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Footstep Power Generation System

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Abstract: Man has used tremendous amount of energy for his daily needs. Therefore large amount of energy has been exhausted and wasted. Footstep power generation system is designed to be very useful at public places like railway stations where lot of people keep walking through all day. In the footstep power generation system the floor sensors capture the electrical energy produced by the pressure and convert it into electrical charge with the help of the piezo transducers which in turn is used as a power source. Thus the piezoelectric technologies is used in flooring. The power source thus generated has a vast amount of applications in home application, agriculture, street lighting and as a energy source for sensors in remote locations.

Keywords: Piezoelectricity, PZT, PVDF, Inverter, ARDIUNO UNO.

1.INTRODUCTION

Now a days electricity is an important one for human population. The demand of electricity is increasing every day. Meanwhile , electrical power has been used by various operation in the modern technology. The production of electricity leads to a huge amount of pollution. Now the gap between the demand and the supply of electricity made a path for the exploration of alternate sources of energy. The demand for the energy is increasing day by day as there is a tremendous increase in the human population. Since large amount of energy has been wasted there is a need for the alternate power generation. This drawback has been removed with the help of the footstep power generation system. The main principle of this power generation technology is piezoelectric effect. The piezo electric effect makes the materials to produce an electric charge when pressure and strain is applied to them. Thus when the pressure is applied the electric potential is produced by the materials with the help of the piezo electricity. The pressure exerted by the moving people is converted into electric current by the embedded piezoelectric material.

2.HARDWARE DESCRIPTION

1.. ARDUINOUNO:

Fig.1 ARDUINOUNO board

The **Arduino Uno** is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.Arduino UNO board consist of analog input pins (A0-A5), digital output pins (D0-D13), inbuilt ADC and Wi-Fi module connects the embedded device to internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated.

2. PIEZOELECTRIC CRYSTAL MATERIAL:

Piezoelectric materials belong to the group of ferroelectric materials. Ferroelectric materials made up of crystals and has polar character without an electric field being applied. The common effect in piezoelectric materials like PbTiO3, PbZro3, PVDF and PZT. The main part of the footstep power

generation is the piezoelectric crystal material. The selection of piezoelectric material is important. For analysis purpose here we are using two piezoelectric materials like PZT and PVDF. For various pressures applied there should be a better output voltage.In order to understand plot the V-I graph of PVDF and PZT material for output voltage corresponding to the various pressures applied. The piezo electric transducer is placed under a test on a piezo force sensor. For measuring voltages by using a voltmeter connected across both of them and measuring current by using an ammeter. Applying various forces on the piezo electric material, different voltage readings are displayed with respect to the force is applied. For each voltage reading across the force sensor, various voltage and current readings are noted.

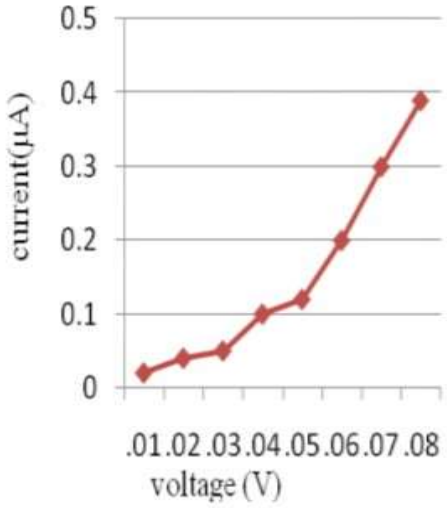

Fig 1: V-I graph of PVDF material

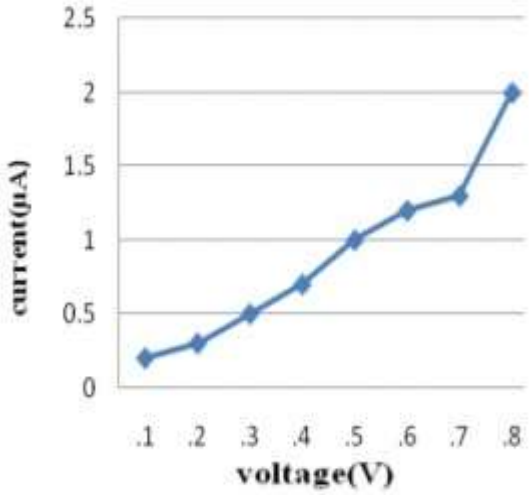

Fig 2: V-I graph of PZT

The output of PVDF is around 0.4V and PZT is around 2V.

