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Energy Harvesting Dance Floor

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Abstract:

The project "Energy Harvesting Through Dance Floor" aims to explore innovative ways to harness and conserve energy in public spaces. By integrating piezoelectric sensors into a dance floor, the kinetic energy generated by dancing can be converted into electrical energy. This energy can then be stored and used to power various applications, such as lighting or sound systems, reducing the dependency on traditional energy sources. Dance floors are popular in various entertainment venues, including clubs, gyms, and event spaces, making them ideal locations for implementing this technology. Not only does this concept promote sustainable practices, but it also raises awareness about energy conservation among the general public, especially the younger generation. This project aims to showcase the feasibility and effectiveness of such an approach, highlighting the potential for energy conservation through innovative means

Keywords: Electric model, energy harvesting, piezo electric material, Piezo Electric Tile (Ceramic), PVDF.

1.0 Introduction

Piezoelectric tiles used on dance floors have garnered a lot of attention recently as a novel and environmentally friendly energy source. Piezoelectric tiles, which generate electricity in response to mechanical stress and store the energy generated by footfall, are now commonly used in dance floors. This technology has been applied successfully in a range of settings, such as clubs and public areas. It can supply electricity for lighting systems and tiny electronic devices. The pressure and frequency of the mechanical stress, which are regulated by the dancers' weight and movements, determine how much energy is produced. A battery or capacitor is used to store the electrical energy produced by the piezoelectric tiles, which can subsequently be utilized to power a variety of electronic devices. There are many advantages of using piezoelectric tiles as a renewable energy source. It is a sustainable and non-intrusive method of producing electricity that may be used in a variety of locations, including public areas, dance floors, and nightclubs. In addition to being clean and eco-friendly, the energy produced by piezoelectric tiles can be utilized to run lighting systems and tiny electronics.

2.0 Literature Review:

Piezoelectricity is the accumulation of an electric charge in some solid materials (such as crystals, ceramics [5], and biological matter such as bone, DNA, and proteins) in response to mechanical stress. Piezoelectricity refers to the generation of electricity using pressure. It comes from the Greek words piezo or piezein, which imply to squeeze or press, and electric electron, which implies amber, an early source of electric charge. French physicists Pierre and Jacques Curie discovered piezoelectricity in 1880.The piezoelectric effect is defined as the linear electromechanical interaction between mechanical and electrical states in crystalline materials that lack inversion symmetry. The piezoelectric effect is a reversible phenomenon in which materials that show the direct piezoelectric effect (the internal creation of electrical charge resulting from an applied mechanical force) also exhibit the reverse piezoelectric effect [6]. Piezoelectricity finds useful in many areas, such as electrical frequency generation, high voltage generation, and sound production and detection, correspondingly raises new research directions toward self-sustainability, which is being achieved through energy harvesting and self-powered sensing technology [3]. Electrical energy may be converted from vibrational energy using a variety of techniques- Electrostatic, electromagnetic, and piezoelectric conversion are the three most used kinds. The majority of current research effort has been focused on piezoelectric conversion due to its simplicity of manufacture, analysis, simple structure and ease of utilization [1]. The goal of this effort is to develop a theoretical understanding of how the dance floor may be used to harvest power. This system is quite expensive and not as accessible and available in India. Piezoelectricity has been identified to have capability to convert waste energy into useful electricity without ‘refueling’. The only drawback to the mechanism is the low output power, however with the evolvement of power electronic drives the system mechanism can be improved significantly [5].

2.1 Components Used:

Sr. No.	Component Name
1	Copper Wire
2	Battery
3	Resistor
4	PZT Sensors
5	Switch
6	USB Port
7	LED
8	Capacitors
9	Transistors
10	Wooden sheet
11	Multimeter

