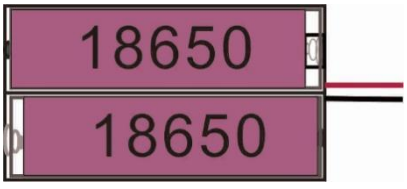
Lesson 10 Test the DC Motors

Table

1. What do you need to prepare

Components	Quantity	Picture	Remark
Battery box with 2pcs 18650 batteries	1		18650 batteries are not included in this kit, please prepared by yourself.
USB Cable	1		

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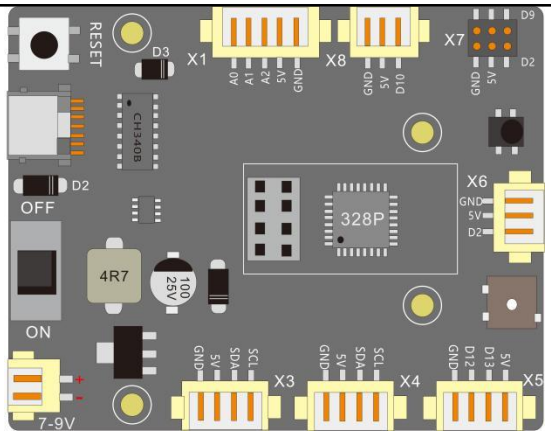
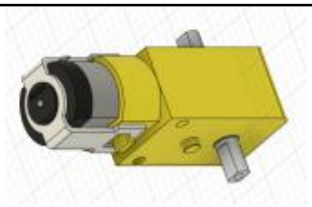
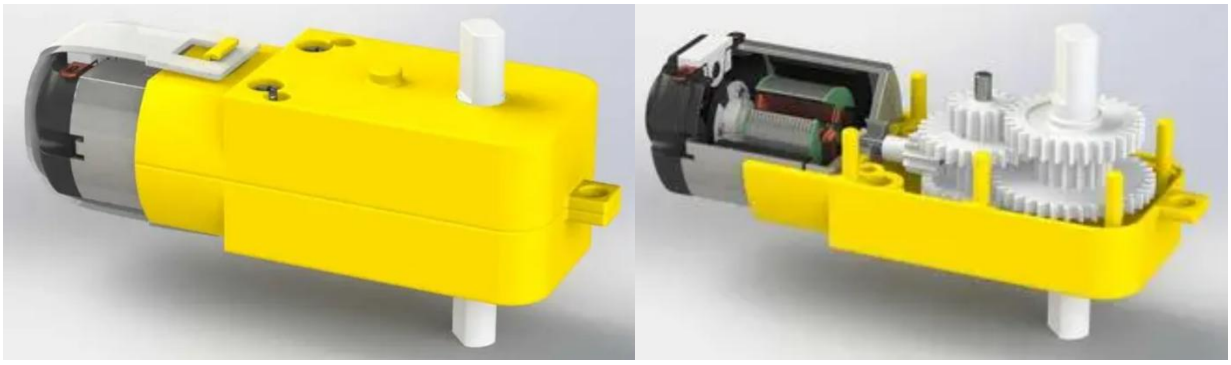
4WD Control board	1		
DC Motor	4		TT motors are not included in this Kit, just for example,you can prepared what you want.

2. Introducing DC Motors

Our products use DC motor as a power device. A DC motor is a device that converts DC electrical energy into mechanical energy. Widely used to drive various equipment, such as electric fans, remote control cars, electric windows, etc. The DC motor is very suitable as the moving mechanism of the trolley.

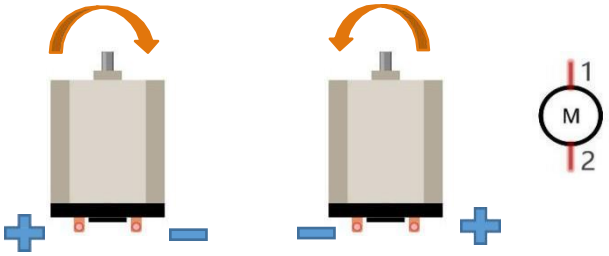
As shown in the figure below, the TT motor consists of a DC motor and related gears, with a yellow outer shell fastened.



