2.Basic communication

2.1. Node settings

Function package path: ~/transbot_ws/src/transbot_bringup

The functions that Transbot SE needs to implement: car speed control, speed information feedback, robotic arm control, robotic arm status feedback, battery voltage feedback, buzzer control, and pan/tilt control.

The contents of setting the underlying driver node of Transbot SE according to the requirements are as follows:

- Topics

  Publish odometer message【/transbot/get_vel】

  Publish imu message【/transbot/imu】

  Post battery voltage news【/voltage】

  Subscribe to car sports news【/cmd_vel】

  Subscribe to robotic arm control messages【/TargetAngle】

  Subscribe to gimbal servo control messages【/PWMServo】

- Service (client)

  Receive buzzer control message【/Buzzer】

  Receive and feedback the current angle message of the robotic arm【/CurrentAngle】

2.2. View node data

1) Start

jetson/Raspberry Pi 4B

```
roscore
rosrun transbot_bringup transbot_driver.py
```

Raspberry Pi 5

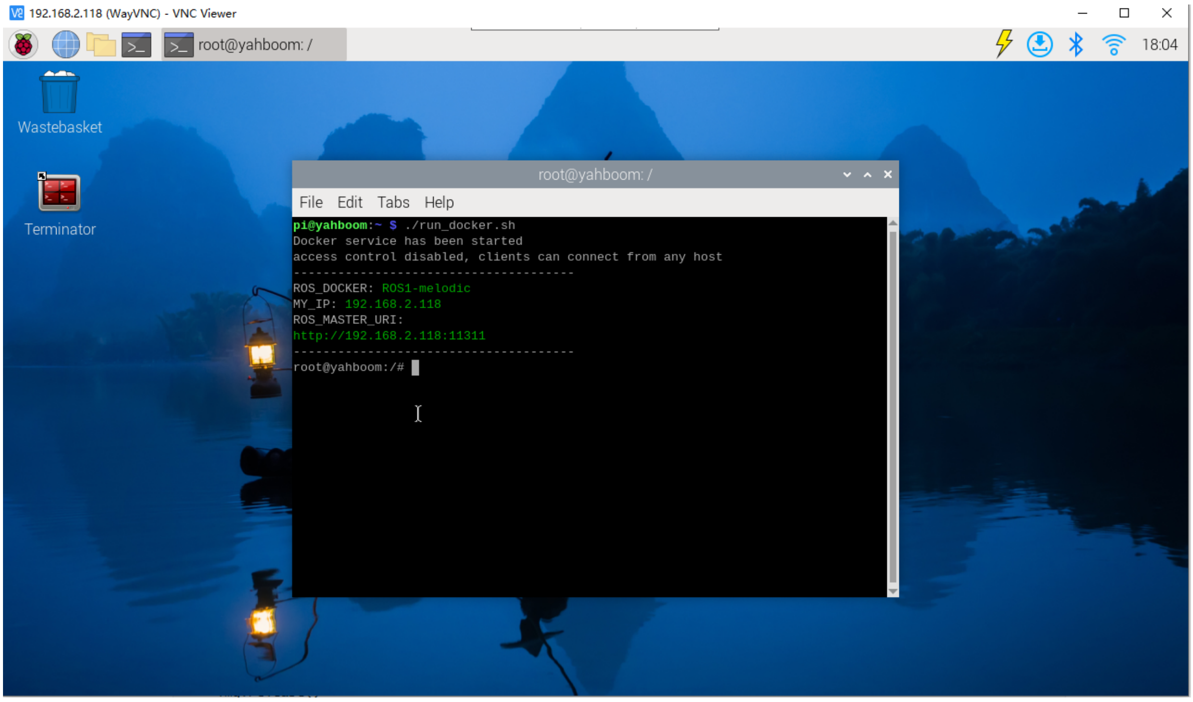
Before running, please confirm that the large program has been permanently closed

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
```



```
pi@yahboom:~ $ ./run_docker.sh
Docker service has been started
access control disabled, clients can connect from any host
--------------------------------------
ROS_DOCKER: ROS1-melodic
MY_IP: 192.168.2.118
ROS_MASTER_URI:
http://192.168.2.118:11311
--------------------------------------
root@yahboom:/#
```

