

# PRINCIPLES AND APPLICATION OF MICROCONTROLLERS

## Arduino Lab3: Wheel Robot

### Introduction

In this lab, you are required to design and build a wheel robot. You are also asked to navigate the wheel robot to circle around a field (Fig. 1). To complete this task, you will need to learn how to control two direct current (DC) motors, moving the wheel robot forward and making right and left turns. After completing this lab you should be able to:

- Perform DC motor control
- Design robot navigation logic

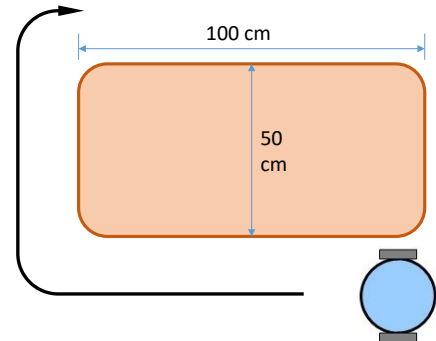


Figure 1: Task of the wheel robot

### Parts List

- A wheel robot set
- An H-bridge board
- An Arduino Uno MCU

### Wheel Robot Set

The wheel robot set provided to you is composed of an acrylic chassis, 2 DC motors, 2 drive wheels, an idle wheel, and a battery case. Figure 2 shows an assembled wheel robot. An H-bridge board is also provided to you for driving the two DC motors.



Figure 2: An assembled wheel robot

### H-bridge

An H-bridge is a circuit that enables a voltage to be applied across a DC motor in either direction. The circuit is known as an H-Bridge because it resembles the capital letter H. An H-bridge typically comprises 4 switches (Fig. 3). The open and close of the switches determine the motor operation. Figure 3 shows the forward and reverse operations of a motor by using an H-bridge. The motor in Fig. 3 will operate only when the diagonally opposite switches are closed.



Figure 3: (a) Forward and (b) reverse operation of an H-bridge motor driver circuit

Figure 4 shows a dual H-bridge board that can be used to control up to 2 DC motors. The board comes with an L298 H-bridge chip and can provide up to 1 Amps of current to each DC motor. The H-bridge board needs to be wired to the motors, Arduino MCU, and battery appropriately. See Fig. 4 for the details. Remember to ground the H-bridge board to the Arduino MCU. Table 1 shows the control logic signals to the H-bridge from the Arduino MCU. The 2 control channels work independently.

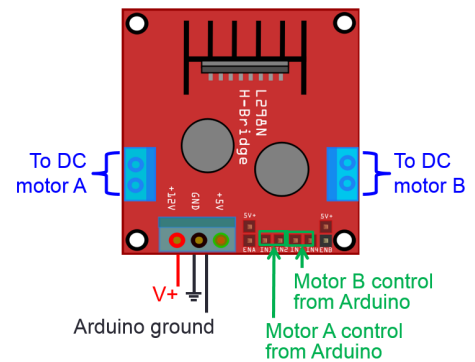


Figure 4: L298 dual H-bridge board

Table 1: Control logic of the L298 dual H-bridge board

IN1	IN2	Motor A	IN3	IN4	Motor B
1	0	CW	1	0	CW
0	1	CCW	0	1	CCW

## Procedure

Assemble your circuit by following the diagram as shown in Fig. 5. We will use pins 5, 6, 10, and 11 as the outputs to control the 2 DC motors. Note that all the GNDs in a circuit should be connected together.

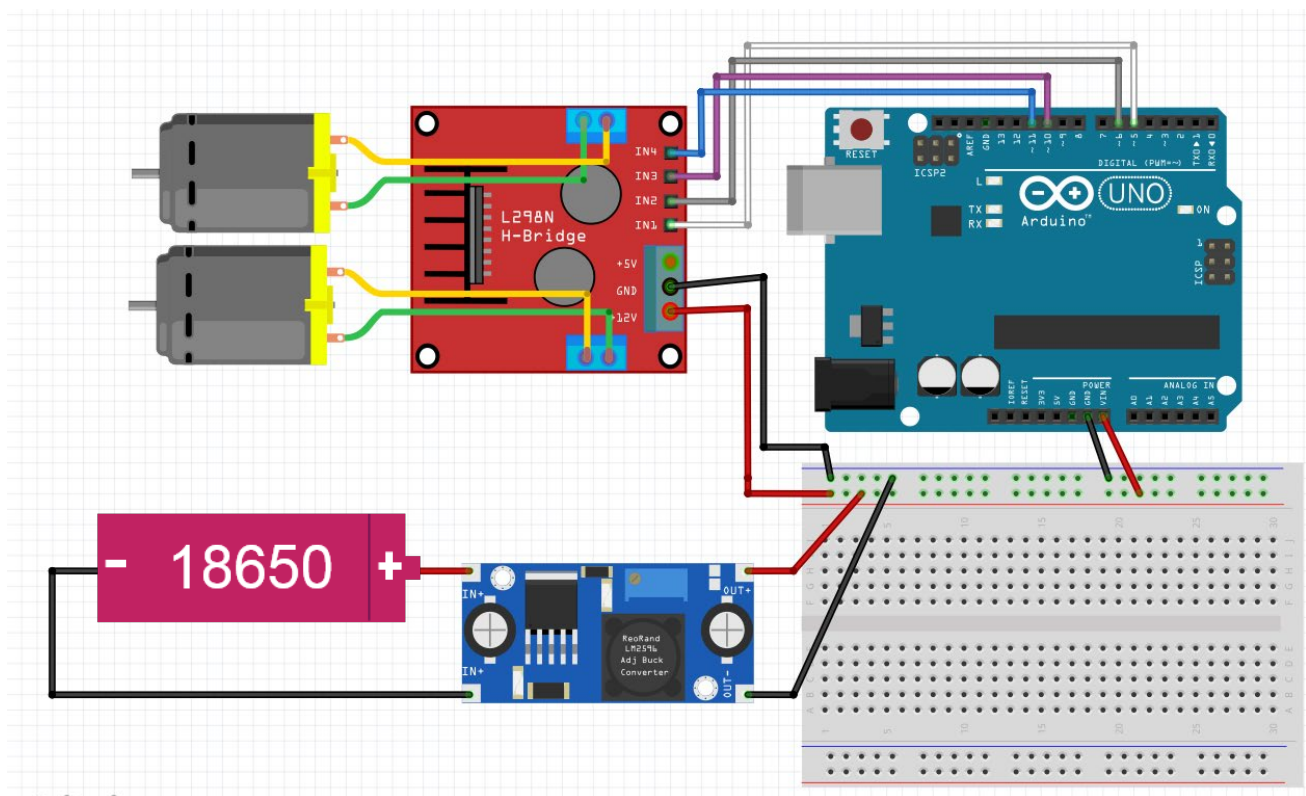


Figure 5: Circuit chart of the line following robot

## **Deliverables**

### Basic points (85%):

Demo your wheel robot to the TAs, or record it in a video. Upload the followings to ceiba: 1) your Arduino scratch, 2) a photo of your physical circuit, and 3) contributions from each teammate to the lab. The contributions must include the information of the tasks each teammate has done and the contributions in percentage. The total percentage should be 100%. All the teammates have to agree with the contributions before they are uploaded.

### Advanced points (15%):

Get 5% if you program your robot to walk each of the three alphabets: K, Y, and F.