2.2 Block Diagram:

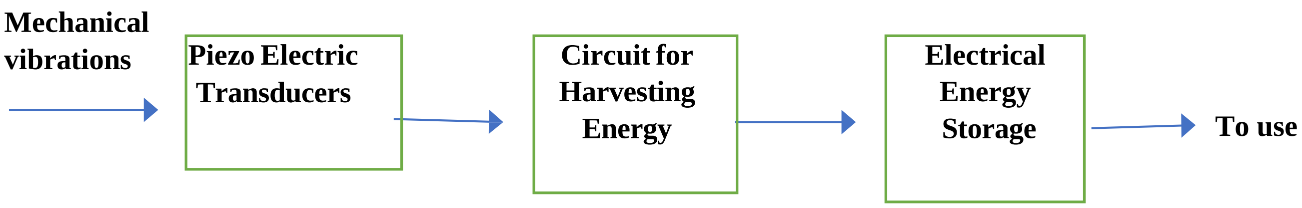

Fig 1: Conversion of Mechanical energy to electrical energy

Three key components make up the process of converting mechanical vibrations generating electrical energy through the application of piezoelectric transducers: the transducing element itself, which transforms mechanical vibrations into an alternate electrical energy; the circuit for collecting the recovered energy, which formats the energy from the piezoelectric generator; and the energy storage, which can be a battery, a capacitor, or a super capacitor and stores the recovered energy.

2.2 Circuit Connections:

In order to ascertain the type of connection that provides the required perceptible voltage and current, three Piezoelectric sensors are linked in series. This series combination has a voltmeter and force sensor linked to it. Voltages that correlate to different pressures placed on this link are reported. In addition, the current and the voltage produced across the series connection are monitored. In contrast to a parallel connection, which produces good current but bad voltage, a series connection yields good voltage but poor current. However, this issue is resolved with a series-parallel connection, which allows for the acquisition of a good voltage and current

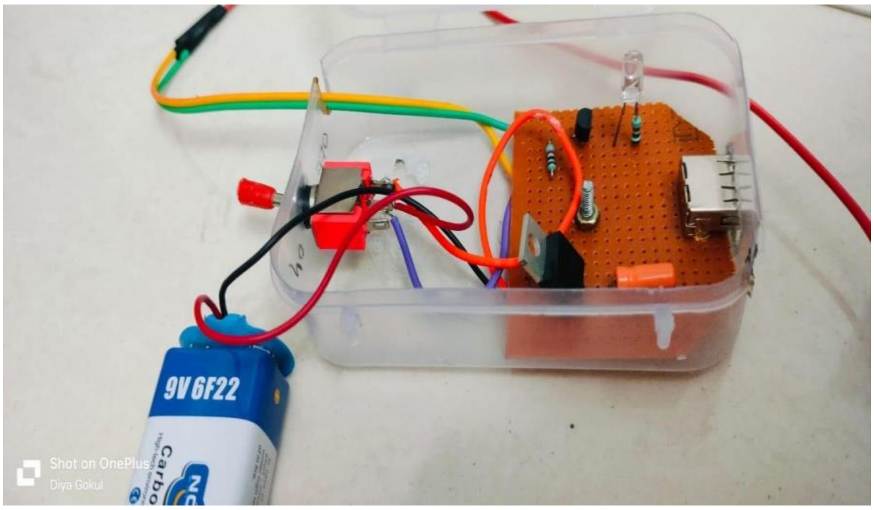

Fig 2: Circuit of the proposed

2.3 Analysis Done on The Piezoelectric Tile:

To test the piezo tile's ability to generate electricity, people weighing between 40 and 65 kg were forced to walk on it. When the greatest weight or force is exerted, the highest voltage is produced. Therefore, a maximum voltage of 40V is produced across the tile when 65 kg of weight is applied to it.