```
roscore
```

Enter the same docker from multiple terminals

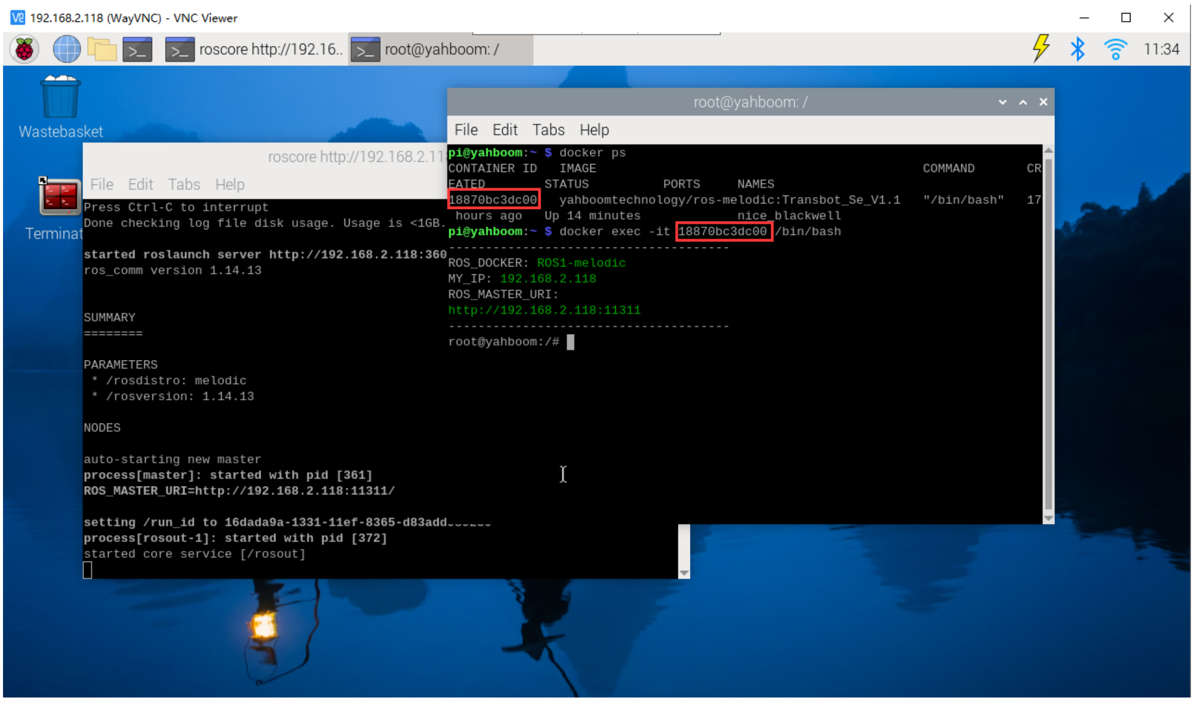
Keep the program of the previous docker terminal running and open a new terminal

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
```



```
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.2.118:360
ros_comm version 1.14.13


SUMMARY
========

PARAMETERS
 * /rosdistro: melodic
 * /rosversion: 1.14.13

NODES

auto-starting new master
process[master]: started with pid [361]
ROS_MASTER_URI=http://192.168.2.118:11311/

setting /run_id to 16dada9a-1331-11ef-8365-d83add
process[rosout-1]: started with pid [372]
started core service [/rosout]
```

```
pi@yahboom:~ $ docker ps
CONTAINER ID   IMAGE                                           COMMAND       CR
EATED          STATUS          PORTS     NAMES
18870bc3dc00   yahboomtechnology/ros-melodic:Transbot_Se_V1.1   "/bin/bash"   17
 hours ago     Up 14 minutes             nice_blackwell
pi@yahboom:~ $ docker exec -it 18870bc3dc00 /bin/bash
-------------------------------------
ROS_DOCKER: ROS1-melodic
MY_IP: 192.168.2.118
ROS_MASTER_URI:
http://192.168.2.118:11311
-------------------------------------
root@yahboom:/#
```

```
rosrun transbot_bringup transbot_driver.py
```

2) View the node graph

jetson motherboard/Raspberry Pi 4B

```
rqt_graph
```

Raspberry Pi 5

Enter the same docker from multiple terminals

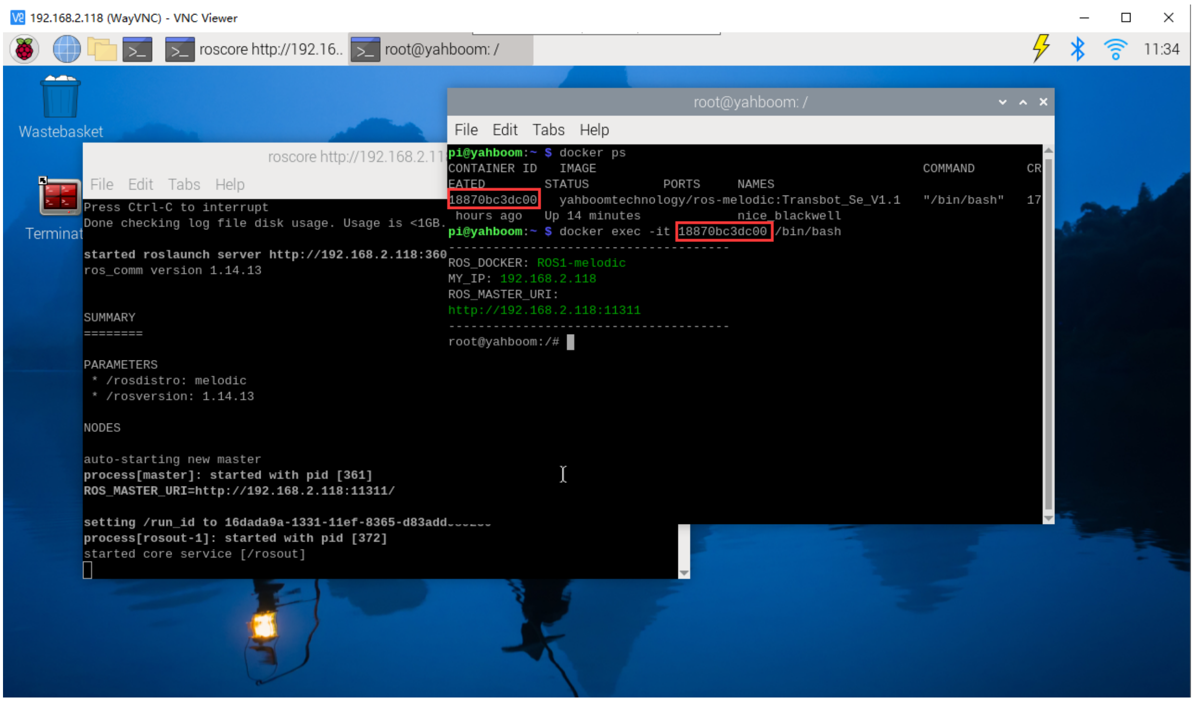
Keep the program of the previous docker terminal running and open a new terminal

