

**CENG4480 Embedded System Development and Applications**  
**The Chinese University of Hong Kong**  
 Laboratory 8: Motors Control

Student ID:

2018 Fall

## 1 Introduction

In this exercise you will learn how to implement motors control by using Arduino microcontroller.

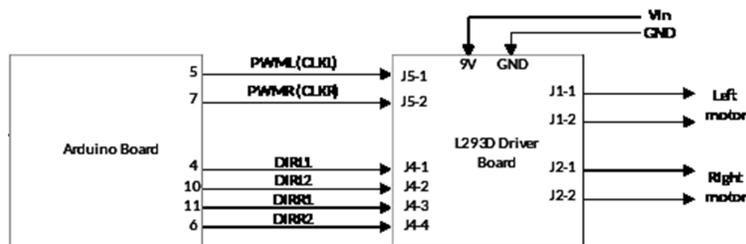


Figure 1: Block Diagram of Motors Control

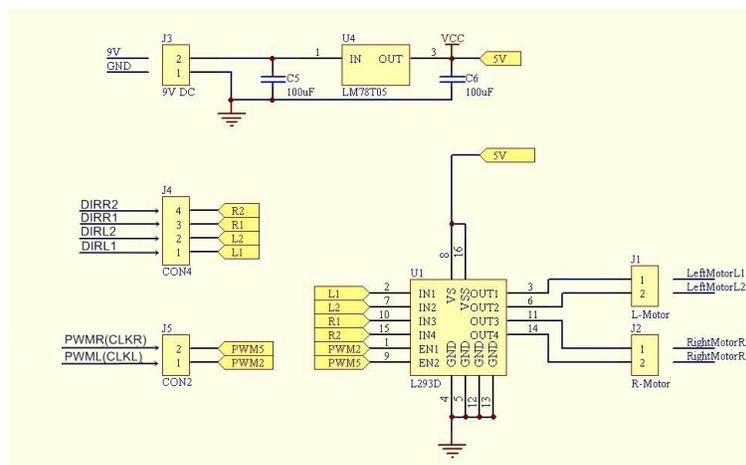


Figure 2: Schematic Diagram of L293D Board

## 2 Objectives

By completing this lab session, you should know:

- 1) To learn how to use motor driver L293D
- 2) To learn how to use PWM to control motor speed
- 3) To learn how to implement motor speed control by using Arduino microcontroller

### 3 Procedures

#### 1) Connect the IMU module to Arduino board

Use dupont wires connect the VCC, GND, SDA, SDC of the IMU module to Arduino board as shown on Figure 3. (refer to sample)

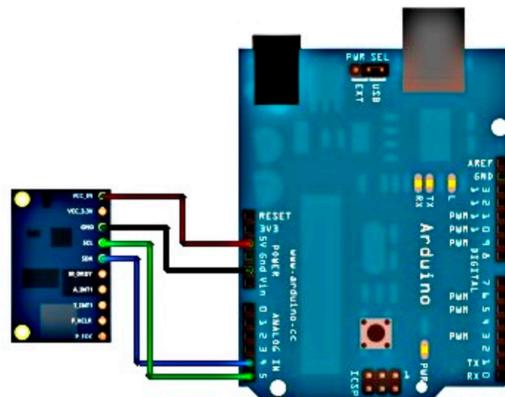


Figure 3: Connection of IMU module

#### 2) Connect the IMU module to Arduino board

- Attach the IMU module on the platform by using plastic tape.
- Make sure it can rotate freely along the x axis.

#### 3) Connect the L293D driver to Arduino board

Use male to female dupont wires connect PWML, PWMR, DIRL1, DIRL2, DIRR1, DIRR2, Vin and GND of L293D driver board to Arduino as shown in Figure 1. (refer to sample)

#### 4) Connect motor to L293D driver board

Connect the two wire of motor to L293D driver board J1-1 and J1-2.

#### 5) Connect oscilloscope inputs to L293D driver board

- Connect Channel 1 input of oscilloscope to L293D driver board J2-1
- Connect Channel 2 input of oscilloscope to L293D driver board J2-2

#### 6) Connect USB cable from PC to Arduino board

#### 7) Connect power adapter to Arduino board

The whole setup of the experiment is as shown in Figure 4.

