Footstep Power Generation Using Piezoelectric Sensor

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Abstract- *The growth of the cosmos is represented by energy consumption. To meet the current demand, the modern world needs a significant amount of electrical energy. However, due to the massive demand of energy, conventional energy resources are steadily declining. Therefore, other energy sources are needed. However, they also need to be clean, eco-friendly, and sustainable in order to close the gap between the supply and demand of electricity. Addressing the energy problem is the main goal. It entails the generation of power through walking. Utilizing the force that a person's weight and energy exert on the ground while they walk is the idea. The goal of the power generating floor is to use piezo sensors to convert the mechanical stress placed on the floor into electrical power. Piezoelectric components are used in this method.*

Keywords- footstep power generation, piezoelectric sensor, kinetic energy, power system.

I. INTRODUCTION

Energy harvesting, also known as energy capture or energy storage, is the process by which energy is obtained from outside sources and used to directly power equipment or is captured or stored for later use. Energy sources are being used much more frequently thanks to the development of technology. The newest and most inventive development in the field of energy harvesting is piezoelectric energy harvesting. The property of some materials known as piezoelectricity, most notably crystals and specific ceramics, to produce an electrical potential in response to applied mechanical stress. This could manifest as the separation of electrical charge from the crystal lattice.

The Greek verb "piezien" (which meaning to press or squeeze) is the root of the term "piezo," which signifies piezoelectric. The Curie brothers discovered quartz in 1880 and discovered that it altered its dimension when exposed to an electric field and produced an electric charge when pressure was applied. Since then, hundreds of ceramic and plastic materials have been discovered to possess piezoelectric characteristics. One of the main issues is capturing the energy from such piezo-based resources and making it accessible to the end users. The best piezoelectric materials are chosen for each application outof the more than 200 available for use in energy harvesting. Although lead zirconate titanate, popularly known as PZT, was the first piezoelectric ceramic discovered, barium titanate was the first to be discovered as a piezoelectric ceramic.

II. LITERATURE SURVEY

1) ***Foot Step Power Generation Using Piezoelectric Sensor(Anis Maisarah Mohd Asry ,Farahiyah Mustafa , Sy Yi Sim, Maizul Ishak , Aznizam Mohamad,2019).***

The present research uses a piezoelectric sensor to show how human locomotion generates electricity. Mechanical energy is transformed into electrical energy via the transducer.when the footstep applies pressure on the piezoelectric transducer.

2) ***Design of footstep power generator using piezoelectric sensors (Akshat Kamboj, Altamash Haque, Ayush Kumar, V. K. Sharma, Arun Kumar , 2017).***

The physical foot interface is laid on a chain sprocket arrangement and spring that is connected to piezoelectric sensors in the system described in this study. The sensors provide AC voltage, which is converted to DC supply by DC generators. The DC outputs are then stored in two batteries, one of which is six volts in capacity, which are coupled to an inverter that transforms 12V to 220V AC. The operating of a load will use the AC output power.

3) ***Power Generation for Auto Street Light Using PZT (Mrinmoy Dey Tawhida Akand and Sadeka Sultana, 2015).***

This study outlines the usage of piezoelectric plates, which create reasonable voltage when a vehicle applies pressure on them. Utilizing bridge rectifiers, the AC signal is corrected. A 12V battery is charged by the charging circuit, and this DC voltage is then converted to AC voltage by the inverter circuit. A dark sensor circuit detects the time of day and activates an inverter to turn on the street lights. This paper ensures the use of a step-up transformer to increase the voltage from 15 V AC, which a flip-flop converts to 12 V DC, to 250 V AC.

4) ***Power Generating Slabs: Lost energy conversion of human locomotive force into electrical energy (Rajesh Kumar Datta, Sazid Rahman, 2014).***

The paper describes a design that features an iron top plane on which the force of footsteps is applied. Helicalsprings are employed below the highest spot. The top plane is joined, and a rack and pinion assembly transforms the mechanical force into rotational force. Direct current is produced using a dynamo. A commutator is used to produce the dc current. A battery is used to store the generated voltage.

5) ***Electrical power generation using foot steps for urban area energy applications (Joydev Ghosh, Supratim Sen, Amrit Saha, Samir Basak, 2013).***

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III. PROPOSED SYSTEM

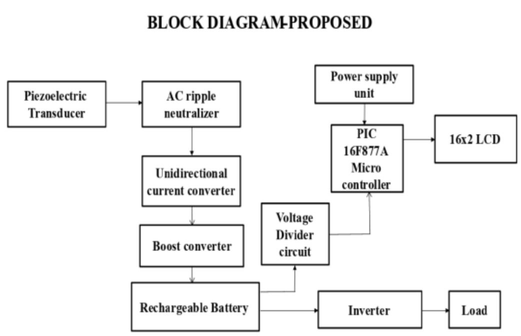

Figure1.Block Diagram

The proposed system was created to show power produced by human movement through a piezoelectric sensor and stored in a battery.

