Lab 1 – Feasibility Model Phase 1

ECE 298 – S2021

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# Part 1 – Project Design Requirements

1. **Functional Requirements**
   1. Requirement
   2. …
2. **Non-functional Requirements**
   1. Requirement
   2. …
3. **Constraint Requirements**
   1. Requirement
   2. …

# Part 2 – Project Considerations for I/O

## **Project Sensors and User Inputs**

{Details}

## Project Actuators and User Outputs

**Motor**

An actuator required for the project is a DC motor that will control the speed of rotation of the wheelchair’s wheels.

**Motor Connection**

Due to the high-current draw of a brushless DC motor, the motor will be connected to the MCU via a transistor whose gate voltage is connected to the analog OUTPUT pin on the MCU, and whose source voltage is provided by the power supply. The MCU will control how much current flows through the transistor to adjust the speed of rotation of the motor.

## Project MCU Internal Resources

{Details}

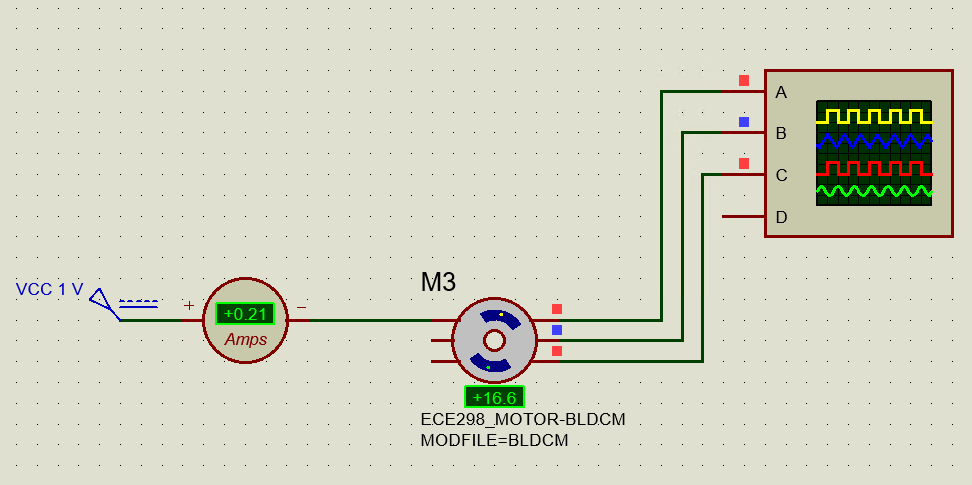
# Part 3 – Device Testing Methodology

## Device 1 – ECE298-MOTOR-BLDCM

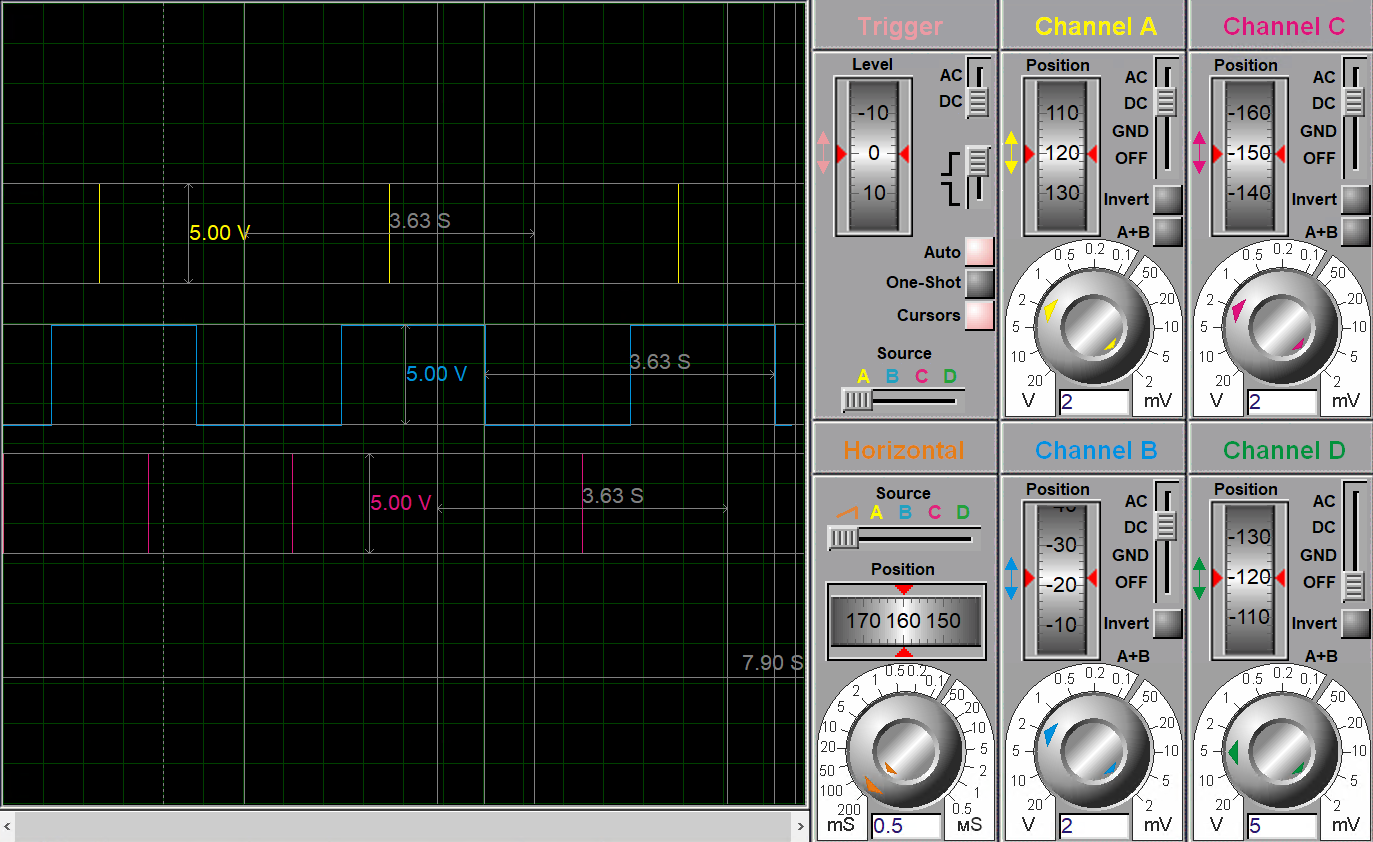
The ECE298-MOTO-BLDCM is the brushless DC motor that will be used to control the speed of revolution of the wheels on the wheelchair. This motor’s rotation speed is controlled by a DC voltage, and the voltage/current that the motor draws from a power source is proportional to the rotation speed of the motor.

