Intelligence In Biological Systems

Harvesting Energy using the concept of Piezoelectric effect

Abstract:

When a person walks, pressure is exerted on the ground and this pressure can be converted into electrical energy and it can be used to power electronic devices. In this report a Mobile charging system is designed. A piezo electric generator is placed in the shoe. The power that is generated by piezo electric generator when a person walk is transferred to the device by using a charger wire as a medium to supply electricity.

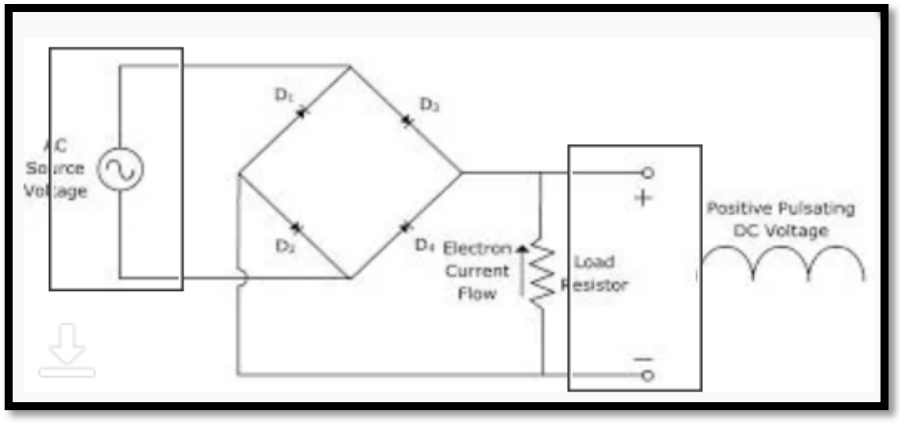
Introduction:

Harvesting mechanical energy from human motion is an attractive approach for obtaining clean and sustainable electric energy. Piezoelectricity is electrical energy produced from mechanical pressure (such as walking, running). When pressure is applied to an object, a negative charge is produced on the expanded side and a positive charge on the compressed side of the piezoelectric crystal. Once the pressure is relieved, then electrical current flows across the material.

The main power source or the core of this project is a component known as the piezoelectric transducer. The piezoelectric transducer or piezo elements are comprised of materials such as crystals and certain ceramics that have a special property that allows them to convert physical energy into AC current. This technology is made to use in our project by putting piezo elements underneath our feet in such a way that every time we take a step we are using our weight to push on the piezoelectric elements, which further converts this energy into electricity. The limitation of this method is that the current obtained is in AC format. In order to charge a phone, this must be converted into DC. For this we create a bridge rectifier with diodes.

Design:

The design consists of a circuit in which piezo plates are firstly connected to diode which in turn is connected to capacitor through switch and finally to USB.



Procedure:

1. To make piezoelectric generator, first we need a plastic base. Here, we used 3d cad files. We must provide holes to that plastic base, so we can place our piezoelectric elements in it. We must place those elements in the area where more pressure is applied.
2. So, we had finished making of plastic base.
3. After finishing this, now we have to hot glue them on. Take the hot glue gun and apply some amount of hot gum around the holes in the plastic base, after applying the glue immediately take the piezo plates and place them and press them inside the hole before the gum becomes cool. Be careful that too much glue should not be applied. And we must make sure that this glue should not be in contact with the wires as we solder them. After we have glued the piezo in their respective areas, we must glue the cardboard pieces onto each piezo element.
4. As we know that piezo elements produce more amount of voltage, but they don't produce many amps. So, to overcome this issue we must wire all the piezo elements in parallel that means we have solder positives to each other and all negatives to each other. In this way we can be able to increase generation of amps.
5. We must use hot glue in the solder joints to prevent the braking off of the solder joints. We must connect the piezo elements from one side of the plastic to the other through the holes so they can be soldered in parallel. After completing of soldering of all the piezo elements, we must solder the last element in the chain to the piezo on the toe piece. And we must continue this process until all the 7 piezo elements are connected.

