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FOOT STEP POWER GENERATION: A REVIEW

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Abstract: As the demand of energy is increasing day by day, so the ultimate solution to deal with these sorts of problems is just to implement the renewable sources of energy. The objective of this work is power generation through footsteps as a source of renewable energy that we can obtained while walking on to the certain arrangements like footpaths, stairs, plate forms and these systems can be install elsewhere specially in the dense populated areas. The most common activity in day to day life is walking. Person when walks, he loses some energy to the road surface due to impact, vibration, sound etc, due to the transfer of his weight on to the road surface, through foot falls on the ground during every step. This energy can be tapped and converted in the usable form such as in electrical form and can be temporarily stored for later use. Continuing in that spirit, this paper reviewed the techniques for the generation of electricity as renewable energy sources by using footstep, piezo electric shoe, pavgen slabs and many more need to explore.

Keywords: Renewable Energy, Electricity generation, Piezoelectricity



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INTRODUCTION

The need of energy in the society is constantly rising. In the current scenario, there has been substantial increase in energy consumption. For sustaining this growth, various countries draw a large amount of energy from a variety of sources and can be categorized as conventional and non-conventional source of energy. The main sources are Fossil Fuel Energy, Nuclear Energy and Hydraulic Energy.

Among these, the fossil fuels are used to generate energy in more than 85% of all energy sources. These sources have their own hindrances. Hydraulic Energy system setup is costly, where as Nuclear Energy involves a high risk, and Worst of all; there has been a rapid depletion and exhaustion of fossil fuels globally, for last few decades. At this rate of expenditure the storage of fossil fuel will be exhausted within a few decades. The purpose of this review paper is to analyze various methods of foot step power generation such as footstep power using foot step electricity converter device, using pavgen slabs, liquid droplets and metal electrode embedded in shoe sole, using piezoelectric material

Literature Review

The most common methods generating electricity are as follows:

1. Power generation using piezoelectric material:

The piezoelectric material converts the pressure, stress applied to the material into electrical energy. The source of stress is from the weight of the people stepping on the stairs. As the output voltage from a single piezo-film was extremely low, thus combination of few piezoelectric is used. Two types' possible connections can be done parallel connections and series connections. The output of the piezoelectric material is not a regulated one, so variable to linear voltage converter circuit rectifier is used. Ac ripple neutralizer is the circuit used to reduce the ripples from the piezoelectric output. The AC ripple neutralizer consists of rectifier and ripple filter. Again AC ripples are filtered out using ripple filter and it is used to filter out any further variations in the output and then it can be pass through regulator in order to regulate. The output of the voltage regulator is given to the unidirectional current controller.

Unidirectional current controller means it allows flow of current in only one direction. Mostly used unidirectional current controller devices are as follows:

1. Diode- we already know that it allows an electrical current in one direction. It acts like a switch. A specific diode converts AC into pulsating DC hence sometimes it also called as rectifier.

2. Thyristor-A thyristor is four layer semiconductors that are often used for handling large amount of power. While a Thyristor can be turned on or off, it can also regulate power using something called phase angle control. The output voltage from this piezoelectric is then stored in a battery through ac ripple neutralizer which does exactly opposite job of the rectifier and filter which converts the stored direct current (DC) energy in batteries back into alternating current (AC). An inverter is connected to battery to drive AC load. LCD display is used for displaying generated voltage. For this purpose microcontroller AT89S52 is used. The microcontrollers consist of crystal oscillator and which is used for its operation. The output of the microcontroller is then given to the LCD which then displays the voltage levels. From this system we are generating energy by human footsteps using the piezoelectric effect. Piezoelectric effect is the effect which converts mechanical stress, strain, pressure into electrical energy. This idea not only overcome the energy crises problem but also helps to maintain the eco-friendly environment for generating energy.



Fig 1: Energy generation using piezoelectric material

2. Energy generation Using Rack & Pinion Assemble And Chain Drive Mechanism

In this project we are generating electrical power as non-conventional method by simply running on the train in the foot step. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using foot step needs no fuel input power to generate the output of the electrical power. This project using simple drive mechanism such as rack and pinion assemble and chain drive mechanism. For this project the conversion of the

force energy in to electrical energy. The control mechanism carries the rack & pinion, D.C generator, battery and inverter control. We have discussed the various applications and further extension also. So this project is implemented to all foot step, the power generation is very high. The initial cost of this arrangement is high.



