Contents

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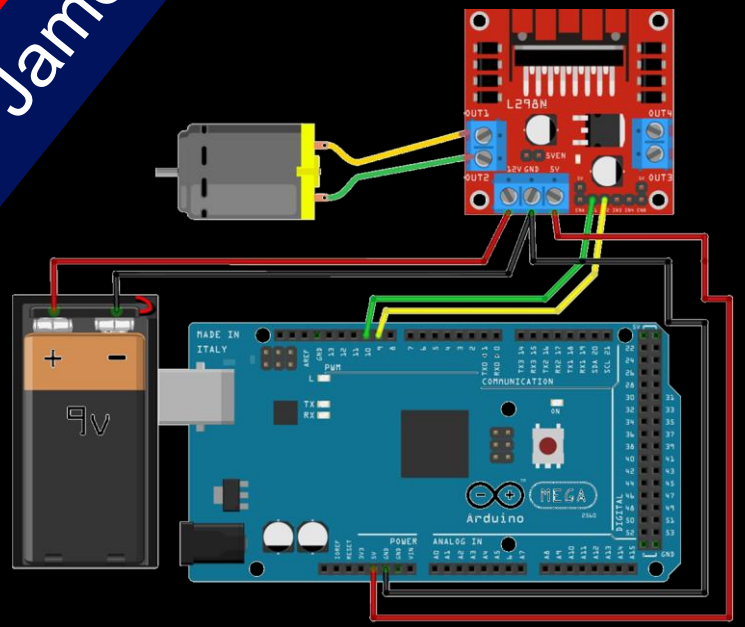
DC Motors On/Off, PWM and Polarity Control



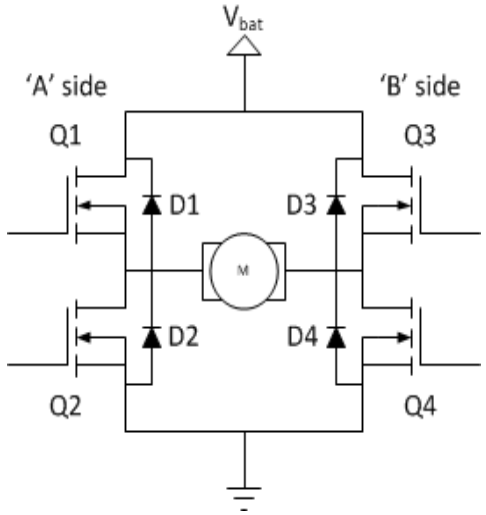
Key Learning Points

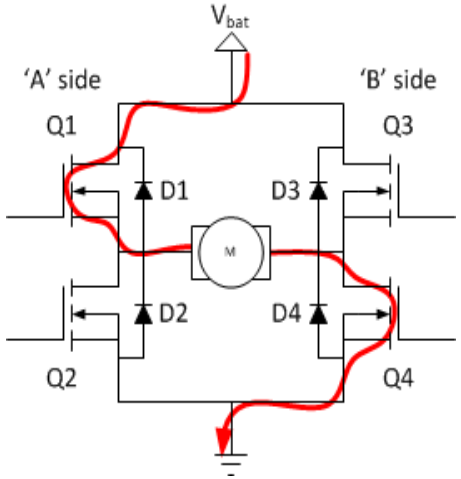
After this Lecture, you will be able to:

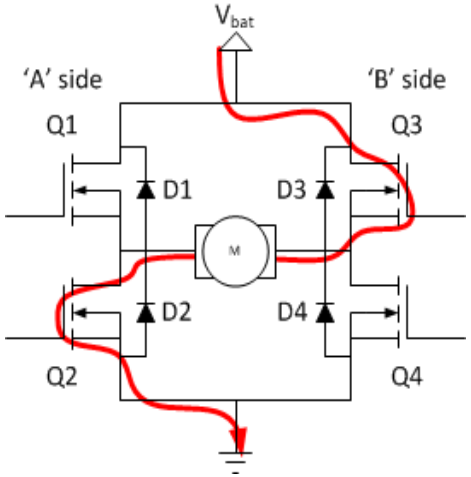
1. Understand the hardware used for ‘driving’ and changing the polarity of a DC motor
2. Use Simulink for the speed and polarity ‘control’ of a DC motor

