

PIEZOELECTRIC GENERATOR COUPLED WITH SOLAR PANEL

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Abstract : Piezoelectric generator is an efficient way to generate electricity. In this project, using piezo crystal disc, a surface is made on which by applying mechanical stress, electrical energy is generated. Piezo crystals of different dimensions are used to make a circular surface and to strengthen it. A solar panel is also connected with this piezo system. Energy is generated by combining a solar panel with the piezo system.

Keywords— piezoelectric generator, solar panel surface, round piezo crystals, mechanical stress.

I. INTRODUCTION

In piezoelectric generator coupled with solar panel surface, energy is being generated from piezo discs and also from solar energy. The piezoelectric effect is defined as the generation of electric charge by applying mechanical stress on piezo discs. The reverse is also true for these materials i.e. by applying an electric current, these materials have the tendency to change their dimensions. All materials do not show this property, only some materials, lacking a center of symmetry on the atomic scale, can possess piezoelectricity. These materials include certain ceramics like Lithium niobate, Gallium arsenide, Zinc oxide, Aluminum nitride, Lead zirconate titanate (PZT)[3][6], barium titanate. Some biological matter like DNA, bones and various proteins exhibit this property. Rochelle salt and Quartz single crystal are the materials commonly used by industries. Now certain polymers like Polyvinylidene fluoride (PVDF) film also show this property and thin film sheets can be made from these materials[1][2]. To implement the piezoelectric effect in the industry, it is not necessary to apply only mechanical stress, wind pressure can also be used[2]. In Polyvinylidene fluoride film, wind pressure is used to generate a charge on the surface. When wind pressure is applied, the thin film moves back and forth, the movement of which depends on the wind speed. One of the main advantages of these materials is that they can be molded into different dimensions. In this project, a series of piezo discs and a solar panel are connected on a surface in which by simply applying mechanical stress, it is possible to generate electricity using the solar panel, mounted on the surface of piezo crystals[4][7].

Historical Background

Two scientists, Pierre and Jacques Curie found an interesting behavior about some materials. They discovered the effect on applying mechanical stress, material exhibit electric charge on their surface. Later on, they gave the name to the effect called the piezoelectric effect. Word 'piezo' is derived from the Greek word 'piezein' which means to squeeze or press. In the 1950s, this principle was used in quartz watches to achieve accuracy.

Need of the piezoelectric generator

It is known that resources on this earth are limited and vanishing with time. Therefore, resource conservation must be of prime importance to humans. Scientists from all over the world have been trying to use renewable energy to fulfill human daily needs from very long, like wind and solar energy to generate electricity. The piezoelectric effect is one of the ways to generate electrical energy. With this project, generation of energy can be done easily by applying mechanical stress. The magnitude of the generation of energy is proportional to stress applied. This project proves very useful in crowded areas where a number of footfalls are huge[4][5][7]. Also, it is a very convenient way of generating electricity as it does not require any extra human effort for the energy generation purpose up to a certain limit.

