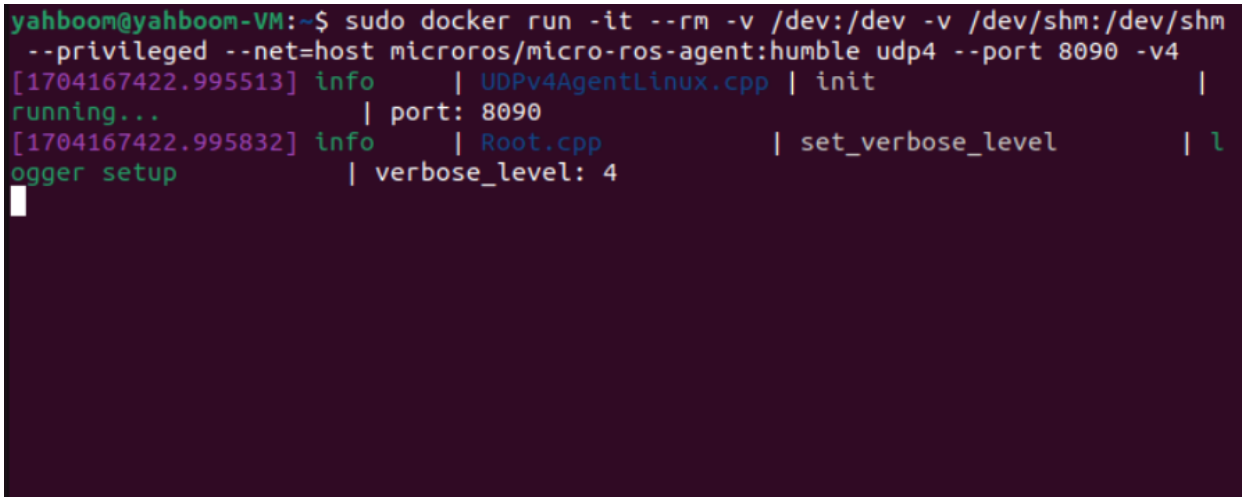
1. Program function description

The car connects to the agent and runs the program. The radar on the car scans whether there are obstacles within the set range. If there are obstacles, it will automatically adjust its speed according to the location of the obstacles to avoid them. Parameters such as the radar detection range and obstacle avoidance detection distance can be adjusted through the dynamic parameter adjuster.

2. Start and connect to the agent

Taking the supporting virtual machine as an example, enter the following command to start the agent:

```
sudo docker run -it --rm -v /dev:/dev -v /dev/shm:/dev/shm --privileged --net=host
microros/micro-ros-agent:humble udp4 --port 8090 -v4
```



Then, turn on the car switch and wait for the car to connect to the agent. The connection is successful, as shown in the figure below.

```
[1702630014.015846] info     | ProxyClient.cpp    | create_participant     | participant created     | client_key: 0x0B62A009, part
icipant_id: 0x000(1)
[1702630014.135363] info     | ProxyClient.cpp    | create_topic           | topic created           | client_key: 0x0B62A009, topi
c_id: 0x000(2), participant_id: 0x000(1)
[1702630014.223689] info     | ProxyClient.cpp    | create_publisher       | publisher created       | client_key: 0x0B62A009, publ
isher_id: 0x000(3), participant_id: 0x000(1)
[1702630014.415510] info     | ProxyClient.cpp    | create_datawriter      | datawriter created      | client_key: 0x0B62A009, data
writer_id: 0x000(5), publisher_id: 0x000(3)
[1702630014.428530] info     | ProxyClient.cpp    | create_topic           | topic created           | client_key: 0x0B62A009, topi
c_id: 0x001(2), participant_id: 0x000(1)
[1702630014.527190] info     | ProxyClient.cpp    | create_publisher       | publisher created       | client_key: 0x0B62A009, publ
isher_id: 0x001(3), participant_id: 0x000(1)
[1702630014.543889] info     | ProxyClient.cpp    | create_datawriter      | datawriter created      | client_key: 0x0B62A009, data
writer_id: 0x001(5), publisher_id: 0x001(3)
[1702630014.554490] info     | ProxyClient.cpp    | create_topic           | topic created           | client_key: 0x0B62A009, topi
c_id: 0x002(2), participant_id: 0x000(1)
[1702630014.737059] info     | ProxyClient.cpp    | create_publisher       | publisher created       | client_key: 0x0B62A009, publ
isher_id: 0x002(3), participant_id: 0x000(1)
[1702630014.755072] info     | ProxyClient.cpp    | create_datawriter      | datawriter created      | client_key: 0x0B62A009, data
writer_id: 0x002(5), publisher_id: 0x002(3)
[1702630014.818985] info     | ProxyClient.cpp    | create_topic           | topic created           | client_key: 0x0B62A009, topi
c_id: 0x003(2), participant_id: 0x000(1)
[1702630014.840001] info     | ProxyClient.cpp    | create_subscriber      | subscriber created      | client_key: 0x0B62A009, subs
criber_id: 0x000(4), participant_id: 0x000(1)
[1702630014.864010] info     | ProxyClient.cpp    | create_datareader      | datareader created      | client_key: 0x0B62A009, data
reader_id: 0x000(6), subscriber_id: 0x000(4)
[1702630014.959908] info     | ProxyClient.cpp    | create_topic           | topic created           | client_key: 0x0B62A009, topi
c_id: 0x004(2), participant_id: 0x000(1)
[1702630015.033537] info     | ProxyClient.cpp    | create_subscriber      | subscriber created      | client_key: 0x0B62A009, subs
criber_id: 0x001(4), participant_id: 0x000(1)
[1702630015.140350] info     | ProxyClient.cpp    | create_datareader      | datareader created      | client_key: 0x0B62A009, data
reader_id: 0x001(6), subscriber_id: 0x001(4)
[1702630015.158510] info     | ProxyClient.cpp    | create_topic           | topic created           | client_key: 0x0B62A009, topi
c_id: 0x005(2), participant_id: 0x000(1)
[1702630015.241039] info     | ProxyClient.cpp    | create_subscriber      | subscriber created      | client_key: 0x0B62A009, subs
criber_id: 0x002(4), participant_id: 0x000(1)
[1702630015.347393] info     | ProxyClient.cpp    | create_datareader      | datareader created      | client_key: 0x0B62A009, data
reader_id: 0x002(6), subscriber_id: 0x002(4)
```

