



A Study of Human Footsteps for Power Generation

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Abstract

The major problems in today's world are pollution and energy deficiency. Demands for electricity is projected to increase in the future. We are using the non-renewable energy sources such as petroleum as well as renewable sources like solar, wind, tidal power etc., but still we couldn't overcome our power needs. Also, the global pollution due to traditional sources of energy such as fossil fuels moves scientists to search for other sources of green energy. we have to generate electricity through each and every possible ways. One sustainable and green source of energy is the power generation from the human footsteps. This research aims to review the design and the test of the simple device that converts the kinetic energy of the human footsteps to electrical energy. This device may be used in all crowded spots with a big number of pedestrians such as mosques, churches, underground stations, schools, theaters, stadiums, shopping malls, sidewalks, etc. It's an eco-friendly; easily accessible and non-conventional power generation system compared to existing systems.

Keywords: power Generation, sustainability, Energy harvest, footfalls, electro-kinetic floor. Step power.

Introduction

The usage of traditional power generation method such as burning of coal, wood, diesel etc. is continuously consuming our natural resources such as fossil fuels which causes lots of pollution. Nowadays people have begun to use electricity from renewable sources, like windmills, hydro energy, and solar energy, but these have some limitations in the process of producing electricity. So it is desirable to identify the everyday activity of a human, to harvest energy. By this, a new method has been found to generate electricity is from walking which is the most common activity in day to day life. When a person walks, he loses energy to the road surface in the form of 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. walking energy is wasted in the form of vibration to the surface. And this wasted energy can be converted into electricity.

Whenever a person walks, manages to lose energy towards the floor by means of influence, vibration, and audio and so on, a result of the move of excess weight to the floor. That energy may be used and converted into electrical energy. The actual electro-kinetic floor is really an approach to make electrical energy by using the kinetic energy of the person who walks on the floor. Producing this type of energy will be cost effective. The power floor does not need any fuel or perhaps any sort of energy resource, simply making use of kinetic energy. Based upon your excess weight from a person moving on the floor. This energy can be tapped and converted in the usable form such as in electrical form which is one of the most used ones. The consumed energy can be used for the lights on the rural area or the crowded places like railway stations, colleges etc

Background

Earlier various researchers had work on the conversion of dynamic energy to electrical by human locomotion Jeff Krupenkin and Ashley Taylor proposed a new technique called reverse electro-wetting in which motion of conductive liquid on dielectric coated conductive substrate causes to create electrical energy [1], so whenever there is any vibration on the upper plate due to human locomotion or by any mean could result in producing electrical energy.

Scientist of the hull university also worked on transforming man motion in to electrical energy and get positive results. Various experiments had made in japan also to harnesses energy from footsteps. They installed the special flooring tiles on the Tokyo japan busiest stations and observe that an average person weighting 60 kg can generate 0.1 watt in single second. A similar approach with different mechanism for generation of electricity from footstep is proposed by Tom Jose V [2]. He used rick and pinion gear system with dynamo fitting with its gear mechanism as shown in following figure1.

Idea

The basic idea of this work is to design and implement a device that generates energy from the human footsteps. This goal is achieved by converting the resulting force of the weight of the human body that is transferred to the ground by footsteps to a useful mechanical torque. Thus, electricity can be generated when coupling this device to an electric generator. This idea is much suitable for crowded places such as airports, train and underground stations, theaters, stadiums, universities, churches, and mosques.

As for Makkah, due to its holly places, a huge number of people, that may reach millions, gather in particular times of the year. Usually, people have to march for long distances when performing their worshipping activities. The total amount of energy resulting from their footsteps is enormous. Good utilization of the footsteps energy may save a big sum of money that goes for electricity generation from traditional fossil fuel. [3]

Methodology

Kinetic energy is the movement energy of an object. The kinetic energy of a moving bicycle or car can be converted into other forms of energy. For example, the cyclist could encounter a hill just high enough to coast up, so that the bicycle comes to a complete halt at the top. The kinetic energy has now largely been converted to gravitational descent. potential energy that can be released by freewheeling down the other side of the hill. Since the bicycle lost some of its energy to friction, it never regains all of its speed without additional pedaling. The energy is not destroyed; it has only been converted to another form by friction.[4] Alternatively the cyclist could connect a dynamo to one of the wheels and generate some electrical energy