II. CIRCUIT DIAGRAM

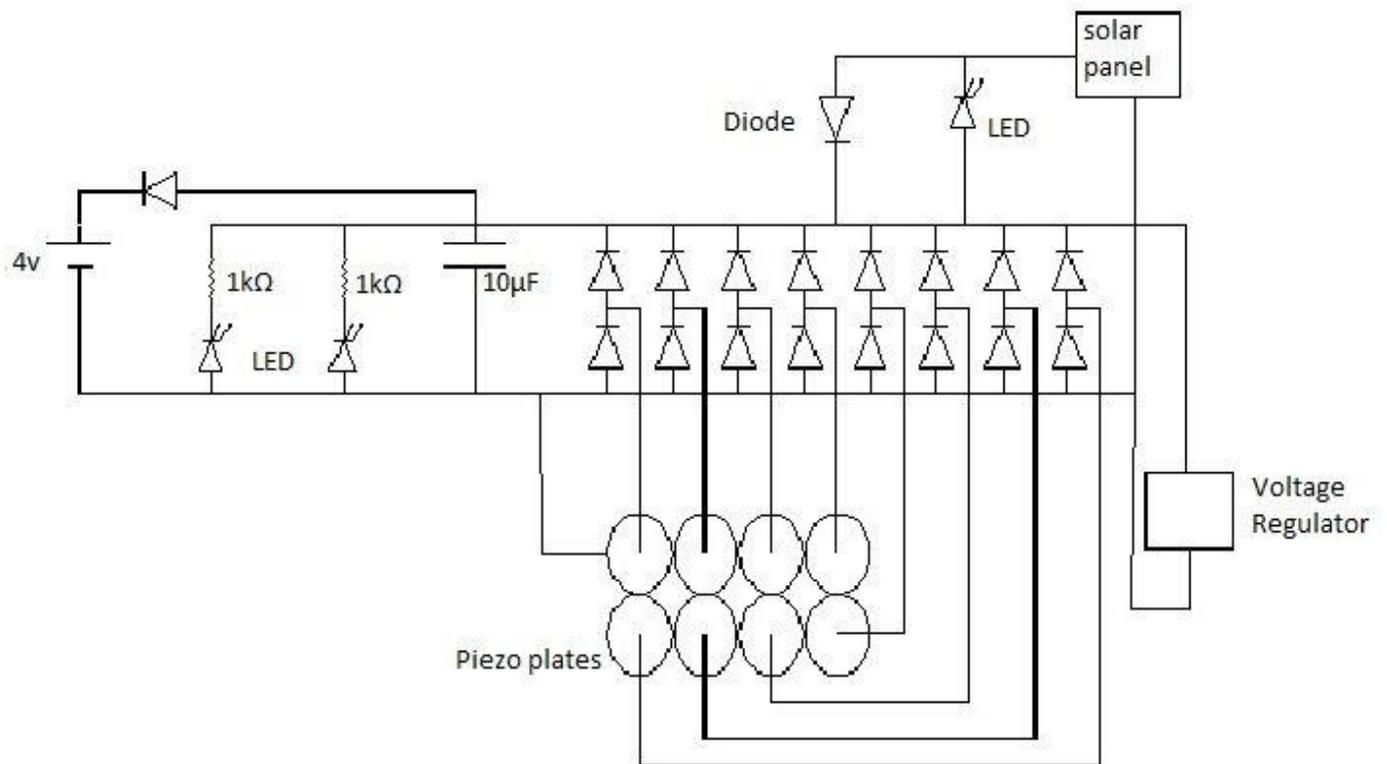


Fig. 1. Piezo parallel connections

III. ELEMENT'S CONFIGURATION

TABLE I. A PIEZO CRYSTAL'S CONFIGURATION

PIEZO CONFIGURATION	
Weight	2 grams
Color	Copper and Silver
Material	Bronze
Resonating Frequency	4.6 KHz
Resonance Impedance	200 Ohms
Capacitance	20 nF
Shape	Round



Fig. 2. A piezo crystal or disc

IV. BLOCK DIAGRAM

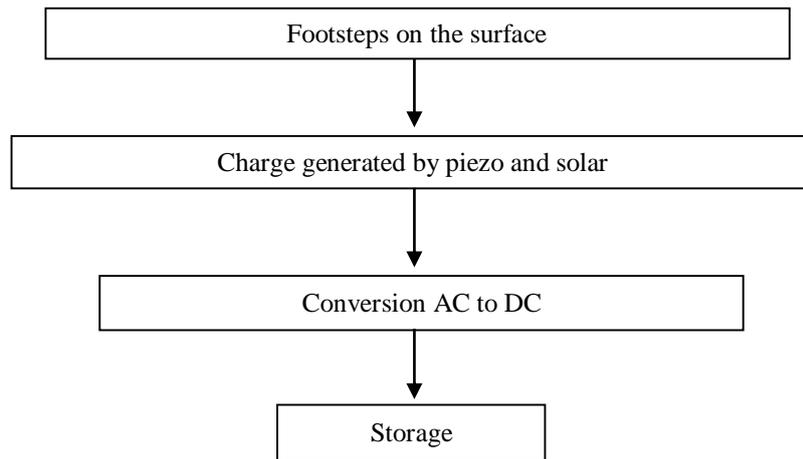


Fig. 3. Flowchart of generation of a voltage signal

V. WORKING PROCEDURE

- Piezo crystals are connected on a surface. A solar panel is also connected and placed over the discs.
- When pressure is applied on the surface electric charge is produced.
- This project is working under certain conditions:
 - When pressure is applied on the surface then only piezo discs works.
 - When only solar panel works.
 - Both solar panel and piezo discs contribute in energy generation.
- Energy generation by piezo crystals depends upon the surface area on which pressure is applied. If the pressure is applied on all the crystals equally, then the maximum charge is generated.

VI. MERITS

- No requirement of fuel.
- Reliable.
- No air pollution.
- No noise pollution.
- Power is generated by simply applying pressure on the surface.
- Generated power is easy to transmit and store.
- Cost efficient.
- High strength.
- Low maintenance.



Fig. 4. Hardware circuit of the volatge generator



Fig. 5. Piezo discs parallel connections

VII. RESULT

TABLE II. EXPERIMENTAL VALUES OF OUTPUT VOLTAGE OF PIEZOELECTRIC GENERATOR

S. No.	Voltage Regulator		
	Source used	Number of footfalls (Tapping)	Voltage (in volts)
I	Piezo crystals	25	4
		50	8.9
		100	15
II	Solar surface and piezo crystals	25	8
		50	40.44
		100	81.92

VIII. CONCLUSION

The project “Foot step power generation to run ac and dc loads” is successfully tested and implemented which is the best economical as well as an affordable energy solution to common people. This can be used for many applications in rural and urban areas where the power supply is less or totally absent. As India is a highly populated country where energy management is a colossal challenge, hence through this idea, it will become relatively possible to drive both ac as well as dc loads just by applying mechanical stress on the piezoelectric crystals.

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