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Energy Harvesting Using Human Locomotion

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ABSTRACT: In this project, we are using a non-traditional approach to generate electricity by just running on the train in the FOOT STEP. The use of non-conventional energy is crucial for our country right now. FOOT STEP is a non-conventional energy source that produces electrical power without the use of fuel. This project makes use of straightforward drive mechanisms like a chain and pinion assembly.

The transformation of force energy into electrical energy is required for this endeavour. The rack and pinion, D.C. generator, battery, and inverter control are all carried by the control mechanism. The numerous applications and future extensions have also been covered. Because of the high level of power generated by this project, it is deployed to all FOOT STEP. This arrangement has a high initial cost.

The most prevalent type of energy used worldwide is electricity. This essay focuses on creating a system that generates electrical energy that would otherwise be wasted while people are walking. Steps are a natural resource that is still unexplored. Nonetheless, this energy is produced is affordable and safe for people. Steps can be used to transform mechanical energy into electrical energy.

This project will do so in a far cleaner, more cost-effective way by reducing both global warming and load shedding. The setup's weight is an important consideration because this project directly involves human movement.

KEYWORDS : Inverter, Renewable energy, DC Generator, Electricity

I. INTRODUCTION

In this project, we are using a non-traditional approach to generate electricity by just running on the train in the FOOT STEP. The use of non-conventional energy is crucial for our country right now. FOOT STEP is a non-conventional energy source that produces electrical power without the use of fuel. This project makes use of straightforward drive mechanisms like a chain and pinion assembly.

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1.1 NEED OF NON-CONVENTIONAL ENERGY

By the end of 2020, the fuel reserves in the will have been completely depleted. India might not have the opportunity to consume petroleum products. We made an effort to exploit the non- polluting natural resource of petrol energy while keeping this perilous condition in mind.

The primary requirement for the continuation of humanity is the development of new sources of affordable, environmentally friendly, and perpetual electrical energy to replace the energy derived from increasingly dwindling fossil fuel resources. Only around 25 years' worth of oil and 75–100 years' worth of coal are left in our reserves. The population's reliance on coal in thermal power plants would result in global climatic change, which would cause global drought and de certification.

Nuclear power plants' buzzards are only motivated by will. Now, microwaves are used to beam electricity directly to orbiting satellites. Even though several nations have made significant progress towards developing solar photo voltaic and solar thermo electric energy sources, solar power stations (s.p.s.) nevertheless offer a viable alternative. Solar installations that are located on Earth have certain basic drawbacks.

As we all know, humankind will always have plenty of energy. It is liquid fluid today, but tomorrow it could be uranium with a risk factor. Wherever there is human activity and energy production, there is risk. The availability of uranium will be limited, just as it is for fossil fuels. If uranium is utilized extensively, it might be swiftly depleted.

As a result, using the vast, unending solar energy supply lessens our reliance on fossil fuels. The solar energy harnessing system has benefits for the environment because it doesn't release any pollutants into the atmosphere, unlike when fossil fuels are burned. Hence, as a long-term alternative to all the finite fuel systems, solar energy systems can be thought of. Thus, neither now nor in the near future will there be an energy shortage?

1.3 OBJECTIVE

The primary goal of this project's implementation is to design and develop electricity using human footfalls. to bring electricity to remote areas. to encourage the use of unconventional sources of energy. to protect traditional energy sources. to keep the electricity on hand for future usage. to generate electricity at the lowest possible cost.

II. LITERATURE SURVEY

FOOTSTEP POWER GENERATION

In this study, Sayyed Ibrahim Yusuf makes the hypothesis that when subjected to mechanical strains, vibrations, forces, pressures, and other factors, piezoelectric materials produce electrical energy. The piezoelectric transducer is excellent for energy harvesting applications because to its energy conversion properties.

The energy harvesting procedure entails capturing ambient energy close to the sensor and transforming it into useful electrical energy. Energy harvesting offers a potentially endless supply of energy compared to batteries for wireless sensors and other on-board electronics. Energy harvesting (EH) is the technique of collecting minute amounts of power from outside natural energy sources, storing it, and then using it later. EH equipment frequently transforms ambient energy into electrical energy. EH devices can be utilised to build a self-contained power supply system by integrating the proper electronics.