DC 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.

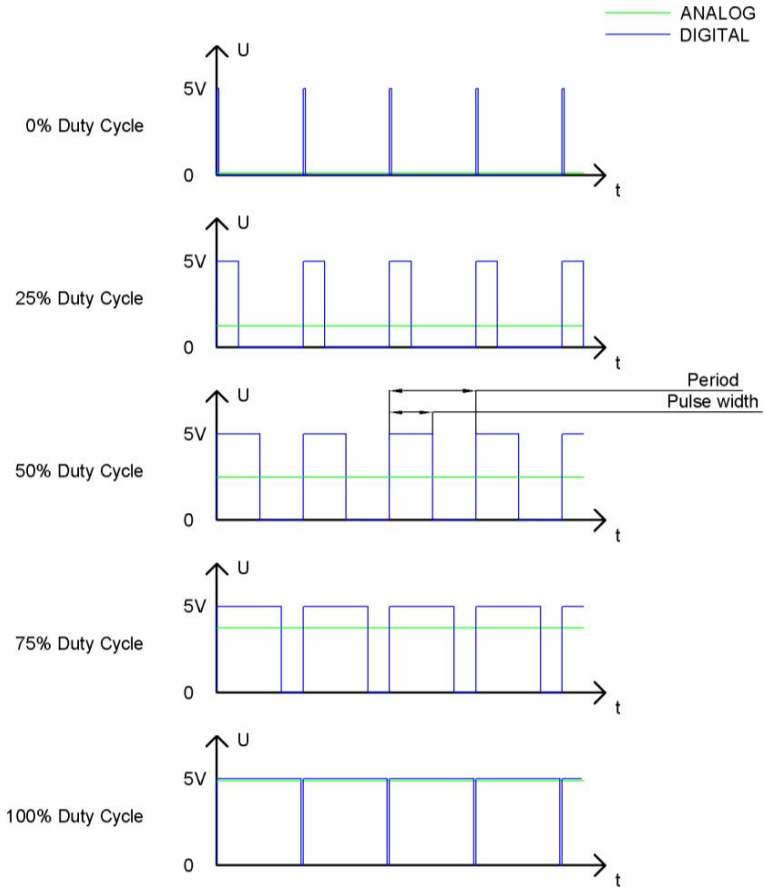
And the speed of motor depends on the voltage between two ends. The larger the voltage, the lager the speed.



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 analogs signal voltage vary between 0V-5V (high level is 5V) corresponding to the pulse width 0%-100



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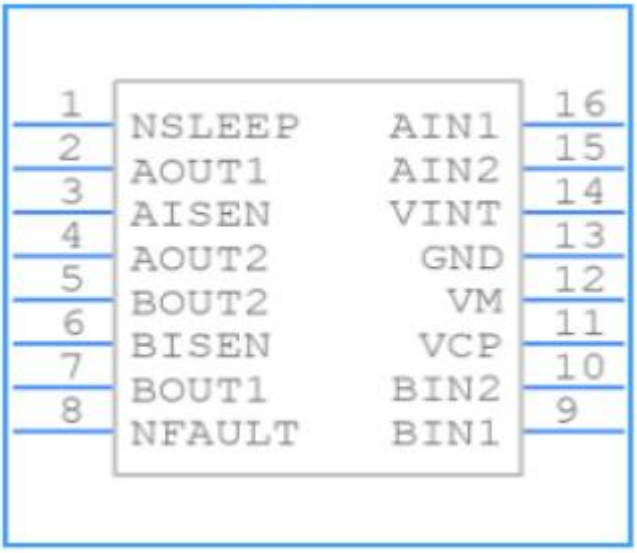
The longer the PWM duty cycle is, the higher the output power will be. Now that we understand this relationship, we can use PWM to control the brightness of an LED

or the speed of DC motor and so on.

