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Hybrid Power Generation in Indian Scenario

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Abstract: In the era of 21st century, man is always hungry about power but conventional resources of power are not going to last forever, So, non-conventional and natural resources are required to get the energy. It is therefore need of the time that some alternate sources are to be identified for the sake of effective and green energy. The reliability of any one source is impractical in the era of if-then else loop or plan B. So, more than one source is to be identified. Piezoelectric and Solar technology are identified for the purpose of power generation in few cases. Solar energy may not be available 24x7 and 365 days, so in that duration, piezo can get power stored. It is renewable, inexhaustible and environmental pollution free. This paper deals with Hybrid technology that is a combination of piezoelectric and solar power generation which will be stored in battery and can be utilized whenever required for utilities.

Keywords - Piezoelectric cells, Solar energy, Hybrid power.

I.INTRODUCTION

In this era of increasing energy costs and decreasing supplies of fossil fuels, emphasis on protecting the environment and creating sustainable forms of power have become vital, high priority papers for modern society[2]. This paper proposes the design and implementing an alternative for sustainable generation of energy. Renewable energy systems are likely to become widespread in the future due to adverse environmental impacts and escalation in energy costs linked with the exercise of established energy sources. The proposed idea is to combine the energy producing generators i.e piezo generator and solar panel to provide with a sustainable form of energy[1]. Solar energy is an important source of renewable energy. Solar-powered Photo voltaic panels convert solar rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. Solar powered electrical generating systems helps reduce negative impact on the environment.

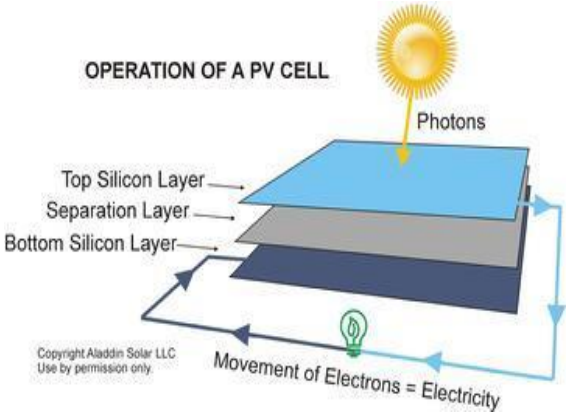

Fig 1.1: Operation of a Photo Voltaic cell

Piezoelectric materials have two properties that are defined as direct and converse effect. Direct effect is the property of some materials to develop electric change on their surface when mechanical stress is exerted on it, while converse effect is the property of some materials to develop mechanical stress when an electric charge is induced. Research demonstrates that the piezoelectric qualities of the solar cells' inorganic layer can be used to boost the overall efficiency of hybrid systems, which is promising for wherever sound and sun are together[3]. The efficiency of piezoelectric devices is influenced by the type of crystals due to the variety of their properties. However, Lead Zircon-ate Titanate (PZT) crystals are being used widely to achieve a high piezoelectric effect. The ease of fabrication to any complex shape, high material strength and long-life service, resistant to humidity and heat temperature over 100°C, are all distinctive factors of PZT. In addition to crystalline material suggested, **Table 1** shows other parameters that plays a major role to determine the best outcomes of the piezoelectricity[4] .

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TABLE 1: Piezoelectricity parameters

Sr. No.	Properties	Description
1.	Geometry	The most efficient form to produce more energy is tapered shape.
2.	Thickness	More energy is produced with thinner material.
3.	Loading Mode	More energy is produced with increase in mass or force.
4.	Fixation	Fixation at one end will result in more deflection, thus more energy when subjected to external force, than when fixed at two ends.
5.	Structure	Bi-morph structures produce double the energy output than unimorph structure.

