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Generation of Power from Footprints

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Abstract: *The extensive use of fossil fuels has been recognized as a significant contributor to climate change. Additionally, these non-renewable resources are depleting rapidly, leading to an urgent need to explore alternative sources of energy. Walking is one of the most common activities in daily life, during which humans lose energy to the surface in the form of vibrations or tremble. Harnessing this otherwise wasted kinetic energy and converting it into electricity presents a sustainable solution to meet small-scale energy requirements.*

In this project, we focus on designing, fabricating, and testing a simple yet effective device capable of converting the kinetic energy generated by footsteps into electrical energy. This energy is harvested using a specially designed platform, which can be installed at the entrance of rooms, classrooms, or other commonly used areas. The captured energy is then transmuted into electrical form, stored in a battery, and utilized for powering LED lights or similar low-energy devices at the entrance.

The objectives of this project include the development of a robust and efficient energy-harvesting platform, integrating it with generators and storage units to ensure smooth operation. The fabricated device was thoroughly tested for its ability to generate and store electricity under various conditions. This innovative approach not only reduces reliance on fossil fuels but also promotes sustainability by utilizing everyday human activity to generate clean energy.

The designed platform can find applications in educational institutions, workplaces, and other high-footfall areas, where the generated energy can be used for lighting or other low-power applications. The project demonstrates a practical and scalable model for energy harvesting, contributing towards a greener and more sustainable future.

Keywords: Footprint, LED, Generator, Battery, Energy Harvesting, Sustainability

I. INTRODUCTION

Nowadays energy and power are the one of the basic necessities regarding this modern world. 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.

Man has needed and used energy at an increasing rate for his sustenance and wellbeing ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food.

Proposal for the utilization of waste energy of foot Power with human locomotion is very much relevant and Important. Man has needed and used energy at an increasing rate for his sustenance and well-being ever since He came on the earth a few million years ago. With further Demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling.

Basic Working Factors:

"Low power consumption of electronic device"

(It would be as an advantage and the system would prefer usage of electronic system)

Mechanical energy generated while stepping the platform in the form of force acting on platform from the foot

(This mechanical energy would be used to generate Electrical energy.)

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Basic theory of project:

Basically in our project we would employ piezoelectric transducer which act as electromechanical converter to convert the produced mechanical energy into electrical energy while stepping ok the platform .

Basic theory of piezoelectric generator:

The piezoelectric generator basically consist of piezoelectric material which generated electric energy when they are stressed by mechanical vibration produced upon stepping on the stairs.

This produced electric charge is stored in the batter.(Here we are using Nickel metal hydride battery) which is the used to run the connected load like light emitting diode.(LED)

Overview of project design:

Moving stairs tread

- The moving stairs would be assembled along with a base plate such that it is hinged on one side to give a single degree of freedom.

Piezoelectric material

- It is employed between the moving stairs tread and the base plate such that it gates the mechanical vibration from the platform

LED or other lighting

- Light emitting diode would be employed of sufficient ratings to satisfy the usage need.

Overview of project application:

- Basically the piezoelectric material are special type of material which lie in the class of ferroelectric.
- This material basically consist of significant number of Dipoles
- The dipoles originate due to the local large seperation in the crystal.

Piezoelectric generator principle:

The conversion chain starts with mechanical energy source: staircase movement on the stairs produces vibration and they are converted into electricity via piezoelectric element. The electricity produced is thereafter formatted by static converter before supplying a storage system or the load .(Electric device)

Instrument

In this research paper following components is used to generate electricity by converting footstep energy into electrical energy

- Piezoelectric Sensor
- Inverter
- Battery
- Rectifier
- Voltage regulator
- Footstep body
- Capacitor

Piezoelectric sensor: Piezoelectric Detector is a device that measure change in the pressure as well as acceleration, temperature, strain, and force by changing them all too electrical energy via the piezoelectric effects. It is a powerful tool that may be used to assess a variety of factors. They are utilized in a variety of sectors for quality assurance, process control, and research and development.

