The Piezofloor

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RUTGERS
School of Engineering

I will be attending Rutgers University School of Engineering at New Brunswick.

My major will be Electrical and Computer Engineering

Mission Statement

The purpose of this project is to create a floor that can convert human, mechanical waste energy into electricity, which can be stored and utilized later. By nature of piezoelectricity, the generator does not produce any pollutants and does not consume any nonrenewable energy sources, making it a sustainable, clean energy source.

Application to Real World Problems

85% of Energy

40 Years

80 Years

1. Sustainable
2. Simple to use
3. Easy to implement/install

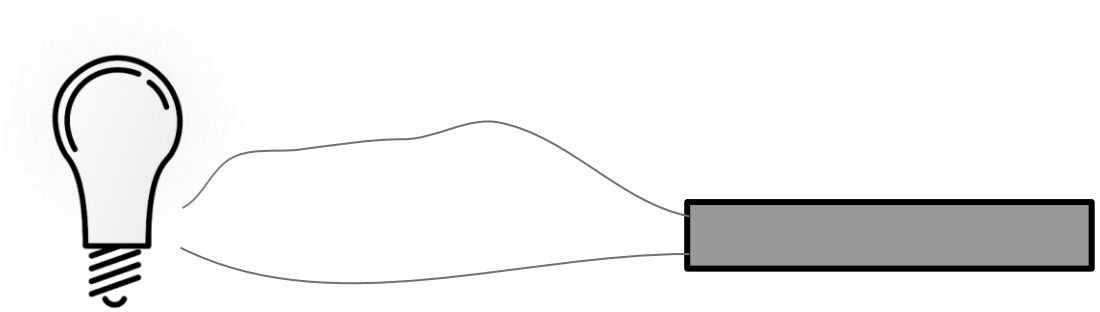
Green Aspect

The Piezofloor functions from a concept called the Piezoelectric Effect: the ability of certain materials to generate an electric charge in response to applied mechanical stress.

- **Only mechanical energy required**
- **No waste products**
- **Requires little natural resources**

What is Piezoelectricity?

Ability of certain materials to produce a voltage when a mechanical stress is applied to them.



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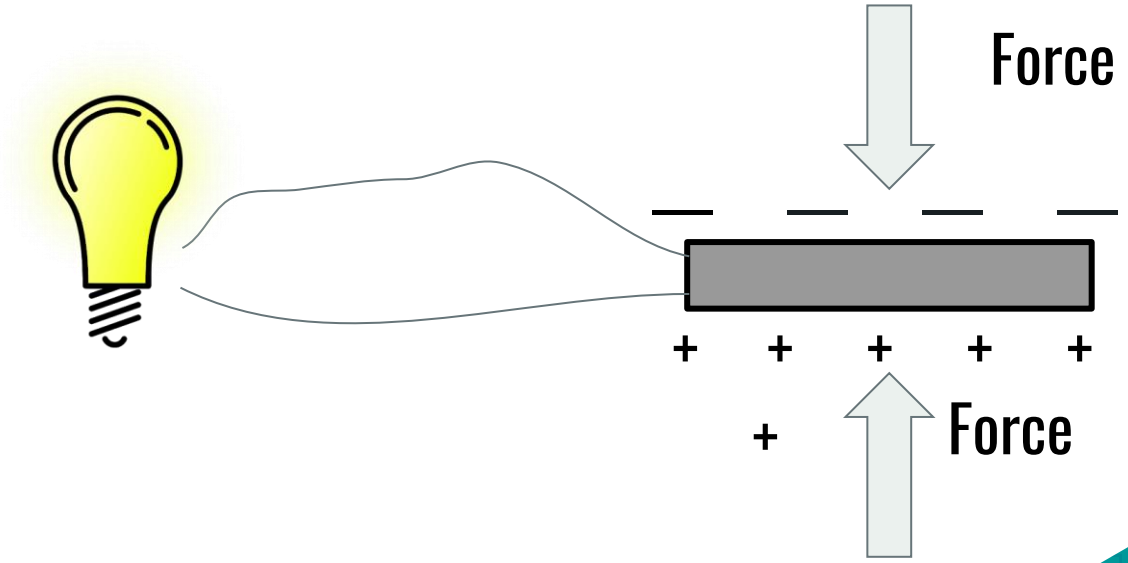
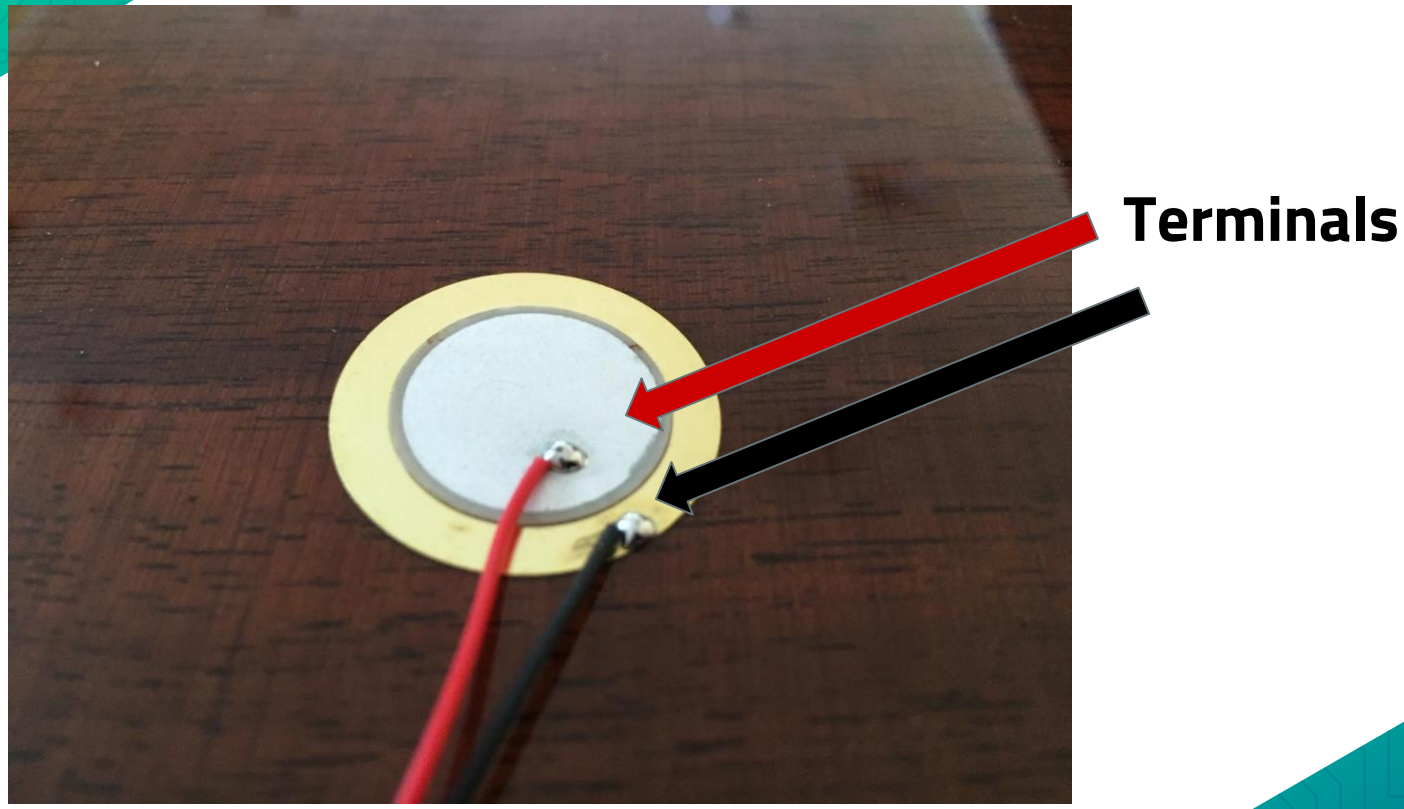



