Ryerson Rams Robotics

Hardware Training Package: 1 of 2

Start Date: Wed October 7, 2020

Due Date: Sun October 18, 2020

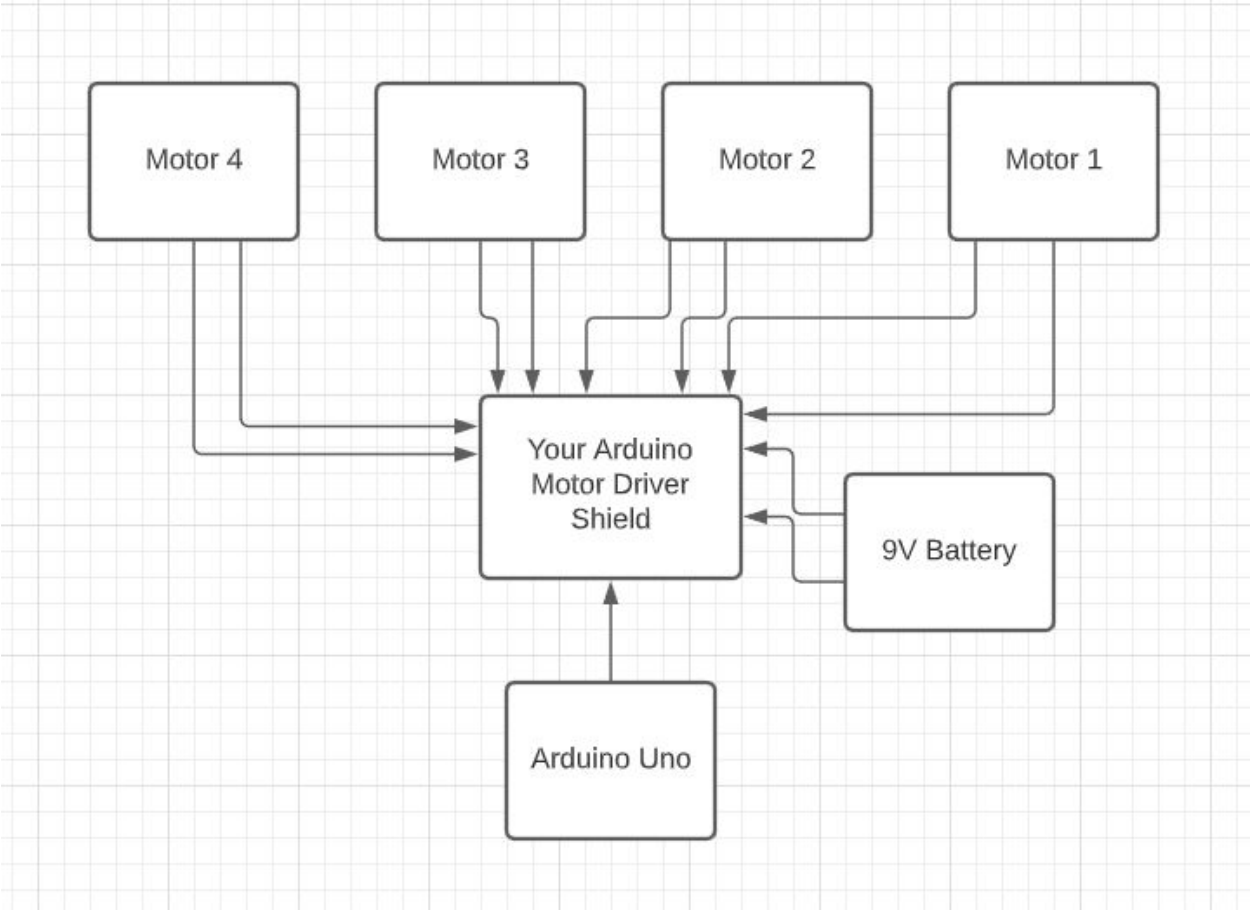
Introduction

A new project has started at Ryerson Rams Robotics. The team would like to develop a mini rover to test new drive and motor controls. You are tasked with designing the motor control system and must create an **Arduino Motor Driver Shield** to go along with it.

