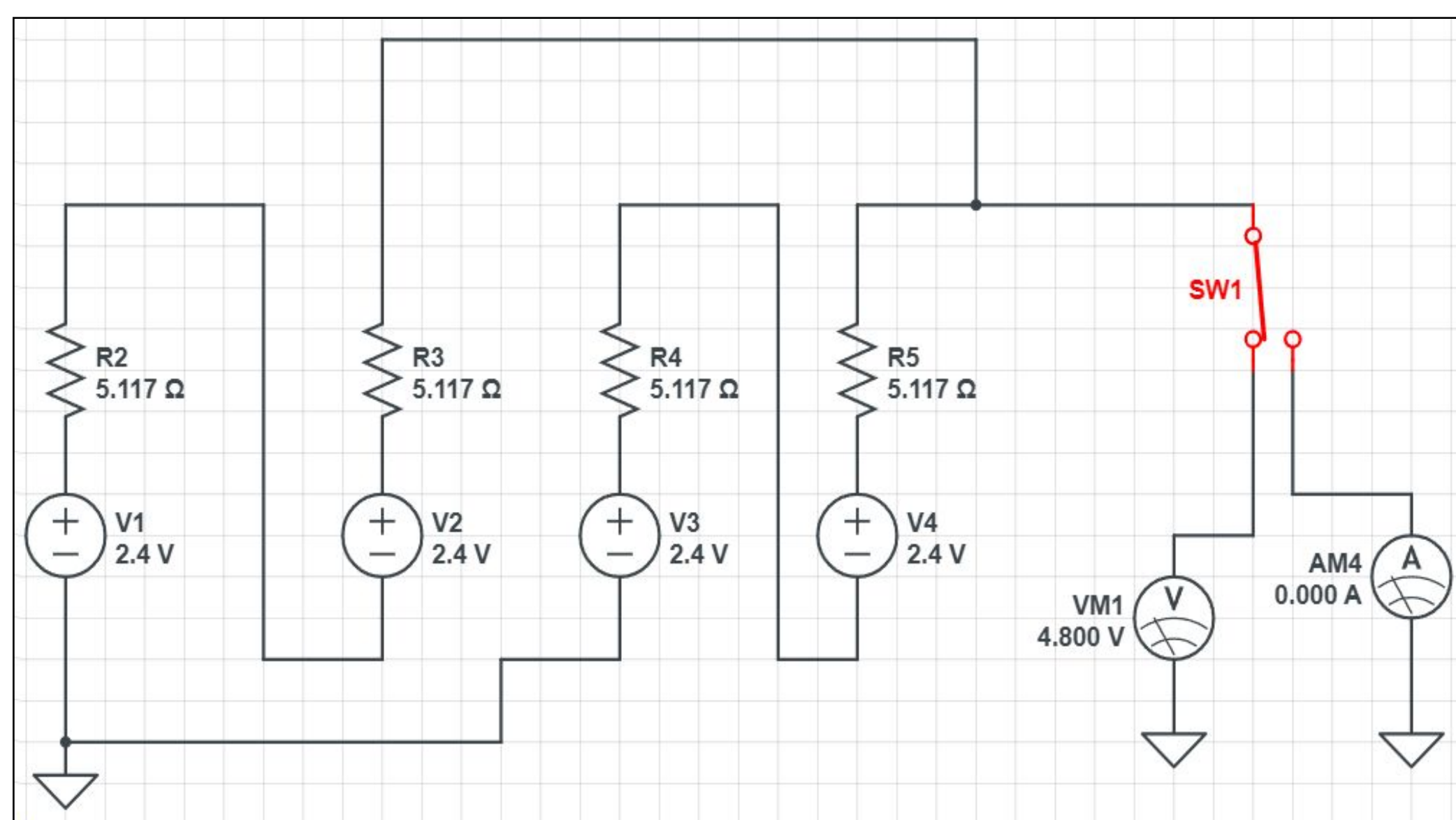


Problem Definition

In 2021, approximately 52.3 million people in Americans went camping in some form, and approximately 60 million went hiking. A charged phone is necessary for emergencies and communication; however, it is difficult to recharge devices or battery banks far from civilization and existing solutions are big, bulky, and tedious to carry. As well, existing devices and battery packs tend to drain quickly due to thermal conditions and frequent usage.