Terminals


DT838B
DIGITAL
MULTIMETER

Bill of Materials

3x Wooden Boards	~	$25
36 x Piezoelectric Discs	~	$21
Breadboard (given)		
Jumper wires (given)		
Capacitor Assortment	~	$9
Resistors (given)		
40x Springs	~	$50
2x Bridge Rectifiers	~	$6
PVC Pipe	~	$6
Blue-light LEDs (given)		

Total ≈ $117

Essential Learnings

Electrical Engineering

- Concept of Power Efficiency and Power Maximization
- Effects of Resistance
- Ohm's Law
- Piezoelectricity
- Battery
- Basic circuitry components
- Capacitance
- Alternating vs. Direct Current
- Bridge rectifiers
- Parallel vs. In-series
- Relationship between current, voltage, and power

Mechanical Engineering

- Understanding of dimensions
- Knowledge of tools such as power drills, saws, and sandpaper.
- Understanding of optimal materials for certain purposes (i.e. durability, pliability, and density)
- Understanding of how pipes can provide stability and structural integrity.
- Understanding of compression springs and distribution of force.

Proposed vs. Actual Timeline

June - August	September - November	December - March	April - mid-May	Mid-May - June
Materials Learning/ planning	Developing the generator.	Developing the case for the generator.	Testing the prototype.	Tweaking and finishing up until presentation.

Proposed

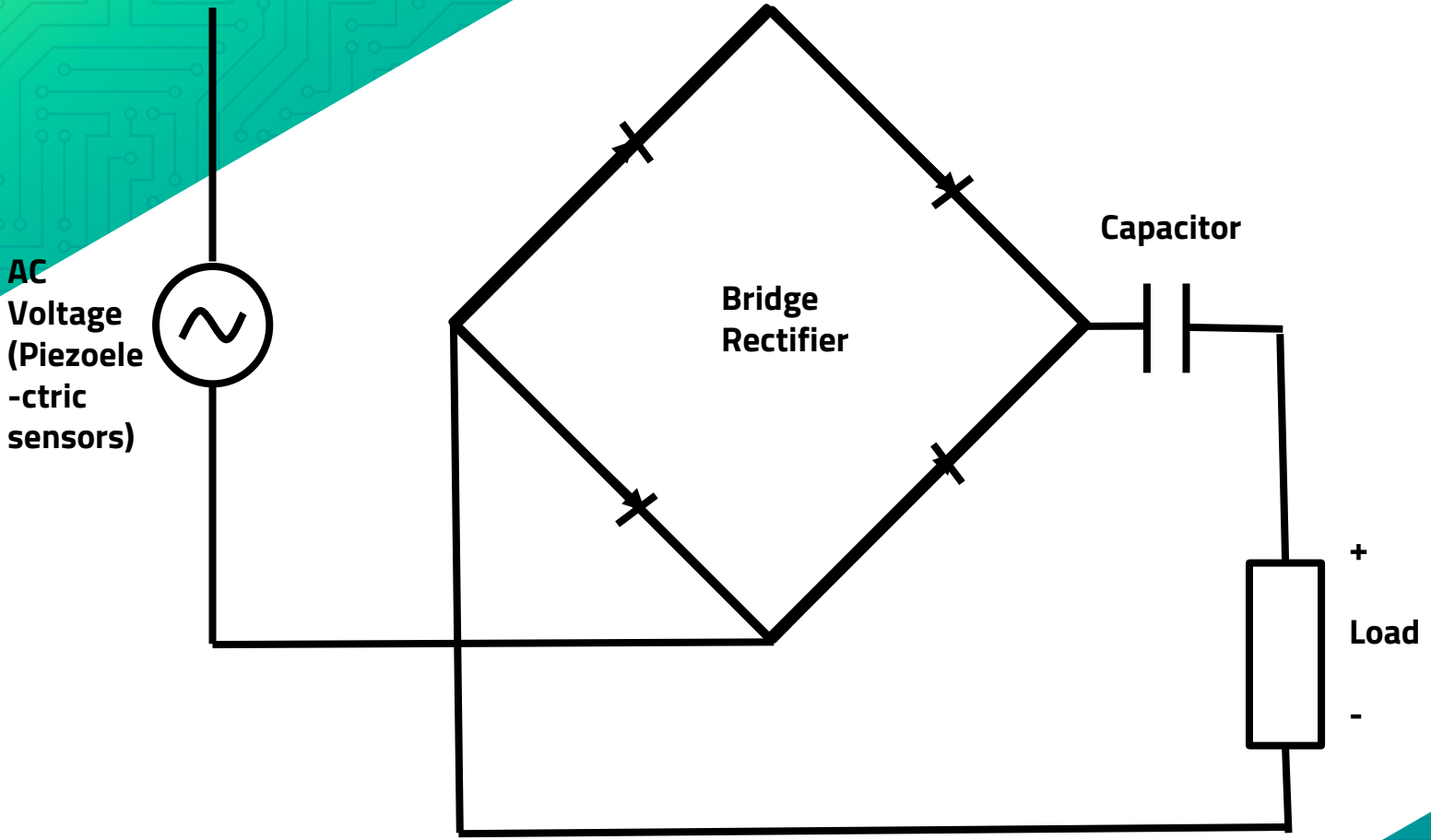
June - August	September - November	December - March	April - mid-May	Mid-May - June
Finding mentors and thinking of project design.	Acquiring materials and meeting with mentors to discuss designs or concepts	Begin building the floor and frame of the project—no circuitry yet	Implementing the piezoelectric discs into a circuit the into the project	Testing prototype and tweaking

Actual

Research and Solutions

1. How do I make the piezoelectric energy useful?
2. How can I make my project more stable?
3. What can be replaced or improved upon?

