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System for Generating Power from Footsteps

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ABSTRACT

Man has required and used energy at an increasing rate for sustenance and well-being since the dawn of time. Many energy resources have been depleted and wasted as a result.

Daily power outages in nearly all towns and villages in some emerging and recently industrialized countries last for several hours. Residents in these countries can use a power inverter or a diesel/petrol-powered electric generator in their homes during a power outage. Industrial and information technology centers frequently use standby generators. As a result, the electricity shortage worsens.

There are a variety of alternative methods for producing electricity, one of which is footstep energy generation, which can be a very efficient method.

For densely populated countries like India, where railway stations, bus stops, malls, and other tourist attractions are constantly crowded, the proposal for utilizing waste energy of foot power with human locomotion is very relevant and important.

The most common human activity is walking. As a result of his weight being transferred to the road surface via footfalls on the ground at each step, a person loses energy to the road surface in the form of impact, vibration, sound, and so on when walking. This energy can be captured and converted into something useful, such as electricity. This device can convert foot impact energy into electrical energy if it is placed in a walkway.

As a result, whenever a person steps on a tile, mechanical energy or pressure is converted to electrical energy. A piezoelectric sensor is a device that detects a person's vibration and converts an applied pressure into voltage.

The electrical energy produced by a person's foot pressure is captured by floor sensors when we design the floor with piezoelectric technology or sensors. The sensors are connected in both series and parallel. The resulting voltage is passed through a ripple filter for modulation and distortion correction. It then passes through a MOSFET converter, which performs pulse width modulation. The total voltage generated is calculated using the voltage sensor. An analog to digital converter is used to convert analog data into digital data.

KEYWORDS: *Piezoelectric Sensor, Power Generation, Footsteps, Energy*

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INTRODUCTION

Electricity is now a necessary part of human life in daily activities, and the electricity demand is growing at an exponential rate. For its various operations, modern technology necessitates a large amount of power in the form of electricity.

As the single largest source of pollution, electricity generation contributes the most to global pollution. In addition, the exponentially increasing demand for electricity has created a large gap between supply and demand.

As a result, researchers and innovators in the field of energy harvesting are attempting to investigate alternative energy sources and their potential applications. As a result, the primary goal of modern technology is to develop and provide a pollution-free method of generating electricity for the growing human population that has a minimal environmental impact.

The piezoelectric effect is used to generate electricity in this technology. When pressure and strain are applied to a material that exhibits the piezoelectric effect, an electrical charge can be generated. When we apply pressure to piezoelectric sensors, they generate electricity. The Arduino is used for computations, programming, and display of the voltage generated on the LCD. This energy is now stored in a rechargeable battery. There is no requirement for an external power supply.

The main goal is to develop cleaner and more efficient power generation techniques that will help to prevent global warming and power shortages, allowing many people who have been without electricity to finally have access to it.

This is a non-traditional system, so there is no need for gasoline. Because there are no moving parts, it has a longer service life. It generates its own energy, so no external power is required.

When compared to previous inventions that used a variety of mechanical components to transfer energy, it uses fewer components. Running or exercising on the step generates power as well.

Agriculture, home applications, street lighting, metro areas, and a source of energy in remote locations are all possible applications for this system.

FOOT STEP METHOD FOR POWER GENERATION

This electric power is produced unconventionally. As a result, electricity is generated by walking or running. On a footstep, I'm running. Non-conventional energy is now in use. is quite significant. This system introduces the concept of power. generation using non-conventional energy that does not pollute the environment input is required to generate electrical output. In this case, It takes a long time to convert force energy into electrical energy. This technology is founded on the premise of the piezoelectric effect is characterized by its capacity to accumulate electrical charge. They are charged as a result of the pressure and strain applied to them. Piezoelectric ceramics are a type of ceramic that has a piezoelectric effect. ferroelectric materials ferroelectric The crystals are these materials. They also don't require the application of an electric field.

Literature Survey:

The "Crowd Farm," a setup that would extract energy from pounding feet in busy settings, was recently introduced by MIT (USA) architecture students James Graham and Thaddeus Jusczyk, who are working on the concept of harnessing the force of human movement. This method is an attempt to use human power as a long-term energy source. Limitation: To generate power, the user had to pound his or her feet, which required extra effort, and the device's total cost was quite high.

