

Piezo Electric Based Energy Harvesting From Footsteps

M.Saranya¹, S.Selvarasu²PG Scholar, Department of ECE, Muthayammal Engineering College, Rasipuram, Tamilnadu, India¹Assistant Professor, Department of ECe, Muthayammal Engineering College, Rasipuram, Tamilnadu, India²

ABSTRACT: The method is to generate the electrical power from wasted mechanical energy. Here the generation of electrical power from footsteps by people walking. As low power and wearable electronic devices are more and more present in our everyday life, there is a growing need for the delivery of power to different points of the human body and power requirements of most modern electronic portable devices are decreasing, it becomes possible to use the energy harvesting from human body activity. The portable-energy sources must be associated with environmental issues and imposed regulations. These demands support research in the areas of portable-energy generation methods. The piezoelectric materials become a strong candidate for energy generation and storage in future applications. Electroactive β -polyvinylidene fluoride used as energy harvesting element, together with the electronics needed to increase energy transfer and storage efficiency. An electrostatic generator was also included in order to increase energy harvesting.

KEYWORDS: PIC microcontroller, LCD display, Dc converter, piezo electric power plant

I. INTRODUCTION

To generate the electrical power from wasted mechanical energy by people walking on the footsteps. As low power and wearable electronic devices are more and more present in our everyday life, there is a growing need for the delivery of power to different points of the human body and power requirements of most modern electronic portable devices are decreasing, it becomes possible to use the energy harvesting from human body activity. In order to power the electronic devices such as mobile, laptop and also to save the energy from the main power supply this energy harvesting system can be used, because in this project the wasted mechanical energy in the form people walking over the footsteps is converted into the electrical energy and it can be used in the commercial applications.

II. EXISTING SYSTEM

The use of piezoelectric polymers in order to harvest energy from people walking and the fabrication of a shoe capable of generating and accumulating the energy. In this scope, electro active β -polyvinylidene fluoride used as energy harvesting element was introduced into a bicolor sole prepared by injection, together with the electronics needed to increase energy transfer and storage efficiency. An electrostatic generator was also included in order to increase energy harvesting. The idea to use footwear to produce energy has been pursued for a long time. Several patents based either on electrical, mechanical, or piezoelectric systems have been registered. Conventional methods were used in order to fabricate the sole, with no modification of the industrial production process. Through the simple configuration and electronics, energy harvesting is possible. In order to get energy values suitable for the functioning of electronic appliances, improvements in the material, in order to improve electromechanical conversion, and in the readout electronics, in order to optimize the energy transfer, and the precise determination of the geometry and number of the piezoelectric generators should be performed.

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Disadvantages

- Energy losses is more
- Efficiency is reduced

III. PROPOSED SYSTEM

This project is to generate the electrical power from wasted mechanical energy. Here we are going to generate the electrical power from footsteps. Each piezo electric plate generates milli voltage. Here we construct the piezo electric power plant. This power plant is placed in the footsteps. Whenever the human go through the footsteps we get mechanical energy. This mechanical energy given to that piezo electric plant so we get electrical energy from that. This output is given to the DC to Dc converter (Boost converter). Here we use boost converter. In a boost converter there is a MOSFET in the boost converter. By switching the MOSFET we increase the voltage level. The PIC microcontroller is used to generate the PWM signal for switching the MOSFET. This pulse is given to the MOSFET via driver circuit. It provides the isolation between PIC and MOSFET. Here we use two voltage dividers for measure the output voltage of the boost converter and battery. This output is given to the PIC microcontroller. We get these details via the LCD display.

IV. SYSTEM FLOW DIAGRAM

PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory(both ROM and RAM)
- Some parallel digital i/o

Microcontrollers will combine other devices such as:

- A timer module to allow the microcontroller to perform tasks for certain time periods.
- A serial i/o port to allow data to flow between the controller and other devices such as a PIC or another microcontroller.
- An ADC to allow the microcontroller to accept analogue input data for processing.

Microcontrollers are:

- Smaller in size
- Consumes less power
- Inexpensive

Micro controller is a standalone unit, which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory.

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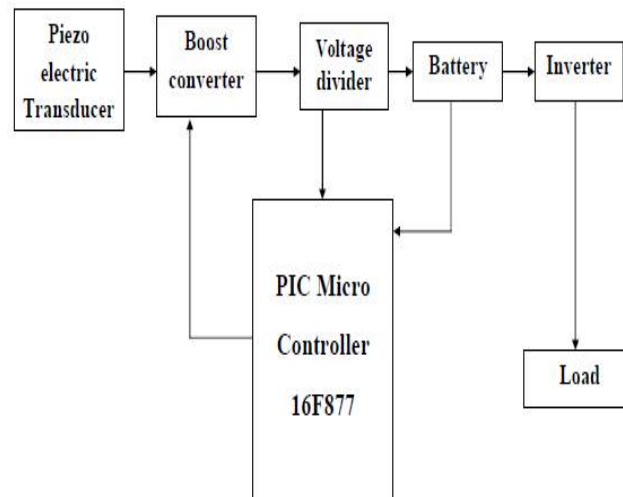


Fig 1: BLOCK DIAGRAM SETUP

V. PIEZOELECTRIC TRANSDUCER

A **piezoelectric transducer** is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. The conversion of electrical pulses to mechanical vibrations and the conversion of returned mechanical vibrations back into electrical energy is the basis for ultrasonic testing.