Piezoelectric materials produce AC voltage, which can be converted into continuous, DC voltage for conventional use. This is completed by the use of a bridge rectifier, capacitor, and resistor.


AC
Voltage
(Piezoele
-ctric
sensors)
Bridge
Rectifier
Capacitor
+
Load
-

Springs and PVC pipe will provide support and prevent shearing.

Acrylic boards are not suited for this project because they bend too easily. I was better off finding new piezoelectric discs than trying to salvage the ones that would not work.

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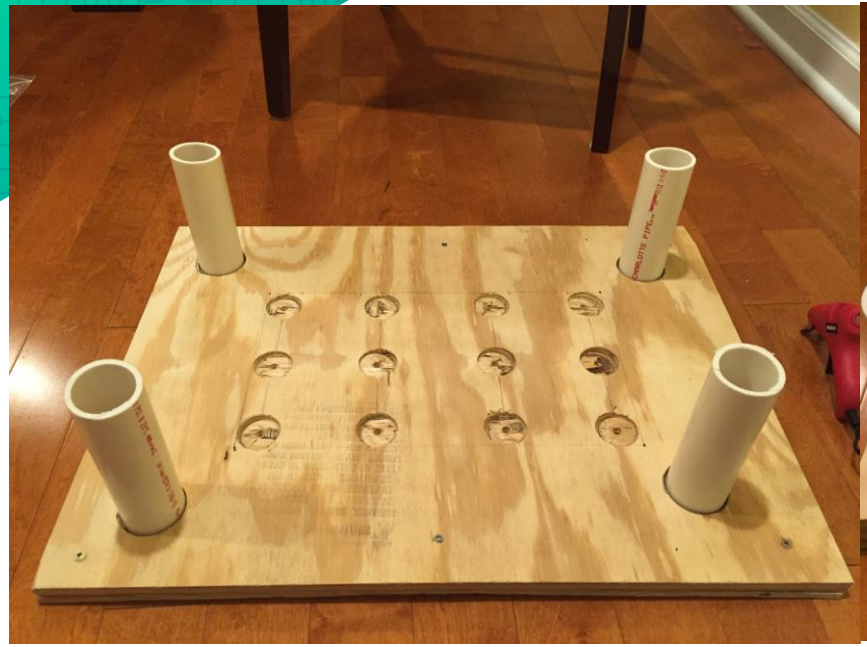
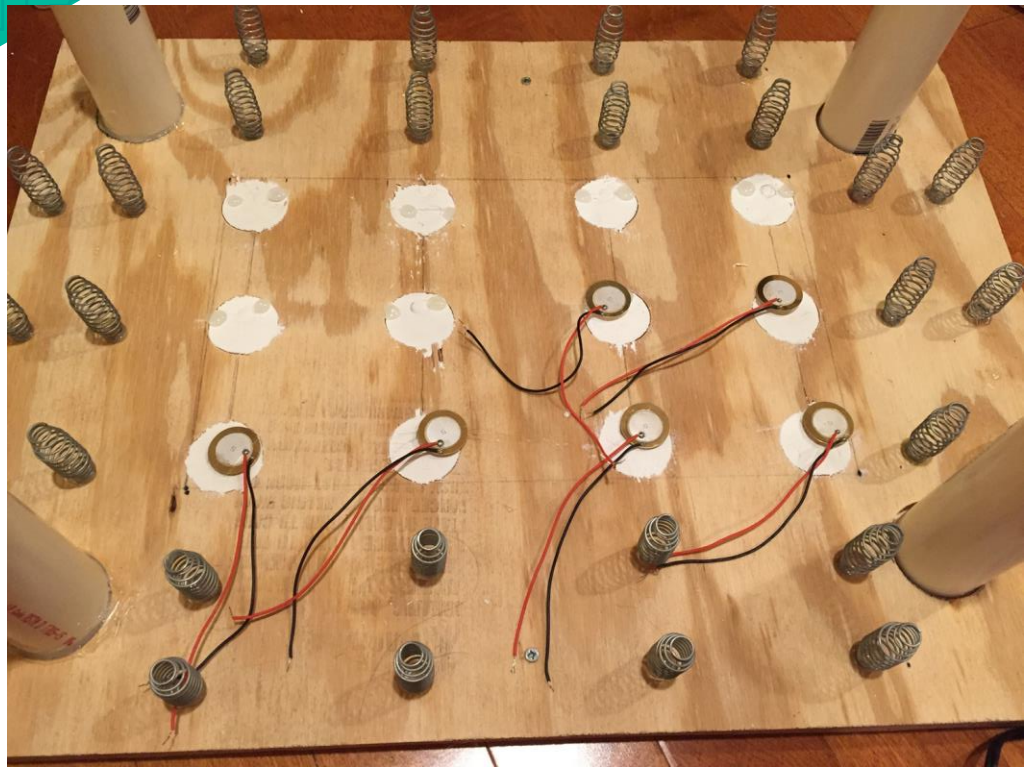
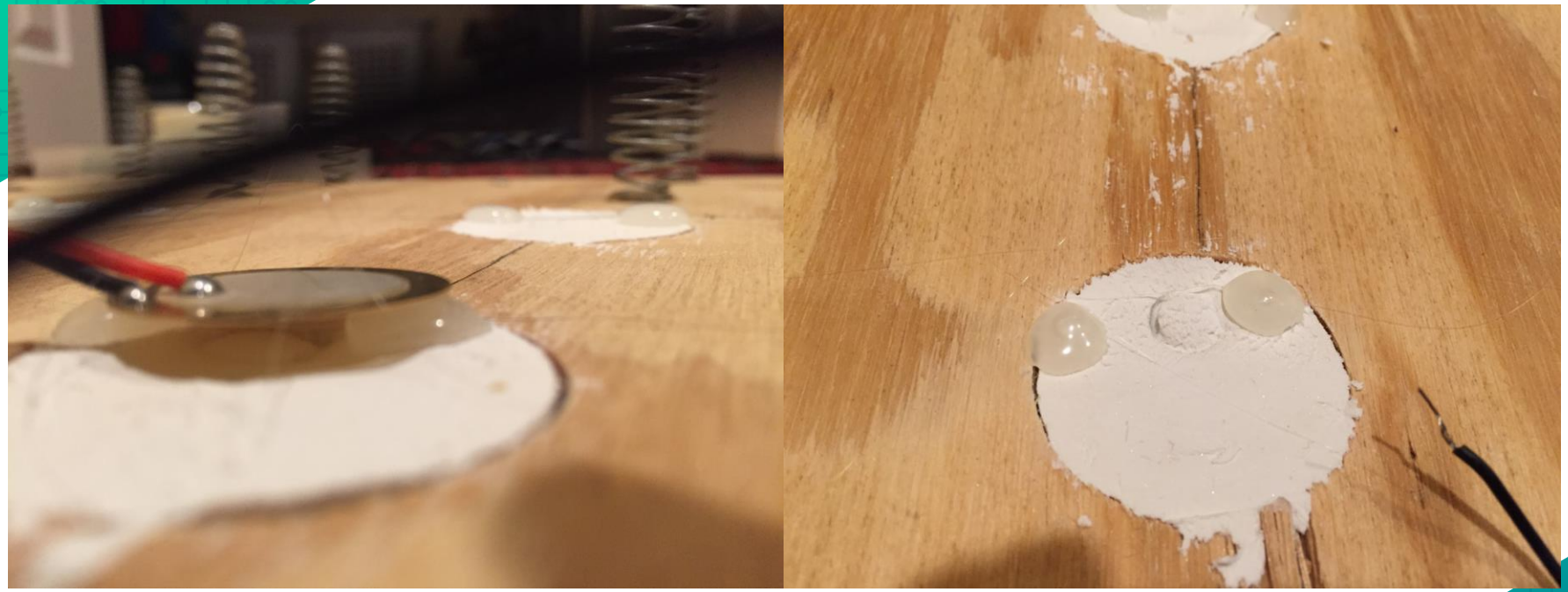
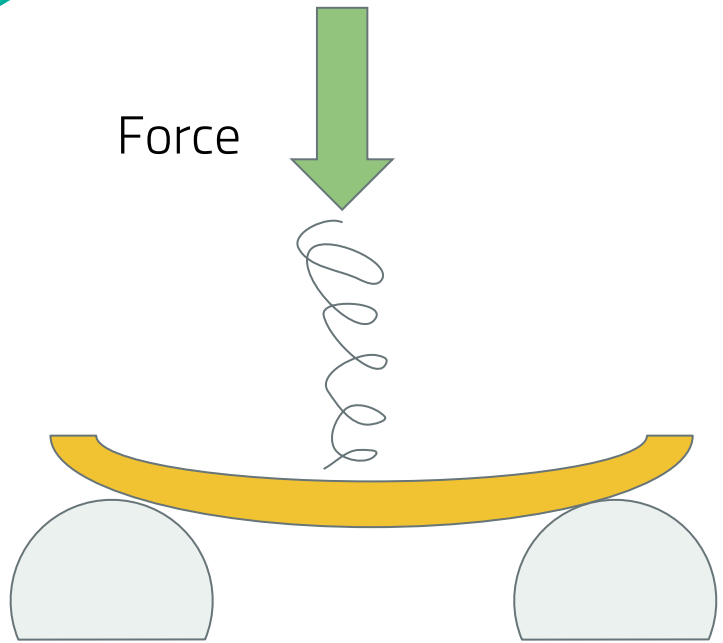
Development and Testing





