IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, August 2023

Advanced Footstep Power Generation System

Manjesh N[1], Aparna[2], Batta Siva Jyothi[3], D Salman[4], Siddartha P[5]
Department of Electronics and Communication Engineering[1*,2,3,4,5]
R. L. Jalappa Institute of Technology, Doddaballapur, Karnataka, India
Corresponding author: Mr. Manjesh N and Email id:manjeshn@rljit.in

Abstract: *The demand for sustainable and renewable energy sources has led to increasing interest in harnessing human kinetic energy as a potential power source. This abstract presents an overview of an advanced footstep power generation system designed to harvest energy from the footsteps of individuals. The proposed system utilizes piezoelectric materials integrated into a specially designed flooring mechanism. As a person walks or runs on the floor, the mechanical stress exerted by their footsteps is converted into electrical energy through the piezoelectric effect. This energy is then stored or directly utilized for various applications, offering a promising solution for powering small-scale electronic devices or supplementing existing power grids. The proposed advanced footstep power generation system offers numerous benefits, including its scalability, sustainability, and compatibility with existing infrastructure. By integrating this technology into public spaces, such as airports, train stations, or shopping malls, a significant amount of energy can be harvested from the collective footsteps of people, reducing dependence on fossil fuels and contributing to a greener and more sustainable future. To maximize the efficiency of energy harvesting, advanced control algorithms and monitoring systems are implemented. These systems continuously monitor footstep patterns, energy generation, and power consumption, allowing for adaptive control and optimization of the power generation process. Additionally, the system incorporates user-friendly interfaces to provide real-time feedback and promote user engagement by displaying energy generation statistics and environmental impact data.*

Keywords: Piezoelectric sensors; microcontroller; energy storage units; LCD

I. INTRODUCTION

The growing global demand for sustainable and renewable energy sources has spurred innovative research and development in the field of energy harvesting. One area of interest is the utilization of human kinetic energy as a potential power source. Among various approaches, the harnessing of footstep energy has emerged as a promising avenue for generating electricity from everyday human activities. The concept of generating electricity from footstep energy is rooted in the principle of piezoelectricity. Piezoelectric materials have the unique property of generating an electric charge when subjected to mechanical stress. By integrating these materials into flooring or shoe systems, it becomes possible to convert the mechanical stress produced by human footsteps into usable electrical energy. The advancements in piezoelectric materials, coupled with innovative engineering designs, have led to the development of an advanced footstep power generation system. This system aims to capture and convert the energy generated by footfalls into a renewable and sustainable source of power. To optimize energy conversion and ensure a seamless integration with existing infrastructure, sophisticated power conditioning circuits are employed. These circuits process the generated electrical energy, converting it into a suitable form for immediate use or storage. Energy storage units, such as batteries or supercapacitors, are utilized to store excess energy for later use, enabling a consistent power supply during periods of low foot traffic or increased power demand.

1.1 Existing System

- **Piezoelectric Flooring Systems:** Piezoelectric flooring systems utilize piezoelectric materials embedded in the floor to capture the mechanical stress from footsteps.
- **Energy-Generating Pavements:** Energy-generating pavements utilize various mechanisms to convert footstep energy into electrical power.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, August 2023

- **Shoe-Embedded Energy Harvesting:** Another approach involves integrating energy harvesting mechanisms directly into footwear.
- **Smart Floor Systems:** Smart floor systems combine footstep energy harvesting with advanced sensor technologies.
- **Portable Energy Harvesting Devices:** Some companies have developed portable energy harvesting devices that individuals can carry with them to convert footstep energy into power.

1.2 Proposed System

The system utilizes high-quality piezoelectric materials integrated into the flooring or shoe systems. These transducers are strategically positioned to capture the mechanical stress and vibrations caused by footsteps.The flooring mechanism plays a crucial role in the system's efficiency and user experience. It is designed to be robust, yet comfortable and safe for walking or running. Excess energy generated during high foot traffic periods can be stored for later use through energy storage units. User safety and comfort are paramount considerations in the proposed system. The flooring mechanism is designed to provide a stable and slip-resistant surface, minimizing the risk of accidents

Kinetic energy is one of the renewable energy sources. A significant amount of research was done to see if it was possible to transform kinetic energy into electricity. The majority of past studies focused on the selection of appropriate materials and the sophisticated design of power generators by installing a mechanical footstep power [1].

The purpose of this study is to demonstrate how people can generate electricity by walking on the floor. Consider the forces you exert that are wasted when someone walks. The concept is to transform weight energy into electrical energy. The Power Generating floor's goal is to convert kinetic energy into electrical energy. The world's most pressing concern these days is the energy crisis [2].

