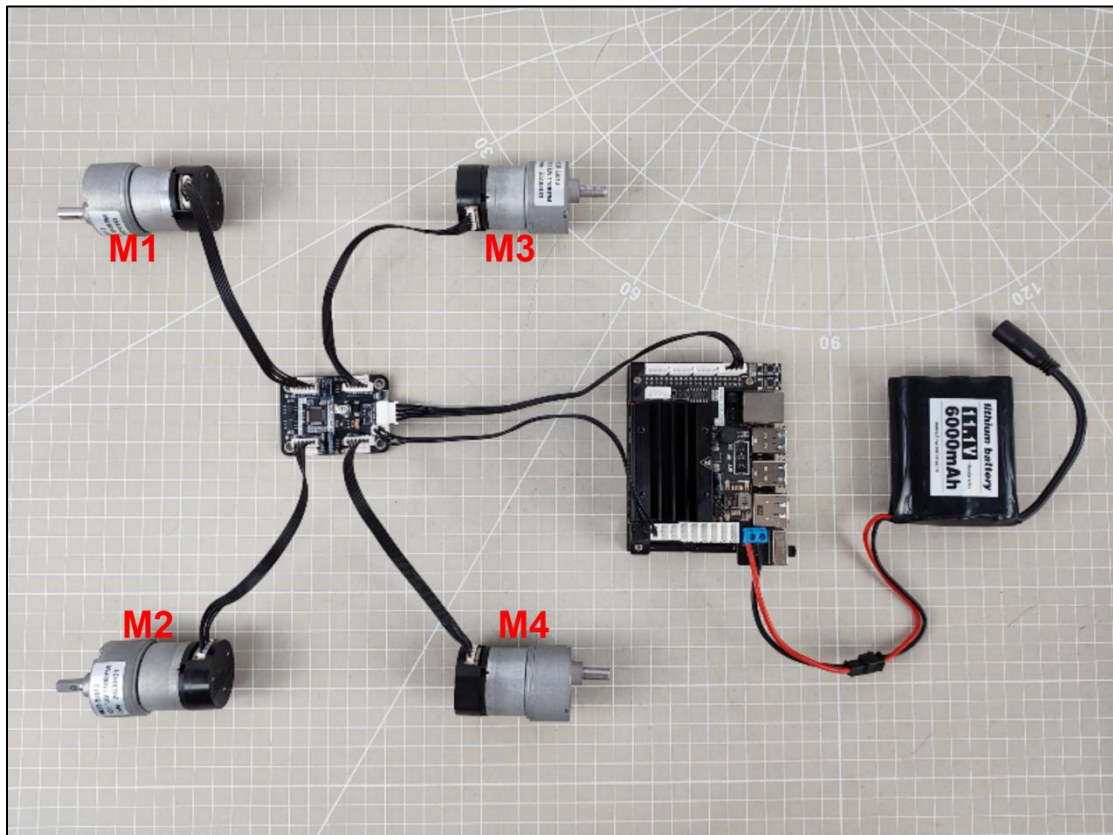


Jetson Nano Development

This lesson employs the Mecanum chassis for control demonstration. It is applicable to Jetson Nano.

1. Hardware Connection

Before calling the program, connect the 4-ch encoder motor driver to the Jetson Nano. The specific connection method is shown below:




2. Program Download



The entered command should be case sensitive. The "Tab" key on the keyboard can be used to complete the keywords.

1) Enable the Jetson Nano controller. Connect it to the NoMachine software. Please refer to the "03 Software Tool" in the same path as this lesson to connect.

2) Double-click  on the system desktop to open the command line terminal.

3) Enter the command "sudo systemctl stop start_app_node.service". Press "Enter" to close the app.

```
jetauto@jetauto-desktop:~$ sudo systemctl stop start_app_node.service
```

4) Enter the command "roslaunch jetauto_controller jetauto_controller.launch" to start the app control.

```
jetauto@jetauto-desktop:~$ roslaunch jetauto_controller jetauto_controller.launch
```

5) Open a new terminal. Enter the command "rostopic pub /jetauto_controller/cmd_vel geometry_msgs/Twist "linear:". Then, press the "TAB" to automatically complete the parameters.

```
jetauto@jetauto-desktop:~$ rostopic pub /jetauto_controller/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"
```

The "linear" parameter sets the linear velocity. The "angular" parameter sets the angular velocity.

