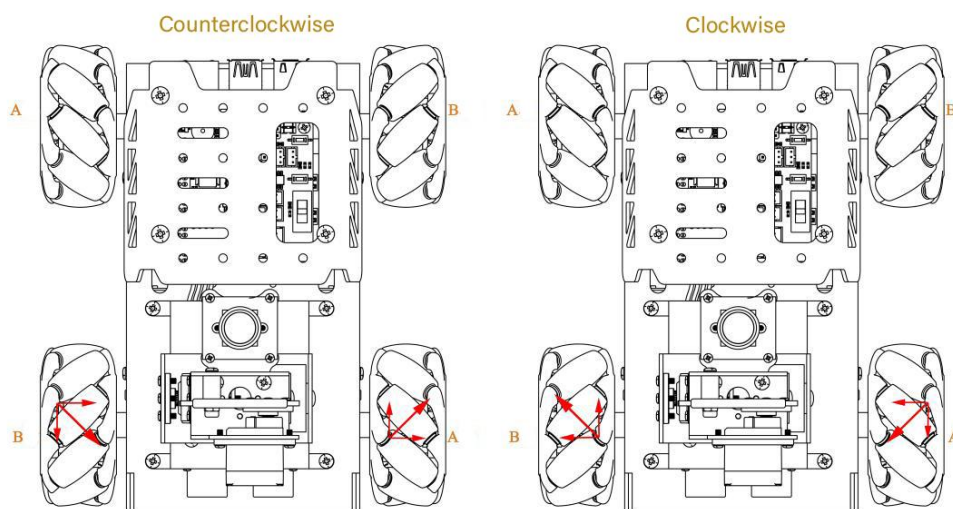


Lesson 6 Drifting Movement

1. Working Principle

According to the characteristic of mecanum wheel characteristics, when the front two wheels do not move, the rear wheel A rotates clockwise and the rear wheel B rotates counterclockwise, the car drift clockwise. The force analysis for car drifting is shown in the following figure:



According to physical kinematics, when forces are equal and opposite to each other, they will counteract each other. Any force can be decomposed into two perpendicular vectors. Take counterclockwise drifting as example. Suppose the speed of wheel A and wheel B rotates at the same speed, a upward force decomposed by wheel A and a downward force decomposed by wheel B will counteract each other, which the direction of resultant velocity is to the right.

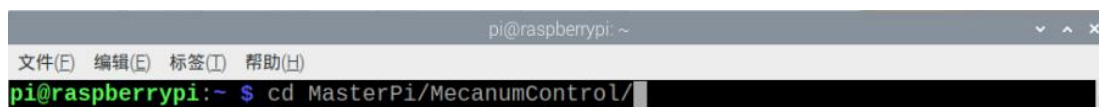
Based on Newton's second law ($F=ma$), if the direction of acceleration is to the right, so the final resultant force is also to the right. At this time, if the front wheel does not move, the car will drift.

2. Operation Steps

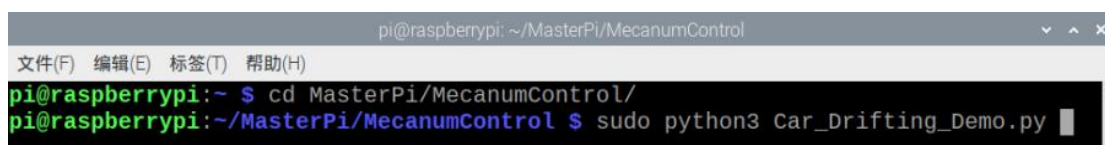
i The entered command should be case sensitive and “Tab” key can be used to fill in keyword.

1) Click  to enter the LX terminal.

2) Enter “cd MasterPi/MecanumControl/” command to come to the directory of game programmings.



3) Enter “sudo python3 Car_Drifting_Demo.py” command and press “Enter” to start game.



4) If want to exit the game, you can press “Ctrl+C”. If fail to exit, please try multiple times.

3. Project Outcome

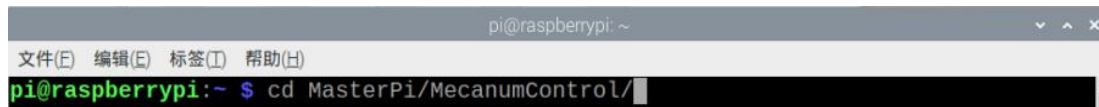
After starting game, MasterPi will drift clockwise first, then counterclockwise.