Inverter: An inverter is a device which transforms direct current into alternating current. Transformers, switching, as well as control circuit are used. Inverters are frequently used to convert dc electricity from solar panels and batteries into AC power. The inverter is a static device that can transform one kind of electrical power into another

Battery: A rechargeable battery, also known as a store battery, secondary cell, or accumulator, is an electrical battery that may be charged using an electrical circuit. When there isn t any A.C. electricity, the battery comes in handy. The charge that is produced by the circuit is stored in the battery. The voltage is stored in D.C form.

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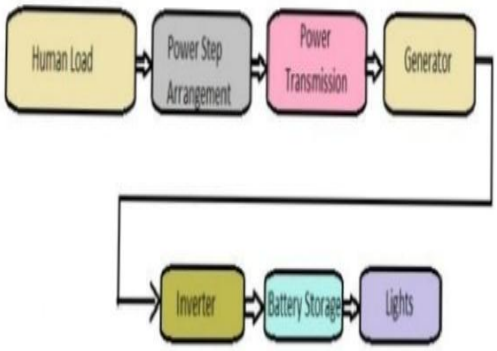
Rectifier: A rectifier is a device that converts alternating current into direct current. It is made up of one or more diodes and allows a current to travel in just one direction through it. Rectifications are the procedure of turning AC into DC. The rectifier s purpose is to change AC electricity to DC power. Rectifiers are found in virtually all electrical and electronic apparatus s power supply. In this project, bridge rectifier is used to convert A.C power to D.C power.

Voltage regulator: A Voltage Regulator (VR) is just an electrical or electronic device that generates Irrespective of input voltage or load conditions; it maintains a consistent output voltage. Voltage regulators keep power distribution voltages within a range that other electrical components can handle. Depending on the design, it may control both AC and DC voltages. It protects protective gadgets from harm by acting as a shield.

Capacitor: A capacitors is an electrical energy storing device that runs in an electrostatic field. It s a two-terminal passive electrical component. Capacitors serve an even more essential function as filters, filtering the A.C signal, since the electric energy stored in them keeps the information alive after a brief lack of power. The capacitive filter is used in this project to smooth the D.C output and eliminate ripples from the rectifier s output.

Block Diagram



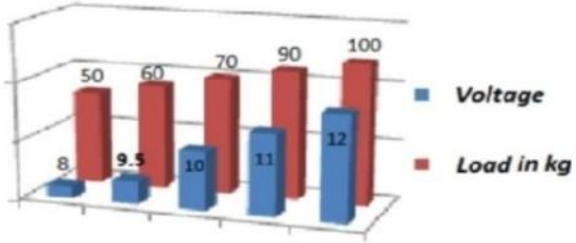
II. EXPERIMENTAL INVESTIGATION

Voltage generator vs load

When the load of person passing through the step is increased the voltage generated will increase considerably.

Load vs voltage

Load (Human weight) in kg	Weight generated V
50	5
60	9.5
70	10
90	11
100	12
110	12



Load vs Voltage

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III. LITERATURE SURVEY

In the review, research papers of power generation are Referred and studied. Some of the reviews are as follow,

Siba brata Mohanty , Sasank shekhar Panda ensure proper Operation that meets the performance requirement, for this they determine the voltage the micro-generator can Generate from various rotation speeds. This can be done by Using a motor to drive the generator and using multi meter To measure the voltage. At the same time we will need to Use sensors to determine the rotation speed of our gears And flywheel and adjust them in order to obtain optimum Speed. Determine the capacitance and number of Capacitors we will use for the storage. An oscilloscope can Be used to see how long does average traffic charges up different capacitors.

Alla Chandra Sekhar1, B Murali Kishore have aim of this Project 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 paper they 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 paper Uses electromagnetic induction principle. In this paper 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 generate this voltage.

