

STEPS TOWARDS POLLUTION-FREE POWER GENERATION BY USING PIEZOELECTRIC DISCS

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ABSTRACT

The increasing demand for electrical energy and the environmental impact of conventional power generation methods have created a need for sustainable and pollution-free energy sources. Piezoelectric energy harvesting is an emerging technology that converts mechanical pressure and vibrations into electrical energy using piezoelectric materials. This paper presents a system for pollution-free power generation using piezoelectric discs. The proposed system captures mechanical energy generated by human footsteps and converts it into usable electrical energy through piezoelectric transducers. The generated electrical energy is rectified, stored, and utilized for low-power applications such as LED lighting, sensors, and portable electronic devices. The system is eco-friendly, renewable, cost-effective, and suitable for installation in high-traffic areas such as railway stations, shopping malls, public walkways, and educational institutions. Experimental observations demonstrate the feasibility of generating electrical energy from otherwise wasted mechanical energy, contributing to sustainable energy development.

INTRODUCTION

Energy plays a vital role in the development of modern society. The continuous increase in population, industrialization, and urbanization has resulted in growing energy consumption. Conventional energy sources such as coal, petroleum, and natural gas are limited and contribute significantly to environmental pollution.

Piezoelectric technology provides an alternative method of energy generation by converting mechanical stress into electrical energy. Piezoelectric materials generate electric charges when subjected to pressure or vibration. This property can be effectively utilized to harvest energy from human movement and mechanical vibrations.

The proposed system focuses on generating electricity using piezoelectric discs placed beneath a platform. When pressure is applied by footsteps, the discs generate electrical energy, which is collected and stored for practical applications. The system provides a clean and sustainable approach to energy harvesting.

LITERATURE SURVEY

Researchers worldwide have explored piezoelectric energy harvesting as a renewable energy solution. Several studies have demonstrated the ability of piezoelectric materials to generate electrical energy from mechanical stress and vibration.

Various researchers have proposed energy-harvesting floors capable of converting pedestrian movement into electricity. These systems have been successfully implemented in railway stations, airports, and public infrastructure.

Recent developments have focused on improving energy conversion efficiency through optimized piezoelectric material arrangements and advanced energy storage systems. Hybrid systems combining

piezoelectric technology with solar and wind energy have also been investigated to increase overall power generation capacity.

The literature review indicates that piezoelectric energy harvesting is a promising technology for sustainable and pollution-free power generation.

IMPLEMENTATION AND WORKING

The proposed system consists of piezoelectric discs, a rectifier circuit, voltage regulator, storage battery, and electrical load.

Block Diagram

Piezoelectric Discs → Rectifier Circuit → Voltage Regulator → Battery Storage → Electrical Load

The piezoelectric discs generate alternating electrical signals when subjected to mechanical pressure. The rectifier circuit converts the AC output into DC power. The voltage regulator stabilizes the generated voltage before storing the energy in a rechargeable battery. The stored energy can then be utilized to power low-energy electrical devices.

Methodology

The project is developed using piezoelectric discs arranged beneath a pressure platform. Mechanical force generated by footsteps is transferred to the discs, producing electrical energy through the piezoelectric effect. The generated electrical output is collected and processed through power-conditioning circuits. The energy is stored in a battery and used for demonstration loads such as LED lamps.

The methodology focuses on maximizing energy harvesting efficiency while maintaining low system cost and high reliability.

Working Procedure

Step 1: Human footsteps apply pressure on the piezoelectric platform.

Step 2: Piezoelectric discs convert mechanical stress into electrical energy.

Step 3: The generated AC voltage is transferred to the rectifier circuit.

Step 4: The rectifier converts AC voltage into DC voltage.

Step 5: The voltage regulator stabilizes the output voltage.

Step 6: Electrical energy is stored in a battery or capacitor.

Step 7: The stored energy powers low-power electrical devices such as LEDs and sensors.

CONCLUSION AND RESULT

The proposed piezoelectric power generation system successfully demonstrates the conversion of mechanical energy into electrical energy. The system provides a renewable and environmentally friendly method of power generation without producing harmful emissions.

Experimental implementation confirms that piezoelectric discs can generate usable electrical energy from human footsteps and mechanical pressure. Although the power generated by individual discs is relatively small, combining multiple piezoelectric elements significantly increases overall energy output.

The system offers a practical solution for energy harvesting in public places and contributes to the development of sustainable and pollution-free power generation technologies.

FUTURE SCOPE

Future improvements may include the integration of advanced energy storage systems, smart monitoring technologies, and Internet of Things (IoT) applications. Larger piezoelectric arrays can be implemented in high-footfall areas to increase energy generation. Hybrid renewable energy systems combining piezoelectric, solar, and wind energy can further enhance efficiency and reliability.

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