3. Start the program

Enter the following command in the terminal to start:

```
ros2 run yahboomcar_laser laser_Avoidance
```

```
yahboom@yahboom-VM:~$ ros2 run yahboomcar_laser laser_Avoidance
improt done
init_pid:  0.1 0.0 0.1
start it
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
10, no obstacles, go forward
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10, no obstacles, go forward
10, no obstacles, go forward
```
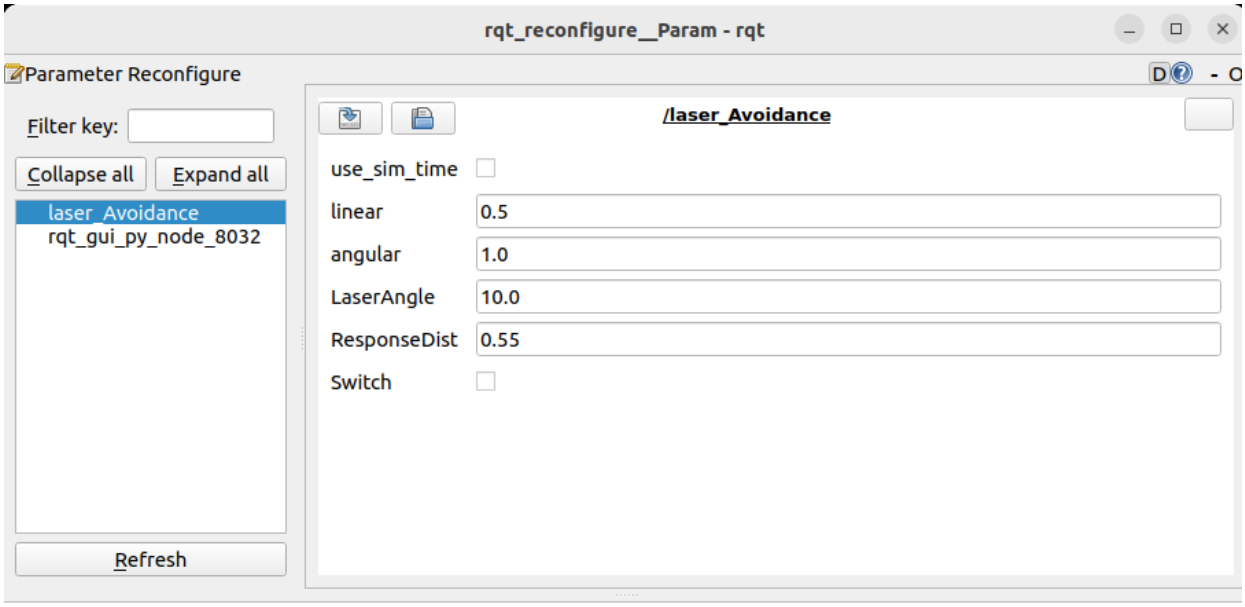

As shown in the picture above, if the radar on the car does not detect an obstacle, it will move forward. Some parameters can be set through the dynamic parameter adjuster and terminal input.

```
ros2 run rqt_reconfigure rqt_reconfigure
```



(System message might be shown here when necessary)

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

The above parameters are described as follows:

- linera：Linear speed
- angular：Angular velocity
- LaserAngle：Radar detection angle
- ResponseDist：Obstacle detection distance. When the detected object is within this range, it is considered an obstacle.
- Switch：Game 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 (taking the supporting virtual machine as an example):

```
/home/yahboom/yahboomcar_ws/src/yahboomcar_laser/yahboomcar_laser
```

laser_Avoidance, 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
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)
#Radar callback function: processes subscribed radar data
ranges = np.array(scan_data.ranges)
for i in range(len(ranges)):
    angle = (scan_data.angle_min + scan_data.angle_increment * i) * RAD2DEG
#Determine whether there are obstacles in front, left or right according to the set
radar detection angle and obstacle detection distance.
if angle > 180: angle = angle - 360
if 20 < angle < self.LaserAngle:
    if ranges[i] < self.ResponseDist*1.5:
        self.Left_warning += 1
if -self.LaserAngle < angle < -20:
    if ranges[i] < self.ResponseDist*1.5:
        self.Right_warning += 1
if abs(angle) <= 20:
    if ranges[i] <= self.ResponseDist*1.5:
        self.front_warning += 1
#According to the detected obstacles, the speed of the car is released so that the
car can avoid the obstacles.
if self.front_warning > 10 and self.Left_warning > 10 and self.Right_warning > 10:
    print ('1, there are obstacles in the left and right, turn right')
    twist.linear.x = self.linear
    twist.angular.z = -self.angular
    self.pub_vel.publish(twist)
    sleep(0.2)

elif self.front_warning > 10 and self.Left_warning <= 10 and self.Right_warning >
10:
    print ('2, there is an obstacle in the middle right, turn left')
    twist.linear.x = self.linear
    twist.angular.z = self.angular
    self.pub_vel.publish(twist)
    sleep(0.2)
.....
```