You can use any extra components needed as long as all 4 motors are controlled using the L293D and all requirements are satisfied. Also, over-designing circuits is just as bad as not meeting requirements, so do not over-design and use your space efficiently.

Also, you can assume the Arduino will already be powered by some external power source.

Block Diagram



Resources

Download Eagle(Use ryerson email) - https://www.autodesk.ca/en/products/eagle/free-download?plc=F360&term=1-YEAR&support=ADVANCED&quantity=1

Using Eagle - https://learn.sparkfun.com/tutorials/using-eagle-schematic/all
Videos:
Pt1. https://www.youtube.com/watch?v=35YuILUlfGs&ab_channel=GreatScott%21
Pt2. https://www.youtube.com/watch?v=j79RRCUsD2c
Pt3. https://www.youtube.com/watch?v=SgT2aUhJQHA

How to import custom footprints - https://www.snapeda.com/te/
Electronics design - https://www.youtube.com/channel/UC6mIxFTvXkWQVEHPsEdflzQ
Arduiono Basics - https://www.youtube.com/watch?v=BtLwoNJ6klE&ab_channel=GreatScott%21

L293D Datasheet - https://www.ti.com/lit/ds/symlink/l293.pdf

Arduino Footprint (Must access with Ryerson Email): https://drive.google.com/drive/folders/1ahFRbTPLQTbkuX4capNTHKvs_V9NHVlW?usp=sharing

TinkerCAD - https://www.tinkercad.com/

Requirements

- Design an Arduino shield that is able to control 4 motors both forwards and backwards using **at least** 1 of the **L293D Half Bridge IC**
- Download and use the Arduino Footprint file from https://drive.google.com/drive/folders/1ahFRbTPLQTbkuX4capNTHKvs_V9NHVlW?usp=sharing
- Create an Eagle CAD schematic of the motor driver circuit
- Create an Eagle CAD board layout of the motor driver circuit (Your board should look similar to the Figure 1.1)

