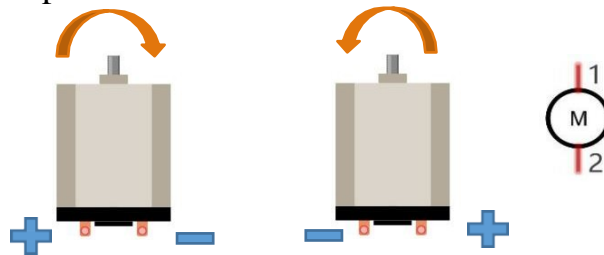


Lesson 2-Testing TT Motor

Knowledge of the TT Motor

When motor is connected to the power supply, it will rotate in one direction. Reverse the polarity of power supply, the motor will rotate in the opposite direction.

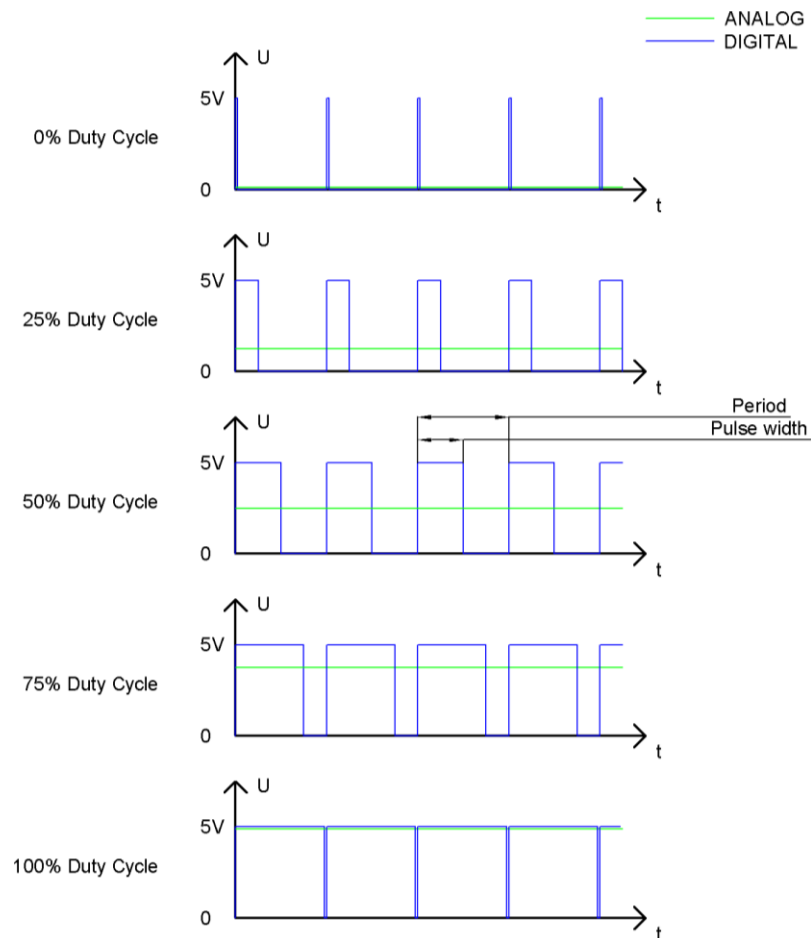
And the speed of motor depends on the voltage between two ends. The larger the voltage, the larger the speed.



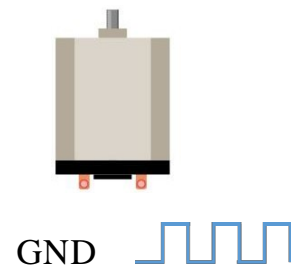
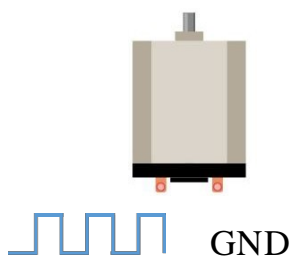
PWM

PWM, Pulse Width Modulation, uses digital pins to send certain frequencies of square waves, that is, the output of high levels and low levels, which alternately last for a while. The total time for each set of high levels and low levels is generally fixed, which is called the period (the reciprocal of the period is frequency). The time of high level outputs are generally called “pulse width”, and the duty cycle is the percentage of the ratio of pulse duration, or pulse width (PW) to the total period (T) of the waveform.

