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School of Mechanical Engineering
College of Engineering
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Mechatronics Lab Manual

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SESSION #7

DC Motor & Encoder (Part 2 – DC motor)

Mechatronics

Lab Manual

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Session Objectives

- Driving a DC motor

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Introduction to TA

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1. DC Motor Driving

Speed of a DC motor could be controlled by changing the input voltage to the motor and the most common method of doing that is by using PWM signal. Most DC motors work with higher voltages and currents than a microcontroller can handle directly. Therefore, transistors (BJTs or MOSFETs) or DC motor drivers are used for this purpose.

1.1. PWM

PWM is a technique that uses to adjust the average value of the voltage by turning on and off the power at a fast rate. The average voltage depends on the duty cycle which is the amount of time the signal is ON versus the amount of time the signal is OFF in a single period of time.

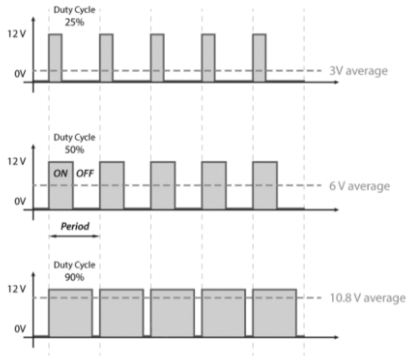

Figure 1: PWM signal

1.2. Driving a DC motor with a BJT Transistor

The Arduino PWM output should be connected to the base of a BJT or the gate of a MOSFET in order to drive the motor. The low power Arduino PWM signal switches on and off the base of transistor through which the high-power motor is driven. The speed of the motor can be controlled by the PWM output. However, the direction of rotation can't be altered in this method.

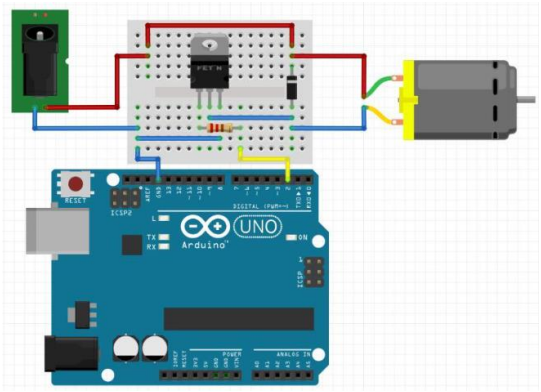

Figure 2: Wiring schematic for driving a dc motor by a BJT

1.3. H-Bridge DC Motor Drive

For controlling the rotation direction, it's just needed to inverse the direction of the current flow through the motor. the most common method of this is by using an H-Bridge. An H-Bridge circuit contains four switching elements (transistors or MOSFETs) with the motor at the center forming an H-like configuration. By activating two particular switches at the same time, we can change the direction of the current flow

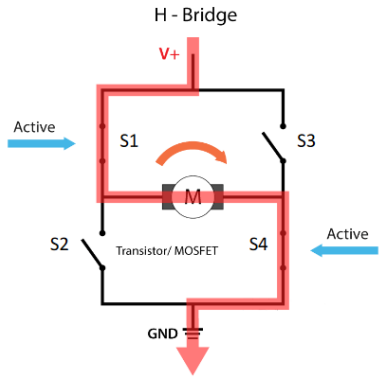

Figure 3: H-Bridge

S1	S2	S3	S4	Rotation
on	off	on	off	+
off	on	on	off	-
off	off	off	off	free
off	on	off	on	locked
on	off	on	off	locked

Figure 4: H-Bridge function table

1.4. L298N H-Bridge DC Motor Driver

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

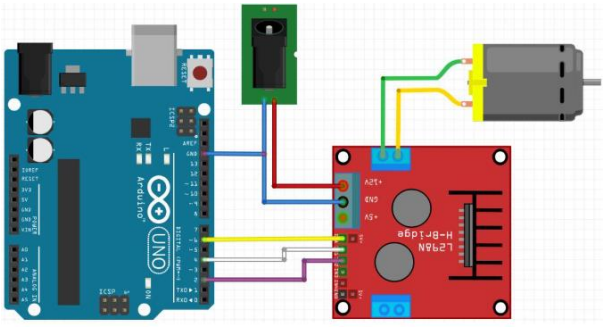

Figure 5: Wiring schematic for L298N H-Bridge DC motor driver

IN1	IN2	Rotation
High	Low	+
Low	High	-
High	High	locked
Low	Low	free

Figure 6: L298N function table

1- Drive the motor with the L298N module. Change the direction and speed of rotation by changing the values of IN1, IN2 and ENA pins.

2- Calculate the velocity of the motor. Change the speed by varying the PWM signal and see the effect.

3- Sample the step response of the system. Use duty cycle of 200. You can uses other serial terminal software such as PuTTY to log the data.