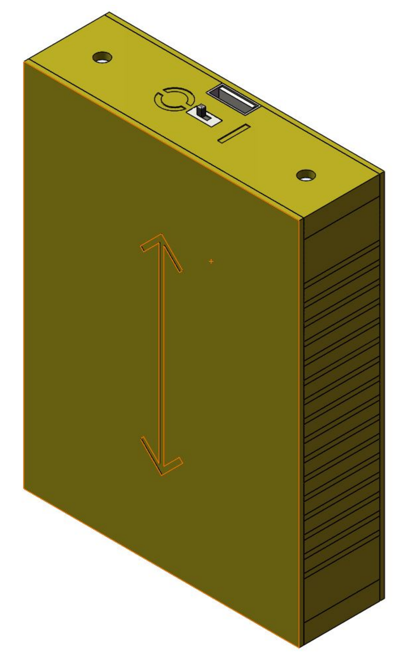
The Pocket Generator a Self-Charging Backup Battery

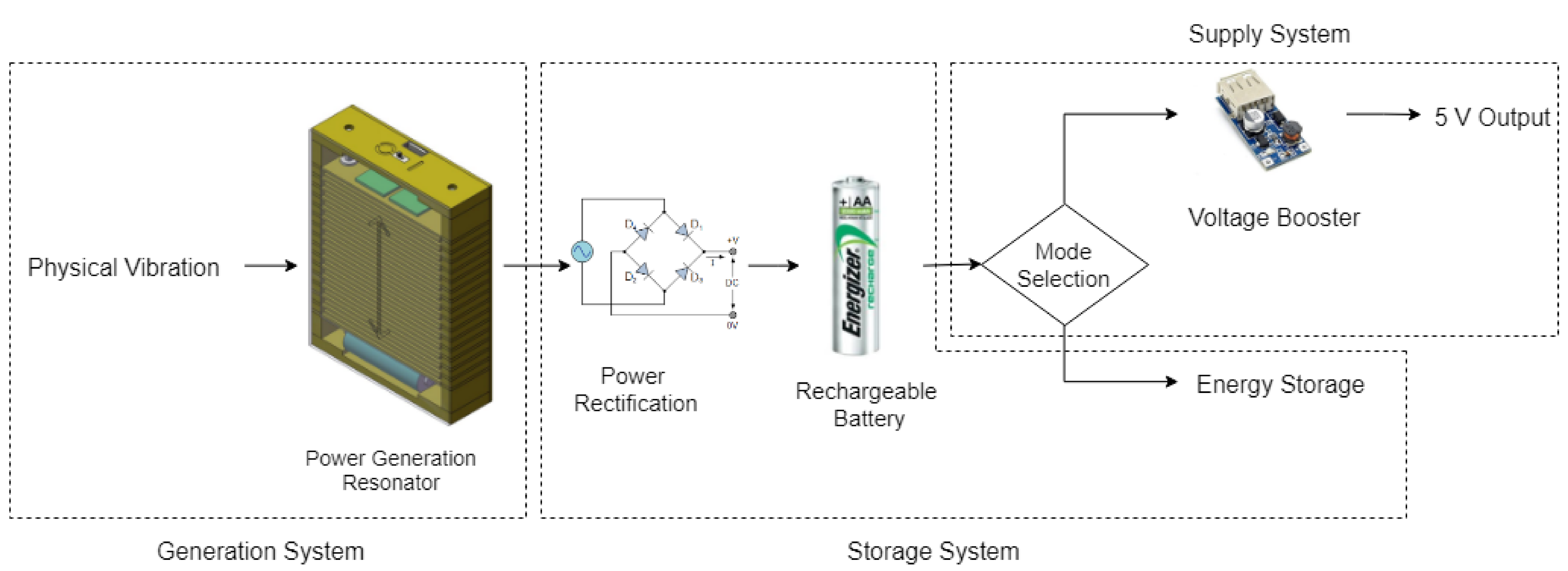
1. Introduction

The purpose of this project was to provide a personal external power source for small electronic devices such as smart phones. The objective was to use triboelectric effects between materials with different electron affinities in order to store energy from mechanical movement. This effect allowed the pocket generator to collect energy as it was carried by a person throughout their daily routine. Directing that energy into a rechargeable battery allowed that energy to be used later for powering a personal electronic device.



