Team 12 Documentation

EvoSkate

Table of Contents

Introduction

This project is a new take on old tech. We are taking the whole concept of an electric skateboard and reversing it, converting mechanical energy from the wheel into electrical energy that can be used to power another electrical device like a phone. This project creates renewable energy from a mode of transportation most people use regularly and use it to power something that they may use just as if not more often.

Our product is not currently complete. It lacks the ability to charge while skating in both directions as well as lacks durability. Furthermore, problems may arise when skating over certain uneven terrains as the motor mount lies close to the floor. In the future, we hope to fix the issues stated above as well as improve and add on to the existing product. This includes a display that will show how much “charge” you have accumulated in the battery as well as an app that can track statistics on how far and how fast you have ridden between charges. Another direction we could take with our product in the future is as an improvement to electric skateboards. This technology could be used to increase the time between charges for electric skateboards by charging the skateboards battery whenever the rider goes downhill.

Materials

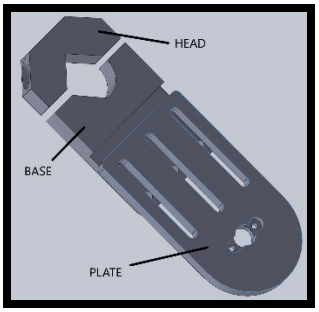
- Longboard
- Laptop with SolidWorks
- 3D-Printer
- 8-32 screw tap
- 10-32 screw tap
- 1” 8-32 screw
- 1” 10-32 screw x 4
- 10-32 hex nut x 2
- 10-32 washer x 2
- High Speed Motor Screws x 2
- 12V DC Motor
- 3/8” width, 12” length timing belt
- Soldering Iron
- Solder
- Wire Strippers
- Wire
- 3.7V Li-on Battery
- TP4056 Lithium Ion Battery Charging Circuit
- LM317 Linear Voltage Regulator
- 2 330 ohm resistors
- 220 ohm resistor
- MC34063A 1.5 A, Step-Up/Down/ Inverting Switching Regulators

- 3 1k ohm resistor
- 220 ohm resistor
- 4.7k ohm resistor
- 3 100uF 12V capacitors
- 18.91 uH inductor
- 470 pF capacitor
- 1N5819 diode
- micro usb charging cable

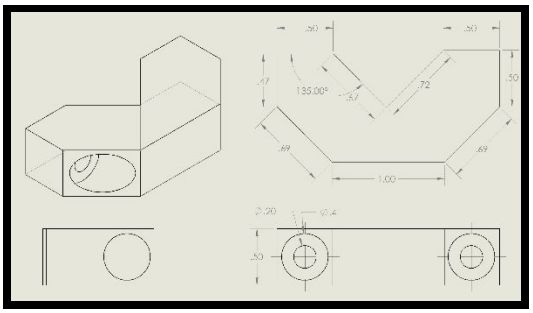
Instructions

Motor Mount

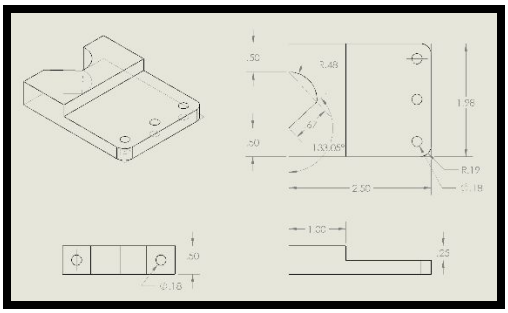
- To make the Motor Mount you will need: A **Laptop with SolidWorks**, access to a **3D Printer**, and the assorted **screws**, **washers**, and **nuts** (see materials list)
- The Motor Mount is split into three subassemblies: the head, the base and the plate



