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WALKING WATTS: FOOT-STEP BASED ELECTRICITY GENERATOR

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Abstract: The footstep electricity generator is a novel approach to harnessing renewable energy from human motion. This system utilizes piezoelectric transducers embedded in flooring materials to convert the mechanical energy generated by footsteps into electrical energy. The generated electricity can be stored and used to power various devices, such as street lights, sensors, and even charge mobile phones. The primary components of this system include piezoelectric sensors, a power management unit, and an energy storage system. When a person steps on the floor, the pressure exerted is converted into electrical energy by the piezoelectric sensors. This energy is then regulated, stored, and made available for use. This technology offers a sustainable solution to energy generation, particularly in high-traffic areas such as sidewalks, train stations, and shopping malls. By capturing the otherwise wasted kinetic energy from footsteps, it contributes to reducing the dependency on traditional power sources and promotes the use of clean energy.

Keywords: Battery, Foot-step power generation, Piezoelectric sensors.

I. INTRODUCTION

The Footstep Electricity Generator is an innovative system designed to harness renewable energy from human motion. By converting the mechanical energy generated from footsteps into electrical energy, this technology offers a sustainable solution to meet part of our energy needs. The core of the system lies in the use of piezoelectric materials, which produce electrical charges when subjected to mechanical stress. Electrical energy has become a basic necessity in our day-to-day activities. The advent of the industrial revolution has drastically changed the way of life. In the past few decades, power consumption has drastically increased as electricity has been used in new industries. Furthermore, the use of fossil fuels as a source of electrical energy has contributed to a serious pollution problem in the environment. As a result, an alternative technique of generating electricity is **FOOT STEP ELECTRICITY GENERATOR.**

- It is basically the energy is collected via piezoelectric transducers, which are responsible for converting mechanical energy to electrical energy.
- The energy generated is stored in a battery or capacitor and can be used to power small electronic devices. The Arduino uno is used to monitor and display the energy generated.

In an era where the demand for sustainable energy solutions is at an all-time high, innovative technologies are emerging to harness renewable resources effectively. One such advancement is the Footstep Electricity Generator, a groundbreaking device that captures the kinetic energy produced by human movement—specifically, footsteps.

As urban populations continue to grow, the need for renewable energy sources becomes increasingly critical. Traditional energy generation methods often rely on fossil fuels, contributing to environmental degradation and climate change. The Footstep Electricity Generator offers a unique solution by transforming everyday activities into a source of clean energy.

The core principle behind the Footstep Electricity Generator is the conversion of mechanical energy into electrical energy. This is typically achieved through: Piezoelectric Materials: These materials generate an electric charge when subjected to mechanical stress, allowing them to convert the pressure from footsteps into usable electricity. Electromagnetic Systems: These systems utilize the movement of magnets within coils to produce electrical current, further enhancing the efficiency of energy conversion. Piezoelectric transducers are embedded in flooring materials, such as tiles or mats.

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When a person walks over these transducers, the pressure from their footsteps deforms the piezoelectric material, generating an electric charge. This electrical energy is then captured, regulated, and stored for various uses.

II. LITERATURE REVIEW

Saranya G ,et al [1] proposed a model Footstep Power Generating System Electrical energy is produced by people walking over the ground surface. Using a Hump Mechanism

Shivani Mahesh ,et al[2] proposed a model Smart Footsteps Power Generation System here Footstep electricity generation involves designing a system with piezoelectric, electromagnetic, or triboelectric materials to convert mechanical energy from footsteps into electrical energy.

H D Lekhana, et al [3] proposed a model Generation And Utilization Of Electricity Using Footsteps As A Source Of Energy, By using non-conventional method to produce electricity by utilizing the waste energy generated during pressure applied while walking through piezoelectric tile.

Somashekhar G.C , et al [4] proposed a model Energy Generation From Footsteps Using Piezoelectric Sensors here The prototype contains a piezoelectric tile containing six piezo sensors connected in series. They generate electrical charges when pressure is applied on them.