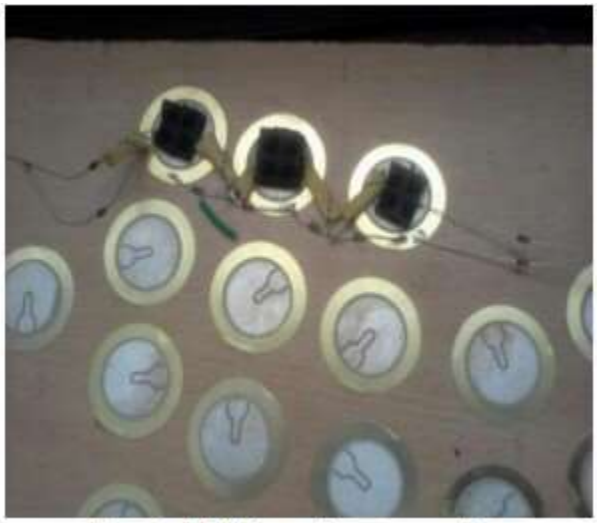

Fig .3: PZT in series connection

Three PZT are connected in series. In a series combination a force sensor and voltmeter is connected , corresponding voltage readings are noted across the series connection and the current is measured. The similar connections are done for parallel and series-parallel connections.

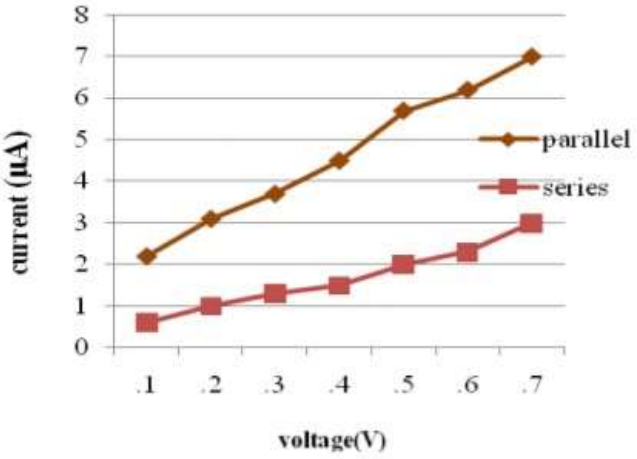

Fig 4: V-I graph of parallel and series connection

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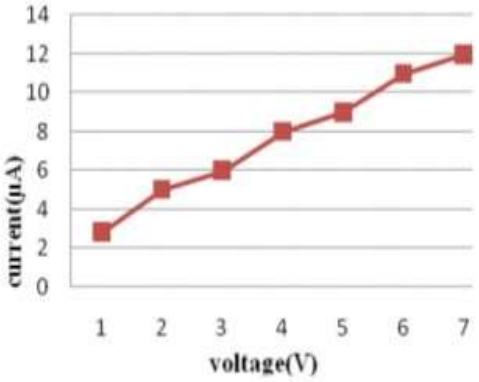

Fig 5: V-I graph of parallel and series combination

3.RELAY:

Relays are act as a switch that open and close circuits electromechanically. The function of relays control one electrical circuit by opening and closing in another circuit. A clear ON or OFF condition is provided by the electromechanical relays since the relatively large distance between contacts and it acts as a form of insulation.

4.INVERTER:

An inverter is an electronic device that convert the direct current (DC) to the alternating current (AC). The design of specific circuitry depend by the input voltage, output voltage, frequency and overall power handling capacity. The inverter does not provide power but the power is provided with the help of DC source. An inverter is dependent on the battery power during the runtime. The inverter has a vast amount of applications in power grid, solar, induction heating, electric motor speed control, etc.

5.MOSFET DRIVER:

A MOSFET driver requires a large amount of charge to drive the voltage up to the ON state and down to the OFF state. A MOSFET driver switches internally the higher voltage or current and allowing the MOSFET to switch faster.

