

PIEZOELECTRIC ENERGY HARVESTING FOR MOBILE CHARGING

**K. Priyanka^{*1}, R. Ajitha^{*2}, T. Priyadharshini^{*3}, B. Sowmiya^{*4},
M. Swetha^{*5}**

^{*1}Assistant Professor, Department Of Electrical And Electronics Engineering, Vivekanandha College Of Technology For Women, Tiruchengode, Tamil Nadu, India.

^{*2,3,4,5}UG Student, Department Of Electrical And Electronics Engineering, Vivekanandha College Of Technology For Women, Tiruchengode, Tamil Nadu, India.

ABSTRACT

In this paper, piezoelectric energy harvesting for mobile charging presented the based on piezoelectric sensors. Human race requires energy at very rapid rate for their living and wellbeing from the time of their arrival on this planet, because of this reason power resources have been worn out and enervated. Proposal for the employment and application of extravagant energy in foots of human is very much to the purpose for extremely populated nations like China and India. Where the streets, rail and bus station are over peopled and packed like sardines moving around the clock. So, using such concept the power can be availed and deployed by converting mechanical energy to electrical energy. Energy Crisis is the main issue of world these days. The motto of this research work is to face this crisis somehow. Though it won't meet the requirement of electricity but as a matter of fact if we are able to design a power generating floor that can produce 100W on just 12 steps, then for 120 steps we can produce 1000 Watt and if we install such type of 100 floors with this system then it can produce 1MegaWatt. Which itself is an achievement to make it significant.

Keywords: Piezoelectric Material, Sensor, Battery, Mobile Charging, Capacitor.

I. INTRODUCTION

Day by day, the population of the country increased and the requirement of the power is also increased. Energy wastage also rose in various ways at the same time. The primary solution is to restructure this energy back into a form that can be used. Electronic devices are being used more frequently as technology advances. Traditional techniques of power generation are becoming insufficient. This energy can be converted to electrical energy by subsequent conversion of mechanical energy. Whenever we move on our feet, our kinetic energy is wasted as heat energy. In this project, we have originated electricity through the human-powered mechanical energy. A different method of generating power is now necessary. In addition, energy is lost in numerous ways, including through human locomotion. The piezo electric sensor can be used to transform the wasted energy into a form that can be used to solve this issue. This can be used for many applications in rural areas where power availability is less or totally absence. This sensor converts the pressure on it to a voltage. This project is used to generate voltage using footstep force. The proposed system works as a medium to generate power using force. For this purpose, piezoelectric sensor is used in order to measure force, pressure and acceleration by its change into electric signals. This system uses voltmeter for measuring output, LED lights, weight measurement system and a battery for better demonstration of the system. In another way, we are also saving natural energy resource.

II. EXISTING SYSTEM

Normally we use solar, wind, tidal to produce electrical energy and it needs large equipment and space also depends on some factor. It also depends on climatic factor such as temperature, etc. It emits pollution. So foot step energy will help to generate wastage in usable form with eco-friendly. It requires more space and cost effective. Maintenance cost also high. Energy source only available in particular time. If fault occur in this system, it affect environment as well as the human being. Sometimes it may cause fire accident. It requires transport facilities then it can install in a place. It creates more noise so it disturbs the people as well as animals and birds.

III. PROPOSED SYSTEM

The proposed an human powered transport has been in existence in forms like running, walking etc. machines led to the enhanced use of human power in an efficient manner. Energy of human locomotion can be converted to electrical energy with the help of promising technologies. In this system, there is a sub flooring block of piezo electric crystals, which imparts an electrical current when people walk across it. The pressure polarizes the crystal there by separating the centers of positive and negative charges. Application of voltage on the crystal produces mechanical distortion of the material. Direct piezo electric effect, which is the phenomenon of generation of voltage under mechanical stress is employed in the system. The application of mechanical stress produces an electric polarization which is proportional to the stress. If the crystal is short circuited, flow of charge can be observed during loading.