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
```



```
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

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```
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CONTAINER ID   IMAGE                                            COMMAND       CR
EATED          STATUS           PORTS     NAMES
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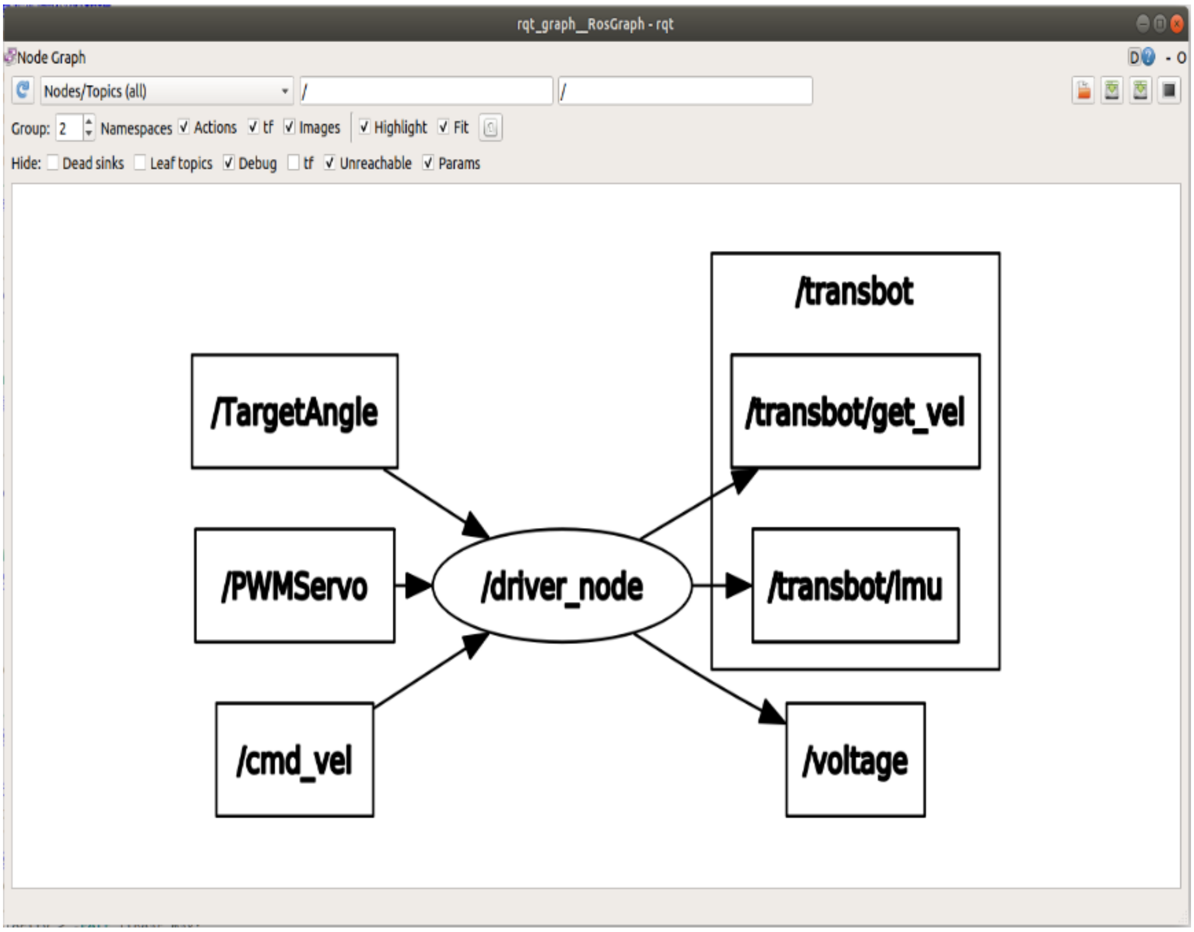
 hours ago     Up 14 minutes              nice_blackwell
pi@yahboom:~ $ docker exec -it 18870bc3dc00 /bin/bash
--------------------------------------
ROS_DOCKER: ROS1-melodic
MY_IP: 192.168.2.118
ROS_MASTER_URI:
http://192.168.2.118:11311
--------------------------------------
root@yahboom:/#
```

```
rqt_graph
```



rqt_graph_RosGraph - rqt

Node Graph

Nodes/Topics (all) / /

Group: 2 ☑ Namespaces ☑ Actions ☑ tf ☑ Images ☑ Highlight ☑ Fit

Hide: □ Dead sinks □ Leaf topics ☑ Debug □ tf ☑ Unreachable ☑ Params

3) View services

jetson motherboard/Raspberry Pi 4B