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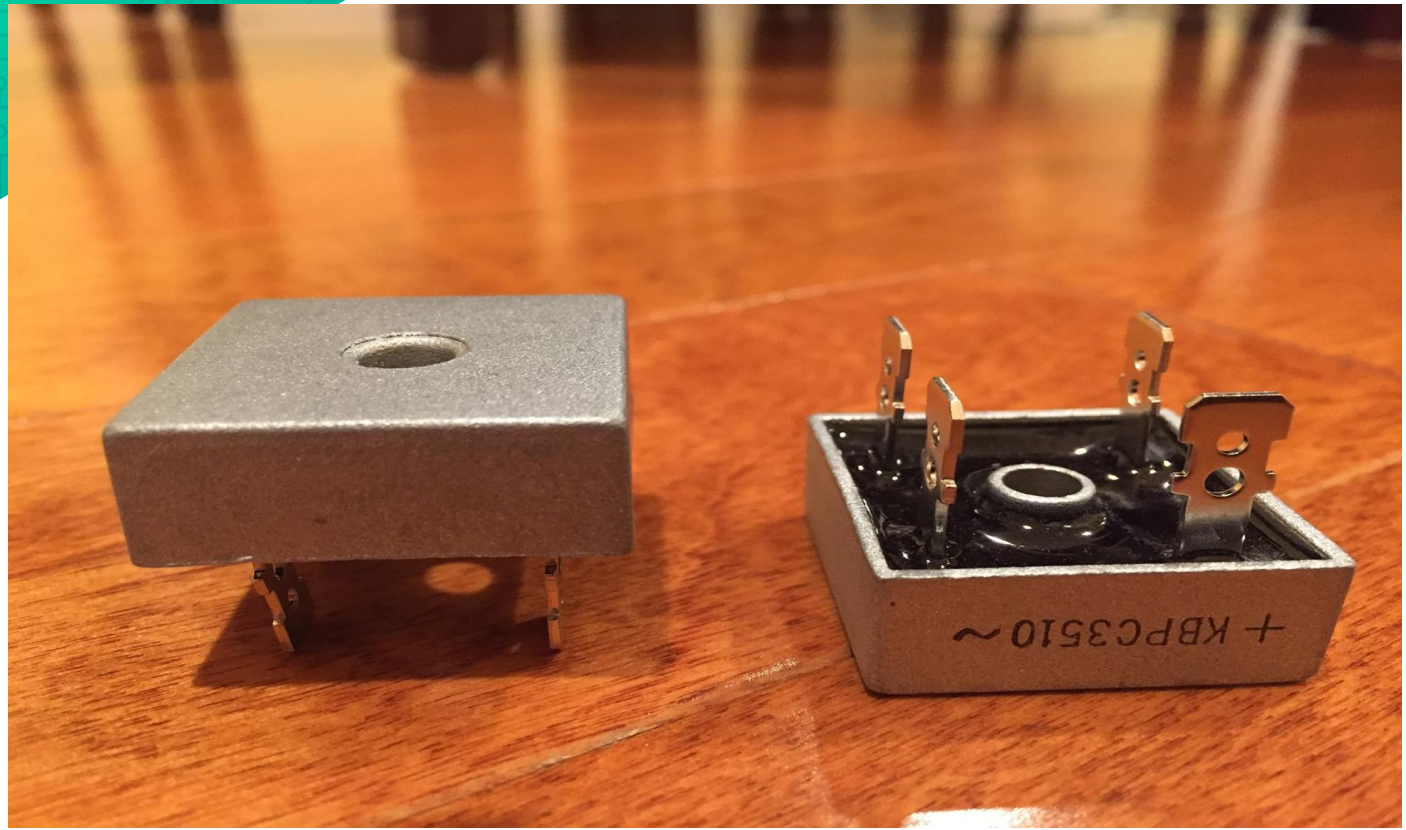
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