The "piezoelectric" sensors under the machine's base are activated by the foot's force, which is the basis for the system's design. The piezoelectric effect is the method by which force is transformed into electrical energy. The user can then check the voltage across the DC loads of the inverter using the circuit's power supply. The lead-acid battery houses the voltage. Finally, a USB cable is used to recharge the circuit. Cell phones, tablets, MP3 players, and rechargeable lights may all be charged thanks to all of these parts, which turn voltage into electricity.

DESIGN OF FOOTSTEP POWER GENERATION USING PIEZOELECTRIC SENSORS

According to P.Venkatesh, the demand for electricity is growing exponentially every day because it is now an essential component of daily life for humans. For all of its various processes, modern technology needs a tremendous quantity of

power in the form of energy. The main cause of pollution in the world is the production of electricity.

The gap between supply and demand for power is also widening due to exponentially rising consumption. Because of this, researchers and innovators in the field of energy harvesting are attempting to investigate potential applications for alternative energy sources.

Therefore, the primary goal of modern technology is to create and offer a pollution-free method of generating electricity from the expanding human population that does not adversely affect the environment. The electricity in this technique is produced via the piezoelectric action. A material that exhibits the piezoelectric effect has the capacity to develop an electrical charge when pressure and strain are applied.

Piezoelectric materials function as transducers, converting the pressure put on them by moving individuals into an electric current. The design of footstep-based power generation employing piezoelectric sensors is presented in this paper along with a thorough analysis of its benefits and drawbacks, as well as the necessary subsystems.

There are numerous research teams actively engaged in piezoelectric footstep power generation. locomotion. High power wind energy conversation system was suggested by Yaramasu et al. as an emerging concept employing the same technology.

ADVANCED FOOT STEP POWER GENERATION SYSTEM

Energy, according to Prasad Anipireddy, is nothing more than the capacity to perform work. The energy resource that is most frequently used in daily life is electricity.

The need for energy is growing today, which is essential for individuals. As a result, a lot of energy resources are produced and wasted. Water, wind, and other resources can be used to generate power, but in order to do so, large plants with substantial maintenance costs must be developed. Other energy sources can be expensive and polluting. The average person cannot afford them.

Walking is the most common activity performed by humans; however, walking causes energy to be wasted in the form of vibration to the surface. Since electricity has become a valuable resource for humans, it is necessary to utilise wasted energy. And power can be created from this squandered energy. utilising the "piezoelectric effect" theory.

Mechanical vibrations have an effect known as the piezoelectric effect. When applied to piezoelectric material, pressure or strain is transformed into electrical form. This study provides insight into the energy expended when climbing stairs.

Every structure includes steps, even modest ones, and as we climb them, a portion of the energy that would otherwise be wasted is used and transformed to electricity by the piezoelectric effect. A certain material's ability to produce an electric charge in response to mechanical stress is known as the piezoelectric effect.

DESIGN AND FABRICATION OF FOOT STEP POWER GENERATION USING PIEZO ELECTRIC TRANSDUCERS

Piezo electricity, according to Sabarish.theory R's in this publication, is the capacity of some materials (particularly crystals and some ceramics) to produce an electrical potential in reaction to applied mechanical stress. This could manifest as an electric charge separation across the crystal lattice. The injected charge creates a voltage across the material if it is not short circuited. The word is a translation of the Greek verb piezien, which means to press or squeeze.

Mostly, converters of the alternator type or the well-known dynamo are used to convert mechanical energy into electrical energy. However other natural processes, such as piezo electricity, are also capable of converting mechanical motion into electrical energy. The piezoelectric effect is the phenomenon that causes piezoelectric material to generate an electric charge when a force is applied.

There are two types of the piezoelectric effect: the direct effect, which describes how a material may convert mechanical strain into electrical charge, and the inverse effect, which describes how a material can change an applied electrical potential into mechanical strain energy.

The material's capacity to operate as an actuator is due to the reverse piezoelectric effect, whereas its capacity to function as a sensor is due to the direct piezoelectric effect. When a substance can convert electrical energy into

mechanical strain energy and mechanical strain energy into electrical charge, it is said to be piezoelectric.

