GENERATING ELECTRICITY USING FOOTSTEPS

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Abstract- The country's population is growing daily, and with it so is the need for electricity. At the same time, there was an increase in energy waste in numerous ways. The answer is to convert this energy back into a form that can be used. As this progressed, so did the energy consumption and use of electronic devices. Conservative power producing techniques are running out of steam. An alternative approach to electricity generation becomes necessary. Simultaneously, human activity is wasting energy and depleting a variety of energy resources. Every day, millions of people go about. To solve this issue, the energy waste can be transformed into a form that can be used by employing a piezoelectric sensor, which can convert even simple footstep movements into electrical energy.

Keywords— *alternate method, piezoelectric sensor, simple footstep movements into electrical energy*

INTRODUCTION

The mechanism designed for this footsteps power generating project generates voltages using the gentle force of footsteps. Piezoelectric sensors are used to source and store energy for later use. The force and pressure of the footsteps will be converted into electrical impulses via the system's piezoelectric sensors. It will entirely rely on the pressure exerted by human footfall and transform it into functional power. This project makes use of basic human walking mechanisms, such as steps. The number of electronic devices also arose inadequate generation of power by conservative means. This project includes a working model of Footstep Power Generation. Piezoelectric sensors connected in series are used to build this concept in order to boost the voltage output of the sensor and produce AC power. Because the sensor generates AC voltage, it can create two different sorts of output voltages: An alternative approach to electricity generation is required. Human movement wastes energy in numerous ways at the same time the piezoelectric sensor, which senses pressure by converting it to a voltage, can be used to alleviate this issue by converting waste energy into useful form. Thus, we are producing power by utilizing this energy-saving technique, which is the footstep power generation system. With the help of this project, voltage is produced utilizing footstep force. These devices are therefore installed in public areas where people go for a walk. Then, with every footstep, these systems might produce voltage. The suggested system functions as a conduit for force-based power generation. For public areas like bus stops, theaters, train stations, and retail centers, this idea is quite helpful.

SOFTWARE IMPLEMENTATION

For this project, we're employing software, which might be any programming language with compilers that can output A development environment is offered by Atmel for their 8-bit ADC and 32-bit ADC microcontrollers: The Arduino IDE has specific code architecture guidelines to support the languages C and C++. We chose Arduino software because it allows us to see the overall input and output as well as the amount of voltage generated by human steps through a display.

NEED OF SYSTEM

The concept of turning footsteps into electrical energy is part of the broader field of energy harvesting, which involves capturing and converting ambient energy from the environment into usable electrical power. Using human motion to generate electricity without relying on traditional fossil fuels or grid-based energy sources. In remote or off-grid areas where access to electricity is limited, footstep energy harvesting can be a valuable source of power for small-scale applications such as lighting, sensors, or communication devices. Footstep energy harvesting systems can be useful in emergency situations where traditional power sources are unavailable. For example, during natural disasters or power outages, people walking in emergency shelters or evacuation routes could contribute to powering essential devices. Integrating footstep energy harvesting into urban infrastructure, such as sidewalks, pedestrian walkways, or public transportation stations, can help power smart city applications, lighting, and sensor networks. Footstep energy harvesting can be incorporated into wearable devices, like shoes or insoles, to generate power for small electronic components such as fitness trackers, health monitors, or communication devices, reducing the need for frequent battery replacements. In remote or ecologically sensitive areas, footstep energy harvesting can power sensors for environmental monitoring, allowing for continuous data collection without the need for frequent battery changes or wired connections. Footstep energy harvesting can potentially reduce the environmental impact of battery production, disposal, and recycling by providing an alternative or complementary power source for low-power electronic devices. Implementing footstep energy harvesting systems in public spaces, educational institutions, or events can raise awareness about sustainable energy practices and encourage people to think about their energy consumption.

COMPONENTS

A. Piezoelectric Sensors

This sensor is the most crucial component of the project since without it, we couldn't produce and transform the pressure energy into electrical energy. Since it operates using the piezoelectric effect principle, it is referred to as an electricity sensing element. A measurement tool for single crystals, which are available from artificial proposals and can be bought from retailers like PZT Ceramics, is used to measure crystals and bones.

Not all materials use piezoelectric sensors for touch, vibration, shock, or flex actions. They transfer the applied force to the electrical element and are employed in industries like consumer electronics, healthcare, aerospace, and nuclear instrumentation. The electrical substance becomes charged as soon as pressure is applied to the thin film that is already there, and voltage starts to be produced. The pressure exerted determines how much voltage is produced.

B. Arduino Uno Board

We make use of The ATmega328 microprocessor that is the foundation of the Arduino Uno board. This board's primary source for the display's input-output voltage counting. The Arduino Uno board is being used because of how much data we can produce while walking and how much power we have. In essence, on an Arduino board. Six of its fourteen digital input/output pins can be utilized for PWM. Results. The board features a 16 MHz crystal oscillator, six analog inputs, a power jack, a USB port, and a reset button. It comes with everything required to support the microcontroller; all you need to do is plug it in using a USB cable, an AC-to-DC adapter, or a battery, and wait a few seconds for it to work. input voltage for the When the Arduino board is powered by an external source this pin can be used to deliver voltage, or if voltage is supplied via the power jack, the regulated power supply utilized for the on condition This Atmega 328 Arduino microcontroller's flash memory has 32 KB available for storing code. EEPROM-1 KB, SRAM-2 KB After installing the Arduino IDE software on the PC, use the USB cable to connect the Arduino board to the computer. Because of this, Arduino boards come with a working programmer and a USB cable for power requirements, making them easily accessible from anywhere.