```
rosservice list
```

Raspberry Pi 5

Enter the same docker from multiple terminals

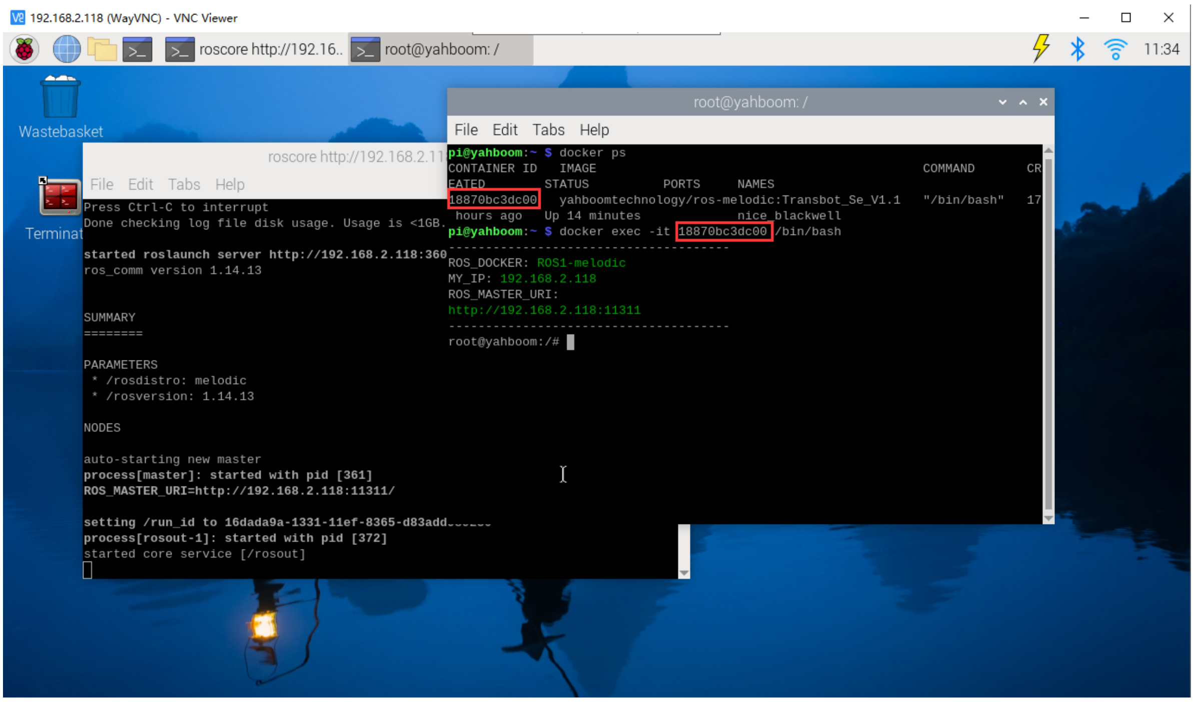
Keep the program of the previous docker terminal running and open a new terminal

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
```



```
Press Ctrl-C to interrupt
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process[master]: started with pid [361]
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setting /run_id to 16dada9a-1331-11ef-8365-d83add......
process[rosout-1]: started with pid [372]
started core service [/rosout]
```

```
pi@yahboom:~ $ docker ps
CONTAINER ID   IMAGE                                               COMMAND       CR
EATED          STATUS           PORTS     NAMES
18870bc3dc00   yahboomtechnology/ros-melodic:Transbot_Se_V1.1    "/bin/bash"   17
 hours ago     Up 14 minutes              nice_blackwell
pi@yahboom:~ $ docker exec -it 18870bc3dc00 /bin/bash
-------------------------------------
ROS_DOCKER: ROS1-melodic
MY_IP: 192.168.2.118
ROS_MASTER_URI:
http://192.168.2.118:11311
-------------------------------------
root@yahboom:/#
```

```
rosservice list
```

Print as follows (mainly used):

```
/Buzzer
/CurrentAngle
/PWMServo
/voltage
... ...
```

Command line publishing service

jetson/Raspberry Pi 4B

```
# buzzer
rosservice call /Buzzer "buzzer: 1" # Turn on the buzzer
rosservice call /Buzzer "buzzer: 0" # Turn off the buzzer
# Get the current angle of the robotic arm
rosservice call /CurrentAngle "apply: 'GetJoint'"
```

Raspberry Pi 5

Enter the same docker from multiple terminals

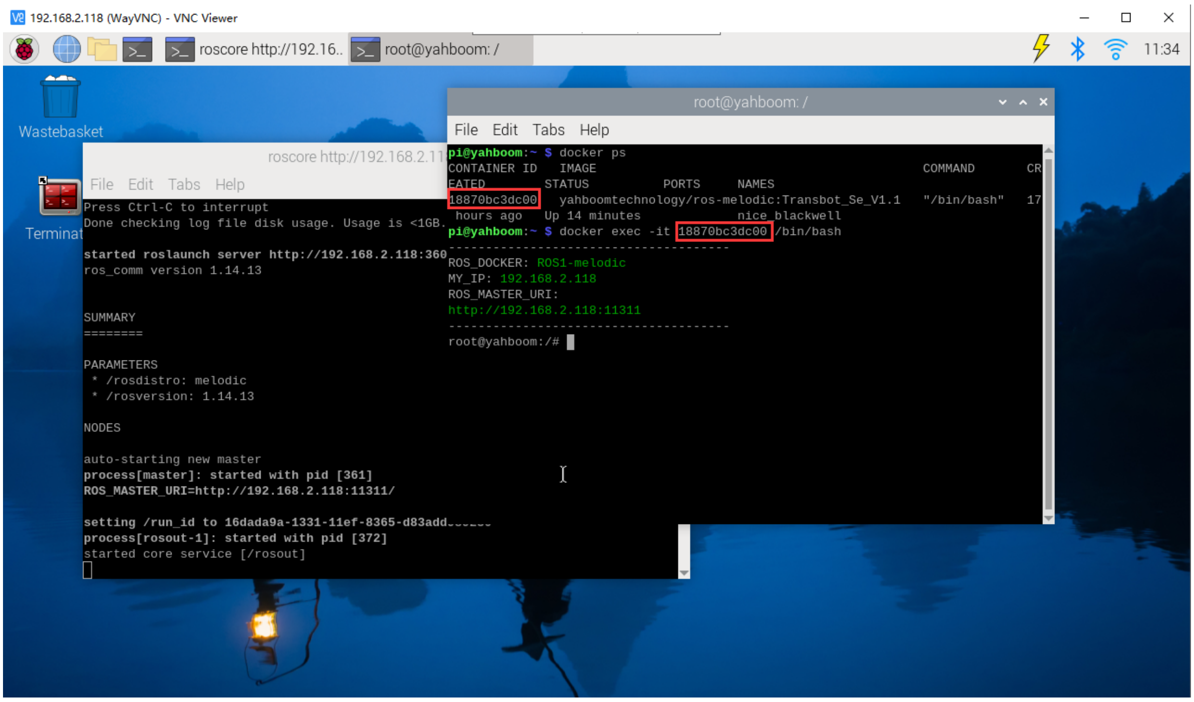
Keep the program of the previous docker terminal running and open a new terminal

