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Generation of Electricity by Piezoelectric Transducer and Vibration Control

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***Abstract*— With the increase in energy consumption of the portable electronic devices, the concept of harvesting alternative renewable energy in human surroundings arise a new interest among us. In this paper we try to develop a piezoelectric transducer that can produce energy from vibration and pressure available on some other term (like walking).Piezoelectricity refers to the ability of some materials to generate an electric potential in response to applied pressure. In this paper we also introduce the new opportunities for control of vibration and damping in flexible structures which are generated due to acceleration cause by pressure. We focused on vibration and noise because they can short the life of any electrical and electronic equipment . In particular the paper present an overview of literature on piezoelectric transducer to generate energy and controlling the vibration and noise produced by discussing recent observation on feedback nature of piezoelectric shock sensor and damping system.**

Keywords: **PZT, PVDF, MOSFET**

I. INTRODUCTION

Brain Machine Interface (BMI) is a domain concerning recording, collect, communication, interpretation of the electroencephalogram. Electroencephalogram (EEG) is a one type of method it uses for the measure the brain activity and it is converted into electrical signal. Electroencephalogram is a record of the electric signal generated by the different corporative action of brain cells. EEG can be measured by means of electrodes placed on the outer side of scalp or directly on the outer side of cortex. It also called electrocorticogram (ECoG).In simple language EEG use for measurement the different type of brain voltage fluctuations as detect from outer side of scalp electrodes. In the EEG is a process depends upon six electrodes have been studied during the performance of five mental state (calculation, body moment, mental task, imagination, geometrical figure rotation, for which poor results had been obtained with autoregressive models before, were the principal objective of this project. brain computer interface (BCI) is used for reduce the human effort .in our project we design circuit for speed control of motor .only we can control the speed of brain concentration power. also we are control all home appliance by brain concentration power. we know the in India five Lakh people are totally handicap .they are not doing anything without hand and legs ,so we are design one prototype wheelchair ,it is control by only concentration power. Brian machine interface technique is used for all field electrical, mechanical, medical, and civil, computer and so on. Electricity production is the single largest source of pollution in the whole world. This technology is based on a principle called the piezoelectric effect, in which certain materials have the ability to build up an electrical charge from having pressure and strain applied tothem. Piezoelectricity refers to the ability of some materials to generate an electric potential in response to applied pressure. Harvesting of energy which means energy is already available, but is going to waste if not utilized. Embedded piezoelectric material can provide the magic of converting pressure exerted by the moving people into electric current.Vibration is generated as a result of mechanical disturbance from sources such as music/sound, noise, engine, wind and many more. Detection of vibration is an important sensor technology for monitoring the operation of machines, bridges and buildings, warrant of security, prediction of natural disasters and more. With scientists' exploring and researching, and accordingly the test methods and the types of sensors are evolving and maturing.

II. RESEARCH ELABORATIONS

A. Study Of Piezo Materials

Piezoelectric ceramics belong to the group of ferroelectricmaterials. Ferroelectric materials are crystals which are polar without an electric field being applied. The piezoelectriceffect is common in piezo ceramics like PbTiO3, PbZrO3,PVDF and PZT. Here we do the comparison on the 2most commonly available piezoelectric material - PZT andPVDF, to determine the most suitable material was done. Thecriterion for selection was better output voltage for variouspressures applied. In order to understand the outputcorresponding to the various forces applied, the V-Icharacteristics of each material namely, PZT and PVDF wereplotted. For this the Piezo transducer material under test isplaced on a Piezo force sensor.

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Voltmeters are connectedacross both of them for measuring voltages and an ammeter isconnected to measure the current.. For each such voltagereading across the force sensor, various voltage and currentreadings of the Piezo test material are noted.

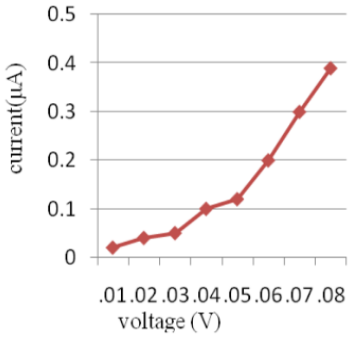

Fig 1: V-I graph of PVDF material

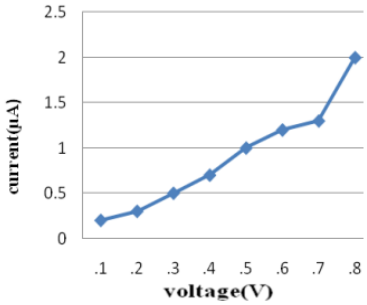

Fig 2: V-I graph of PZT

The voltage from PZT is around 2 V where as that ofPVDF is around 0.4V.We can thus conclude that betteroutput is obtained from the PZT than the PVDF.

B. Study of connections

Next to determine the kind of connection that givesappreciable voltage and current necessary, three PZT are connected in series.

Fig .3: PZT in series connection

A force sensor and voltmeter is connected to this seriescombination. As varying forces are applied on thisconnection, corresponding voltages are noted. Also the voltage generated across the series connection and the currentis measured. Similarly the connections are done for paralleland series-parallel connections are done and the graphs are asin figures 3 and 4.