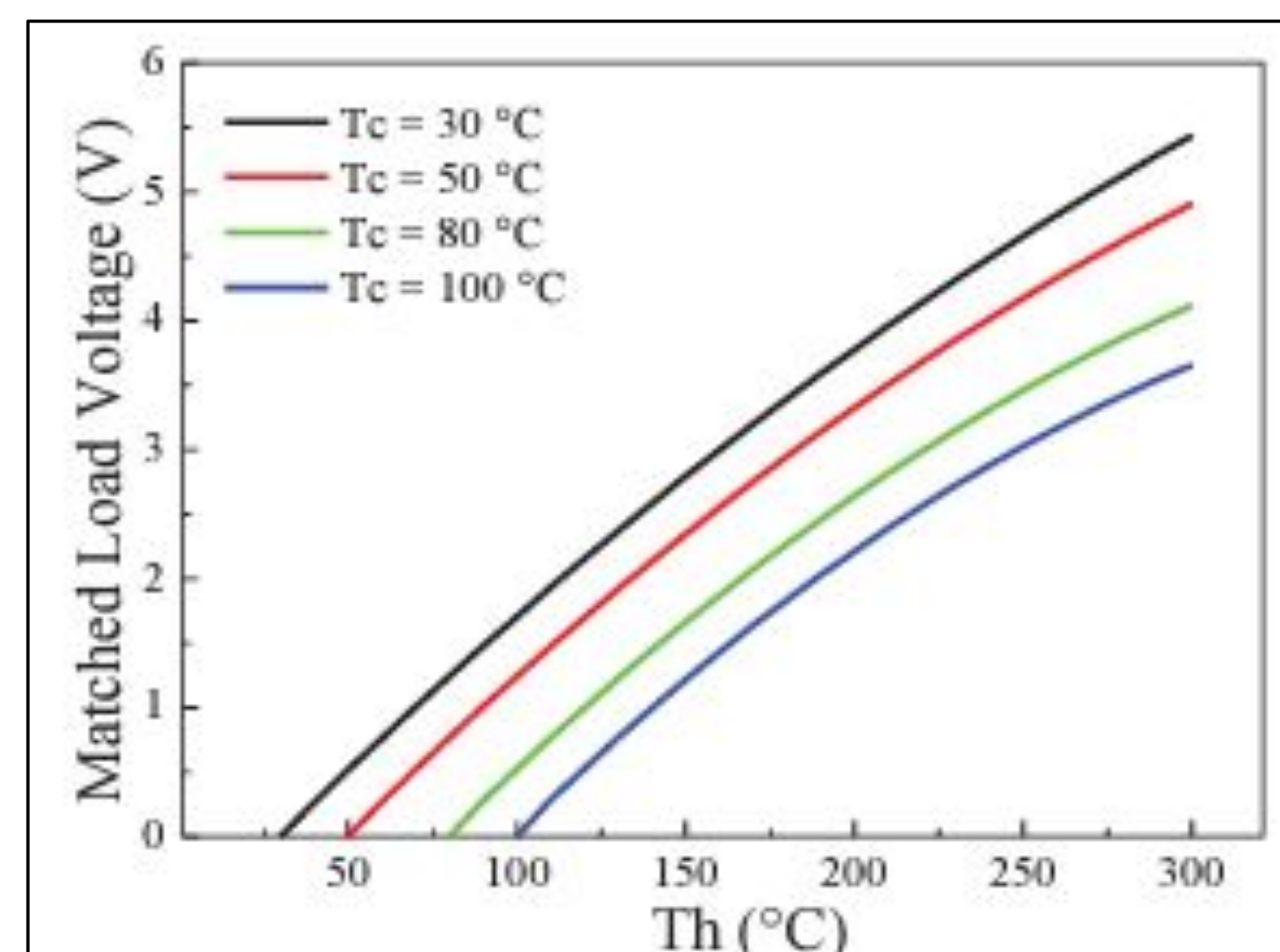
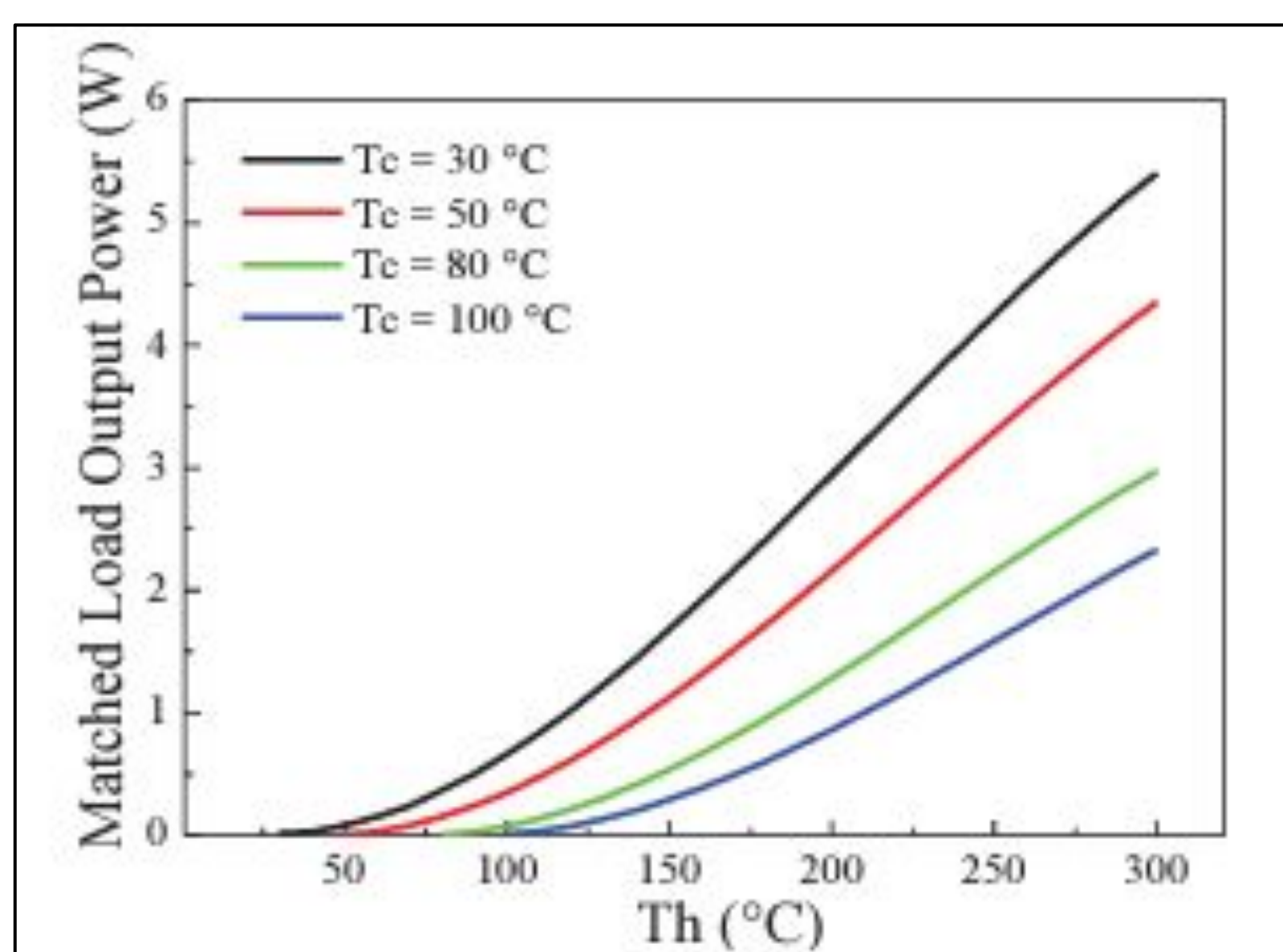
This design seeks to generate power using thermoelectric generators in a lightweight and compact form factor.

