# CSC 615 Assignment 3 – Motors & Motor Shield – Zoom

This is an INDIVIDUAL assignment. You can (and should) work in groups to research how to do the assignment, but each person should code their own version and make their own submission.

This is a physical class, so I will want to see what you do in action. Documentation, including short video clips (can use your cell phone) are required as part of the submission.

You will also need to submit hardware drawings. These should be neat (can be either electronic or hand drawn, then scanned) of how the hardware is connected to the Raspberry Pi. This includes which pin (physical and GPIO), positive and negative flow, resisters, etc. I should be able to rebuild your setup from this diagram and then run your program and get the same results. Also see https://www.circuit-diagram.org/editor/# if you want to use that (they have a Raspberry Pi template).

## Assignment Description

1. Read the following page "Component Knowledge". NOTE, you will be using the WaveShare Motor controller HAT board with I2C interface. Make sure to focus on that one and if you are a hardware manager, you will need to remove the SB Motor Shield before mounting the WaveShare board..

2. This is the first of a two part assignment. In this first part you will control a motor. The motor should stop, go forward, backward, as well as speed control (Pulse Width Modulation).

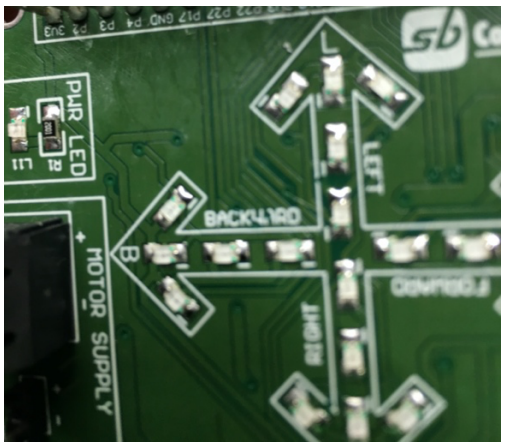
   You will also use a **Button**, and the purpose of the button is to start your program. So, you will run your program and it will wait until the button is pressed. Once it is pressed, then you will show the motor running forward for at least 2 seconds, then slow down to 15% gradually, then stop the motor for at least one second, then start the motor slowly and gradually increase speed to max but in reverse (backwards).

3. You are to connect the motor to any channel on the Motor HAT. See the specifications to determine the pins and the pin numbers or method.

4. Submit your homework in github (see link in iLearn assignment) and submit the PDF writeup in iLearn per the submission details below.

# IMPORTANT – Powering the motors

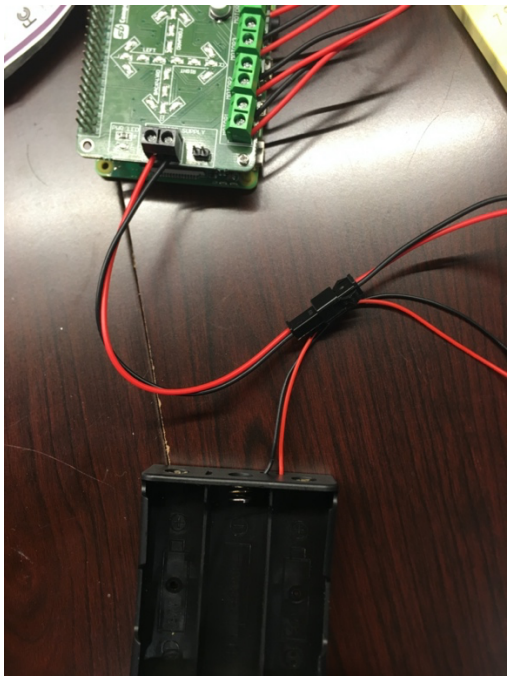
To power the motors, you need a separate power source. This is what the 3 Yellow 18650 batteries are for. Take note that the motor supply connector at the end of the motor shield has a positive and negative marked as shown in the picture below. In the individual kits you have a 9-Volt "snap" connector.



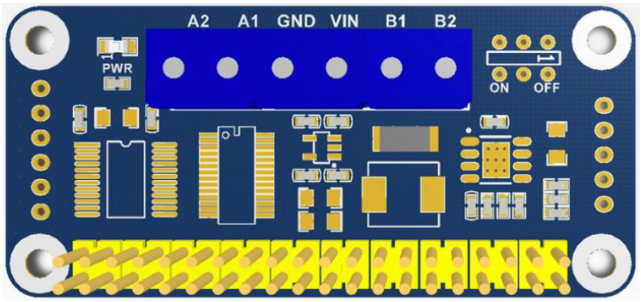


Use the power connector in the kit to connect the battery pack to the motor shield. My connector is a little different but see the picture below. Make sure to observe the polarity. By doing this, it is easier to connect and disconnect the battery from the Pi and reduces the chance of getting the polarity wrong.

Make sure to observe the polarity of the batteries into the battery case. Once inserted and connected, then connect the regular battery power to the Raspberry Pi.



# Component Knowledge – WaveShare Motor Drive HAT




This board uses I2C communication to control the motors with on-board PWN rather than through Raspberry Pi GPIO pins. This is efficient as the Pi has limited hardware PWM capability.

A single motor can be connected without additional power, though you can use a nine-volt battery to give it some extra juice! ☺

The link below provides the necessary information and user manual to show the i2c commands needed to control the motor. This is a great way to see how two different boards communicate using data verses just pin i/o.

https://www.waveshare.com/wiki/Motor_Driver_HAT

**Note**: You may use the PCA9685.c, the PCA9685.h, the DEV_Config.c, the DEV_Config.h, and the debug.h files for this project from the sample code. BUT, you **can not** use the MotorDriver.c or MotorDriver.h files – you must write that code on your own.

## Submission Details

You need to submit the following files into your GitHub repository:

1. All .c and .h source code files.

2. A makefile file to build your program (the file MUST be called **`makefile`**). The executable output files MUST be called **`assignment3`**.

3. A PDF that is clear and readable with your hardware diagram and short writeup on the assignment including and difficulties and resolutions (make sure to indicate polarity and pin numbers). In addition, this PDF must ALSO be submitted in iLearn.

4. A mp4 file showing your motors in action (show both the motor and the motor shield).

All parts of the submissions must have your name and student ID number. For Video's please have at least a 2 second clip at the beginning with your Student ID card clearly visible. (In absence of **your student ID card print out your Name and ID number on paper and film that**).

Please post questions to the slack channel.

## Grading Criteria

Grading criteria will be based on the following:

| | |
|---|---|
| Completion and success of the assignment | 25% |
| Code well structured, original and well documented | 50% |
| Hardware Diagram | 15% |
| Video | 10% |
| Instructions followed (this includes submission requirements) This is only a detractor from your grade, i.e. failure to follow the instructions will result in a reduction from the grade calculated from the criteria above. | -50% |