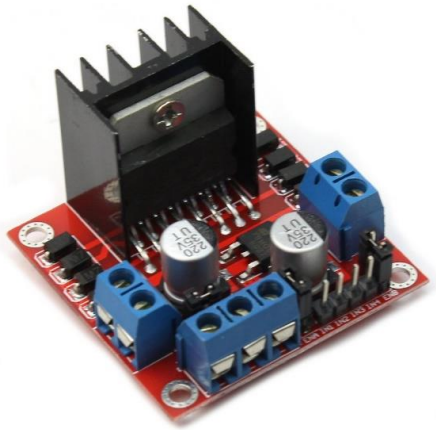
2.1 Introduction

- A H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load, e.g., a DC motor
- The configuration of a H-bridge contains four switches, with the load at the centre, hence the H-bridge configuration
- All four switches can be turned on and off independently









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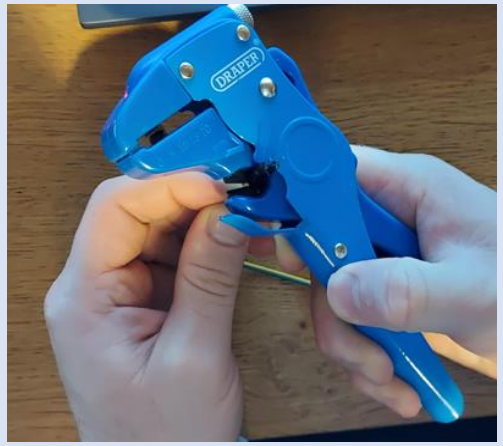
2.2 Hardware

- The steps here detail how to prepare the two male-female/male wires to use with the DC motor (as shown in the previous slide), i.e., creating the 2-x male-copper wires
- For this you will need a wire stripper and two hands

1

- Use the wire stripper to cut the female end of the two wires off

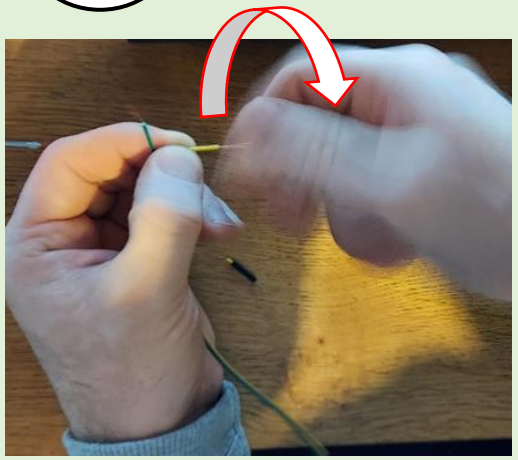


2

- Use the wire stripper to strip the plastic off the cut ends of the two wires

3

- Twist the exposed wire ends until the wires are not fray (i.e., get rid of the loose threads)



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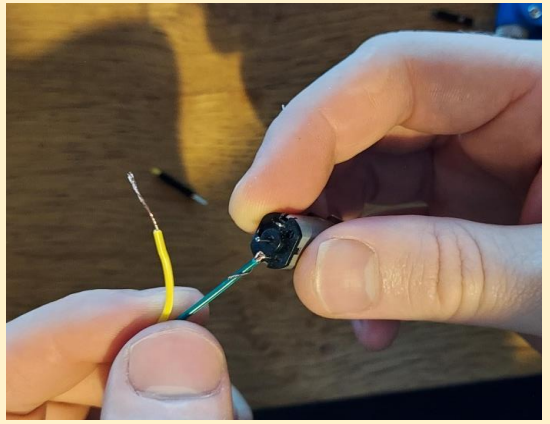
- Thread and twist the wire ends into the DC motor positive and negative terminals



