Generation of Electrical Energy by Footstep Using Microcontroller

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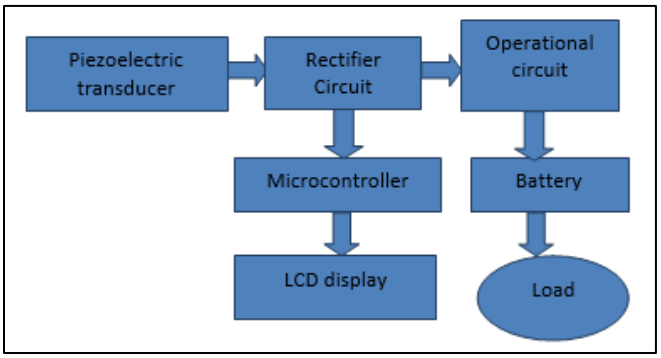
Abstract— In this project we are generating electrical energy by means of a nonconventional method just by walking on the footsteps. Non-conventional system for energies are very much required at this time. If this project is installed in highly dense areas such as railway stations, clubs, parks etc. then maximum amount of energy can be abstracted from it. By simply walking on footpath, electricity is generated. The designs were considered in relation to common morals. The project is able to perform basic tasks that reinforce important EE concepts in footpaths, hospitals, factories etc. This generated energy is, however, cost effective and nonhazardous for human. Footsteps are an untapped natural resources. Since this project is related directly to the human movement, the weight of the setup is a crucial factor.

Keywords: Piezoelectric Transducer, Rectifier Circuit, Microcontroller, Operational Circuit, Battery, LCD Display

I. INTRODUCTION

The process of producing electrical power from different types of energy sources is called electricity generation. This type of energy is an essential part of nature. We generate electricity (secondary energy source) by converting primary sources of energy like atomic, gasoline, coal, and other natural sources. Fossil fuels pollute the environment. Atomic power plant requires careful handling of both raw as well as waste material. The world has already used large amount of energy resources for power production. The extensive usages of available resources in recent years created a demand for the future generation. we ever thought that we could generate electricity with our footsteps? Walking is a widespread practice every day. A person transfers energy through impact or vibration to the road surface. This energy can be converted to electrical energy by subsequent conversion of mechanical energy. In this project, we have originated electricity through the human powered mechanical energy (Footstep).

Piezoelectric transducers are a type of electro acoustic transducer that convert the electrical charges produced by some forms of solid materials into energy. The word "piezoelectric" literally means electricity caused by pressure. Piezoelectric Transducer works with the principle of piezo-electricity. The faces of piezoelectric material, usual quartz, is coated with a thin layer of conducting material such as silver. When stress has applied the ions in the material move towards one of the conducting surface while moving away from the other. Piezoelectric igniters are commonly used for butane lighters, gas grills, gas stoves, blowtorches, and improvised potato cannons. Electricity Generation — Some applications require the harvesting of energy from pressure changes, vibrations, or mechanical impulses. A piezoelectric transducer is used for measuring non-electrical quantities such as vibration, acceleration, pressure and the intensity of sound.



Active transducers are those which do not require any power source for their operation. They work on the energy conversion principle. They produce an electrical signal proportional to the input (physical quantity). Piezoelectric, thermocouple, and photovoltaic cell transducers are some examples of active transducers. The piezoelectric materials possess advantages of high sensitivity, high resonance frequency, high stability, etc. The piezoelectric materials can produce only electrical response to the dynamic mechanics. One disadvantage of piezoelectric materials is that they cannot be used for truly static measurements. The working principle of a Piezoelectric Transducer is based on the fact that when a mechanical force is applied on a piezoelectric crystal, a voltage is produced across its faces. Thus, mechanical phenomena is converted into electrical signal.

Basic principle of the transducer is to use a current source (or voltage source and a voltage regulator) and an amplifier generates a voltage signal. The resistance of RTD sensor will be increased with the rising temperature.

II. LIST OF COMPONENTS

1) VOLTAGE REGULATOR (LM 7805)
2) RECTIFIER
3) LED
4) 1N4007
5) RESISTORS
6) CAPACITORS
7) PIEZO SENSOR
8) BATTERY
9) MICROCONTROLLER

1) Voltage Regulator (LM 7805)

As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level.

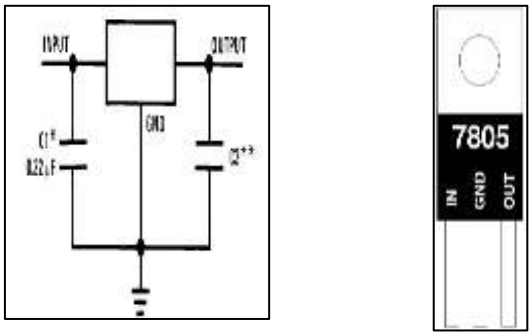


Fig. 2.1 VOLTAGE REGULATOR (LM 7805)

2) Rectifier

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability and full wave rectification.

