ME:4145 Industrial Internet of Things

Lab #4
DC Motor Control

Introduction

The objective of this lab is to introduce you to DC motor control. You will be specifying the state (on/off), direction and speed using pulse width modulation (PWM). Any supporting documents or codes will be located on the ICON course web page in the "Files → Labs → Lab04" directory. Please keep in mind that it is your responsibility to make sure the pin numbers and board format are correct. In my examples I tend reuse pins numbers for each lab.

Getting Started

What you will need

To complete this lab, you will need the following components:

- small DC motor (3-5V)
- 1 × GREEN LED
- 1 × RED LED
- 1 × BLUE LED
- 1 × ORANGE LED (or substitute)
- L293D dual h-bridge motor driver
- breadboard
- resistors
- jumper wires

Raspberry Pi connections

L293D and motor

To control the state and direction (CW vs. CCW) of your motor, the L293D h-bridge motor driver will be employed. The L293D is a general purpose dual h-bridge chip capable of driving two DC electric motors and one stepper motor up to a maximum of 600mA. However, similar to LEDs, one must be careful not to pull to much current from the RPi when driving a DC motor or stepper. A general wiring diagram for the L293D and DC motor is provided in Fig. 1. Please note that the GPIO pins used, other than the ground

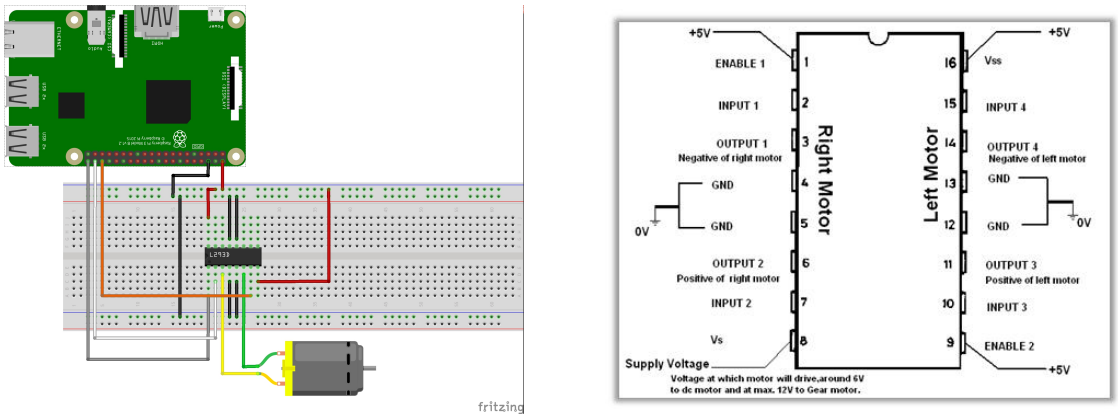

Figure 1: (a) L293D and DC motor wiring example (b) L293D diagram.

and power, do not need to be the exact ones as shown. To identify the orientation of the L293D, look for the small notch on the top of the chip.

An example Python script for getting started is located on the ICON course web page in the Lab #4 folder. This script is the basic code for controlling a single DC motor with the L293D and RPi. The example script uses GPIO pin descriptions according to the **BCM** and pin connections as previously shown in Fig. 1a. Do **NOT** use this script until you have decide which description you are using and verified the pin assignments. Failure to do so can result in damage to the RPi, L293D and DC motor.

Referring back to Fig. 1a, the DC motor is powered directly from the RPi. If you are using the motor provided in the kit this is fine since the motor does not draw much current. However, if you are using a different motor, it is your responsibility to ensure it does not exceed the RPi output capabilities. If your motor does exceed what the RPi can provide an external power supply will be required. An example of wiring this is shown in Fig. 2 for reference.

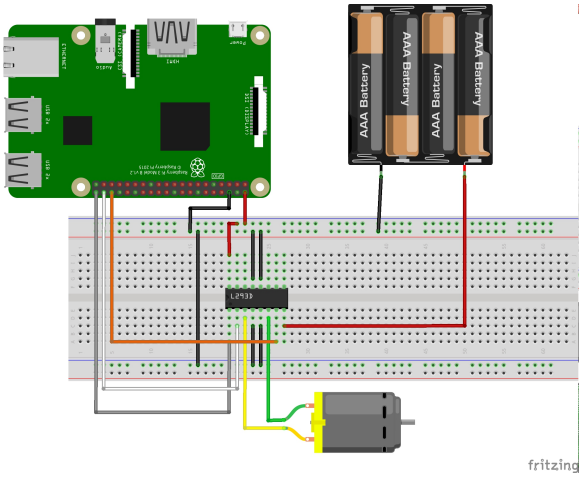

Figure 2: L293D and DC motor wiring example with external power source.

Task

Write a Python program that will do the following in order:

- run the motor CW for 5 seconds
- run CW at half speed for 10 seconds
- stop for 5 seconds
- run CCW for 5 seconds
- run CCW at half speed for 10 seconds
- stop for 5 seconds

It be may useful to put a piece of tape or attach a small piece of cardboard to our motor shaft to make it easier to identify the motor direction. Furthermore, your program should also control LEDs according to the following conditions:

- turn a green LED on when your motor is running (CW or CCW).
- turn a blue LED on when your motor is rotating CW.
- turn a orange LED on when your motor is rotating CCW (or substitute a different color).
- turn a red LED on when your motor is off.

This motor/LED sequence will repeat indefinitely until the user terminates it.

Submission Materials

Upload the following to ICON no later than the due date:

1. Python script/s
2. Video of your functioning lab with explanation of what is occurring.