The longer the output of high levels last, the larger the duty cycle and the higher the corresponding voltage in analog signal will be. The following figures show how the analog signal voltage vary between 0V-5V (high level is 5V) corresponding to the pulse width 0%-100%:



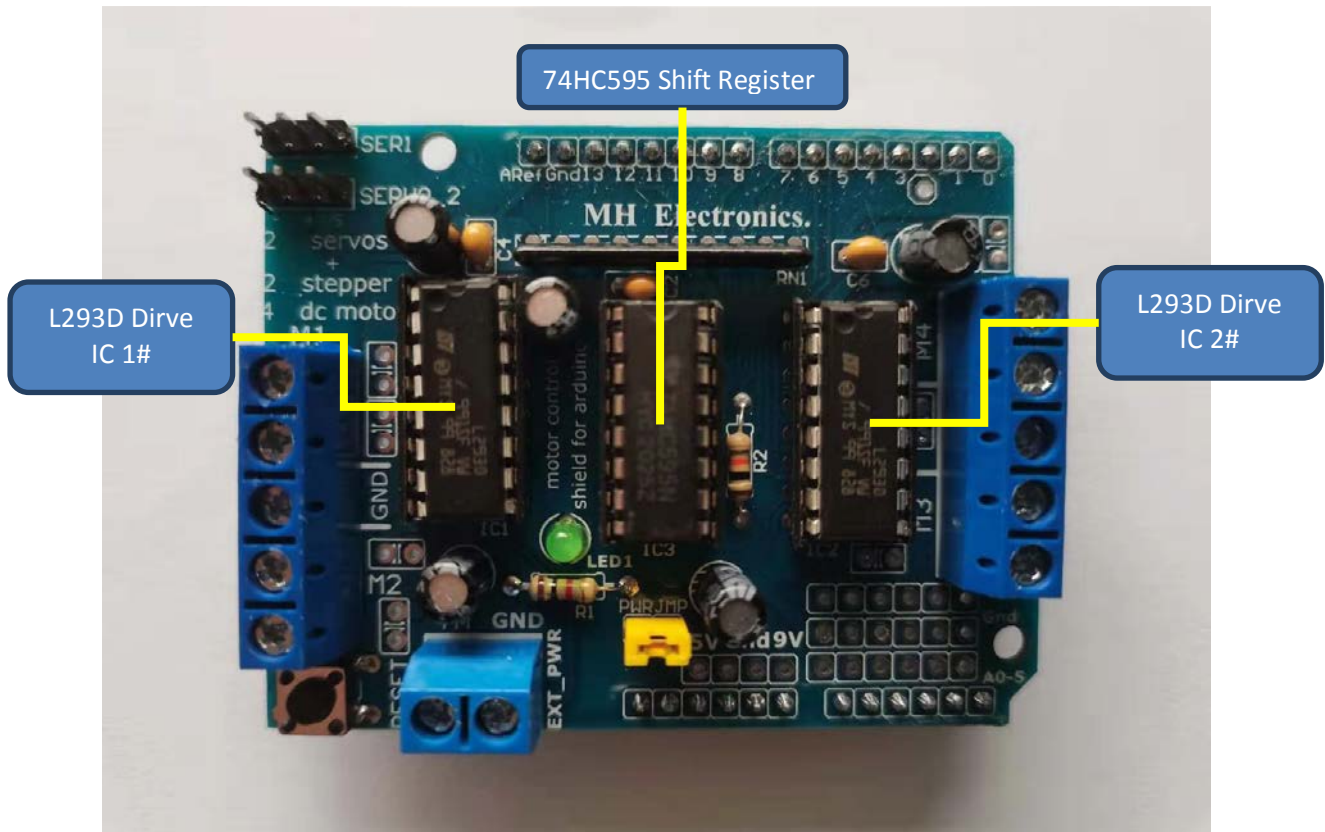
The longer the PWM duty cycle is, the higher the output power will be. Now that we understand this relationship, we can use PWM to control the brightness of an LED or the speed of DC motor and so on.



In this course, a L293D motor control shield will be used with UNO board, which can control the rotation of 4 DC motors at the same time.