Fig 2. Arrangement of Rack & Pinion Assemble

3. Foot step electric device:

In order to develop a technique to harness foot step energy, a foot step electricity generating device was developed in the Reactor Control Division, BARC. If this device is embedded in the footpath, will convert foot impact energy into electrical form. The downward movement of the plate results in rotation of the shaft of an electrical alternator fitted in the device, to produce electrical energy. The electricity generated from these devices can be used for street lights. This is a mechanical arrangement so efficiency is not so good and wear tear problem is there. The weight is less then 50kg then this device will not work



Fig 3: Footstep electric converter device

4. Electricity generation using PaveGen :

Paving slabs that convert energy from people's footsteps into electricity are set to help power Europe's largest urban mall, at the 2012 London Olympics site. The recycled rubber "PaveGen" paving slabs harvest kinetic energy from the impact of people stepping on them and instantly deliver tiny bursts of electricity to nearby appliances. The slabs can also store energy for up to three days in an on-board battery, according to its creator. The recycled rubber "PaveGen" paving slabs harvest kinetic energy from the impact of people stepping on them and instantly deliver tiny bursts of electricity to nearby appliances. The slabs can also store energy for up to three days in an on board battery, according to its creator. Paving slabs that convert energy from people's footsteps into electricity are set to help power Europe's largest urban mall. Cost of installation and complex designing process are the limitations of this method.



Fig 4: PaveGen slabs

5. Footwear embedded harvesters:

In this method liquid droplets are placed between the electrodes coated with dielectric film. Droplets and electrodes are connected to an external electrical circuit. Movement causes the interface between the droplets and the electrodes to decrease, which releases an electrical charge which flows back into the electrical circuit and generate electrical current . Limitation of this method is maintenance cost is high and droplets life time.



Fig 5: footwear embedded harvester

6. Piezoelectric shoe:

Apart from tiles, roads, dance floors, attempts are made to harvest energy from our daily movements by installing piezoelectric crystals in the shoes also. These shoes would have piezoelectric crystals at the rear end or near heel. Thus with each step piezoelectric crystal would go through pressure and force which in turn can generate enough energy to power cell phones, mp3 players etc. If these such shoes undergo through movements daily then these will be able to generate electricity enough to charge up the small electronic devices or gadgets. Often we can do that with a piezoelectric transducer, a transducer is simply device that converts small amount of energy from one kind to another for instance converting light, sound or mechanical pressure into electrical signals The piezoelectric effect a material's capacity to convert mechanical energy into electrical energy, and the inverse is observable in a wide array of crystalline substances that have asymmetric unit cells. When an external force mechanically strains a piezoelectric element, these polarized unit cells shift and align in a regular pattern in the crystal lattice. The discrete dipole effects accumulate, developing an electrostatic potential between opposing faces of the element .Relationships between the force applied and the subsequent response of a piezoelectric element depend on three factors: the structure's dimensions and geometry, the material's piezoelectric properties, and the mechanical or electrical excitation vector.



Fig 6: piezoelectric shoe

7. Power generation using electromagnetic induction principle

The ultimate aim of this method is to develop much cleaner cost effective way of power generation method, which in turns helps to bring down the global warming as well as reduce the power shortages In this project we are generating electrical power as non-conventional method by simply walking or running on the foot step. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using foot step is converting mechanical energy into the electrical energy. This method uses electromagnetic induction principle. In this method the pressure energy is converted into electrical energy. The control mechanism carries the copper coil and bar magnetic which is used to generate voltage, a rechargeable battery is used to store this generated voltage.

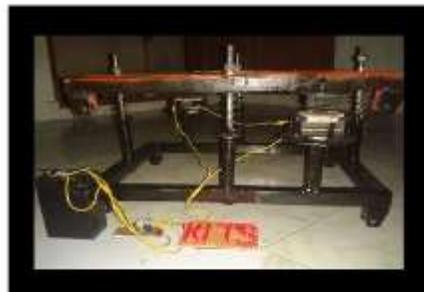


Fig 7. Power generation using electromagnetic induction principle

CONCLUSION

“Energy can neither be created nor be destroyed It can be transferred from one form to another” It is one of the similar approach to generate the energy using piezoelectricity principle. The analysis shows various methodologies for generation of electricity. There is no need of power from the mains and there is less pollution in this source of energy. This paper presents an adaptive approach to harvesting electrical energy from footsteps. Different methodologies for generation of electricity by walking is reviewed and analyzed. We analyzed that some of the methodologies are not feasible in some conditions due to too much complexity in real time portable charging and some are feasible but they are in an analysis stage. This can be used for many applications in rural areas where power availability is less or totally absence.

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