Kiran Boby, Aleena Paul K ,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. As the power output from a single piezo-film was extremely low, combination of few Piezo films was investigated.

IV. METHODOLOGY

Our paper study about the generation of electrical power by using foot step power. The foot power of human being which is generally waste power by using this foot step power electricity will be generated. It uses piezoelectric effect which converts mechanical power into electrical power. Basically, it is types of transducers which convert one form of energy into another form.

The complete set-up consists of different arrangements as well as electrical and electronics devices. The foot step energy is absorbed by foot step arrangement after that this absorb energy is fed to the Piezoelectric material which convert foot step power into electrical power.

Generating power from a footprint can involve various methodologies, often categorized under energy harvesting techniques. Here are some

1. Piezoelectric Energy

Harvesting :

Principle: Utilizes materials that generate an electric charge when mechanically stressed.

Implementation: Installing piezoelectric materials in walkways or floors that generate electricity from footsteps.

2. **Electromagnetic Induction:**

Principle: Involves moving a magnet through a coil to induce an electric current.

Implementation: Using foot traffic to compress springs that move magnets past coils, generating electricity.

3. Triboelectric Nanogenerators (TENGs):

Principle: Converts mechanical energy from friction into electrical energy.

Implementation: Footsteps create friction between dissimilar materials, producing charge that can be harvested.

4. Mechanical Energy

Conversion:

Principle: Converts kinetic energy from footsteps into other forms of energy.

Implementation: Mechanical systems (like gears or levers) that convert footfall energy into rotational energy for power generation.

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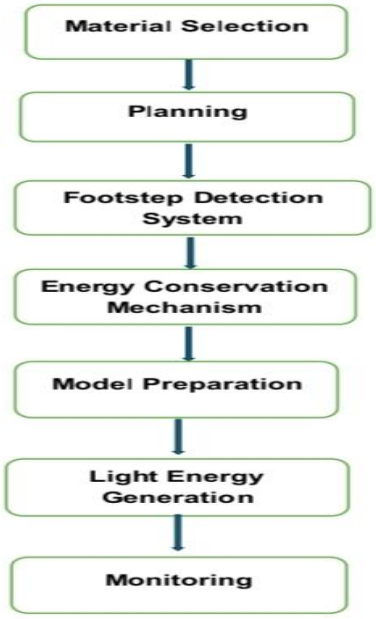
Discussion

The output of the piezoelectric material under discussion was investigated to see how it relates to the various pressures and strains applied to it. The voltages created across the piezoelectric materials and the quantity of current flowing through them is measured using voltmeters and ammeters, respectively. The energy can be stored in the capacitor by charging it, and the capacitor can then be discharged when needed. This circuit s energy harvesting capacity, on the other hand, isn t particularly impressive. After the bridge rectifier step, a DCto-DC converter can be used to address this difficulty.

The installation of a DC-DC converter resulted in a seven-fold improvement in energy harvesting. A switching device is located in parallel with the piezoelectric element. In a twelve V battery, the DC voltage will be stored. There is only one battery utilized. An inverter converts the twelve V DC batteries into AC electricity. A voltage of about 40 V may be generated by a single piezoelectric tile. Depending on the power needs, the tiles are linked in series or parallel. The conversion of mechanical energy into electrical energy is used to arrange electrical equipment. The electrical system is well-designed to efficiently convert mechanical energy to electrical energy.

Flow chart



V. CONCLUSION

The waste energy of human during walking is used In this system. Foot step is an uninterrupted an renewable source of energy. The system repeatedly operates in a short duration of time and is not possible for the turbine 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.

Through many systems are available for power generation from footsteps ,the proposed system is very economical and affordable . Many people in our country cannot enjoy the facility used for generating electricity . Though power producing in this process is minimal as a whole country , This will be a considerable source of electrical energy. This project also reduces global warming.

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