Foot Steps Power Generation System

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ABSTRACT

Piezoelectric (P.E.) is the electrical charging that amass in certain hard materials in reaction to applied mechanical pressing. Electrical appears voltage on all parts of a crystal sides when the content it to mechanical press by pushing it. practically, the crystal becomes a type of tiny batteries with a positive charging on one face and a negative charge on the cross face; current flows if we links the two faces together to make a circuit. In the otherwise effect, a crystal becomes mechanically stressed deformed in case when a voltage is applied across its opposite faces.

We can use P.E. materials to generate electrical energy by compressing a certain weight or footsteps, and this electrical energy is considered to be clean and renewable energy from this device.

Keywords: *Piezoelectric; footsteps; energy; solid materials; electrical energy.*

INTRODUCTION

P.E. was discovered by two French scientists' brothers, Jacques and Pierre Curie, in 1880. They found out about P.E. after first realizing that pressure applied to quartz or even some certain crystals creates an electrical charge in that certain material. They later referred to that strange and scientific phenomenon as the piezoelectric effect. P.E. is the electrical charge that disperses and accumulates in certain solids in response to applied mechanical stress. And that word (P.E.) means electricity resulting from pressure and latent heat and is derived from a Greek word. The P.E. effect results from the linear electromechanical interaction between the mechanical and electrical states in crystalline materials without reflection symmetry, which generates electric charges resulting from kinetic or mechanical energy. clean energy.

1- Piezoelectricity Principles [1]

The active element of an accelerometer is a piezoelectric material. Figure 1 illustrates the piezoelectric effect with the help of a compression disk. A compression disk looks like a capacitor with the piezoceramic material sandwiched between two electrodes. A force applied perpendicular to the disk causes a charge production and a voltage at the electrodes. the converse of this relationship was confirmed: if one of these voltage-generating crystals was exposed to an electric field it lengthened or shortened according to the polarity of the field, and in proportion to the strength of the field.

2- System Tools

2-1 P.E. Sensor

Also known as a P.E. transducer, is a device that uses the P.E. effect to measure changes in pressure, temperature, acceleration, strains or force by converting these into an electrical charge.

2-2 Vibration Sensor

A vibration sensor is a device that measures the amount and frequency of vibration in a given system, machine, or piece of equipment .

2-3 LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons

2-4 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric

2-5 Capacitor

A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals

2-6 PCB Board

A printed circuit board (PCB) mechanically supports and electrically connects electrical or electronic components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate.

2-7 Resistor

Resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

3- Design and Implementation

There are several types of energy sources, including clean energy, which depends on several natural factors and collects power from pressing changes, mechanical impulses, vibrations, and others. power can be harvested using P.E. materials to convert deflection or displacements into electrical energy that can be used or stored for later uses. The project wiring and design of the piezoelectric system components are described below. there are many electronic elements connected together need to be understand, the following figure (3-1) shows project main diagram.

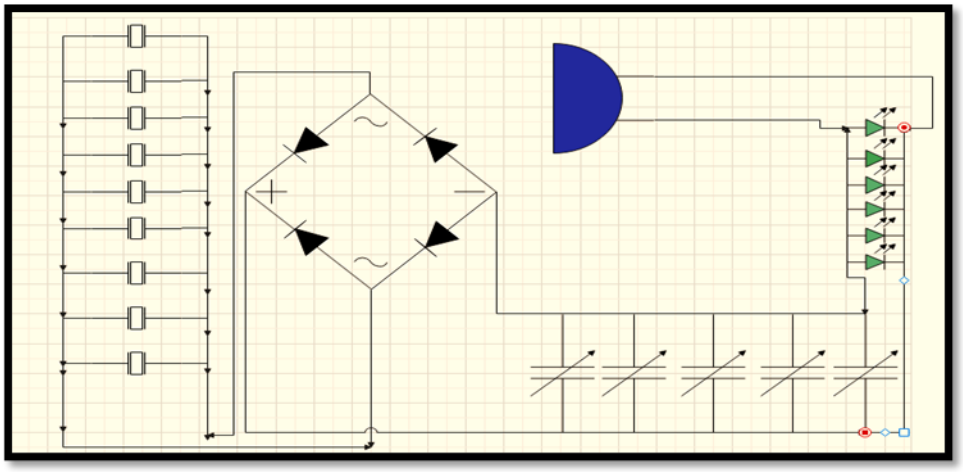

Figure (3-1) Project Main Diagram

By connecting the hardware tools there are many electronic elements connected together need to be understand, first Piezoelectric Sensors Connect to Vibration Sensor

using nine Piezoelectric sensors as input connected each piezoelectric with vibration sensor, each piezoelectric sensor connected via two wires GND and VCC to vibration sensors, second all vibration sensors connected parallel to each other via two wires GND and VCC, using Six 470 uF Capacitor connected parallel to contains large amount of voltage, Rectifier Connection of Diodes the Main purpose to of using diodes is to make bridge rectifier to the circuit.

Now bridge rectifier is ready to use and connected to parallel capacitors. Next, Connect Rectifier to Parallels Capacitor the Connection of bridge rectifier can be complete without connecting it to the parallel capacitors via capacitors positive and negative signals, after finishing connections of both (Parallels Connection of Capacitors and Rectifier Connection of Diodes), circuit has to complete by wiring both positive and negative signals of rectifier to parallel vibration sensors. Finally Connect Circuit to LED and Buzzer, take two signals from parallel 470 uF Capacitors and connected it via two wires for two side, one side for buzzer and other for 220k resistors which is last connect to thirteen green LED. Figure (3-1) Shows Final Project Design.

Figure (3-2) Project Main Diagram

4- System Work

When pressure is applied to piezoelectric sensors and systems, the resulting voltage has a potential difference of the same magnitude as the power. Therefore, it can be easily used to converts mechanical energy into electrical energy. P.E. sensors generate an analog output voltage. It results in a constant charge of constant force corresponding across the sensor. However, this will leaks over time due to incomplete insulation, internal sensor impedance, electronics attached to the system, etc. There is also an opposite manner P.E. effect whereby applying a voltage to a material changes its shape. When a force is applied to a P.E. material, an electric charge is generated across the crystal. This can be measured as voltage proportional to pressure. There is also an inverse P.E. effect whereby applying a voltage to a material changes its shape. Then, the pressure is converted into vibration which is also converted by the vibration sensor into electrical energy. Then transfer it to the bridge rectifiers which produce a large DC power output. 470uF capacitors clean up the signals captured by the bridge rectifiers to facilitate output. Finally, the output is shown as 13 green LED and Buzzer.

5- Conclusion

Piezoelectricity is the charge produced by certain materials when mechanical stress is applied and converted into electrical. Piezoelectric pressure sensors exploit this effect by means of gauges including the measurement of voltage across a piezoelectric element resulting from the applied pressure. They are very powerful and useful and are used in a wide range of industrial, medical, and all other energy applications.

When a force is applied to a piezoelectric material, an electric charge is generated across the faces of the crystal. A scale can be used as a measure of that voltage proportional to the pressure. There is also an inverse piezoelectric effect whereby applying a voltage to a material changes its shape.

Incomplete insulation, internal sensor impedance, attached electronics, etc. As a result, piezoelectric sensors are not usually suitable for measuring static pressure.

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