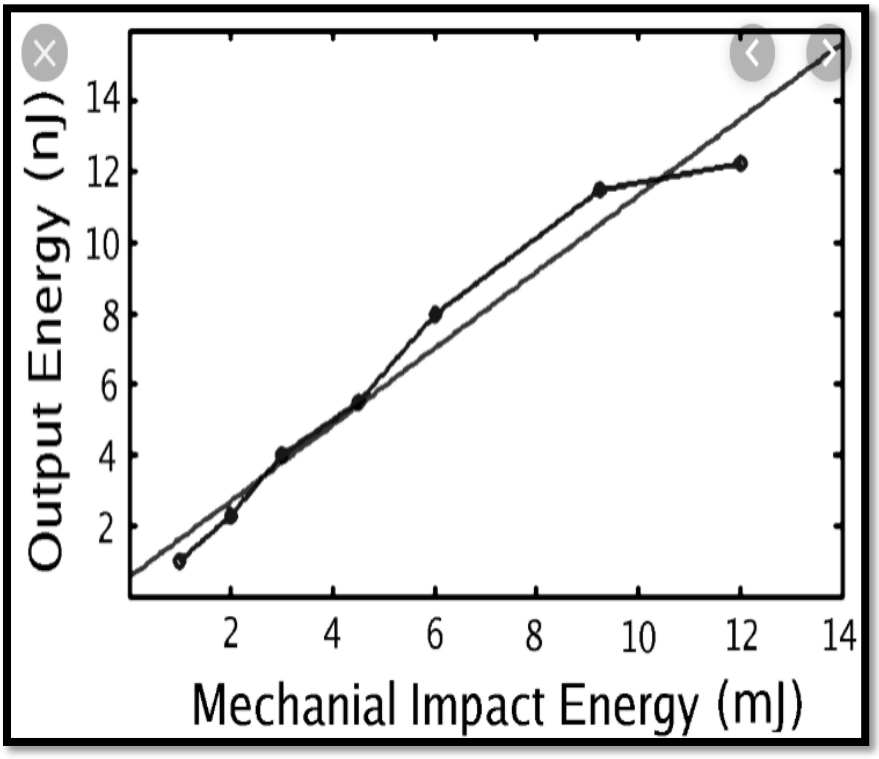
Wiring:

1. The wiring or the connections of the diodes to piezo element wires are to be mainly done by the diagrams.
2. Since the current is AC, we can easily make the connections as they are interchangeable, as long as they are connected to the correct diodes.
3. Remove the USB charge cable from battery pack, revealing all, the wires.
4. Take caution while removing the red and black wires, as they are to be mainly used for the project.
5. Twist the frayed wire strands of each wire, and tin them with solder
6. Solder the wires to the appropriate diodes, giving attention to the polarity as they are DC.

Installation:

1. After we have completed the piezo electric generator, for the purpose of installation, we remove the soul of the shoe and attach the generator below it.
2. We then cover the generator using the original soul and extend the connection from the generator to the phone, which is attached beneath the lacing using a charging cable.
3. Now simply walk ahead knowing your phone is charging every step of the way.
4. Piezoelectric generators (energy harvesters) offer a robust and reliable solution by converting normally wasted vibration energy in the environment to usable electrical energy.

Result:



The graph shows the variation of mechanical energy (pressure applied on the piezo) isn't increasing linearly with electrical energy (voltage) .

Conclusion:

1. There are various methods to harvest energy one among them is piezo electric effect, which you can say as the cheap method that requires only mechanical energy to produce electric energy.
2. So, we should find the ways to make use of piezo electric effect in our daily basis.
3. There are tissues in our body that functions as piezo electric generators like-

ORGAN	PIEZO ELECTRIC MOLECULE
Hair	Keratin
Bone	Collagen
Tendon	Collagen
Lung tissue	Elastin
Skin (dermis)	Collagen
Skin (horny layer and epidermis)	Keratin
Breast tissue	Collagen
Outer hair cell	Prestin
Muscle	Actin and myosin

Piezo electric elements are used as-

1.**Sensing Elements:** Detection of pressure variations in the form of sound is the most common sensor application, E.g.- piezoelectric microphones, sound waves bend the piezoelectric material, creating a changing voltage.

2.**Ultrasound Imaging:** Piezoelectric sensors are used with high frequency sound in ultrasonic transducers for medical imaging. These are used to detect on unborn baby movements.

3.**Sonar Sensors:** In the detection and generation of sonar waves, applications include power monitoring in high power applications such as medical treatment, sonochemistry and industrial processing etc..

4.**Chemical& Biological Sensors:** Piezoelectric microbalances are used as very sensitive chemical and biological sensors. Piezo are also used as strain gauges.