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Power Generation Using Piezoelectric & Thermoelectric from Footstep Technique

Saranya L[1], Divya M[2], Kalki B[3], Pavithra P[4]
[1]Assistant Professor, Department of Electronics and Communication Engineering
[2,3,4]Student, Department of Electronics and Communication Engineering
Karpagam College of Engineering
Coimbatore, TamilNadu,India
saranyalece@gmail.com[1],divyamalai2k@gmail.com[2]

ABSTRACT:

In this paper, a foot step power generation technique is designed using piezoelectric sensors and thermoelectric plate. As recent technology is getting developed, the power requirements are also increasing. To overcome that, we use various methods to generate electricity. Here, we design a technique which is used to generate electrical energy from non biodegradable waste by burning it and also obtain energy from the Piezo electric sensors .The design methodologies is implemented, where people walks more like railway stations, busy streets etc, [4]. This design is carried out to generate electricity from Waste Materials, foot power and store electricity in battery to lighten the street lights.

Keywords: Piezo electric sensor, Thermo electric, Non-biodegradable, Electricity.

1. INTRODUCTION:

Due to the developments in the recent technologies, the world is moving very fast. The daily requirements are increasing day by day. The world's renewable power capacity has doubled in 10 years. 65 of 195 countries are using renewable resources for atleast 50% of their daily electricity. The need for electricity is getting increased for all the domestic purposes. In this paper, the electricity is generated by using piezoelectric effect. The design of footstep power generation using piezoelectric sensors and thermoelectric plate is discussed along with their merits, demerits, equipment and their requirements.

2. EXISTING SYSTEM:

In the existing system, the heat energy that is created from foot power generation and also the energy generated out of that has not widely used to generate the electricity, which is giving more importance to the other form of renewable energy sources like solar and wind. Here, the piezoelectric sensors are used to create electricity in foot power areas and doesn't consider the other forms of energy that is formed in the same foot power area.

3. PROPOSED SYSTEM:

To overcome the disadvantages through the present system and to utilize more electricity in proposed system, the thermoplates are introduced to convert the heat energy into electrical energy to compensate the loss. For a 1 deg Celsius, one thermoplate produces 0.08mA at 5VPiezo electric sensor which is one of the most important components of this design. When a

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pressure is given on this sensor it converts the vibrations in to electrical energy. In this design, fifteen piezoelectric sensors are arranged in a parallel combination and the output of the sensor obtained will be a AC component [1].

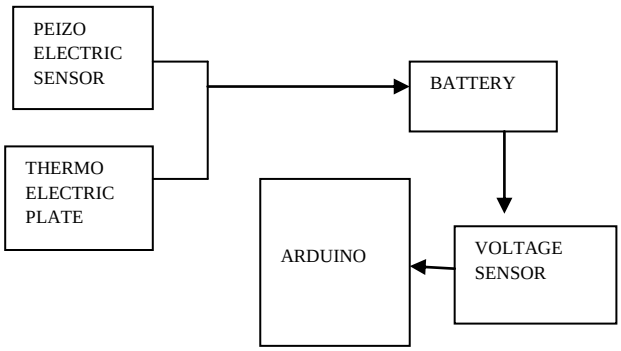

Figure 1: Block Diagram of Proposed Grid System

To convert it into a DC, the rectifiers are used through which the conversion from AC to DC is done and the charge is stored in capacitor [5].Thermo electric plates works on the principle of seebeck effect. When the Thermoelectric module is heated it generates the electricity. Here, the thermo electric module is used to overcome the loss of electricity due to heat. The output of the thermoelectric module is DC. The output of the piezoelectric sensor and thermoelectric module is stored in a battery for later use. To detect the amount of voltage in battery a voltage sensor is used and it is connected to arduino.LCD program is dumped in the arduino to display the voltage level of battery using LCD[7].

3.1.PIEZOELECTRIC SENSOR

When the technology is developing, all the facility necessities are conjointly multiplied for example when a person is walking he may result in some individual losses in Kinetic Energy. This device converts the energy in to a current. In this device a crystal is place between a electrodes on either sides. In crystal, the atoms aren't symmetrically organized. When we ironed, the positive charge moves upward and the charge moves downward. If we have a tendency to connect 2 wires across it, the positive charge pulls the negatron from the wire and the charges repel the negatron from the wire, thus it creates the electricity across the wire.

Figure 2: Piezoelectric Sensor

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The natural Piezo electric material includes, quartz, tourmaline which possess low electricity. The use of artificial materials like Lead zirconate titanate, Rochelle salt, lithium sulphate, dipotassium tartarate can generates more electricity[2].There are two types of piezoelectric effect: Direct piezo electric effect material which acts as a sensor converting mechanical energy in to electrical energy and in Reverse piezoelectric effect material acts as an actuator which converts electrical energy to mechanical energy. The Piezoelectric ceramics area unit is best-known for the area unit referred as the electricity and reverse electricity effects. The benefits of mistreatment electricity materials embrace high mechanical device transformation potency. The electric potential output is given by,

$$E=gt*(F/A)=gt*P.$$

Where,

g=voltage sensitivity(Vm/N)

g=K/t

K=piezoelectric constant

T=thickness of crystal

F=force applied

A=area of crystal surface

P=pressure=F/A

3.2. THERMOELECTRIC PLATE

The Thermoelectric generator works on the principle of Seebeck effect. Here a P type and N type semiconductors are connected in series and it is covered with thermally conducting plates on both the sides[6].If we heat at one side the other side gets cold, due to the temperature difference there will be an flow of electrical energy in the wire**.**