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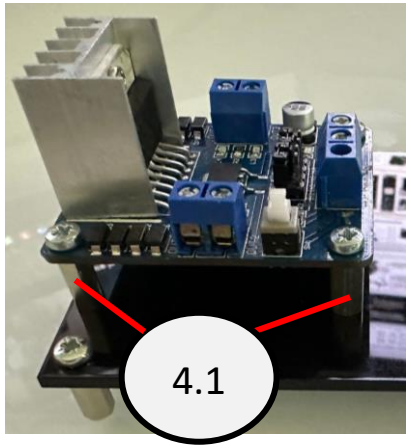
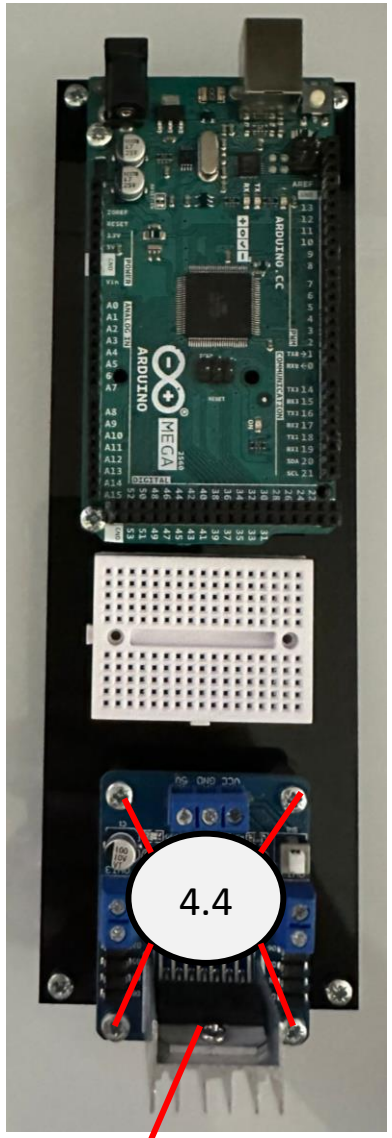
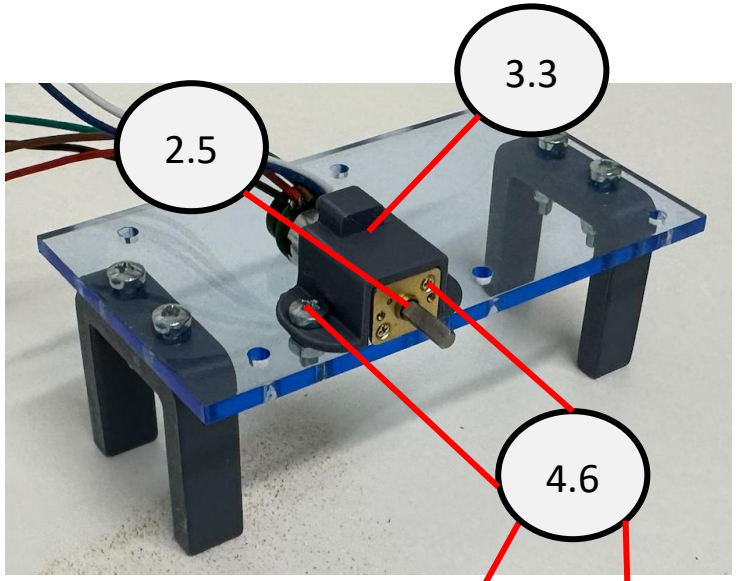
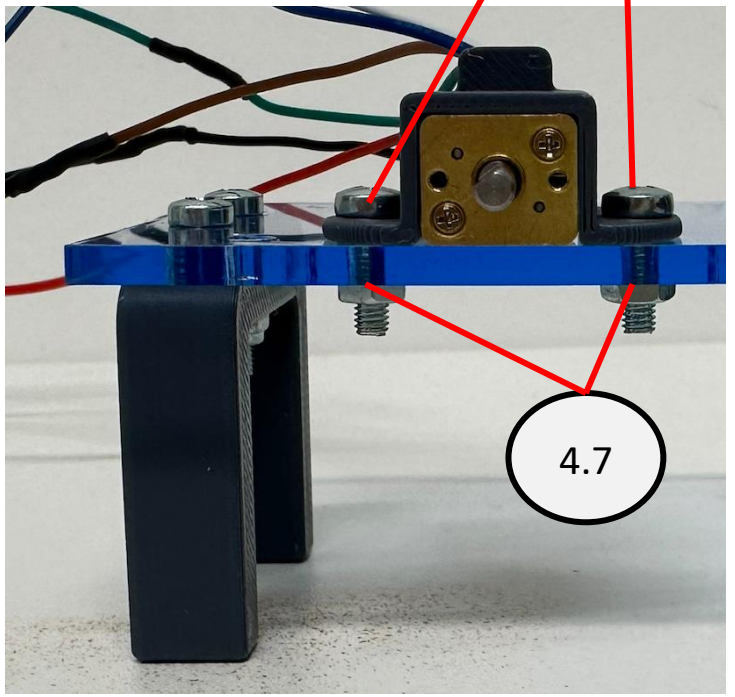
2.2 Hardware