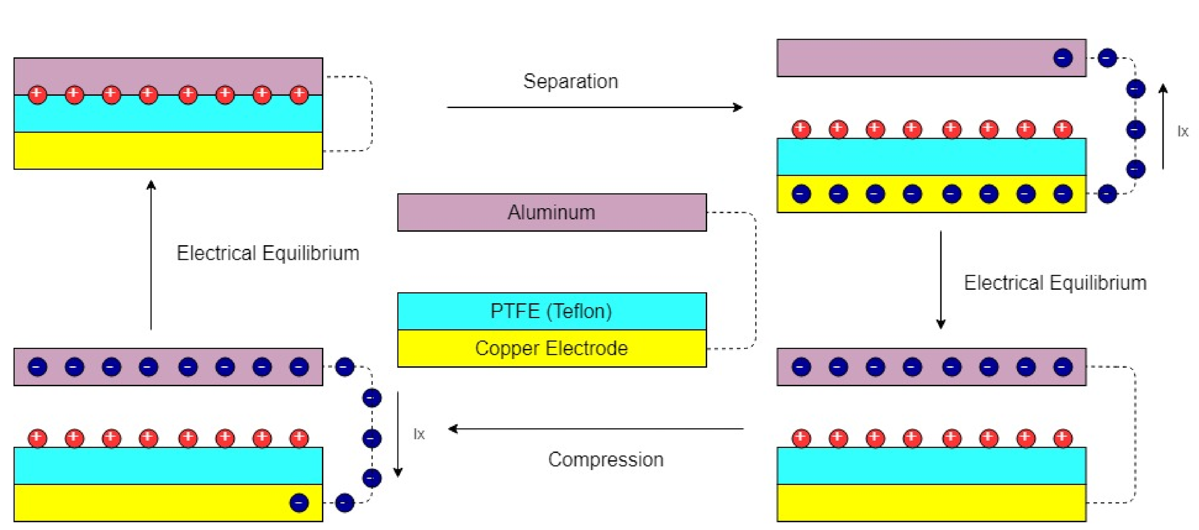
2. System Overview

The system diagram below shows the design of the pocket generator. The generation system uses triboelectric layers to drive an alternating current of electricity. The storage system rectifies the power coming out of the generator so it can charge a battery. Using a selection switch, the power from the battery can be directed to a booster circuit where it can be used to charge a device through a USB connection.



