Power Generation by Piezoelectric Material

Abhishek Gaur[1] Aditya Pandey[2] Priyanka Agarwal[3]
[1,2,3]Department of Electronic and Communication Engineering
[1,2,3]Rajasthan Technical University, India

Abstract— In Footstep Power Generation, we proposed a power generation technique through piezo sense control generator framework that uses the piezoelectric sensors to sustainable power source that we can get while strolling on a specific course of action like venturing foot on a piezo tiles Nowadays energy and power are some of the basic requirements of this modern world. We can implement this leg phase power generation system by generating additional power by heat and it can be achieved by the load. Here we make use of the piezoelectric sensor on which when pressure is applied, voltage is generated. Depending on the voltage requirement the number of sensors can be increased. This can be used directly to small appliances or can be stored in a battery and then be used. We should study the current methods of footstep power generation which are rack and pinion arrangement and piezoelectric crystals and are about to modify the existing system. Keywords: flagging, stairs, plate form, and footstep power generation system.

Keywords: piezoelectric sensors, Peltier Sensor, Footstep Power Generation

I. INTRODUCTION

This project includes number of simple setup and component that is installed under the walking or standing platform. Many commercial devices use manpower to produce electricity such as hand-crank generators, and paddle generators. These generators require long-term focused human effort, which may prevent the user from performing other tasks. By this time, it would not be wrong to say that the Sun was directly or indirectly supplying all of man's energy needs and that person was only using renewable sources of energy.

II. PIEZOELECTRIC SENSOR

A piezoelectric sensor is a device that converts them into electric charge to measure changes in pressure, acceleration, temperature, stress, or force using a piezoelectric effect.
Piezoelectric sensors are versatile devices for the measurement of various processes. They are used in many industries for quality assurance, process control, and research and development. Pierre Curie discovered the piezoelectric effect in 1880, but only in the 1950s did manufacturers begin to use the piezoelectric effect in industrial sensing applications. Since then, this measurement principle has been increasingly used and has become a mature technique with excellent inherent reliability.

They have been used successfully in various applications, such as tilt sensors in medical, aerospace, nuclear devices, and consumer electronics, or as a pressure sensor in the touchpad of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either plugged directly into additional holes in the cylinder head or the spark/glow plug is equipped with a built-in miniature pyroelectric sensor the rise of piezoelectric technology is directly related to a set of inherent benefits. Many piezoelectric materials have a higher modulus of elasticity than many metals and go up to 106 N / m / s. Even though piezoelectric sensors are electrical systems that react to compression, the sensing elements show almost zero deflection. This piezoelectric sensor gives ruggedness, an extremely high natural frequency and excellent linearity over a wide amplitude range.

Additionally, piezoelectric technology is insensitive to electromagnetic fields and radiation, enabling measurements under harsh conditions. Some of the materials used (especially gallium phosphate or tourmaline) are extremely stable at high temperatures, giving the sensors the ability to operate up to 1000 °C.

Tourmaline Shows piezoelectricity in addition to piezoelectric effect; It is the ability to generate an electrical signal when the temperature of the crystal changes. This effect is also common in piezochemical materials. In Piezoelectric Sensorics (2002) Gautsky presents a comparison table of characteristics of piezo sensor materials of other types

III. PELTIER SENSOR

It is the direct conversion of electric voltage through thermocouple and vice versa temperature difference. Thermoelectric devices create a voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, heat is transferred from one side to another, creating a temperature difference. At the atomic scale, an applied temperature gradient causes charge carriers in the material to propagate from the hot side to the cold side. This effect can be used to generate electricity, measure temperature, or change the temperature of objects.

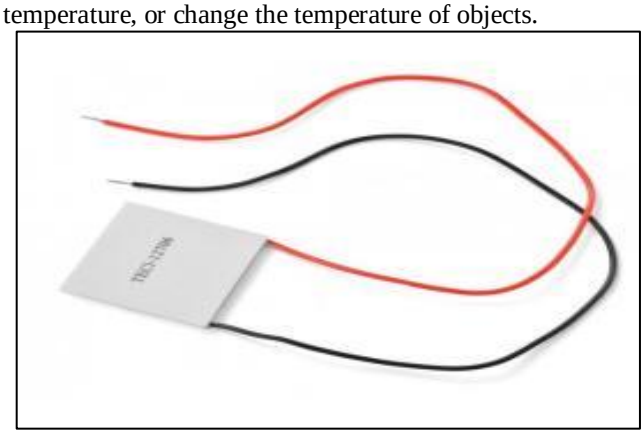

Fig. 1: physical image of piezoelectric sensor

Because the direction of heating and cooling is determined by the polarity of the applied voltage, thermoelectric devices can be used as temperature controllers.

