3. Robot control

1. Program Function Description

Turn on the chassis, run the handle/keyboard control program, you can use the handle or keyboard to control the movement of the cart, the handle also has a control buzzer, control the lights and other functions.

2. Program code reference path

After entering the docker container, the source code of the joystick control function is located in, take R2 model for example.

```
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_ctrl/yahboomcar_ctrl/yahboom_joy_R2.py
```

Upon entering the docker container, the location of the keyboard control function source code is located at, the

```
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_ctrl/yahboomcar_ctrl/yahboom_keyboard.py
```

3. Program startup

```
#底层驱动
# Underlying drivers
ros2 run yahboomcar_bringup Ackman_driver_R2
#手柄控制
#Joystick control
ros2 run yahboomcar_ctrl yahboom_joy_R2
ros2 run joy joy_node
#键盘控制
# Keyboard control
ros2 run yahboomcar_ctrl yahboom_keyboard
```

It should be noted here that the joystick and keyboard cannot run at the same time, as the keyboard control, when activated, defaults to sending a message of 0 data for speed when the keyboard is not pressed.

3.1. Joystick Control

After opening, press the "START" button, hear the buzzer sound, then you can start the remote control. **The remote control will enter the sleep mode after it has been turned on for a period of time without being used, and you need to press the "START" button to end the sleep**. If you want to **control the trolley operation**, you also need to **press the R2 button**, **release the motion control lock**, before you can use the joystick to control the trolley movement.

Remote control effect description.

Handles	Effects
Left Stick Up/Down	Forward/Backward Straight
Right Stick Left/Right	Front Wheel Left/Right Turn
Right "1" button	Control light effect
Right "2" button	Unlock/Lock motion control
"START" button	Control Buzzer/End Sleep
Left Rocker Down	Adjust Line Velocity Level
Right Rocker Down	Adjust Angular Velocity

3.2. Keyboard Controls

Description of the keys.

- Direction control

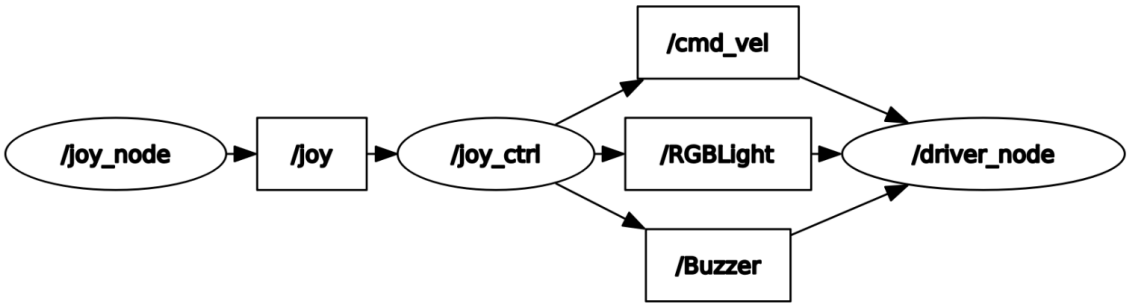
【i】or【I】	【linear，0】	【u】or【U】	【linear，angular】
【,】	【-linear，0】	【o】or【O】	【linear，-angular】
【j】or【J】	【0，angular】	【m】or【M】	【-linear，-angular】
【l】or【L】	【0，-angular】	【.】	【-linear，angular】

- speed control

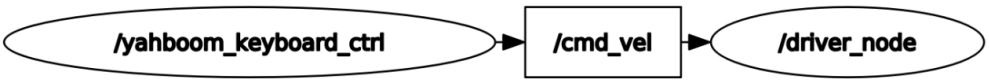
button	speed change	button	speed change
【q】	both linear velocity and angular velocity are increased by 10%	【z】	both linear velocity and angular velocity are decreased by 10%
【w】	only linear speed increased by 10%	【x】	only linear speed decreased by 10%
【e】	the angular velocity is increased by 10% only	【c】	the angular velocity is decreased by 10% only
【t】	line speed X axis /Y axis direction change	【s】	stop keyboard control