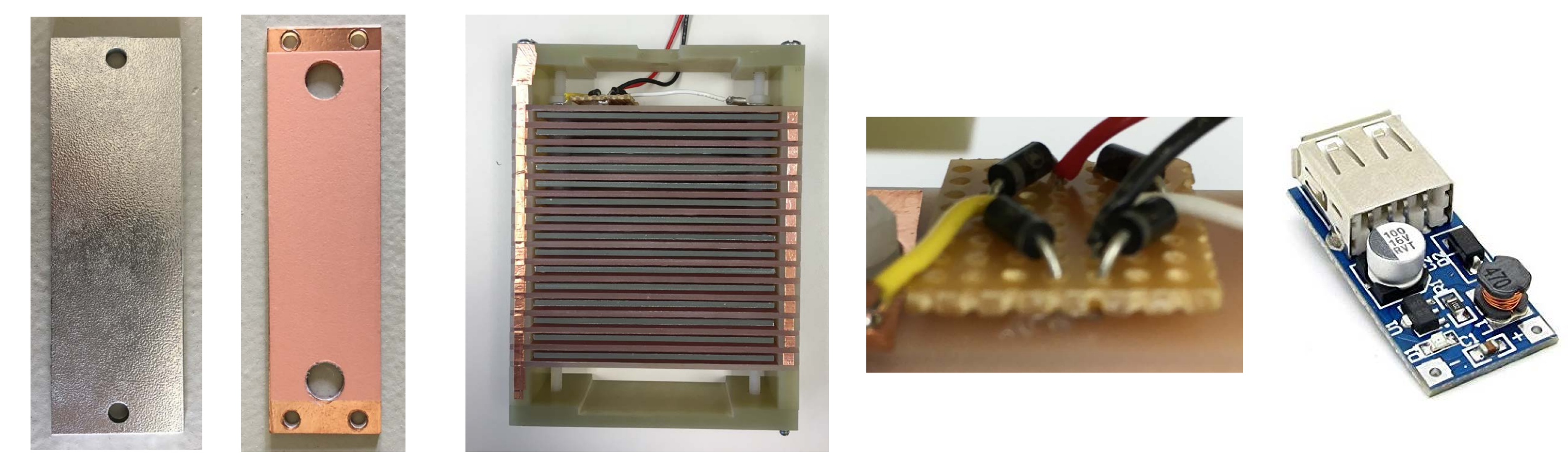
3. The Triboelectric Generator

The triboelectric generator uses material with different electron affinities to drive an alternating current. For this design, aluminum was selected as the material with a positive affinity because of its capability of also acting as an electrode. PTFE (Teflon) was selected as the other material because of its strong negative electron affinity, and it was placed on a copper electrode. The figure below shows how the contact and separation of these layers caused a flow of electrons between the two electrodes.



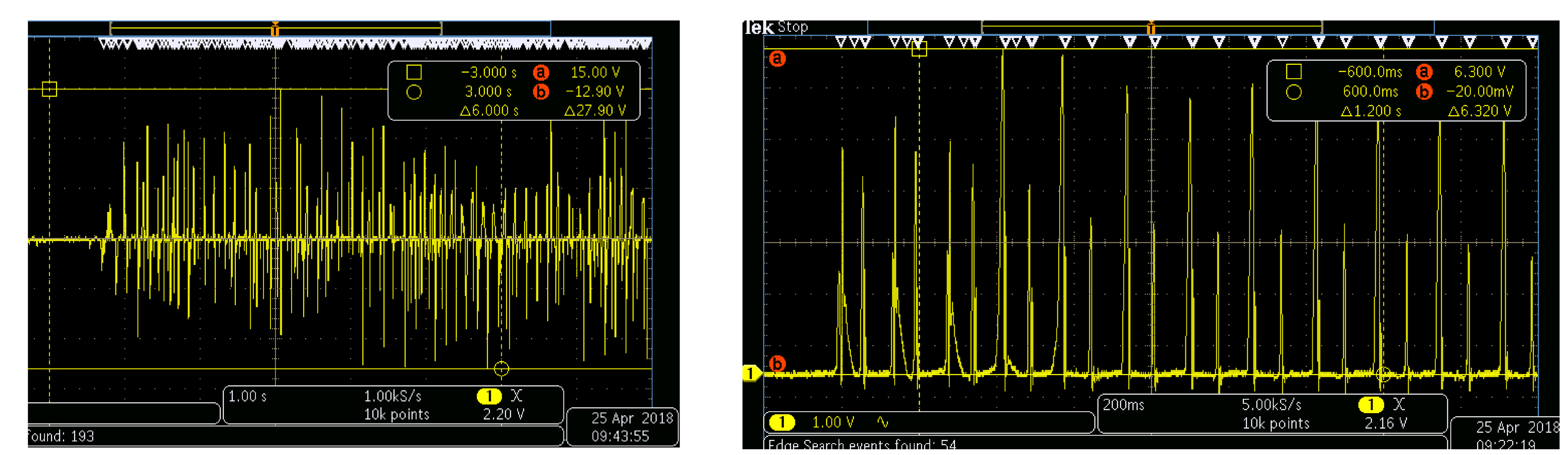
4. Methods and Materials

The system used FR4 to support the triboelectric layers that were used for power generation. Placing these layers on slides that were cut from the FR4 allowed them to be compressed against fine grit sand paper in order to magnify the surface area of the contact materials. The layers were assembled in a resonator to allow the surfaces to contact repeatedly as they were vibrated. The generated electricity was directed to a rechargeable battery through a diode bridge rectifier. In addition, the battery was connected to a voltage booster circuit to convert the 1.2 V from the battery to the required 5 V output required by a USB source.



5. Results

The system was able to generate electricity as shown below. The figures show the electrical output from the generator as the resonator vibrated. Tight tolerances in the system kept the resonator from exciting without vigorous vibration, which would need to be improved in future designs. Also, the power output from the device was significantly less than what was desired from the pulses of the generator.



6. Conclusion

The Pocket Generator showed that the system could successfully generate electricity. However, it was limited in its ability to produce enough power for a viable system due to tolerances that inhibited the function of the resonator, and the lack of resources for surface modification of the contact materials. The tolerances could be improved in a future design to allow the resonator to vibrate freely, and to ensure that each surface of the stacked layers is able to make contact. If the resources necessary for nano surface modification of the contact layers could be acquired, the effective surface area of the design could be significantly magnified to increase the output power performance of the generator.

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