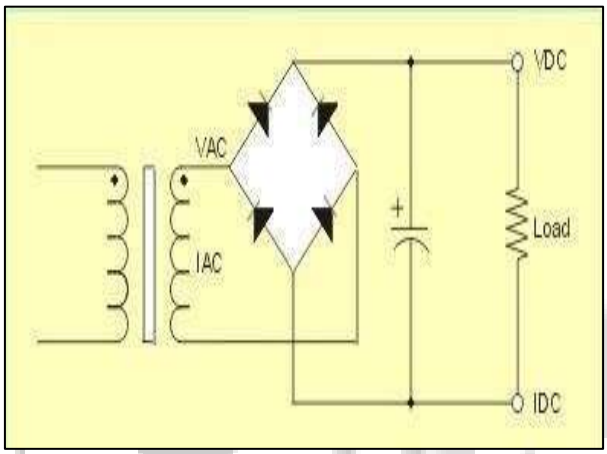


Fig. 2.2: RECTIFIER

3) LED

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting.

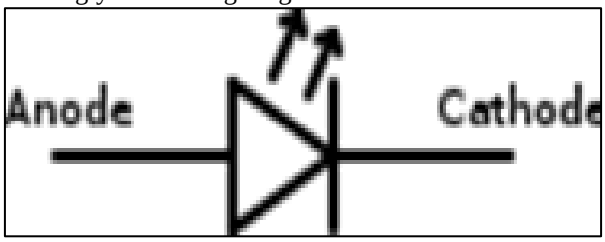


Fig.2.3 Symbol of LED

4) 1N4007

Diodes are used to convert AC into DC these are used as half wave rectifier or full wave rectifier. Three points must he kept in mind while using any type of diode.

- Maximum forward current capacity
- Maximum reverse voltage capacity
- Maximum forward voltage capacity

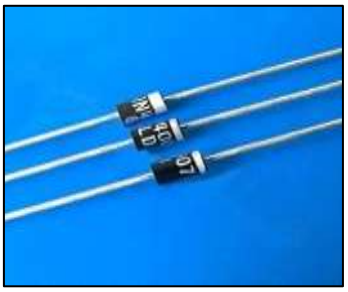


Fig. 2.4: 1N4007 Diodes

5) Resistor

A resistor is a two-terminal electronic component designed to oppose an electric current by producing a voltage drop between its terminals in proportion to the current, that is, in accordance with Ohm's law: V = IR

Resistors are used as part of electrical networks and electronic circuits.

Fig. 2.5: Resistor

6) Capacitor

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

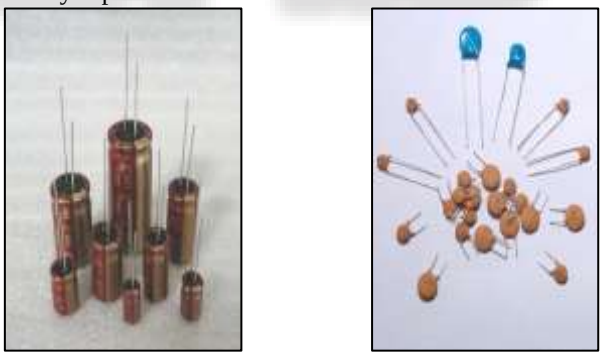


Fig. 2.6: Capacitor

7) PIEZO SENSOR

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal.

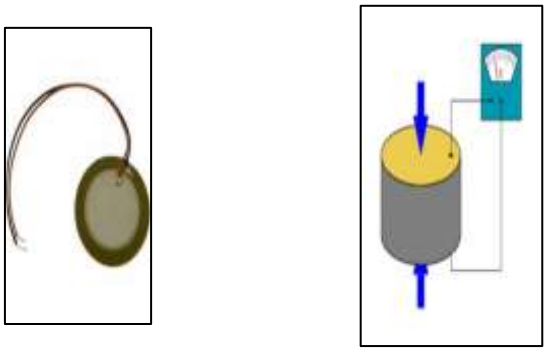


Fig. 2.7: PIEZO SENSOR

8) BATTERY

Battery (electricity), an array of electrochemical cells for electricity storage, either individually linked or individually linked and housed in a single unit.

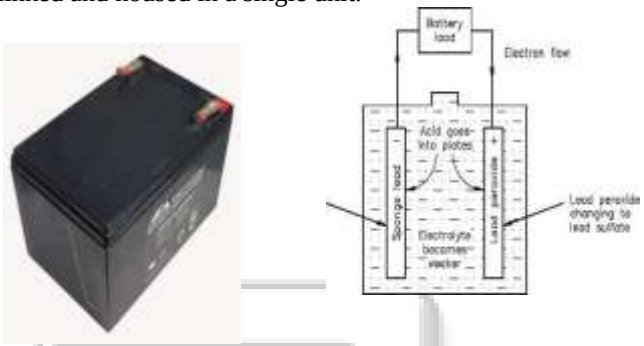


Fig. 2.8: Battery

9) MICROCONTROLLER

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input.