To control the device, a voltage source will be connected to the P1A pin only (explained below). This voltage source will be an analogue output pin from the MCU (check if this is allowed!!).

The schematic used to test the DC brushless motor is below:

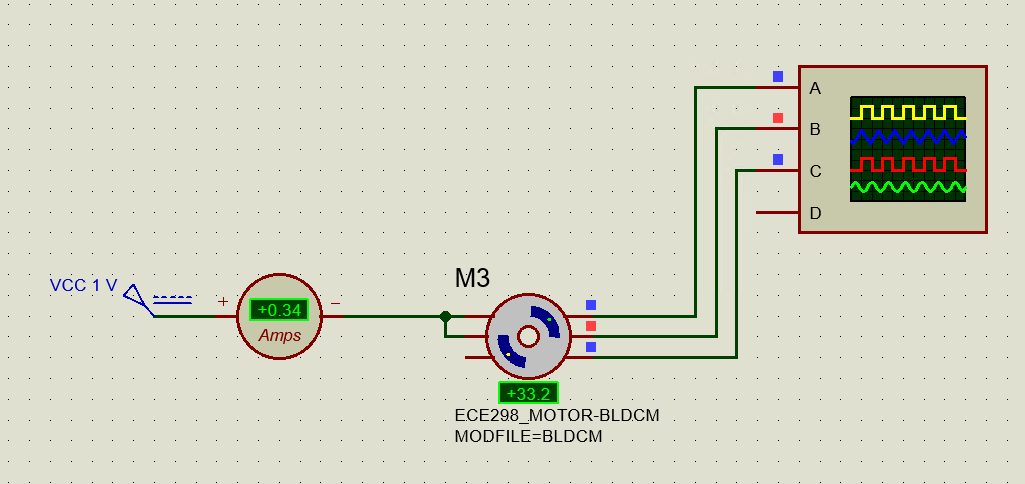
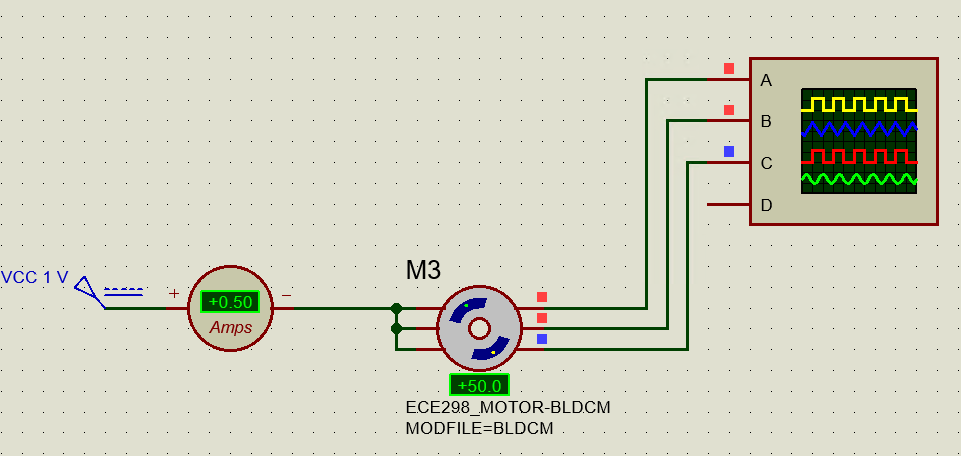


The DC motor’s P1A pin is connected to a voltage source of 1 V, drawing an average current of around 200 mA. The output B[1..3] pins are connected to an oscilloscope to monitor the output of the motor. It is seen that the rotation speed (in RPM) of the motor is directly proportional to the voltage supplied, where, at 1 V, the motor’s rotation speed is 16.66 RPM. The current drawn is similarly proportional to the rotation speed, drawing 200 mA/16.66 RPM = 12 mA/RPM. Below is an oscilloscope capture of the output of the B[1..3] pins for the same schematic:



It is shown that to identify a forward rotation, the rising edge of B1 is when B2 is low. It is shown the output of the motor is a square wave from 0-5 V with a period of 3.63 s at 1 V input. This period is inversely proportional to the rotation speed. The duty cycle of the square wave is 50%.

When the same power supply is connected to P1 and P2, the rotation speed, and current drawn, doubles. Likewise, when all three pins are connected to power, the rotation speed, and current drawn triples:

## Device 2 – PART\_NUMBER

{Details}

# Part 4 – System-Level Design

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