IV. SYSTEM DESIGN

The ceramic's structure and the force or stress applied to it determine this piezoelectric sensor's output tension.Alternating current is produced when pressure is applied to the piezoelectric sensor. The waves are removed with an AC ripple neutralizer.The current is transformed to flow in a single direction using a unidirectional current converter.The output voltage is raised using a voltage booster, which is kept in the battery.Voltage divider is used to supply reference voltage to the microcontroller.

The battery voltage is shown on LCD by the microcontroller. PIC 16F877A microcontroller is utilised to measure battery voltage in addition.A battery's stored output voltage is transformed into AC by an inverter and then given to the load.

V. EXPERIMENTAL SETUP

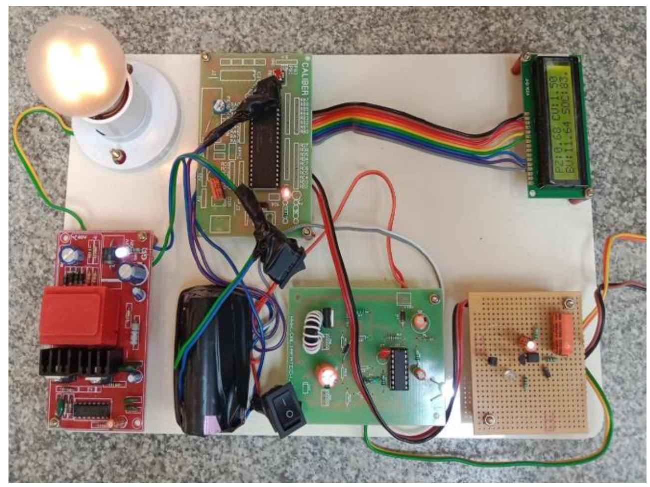

Figure 2(a). Snapshot Of Proposed Hardware Kit

Figure 2(b). Snapchat Of Proposed Hardware Kit

In figure 2(b) shows the upper and lower of this piezoelectric tile are separated by 16 cells of piezoelectric transducers. The piezoelectric transducer is positioned in the space between the two gaps of tiles.To collect the voltage produced by the 16 cell piezoelectric transducers during those activities, the participants are required to perform foot pressing or pumping actions on this piezoelectric tile.The output of the piezoelectric sensor is filtered using this circuit to remove any AC ripple or noise. The unidirectional current converter circuit is then supplied with the output from this circuit.

The output of the piezoelectric sensor is filtered using this circuit to remove any AC ripple or noise. The unidirectional current converter circuit is then supplied with the output from this circuit.The AC output from the AC ripple neutralizer is converted into a DC output using this circuit. The boost converter circuit is then given the output from this circuit.

The voltage of the DC output from the unidirectional current converter is raised using the boost converter circuit. The rechargeable battery receives the circuit's output after that.The piezoelectric sensor produces energy, which is then stored by the rechargeable battery. The inverter circuit is then supplied with this battery's output.The inverter circuit is used to transform the rechargeable battery's DC output into an AC output. The load is subsequently fed with the circuit's output.

The device that uses the energy produced by the piezoelectric sensor is referred to as the load. It could be a light bulb or an electrical device.The voltage divider circuit is used to give the reference voltage to the PIC Microcontroller.It can be configured to change the output voltage as needed for the load. The output from this microcontroller is then fed to the LCD. The stored energy in a battery is displayed on LCD.

V1. RESULT AND DISCUSSION

An inventive technique to harness the energy of walking is to use a piezoelectric sensor to generate energy with each footstep. It has the potential to be applied in a number of ways, such as powering street lamps, charging mobile phones, and reducing reliance on conventional energy sources.The technology is still in its infancy, so more study and development are required before it can be used widely.
The power stored in the battery is displayed on the LCD screen.

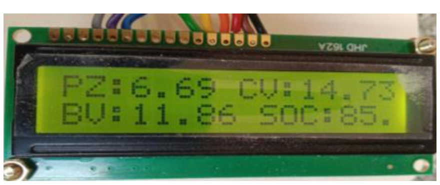

Figure 3. Status of Battery in LCD Display

PZ-Piezoelectric Sensor
CV-Constant Voltage
BV - Battery Voltage
SOC – State Of Charge

VII. FUTURE SCOPE

- Utilization of unused energy is very much relevant and important for highly populated countries in future.
- This project can be implemented in real time applications such as dancing floor ,exercise floor, malls ,etc.,

VIII.CONCLUSION

A promising idea for producing electrical power from the energy of human footfall is the foot step power generation employing piezoelectric sensor. This straightforward and economical technology has a wide range of uses, from powering tiny gadgets to large-scale energy infrastructures. This technology has the ability to completely alter how we produce electricity, reducing our reliance on fossil fuels and paving the path for a more sustainable energy future.

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