- Set-up the CLB rig as illustrated to the right, using the following components:
  - 2.3: L298N dual H-bridge motor driver
  - 2.5: Brushed geared DC motor with encoder
  - 3.3: DC motor mount
  - 4.1: 4 x hex threaded spacer, 12mm, M3
  - 4.4: 8 x bolt, 6mm, M3
  - 4.6: 2 x bolt, 16mm, M3
  - 4.7: 2 x nuts, M3









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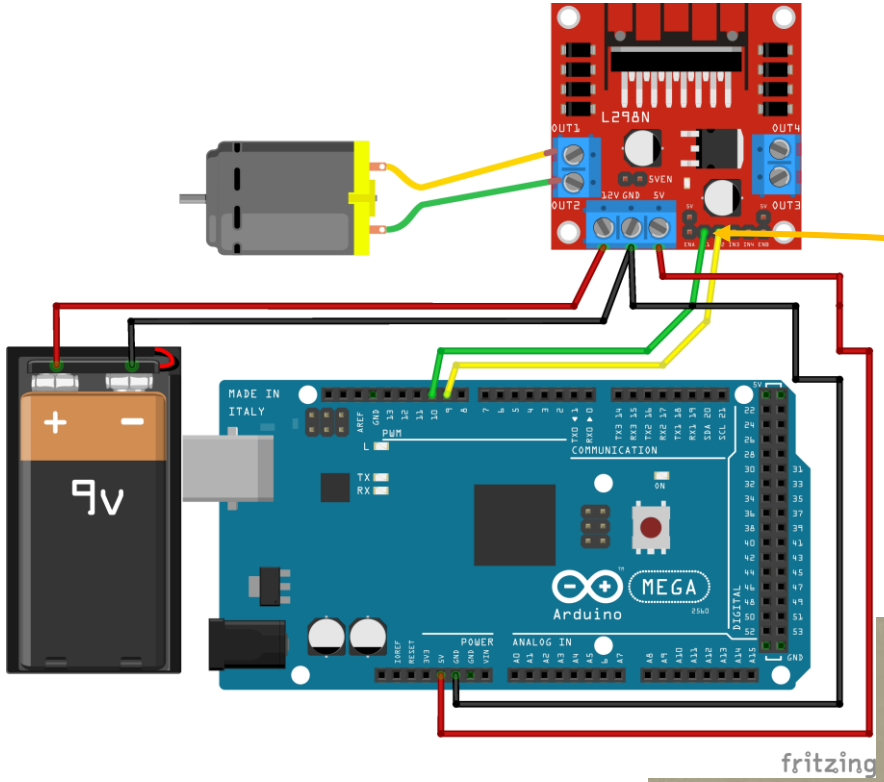
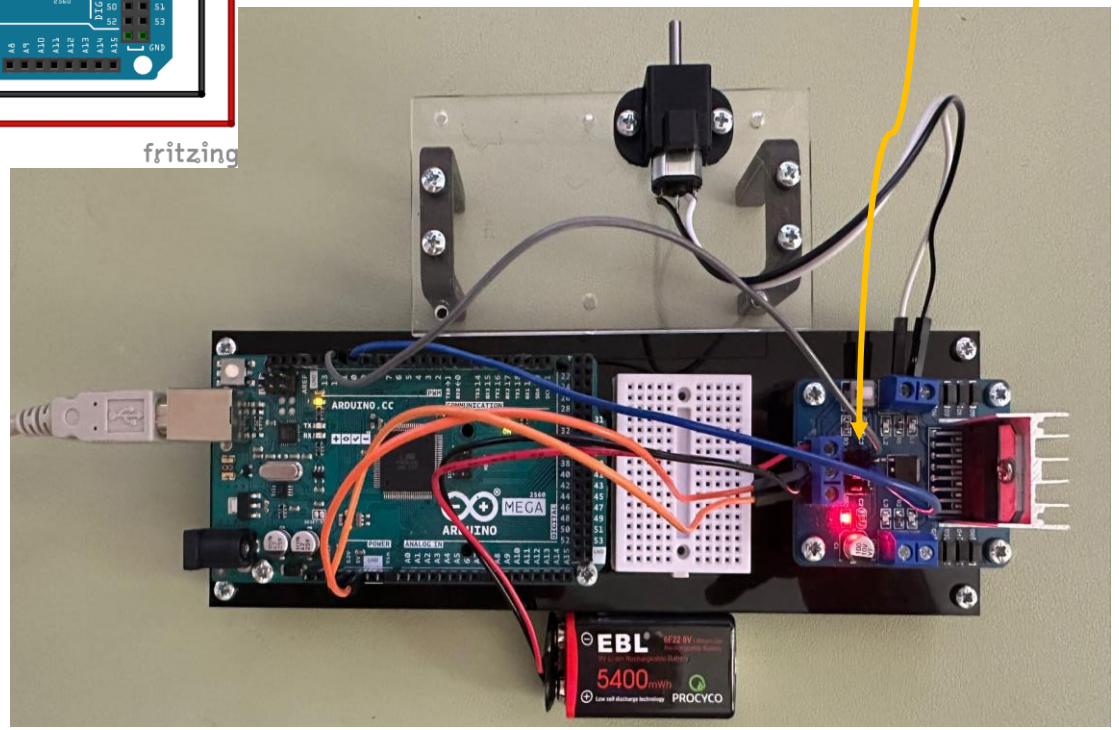
2.2 Hardware

