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Design of Footstep Power Generator Using Piezoelectric Sensors

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***Abstract*— Electricity is the most general forms of energy used across the world. This project focuses on designing a setup that leads to the generation of electrical energy which is going to waste when humans are walking. Footsteps are untapped natural resources. This generated energy is, however, cost effective and non hazardous for human. Electrical energy can be produced by converting mechanical energy using footsteps. Generating the electric power through the fabrication of footstep arrangement using the electromagnetic induction principle. In this project the pressure energy is converted into electrical energy. The control mechanism carries the copper coil and electromagnet which is used to generate voltage, a rechargeable battery is used to store this generated voltage. This project will reduce the global warming and load shedding in a much cleaner cost-effective way. Since this project is related directly to the human movement, the weight of the setup is a crucial factor.**

***Index Terms*— Piezoelectric sensors, diode, inverter.**

I.INTRODUCTION

The process of producing electrical power from different types of energy sources is called electricity generation. This type of energy is an essential part of nature. We generate electricity (secondary energy source) by converting primary sources of energy like atomic, gasoline, coal, and other natural sources[1-4]. Fossil fuels pollute the environment. Atomic power plant requires careful handling of both raw as well as waste material. From the birth of earth, man has needed and used energy at an increasing rate prior to his existence. The world has already used large amount of energy resources for power production. The extensive usages of available resources in recent years created a demand for the future generation. After realising the availability issues of the non-renewable sources, the renewable sources of energy like wind, water, and sun are being consistently and increasingly used by people to generate power. Our focus now is on the renewable energy, which is essential and nonpolluting. Have we ever thought that we could generate electricity with our footsteps. Walking is a widespread practice every day. A person transfers energy through impact or vibration to the road surface. This energy can be converted to electrical energy by subsequent conversion of mechanical energy. Whenever we move on our

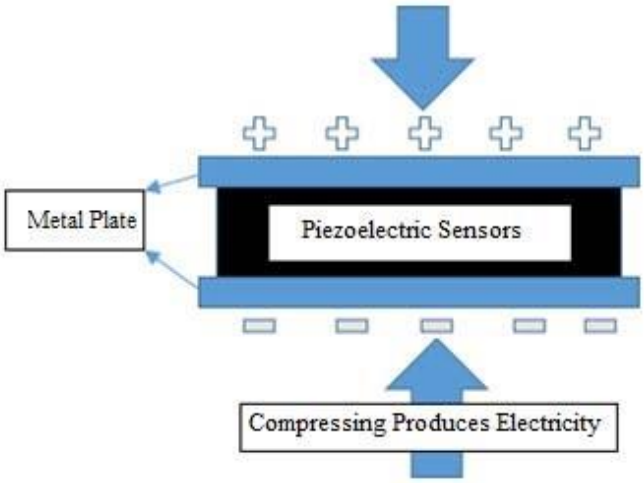

Fig. 1. Piezo electric mechanism.

feet, our kinetic energy is wasted as heat energy. In this project, we have originated electricity through the human powered mechanical energy.study of their merits, demerits, the sub equipment and their requirements. Day by day, the population of the country increased and the requirement of the power is also increased. At the same time the wastage of energy also increased in many ways. So reforming this energy back to usable form is the major solution. As technology is developed and the use of gadgets, electronic devices also

increased. Power generation using conservative method becoming deficient. There is a necessity arises for a different power generation method. At the same time the energy is wasted due to human locomotion and many ways. To overcome this problem, the energy wastage can be converted to usable form using the electromagnet and coil.

Kinetic energy is the energy of motion and can therefore be found in every object that moves.In addition to these we have developed a new methodology of generating power using human energy and the name of this alternative is a "FOOT STEP POWER GENERATION". This model converts the pressure on it to a voltage. So by using this energy saving method, that is the footstep power generation system we are generating power.

II.EXPERIMENTAL SETUP AND WORKING

In this project the pressure energy is converted into electrical energy. The control mechanism carries the copper coil and electromagnet which is used to generate voltage. After rectifying the generated voltage , it is stored in the rechargeable battery.

At the real time, when the voltage is generated , there may be or may not be the requirement of electricity. The requirement of electricity depends on its utilisation by loads. Therefore, the generated voltage is store in the battery to fulfill the future requirement, so that when there is utility of electricity we can directly use the stored voltage from battery.