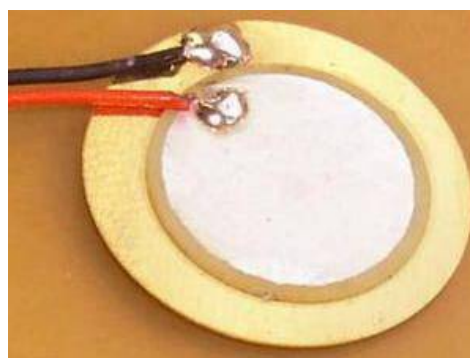


Fig 2: PIEZO ELECTRIC PLATE

The active element is the heart of the transducer as it converts the electrical energy to acoustic energy, and vice versa. The active element is basically a piece of polarized material (i.e. some parts of the molecule are positively charged, while other parts of the molecule are negatively charged) with electrodes attached to two of its opposite faces. When an electric field is applied across the material, the polarized molecules will align themselves with the electric field, resulting in induced dipoles within the molecular or crystal structure of the material. This alignment of molecules will cause the material to change dimensions. This phenomenon is known as electrostriction. This phenomenon is known as the piezoelectric effect.

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Additional information on why certain materials produce this effect can be found in the linked presentation material, which was produced by the Valpey Fisher Corporation. Piezoelectric Effect (PPT, 89kb) Piezoelectric Elements (PPT, 178kb) The active element of most acoustic transducers used today is a piezoelectric ceramic, which can be cut in various ways to produce different wave modes. A large piezoelectric ceramic element can be seen in the image of a sectioned low frequency transducer.

VI. WORKING PRINCIPLE

Piezoelectric transducers are made of both positive and negative elements that align themselves when in the presence of an electric field. This property causes them to actually change dimensions. When an alternating electric field is applied to the transducer, the material vibrates back and forth and produces an ultrasonic frequency. While most piezoelectric materials move back and forth between states, some are locked into their position and simply produce an electric current when mechanical forces physically move them.

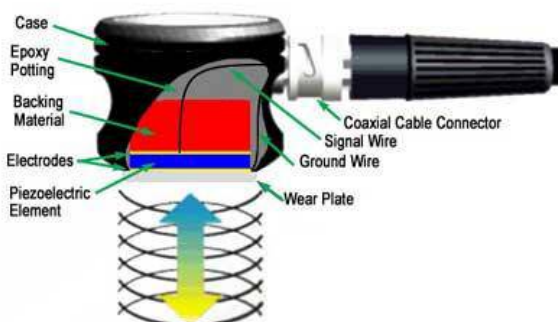


Fig 3: PIEZO ELECTRIC PLATE SETUP DIAGRAM

These types of piezoelectric materials are the foundation of ultrasonic sensors. Piezoelectric transducers were once made of piezoelectric crystals, but are now made of ceramic. They produce a wavelength that is twice the size of the element's thickness. Because of this, elements are cut to be $\frac{1}{2}$ the size of the desired wavelength. This also means that thinner elements produce higher frequencies.

VII. APPLICATIONS AND ADVANTAGES

Piezoelectric transducers are most commonly used to produce ultrasonic frequencies and are sometimes referred to as ultrasonic transducers. They are also used as pressure meters and can be used at traffic lights to detect traffic, in fluid systems to eject and pump fluids, and in speakers to produce sound waves. Piezoelectric transducers can also be used in printing, vibration control, and noise suppression for both industrial and military vehicles such as helicopters, launch vehicles, submarines, and space platforms.

ADVANTAGES

Piezoelectric transducers are advantageous because of their ability to convert electrical and mechanical energy. They are now made of ceramic because ceramic is malleable, low voltage, and has efficient piezoelectric properties. Ceramic piezoelectric transducers can also withstand temperatures up to 300°C, magnetic fields, and other natural conditions.

VIII. OUIPUT WAVEFORM

When a voltage is applied across a MOS structure, it modifies the distribution of charges in the semiconductor.

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If we consider a P-type semiconductor (with NA the density of acceptors, p the density of holes; $p = NA$ in neutral bulk), a positive voltage, V_{GB} , from gate to body (see figure) creates a depletion layer by forcing the positively charged holes away from the gate-insulator/semiconductor interface, leaving exposed a carrier-free region of immobile, negatively charged acceptor ions. See doping (semiconductor).

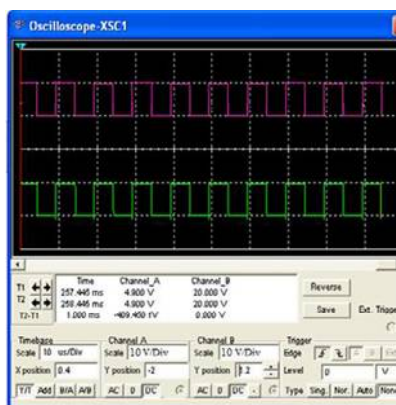


Fig 4: OUTPUT WAVEFORM

IX. CONCLUSION

There are several methods available to generate energy harvesting. For the energy harvesting from human energy, the piezoelectric materials associated with PIC microcontroller seems to be one of the most promising elements. The electroactive polymers based on β -PVDF have been used in order to fabricate an energy-harvesting system fully integrated in the footsteps. In order to get energy values suitable for the functioning of electronic appliances, improvements in the material and the precise determination of the geometry and number of the piezoelectric generators should be performed.

FUTURE ENHANCEMENT

This system no needs any external power for its operation and it generate the electric power from the wasted mechanical energy resources. So this feature makes the system to establish under the ground surface, so due to the pressure to the ground surface lot of electrical power can generated in future.

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