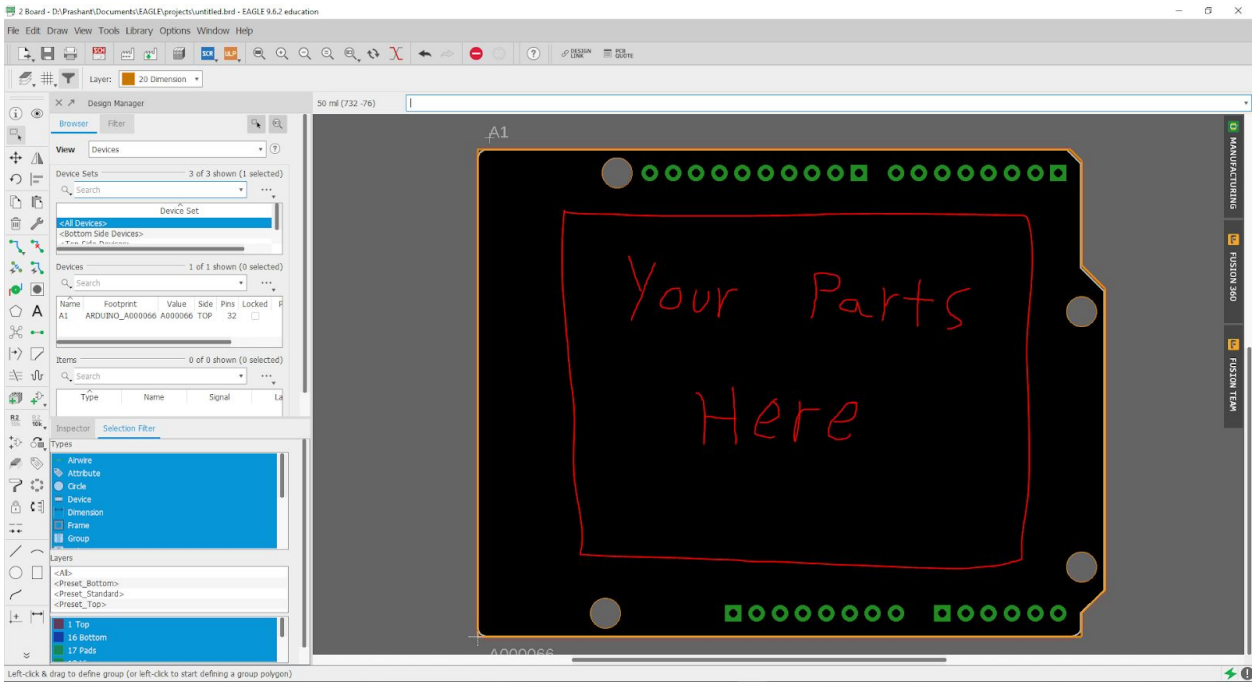


Figure 1.1 Basic layout of a Arduino shield

- **Any 8 Digital pins** on the Arduino must be connected to the inputs of the motor driver circuit to allow control of the motors.
- You will also need **4 pairs of motor V+ and V- header pins (8 Pins in total)** to be connected to the 4 motors
- **All motors** will run off a **separate 9V Battery** and therefore 2 extra pin headers must be added as a supply line in for the motor drivers
- The mini rover will have 4 motors, 2 on each side of a rectangular body. Each motor **must be able to spin forward and backwards**. See *Figure 1.4*.
- EVERYTHING must be labeled with appropriate labeling and clean design. Use your space wisely and make it look nice. For example, take a look at *Figure 1.2* and *1.3*