In contrast to manmade piezoelectric materials like PZT (Lead Zirconate Titanate), which have favourable features, natural piezoelectric materials like quartz do not have any intriguing properties for the generation of electricity. Ferro electric materials are a class of materials that includes piezoelectric materials. One of the characteristics that distinguishes a ferro electric material from other materials is the orientation of its molecular structure, which results in the presence of an electric dipole, or local charge separation.

Electric dipoles are randomly oriented throughout the artificial piezoelectric material composition, but when a sufficiently high electric field is applied, the electric dipoles rearrange themselves in relation to the electric field; this is known as poling. The material is referred to as being poled when the dipoles continue to keep their orientation after the electric field has disappeared.

The material will display the piezoelectric effect once the poling procedure is finished. Two linearized constitutive equations can simulate the mechanical and electrical behaviour of a piezoelectric material. Two mechanical and two electrical variables are present in these equations. The following matrix equations can be used to simulate the direct influence and the opposite impact.

$D = d \cdot T + T \cdot E$, Direct Piezoelectric Effect (1) Piezoelectric Effect in Reverse: $S = sE \cdot T + dt \cdot E$ (2)

Where S is the strain vector, d is the matrix of the piezoelectric constant, E is the electric field vector, D is the electric displacement vector, T is the dielectric permittivity matrix at constant mechanical stress, sE is the matrix of compliance coefficients at constant electric field strength, and T is the stress vector.

The matrix transposition is indicated by the subscript t . Any surface of the material can recover an electric voltage when it is deformed or stressed (via electrodes). To enable this ability to recover electric potential, the piezoelectric characteristics must therefore have a sign convention.

SMART LIGHTNING USING PIEZO ELECTRICITY

In this work, Ruchita Rao makes the suggestion that "Smart Street Lighting" intends to improve street light effectiveness by automating their regulation as and when necessary, without utilizing any external source. Due to deformation brought on by the pressure of passing vehicles, the piezoelectric material installed beneath the road tends to vibrate when vehicles are travelling on it.

Piezo electricity is the accumulation of an electric charge under the influence of mechanical stress in some solid materials (such as crystals and some ceramics). We have a number of piezoelectric transducers since the amount of electricity produced by a single piezo is quite little and not feasible. The amount of electricity produced rises due to the numerous piezo arrays and the intense pressure from the heavy vehicles.

Energy harvesting circuits are used to further rectify and regulate the electricity produced by these transducers. Now that electricity created throughout the day is stored in batteries, this instantaneous energy is not used directly. So, the battery's total amount of electricity is sufficient to operate street lights.

Also, there is an automated circuit that regulates the street lights based on the time of day and night as well as the volume of vehicles present at any given moment. During the day, street lights will be off, and at night, they will automatically switch on. If there is a reasonable quantity of traffic at night, street lights will shine with a high density; otherwise, they will glow with a moderate intensity, further conserving energy.

III. PROPOSED SYSTEM

Under the floor is where this system, which also consists of a rack and pinion, springs, chain, ratchet mechanism, sprockets, dynamo, battery, etc., is installed. When the pressure is released in this arrangement, springs are used at each end to return to their initial positions.

A floor-mounted rack and pinion are connected together. Linear motion is converted to rotary motion using a rack and pinion. As a force is applied to the floor, the rack shaft rotates and transfers that motion to the sprocket.

Chain transfers the rotation of the larger sprocket to the smaller one. In order to increase the rotational speed, gears are offered. The smaller sprocket rotates in the same direction as the larger sprocket at the same speed in both the forward and backward directions.

Electricity is produced by the dynamo when it is placed in motion and is then stored in a battery. In this design, the chain drive is only capable of forward rotation. In many different circumstances, we are able to employ mechanical energy in the form of electricity in this way.

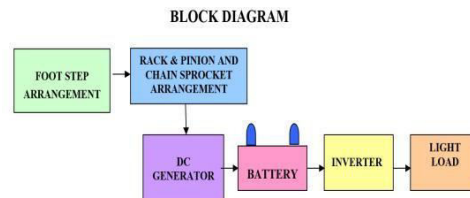


FIG : FOOT STEP POWER GENERATION

IV. METHODOLOGY

In this case, an unconventional method is used to produce electricity. Hence, walking or running on foot steps generates power.