This project is used to generate voltage using footstep force. The proposed system works as a medium to generate power using force. This project is very useful in public places like bus stands, theaters, railway stations, shopping malls, etc. So, these systems are placed in public places where people walk and they have to travel on this system to get through the entrance or exit.

These systems may generate voltage on each and every step of a foot. For this purpose, piezoelectric sensor / electro-magnet mechanism is used in order to measure force, pressure and acceleration by its change into electric signals. This system uses voltmeter for measuring output, led lights, weight measurement system and a battery for better demonstration of the system.

Whenever force is applied on piezoelectric sensor / electro-magnet mechanism, then the force is converted into electrical energy. In that movement, the output voltage is stored in the battery. The output voltage which is generated from the sensor is used to drive DC loads.

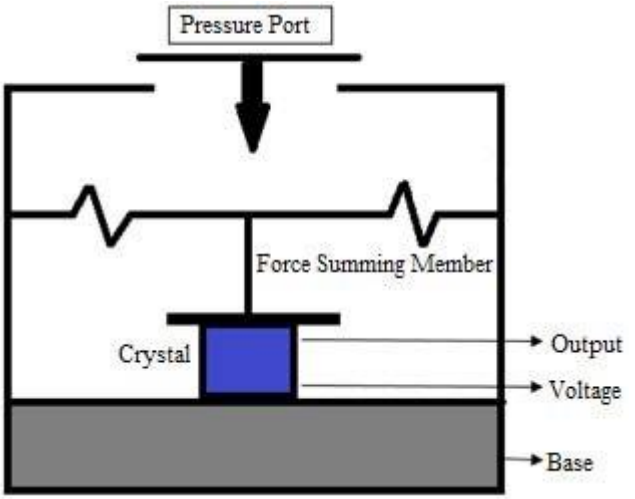

Fig. 2. Piezo electric crystal sensor system using piezo electric sensors.

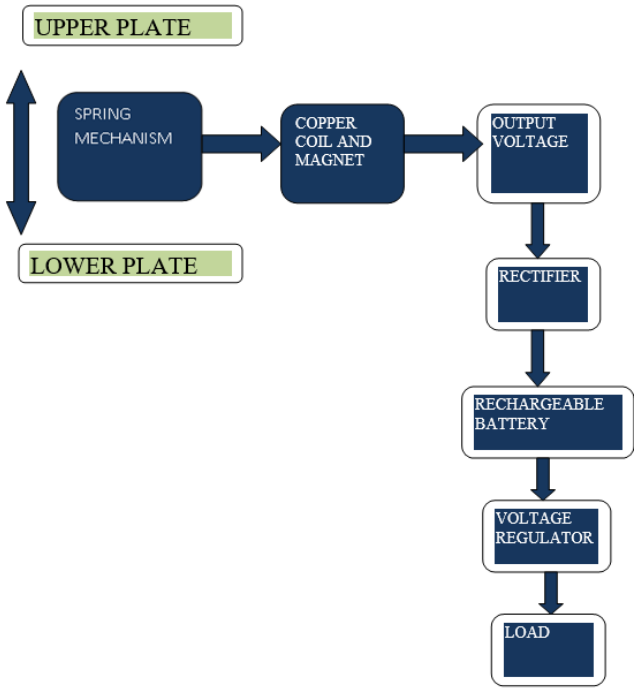

Fig. 3. Block Diagram of foot step power generator.

Figure 4 ,We have seen that when a DC current pass through a long straight conductor a magnetizing force, H and a static magnetic field, B is developed around the wire. If the wire is then wound into a coil, the magnetic field is greatly intensified producing a static magnetic field around itself forming the shape of a bar magnet giving a distinct North and South pole.

The magnetic flux developed around the coil being proportional to the amount of current flowing in the coils winding. If additional layers of wire are wound upon the same coil with the same current flowing through them, the static magnetic field strength would be increased.