Chun Kit Ang, et al [5] proposed a model Development of a footstep power generator in converting kinetic energy to electricity, This model is designed based on the rack and pinion concept, aiming to reduce the complexity of mechanical structure the rack and pinion

Jeevan P, et al [6] proposed a model Advanced Footstep Power Generation System to Charge E-Vehicles, This project uses regulated power supply.

Iqbal Mahmud [7] proposed a model Electrical Power Generation Using Footsteps, In the design, the footwear consists of water cushioned soles. Thus, whenever we put pressure by the weight of the body on it, the water flows to the mini turbines and produce electric power.

Thejaswini R , et al [8] proposed a model Micro Power Generation using Piezo & Cam-Gear Mechanism, in this model Piezo materials and Cam-Gear arrangement is used to harvest energy from footsteps of human beings.

Sarat Kumar Sahoo [9] proposed a model FOOT STEP POWER GENERATION, here Non conventional system for energies are very much required at this time. Energy generation using footsteps requires no any fuel input to generate electricity.

Marshiana.D, et al [10] proposed a model Footstep Power production using Piezoelectric Sensors, here A substitute strategy for generation of power is finished by utilizing piezo plate.

III. PROBLEM STATEMENT: GAP IDENTIFIED

The current energy-harvesting systems are either inefficient, costly, or lack real-time monitoring capabilities. Furthermore, the use of fossil fuels as a source of electrical energy has contributed to a serious pollution problem in the environment. As a result, an alternative technique of generating electricity is **FOOT STEP ELECTRICITY GENERATOR** This project addresses the challenge of converting mechanical energy from human footsteps into electrical energy using piezoelectric sensors, coupled with an Arduino uno for efficient energy monitoring and utilization.

IV. OBJECTIVES

The objectives of the proposed model as follows:

- To design a system that converts mechanical energy from footsteps into electrical energy using piezoelectric sensors.
- To implement circuits (rectifiers, voltage regulators, and storage units) that stabilize, store, and utilize the harvested energy effectively.
- To use Arduino Uno to measure, monitor, and display the generated voltage or power output in real-time.
- To create a low-cost, scalable system suitable for public spaces, walkways, and other high-traffic areas.
- To promote sustainability by demonstrating a renewable energy solution with minimal environmental footprint.
- To develop a system that can be expanded for larger platforms and adapted for diverse applications, such as powering small devices.

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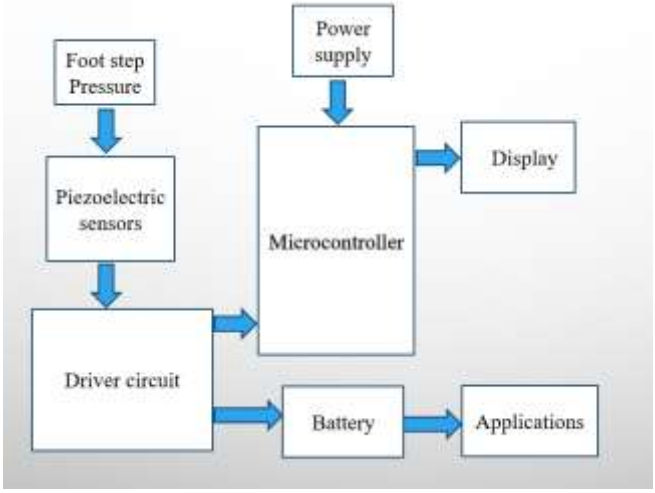
V. METHODLOGY

1. BLOCK DIAGRAM

The block diagram of the proposed model is given below



. Fig 1.1: block diagram of the proposed model

This block diagram represents a system that generates power using footstep pressure, likely for applications such as energy harvesting.
Explanation of Components:
Footstep Pressure:
This is the input source, where mechanical pressure is applied by footsteps.
Piezoelectric Sensors:
These sensors convert mechanical energy (footstep pressure) into electrical energy through the piezoelectric effect.
Driver Circuit:
The driver circuit processes and regulates the electrical energy generated by the piezoelectric sensors.
Battery:
The generated and regulated energy is stored in a battery for future use.
Microcontroller:
This acts as the control unit, managing the system's operations. It connects to the power supply, processes data, and interfaces with other components.
Power Supply:
Provides necessary power to the microcontroller and other components in the system.
Display:
Shows information about the system, such as energy generated, system status, etc.
Applications:
The stored energy is used to power various devices or applications.
This setup is commonly used in energy harvesting projects where human motion is utilized to generate power.