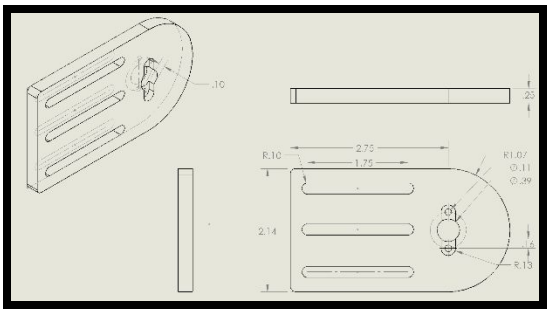
- **The Head:** Copy the CAD and 3D Print with standard quality and 30% infill



- **The Base:** Copy the CAD and 3D Print with standard quality and 30% infill



- **The Plate:** Copy the CAD and 3D Print with standard quality and 30% infill



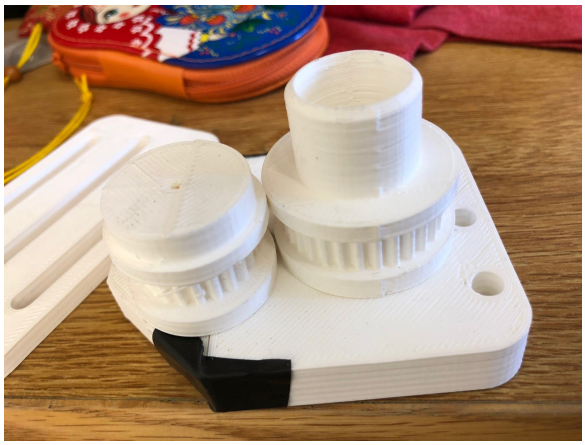
- Use the **10-32 Tap** to Tap the two **0.18”** holes on **The Base**

The Gears

- There are two gears, the **wheel gear** and the **motor gear**

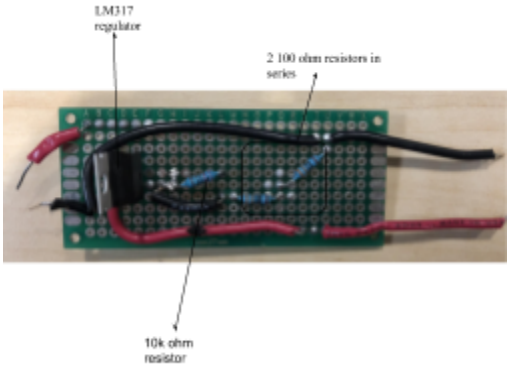
Wheel to motor gear ratio is 1:1.33

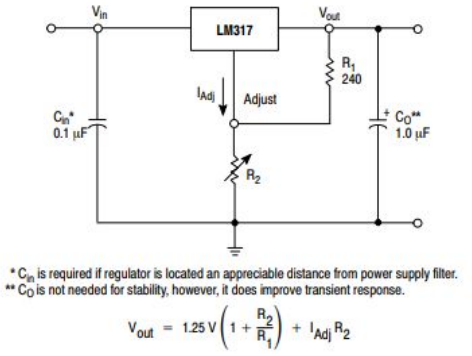
The printing were made in 50% infill to make it sturdier.



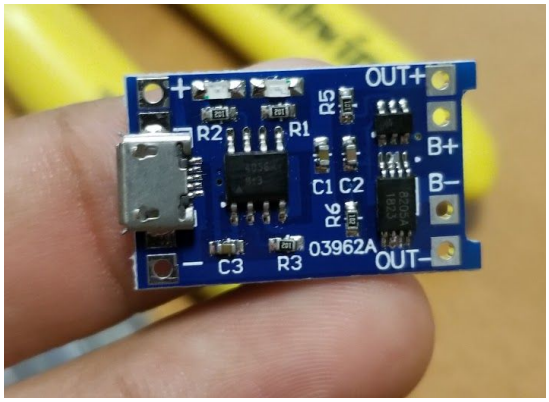
The Circuits

- Voltage Step Down Circuit: used to lower the output voltage from the motor (~7V - 12V) to a voltage of ~5V to charge the lithium ion battery through the TP4056 charging circuit. The circuit diagram is shown below on the next page. The lM317 regulator is the core of this circuit. Use 2 330 ohm resistors in series for R2 and a 220 ohm resistor for R1. Do not use Cin or Co in the circuit diagram below.