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Operational Description

In this project a gear system is attached with flywheel which causes to rotate the dynamo as the tile on the deck is pressed. The power that is created is saved in the batteries. In addition we will be able to monitor and control the amount of electricity generated. When an individual passes it pushes the tile on the ground surface which turns the shaft beneath the tile, this is limited by clutch bearing which is underpinned by holders. Primary shaft rotates approx. twice by a single tile push. The movement of the prevailing shaft turns the gearbox shaft which builds it 15 times (1:15) then its movement is smoothed by the help of flywheel which temporarily stores the movement, which is conveyed to the DC generator (it generates 12V 40 amp at 1000 rpm). Energy generated is stored in the batteries, an inverter circuitry is implemented to convert the DC to AC, so that we can sprint the home electrical load. Further a micro controller based home mechanization framework is implemented which controls rooms prudently.[5] Entire framework is put on the iron bars called channels.

Working Principle

The piezoelectric material converts the pressure applied to it into electrical energy. The source of pressure can be either from the weight of the moving vehicles or from the weight of the people walking over it. The output of the piezoelectric material is not a steady one. So a bridge circuit is used to convert this variable voltage into a linear one. Again an AC ripple filter is used to filter out any further fluctuations in the output. The output DC voltage is then stored in a rechargeable battery.[6] The energy also produced by heat using the peltier sensor at load. An inverter is connected to battery to provide provision to connect AC load. The voltage produced across the tile can be seen in a LCD. For this purpose micro controller AT89S52 is used.

A. Super Capacitor

Super capacitors also called ultra capacitors and electric double layer capacitors (EDLC) are capacitors with capacitance values greater than any other capacitor type available today. Capacitance values reaching up to 400 Farads in a single standard case size are available.[7] Super capacitors have the highest capacitive density available today with densities so high that these capacitors can be used to applications normally reserved for batteries. Super capacitors are not as volumetrically efficient and are more expensive than batteries but they do have other advantages over batteries making them the preferred choice in applications requiring a large amount of energy storage to be stored and delivered in bursts repeatedly.

B. Relay:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.[8]

C. Battery:

Battery consists of electrochemical cells to store electricity in a single unit. In battery stored chemical energy is transformed into electrical energy.[9] Some batteries are used once and some of them are rechargeable. Large batteries also provide stand by operation i.e. mobile, laptops etc.

D. Inverter:

An inverter is an electrical power converter that changes direct current (DC) to alternating current (AC). The input voltage, output voltage, and frequency are dependent on design. Static inverters do not use moving parts in the conversion process. Some applications for inverters include converting high-voltage direct current electric utility line power to AC, and deriving AC from DC power sources such as batteries.

Advantages and Disadvantages

Based on the above descriptions, illustrations and tests, the points of advantages and disadvantages can be stated.

Advantages

- Clean and unlimited source of energy.
- Simple design and construction.
- Short period of design, manufacturing, and assembly.
- Large-scale power generation is possible when a big number of the devices is placed in crowded places.
- No coolant is required.

Disadvantages

- Capacity of power generation is dependent on the density of passing persons (pedestrians).
- The top plate is slightly inclined above the horizontal level.
- The device is relatively heavy because of using steel for the main frame.
- The device is relatively not cheap due to the cost of steel parts and manufacturing operations.

Conclusion

The project "FOOT STEP POWER GENERATION" is successfully tested and implemented which is the best economical, affordable energy solution to common people. Though being advantageous in several aspects, such as manufacturing, installation, aesthetics, maintenance, availability etc, this technology can only contribute to low power applications. It requires highly-efficient converter mechanism and storage devices and has a less storage lifespan. Besides, the materials used in manufacturing the devices must be highly durable, as they will be operating throughout the year. As of today, this technology is in its nascent stages due to the above stated reasons. Development in the areas of storage and transmission of energy may eliminate all the drawbacks and make this an effective technology for power harvesting. This can be used for many applications in rural areas where power availability is less or totally absence. As Iran is a developing country where energy management is a big challenge for huge population.

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