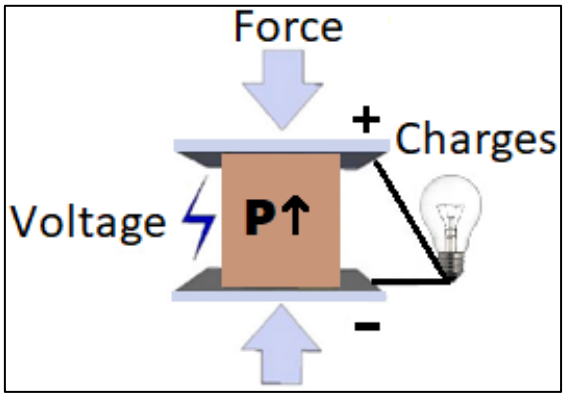

Fig. 2: diagramatic representation of piezoelectric sensor

The increase in energy consumption of those transportable electronic devices creates a replacement interest among the various renewable energy Americas in the human environment. In this project, I try to develop a power generator. This can remove vibration and energy from pressure on the market in another period. Two main materials are used for piezoelectric sensors: piezoelectric ceramics and single-crystal materials Ceramic materials (such as PZT ceramics) have piezoelectric constants/sensitivity that is approximately two times higher than those of natural single crystal materials and can be produced by inexpensive sintering processes. In piezocare, the effect of piezo is "trained", so their high sensitivity decreases over time. This decline is highly correlated with increased temperature.

IV. Power Generation Methods

A piezoelectric sensor is made of piezoelectric material (quartz-most commonly used). It converted mechanical stress into electric charge. The output of the piezoelectric sensor is AC. We need a complete bridge rectifier to convert it to DC.The output voltage of the sensor is less than 30Vp-p, you can feed the output of the piezoelectric sensor or store it in a battery or other storage device. The impedance of piezoelectric sensors is less than 500 ohms. Operating and storage temperature ranges are -20 ° C ~ + 60 ° C and -30 ° C ~ + 70 ° C respectively.

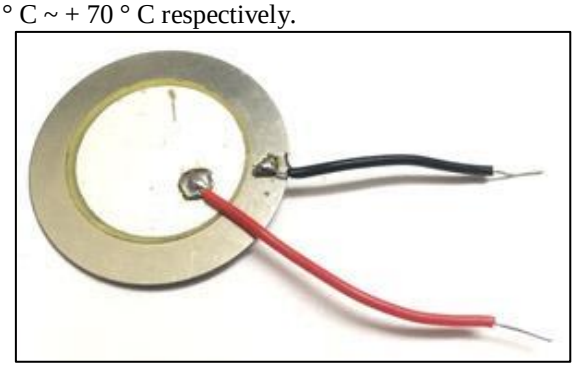

Fig. 3: piezoelectric sensor

Power generation from mechanical vibrations typically uses near-vibration oscillations, which use power-gathering equipment as an auxiliary degree energy supply, then converting it to auxiliary electrical energy to power alternative devices. Huh. The analysis in the following 3 sections has used mechanical vibrations to determine the amount of power and volume capable of generating power, starting from the digital energy philosophy to the wireless transmitter.

V. Proposed Architecture

The diagram of the footstep power generation system is shown below. The larger sprocket is coupled to the smaller cycle sprocket with the help of chains. This large sprocket is used to transfer the rotation force to the smaller sprocket. The smaller sprocket is moving in the same direction forwards and reverses the direction of the rotational movement of the larger sprocket.