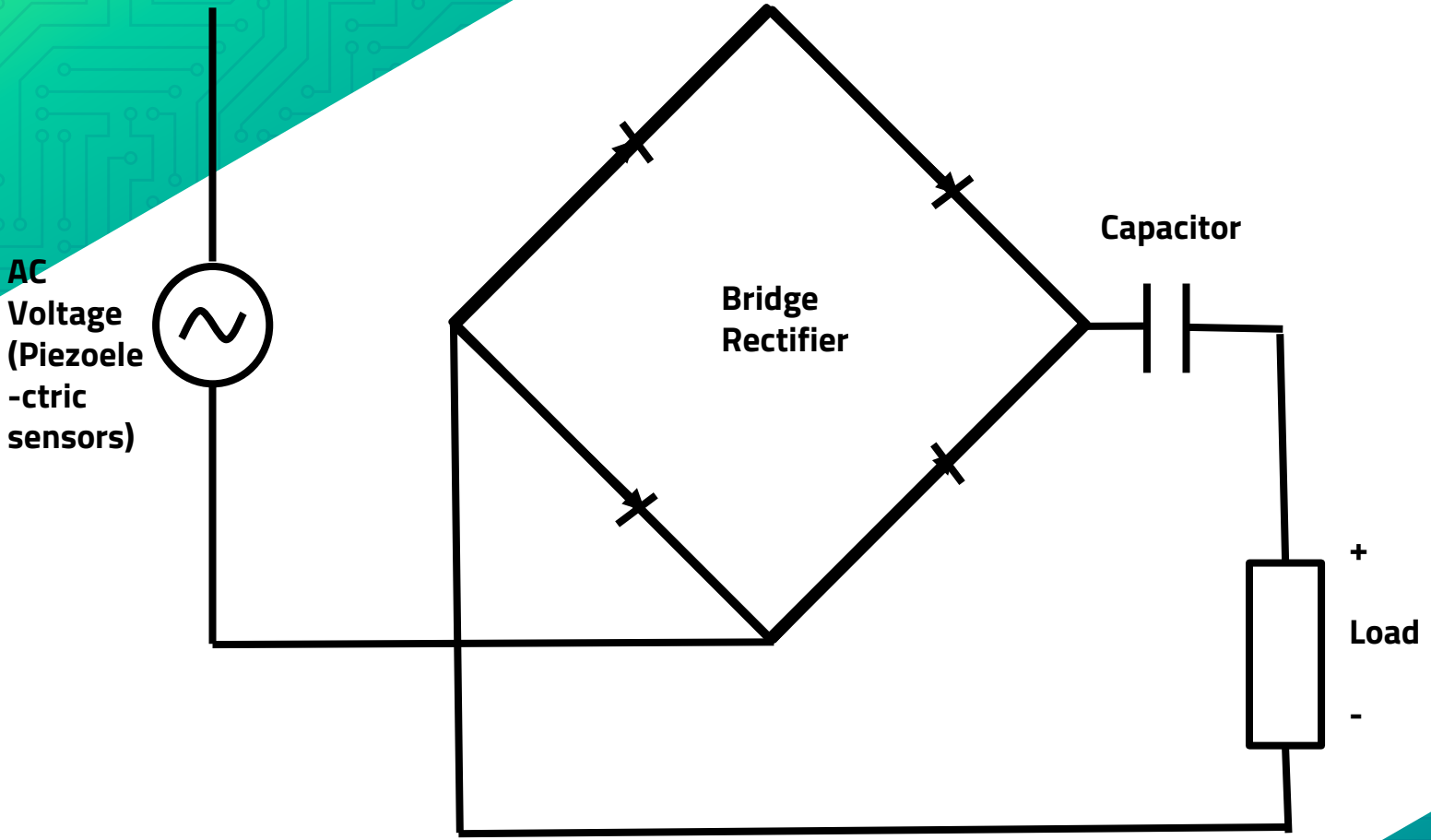
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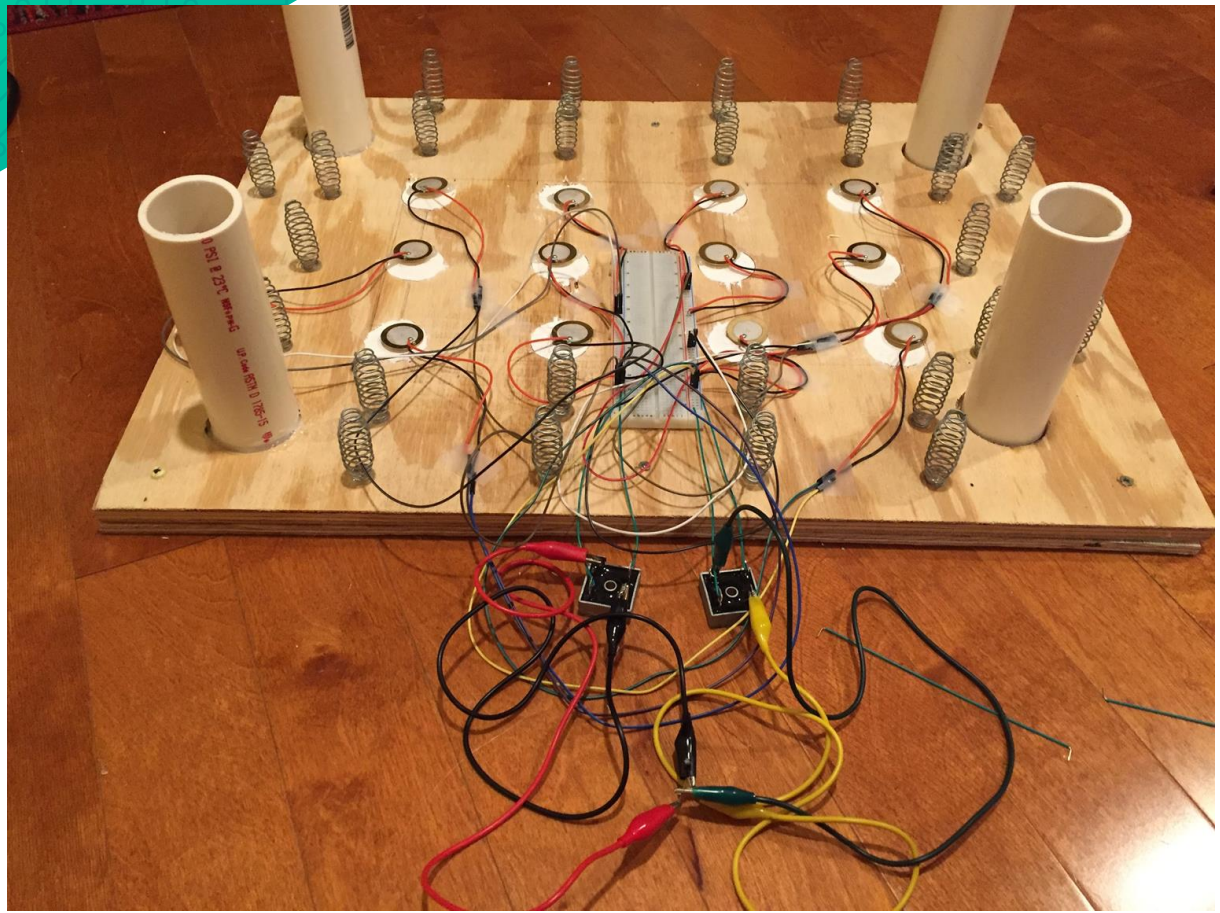

