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Advanced Foot Step Power Generation System

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A B S T R A C T

The production of electric power from the foot step movement of the peoples and the pressure exerted during walking which is fritter away, is the main theme of this paper. The mechanical power transformation into electrical power as the pressure exerted by the footstep and by using transducers is basically called as "Foot step power generation system". Power is produced by the power generating floor and it is basically the production of electrical energy from kinetic energy. As today electricity demand is increasing and it is unable to overcome this global issue by using the traditional power generating sources. Demand and supply gap is the major issue of energy crisis. The main aim is to overcome the power crisis throughout the world although it is not enough to fulfill over excessive demand of electrical energy but it will be able to change and decrease reliance on old method of generating electricity. This system can be installed at homes, schools, colleges, where the people move around the clock. When people walk on the steps or that of platform, power is generated by using weight of person. The control mechanism carries piezoelectric sensor, this mechanical energy applied on the piezoelectric crystal into electrical energy. When there is some vibrations, stress or straining force exert by foot on flat platform. It can be used for charging devices.

Keywords:Piezoelectric sensor, IN4007, LM7805 & LED, Relay, Lead Acid Battery.

1. Introduction

The aim behind the work is to install a power generating system in order to overcome the power crisis throughout the regions. Human power transport has been in existence since time immemorial in the form of walking, running & swimming. However, modern technology has led to machine to enhance the use of human power in more efficient manner. In this context, pedal power is an excellent source of energy and has been in use since the 19'th century making use of most powerful muscles in the body. 95% of the exertion put into pedal power is converted into energy. Pedal power can be applied to wide range of job is a simple, cheap and convenient source of energy. However, human kinetic energy can be useful in a nos. of ways but it can also be used to generate electricity based on different approaches and many organizations are already implementing human power technologies to generate electricity to power small electronic appliances. Piezoelectricity is the electric charge that accumulates in certain solid materials in response to applied mechanical stress.

In this paper, piezoelectric sensor is most important thing and plays a vital role in the smart systems development. It has become an essential part in the current day to day technologies. This article discusses about foot step power generating system using piezoelectric transducer. This system is responsible for power generating system based on piezoelectric effect.

2. System Model

To give better voltage and current, three PZT are connected in series .A force sensor and voltmeter is connected to this series combination. As varying forces are applied on this connection and corresponding voltages are noted. Voltage and current generated across the series connection is measured. The voltage and current generated across the parallel connection is measured. From series connection obtained current is poor and from parallel connection obtained voltage is poor. To overcome this problem rectifier in series-parallel connection is used.

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VOLTAGE REGULATOR 7805

The LM78XX/LM78XXA series of three-terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a Wide range of applications. Each type employs internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output Current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

LED:

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. When a light-emitting diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons.

LEAD ACID BATTERY

Lead-acid battery have good high-low temperature tolerance and high-current discharge performance, low-cost electrode materials and loose The assembly environment, mature charging mechanism and high security have an absolute advantage in the communications and UPS power industry, the automotive industry, industrial and mining enterprises and weapon systems.

PIEZOELECTRIC TRANSDUCER

A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. Piezoelectric materials exhibit the unique property known as the piezoelectric effect. When these materials are subjected to a compressive or tensile stress, an electric field is generated across the material, creating a voltage gradient and a subsequent current flow. This effect stems from the asymmetric nature of their unit cell when a stress is applied. Piezoelectric force sensors should have an operating temperature range from -50 to 350 ºC and should have sensitivity of approximately 105 pC/N.

PIEZOELECTRIC EFFECT

The piezoelectric effect refers to a variation in electric polarization that is produced in some materials when pressure is applied on them. This pressure-dependent variation in polarization establishes as a measurable potential difference across the material. Referred to as the direct piezoelectric effect, this phenomenon is evident in many naturally occurring crystalline materials, including quartz, Rochelle salt, and even human bone. Engineered materials, such as lithium niobate and lead zirconate titanate (PZT), exhibit a more distinct piezoelectric effect. Piezoelectricity describes interconversion between electrical charge and mechanical strain. The direct piezoelectric effect is experiential as a change in surface charge density of a material in response to an external pressure.

METHODOLOGY:

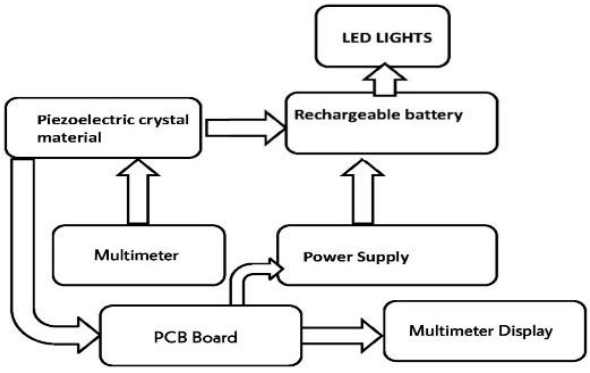

Fig. 1 - Block diagram & working of proposed system

The above figure presents the block diagram representation of the proposed concept. If you squeeze or stretch a piezoelectric crystal, you deform the structure, pushing some of the atoms closer together or further apart, upsetting the balance of positive and negative, and causing net electrical charges to appear. This effect carries through the whole structure so net positive and negative charges appear on opposite, outer faces of the crystal. Normally, the charges in a piezoelectric crystal are exactly balanced, even if they're not symmetrically arranged. If you squeeze the crystal (massively exaggerated in this

picture!), you force the charges out of balance. Now the effects of the charges (their dipole moments) no longer cancel one another out and net positive and negative charges appear on opposite crystal faces. By squeezing the crystal, you've produced a voltage across its opposite faces and that's piezoelectricity!

When one steps on the weighing machine the piezoelectric disc gets compressed. After the leg is lifted the crystal is decompressed. Thus a full vibration is sensed by the crystal disc and a voltage across it is produced. This voltage is sensed by the Digital Multimeter and displayed on its display.

DESCRIPTION OF THE SYSTEM:

A working model of Footstep Power Generation is demonstrated in this project, the basic working of this model has been presented as a block diagram (Fig.1). To implement this model four piezoelectric sensor that are connected in series to increase the voltage output, this sensor generates AC voltage which is transferred to the bridge rectifier. The output voltage from the sensor can be of two types because it produces AC voltage:

Positive: When positive voltage is received then it is passed into the forward bias mode which will in turn charge the battery.

Negative: When a negative voltage is received then it is transferred to the reverse bias of the bridge rectifier. This way no voltage loss is observed during a complete cycle. An additional resistor of 470 Ohm is placed in series along with a capacitor of 4.7 mF with the LED to make the glow more noticeable.

3. Conclusion

This project can be used in both the home and Industry .It helps in saving the energy and electricity. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China. The best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absence. By using this project we can drive both A.C. as well as D.C loads according to the force we applied on the piezo electric sensor. Our prototype demonstrates that a floor generator can be done. In future, we can improve our project by installing piezoelectric sensors in public areas like streets, while people walking on the street and energy is generated. With this energy, we can turn on street lights that are useful to the public. In addition, by placing this piezoelectric sensor in tiles placed throughout the house, electric energy is produced every time someone steps on the tiles. We can use this energy for a variety of purposes such as turning on a fan or lights etc.

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