L293D motor control shield introduce

The L293D motor control shield is mainly composed of 2 L293D motor driver chips and a 74HC595 shift register. Its structure is as follows



Functions of L293D motor control shield

- L293D is a dual-channel H-bridge motor driver that can drive a pair of DC motors or a single stepper motor.
- Since the shield has two L293D motor driver chipsets, which means it can drive up to four DC motors individually, it is ideal for building a four-wheeled robotic platform.
- The shield provides a total of 4 H-bridges, each of which can supply up to 0.6A to the motor.
- The shield also comes with a 74HC595 shift register that extends the 4 digital pins of the UNO board to the 8 direction control pins of the two L293D chips.
- The shield has an array of pull-down resistors to keep the motors off during power up.
- Onboard LEDs indicate that motor power is OK. If it is not lit, the motor will not run.
- The RESET button is the reset button of the UNO board (when the L293D shield is installed on the UNO board).

Power the motors through the control shield

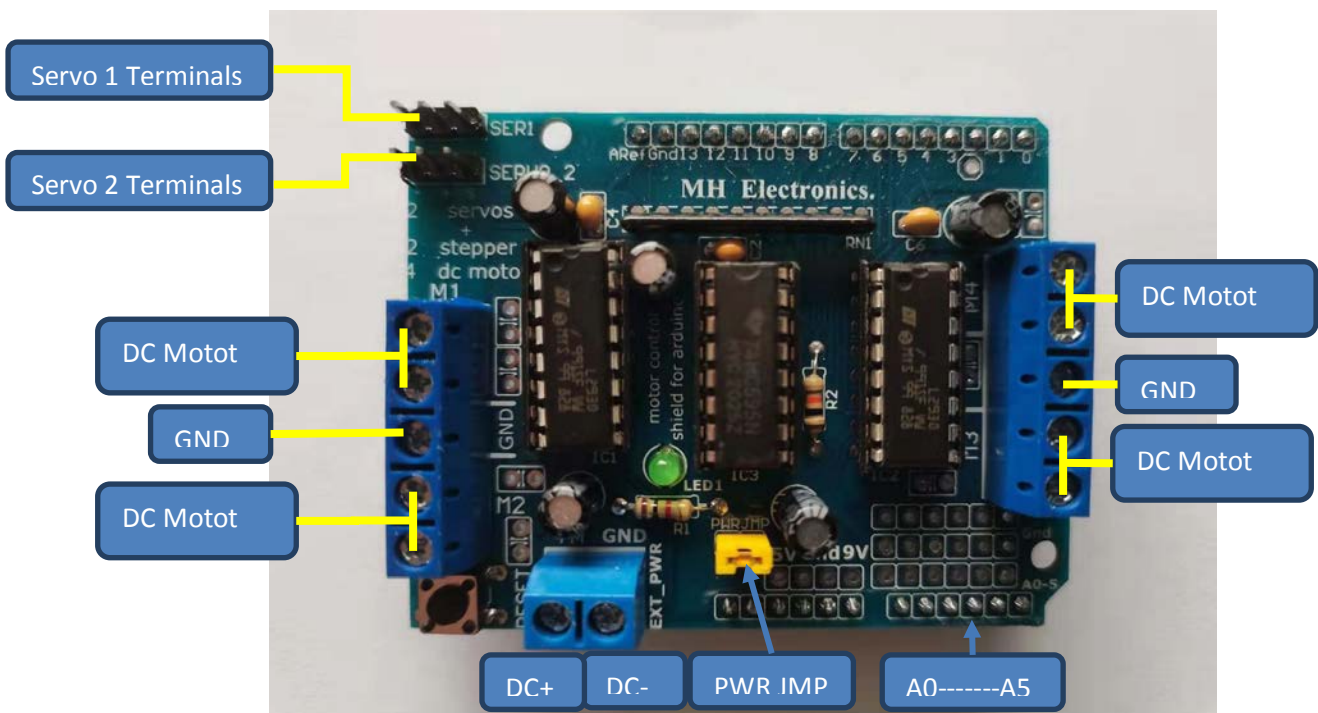
Use a single DC power supply to power both the UNO board and the control shield board, just plug the DC power supply into the DC jack of the UNO board or the 2 pin EXT_PWR on the control shield board.

Please keep the power jumper of the control shield on the board, it can only be used when the working voltage of the motor is less than 9V.

Note:

Do not supply more than 9V at the EXT_PWR input when the jumper is in place, or you may damage the Arduino UNO Board!