The USB charging converter convert 12V dc to 5V dc. It consist of IC-AD84064, capacitor, diode and LED. All of this component convert voltage to charge device like as Mobile, IPod, Tab, MP3 devices, and charger light etc. All the rechargeable equipment will be charged.

IV. BLOCK DIAGRAM OF PROPOSED SYSTEM

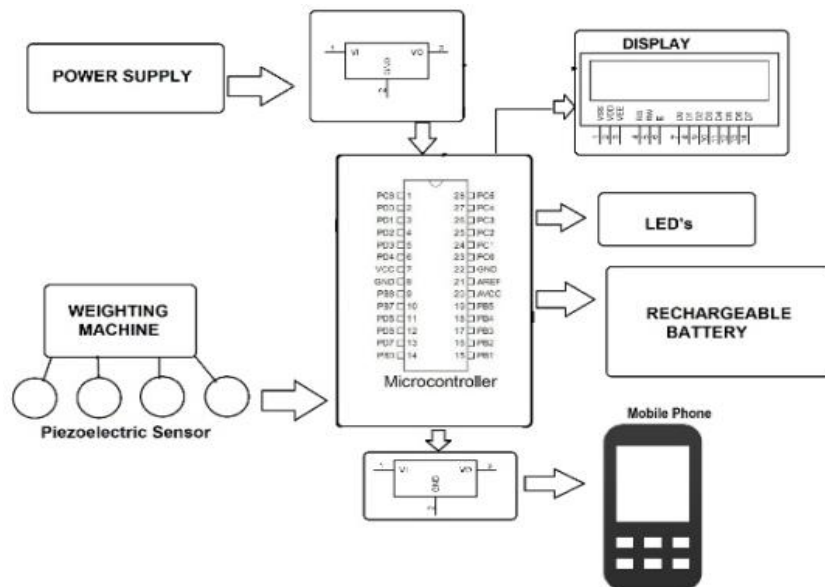


Figure 1: Block diagram of proposed system

The main components of the system include piezoelectric sensors, voltage boosters, voltage regulator, PIC microcontroller, battery, LCD display, LDR and a socket for mobile charging. The principle of working of the foot step power generation device is that if a person who weight's more than 60kgs is allowed to walk on the tile, develops a mechanical movement due to the compression of the springs below the upper tile. When the upper tile is pressed on to the piezo sensors connected in series and parallel, it produces an alternating current in the sensors for a few seconds or less due to the piezoelectricity. When the person walks or runs on the rubber corks or stubs which are placed on the piezo sensors increases the impact pressure applied by the upper tile. The LCD screen and Arduino MEGA 2560 microcontroller setup is used to know how much voltage is been stored by the battery and to count the number of steps that are applied on the tile. The program Code in C language is written to display the voltage stored per step and for the number of steps. In this system the power generated has been used for two applications such as lighting a street light and charging a mobile phone. A pull-down resistor is used in the socket to pull down the voltage to 5v. The power is generated by simply walking over a step. The system does not need any fuel input for its functioning this is a non-conventional system in which battery is used to store the generated power.

Arduino takes both analog as well as digital inputs. Normally supply to the Arduino board is given by USB cable through which the board is interfaced with the computer to dump the code to display the voltage. The 5V power supply is supplied to the Arduino board and to the LCD screen. Hence when a person walks or runs on the tile,

power is generated on the sensors and is stored in battery and at the same time power is supplied to the Arduino and the number of steps and voltage stored per step is displayed. This is the flow chart for the Arduino monitoring and display of the output from the footstep generator.

V. HARDWARE SPECIFICATION

a. Piezoelectric sensor

It is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. When a force is applied to a piezoelectric material, an electric charge is generated across the faces of the crystal. This can be measured as a voltage proportional to the pressure (see diagram to the right). A given static force results in a corresponding charge across the sensor.

b. Battery

It is a type of rechargeable battery, which uses lithium ion Phosphate as a cathode material. Li ion batteries have somewhat high energy density, light weight offer longer lifetime.