3.HARDWARE IMPLEMENTATION:

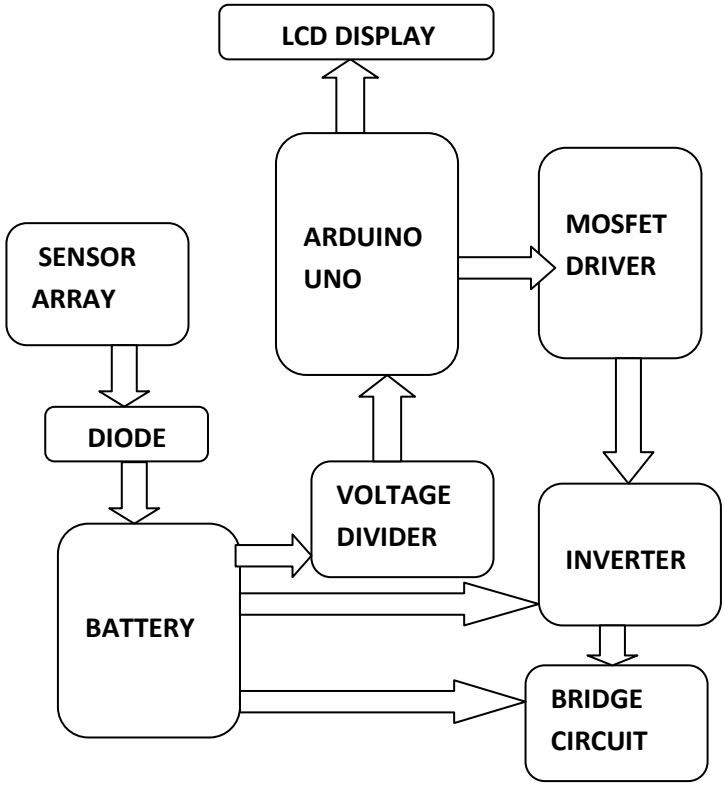

Fig 6: Hardware setup

The battery is supplied with the voltage generated from the piezo tile for recharging and supplying the dc loads. Generated voltage is given to an inverter and supplied to all the ac loads. The voltage generated across a piezo tile is displayed on the LCD by using ARDIUNO UNO.

4. WORKING:

The pressure applied to the piezo electric material convert it into electrical energy. The pressure can be given by the people walking over it. The output of the piezo electric material is not stable. Bridge circuit converts the variable voltage into a linear voltage. AC ripple filter is used to filter any fluctuations in output.

The output of the DC voltage is stored in a rechargeable battery. The output from a single piezo tile was extremely low, so combination of piezo tile is connected. Two possible connections are made – parallel and series connection. For parallel connection there is no increase in voltage , where as in series connection by using additional piezo tile there is increase in voltage. So we are using both parallel and series connection for producing 40V voltage with high current density. The battery is connected to an inverter to provide AC load. The output voltage can be seen in a LCD. For this purpose ARDIUNO UNO is used.

ARDIUNO UNO uses a crystal oscillator for this operation.

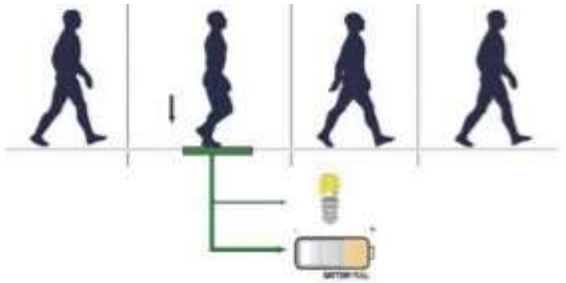

Fig 7: Schematic representation of the working model

Fig 8: Hardware module

In this circuit the IC CD4047 inverter is used. This inverter converts the DC voltage stored in the battery to AC voltage. Two pulse trains produced with the help of IC CD4047 phase shifted by 180 degree. A 12V supply is given to the two MOSFETs used in the inverter circuit. The MOSFETs are switched ON by using the output of the transistor. The output pulses are connected to a transformer, we obtain 220V Ac supply.

4. CONCLUSION:

A piezo film is capable of generating 40V. By doing a comparison between various piezo electric material that shows PZT superior in characteristics. Also by doing a comparison of series parallel combination is suitable. The voltage is generated by applying the pressure on the tile. The generated voltage is studied and we found a linear relation. The implementation of footstep power generation is used in crowded areas. We can also used in a street lighting without the help of power lines, charging ports, lighting of pavement side buildings.

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