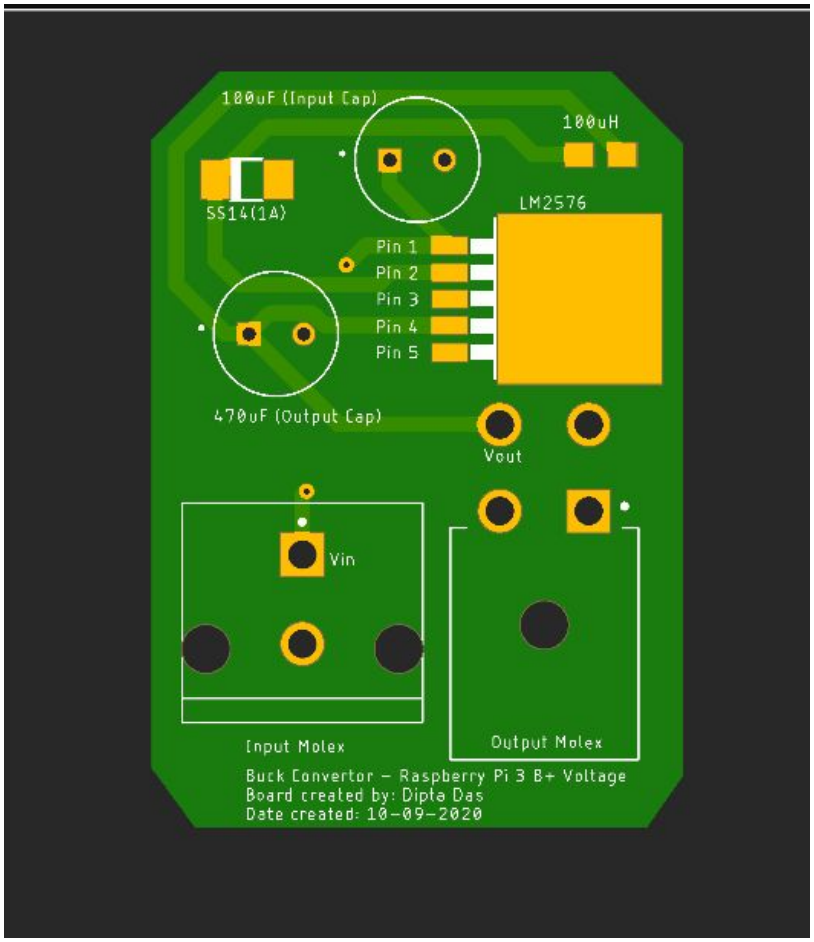


Figure 1.2 : Labeled Buck Converter created by R3 member Dipta Das

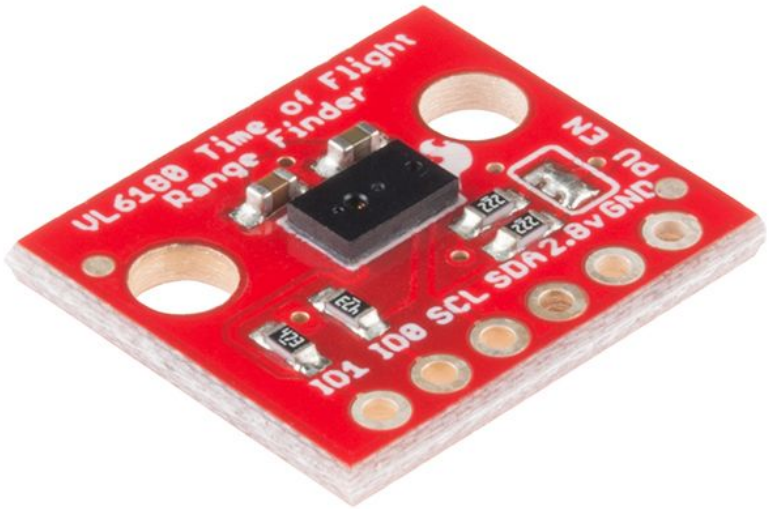


Figure 1.3 : Flight Range Finder with clear labels of inputs from Sparkfun Electronics

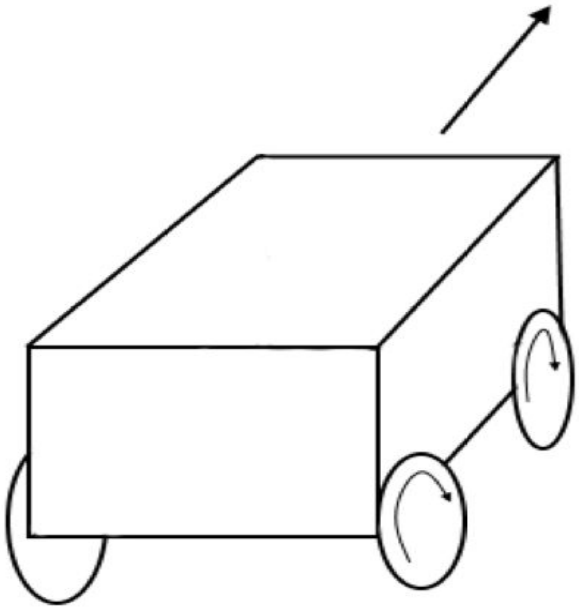


Figure 1.4 : The Mini rover has 4 wheels that are able to move in both directions

Where to Start (Tips)

- Research how the L293D works and wiring diagrams of the IC.
- Figure out how to create a circuit using the L293D to control 1 motor back and forth, then work on adding in the other 3 motors
- Look at the resources posted above and familiarize yourself with Arduino.
- Find out which pins are digital pins and then wire them up to the L293D to allow for motor control
- If you are a complete beginner, you may want to plan out the circuit first on a piece of paper or in TinkerCAD. TinkerCAD is a great website that allows you to build and simulate circuits.
- TinkerCAD is not required for this Evaluation but it will allow you to test your circuit and check if you designed your circuit correctly. You may need to learn very basic Arduino commands to make the motors spin and resources are widely available online.
- After designing the circuit, you need to learn how to design boards in Eagle CAD. Tutorials can be found in the resources section.
- Once you have figured out how to use Eagle, create a schematic diagram of your motor driver circuit on Eagle and find necessary components on SnapEDA or in the Eagle Libraries. SnapEDA is a website where you can download schematic symbols and footprints of popular ICs. For example, if I need the Eagle symbol for an **LM741J** operational amplifier, I would search up **LM741J** on SnapEDA, and I would get the part below. Follow the guide for SnapEDA in the resources section to learn how to import the file into Eagle. (Also, you need to make an account)