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
```



```
pi@yahboom:~ $ docker ps
CONTAINER ID   IMAGE                                              COMMAND       CR
EATED          STATUS           PORTS     NAMES
18870bc3dc00   yahboomtechnology/ros-melodic:Transbot_Se_V1.1   "/bin/bash"   17
 hours ago     Up 14 minutes              nice_blackwell
pi@yahboom:~ $ docker exec -it 18870bc3dc00 /bin/bash
--------------------------------------
ROS_DOCKER: ROS1-melodic
MY_IP: 192.168.2.118
ROS_MASTER_URI:
http://192.168.2.118:11311
--------------------------------------
root@yahboom:/#
```

```
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.2.118:360
ros_comm version 1.14.13


SUMMARY
========

PARAMETERS
 * /rosdistro: melodic
 * /rosversion: 1.14.13

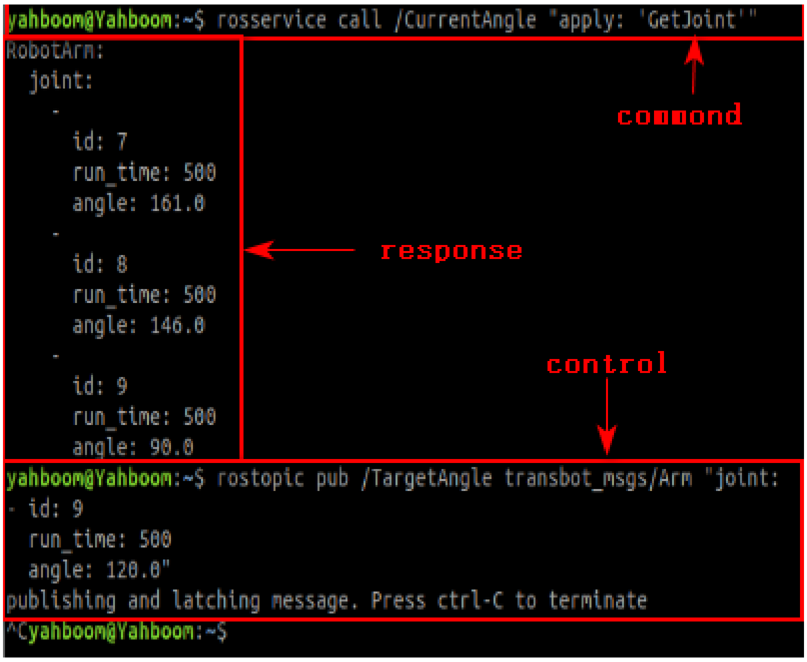
NODES

auto-starting new master
process[master]: started with pid [361]
ROS_MASTER_URI=http://192.168.2.118:11311/

setting /run_id to 16dada9a-1331-11ef-8365-d83add
process[rosout-1]: started with pid [372]
started core service [/rosout]
```

```
# buzzer
rosservice call /Buzzer "buzzer: 1" # Turn on the buzzer
rosservice call /Buzzer "buzzer: 0" # Turn off the buzzer
# Get the current angle of the robotic arm
rosservice call /CurrentAngle "apply: 'GetJoint'"
```

- Robotic arm



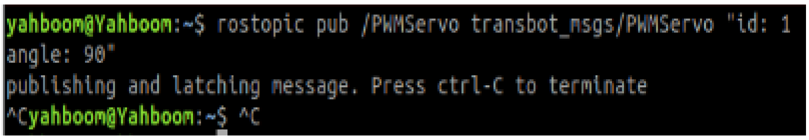
```
yahboom@Yahboom:~$ rosservice call /CurrentAngle "apply: 'GetJoint'"
RobotArm:
  joint:
    -
      id: 7
      run_time: 500
      angle: 161.0
    -
      id: 8
      run_time: 500
      angle: 146.0
    -
      id: 9
      run_time: 500
      angle: 90.0
yahboom@Yahboom:~$ rostopic pub /TargetAngle transbot_msgs/Arm "joint:
- id: 9
  run_time: 500
  angle: 120.0"
publishing and latching message. Press ctrl-C to terminate
^Cyahboom@Yahboom:~$
```

id	corresponding servo	angle range	running time
7	Steering gear connected to the body	[0, 225]	[10, 2000]
8	Section 2 steering gear	[30, 270]	[10, 2000]
9	Gripper servo	[30, 180]	[10, 2000]

Do not copy when issuing control instructions; type by hand and double-click the [Tab] key to complete.

- PTZ control

Control commands, such as the picture below

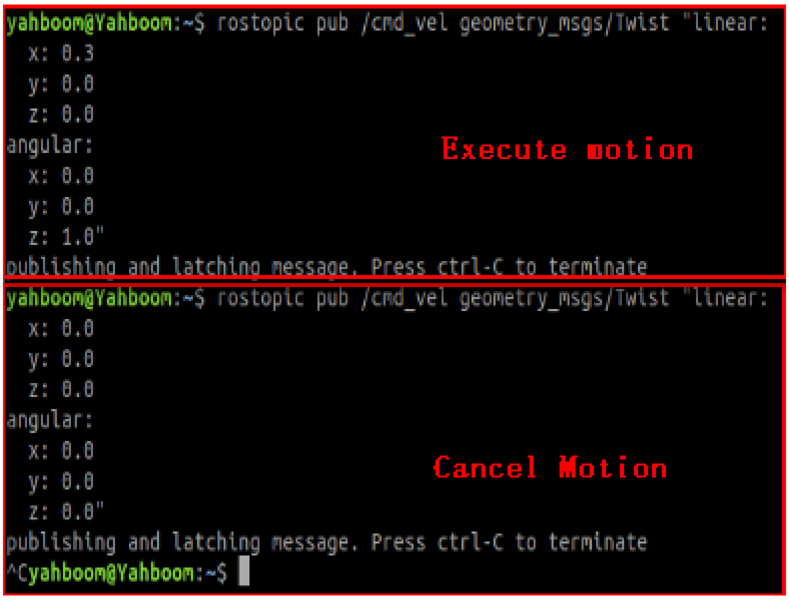


