

A Wearable Bracelet for Thermoelectric Energy Harvesting

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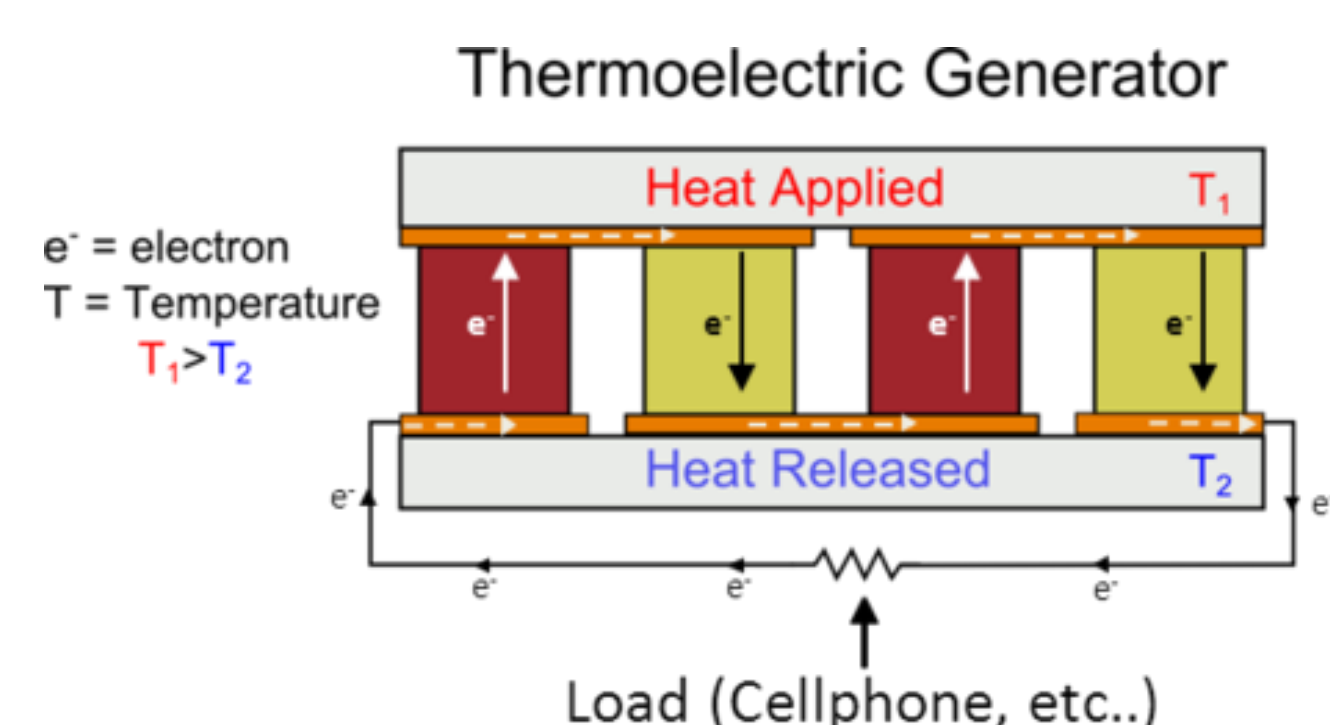
Advised by Feifei Lian, Rachel Luo, and Prof. Eric Pop

Motivation

How can human body heat be used to power small electronics and devices, such as LEDs?

Background

Seebeck Effect: $\Delta T \rightarrow \Delta V$



$$V = \alpha \Delta T - i R_{TEG}$$

$$\text{Figure of Merit: } zT = \frac{\alpha^2 \sigma T}{k}$$

α = Seebeck Coefficient
 σ = Electrical Conductivity
 k = Thermal Conductivity
 TEG = Thermoelectric Generator