Electricity is critical and increasingly demanded. A great deal of energy was lost and depleted. When walking on a population of humans, an alternative means of generating energy was found the vibration between the surface and the move was wasted. The use of this wasteful energy will create and satisfy demand for electrical energy [3].

1.3 Technology Used

A. Hardware Requirements:

- ATMEGA 328 Microcontroller
- Power supply
- LCD display
- UART
- Wi-Fi
- Piezo electric plates
- Relay

B. Software Requirements:

- Embedded C programming
- Arduino IDE
- Express PCB

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, August 2023

II. BLOCK DIAGRAM

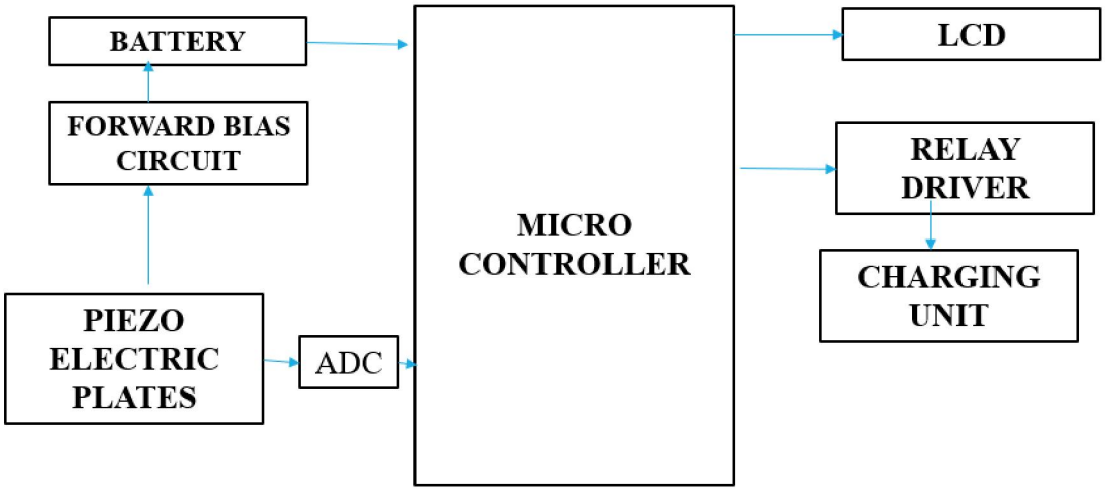

Fig 2.1: Block diagram

- **LCD:** The LCD is a visual output component used to display information or data in a human-readable format.
- **Piezo electric Sensors:** A piezoelectric sensor is a device that converts mechanical stress or pressure into an electrical charge or voltage, based on the piezoelectric effect. It is widely used in various applications such as pressure sensing, force measurement, vibration analysis, and acoustic sensing.
- **Arduino Uno Microcontroller**: The Arduino One is a microcontroller board that serves as the central processing unit for the system. It receives input signals from the piezo electric sensor, processes them, and controls the overall system operation.
- **Forward bias Circuit:** A forward bias circuit is a configuration used to apply a voltage in a specific direction across a diode or semiconductor device, allowing current to flow easily through the device. It is commonly employed in electronic circuits for various purposes, including rectification, amplification, and signal processing.
- **Battery**: A battery is a portable device that stores chemical energy and converts it into electrical energy through a chemical reaction. It consists of one or more electrochemical cells, which are composed of positive and negative electrodes immersed in an electrolytic
- **ADC:** An ADC is an electronic device used to convert analog signals into digital representations. It is commonly used in various applications, such as data acquisition systems, communication systems, and control systems.
- **Relay driver**: A relay driver is an electronic circuit that is designed to control and drive the operation of an electromechanical relay. Its purpose is to provide the necessary electrical current and voltage to activate the relay coil, enabling the switching of larger currents or voltages in other parts of the circuit.
- **Charging unit:** A charging unit, also known as a charger, is an electronic device used to replenish the energy in rechargeable batteries or other energy storage systems. It provides a controlled current and voltage to the battery, ensuring safe and efficient charging.

III. RESULT AND DISCUSSION

The result of an advanced footstep power generation system is the generation of electrical energy by harnessing the kinetic energy produced from human footsteps. This technology aims to convert the mechanical energy generated by individuals walking or running into usable electrical power. The advanced footstep power generation system utilizes specialized devices such as piezoelectric sensors or electromagnetic generators embedded in the flooring or footwear. These devices convert the vertical movement or pressure exerted by foot impact into electrical energy. The system has

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, August 2023

several potential benefits, including the ability to generate clean and sustainable energy in high-traffic areas or public spaces. It can be used to power low-energy devices such as lighting systems, charging stations for mobile devices.