- The task involves connecting a H-bridge and DC motor to an Arduino
- Required hardware for the exercise:
  i. Supported Arduino Uno board
  ii. USB cable
  iii. H-bridge
  iv. DC gearbox (50:1) 6V motor
  v. 9V battery
  vi. 9V power jack
  vii. 2 x male-male wires
  viii. 2 x male-female wires
  ix. 2 x male-copper wires



Note that 'In1' and 'In2' appear in a different position on the H-bridge to the one being used here



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2.3 Algorithm Design

- The Simulink block diagram for the H-bridge algorithm design is given
- The logic for operating the 'forward' and 'reverse' motion of the DC motor is given
- Note that to realise this in real-time on a system, the switches would need to be external

- Logic of the H-bridge working:

  Forward

  IN1 -> High

  IN2 -> Low

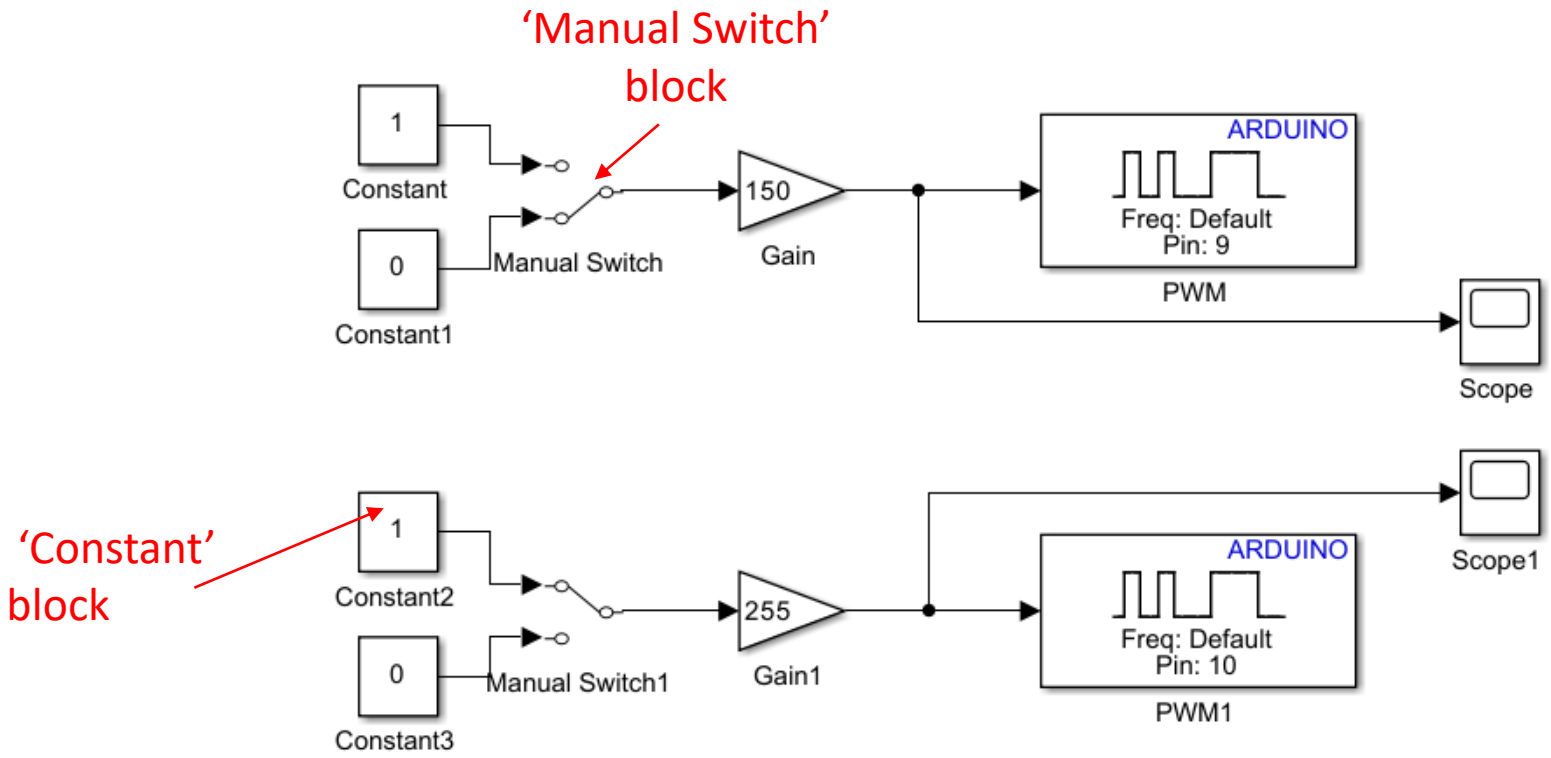
  Reverse

  IN1 -> Low

  IN2 -> High

  Stop

  Both are Low or High



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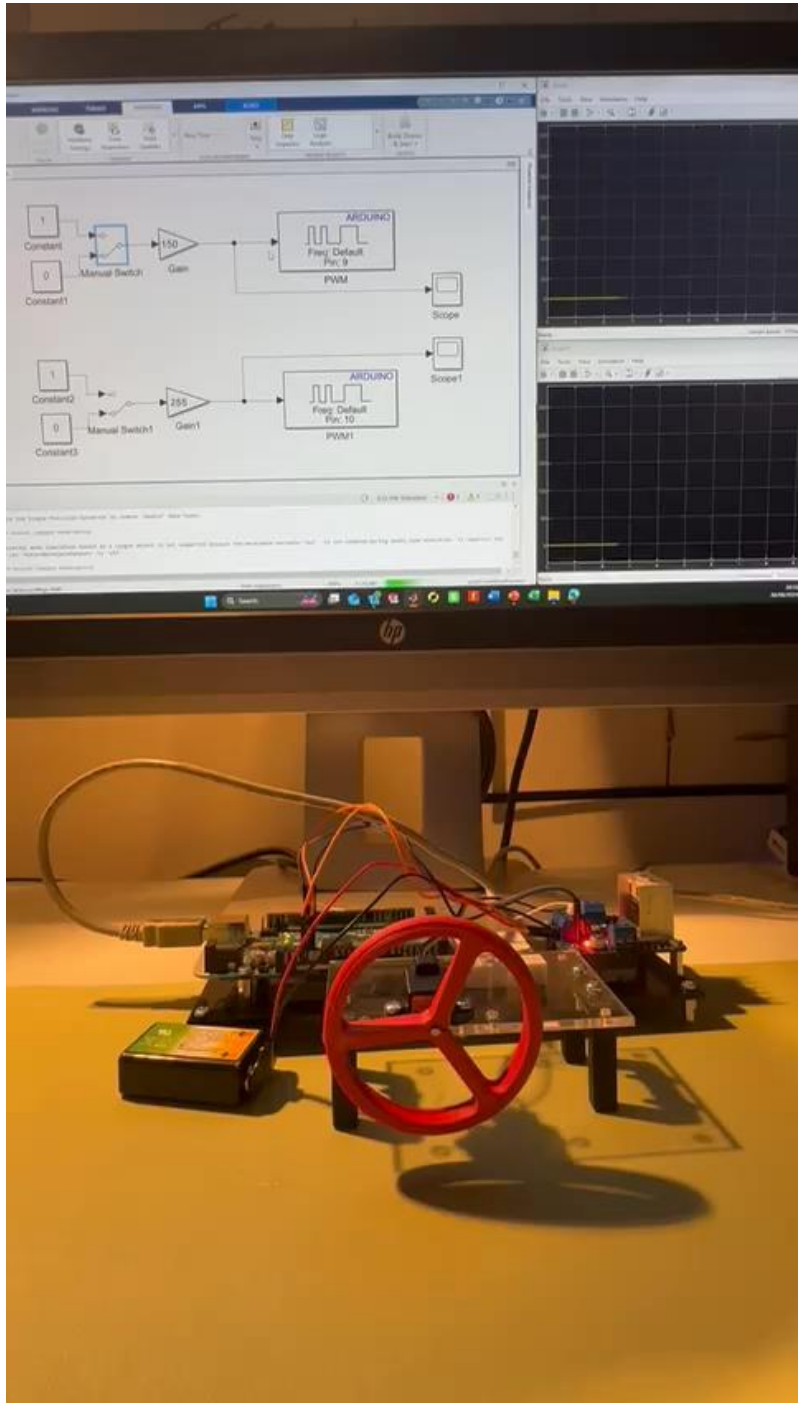
2.3 Algorithm Design

- Combines the pulse width modulation (PWM) and H-bridge