```
yahboom@Yahboom:~$ rostopic pub /PWMServo transbot_msgs/PWMServo "id: 1
angle: 90"
publishing and latching message. Press ctrl-C to terminate
^Cyahboom@Yahboom:~$ ^C
```

id	corresponding servo	angle range	camera
1	Move left and right (X)	[0, 180]	High frame rate
2	Move up and down (Y)	[0, 180]	High frame rate

4) View topic messages

Publish topics from the command line and drive the car



```
yahboom@Yahboom:~$ rostopic pub /cmd_vel geometry_msgs/Twist "linear:
  x: 0.3
  y: 0.0
  z: 0.0
angular:
  x: 0.0
  y: 0.0
  z: 1.0"
publishing and latching message. Press ctrl-C to terminate
```

Execute motion

```
yahboom@Yahboom:~$ rostopic pub /cmd_vel geometry_msgs/Twist "linear:
  x: 0.0
  y: 0.0
  z: 0.0
angular:
  x: 0.0
  y: 0.0
  z: 0.0"
publishing and latching message. Press ctrl-C to terminate
^Cyahboom@Yahboom:~$
```

Cancel Motion

Note: Do not copy and paste; type by hand and double-click the [Tab] key to complete.

Using the rqt_topic tool

jetson motherboard/Raspberry Pi 4B

```
rosrun rqt_topic rqt_topic
```

Raspberry Pi 5

Enter the same docker from multiple terminals

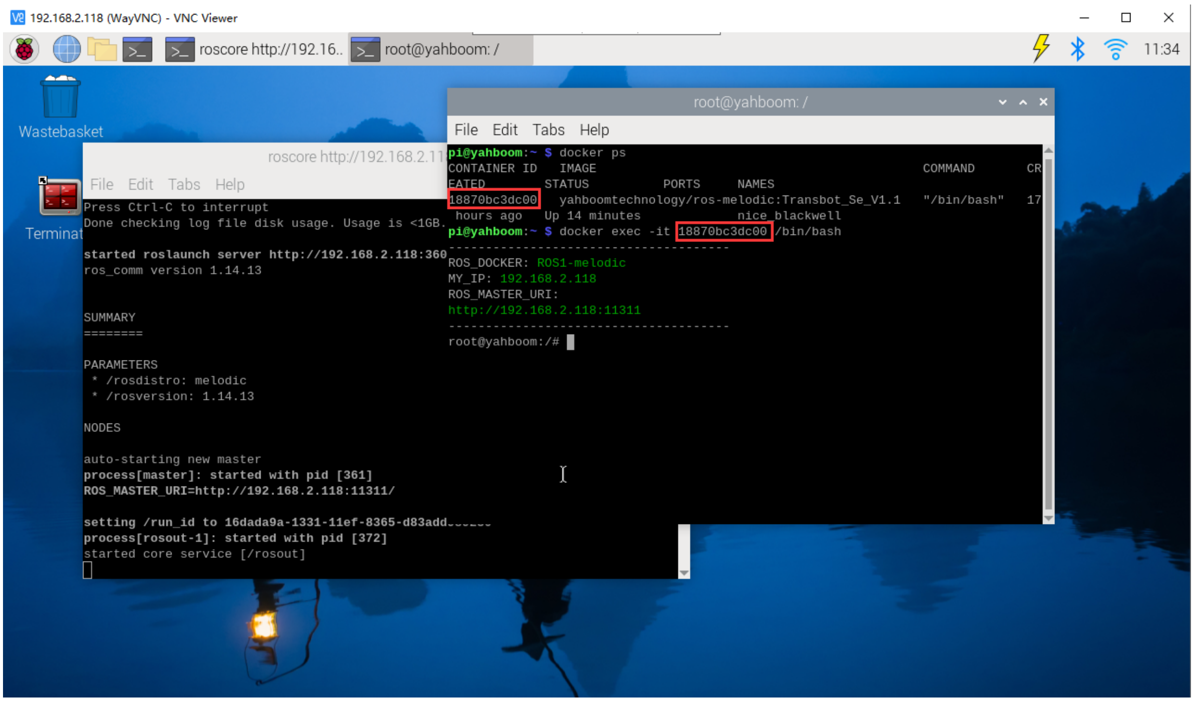
Keep the program of the previous docker terminal running and open a new terminal

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
```



```
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.2.118:360
ros_comm version 1.14.13


SUMMARY
========

PARAMETERS
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NODES

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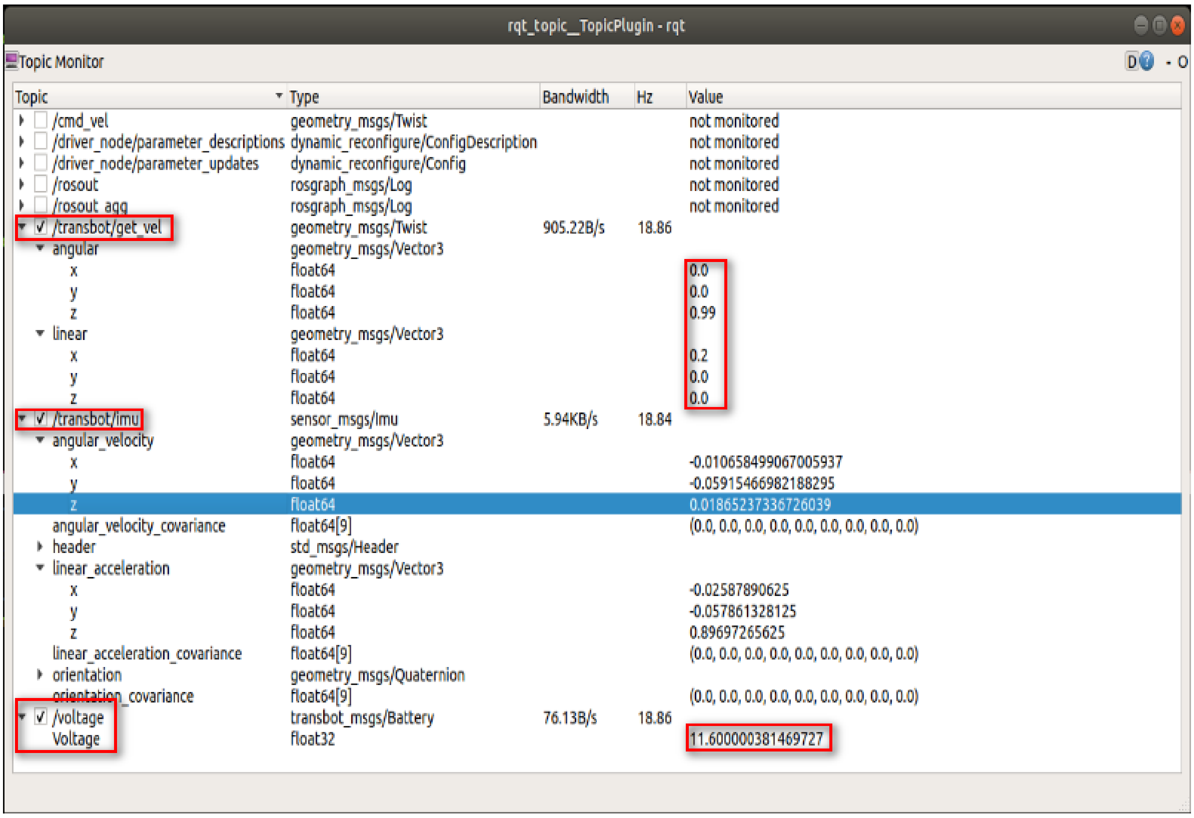
process[rosout-1]: started with pid [372]
started core service [/rosout]
```

```
pi@yahboom:~ $ docker ps
CONTAINER ID   IMAGE                                           COMMAND       CR
EATED          STATUS          PORTS     NAMES
18870bc3dc00   yahboomtechnology/ros-melodic:Transbot_Se_V1.1   "/bin/bash"   17
 hours ago     Up 14 minutes             nice_blackwell
pi@yahboom:~ $ docker exec -it 18870bc3dc00 /bin/bash
-------------------------------------
ROS_DOCKER: ROS1-melodic
MY_IP: 192.168.2.118
ROS_MASTER_URI:
http://192.168.2.118:11311
-------------------------------------
root@yahboom:/# 
```

```
rosrun rqt_topic rqt_topic
```