Prototypes

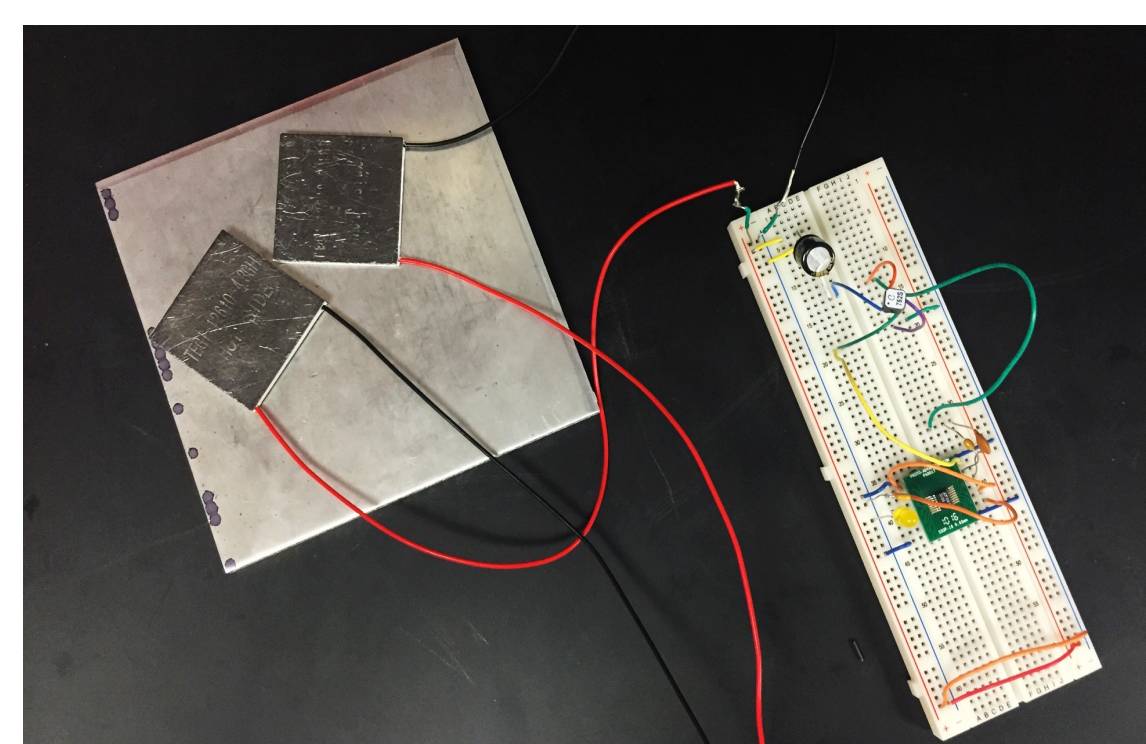


Figure 1. Breadboard prototype with large TEGs



Figure 2. TEG Bracelet formed from 1 cm x 1 cm TEGs

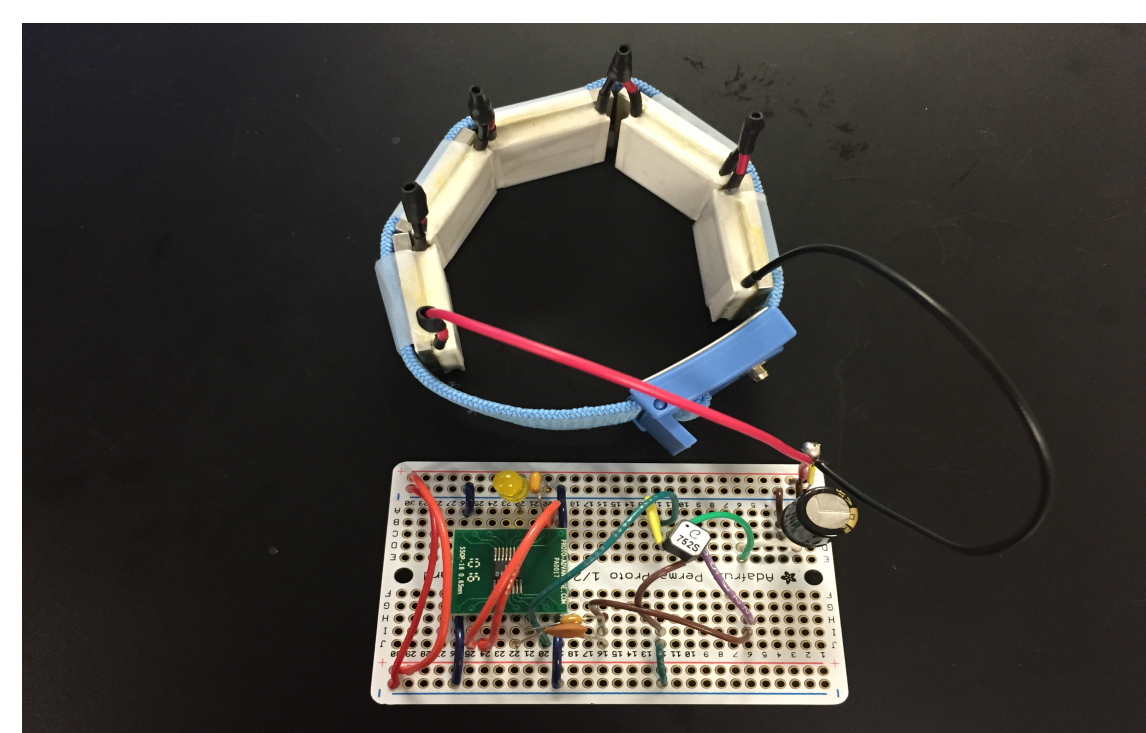


Figure 3. Current bracelet with 2.3 cm x 2.3 cm TEGs and perf board

Figure	TEG Input Voltage (mV)
1	250
2	10 - 20
3	175

Future Work

- Boosting power
- Adding storage capacitor for extra voltage
- Increasing efficiency
- Using different materials and heat sinks
- Making PCB
- Cost reduction and packaging