3. Introducing DRV8833

The DRV8833PWPR is a driver for 2A low voltage Dual brush DC or single bipolar stepper motor (PWM Ctrl). it provides a dual bridge motor driver solution for toys, printers, and other mechatronics applications. The device features two H-bridge drivers that can drive two DC brush motors, a bipolar stepper motor, solenoons or other inductive loads. The output driver module of each H-bridge consists of N-channel power MOSFETs configured as H-bridges to drive the motor windings. Each H-bridge includes a circuit to regulate or limit the winding current. Internal shutdown function with fault output pins provides overcurrent protection, short circuit protection, undervoltage locking and overheat protection. A low-power sleep mode is also provided.

Symbol



4. Principle

One DRV8833 can control two TT DC motor, When the enabling pin NSLEEP of DRV8833 is at high level, both full H-bridges are conducting, The AIN1 signal will be output from AOUT1 through the H-bridge, The AIN2 signal is output from AOUT2 through the H-bridge The AIN1 signal is output by the main control chip Atmega328p, AIN1 is simultaneously connected to the inverter output signal AIN2, which is the inverted signal of AIN1. When AIN1 is at a high level, AIN2 is a low level, when the H-bridge is conducting, AOUT1 outputs a high-level signal, AOUT2 outputs a low-level signal, AOUT1 and AOUT2 are connected to the motor, and the motor is rotating forward at this time; When AIN1 is at low level, AIN2 is a high level, when the H-bridge is conducting, AOUT1 outputs a low-level signal, AOUT2 outputs a high-level signal, AOUT1 and AOUT2 are connected to the motor, and the motor is reversed at this time.

The DRV8833 enable pin NSLEEP signal determines the motor speed, because the higher the voltage of the NSLEEP signal, the higher the voltage when the corresponding AIN1 or AIN2 is a high-level signal, AOUT1, AOUT2 connected to motor, The higher the voltage between AOUT1 and AOUT2, the faster the motor rotates. Therefore, NSLEEP is generally connected to the PWM signal pins (3,5,6,9,10,11) of Arduino. As long as the duty cycle of the PWM signal is adjusted, the motor speed can be controlled. The higher the duty cycle, the higher the output voltage, and the faster the motor rotates. The lower the duty cycle, the lower the output voltage, and the slower the motor rotation speed.

There are two DRV8833 on the 4WD control board, which are silk printed as U6 and U10 respectively. U6 controls M1 and M2 motors; U10 controls M3 and M4 motors.

Atemega328p controls the pin signals of DRV8833, thereby controlling the rotation and speed of the motor.

The corresponding relationship is shown in the table below

Atemga328p Pin	DRV8833(U6) Pin(IN)	DRV8833(U6)Pin (OUT)	Motor

D6	NSLEEP		
D8	AIN1	AOUT1,AOUT2	M1
D7	BIN1	BOUT1,BOUT2	M2
	DRV8833(U10) Pin		
D5	NSLEEP		
D4	AIN1	AOUT1,AOUT2	M3
A3	BIN1	BOUT1,BOUT2	M4