Topic	Type	Bandwidth	Hz	Value
□ /cmd_vel	geometry_msgs/Twist			not monitored
□ /driver_node/parameter_descriptions	dynamic_reconfigure/ConfigDescription			not monitored
□ /driver_node/parameter_updates	dynamic_reconfigure/Config			not monitored
□ /rosout	rosgraph_msgs/Log			not monitored
□ /rosout_agg	rosgraph_msgs/Log			not monitored
☑ /transbot/get_vel	geometry_msgs/Twist	905.22B/s	18.86	
angular	geometry_msgs/Vector3			
x	float64			0.0
y	float64			0.0
z	float64			0.99
linear	geometry_msgs/Vector3			
x	float64			0.2
y	float64			0.0
z	float64			0.0
☑ /transbot/imu	sensor_msgs/Imu	5.94KB/s	18.84	
angular_velocity	geometry_msgs/Vector3			
x	float64			-0.010658499067005937
y	float64			-0.05915466982188295
z	float64			0.018652373336726039
angular_velocity_covariance	float64[9]			(0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0)
header	std_msgs/Header			
linear_acceleration	geometry_msgs/Vector3			
x	float64			-0.02587890625
y	float64			-0.057861328125
z	float64			0.89697265625
linear_acceleration_covariance	float64[9]			(0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0)
orientation	geometry_msgs/Quaternion			
orientation_covariance	float64[9]			(0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0)
☑ /voltage	transbot_msgs/Battery	76.13B/s	18.86	
Voltage	float32			11.600000381469727

As can be seen from the picture, the data can be printed only by putting a √ mark in the previous box. At this time, the battery voltage is 11.6V; the car's linear velocity and angular velocity decibels are [0.2, 0.99]; and the car's imu information is also available.

5) Dynamic parameter configuration

No adjustments are needed at this time, just for reference.