The students' test case was a prototype stool that generates power through the passive act of sitting, which was displayed at the Venice Biennale and in a railway station in Torino, Italy. The weight of the person in the seat spins a flywheel, which powers a dynamo that powers four LEDs. In each scenario, there would be a sub-flooring system made up of individual blocks.

Limitation: While this project is extremely beneficial, it does not provide the same amount of energy as a footstep.

This contraption was made by Vidyavardhaka College of Engineering students and includes a pedestrian plate, springs, connecting rods, a DC generator, LED lamps, cables, a 3-way switch, and battery arrangements.

Working: The plate will slightly sag due to the weight of the person walking on it. A dc geared motor's shaft rotates as the plate moves downward, producing electrical energy. Because the device's springs expand, the top plate returns to its original position. Limitation: More components are required in this case.

India

India has a serious energy shortage. It is heavily reliant on coal at the moment, and consumer demand is expected to double by 2040, making its green energy targets appear unattainable. Hari Anand and Binod Kumar Singh of the University of Petroleum and Energy Studies in Dehradun, India, believe that harvesting energy from footsteps could be part of the solution.

Their new study, published in the De Gruyter journal Energy Harvesting and Systems, reveals that Indians are overwhelmingly positive about the power generated by piezoelectric tiles.

Delhi and Mumbai are notoriously congested, particularly at railway stations, temples, and large commercial buildings. Researchers wondered if piezoelectric tiles, which generate energy through mechanical pressure, could be used to convert this footfall into something useful.

Piezoelectric tiles are made from special materials like crystals and ceramics that build up an electric charge when mechanical stress is applied, such as when a foot presses down.

Anand and Singh conducted a survey to learn how Indians feel about the reliability of their household power and how they feel about generating their electricity. They also inquired about how much people walked daily and whether they would consider installing piezoelectric tiles in their homes.

They discovered that more than one out of every five people in their area experienced frequent power outages, highlighting the potential benefits of household energy generators like piezoelectric tiles.

Around 40% of those polled said they walk for more than three hours per day, and 70% said they would be willing to generate their electricity with their feet.

World

This project uses the Arduino Uno as the microcontroller to create a new source of renewable energy on a low-cost budget. The goal of the footstep power generation system is to convert the typically wasted energy that surrounds a system into electrical energy. The energy is obtained through the use of piezoelectric materials. This method uses piezoelectric components, which convert deformations caused by different means into electrical charges using the piezoelectric effect. The electrical energy can then be regulated or saved for later use. In this project, we use a non-traditional method to generate electrical power by simply walking or running as the input source. After that, the piezoelectric sensor will send the signal to the Arduino Uno, which will convert it to electrical energy. The amount of voltage generated by the circuit will then be displayed on the LCD. In this project, the highest voltage generated is 8.29 V. The mobile phone can then be charged using the voltage stored in the battery. The findings revealed that this footstep generation system is critical for use in today's world.

A. Working

The key notion behind how this system works is that it captures unused energy from the environment and converts it into electrical energy. The piezoelectric is placed under an insulating material such as hard rubber and produces the electrical energy that can be stored and utilized for domestic purposes. Pressure is created by footsteps and waterfall pressure. Piezoelectricity is a property of piezoelectricity. When we apply pressure to a material, it generates electricity.

There are two axes: mechanical and electrical. When we apply pressure to the mechanical axis, the electrical axis generates power. The term "piezo" refers to a material's development of electrical polarization in response to mechanical strain. This phenomenon is referred to as the direct effect or generator effect, and it is used extensively in the production of sensors.

B. Commercial Utility:

1. Twenty tiles will be strewn along the central crossing between London's Olympic stadium and the newly opened Westfield Stratford City mall. In the first year, it is expected that 30 million people will visit.
2. In front of ticket counters and every time a ticket is issued the mats, special flooring tiles, and passenger steps on the mats They're installed, and they cause a slight vibration that may be heard as a source of energy
3. This system can be implemented on the floor area of Thousands of people who work in stairwells, schools, and colleges.