Features of Arduino Uno Board:

- Board of microcontroller: ATmega328
- Board operating voltage: 5v
- Microcontroller clock speed: 16 MHZ
- Digital i/o pins: 6 is Ip /6 is Op
- Dc current per I/O pins: 40mA
- SRAM: 2KB • EEPROM: 1KB
- Input Voltage: 7-12 v
- Flash Memory is: 32 KB C.

C. Lead Battery 12V

Firstly, we employ a form of rechargeable battery called a lead battery. Lead-acid batteries, the original form of rechargeable battery, have a comparatively poor energy density. Between the boiling point and the freezing point of aqueous H2SO4 solutions, these batteries function across a relatively broad temperature range. They don't require any further temperature regulation when used within this range. One of the 12-volt battery's greatest benefits is that it uses less power from piezoelectric sensors and saves electricity multiple times over. One type of battery that may store electrical energy as chemical energy and subsequently convert it to electrical energy is a storage battery, also known as a secondary battery. Battery charging is the process of converting electrical energy from an external electrical source into chemical energy.

D. Voltage Regulator

A voltage regulator is employed regardless of changes in the input voltage or load conditions, this voltage regulator circuit generates and maintains a fixed output voltage. The voltage regulator maintains the power supply voltages within an acceptable range for the other electrical components. Voltage regulators can convert power between AC and DC. However they are most frequently used to convert DC to DC. A specific voltage is needed for a number of devices to function, including your car's alternator-powered battery, your home's plug that provides you with endless energy, and your cell phone, which you most likely carry with you at all times. These are the rated output voltages that are constant only when the input voltage is 2.5 V or more than the output voltage, by the 78XX and 79XX integrated circuits. A LM7809 IC cannot provide a 9 V output if it is driven by a 9 V Li-Ion battery.

E. Capacitors

This project makes use of a variety of capacitor types. An electrical device with two terminals that may store energy as an electric charge is called a capacitor. It is made up of two electrical conductors spaced apart by a certain amount of distance. An electrostatic field of energy is stored in a capacitor, a passive electrical component. A capacitor's most basic configuration consists of two conducting plates that are divided by a dielectric, which is an insulating substance. The capacitance is inversely proportional to the distance between the plates and directly relates to the surface areas of the plates. A capacitor is a device that retains electrical energy in an electric field for a brief period of time. Put another way, it's a gadget with an electrical storage capacity. How is that accomplished? by employing an insulator to keep two metal plates—typically composed of copper and aluminum—separated. Electrons are charged onto the plates when electricity is applied. After that, the energy is stored in the capacitor until needed. When necessary, the capacitor releases that energy to power your device.

F. 12V DC to 220V AC Inverter

In locations where receiving AC power from the mains is not feasible, inverters are frequently required. The DC electricity is converted to AC power using an inverter circuit. There are two types of inverters. Inverters that are quasi-modified or true/pure sine wave inverters. Modified or quasi-inverters are less expensive than these true/pure sine wave inverters. With a 12VDC power source, this straightforward DC to AC inverter generates 220VAC. It can power very light loads, such as wireless phones and night lamps, but by adding more MOSFETs, it may be upgraded to a strong inverter. It drives the output power with two power IRFZ44 MOSFETs and uses the 4047 IC as an astable multivibrator running at about 50 Hz in frequency. Power MOSFETs used in a push-pull configuration are directly driven by the IC's 10 and 11 pin outputs. The output transformer features two amps on the secondary, 230 volts on the primary, and a 9 volt to 0 volt circuit.

ADVANTAGES

- Renewable and Sustainable
- Reduced Environmental Impact
- Smart Infrastructure Integration
- Low Maintenance
- Educational Awareness
- Emergency Power Source
- Innovative Wearable Technology

DISADVANTAGES

- Limited Power Generation
- Efficiency Challenges
- Scalability Issues
- Durability Concerns
- High Initial Costs
- Dependence on Human Movement
- Technological Complexity

CONCLUSION

Using a piezoelectric sensor, this footstep power generating system is highly valued and demanding. Converting the kinetic energy of human footstep movements into electrical power is one of the most renewable energy ways. A widely acknowledged fact is that 11% of our primary energy comes from nonconventional sources. Since this project has been launched, it will not only increase and complicate our current energy-related issues, but it will also produce energy through human activity, which is one of the characteristics of free energy. For the common public, the most accessible and affordable energy solution is the Advanced Footstep Power Generation Using Piezo Sensor, which has undergone successful testing and deployment.

RESULTS

Generating electricity from footsteps, a concept known as piezoelectricity, has gained traction as a promising method for sustainable energy generation. Companies like Pavegen have developed flooring systems embedded with piezoelectric materials, which convert the kinetic energy from footsteps into electrical power. These systems are commonly deployed in high-traffic areas such as malls, stadiums, and transportation hubs, where they can harness the energy generated by pedestrians to power lighting, signage, or other low-power devices. By utilizing footstep-generated electricity in public spaces, cities can reduce their reliance on conventional energy sources, lower carbon emissions, and raise awareness about energy conservation and sustainability. Ongoing research aims to improve the efficiency and scalability of piezoelectric materials and systems, exploring new materials and engineering designs. Furthermore, integrating footstep-generated electricity into smart grid systems can enhance the resilience of the grid and complement other renewable energy sources like solar and wind power. Additionally, piezoelectric materials can be incorporated into wearable technology to capture energy from body movements, extending device lifespan and reducing the need for external charging. Innovation challenges and competitions drive advancements in the field, fostering collaboration among researchers, engineers, and entrepreneurs. While challenges such as efficiency, cost-effectiveness, and scalability remain, generating electricity from footsteps holds significant promise for contributing to sustainable energy solutions, particularly in urban environments with high foot traffic.

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