jetson/Raspberry Pi 4B

```
rosrun rqt_reconfigure rqt_reconfigure
```

Raspberry Pi 5

Enter the same docker from multiple terminals

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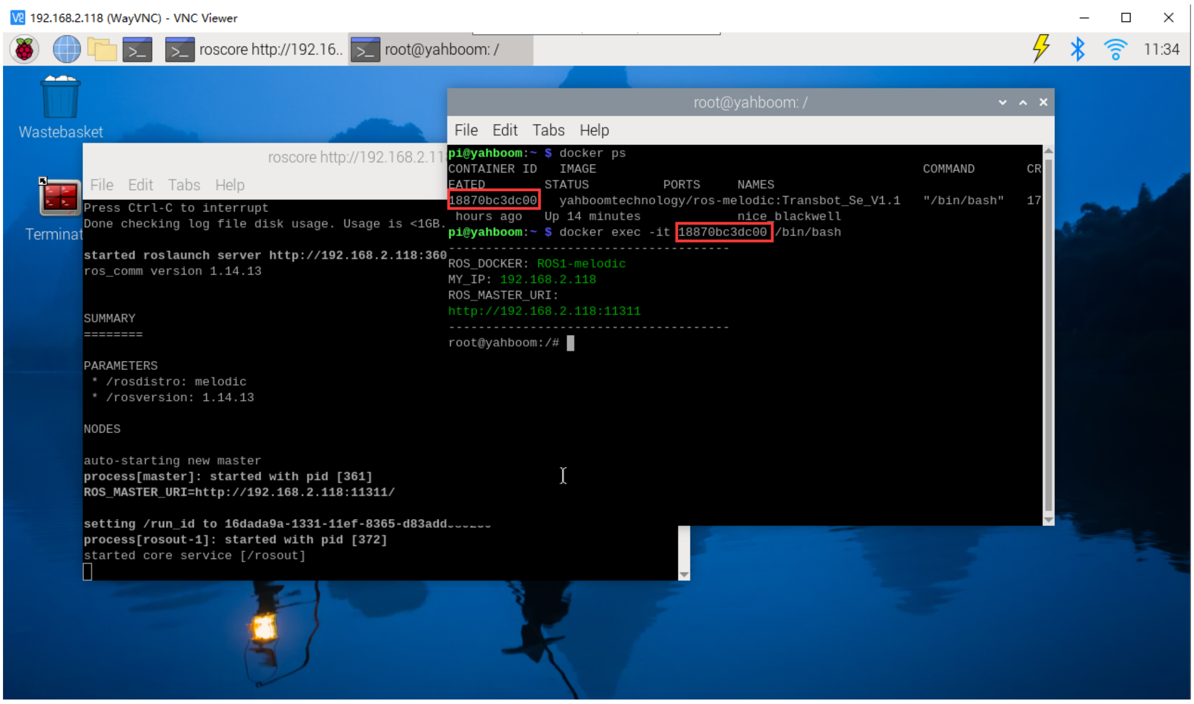
Enter the following command

```
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
```



```
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://192.168.2.118:360
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```

```
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CONTAINER ID   IMAGE                                         COMMAND       CR
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MY_IP: 192.168.2.118
ROS_MASTER_URI:
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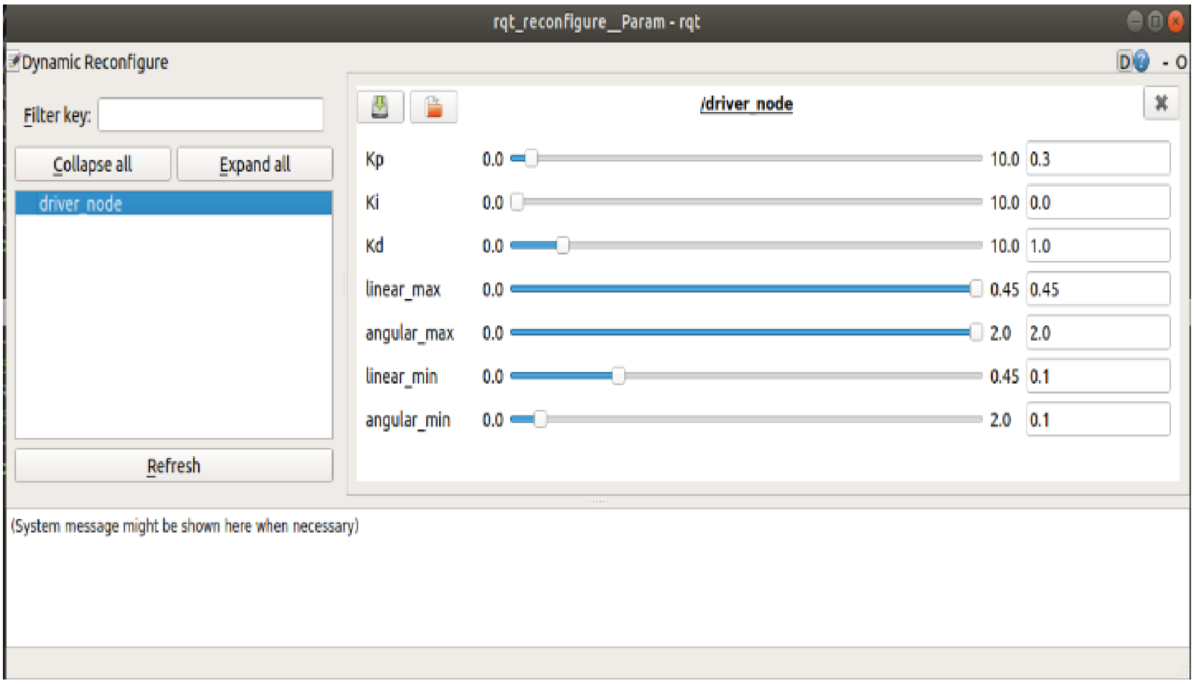
-------------------------------------
root@yahboom:/# 
```

```
rosrun rqt_reconfigure rqt_reconfigure
```



```
Kp           0.0  10.0  0.3
Ki           0.0  10.0  0.0
Kd           0.0  10.0  1.0
linear_max   0.0  0.45  0.45
angular_max  0.0  2.0   2.0
linear_min   0.0  0.45  0.1
angular_min  0.0  2.0   0.1
```

(System message might be shown here when necessary) 【linear_max】: Maximum limit of linear speed

【angular_max】: Maximum limit of angular velocity

【linear_min】: Minimum limit of linear speed

【angular_min】: Minimum limit of angular velocity