Output/input terminal of the L293D motor control shield



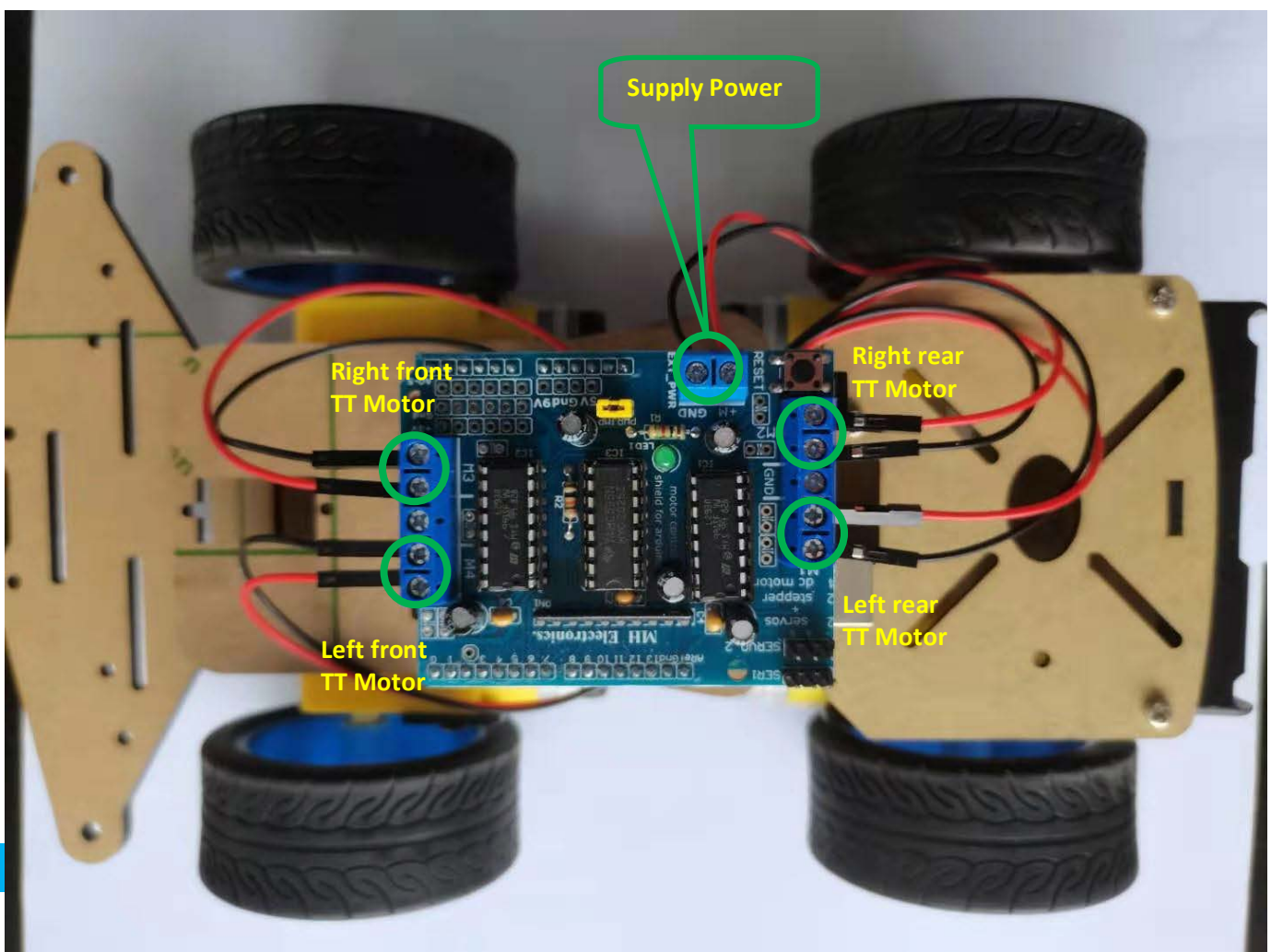
- The output channels of the two L293D chips output M1, M2, M3 and M4 through two 5-pin screw terminals. These terminals support DC motors with operating voltages between 4.5 and 25V.
- Each channel on the module can supply up to 600mA to the DC motor. However, the amount of current supplied to the motor depends on the power supply to the system.
- You can also connect two stepper motors to the output terminals. One stepper motor is connected to motor ports M1-M2 and the other is connected to M3-M4.
- If it is a unipolar stepper motor, connect the center tap of the unipolar stepper motor to the GND terminal.
- Two servos can be connected by pulling the 16-bit PWM output lines out to two 3 pin connectors.