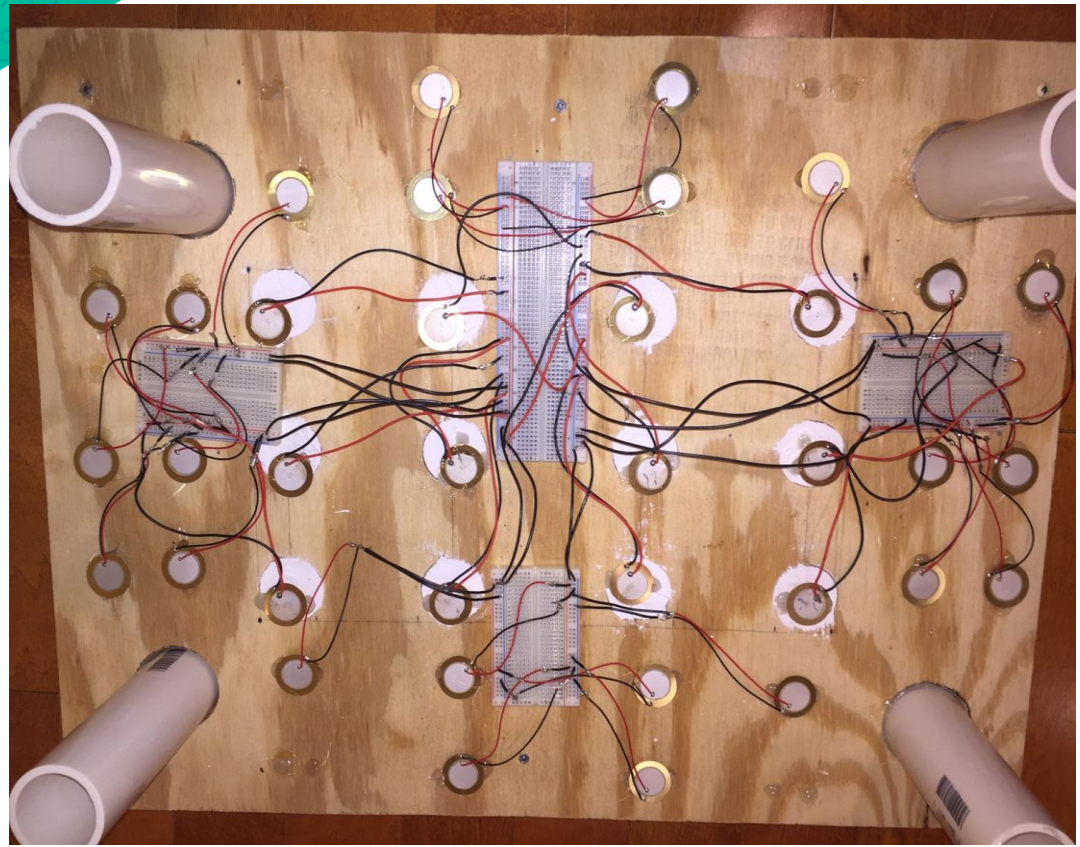

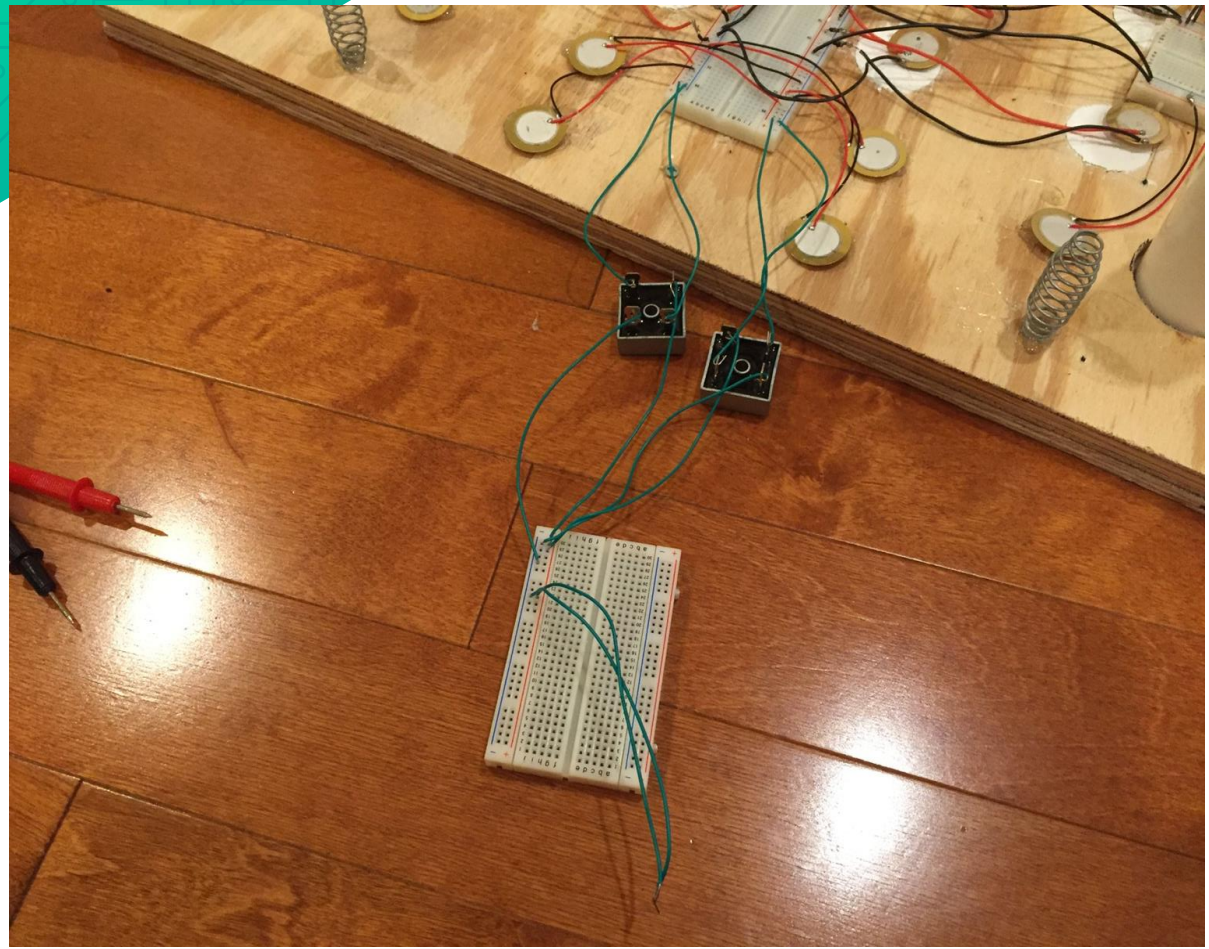

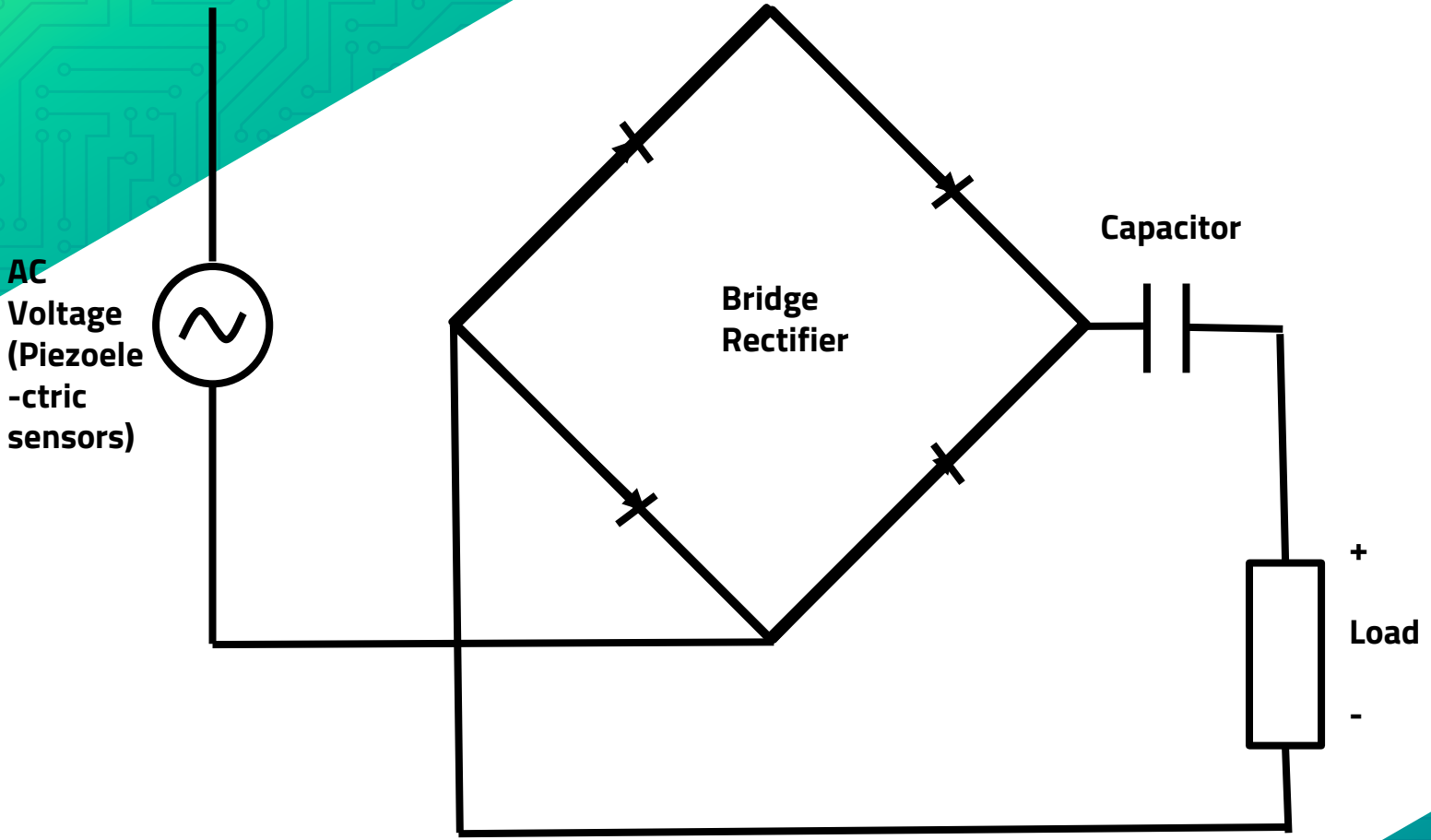
