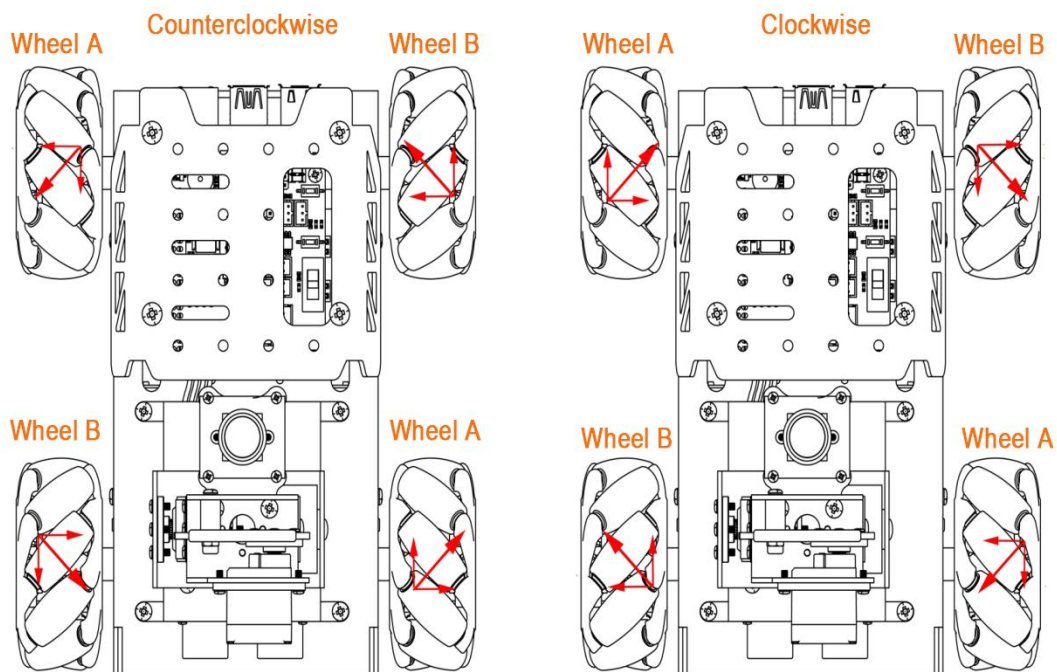# Lesson 4 Turn

1. Working Principle

According to characteristic of mecanum wheel, only when two left wheels rotate in reverse and two right wheels rotate forward, car turns counterclockwise on the spot. When two left wheels rotate forward and two right wheels rotate in reverse, car turns clockwise on the spot. The analysis of force is as pictured.

2. Operation Steps

The input command should be case sensitive. Keywords can be complemented by "**Tab**" key.

1) Start TurboPi. Connect to robot system desktop through VNC. For how to operate, refer to the file in "**3. Assembly and Debugging\Lesson 3 Remote Desktop Installation and Connection**".
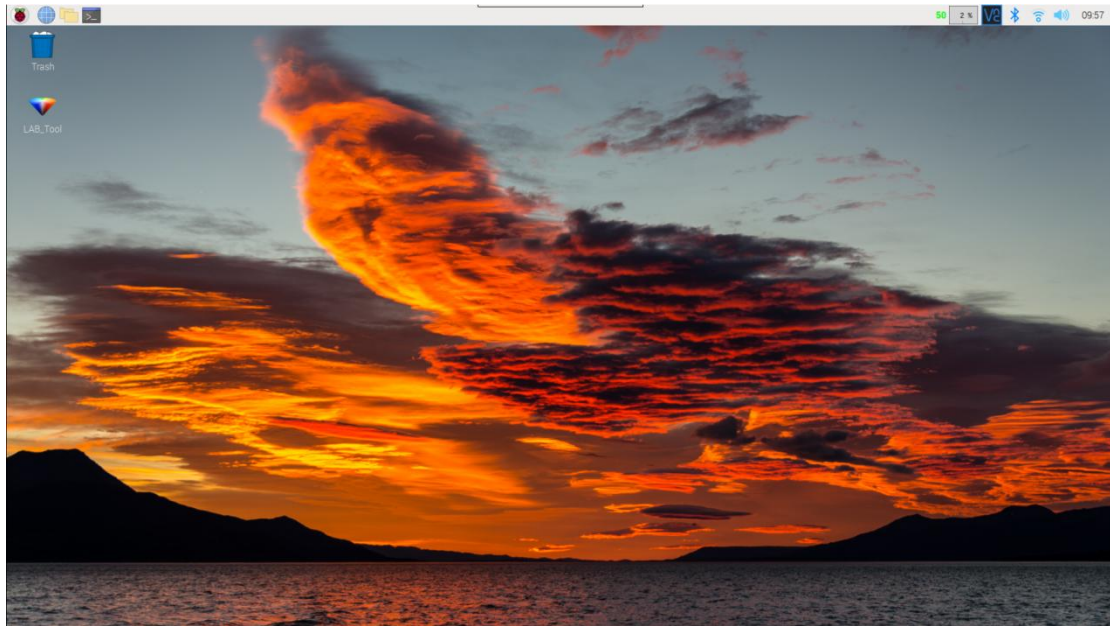
2) Click or press "**Ctrl+Alt+T"** to enter the LX terminal.