Use the left and right arrow keys to modify the corresponding parameters. For example, set the M1 to M4 motors to rotate clockwise, modify the value of the linear velocity "X" to "0.3". Press "Enter" to execute.

```
jetauto@jetauto-desktop:~$ rostopic pub /jetauto_controller/cmd_vel geometry_msgs/Twist "linear:
x: 0.3
y: 0.0
z: 0.0
angular:
x: 0.0
y: 0.0
z: 0.0"
```

Note: The unit of the parameter is meters per second. The recommended range is between -0.6 and 0.6.

6) If you want to exit the program, press "Ctrl+C" in the terminal interface. If it fails to close, try again.

7) After closing the program, enter the command "sudo systemctl start start_app_node.service" to start the app auto-start service.

```
jetauto@jetauto-desktop:~$ sudo systemctl start start_app_node.service
jetauto@jetauto-desktop:~$
```

8) Once the startup is complete, the buzzer will sound a short beep.

Note: If the app auto-start service is not started, it will affect the normal implementation of the corresponding program. If you restart the Mecanum chassis, the APP auto-start service will also be restarted if the command for auto-start is not entered.

3. Program Outcome

After starting the program, M1 to M4 motors will rotate clockwise at a speed of 0.3 meters per second.

4. Program Analysis

◆ Subscribe motion control node

Subscribe to the topic messages published by the "jetauto_controller" node to obtain data related to movement.

```
25 rospy.Subscriber('jetauto_controller/cmd_vel', Twist, self.cmd_vel_callback)
26 rospy.Subscriber('cmd_vel', Twist, self.app_cmd_vel_callback)
```

◆ Load parameter

Load the linear velocity and angular velocity parameters from the command.

```
22 self.linear_factor = rospy.get_param('~linear_correction_factor', 1.00)
23 self.angular_factor = rospy.get_param('~angular_correction_factor', 1.00)
```

```
48 linear_x = self.linear_factor*msg.linear.x
49 linear_y = self.linear_factor*msg.linear.y
50 angular_z = self.angular_factor*msg.angular.z
```

For the linear velocity "linear", only the X and Y values are needed. If X is not 0

and Y is 0, the four motors will rotate clockwise and counterclockwise. Counterclockwise if X is negative; clockwise if it is positive. If X is 0 and Y is not 0, the rotation direction of M2 and M3 motors is opposite to that of M1 and M4 motors. The unit of linear velocity is meters per second, and the range is between "-0.7" and "0.7".

For the angular velocity "angular", only the Z value is needed. If Z is positive, M1 and M2 motors rotate in counterclockwise and M3 and M4 motors rotate clockwise. If Z is negative, the opposite happens. There is no X and Y direction. The unit of angular velocity is radians per second, and the recommended range is between "-3.5" and "3.5".

◆ Motor rotation control

Calculate the linear velocity and angular velocity to obtain the required parameters for motor rotation. Then, use the "set_velocity" function to control the motor rotation.

```
64 self.mecanum.set_velocity(speed, direction, angular_z, speed_up=speed_up)
```

The parameter meanings of the function are as follows:

- The first parameter "speed" sets the motor rotation speed, with a unit of millimeters per second and a range of "-100" to "100". When the value is negative, the motor rotates counterclockwise.
- The second parameter "direction" sets the direction of movement, with a unit of degrees and a range of "0" to "360". 90 degrees is clockwise rotation of the four motors; 270 degrees is counterclockwise rotation of the four motors; 0 degrees is clockwise rotation of M1 and M4 motors and counterclockwise rotation of M2 and M3 motors; 180 degrees is counterclockwise rotation of M1 and M4 motors and clockwise rotation of M2 and M3 motors. Other directions can be determined accordingly.
- The third parameter "angular_z" sets the offset rate, with a unit of 5 radians per second and a range of "-2" to "2". When the value is positive, M1 and M2 motors rotate in reverse and M3 and M4 motors rotate forward. When the

value is negative, the opposite happens.

- The fourth parameter "speed_up" sets the time required to increase acceleration. When the speed increases too quickly, slow down the speed increase process.