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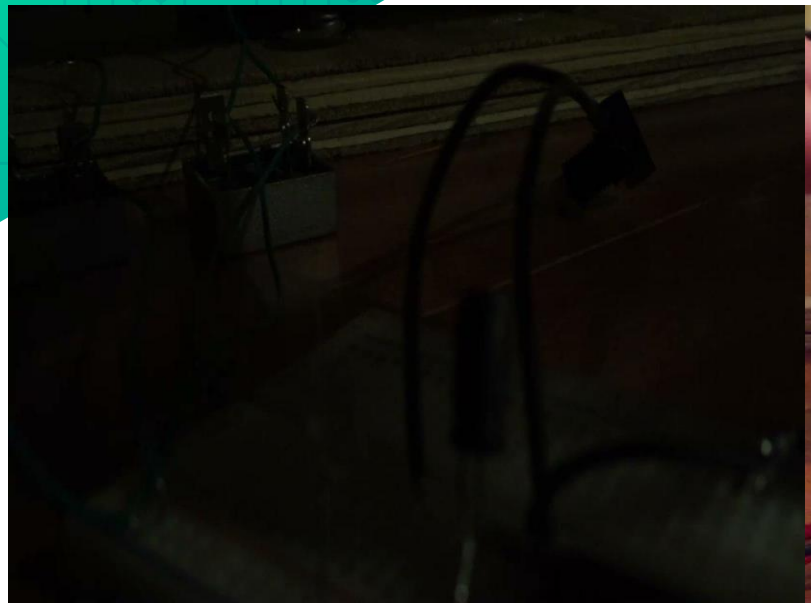