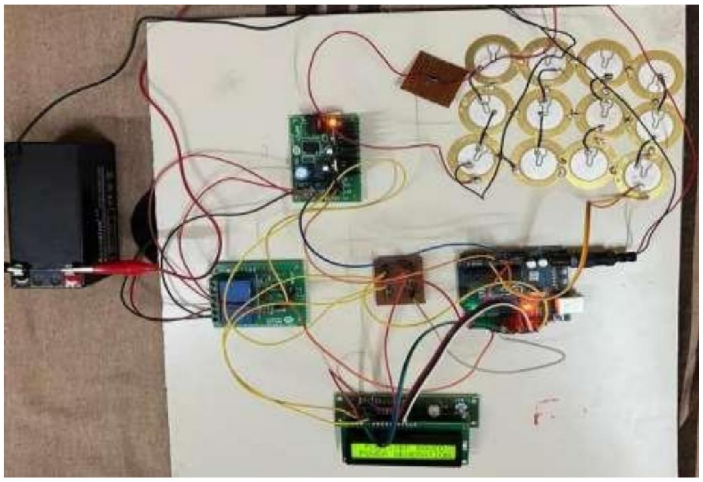

Fig 3.1: Working Model

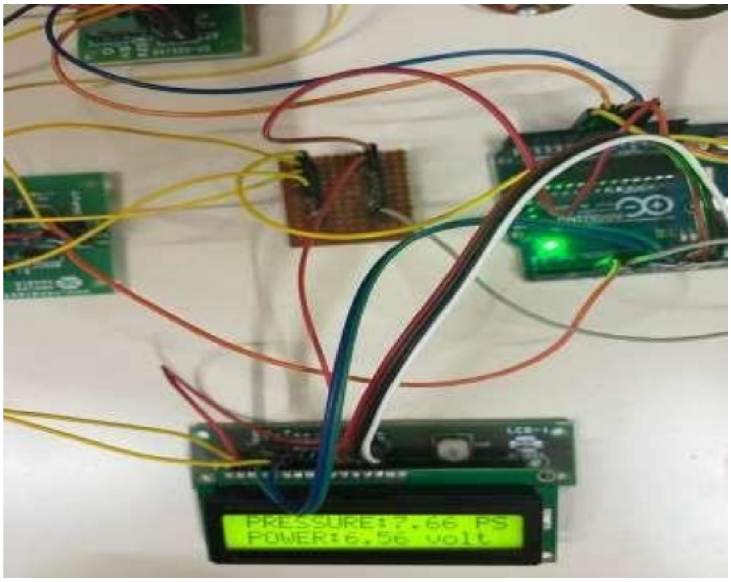

Fig 3.2: Output of Pressure and Power

IV. CONCLUSION

In conclusion, the advanced footstep power generation system harnesses the mechanical energy from human footsteps and converts it into usable electrical energy. This innovative technology utilizes either piezoelectric materials or electromagnetic induction principles to capture and convert the energy generated by foot impacts. By implementing this system, a sustainable and renewable source of electricity can be achieved, particularly in high-traffic areas or public spaces where footfall is abundant. The system offers the potential to generate significant electrical power by effectively harvesting the energy generated by human locomotion. In summary, the advanced footstep power generation system represents a promising technology that can contribute to sustainable energy solutions by harnessing the power of human movement and converting it into usable electrical energy.

REFERENCES

[1] Prabaharan R, Jayram Prakash, Vijay Anand. “Power Harvesting by Using Human Foot Step”- International Journal of Innovative Research in Science Engineering and Technology, vol.2, issue 7, July 2013

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, August 2023

[2] Ramesh Raja R, Sheri Mathew. "Power Generation from Staircase (steps)"- International Journal of Innovative Research in Science Engineering and Technology, vol.3, Issue 1, February 2014

[3] V. Panneerselvam, et al., "Portable DC Regulated Power Supply from Footsteps, "International Journal for Scientific Research & Development, vol 5, pp. 916-918, April 2017

[4] E. Bischur, and N. Schwesinger, "Energy harvesting from floor using organic piezoelectric modules," 2012 Power Engineering and Automation Conference, 2012, pp 978-981.

[5] E. Maghsoudi, et al., "A review of walking energy harvesting using piezoelectric materials," IOP Conference Series: Materials Science and Engineering, 2017, pp 1-8