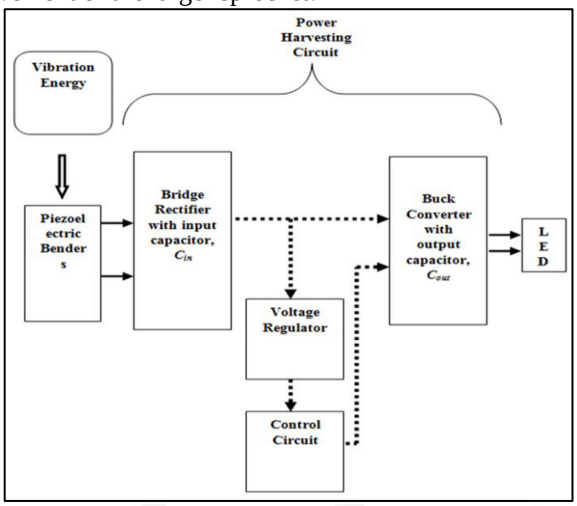

Fig. 4: block diagram of architecture

The pushing power is converted into electrical energy by proper driving arrangement. The rack& pinion, spring arrangement is fixed. The function of spring is to return the step in the same position by releasing the load. The pinion shaft is connected to the supporter by end bearings as shown in the figure.

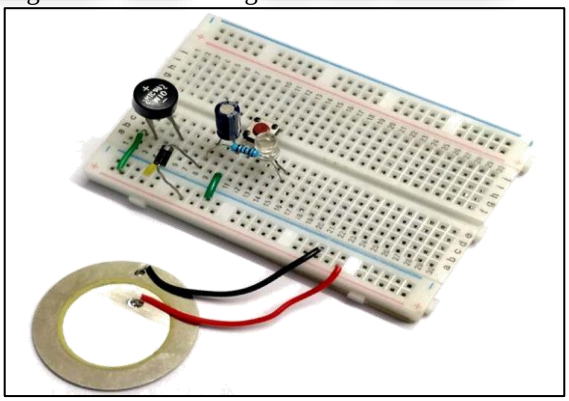

Fig. 5: circuit diagram of architecture

VI. Conclusion

Project work based on the idea of generating electric power without polluting the environment. Waste energy is used in the system as a human walk. The project "Steps Using Power Generation" is successfully tested and implemented.

References

[1] Prabaharan R, Jayramaprakash A, Vijay Anand. “Power Harvesting by Using Human Foot Step”- International

Journal of Innovative Research in Science Engineering and Technology, vol.2, issue 5, July2013

[2] Ramesh Raja R, Sherin Mathew."Power Generation from Staircase (steps)"- International Journal of Innovative Research in Science Engineering and Technology, vol.3, Issue 2, February 2013

[3] Power Generation Using piezoelectric Method

[4] Itika Tandon, Alok Kumar."A Unique Step towards Generation of Electricity via New Methodology"- International Journal of Advanced Research in Computer and Communication Engineering, vol.2, Issue 1, October 2013

[5] Kiran Boby, Aleena Paul K, Anumol. C.V, Josnie Ann Thomas, Nimisha K.K."Footstep Power Generation Using Piezoelectric Transducer"- International Journal of Engineering and Innovative Technology, vol.1 Issue 9, April 2013

[6] Jose Ananth Vino, AP."Power Generation Using Footstep"- International Journal of Engineering Trends and Technology, vol.1, Issue 1, May 2010

[7] Sandeep D. mendhule, Vilas K. Kanakai Dept. of Electronics &Telecommunication Engg. (sandeep.mendhule@rediffmail.com) Harvesting Electrical Energy from Footsteps, ISSN-2347-2200.

[8] Pramathesh.T, Ankur.s, Third year Electronics Engineering, Atharava College of engineering, Mumbai, India. (tpramathesh@gmail.com) Piezoelectric Crystals: Future Source Of electricity, ISSN: 2277-1581.

[9] Kiran Body, Aleena paul K,Anumol.C.V, Josnie Ann Thomas, Nimisha K.K , Dept. of EEE,Foot Step Power Generation Using Piezoelectric Transducers, ISSN:2277-3754.

[10] Pratibha Arun V, Divyesh Mehta, Dept of elec. & telecom. Eco friendly Electricity Generator Using Scintillating Piezo, PP.478-482