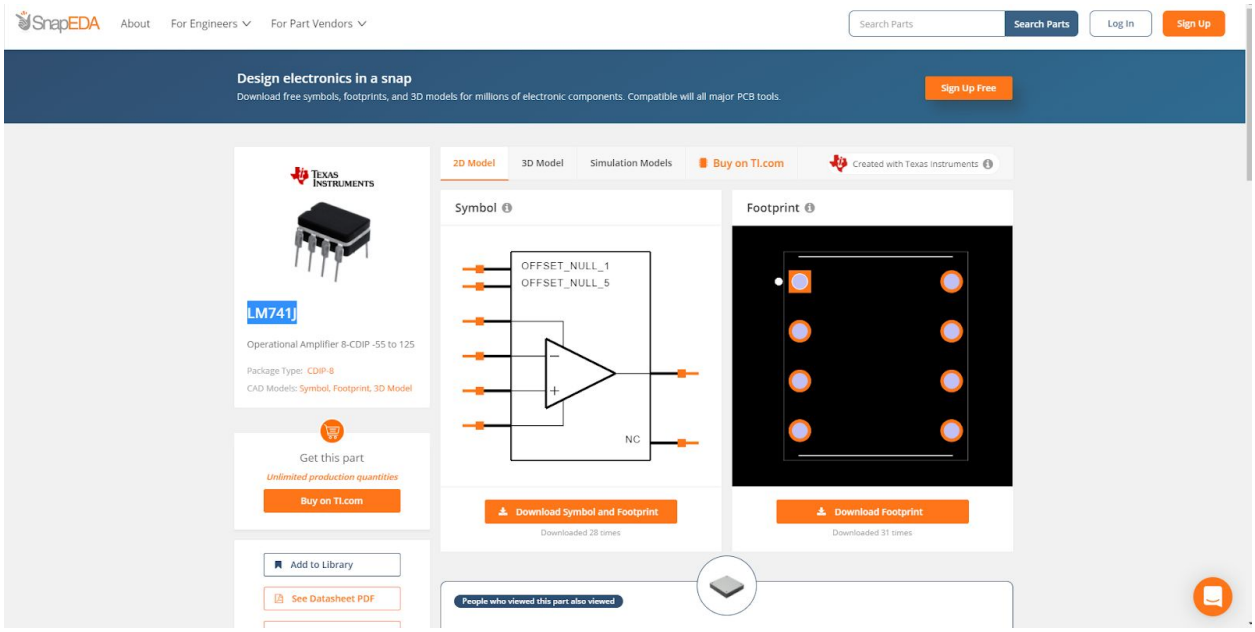


Figure 1.5 : LM741J op-amp symbol and footprint found on SnapEDA

- Once your schematic diagram is completed, you can create your board layout and wire everything up. (Make sure you meet requirements)

What you must Hand In

1. Design Process Summary (text document explaining design process over the week including problems, solutions and challenges)
2. Eagle CAD Schematic
3. Eagle CAD Board Layout
4. (Optional) TinkerCAD Schematics and Arduino Test Code
5. (Optional) Drawn circuit diagrams or design iterations

Please Zip the files and submit them here. Also name the file like so: *“First Name”.”Last NameInitial”.“Evaluation”.* For example, if John Wick wants to submit, he would name his file

John.W.Hardware.zip

To **Submit** your project please use the following link:
https://forms.gle/gzT3AByKKirMi1gt5

Due Date

You will have 1.5 weeks to complete this package, so it is due by Sunday, October 18th at 11:59pm. Any changes made to the part after that deadline will be overlooked, so please finish on time.