3.3. Node Communication

The handle control trolley node communication diagram that



Keypad-controlled trolley node communication diagram that



4. Core Code Analysis

4.1. Handle control code

Take the R2 model as an example, as we said in the previous lesson, the chassis control program, which is also known as Ackman_driver_R2.py, defines three subscribers for speed (/cmd_vel), light band effect (/RGBLight), and buzzer (/Buzzer), so we can control the speed, light band effect (/RGBLight), and buzzer (/Buzzer) by posting that type of topic data in the joystick control code program, yahboom_joy_R2. py can control the velocity, light band, and buzzer just by publishing that type of topic data.

```
#create pub
self.pub_goal = self.create_publisher(GoalID,"move_base/cancel",10)
self.pub_cmdVel = self.create_publisher(Twist,'cmd_vel',  10)
self.pub_Buzzer = self.create_publisher(Bool,"Buzzer",  1)
self.pub_RGBLight = self.create_publisher(Int32,"RGBLight" , 10)
self.pub_JoyState = self.create_publisher(Bool,"JoyState",  10)
```

In addition, we need to subscribe to the "joy" topic data, which tells us which keys (joystick and buttons) have been changed, i.e.

```
#create sub
self.sub_Joy = self.create_subscription(Joy,'joy', self.buttonCallback,10)
```

The main thing to look at is the callback function for this joy topic, which parses the received value, assigns it to the publisher's variable, and finally publishes it.

```
def buttonCallback(self,joy_data):
    if not isinstance(joy_data, Joy): return
    if self.user_name == "root": self.user_jetson(joy_data)
    else: self.user_pc(joy_data)
```

Here the function jumps all self.user_jetson, and the parameter variable passed in is the received topic, the

```
def user_jetson(self, joy_data):
```

To analyze the example of controlling a buzzer, the

```
if joy_data.buttons[11] == 1:
    Buzzer_ctrl = Bool()
    self.Buzzer_active=not self.Buzzer_active
    Buzzer_ctrl.data =self.Buzzer_active
    for i in range(3): self.pub_Buzzer.publish(Buzzer_ctrl)
```

If **joy_data.buttons[11] == 1** i.e. if "start" is pressed, then the value of the buzzer will be changed and published **self.pub_Buzzer.publish(Buzzer_ctrl)** . The others are in order, the principle is the same, they are all assigning values by **detecting the change of key value**. Refer to yahboom_joy_R2.py for detailed code.

4.2. Keyboard Control Code

Keyboard control can only control the motion control of the cart, it cannot control the cart's light strip and buzzer, therefore, there is only one /cmd_vel speed publisher that

```
self.pub = self.create_publisher(Twist,'cmd_vel',1)
```

The program also defines two dictionaries to detect changes in the keyboard when letters are pressed, the

```
moveBindings = {
    'i': (1, 0),
    'o': (1, -1),
    'j': (0, 1),
    'l': (0, -1),
    'u': (1, 1),
    ',': (-1, 0),
    '.': (-1, 1),
    'm': (-1, -1),
    'I': (1, 0),
    'O': (1, -1),
    'J': (0, 1),
    'L': (0, -1),
    'U': (1, 1),
    'M': (-1, -1),
}

speedBindings = {
    'Q': (1.1, 1.1),
    'Z': (.9, .9),
    'W': (1.1, 1),
```

```
    'X': (.9, 1),
    'E': (1, 1.1),
    'C': (1, .9),
    'q': (1.1, 1.1),
    'z': (.9, .9),
    'w': (1.1, 1),
    'x': (.9, 1),
    'e': (1, 1.1),
    'c': (1, .9),
}
```

Entering a while loop, the program reads the value of the keyboard press and then makes a layer upon layer of judgment that

```
key = yahboom_keyboard.getKey()
if key=="t" or key == "T": xspeed_switch = not xspeed_switch
elif key == "s" or key == "S":
...
if key in moveBindings.keys():
...
elif key in speedBindings.keys():
..
```

Finally, assign to twist.linear.x, twist.linear.y, twist.angular.z based on the multi-layer judgment and post it.

```
if xspeed_switch: twist.linear.x = speed * x
else: twist.linear.y = speed * x
twist.angular.z = turn * th
if not stop: yahboom_keyboard.pub.publish(twist)
if stop:yahboom_keyboard.pub.publish(Twist())
```

Refer to yahboom_keyboard.py for detailed code.