Proposed System:

The solution to the previous constraint is that we will use fewer components in this project than in previous low-cost systems. It necessitates the use of low-cost electronic components that are widely available. There is no need to exert additional effort because simply walking will suffice.

1. The maximum theoretical voltage generated

When a force is applied to a piezo material, a charge is created across it. As a result, it's considered a perfect capacitor. As a result, it can be used with any capacitor equations. In this project, we use a single tile to connect ten piezos in series. Four of these series links are connected in a parallel manner. The equivalent voltage is Veq=V1+V2+V3+V4+V5+V6+V7+V8+V9+V10 when 10 piezoelectric discs are connected in series. As a result, the total of the individual voltages produced across each piezoelectric disc is the net voltage produced in a series connection. A single piezo disc has a 0.3V output voltage.

As a result, the maximum voltage that can be generated across the piezo tile is 0.39V. As a result, the maximum voltage that can be generated across the piezo tile is around 0.39V.

2. ANALYSIS DONE ON THE PIEZO TILE

To test the piezo tile's ability to generate voltage, people weighing 40kg to 75kg were forced to walk on it. In, the relationship between a person's weight and power generated is depicted. When the maximum weight/force is applied, the maximum voltage is produced. When a weight of 75 kg is applied to the tile, it generates a maximum voltage of 2V.

Advantages:

- There is no need for gasoline; this is a non-traditional system.
- Generating power is just a matter of taking one step at a time.
- Because there are no moving parts, the product has a long service life.
- It generates its energy, so no external power is required.
- Despite being small, it is extremely sensitive.
- Reliable, cost-effective, and friendly to the environment.
- The use of non-renewable energy sources is reduced.
- When running or exercising on the step, power is also produced.
- Exceptionally wide dynamic range, almost noise-free

Disadvantages:

- Only applies to a single location.
- There is a significant upfront cost associated with this setup.
- Temperature changes have an impact on output.
- There is a significant upfront cost associated with this setup.
- Batteries should be treated with caution.

Scope:

Wasted energy utilization will become increasingly relevant and important in the future for densely populated countries.

1. Floor Tiles

Japan has already begun experimenting with the piezoelectric effect as a source of energy. On the walking tiles, they use a piezoelectric effect. As a result, each time When someone walks across the tiles, it causes a tiny vibration. can be used as a source of energy Rubber is used to make the flooring tiles, which can be easily cleaned. soak up the vibrations When humans interact, a vibration is created. It is being walked on. Piezoelectric material is used under these tiles. are positioned When the movement of the material senses, it reacts. will be able to generate electricity. The energy that is generated is The battery is constantly being charged. We generated our electricity. can make use of the lamp's lighting Step by step, energy is generated. One guy is insufficient, but as the number of stairs grows, Eventually, energy production rises as well.

2. Dancehalls

Another country that has begun experimenting with the usage of piezoelectric crystals for energy generation in DJ clubs in Europe. The dancer's feet press on the floor. and piezoelectric materials come into touch with each other and create electricity. The amount of electricity generated is only 02- 20 watts. It is determined by the dancer's foot impact. If you're in a hurry, A large amount of energy is released when a piezoelectric crystal is compressed of vitality

Application:

1. Footstep energy can be used for agriculture, domestic purposes, and street lighting.
2. Footstep power production can be used in the event of a power outage.
3. Metropolitan areas, rural applications, and so on.

Conclusion:

A piezoelectric plate that can generate 1 volt has been developed. PZT generates how many piezoelectric are placed, according to a comparison of various piezoelectric materials. in the form of tiles In addition, it was discovered that the series-parallel combination connection is more useful in comparison. The driving force applied to the tiles, and a comparable voltage produced in Design tiles made of piezoelectric material. It is primarily used in congested areas. This can be utilized in the home without the usage of electricity.

lines. It can also be used as a phone charger, a street light, and so on.

As a result, we developed a power generation system that is both clean and environmentally beneficial. This overview describes how the project functions and will be implemented in the future.

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