Unused pins on L293D motor control shield

Mount the shield on the UNO board, it does not occupy the digital pins #2, #13 and analog pins A0-A5 of the UNO board. If you want to use these pins, you can connect some headers to the corresponding places.

Circuit connection

First fix the UNO board on the 4WD car body, install the L293D motor control shield on the UNO board, and then connect the 4 TT motors to the L293D expansion board as shown in the figure below, and connect the power wire of the 18650 battery box to the EXT_PWR terminal of the control shield, note that the positive and negative poles cannot be connected wrongly.

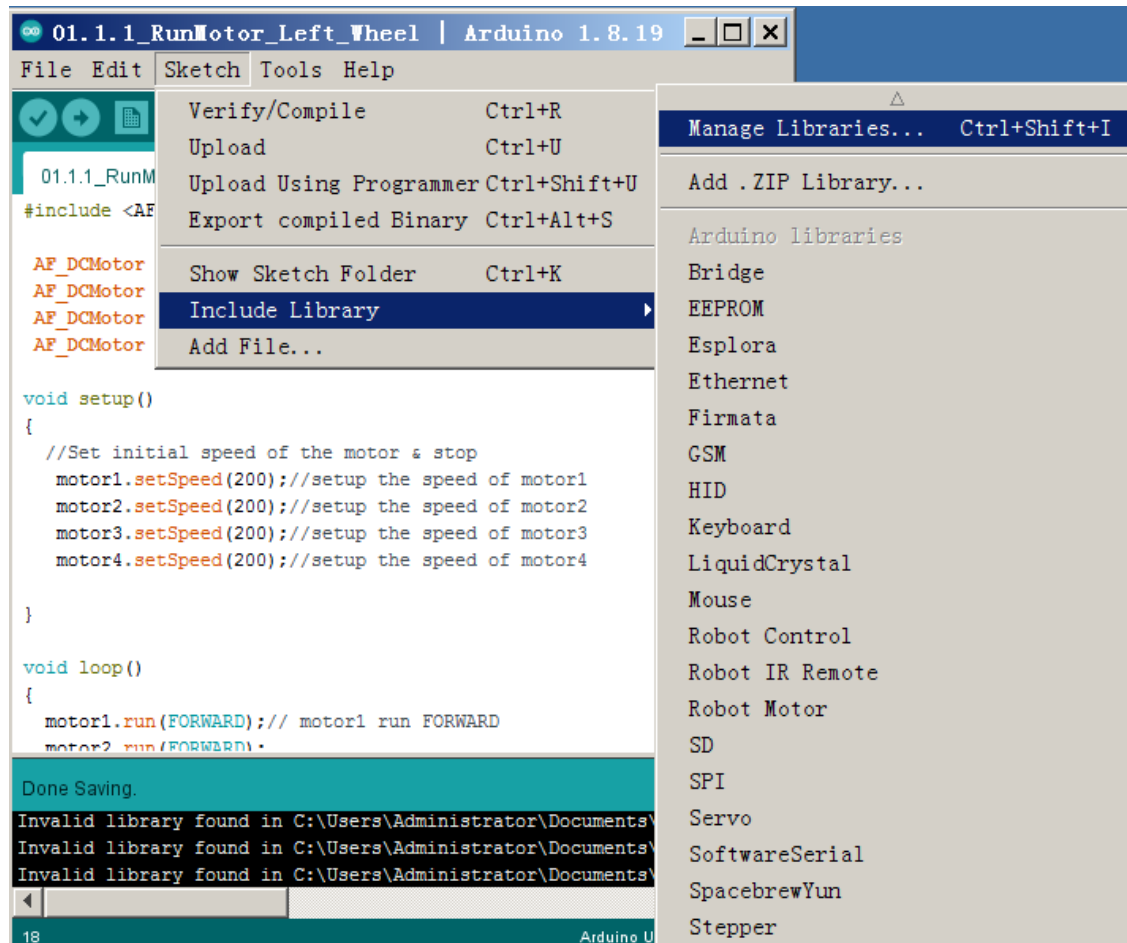


Install AFMotor Library

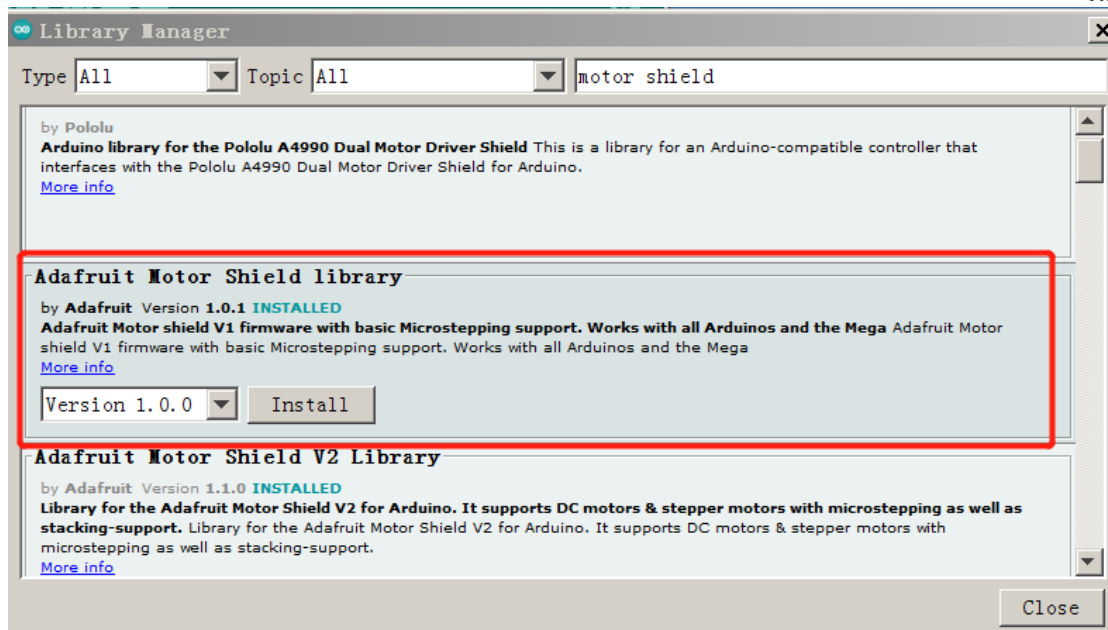
In order to establish communication with the L293D motor control shield, we need to install the

AFMotor.h library first so that it can issue commands to control DC, stepper and servo motors.

Click to open Arduino IDE, then click “Sketch”>“Include library”>“Manage Libraries...”, Wait for the library manager to download the library index and update the list of installed libraries.



Type "motor shield" to filter your search. Look for the Adafruit Motor Shield library (Version 1) provided by Adafruit. Click the entry and select Install.



Click "File---"Open" in the IDE interface, and select the code under the path of "4WD Car Chassis Kit Tutorial\ Sketches\ 02.1_Testing_TT_Motor".