4. Function Extension

The default speed of rotation is 0.3. This section will modify the rotation speed of clockwise drifting to 0.5 and the specific operation steps are as follow:

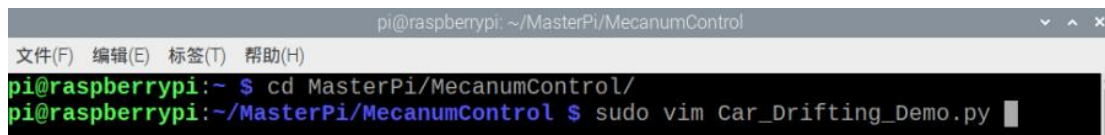
1) Click  to enter the LX terminal.

2) Enter “cd MasterPi/MecanumControl/” command and press “Enter” to come to the directory of game programmings.



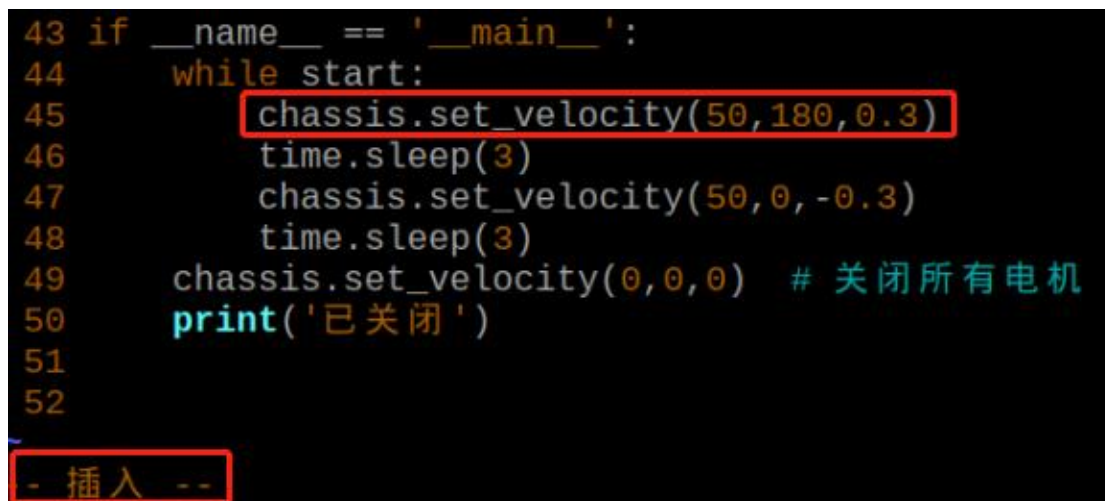
```
pi@raspberrypi: ~  
文件(E) 编辑(E) 标签(T) 帮助(H)  
pi@raspberrypi:~ $ cd MasterPi/MecanumControl/
```

3) Enter “sudo vim Car_Drifting_Demo.py” command and press “Enter” to open the program file.



```
pi@raspberrypi: ~/MasterPi/MecanumControl  
文件(F) 编辑(E) 标签(T) 帮助(H)  
pi@raspberrypi:~ $ cd MasterPi/MecanumControl/  
pi@raspberrypi:~/MasterPi/MecanumControl $ sudo vim Car_Drifting_Demo.py
```

4) Find the code to be modified and press “i” to enter the editing mode.



```
43 if __name__ == '__main__':  
44     while start:  
45         chassis.set_velocity(50,180,0.3)  
46         time.sleep(3)  
47         chassis.set_velocity(50,0,-0.3)  
48         time.sleep(3)  
49         chassis.set_velocity(0,0,0) # 关闭所有电机  
50         print('已关闭')  
51  
52  
- 插入 -
```

5) In “set_velocity” function, the first parameter represents the rotation speed of the car and we modify it to 0.5. After modifying, press “Esc” and enter “:wq”, and then press “Enter” to save and exit.

```

43 if __name__ == '__main__':
44     while start:
45         chassis.set_velocity(50,180,0.5)
46         time.sleep(3)
47         chassis.set_velocity(50,0,-0.3)
48         time.sleep(3)
49         chassis.set_velocity(0,0,0) # 关闭所有电机
50         print('已关闭')
51
52
:wq

```

Note: The adjustable range of speed is from -2 to 2. When the value is positive, the car will rotate clockwise. When the value is negative, the car will rotate counterclockwise. It is recommended to adjust the value slightly.