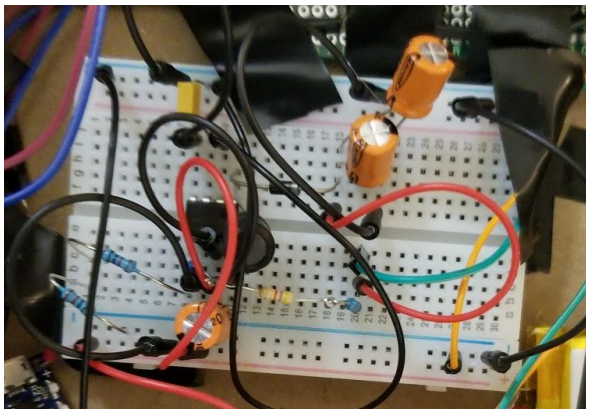


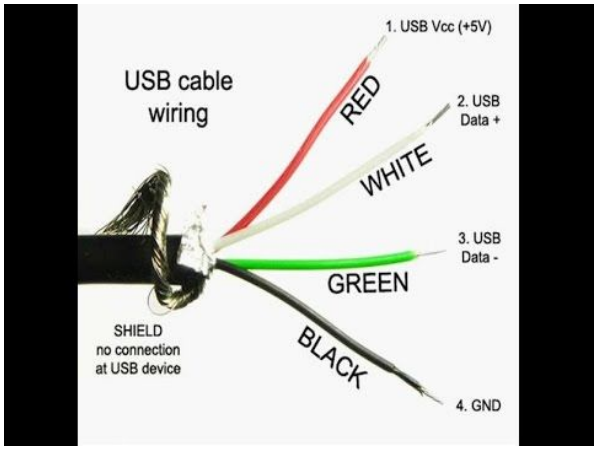
- TP4056 Charging Circuit: A constant current charging circuit for the Li-on battery with built in protection circuits. wire the output from the step-down circuit to the + and - input terminals on the left of the circuit. Wire the Li-on battery to the B+ and B- terminals then wire OUT+ and OUT- to the 5v step-up circuit to transform the ~3.7V from the battery to ~5V

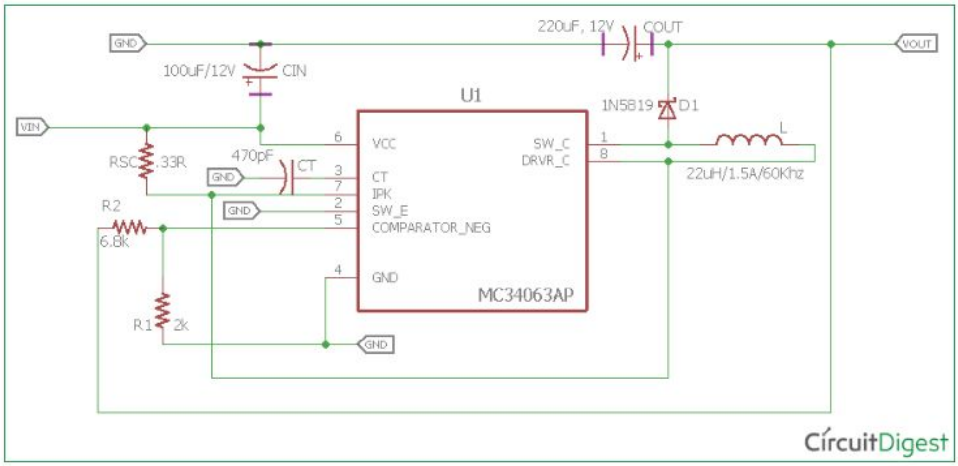


- 5V Voltage Step-up Circuit: The voltage step-up circuit steps up the voltage from the Li-on output ~(3.3V - 4.2V) to 5V. this circuit is used to step up the voltage so that it can be used to power a phone through a spliced micro usb charging cable. To do this cut off the usb 2.0 male connector then wire the positive lead and negative leads to the output of the step-up circuit. you do not need the data portions of the usb cable. A cable wiring diagram is shown below for more clarity, not all usb cables are the same but this is the most common format. The circuit diagram is below on the next page. R1 is made with two 1k ohm resistors in series. R2