2.4 Hardware Description:

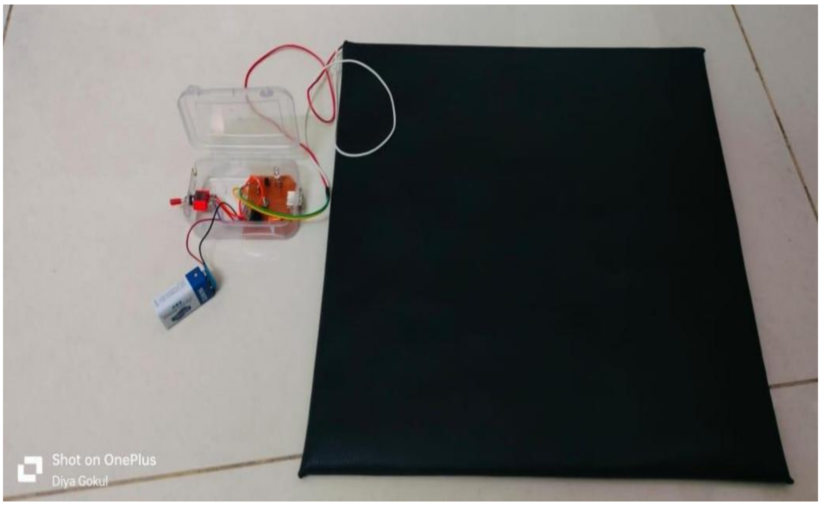

Fig 3: Energy Accumulating System

A typical power harvesting system is seen in Figure. It consists of an external energy source, a harvesting circuit to maximize the efficiency of collecting energy, a piezo electric crystal to transform external energy into electric power, and a storage battery or a load circuit. The harvesting of electrical energy derived from surrounding sources such as sunlight, temperature variation in elevation and resonances and has been the subject of much investigation. Out of all the energy sources that may be used, mechanical vibration is one that can be readily obtained by implementing micro-electro mechanical systems technology. It is possible to transform mechanical vibration energy into useful electrical energy by using piezoelectric, electromechanical, and electrostatic transducers. Because of its high energy density, piezoelectric probes are thought to be a good alternative to electrostatic and electromagnetic actuators.

3.0 Result:

The project to capture energy using piezoelectric tiles has been completed successfully. This ingenious technology generates energy from foot movement in the defined region. The tile's capacity to transfer mechanical stress to electrical charge has been effectively used to generate a modest but considerable quantity of electricity. The study not only proved the viability of piezoelectric tiles as an energy harvesting option, but it also revealed the technology's potential for powering small-scale electronics. This might open the way for more ambitious initiatives that use piezoelectricity in high-traffic places like malls, airports, or train stations.

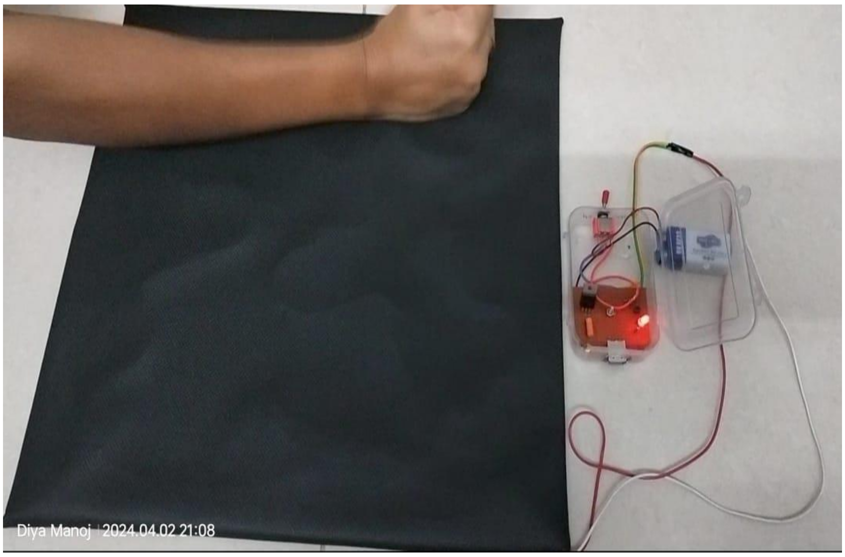

Fig 3: System Implementation

4.0 Discussion:

A comprehensive review of state of art in the domain of piezoelectric energy harvesting tiles is presented. Fundamentals of piezoelectricity is discussed and its analysis is done. Piezoelectricity finds useful in many areas, that is being accomplished using self-powered sensor and energy accumulating technologies. The feasibility aspects, and challenges in adaptation of piezoelectric energy harvesting in floor tiles are discussed. The goal of this effort is to develop a theoretical understanding of how the dance floor may be used to harvest power.

5.0 Future Scope:

By creating effective models and designs, piezoelectric energy harvesting may make a substantial contribution to the production of lowering our dependency on non-renewable resources and tackling the urgent environmental and ecological issues through the use of green and renewable energy. With further research and development efforts focused at overcoming obstacles and maximizing their performance, the future of energy harvesting dance floors employing piezo electric tiles and other piezoelectric energy harvesting devices is bright.

6.0 Conclusion:

The suggested technique uses a PZT substance as a means of energy conversion to transform mechanical vibrations created on a dance floor into usable electrical energy. The output power that is obtained is either used to power other devices or saved in batteries for later use. When several piezo electric materials are compared, it becomes clear that PZT has better qualities. Additionally, a comparison revealed that a series combination connection is more appropriate.

It is discovered that there is a linear relationship between the pressure used on the dance floor and the voltage that results from it. Lightbulbs may be made out of this. Additionally, it can serve as a charging port.

7.0 Conflict of Interest:
The authors of this research declare that there is no conflict of interests.

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