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2. FLOWCHART

The flowchart of the model is shown below;

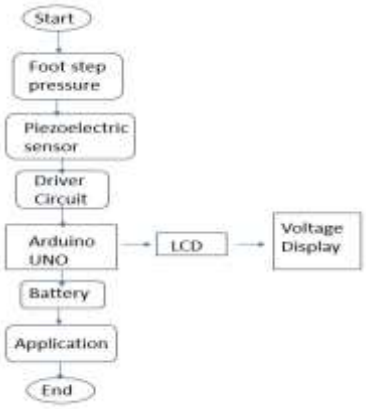

Fig 2.1: Flow diagram of the model

The flowchart represents the process of energy harvesting from footstep pressure using a piezoelectric sensor system. Here's a step-by-step explanation:
1.Start: The system begins operation when footstep pressure is applied.
2. Footstep Pressure: Mechanical pressure from footsteps serves as the energy input to the system.
3. Piezoelectric Sensor: Converts the mechanical pressure into electrical energy using the piezoelectric effect.
4. Driver Circuit: Processes and regulates the electrical energy generated by the piezoelectric sensor to make it suitable for further use.
5. Arduino UNO: A microcontroller that controls the system's operation, processes data from the sensors, and interfaces with the display and battery.
6. LCD: Displays information such as the voltage generated by the system.
7. Voltage Display: Provides real-time feedback on the voltage output from the system.
8. Battery: Stores the regulated electrical energy for powering external applications.
9. Application: The stored energy is utilized to power devices or systems for specific applications.
10. End: Indicates the end of the process or system operation.

This flowchart outlines a straightforward energy harvesting and utilization system, integrating sensing, control, storage, and display.

VI. RESULTS

Footstep electricity generation projects harness energy from human footsteps using piezoelectric technology. These systems convert mechanical pressure from footsteps into electrical energy. A common design involves placing piezoelectric sensors or tiles on floors or walkways that generate electricity when compressed by a person walking.

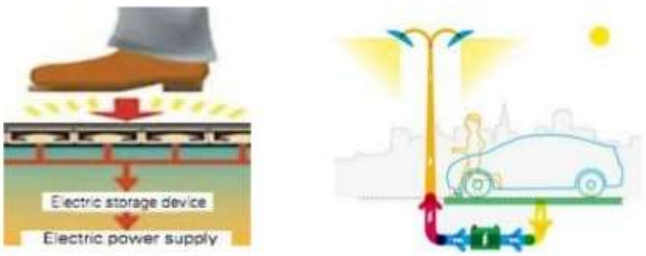

Fig 4.1: Pictorial Representation

The energy produced is often used to power low-energy devices such as LED lights, sensors, or small electronics. This sustainable energy source can be integrated into high-foot-traffic areas like shopping malls, airports, and train stations.

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The technology shows promise for urban sustainability, reducing reliance on traditional power sources while promoting eco-friendly innovation.

VII. CONCLUSION AND FUTURE SCOPE

Conclusion: Footstep electricity generation offers a promising solution for sustainable energy production by harnessing the kinetic energy from human movement. Through piezoelectric technology, this method provides an innovative way to power low-energy devices in high-traffic areas, contributing to urban sustainability. While still in its developmental stages, the potential to reduce reliance on conventional energy sources and promote eco-friendly practices makes footstep electricity generation an exciting area for future research and implementation in smart cities.

Future scope : The future scope of footstep electricity generation lies in expanding its applications and improving efficiency. As technology advances, the development of more durable and efficient piezoelectric materials could increase energy output, making it viable for larger-scale applications. Integration into public infrastructure, such as sidewalks, train stations, and even sports venues, could contribute significantly to urban energy needs. Additionally, combining footstep generation with other renewable energy sources, like solar or wind, could create hybrid systems, enhancing energy sustainability. As global demand for eco-friendly solutions grows, footstep electricity generation may play a key role in sustainable, smart city development.

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