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Foot Step Power Generation

Ritu Singh, Pranay Kumar and Ritu Raj

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Mrs. Ritu Singh[1], Pranay Kumar[2], Ritu Raj Kumar[3]

[1] Assistant Professor, [2] [3] Student

Department of Electronics and Communication Engineering
Sharda University, Greater Noida U.P, India 201306

KEYWORDS

Power – Generation

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ABSTRACT

In Present Scenario Power generation is one of biggest issue for any country. Now-a day's numbers of power sources are present, non-renewable & renewable, but still we can't overcome our power needs. The electrical power consumption is increasing exponentially. Therefore, the need of a fool-proof and economically viable power generation and distribution system demands a certain interest. This paper proposes utilization of human locomotion energy which, although extractable goes mainly to waste. This paper proposes a model that uses human walking, jumping and running as a source of energy and store it for essential use. Such a model is apt in a demography that of a country like India which has such a huge population. The generated power will be stored and then we can use it for domestic purpose. 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. When there is some vibrations, stress or straining force exert by foot on flat platform. It can be used for charging devices e.g., laptop, mobile, etc. It also promotes green energy and environment friendly approach towards energy generation. In this paper we have provided the basic concept and design details of this model and a basic implementation of the same.

Introduction

Energy is nothing but the ability to do the work. In day to day life, Electricity is most commonly used energy resource. 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 Humans are using the renewable energy which are solar, wind etc. but we still could not satisfy our power needs, because of that we have to generate electricity through each and every possible way. This project includes number of simple setup and component that is installed under the walking or standing platform. When person walk or stand on this platform their body weight compresses the setup of system which tends to rotates a dynamo and current produced is stored in dry battery and while the power producing platform is over crowded with moving population, energy is produced is high. Piezoelectric effect is the effect of specific materials to generate an electric charge in response to applied mechanical stress.

Piezoelectric materials and its effects:

2.1 Piezoelectric Effect:

Piezoelectric is the ability of certain materials to generate an electric charge in response to applied mechanical stress. The word Piezoelectric is derived from the Greek piezein, which means to squeeze or

Crossponding Author: Mob- 9110103731, Email id; 06pranay@gmail.com

press, and piezo, which is Greek for "push". Piezoelectricity has both direct and converse effects i.e. mechanical stress results in AC voltage generation and vice versa. This effect is shown by Berlinite (AlPO4), Quartz (SiO2).

2.2 Working

The nature of piezoelectric materials is closely linked to significant quantity of electric dipoles within these materials. A dipole is a vector, so it has a direction and a value in accordance with the electrical charges around. These dipoles tend to have the same direction and are altogether called Weiss domains. The reason why piezoelectric materials create a voltage when a mechanical stress is applied, because the crystalline structure is disturbed and it changes the direction of the polarization of the electric dipoles. A Piezoelectric crystal is placed between two metal plates. Mechanical pressure is then applied to the material by the metal plates, which forces the electric charges within the crystal out of balance. The principle of operation of this sensor can be described as a physical quantity, transformed into a force, which acts on two opposite face of sensor element.

2.3 Piezoelectric Sensor

Sensors are devices used to detect or sense the different types of physical quantities from the environment. A sensor which works on the principle of piezoelectricity is known as a piezoelectric sensor. Where piezoelectricity is a phenomenon where electricity is generated if mechanical stress is applied to a material. Not all materials have piezoelectric characteristics. Additionally, piezoelectric sensors are rugged, have high natural frequency. This phenomenon is not affected to Electromagnetic fields and other radiations. It converts the mechanical stress to electrical voltage. When mechanical stress is applied onto the sensor, electrical charge is accumulated on the crystal that can be extracted using a wire.

3. Components

- Piezo Sensor Tile
- Bridge Rectifier
- Buck-Boost Converter
- Rechargeable Batteries

3.1 Piezo Sensor Connection

A Piezoelectric tile is a tile of dimension 25 cm x 30 cm. The thickness of the tile is 0.9 mm. To use a piezoelectric sensor is the easiest task, just connect the positive and negative terminal to your circuit and press the top of sensor. The output power from a single piezo sensor is very low therefore a combination of few Piezo sensors is used. The piezo sensors can be installed in two possible combinations i.e. series connection, parallel connection. Hence, the net voltage generated in series connection is the sum of individual voltages generated across each piezoelectric disc.

3.2 Bridge Rectifier

A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared to a rectifier with a 3-wire input from a transformer with a centre-tapped secondary winding. Bridge rectifiers convert AC to DC using its system of diodes made of a semiconductor material in either a half wave method that rectifiers one direction of the AC signal or a full wave method that rectifies both directions of the input AC.

3.3 Buck-Boost Converter

A boost converter is a DC-to-DC power converter that steps up voltage from its input to its output (load). It is a power converter having greater output DC voltage than its input DC voltage. It is same as switching mode power supply having at least two semiconductor switches (a diode and a transistor) and at least one energy storage element. Capacitor filter is added output of converter to reduce the ripple in the output voltage. The basic principle of boost converter having two modes of operation, continuous and discontinuous mode.

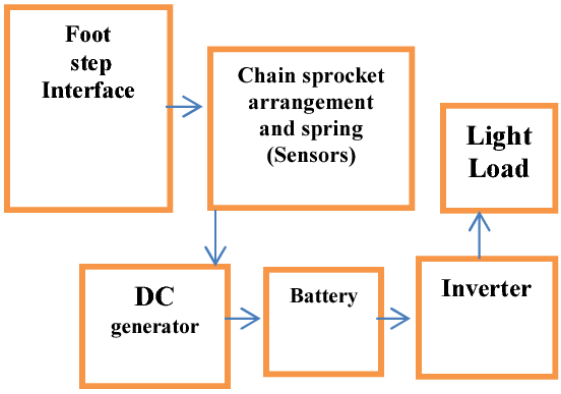
3.4 Rechargeable Batteries

A rechargeable battery, storage battery, or secondary cell, (or archaically accumulator) is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. Common types of rechargeable batteries are lead-acid, nickel-cadmium (NiCd), nickel-metal hydride (NiMH), lithium-ion (Li-ion), lithium-ion

Crossponding Author: Mob- 9110103731, Email id; 06pranay@gmail.com

polymer (LiPo), and rechargeable alkaline batteries.

4. Block Diagram:



5. Calculation and Outputs:

Based on practical results voltages obtained are:

Minimum voltage = 1V per step

Maximum voltage = 8V per step

Considering average weight as of the person stepping on the system to be 53 Kg the average calculation is:

Steps are required to increase 1 V charge in battery = 700 To increase 12 V in battery:

Total steps needed = (12 × 700) =8400 steps.

6. Advantages

- User friendly and easy-to-go utility.
- Simply walking on the step it generates power.
- No need fuel input.
- This is a Non-conventional system.
- The battery is used to store the generated power.

7. Applications

- Foot step generated power can be used for agricultural, home applications, street lighting.
- Metros, Rural Applications etc.
- The pressure generated by footsteps are stored in the rechargeable batteries for a long time and can be used by multiple users.

8. Conclusions

As India is a developing country where energy management is a big challenge for huge population. 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. Thus, we have shown a design of a system capable of harnessing human locomotion energy; and have implemented it around a basic application of charging a mobile device. This project promotes an uninterrupted way of using smart phones and other devices. The described system can be built independently and delivers off the grid power for public/private usage. Lastly, this project is an attractive approach for obtaining clean sustainable energy and is highly consumer friendly.

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Crossponding Author: Mob- 9110103731, Email id; 06pranay@gmail.com

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