5. Program Analysis

The source code of program is located in:
/home/pi/MasterPi/MecanumControl/Car_Drifting_Demo.py

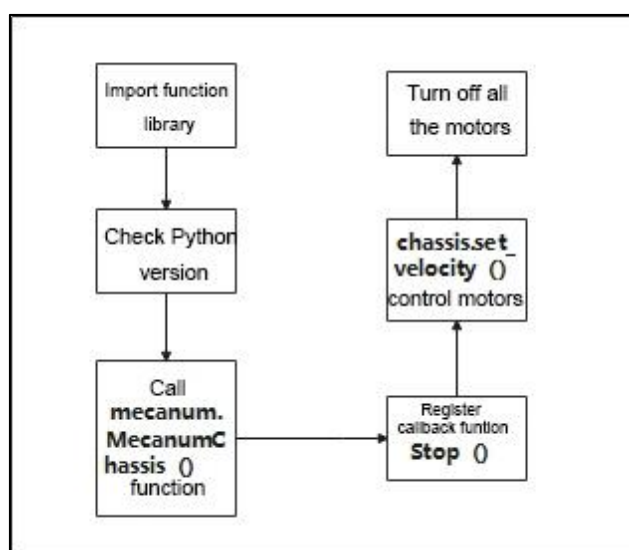
5.1 Import Parameter Module

Import module	Function
import sys	Importing the Python sys module is used for getting access to the relevant function and variables
import time	Importing the Python time module is used for time-related functionalities, such as delay operations.

import signal	The receiving and processing of the signal
HiwonderSDK.mecanum	The control module related to mecanum wheel chassis

5.2 Program Logic and Corresponding Code Analysis

The diagram of program logic refers to the below figure.



From the above figure, the program's logical flow is mainly divided into importing the function library, calling relevant functions, and controlling the motors. The following documentation will be written based on the program's logical flowchart mentioned above.

◆ Import Function Library

During initialization, the function library needs to be first imported for subsequent calling. For the detailed content of importing, please refer to “**3.1 Import Parameter Module**”.

```

3 import sys
4 sys.path.append('/home/pi/MasterPi/')
5 import time
6 import signal
7 import HiwonderSDK.mecanum as mecanum

```

◆ Check Python Version

```

9 if sys.version_info.major == 2:
10     print('Please run this program with python3!')
11     sys.exit(0)

```

`sys.version_info.major` is used to check the major version of Python. If the version is equal to 2, the program will print a message and exit the program.

◆ Call the `mecanum.MecanumChassis()` Function

```

26 chassis = mecanum.MecanumChassis()

```

The call to `mecanum.MecanumChassis()` constructor creates an object of the `MecanumChassis` class and assigns it to the `chassis` variable.

◆ Motor Control

```

43 if __name__ == '__main__':
44     while start:
45         chassis.set_velocity(50,180,0.3)
46         time.sleep(3)
47         chassis.set_velocity(50,0,-0.3)
48         time.sleep(3)
49         chassis.set_velocity(0,0,0) # 关闭所有电机
50         print('已关闭')
51

```

Control motor through `set_velocity` function. There are three parameters in function. This is an example of the code “`chassis.set_velocity(50,90,0)`” as an example:

- 1) The first parameter “50” represents the motor speed, its unit is mm/s and it ranges from -100 to 100. When the value is negative, the motor rotates counterclockwise.
- 2) The second parameter “180” represents the movement direction of car, its

unit is degree and it ranges from 0 to 360. The value of 90° refer to move forward. 270° refers to move backward. 0° refers to move to the right. 180° refers to move the left. Other movement directions are obtained according to the same reference method.

3) The third parameter "**0.3**" represents the rotation speed of the car, its unit is $5^{\circ}/s$ and it ranges from -2 to 2. When the parameter value is positive, the car will rotate clockwise. When the parameter value is negative, the car will rotate counterclockwise.