3) Input command "**cd TurboPi/MecanumControl/**" and press Enter to enter the catalog where game programs are stored.

4) Input command "**sudo python3 Car_Turn_Demo.py**" and press Enter to start the game.

5) If you need to stop this game, you can press "**Ctrl+C**". If the game cannot

be closed, you can try again.

3. Program Outcome

After game starts, TurboPi turns clockwise on the spot first, and then turns counterclockwise on the spot.
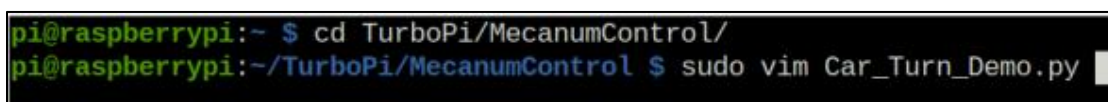
4. Function Extension

The default turning speed is 0.3. You can change the turning speed in the program. For example, 0.5.

1) Click [>_] or press "**Ctrl+Alt+T**" to open LX terminal.

2) Input command "**cd TurboPi/MecanumControl/**" and press Enter to enter the directory where game programs are stored.

3) Input command "**sudo vim Car_Turn_Demo.py**" and press Enter to open program file.

4) Press "I" key to modify the content as pictured. When "INSERT" appears, you can start editing.

```
40 if __name__ == '__main__':
41     while start:
42         chassis.set_velocity(0,90,0.3)# 顺时针旋转,控制机器人移动函数,线速度0(0~
   100),方向角90(0~360),偏航角速度0.3(-2~2) Clockwise turning. Movement control
   function. The linear velocity is 50 (0~100). The direcion angle is 180 (0-350).
   The jaw velocity is 0.3 (-2~2).
43         time.sleep(3)
44         chassis.set_velocity(0,90,-0.3)# 逆时针旋转 Counterclockwise turning
45         time.sleep(3)
46     chassis.set_velocity(0,0,0)  # 关闭所有电机 Turn off all motors
47     print('Closed')
48
49
```
```
- 插入 --                                              37,1        底端
```

5) The third parameter of "**set_velocity()**" function is turning speed. Change it to 0.5. After modification, press Esc, input ":wq", and then press Enter to save and close the program file.

```
40 if __name__ == '__main__':
41     while start:
42         chassis.set_velocity(0,90,0.5)# 顺时针旋转,控制机器人移动函数,线速度0(0~
   100),方向角90(0~360),偏航角速度0.3(-2~2) Clockwise turning. Movement control
   function. The linear velocity is 50 (0~100). The direcion angle is 180 (0-350).
   The jaw velocity is 0.3 (-2~2).
43         time.sleep(3)
44         chassis.set_velocity(0,90,-0.3)# 逆时针旋转 Counterclockwise turning
45         time.sleep(3)
46     chassis.set_velocity(0,0,0)  # 关闭所有电机 Turn off all motors
47     print('Closed')
48
49
```
```
:wq
```

Note: please adjust the speed between -2.0 and 2.0. When the parameter is positive number, TurboPi turns clockwise. When it is negative number, TurboPi turns counterclockwise. We recommend you to increase or decrease the parameter by small number.

5. Program Analysis

The program is stored in **/home/pi/TurboPi/MecanumControl/**

Car_Turn_Demo.py

```python
30  def Stop(signum, frame):
31      global start
32
33      start = False
34      print('关闭中...')
35      chassis.set_velocity(0,0,0)  # 关闭所有电机 Turn off all motors
36
37
38  signal.signal(signal.SIGINT, Stop)
39
40  if __name__ == '__main__':
41      while start:
42          chassis.set_velocity(0,90,0.3)# 顺时针旋转,控制机器人移动函数,线速度0(0~100),
43          time.sleep(3)
44          chassis.set_velocity(0,90,-0.3)# 逆时针旋转 Counterclockwise turning
45          time.sleep(3)
46      chassis.set_velocity(0,0,0)  # 关闭所有电机 Turn off all motors
47      print('Closed')
```

set_velocity function is mainly used to control motor. This function has three parameters. Take "**chassis.set_velocity(0,90,0.3)**" as example.

1) The first parameter "**0**" is motor linear velocity ranging from -100 to 100 mm/s. When the value is negative number, motor rotates in reverse.

2) The second parameter "**90**" is movement direction of car. It ranges from 0 to 360 degree. 90 degrees corresponds to front, 270 degree corresponds to back, 0 degree corresponds to right and 180 degree corresponds to left.

3) The third parameter "**0.3**" is yaw rate ranging from -2.0 to 2.0. 0 means that there is no angular velocity. When the value is positive number, car rotates clockwise. When it is negative number, car rotates counterclockwise. The greater the absolute value, the faster the car moves.