After the code is compiled successfully, connect the UNO board on the 4WD body to the computer with a USB cable, and upload the program.

After the upload is successful, you can power on and test the TT Motor.

Code:

```
#include <AFMotor.h>
AF_DCMotor motor1(1);//define motor1
AF_DCMotor motor2(2);//define motor2
AF_DCMotor motor3(3);//define motor3
AF_DCMotor motor4(4);//define motor4

void setup()
{
  //Set initial speed of the motor & stop
  motor1.setSpeed(200);//setup the speed of motor1
  motor2.setSpeed(200);//setup the speed of motor2
  motor3.setSpeed(200);//setup the speed of motor3
  motor4.setSpeed(200);//setup the speed of motor4
}

void loop()
{
  motor1.run(FORWARD);// motor1 run FORWARD
  motor2.run(FORWARD);
  motor3.run(FORWARD);
  motor4.run(FORWARD);
  delay(3000);
  motor1.run(RELEASE);// motor1 stop run
  motor2.run(RELEASE);
  motor3.run(RELEASE);
  motor4.run(RELEASE);
  delay(3000);
  motor1.run(BACKWARD);//motor1 run BACKWARD
  motor2.run(BACKWARD);
  motor3.run(BACKWARD);
  motor4.run(BACKWARD);
  delay(3000);
  motor1.run(RELEASE);
  motor2.run(RELEASE);
  motor3.run(RELEASE);
  motor4.run(RELEASE);
  delay(3000);
}
```


What's Next?

THANK YOU for participating in this learning experience!

If you find errors, omissions or you have suggestions and/or questions about this lesson, please feel free to contact us: cokoino@outlook.com

We will make every effort to make changes and correct errors as soon as feasibly possible and publish a revised version.

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