Figure 3: Thermoelectric Plate

In power station 2/3rd of energy is lost as heat. The fuel is burnt which produces heat energy then it is converted in to mechanical energy in turbine, and again it is converted into electrical energy in generator. Because of this, huge fuel is wasted and also it increases the

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carbon dioxide level in atmosphere [3]. But this thermoelectric generator (TEG) directly converts the heat energy in to electrical energy. They are also called as Thermoelectric coolers (TEC), Peltier module, Thermoelectric generators (TEG), Peltier tiles, Thermoelectric module, Peltier plates.

3.3. VOLTAGE SENSOR

A Voltage sensor is used to measure amount of voltage in a material. Input pins are Vcc and Gnd and the inputs can be AC or DC voltage. Output pins are Vcc, Gnd, analog output data. There are two types of voltage sensor: capacitive type and resistive type sensor.

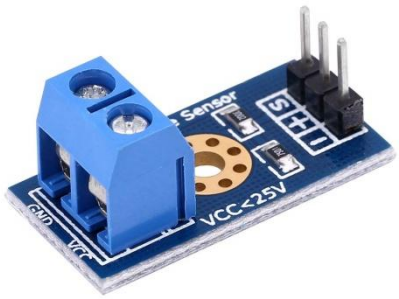

Figure 4: Voltage Sensor

3.5. ARDUINO

Arduino is a circuit board that makes microcontroller for easy use. There are many types of arduino like arduino UNO, arduino nano, arduino mega etc., Arduino UNO can be used to control motors, lightings, cameras. Arduino UNO use series of microcontroller called ATMEGA AVR, the piezoelectric oscillators are used to check how fast the microcontroller is running. The power to the arduino can be given either directly by USB cable or external 9V DC source, reset button is to reboot arduino programs, power pins is to power the arduino. Pins 0-1 is Tx and Rx, Pins 2-13 are for digital inputs and outputs and there will be 6 analog inputs and these measures continuous voltages from 0-5v.

Figure 5: Arduino

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3.6. LCD

Liquid Crystal Display (LCD) does not emit light instead it uses a backlight to produce image in color or monochrome. There are different types of LCD display: Monochrome, Multi color. The arrangement of LCD is Mirror-polarising film-glass filter-negative electrode-liquid crystal layer-positive electrode-glass filter-polarising film-cover glass. It is very compact, thin, low power consumption.

Figure 6: Liquid Crystal Display (LCD)

4. RESULTS &DISCUSSIONS

To overcome the drawback in the existing system additionally the thermoelectric plates are used which converts heat energy in to electrical energy which plays a vital role in power generation using footsteps. The output depends upon the quantity of sensors used and how much pressure is applied to it. The Hardware Implementation of Power Generation using Piezoelectric &Thermoelectric from Footstep Technique is shown in Figure 7.

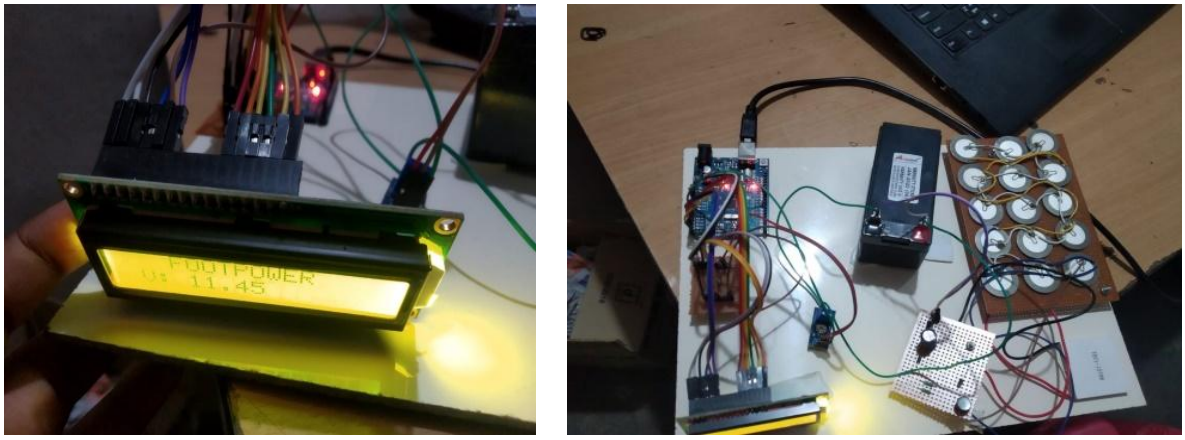

Figure 7: Hardware Implementation of Power Generation using Piezoelectric &Thermoelectric from Footstep Technique

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5. CONCLUSION

In this paper, a smart solution is developed which combines both foot power generation and heat energy conversion for an efficient design. Here, the design involves the generation of electrical energy from heat that is generated from the piezo electric sensor. The designed foot step generation technique is a long lasting methodology through which it supports the need of electricity usage especially in the domestic usages. The developed design can be placed under roads, dancing floors, pavements etc, which is very useful for generation of huge amount of electricity.

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