II.OBJECTIVE

In last few years low power electronic devices have been increased rapidly. The devices are used in a large number to comfort our daily lives. With the increase in energy consumption of these portable electronic devices, the concept of harvesting alternative renewable energy in human surroundings arise a new interest among us[1]. In this paper we try to develop a piezoelectric generator. That can produce energy from vibration and pressure available on some other term (stresses generated by walking). This paper describes the use of piezoelectric materials along with solar panels in order to harvest energy from vibration for generating and accumulating the energy. This concept is also applicable to some large vibration sources which can find from nature. This paper also represents a footstep of piezoelectric energy harvesting model which is cost effective and easy to implement[1]. Renewable energy systems are likely to become widespread in the future due to adverse environmental impacts and escalation in energy costs linked with the exercise of established energy sources. Rather than relying on single source, it is always better to have double resources as in cloudy or rainy weather there may not be sufficient sunlight, which may impact solar power generation. So piezo also serves as alternative for generating electricity as Piezoelectric materials have the unique and useful property of being able to transform mechanical energy into electrical energy, and vice versa[8].

III. SYSTEM ANALYSIS

Lot many times it is seen that, locations like toll are directly placed, which incurs, electric supply to be established and with money, at the same time losses due to transmission lines so the natural resource can save lot much supplied generation. If the electricity is to be generated using only one resource, there is chances that the resource may get exhaust after a period of time or if it a non-renewable resource it may extinct after long years of use. Hybrid Power Systems are designed to minimize power system life-cycle costs and carbon footprint. Power conversion components deliver leading efficiencies and maximum energy harvest from renewable resources. The conversion chain starts with a mechanical energy source from vibration. The vibrations are converted into electricity via piezoelectric element. The electricity produced is thereafter formatted by a static converter before supplying a storage system or the load(electrical device). This is the ability of certain materials to create electrical potential when responding to mechanical changes. To put it more simply, when compressed or expanded or otherwise changing shape a piezoelectric material will output some voltage. Thus solar energy and piezoelectric energy can be used together to provide electricity to a house for low power consuming appliances like lights and fans. This method can also be used for a college or any institution, where many people are present throughout the day. The power required for corridor lights in colleges and malls can be met by this method. This method can provide the best alternative to conventional sources of energy, which will reduce the stress on exhaustible sources[5].

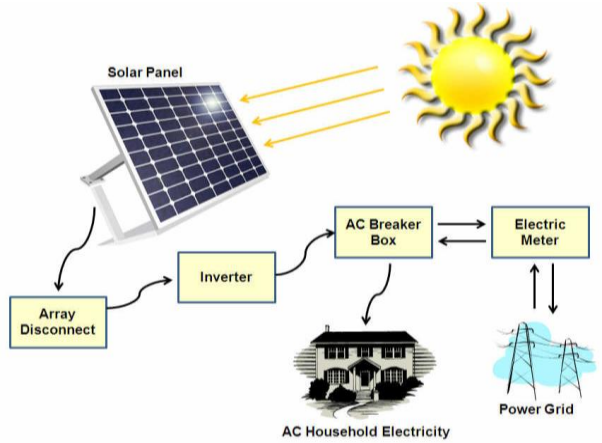

Fig 3.1: Flow chart for solar power generation

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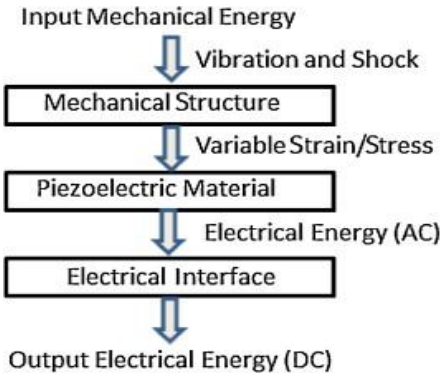

Fig 3.2: Flow chart for solar power generation

IV. IMPLEMENTATION

As depicted in the circuit diagram, the piezo cells are connected in series, the output of these cells is provided to the battery. The output from the solar panel is also connected to the battery .The outputs from solar panel and piezo cells acts as input for the USB which will be useful to charge the battery of a cellular phone. Following figures show the implementation of circuit stated above:

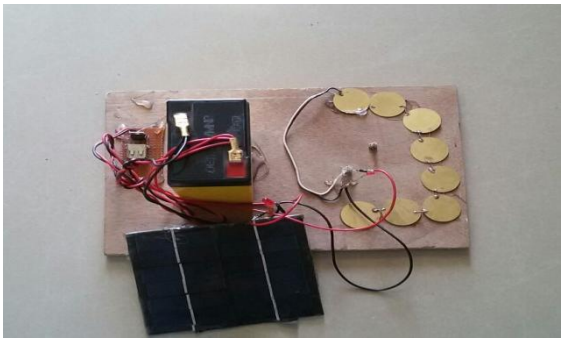

Fig 6.1 – The Complete Setup

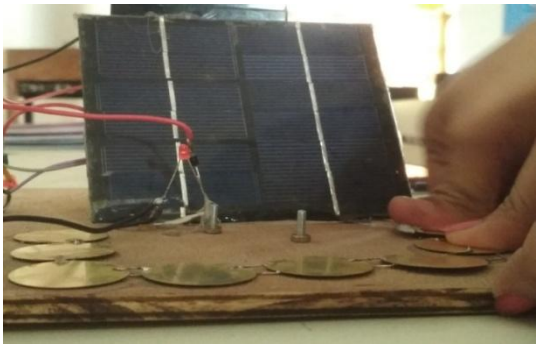

Fig 6.2 - LED glows when pressure is applied on the piezo sensor/transducer

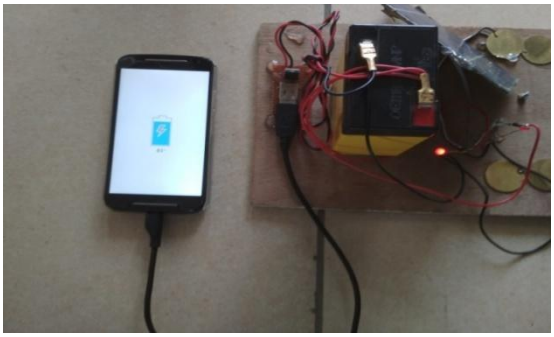

Fig 6.3 - The output is used to charge the phone

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IV.CONCLUSION

The method used to perform power harvesting is to use piezoelectric materials that can convert the ambient vibration energy surrounding them into electrical energy. This electrical energy can then be used to power other devices or stored for later use. This technology has gained an increasing attention due to the recent advances in wireless and MEMS technology, allowing sensors to be placed in remote locations and operate at very low power. The need for power harvesting devices is caused by the use of batteries as power supplies for these wireless electronics[6]. As the battery has a finite lifespan, recharging needs to be done once discharged. Charging of batteries in order to provide energy to the electronic devices in the applications such as borders or hilly regions is a tedious job to do.

The solar energy and piezoelectric energy can be used together to provide electricity to a house for low power consuming appliances like lights and fans. This method can also be used for a college or any institution, where many people are present throughout the day. The power required for corridor lights in colleges and malls can be met by this method. More study and research needs to be done in this area, so that the mass requirement of electricity is met. This can provide the best alternative to conventional sources of energy, which will reduce the stress on exhaustible sources.

For the piezoelectric harvesting device, the main advantages are the ease of application due to its simplified structure. Moreover, these materials are not affected by internal electromagnetic waves. The researchers have explored many piezoelectric materials like Polymer composites, piezoelectric ceramics, polymers etc. in several energy harvesting configurations to adjust the use of this technique in many applications.

Through this paper, we have proposed a new way of harnessing the piezoelectric energy along with solar energy. So these two ideas can greatly help in harnessing the piezoelectric energy thereby improve the results of the system. This technique for generation of power is extremely prudent and is anything but easy to produce. It can be utilized as a part of Rural zones additionally where accessibility of power is less or exceptionally low. It can be utilized to drive both AC and in addition DC load. In developing nation like India we can utilize this strategy for power generation with a specific end goal to uncover the heaps from Renewable and non-Renewable wellspring of energy[7]. We have investigated and observed the feasibility of applying piezoelectricity for converting the mechanical vibrations of roadway to generate useful electricity. We have also investigated the practicability of employing solar concentrators to enhance the output power of the solar panel to a considerable level. We hope that our proposal towards an efficient way to generate electricity will help to more effectively implement the idea within the budget and thereby reducing pressure on conventional power use and current generation.

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