5. Circuit Connection

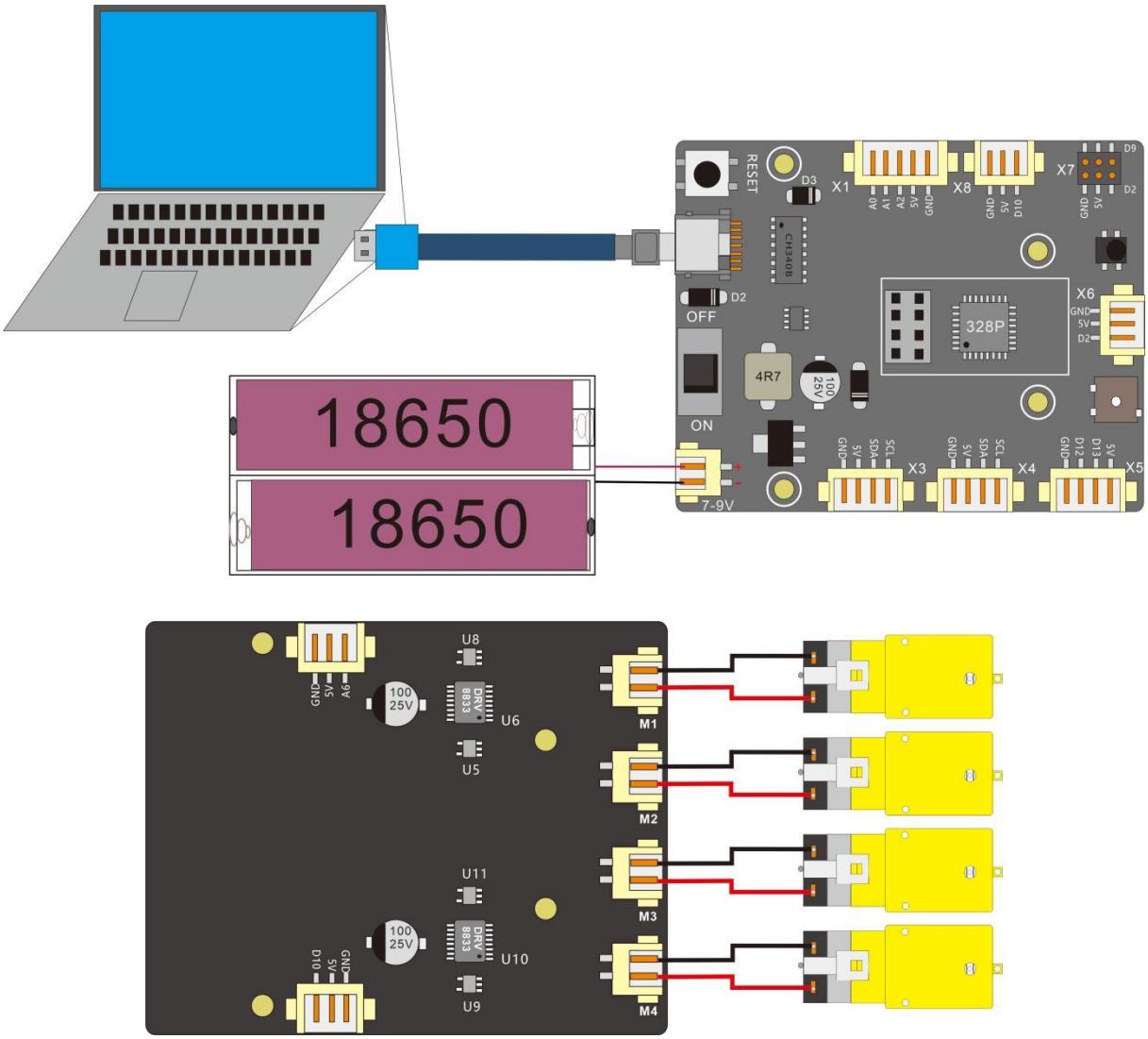
There are 4 DC motor ports on the control board: M1, M2, M3, M4.Please connect the circuit as shown below:

Turn the power switch on the control board to OFF

Connect the four TT motors to the M1 ,M2,M3,M4 ports of the control board respectively

Install two 18650 batteries in the battery box (the batteries need to be prepared by yourself), and connect them to the power port on the control board