YouTube

Control-Lab-in-a-Box (CLB): DC Motors On/Off, PWM and Polarity Control

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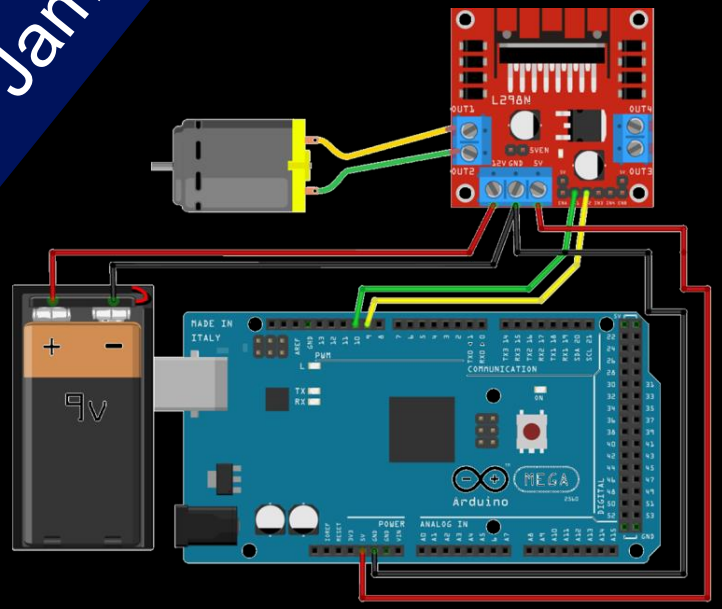

2.4 Summary

- The operation of a H-bridge (hardware) has been detailed in order to drive and change the polarity of a DC motor
- The algorithm design has been detailed for altering a DC motor speed using pulse width modulation (PWM) and the polarity (use of the H-bridge)
- In real-time, it has been successfully demonstrated how to alter a scaled down vehicles DC motor polarity and speed