

# **ENERGY HARVESTING USING PIEZOELECTRIC PLATFORM**

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## **Aim of the Project**

Due to soaring energy prices and an increased environmental awareness there is a growing need for sustainable designs. The world around us has embraced this concept by incorporating solar panels, wind turbines etc. Instead of looking for new ways to generate energy, in this project, we have focused on harvesting energy from everyday activities that would otherwise be lost. A person exerts lots of force when they walk. Noticing that the platform vibrates when someone steps on it, and that these vibrations are vectors of mechanical energy, we can recover and convert the mechanical energy contained in these vibrations into electrical energy by using electromechanical transducers, such as piezoelectric materials. The Piezoelectric platform power harvesting system intends to turn this energy into electrical power using a piezoelectric generator. The electrical energy thus produced can be used to power the low power consuming lighting systems based on LED (Light Emitting Diode).

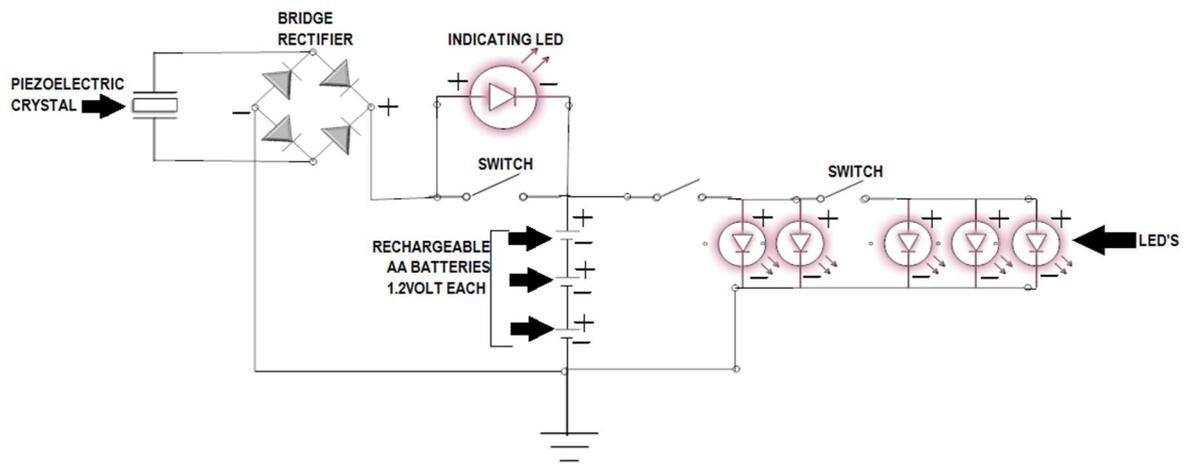
## **Procedural Steps**

Working of piezoelectric platform is quite simple. We are using energy of our body to produce electricity. Actually weight of body helps to produce electricity. When somebody walks on piezoelectric platform due to the weight of the individual this platform is pushed downwards which causes mechanical vibration and this mechanical vibration is converted to electricity with the help of piezoelectric crystal.

Circuit consists of following components

- Piezoelectric crystals- 12 nos.
- Diodes-IN4148- 4nos.
- LED's
- AA batteries-NiMH (nickel metal hydride)- 3nos.
- Switches

All the crystals are pressed at the same time with the help of platform. Platform returns to "up" position via springs of crystals itself. These crystals produce High Voltage High Frequency electric pulse which is bidirectional. That means the voltage produced by piezoelectric crystal has negative as well as positive polarity. For the conversion of Alternating current to Direct Current Bridge Rectifier arrangement is used as shown in the circuit diagram. After this AC to DC conversion this energy is stored in AA batteries. Each battery is rechargeable and of 1.2 volt. Total 3 batteries are used in our piezoelectric platform which is connected in series with each other. Total 3.6volt is used and this energy is then utilized to illuminate LEDs.



**Circuit diagram**

### Calculation

- How much energy is generated/how much time we have to press the plate form to charge the battery?



When all the crystals are pressed together at a time with the help of piezoelectric platform it generates peak voltage of 40volts for 5milliseconds.

By considering internal resistance of NiMH batteries 1 battery has internal resistance of 320 milli ohm so total internal resistance of all battery is 1 ohm, so we can calculate amount of current that flows through battery, 40A current shall flow through batteries for 5 milliseconds.

$$I = V/R = 40/1 = 40\text{Ampere}$$

We can calculate watts of electricity as  $W = V \times I = 40 \times 40 = 1600\text{watts}$

And from that we can also calculate joules of energy generated per second

$$E = W \times t = 5 \times 10^{-3} \times 1600 = 8 \text{ joules/second}$$

In our piezoelectric platform we have put 3 NiMH batteries each of 1800mAh so total battery capacity is 5.4 Ah.

In order to charge the battery to its full capacity we will need 1.8 Amp current for 1 hour. However in said case 40 Amp current is available for 5 millisecond due to one operation.

Hence number of operations required to charge the battery to its full capacity can be calculated as follows:

Charging current = 40Amp

So battery charging time =  $1.8 / 40 = 0.045$  hours = 162000milliseconds

No of operation to charge batteries =  $162000/5 = 32400$

### **LED Bulb (different ways of using this piezoelectric energy)**

Wattage of Bulb

$P = V \times I = 3.6 \times 20 \times 10^{-3} = 0.72$  watt

So total wattage of bulb is  $0.72 \times 5 = \mathbf{3.6}$  watts

The battery capacity is 1800mAh so at 1.8mA current this bulb can last up to 10hours.



### **Conclusion**

Generation of electricity using piezoelectric platform has following advantages:

- Generates tremendous amount of voltage for very short duration. However same can be stored in storage batteries and utilized
- Very simple and economic operation
- Safe and robust design

Hence, piezoelectric platform can be used for distributed power generation at the point of consumption. Proper marketing and improved appearance could encourage people to install the piezoelectric platforms.