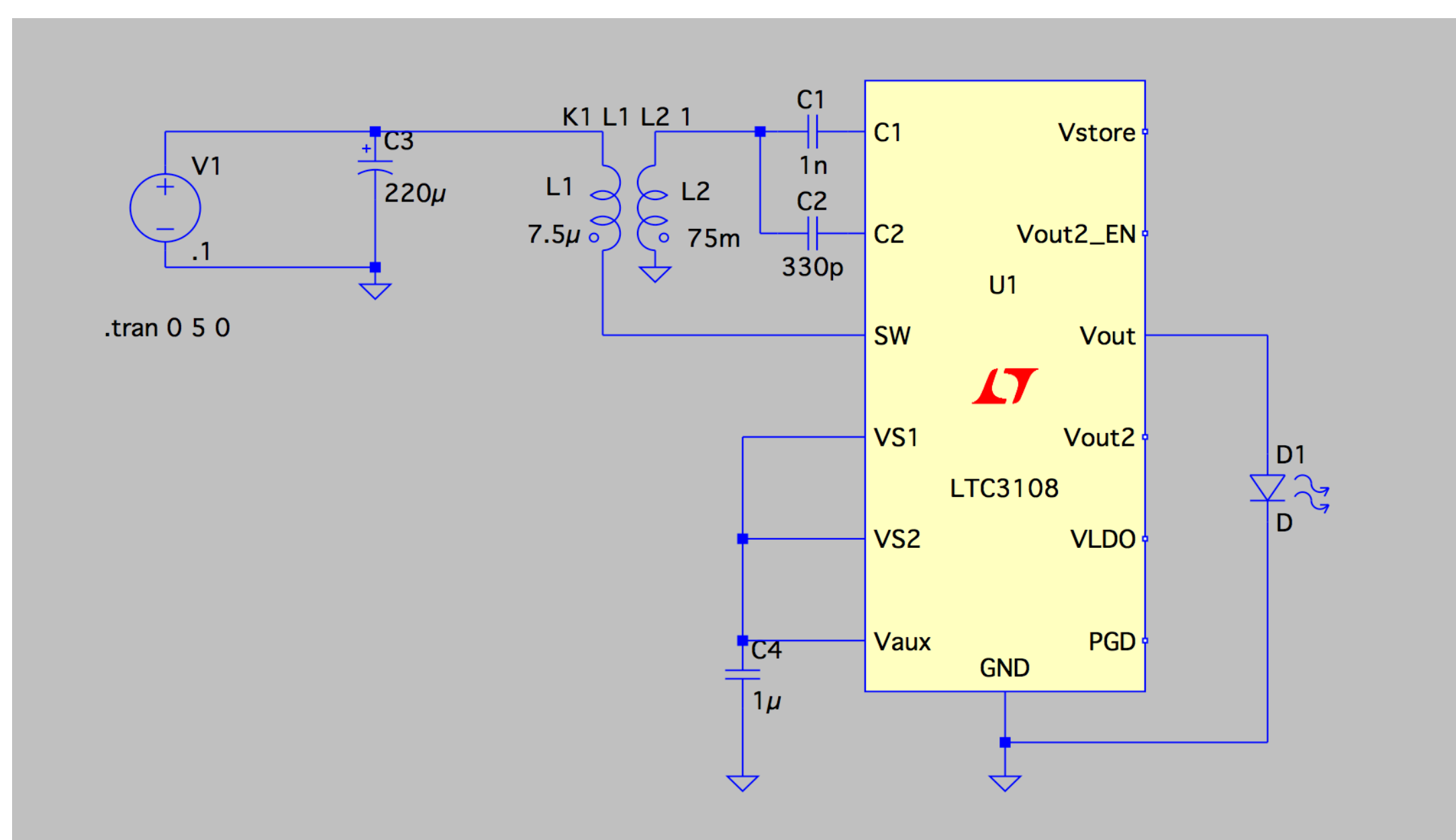


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How it Works

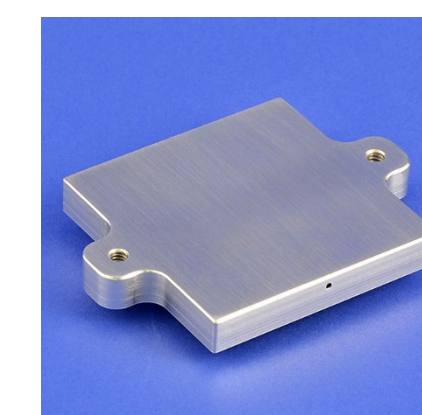


Challenges

- Low output power due to 1:100 transformer

	Expected	Actual
Current (mA)	3	.03
Power (mW)	15	.15

- Minimizing bracelet size while maintaining sufficient input voltage (min 20 mV)
- Maximizing heat differential



- Adjusting to body temperature fluctuations

References

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