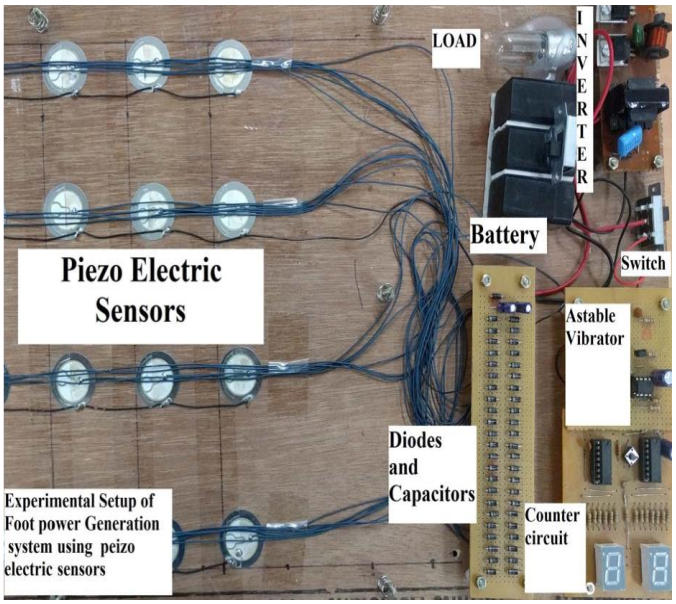

Fig. 4. Experimental setup of Foot step power generator

III.RESULT AND DISCUSSION

V-I characteristics (as in Figure 5) of both the piezoelectric material under consideration were studied to understand the output corresponds to the various pressure and strain applied on them. Voltmeters and ammeter are used for measuring the voltages developed across the piezoelectric materials and amount of current flowing them respectively. As different observed pressure and strain are tested on the piezoelectric material, different voltage readings were noted corresponding to the different pressure and strain.

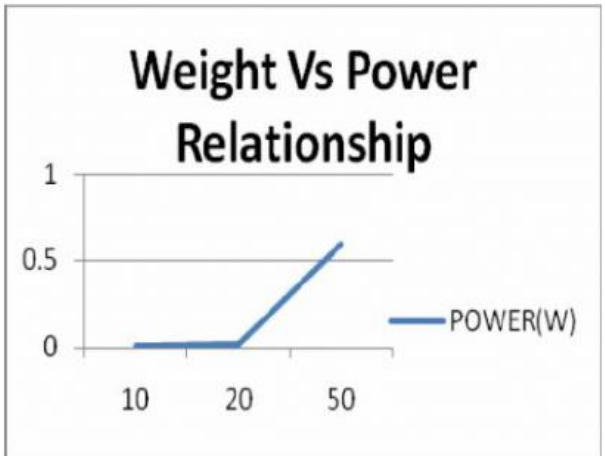

Fig. 5. V-I Characteristics Graph

In this way, the energy can be stored in the capacitor by charging the capacitor, and the capacitor may be discharged on the basis of requirement. However the energy harvesting capacity of this circuit is not very much appreciable. To overcome this problem, after bridge rectifier stage, one may use a DC to DC converter. An improvement by a factor of seven in energy harvesting has been shown by the addition of DC-DC converter. In parallel with the piezoelectric element, it contains a switching device.

The DC voltage will be stored in 6V battery, the number of battery used is 2 in number. The 6V each DC of the battery is converted into AC by power transistor T-1 (NPN). The output of the transistor is fed to the inverter transformer which will convert 12 V to 220Volt which will light up. The number of press or number of jumps on a wooden plank is shown on the 0-99 counter.

IV.CONCLUSION

The waste energy of human during walking is used in this system. Footstep is an uninterrupted and renewable source of energy. The system repeatedly operates in a short duration of time and is not possible to maintain a constant speed. As a result, voltage variation occurred which is controlled by a voltage regulator. The total system of the power generation using footsteps depend mainly on the angle of attack of the flowing medium. High voltage dynamo should be used to produce more electricity. Though many systems are available for power generation from footsteps, the proposed system is very economical and affordable. As Bangladesh is a developing country with a large population, we face difficulty day by day due to power shortage. Many people in our country cannot enjoy the facility used for generating electricity. Though power produced in this process is minimal, as a whole country, this will be a considerable source of electrical energy. This project also reduces global warming.

There is no need of power from the mains and there is less pollution in this source of energy. It is very useful to the places all roads and as well as all kind of foot step which is used to generate the non conventional energy like electricity.It is able to extend this project by using same arrangement and construct in the footsteps/speed breaker so that increase the power production rate by fixing school and colleges, highways etc.

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