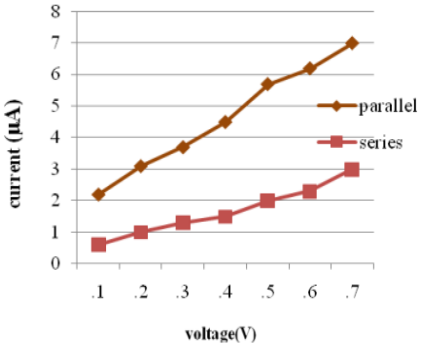

Fig 4: V-I graph of parallel and series connection

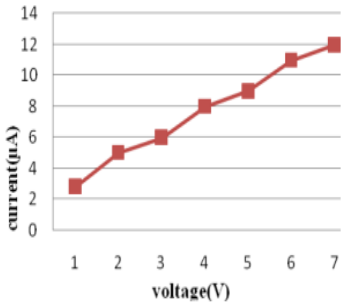

Fig 5: V-I graph of parallel and series combination

III. HARDWARE IMPLEMENTATION

The hardware set up is as shown in figure 6. A tile madefrom piezo material is made. The voltage generated across a piezo tile is supplied to a battery for it to recharge and supplythe dc loads.

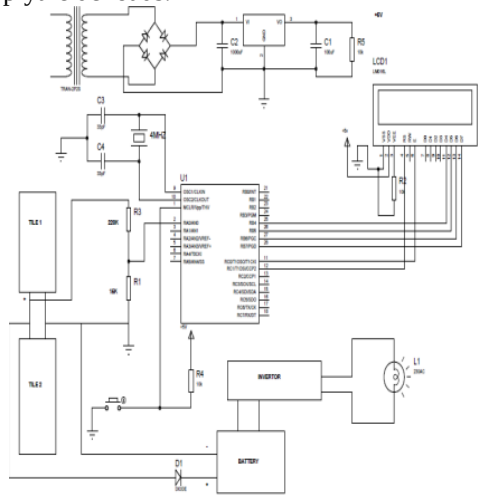

Fig 6: Hardware setup

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IV. WORKING

The piezoelectric material converts the pressure applied to it into electrical energy. The source of pressure can be either from the weight of the moving vehicles or from the weight of the people walking over it.When the flooring is engineered with piezo electric technology, the electrical energy produced by the pressure is captured by floor sensors and converted to an electrical charge by piezo transducers, then stored and used as a power source. The output of the piezoelectric material is not a steady one. So a bridge circuit is used to convert this variable voltage into a linear one. As the power output from a single piezo-film was extremely low, combination of few Piezo films wasinvestigated. The output of the microcontroller is then given to the LCD which then displays the voltage levels.

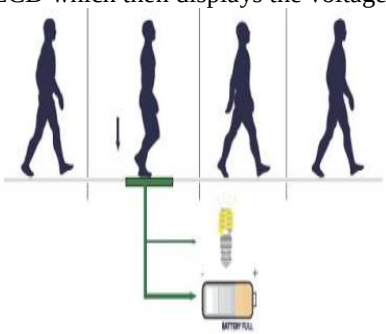

Fig 7: Schematic representation of the working model

Two pulse trains are used to switch transistors configured in common emitter mode producing pulse trains of 12V, which is capable of switching a MOSFET. The sources of the two MOSFETs used in the inverter circuit are supplied with a 12V supply. When the MOSFETs are switched on by the outputs of the transistors, two output pulses of 12V are obtained. These pulses are connected to a step up transformer from whose high voltage side; we obtain the 220V AC supply.

V. MAXIMUM THEORETICAL VOLTAGEGENERATED

When a force is applied on piezo material, a charge isgenerated across it.Thus,all equations governing capacitors can beapplied to it. In this project, on one tile, we connect 3 piezo inseries.10 such series connections are connected in parallel.Thus when 3 piezoelectric discs are connected in series, itsequivalent capacitance becomes:

$$\frac{1}{Ceq} = \frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3}$$

We know, $Q = C * V$

So, $C = \frac{Q}{V}$

Hence, $\frac{Veq}{Q} = \frac{V1}{Q} + \frac{V2}{Q} + \frac{V3}{Q}$

$$Veq = V1 + V2 + V3$$

Hence, the net voltage generated in series connection is thesum of individual voltages generated across each piezoelectric disc. Output voltage from 1 piezo disc is 13V.

Thus, Veq=V1+V2+V3
= 13+13+13
=39V

Thus the maximum voltage that can be generated across thepiezo tile is around 39V.

VI. CONCLUSION

The paper consist of the best economical, affordable energy solution to common people. This can be used in street lighting without use of long power lines. It can also be used as charging ports, lighting of pavement side buildings. we studied the behavior of piezoelectric materials under the influence of externally applied forces and electric current as well..In addition, based on the results gathered in this investigation, the fnal prototype design does fulfll the objective of generating electricity from piezoelectric transducer.. Due to the low cost design of the piezoelectric system it is a practical product which could increase the operating period of most common products. Simultaneously different methods of active vibration control using piezoelectric patches are also discussed in this paper.

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