Finally, connect the control board to the computer with a USB cable

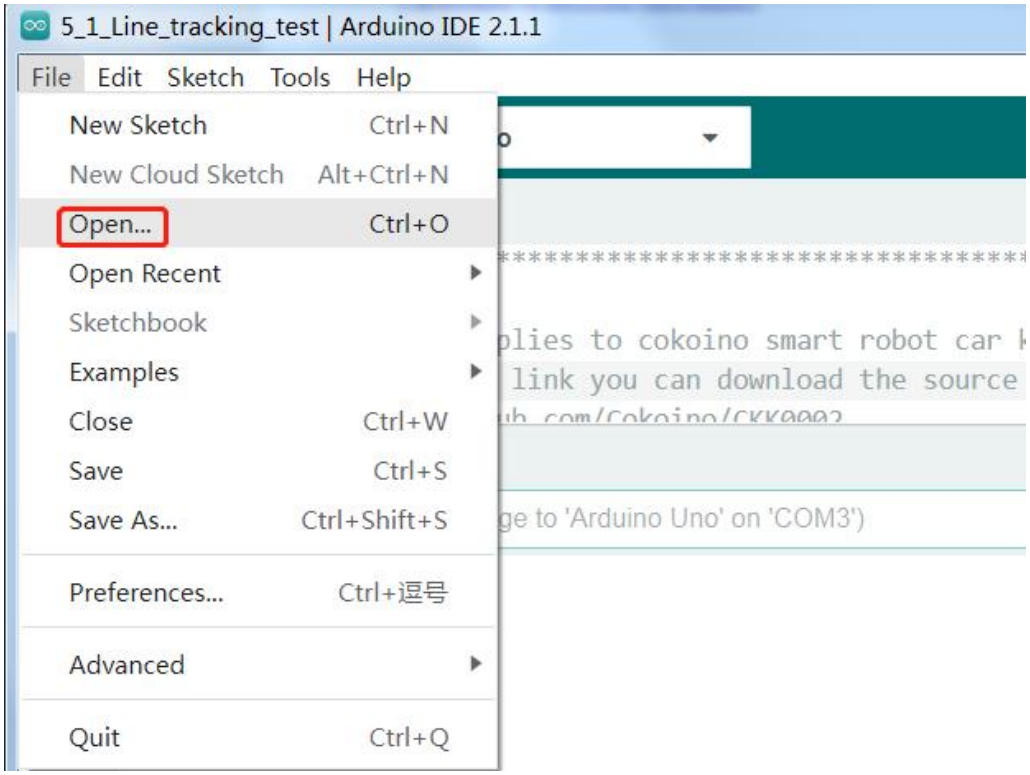


6. Upload the code and test

The code used in this lesson is placed in this folder：“E:\CKK0019-main\Tutorial\sketches”

6.1 Double-click the Arduino IDE shortcut on the desktop to open it

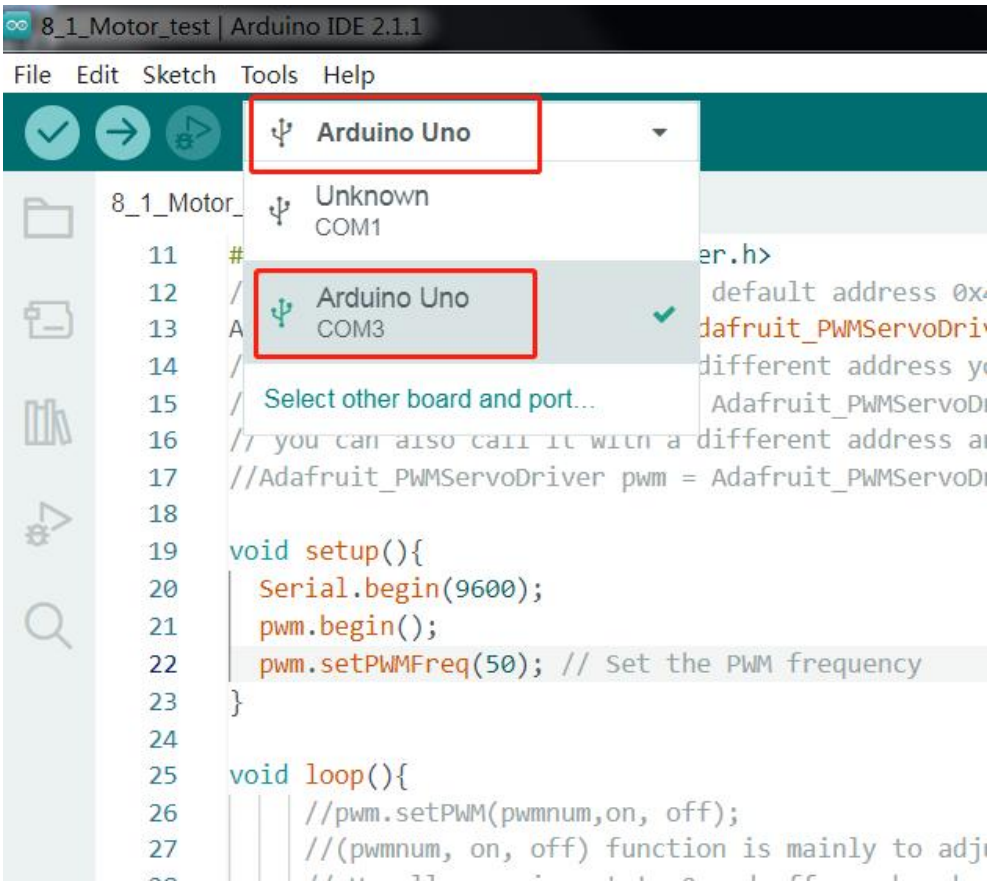
6.2 Click "File" --- "open"