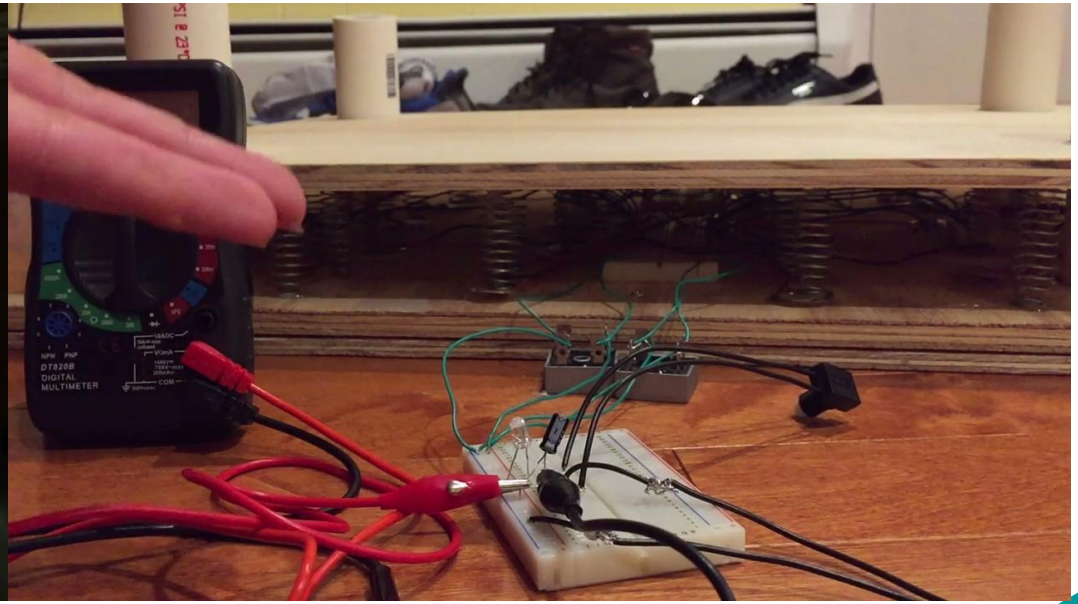
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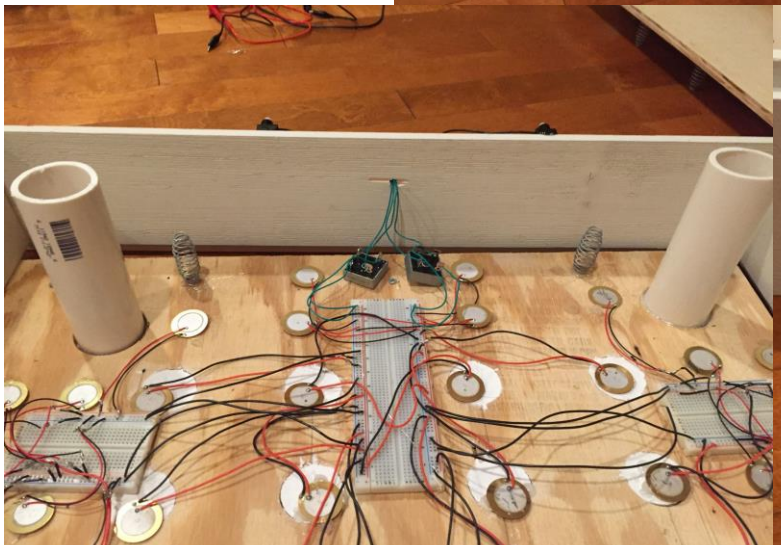
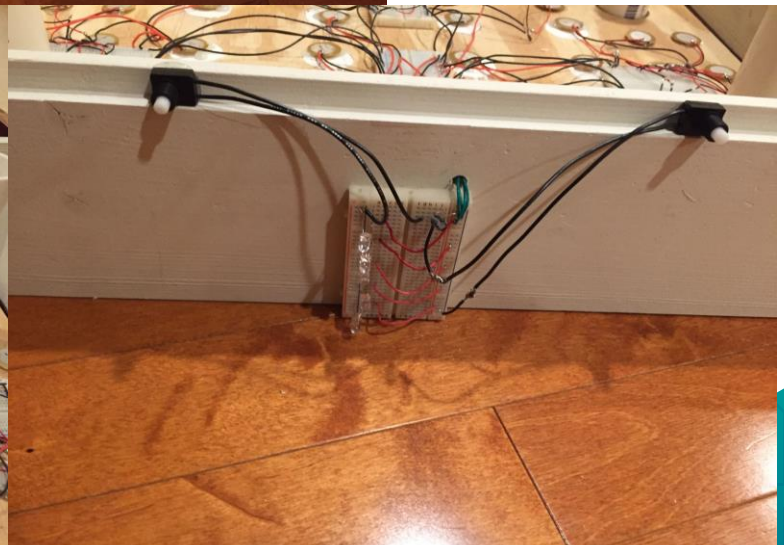
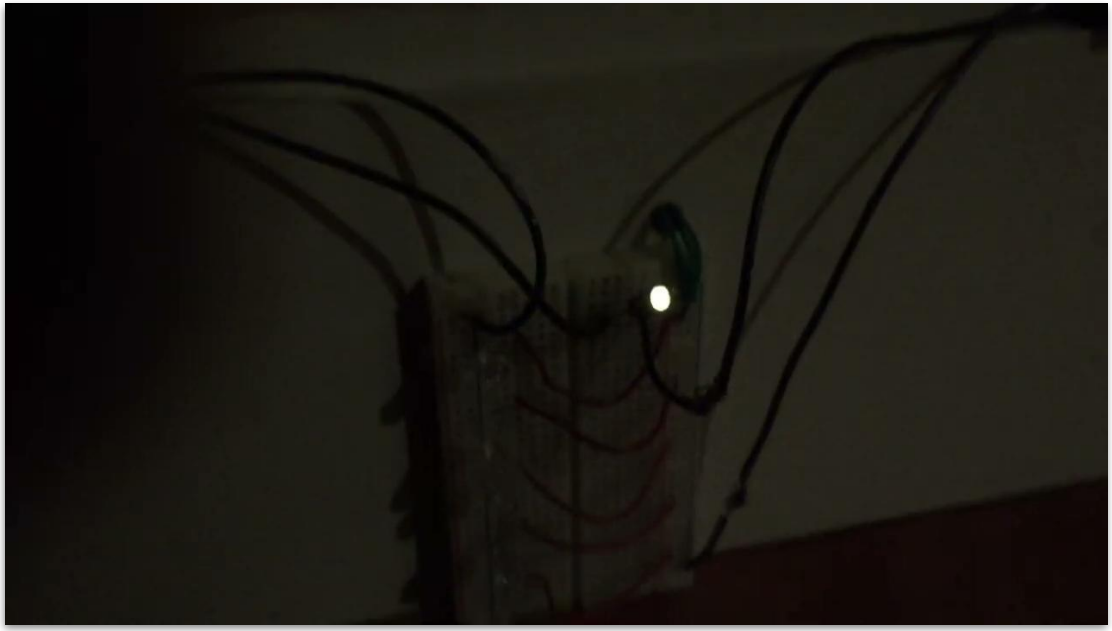




Prototype



Findings

1. **The Piezofloor consistently produces voltage of at least 6 V.**
2. **The Piezofloor is able to continuously produce electricity so long as mechanical energy is supplied to it,**
3. **The Piezofloor is able to produce a high discharge of electricity after a charging period.**

Why This Field of Engineering?

1. Electrical engineering is fun.
2. Renewable energy is a growing industry.
3. Something that I can see myself or many people benefiting from.

Mentors

EHS mentor: Kevin Kerins

- Teaches Electrical Engineering and Engineering Design at Edison High School.
- Part of the Tech Ed

Out-of-school mentor: Professor Yanghyo Kim

- Assistant Professor at SIT's department of Electrical and Computer Engineering
- PhD in Electrical Engineering

Bibliography

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