

Piezoelectric Technology for Next Generation Power Solutions

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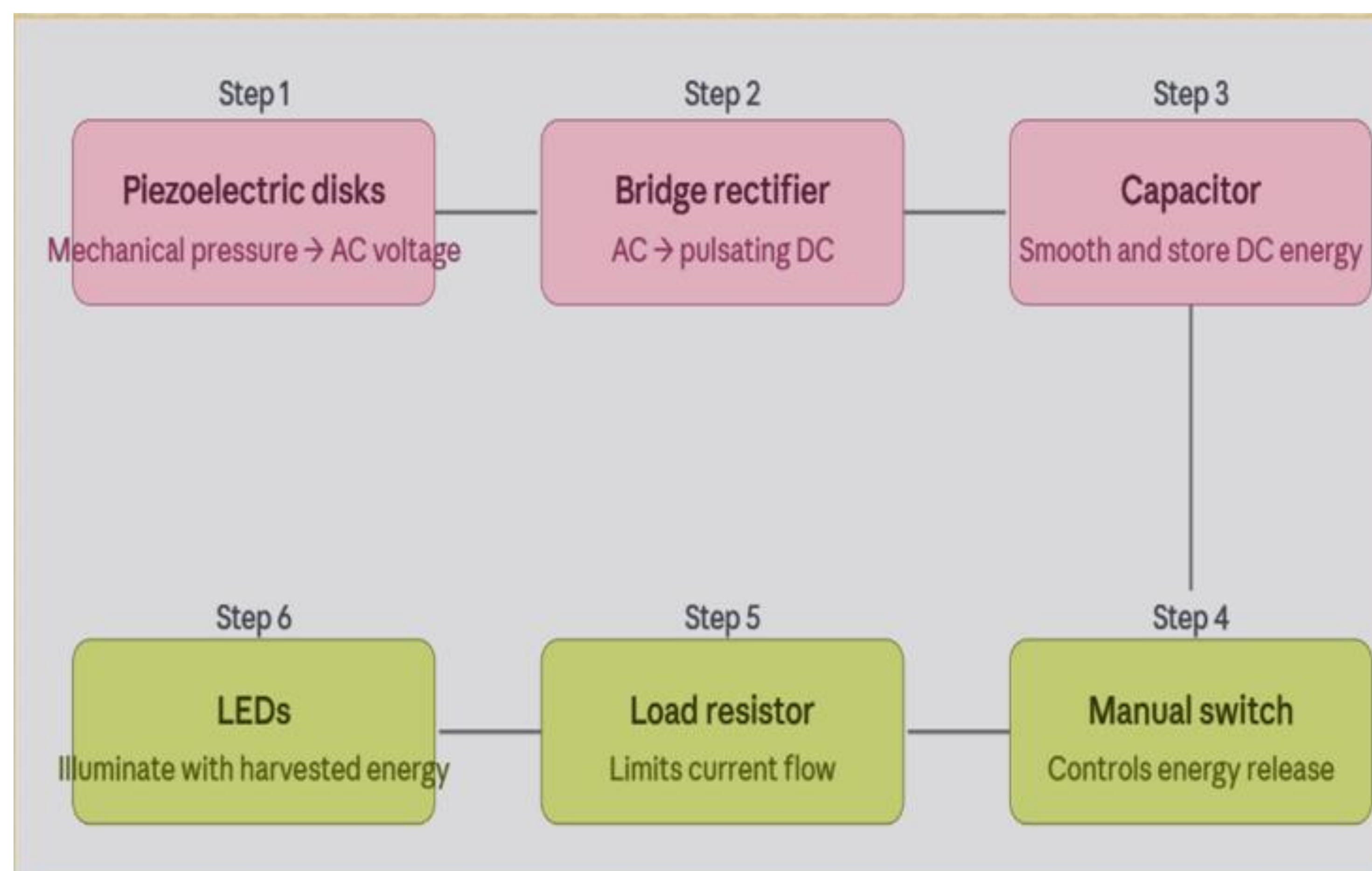


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Introduction

- Design and development of a piezoelectric energy harvester prototype.
- Conversion of kinetic energy into electrical energy.
- System integrates piezoelectric disks, signal conditioning, and energy storage components.
- Generated energy is used to power LEDs, demonstrating practical application as renewable energy.
- Large scale integration is possible.