Fig. 2.9: Microcontroller

III. ADVANTAGES

- Reliable, Economical and Eco-friendly
- Compact and Highly sensitive
- No moving parts – long life
- Self-generating – no external power source required.
- Wide area of application (e.g.: footpath, staircases. etc.)
- No pollution including noise and air.

IV. MAXIMUM THEORETICAL VOLTAGE GENERATED

When a force is applied on piezo material, a charge is generated across it. Thus, it can beassumed to be an ideal capacitor. Thus, all equations governing capacitors can be applied toit. In this project, on one tile, we connect 3 piezo in series.10 such series connections areconnected in parallel. Thus when 3 piezoelectric discs are connected in series, its equivalentcapacitance becomes:1/Ceq=(1/c1)+(1/c2)+(1/c3)
We know,

$$Q=C*V$$

So

$$C=Q/V$$

$$Veq/Q=(V1/Q)+(V2/Q)+(V3/Q)$$

Thus,

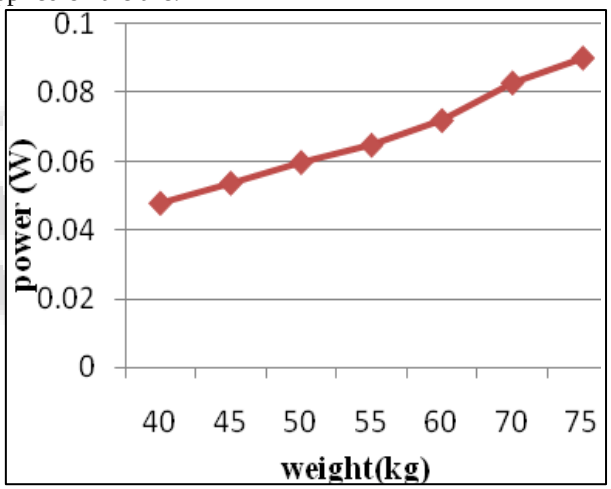
$$Veq=V1+V2+V3$$

Hence, the net voltage generated in series connection is the sum 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.

V. ANALYSIS ON PIEZO TILE

People whose weight varied from 40kg to 75 kg were made to walk on the piezo tile to test the voltage generating capacity of the Piezo tile. The relation between the weight of the person and power generated is plotted in figure 8. From the graph it can be seen that, maximum voltage is generated when maxi-mum weight/force is applied. Thus, maximum voltage of 40V is generated across the tile when a weight of 75 Kg is applied on the tile.



VI. RESULT/CONCLUSION

A piezo tile capable of generating 40V has been devised. Comparison between various piezo electric material shows that PZT is superior in characteristics. Also, by comparison it was found that series- parallel combination connection is more suit-able. The weight applied on the tile and corresponding voltage generated is studied and they are found to have linear relation. It is especially suited for implementation in crowded areas. 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. It will be a huge source of non-conventional energy. Nowadays, Non-conventional energy is becoming must since only by this we can overcome the crisis that is faced in using conventional energy i.e, fossil fuels like coal, petroleum, natural gas, etc. Once these resources are depleted, it takes another decade for restoration and hence the crisis of energy is formed. Producing electricity re-quires 67% energy source from fossil fuels which creates a great crisis specially coal and

petroleum. Thus is implementation may be helpful to meet this energy crisis.

REFERENCE

[1] Shubham kumar, Pankaj Kumar Yadav, Rishav Kumar, "FOOT STEP POWER GENERATION". International Journal of Mechanical Engineering and Technology (IJMET) Volume 7, Issue 2, March-April 2016, pp. 187–190, Article ID: IJMET_07_02_020.
[2] Iqbal Mahmud, "Electrical Power Generation Using Footsteps" European Scientific Journal July 2018 edition Vol.14, No.21 ISSN: 1857 – 7881 (Print) e - ISSN 1857-7431.
[3] Vishwanil V. Sarnaik, Akshay P. Karnewar, Akshay S. Jidge, Tejas P. Pawar ,"Footstep Power Generation" GRD Journal for Engineering | Volume 2 | Issue 7 | June 2017 ISSN: 2455-5703.
[4] Richard, Michael Graham, (2006-08-04)."Japan: Producing Electricity from Train Station & Ticket Gates". Tree Hugger. Discovery Communications, LLC.
[5] Manisha B. Kanawade, Amruta N. Jadhav, Rohini B. Jadhav, Prof. Kalpesh K Bamb ,"Foot Step Power Generation Using PIC Microcontroller",International Journal of Modern Trends in Engineering and Research e-ISSN No.:2349-9745, Date: 28-30 April, 2016.
[6] Mr.A.Adhithan, K.Vignesh, M.Manikandan, "Proposed Method of Foot Step Power Generation Using Piezo Electric Sensor", International Advanced Research Journal in Science, Engineering and Technology Vol. 2, Issue 4, April 2015.
[7] Nilsson J Thorstensson, a ground reaction forces at different speeds of human walking and running. Act Physiological Scandinavica. Vol 136.