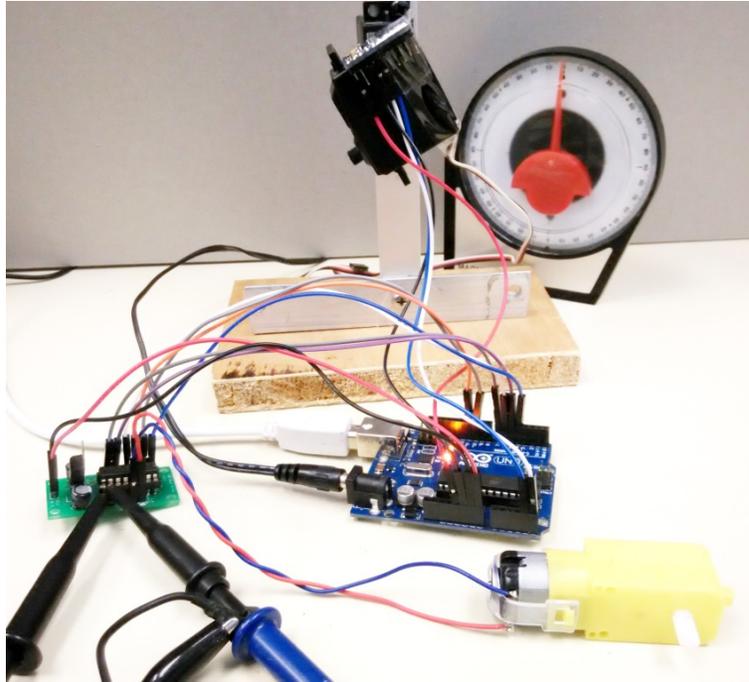


Figure 4: Experiment setup for Lab 8

#### 8) Upload the program Lab8.ino to Arduino board

- Double click Lab8.ino
- Observe the COM port number from Device Manager
- On the Arduino IDE Tools, Serial Port select the correct port number
- On the Arduino IDE Tools, Board select the Arduino Uno
- On the Arduino IDE press the Upload button
- Wait for the uploading program finish

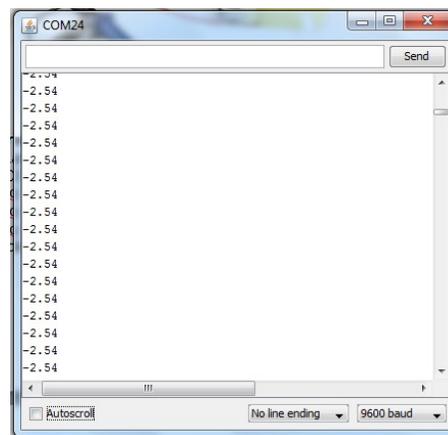


Figure 5: Serial window

### 9) Calibrate the 0 degree of the platform

- Rotate the platform to the 0 degree position (horizontal)
- On the Arduino IDE Tools, select Serial Monitor, you should see the window shown on Figure 5
- Use the number displayed on the COM window as the offset value (in this example = -2.54) and change the offset value in the program to this value (for example: `#define offset -2.54`)
- Upload the program to the Arduino board again
- You should see the value displayed on the COM window is now close to zero

### 10) Rotate the platform to -40 degrees like Figure 6, record the waveform on the oscilloscope screen and measure the duty cycle of the waveform. What is the direction and speed of motor?

The waveform is shown on Figure 7, and PWM Duty cycle is 100%, Direction is +, Speed is +++++.

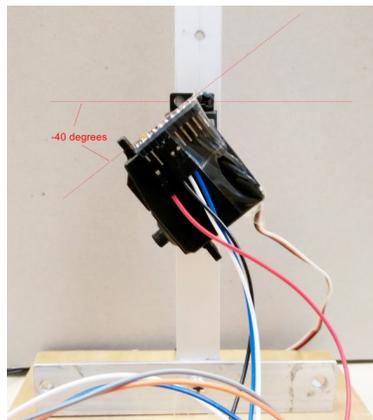


Figure 6: -40 degree

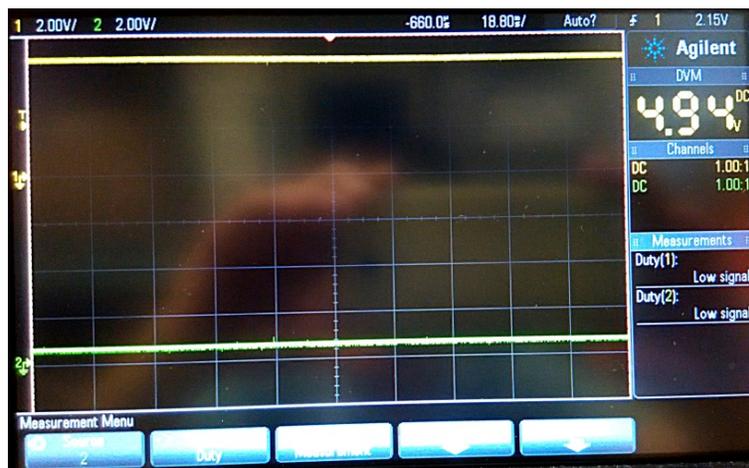


Figure 7: waveform when degree = -40 degree

11) Repeat step 9 for -30, -20, -10, 0, +10, +20, +30 and +40 degrees. Fill in the following table.

Platform Angle (Degree)	Picture of waveform on oscilloscope	PWM Duty cycle	Direction (+ or -)	Speed
-40				
-30				
-20				
-10				
0				
+10				
+20				
+30				
+40				