Block Diagram



Project Limitations

- Limited power generation requires substantial inputs and control.
- Efficiency depends on matching frequencies of input and piezoelectric materials..
- Produces non-linear AC power which requires rectification.
- Materials are fragile and sensitive, reducing long-term durability.
- Lack of effective energy storage prevents consistent or continuous use.

Problem Addressed

- Mechanical energy from daily activities is wasted renewable potential.
- Renewable energy sources remains costly to install and maintain.
- Society remains dependent on costly and inefficient energy systems.

Methods

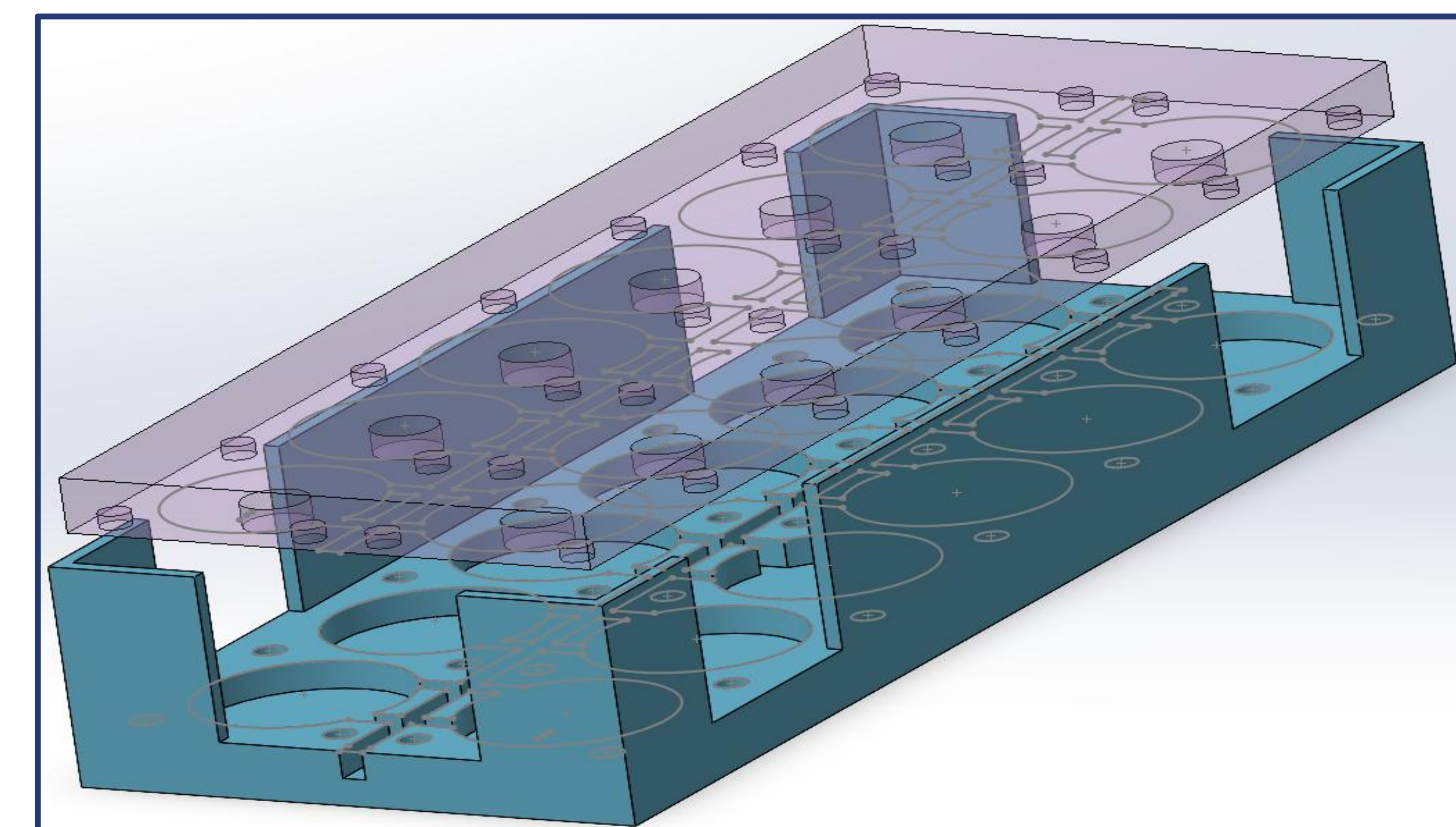
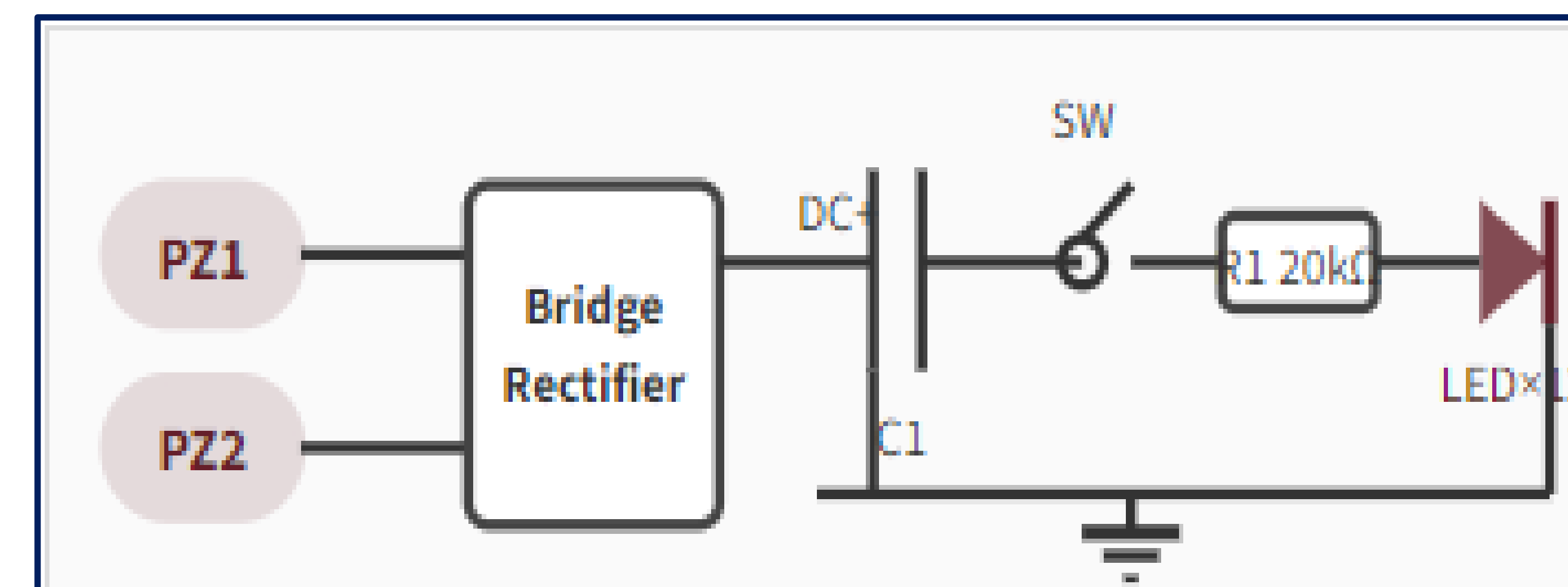
- Piezoelectric disks produce an AC signal; the output is then passed through a bridge rectifier to convert it to DC voltage.
- After rectification, energy is stored in a capacitor (150uF). A switch controls discharge timing through a 20kΩ load resistor (R1). The RC time constant governs illumination duration:

$$\tau = RC \approx 3 \text{ s}$$

- Twelve LEDs are arranged in three parallel rows of four in series, distributing harvested energy across all LEDs while maintaining the required forward voltage.

Results

The finalized circuit converts mechanical impacts from the piezoelectric disks into stored electrical energy. When the switch is activated, the capacitor discharges through the LED array, illuminating all twelve LEDs for approximately 3 seconds.



Next Steps

- Replace manual switch with an automatic threshold-triggered discharge circuit.
- Explore energy storage in rechargeable batteries rather than single capacitors.
- Test system durability under sustained high-frequency loading conditions.
- Increase amount of piezoelectric input and power output.