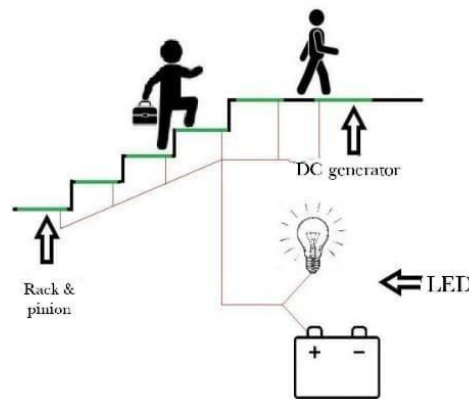


FIG : WORKING OF STAIRS

Non-conventional energy is crucial right now. This technology introduces power generation using unconventional energy, which produces electricity without any input. This results in the conversion of force energy into electrical energy. The principle behind how this system functions is to transform any unused energy from nearby systems into electrical energy.

The piezoelectric will produce electrical energy that can be stored and used for domestic purposes when it is placed under an insulating substance, such as hard rubber. The Piezoelectric property When pressure is applied to a material, electricity is produced. It has an electrical axis and a

mechanical axis. It produces power in its electrical axis when we apply pressure to its mechanical axis. Piezo refers to the process through which a material becomes electrically polarized in response to mechanical tension.

The direct effect, or generator effect, is a phenomena that is fundamentally used in the creation of sensors (mobile phone vibrators, lighters, etc.). The inverse or motor effect, which is a mechanical deformation brought on by the application of an electrical signal, occurs with piezoelectric materials, which are also used in actuators, in certain situations.

V. ADVANTAGES

- ◆ Simply operating the train under these circumstances constitutes power generation.
- ◆ On the track, running or exercising also produces power.
- ◆ With a minor modification, this system can be used as a speed breaker.
- ◆ It requires no fuel input and is therefore an unconventional system.

VI. DISADVANTAGES

- ◆ A slight incline is needed in the foot step, and there are several mechanical moving elements.
- ◆ This agreement has a hefty initial cost.
- ◆ Batteries should be handled with caution

VII. CONCLUSION

In summarizing our project, we can say that FOOT STEP power generation relies on non-renewable energy sources to meet its energy needs. This type of energy does not require electricity from the mains and produces less pollution. It is highly beneficial to the locations with all routes and all types of FABRICATION OF FOOT STEP POWER GENERATION that are used to produce unconventional energy like electricity.

By employing the same layout and building in the foot steps or speed breaker, it is possible to extend this project and enhance the power production rate by repairing schools, colleges, highways, and other structures.

VIII. RESULT

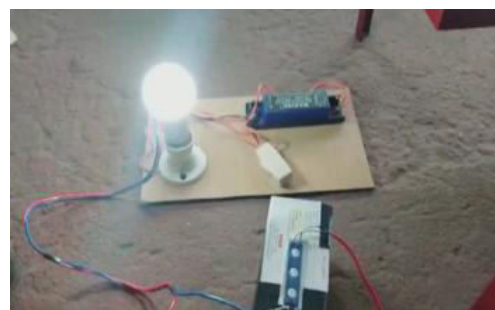
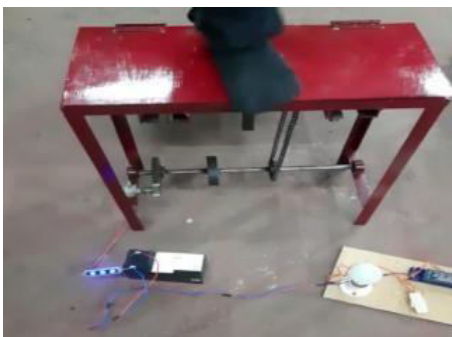


FIG : POWER GENERATION THROUGH FOOTSTEP

IX. FUTURE SCOPE

By expanding the size of the power generation system, we can increase energy production to more than 10.925 kilowatt hours per hour.

We can modify the design to meet any power needs at any scale. It is also used to illuminate parks. By putting this plan into action, we can significantly cut back on our use of traditional energy sources, increasing its value.

This foot step power generation system is the best method to produce energy in countries experiencing energy crises, where the load shading of electricity is caused by a shortage of energy, and the output of electricity production can be increased by increasing the size of the foot steppower generation system. This system has a lower total cost than other energy generation methods.

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