6.3 Select the code in the folder named 7_1_Motor_test

E:\CKK0019-main\Tutorial\sketches\7_1_Motor_test，Click "open"

6.4 Select the board "Arduino UNO"and Port "COM3" (COM port is commonly known as an input output port for a device normally PC which enables communication between Arduino and PC. You can check your arduino com number in device manager, the com port of our arduino board is recognized as COM3 in this tutorial)



6.5 Install Adafruit_PWMServoDriver library

For the installation method, please refer to the method of installing the library Servo.h in Lesson 4

6.6 Click compile button  , successfully compiled the code will display "Done compiling"

6.7 Click upload button  , successfully uploading the code will display "Done uploading". When code is uploaded successfully, the program starts to run.

6.8 Turn the power switch on the control board to the ON state, and then you will see that the motor starts to rotate, forward for 2 seconds---reverse for 2 seconds---stop for 0.5 seconds, and then cycle.

7. Code

8_1_Motor_test.ino

```
//SET THE PIN FOR DRV8833(U6)
const int NSLEEP1 = 6;     // define pin for PWM used to control rotational speed of M1,M2 motor
const int AIN1 = 8;     // define pin used to control rotational direction of M1 motor
const int BIN1 = 7;     // define pin used to control rotational direction of M2 motor
//SET THE PIN FOR DRV8833(U10)
const int NSLEEP2 = 5;     // define pin for PWM used to control rotational speed of M3,M4 motor
const int AIN2 = 4;     // define pin used to control rotational direction of M3 motor
const int BIN2 = A3;     // define pin used to control rotational direction of M4 motor

void setup()
{
  Serial.begin(9600);
  pinMode(NSLEEP1, OUTPUT);       // set to output mode
  pinMode(AIN1, OUTPUT);          // set to output mode
  pinMode(BIN1, OUTPUT);          // set to output mode
  pinMode(NSLEEP2, OUTPUT);       // set to output mode
  pinMode(AIN2, OUTPUT);          // set to output mode
  pinMode(BIN2, OUTPUT);          // set to output mode
}

void loop() {
 analogWrite(NSLEEP1,140); //Start M1,M2 motor and set speed
 analogWrite(NSLEEP2,140); //Start M3,M4 motor and set speed
 digitalWrite(AIN1,HIGH);   //drive the M1 motor foward rotation
 digitalWrite(BIN1,HIGH);   //drive the M2 motor foward rottion
 digitalWrite(AIN2,HIGH);   //drive the M3 motor foward rotation
 digitalWrite(BIN2,HIGH);   //drive the M4 motor foward rottion
 delay(2000);
 analogWrite(NSLEEP1,140); //Start M1,M2 motor and set speed
 analogWrite(NSLEEP2,140); //Start M3,M4 motor and set speed
 digitalWrite(AIN1,LOW);   //drive the M1 motor reverse rotation
 digitalWrite(BIN1,LOW);   //drive the M2 motor reverse rottion
 digitalWrite(AIN2,LOW);   //drive the M3 motor reverse rotation
```

```
digitalWrite(BIN2,LOW);   //drive the M4 motor reverse rottion
delay(2000);
analogWrite(NSLEEP1,0);//stop M1,M2 motor
analogWrite(NSLEEP2,0);//stop M3,M4 motor
delay(500);
}
```

8.Any questions and suggestions are welcome

THANK YOU for participating in this learning experience!

If you find any 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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