Design Calculations & Analysis



TEG circuit for the design;

Datasheets for the TEGs detailing the matched load output power and voltage



Part	Quantity
Thermoelectric Generator	x4
Adafruit microcontroller	x1
Buck/Boost Converter	x1
Finned Heatsink	x1
LED Display	x1
Steel heat retaining plate	x1
Electrical Fan	x1

What is a TEG?

TEG stands for Thermoelectric Generator and it is a small device consisting of two connected ceramic plates. Using the Seebeck effect, when a temperature difference is created across the plates, power is generated due to the conductors between them.

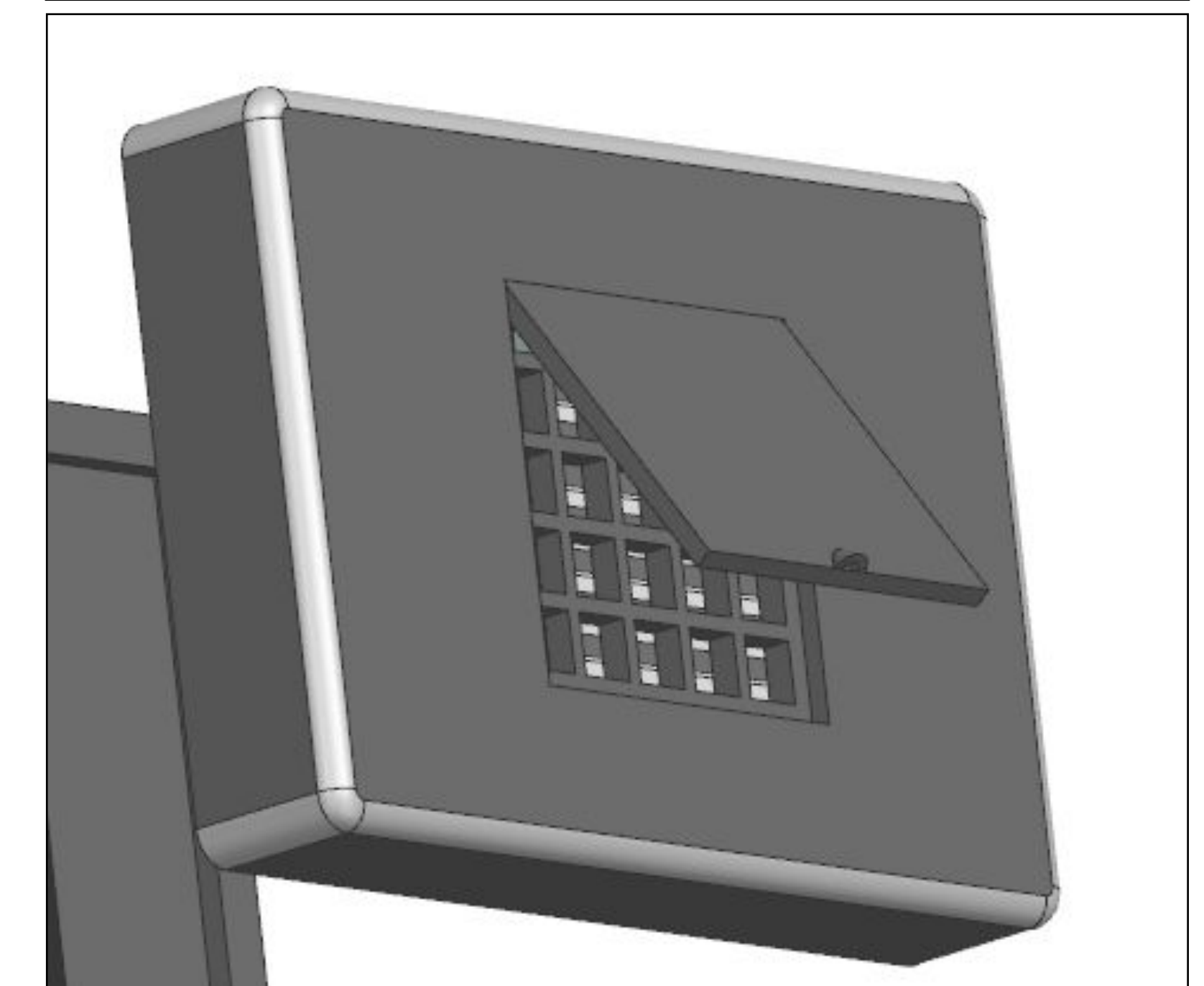
Final Design

Our final design is a handheld thermal powered generator that takes in heat and converts it to electrical energy. It is intended to be propped up beside a campfire to passive generation

The design consists of four TEGs pressed against a heat retaining plate. On the backside is a finned heat sink connected to a fan for active cooling.

A microcontroller as well as a buck/boost converter is added to regulate voltage to safe levels for users to charge their devices.

The housing has a propped panel on the back that opens up, serving the dual function of allowing cooling air flow and the user to stand the device up towards a flame.



Prototype & Test Results

Voltage Testing: The TEGs were connected in 2 groups of parallel, connected in series. On the back of the TEGS the finned heat sinks were attached with thermal paste and the box fan was aimed at the heatsinks to forcibly convect away as much heat as possible. The TEGs were then wired to the voltage buck booster which was wired in series with the multimeter.

The wiring was checked for continuity. The heat gun was then applied to the TEGs. Voltage was measured and recorded after one minute. Early results displayed less than desired voltage with voltages of around 3 volts