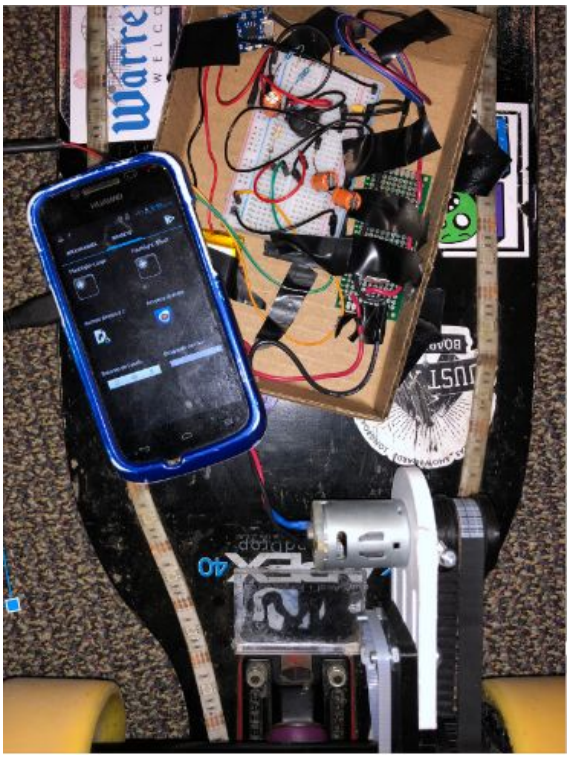
is made with a 1k ohm resistor, a 220 ohm resistor and a 4.7k ohm resistor in series with a value of ~5.92K ohms. the 220 uF capacitor was made with two 100uF capacitors in parallel.

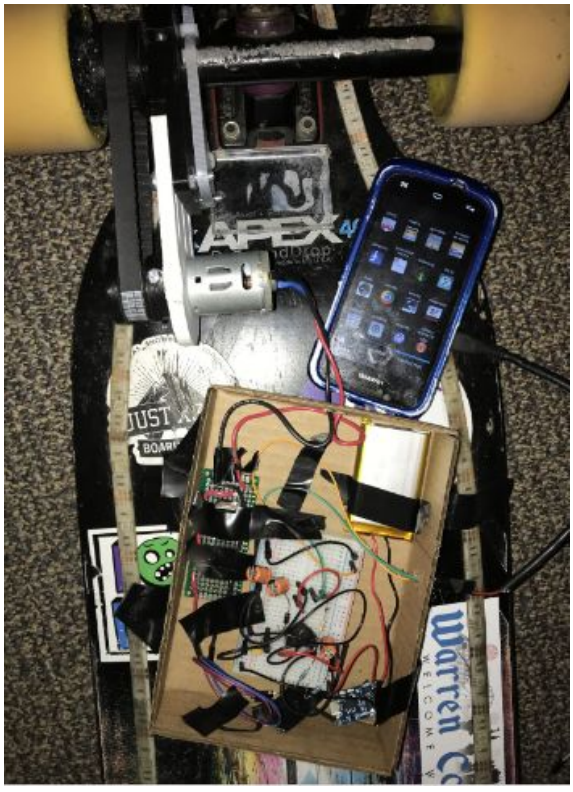






Final Prototype





Conclusion

With more time, we could further improve on the design of our motor mount, making it less likely to scrape the ground on a bump. With more funding, we could make the mount out of machined aluminum instead of 3D printed material increasing durability and decreasing the likelihood of the screws coming loose. We could also afford to buy precision pulleys for our timing belt that would help the efficiency of the system.

References

Special thanks to the MAE 3 Lab for providing all the hardware used in our mount as well as guides for hole sizes for 3D printing. http://mae3.eng.ucsd.edu/