Some types of primary batteries used, for example for telegraph circuits, were restored to operation by replacing the components of the battery consumed by the chemical reaction. Secondary batteries are not indefinitely rechargeable due to dissipation of the active materials, loss of electrolyte and internal corrosion

c. Mobile charging

Designed the external circuit connection the as per the block diagram by using PIC16F677. The input of the PIC is given from the piezo electric crystal. The output from 15th pin of the PIC is given as a socket input.

d. Voltage booster

It is a DC to DC converter and output voltage greater than the input voltage. The device has at least two semiconductors and one energy storage element. It is a class of switched mode power supply.

e. Microcontroller unit

The main controlling unit of the entire system is a microcontroller. The input of the microcontroller is the output from the voltage generator. For the project PIC8F4520 is used. The filter used removes the AC components from the output voltage of the sensor. It acts like a short circuit for ac voltage and open circuit for dc voltage. A LCD display is interfaced with the microcontroller.

f. LCD display

A Liquid-Crystal Display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary image is made up of a large number of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

g. Arduino Uno

The Arduino is a microcontroller board based on the ATmega328. Arduino is an open-source electronics prototyping platform and it is intended for designing, creating interactive objects or environments. Arduino boards are relatively inexpensive compared to others microcontroller.

VI. RESULTS AND DISCUSSION

Figure 2 explains the way in which the foot force is converted into electric power and stored in battery. Figure 3 shows the power storage battery which the mobile is charging.

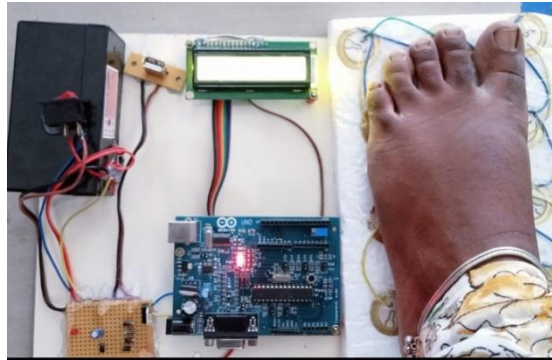


Figure 2: Output energy and battery storage

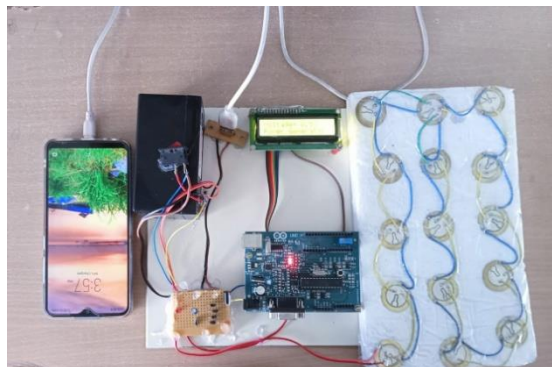


Figure 3: Mobile charging.

VII. FUTURE SCOPE

Utilization of wasted energy is very much relevant and important for highly populated countries in future. The proposed work portrays the concept of Piezoelectric Energy Harvesting and the results obtained after the implementation are very encouraging. Future work of the proposed idea encompasses further amplification of the crystal output to a greater extent. Future lies in the inclusion of advanced material used to design the piezoelectric crystal which further amplifies the crystal output in terms of voltage as well as current. A study could be carried out from the variety of piezoelectric crystals and after comparing the results, the choice of the optimum material for the best performing crystal could be devised.

a. Flooring tiles

People are walking on it. Under these tiles piezoelectric material is placed. When the movement is felt by the material, they can generate the electricity. This generated Japan has already started the use of piezoelectric effect for energy generation. They implement piezoelectric effect on the walking tiles. Thus, every time people step on the tiles; they trigger a small vibration that can be stored as energy. The flooring tiles are made up of rubber which can absorb the vibration. This vibration generates when energy is continually stored into the battery.

b. Dance floors

Some countries have started to experiment the piezoelectric crystals in night clubs. The floor will be compressed by dancer's feet and piezoelectric materials make contact there by generating power. The generated power can be in the range of 2W to 20W. The scope of our project is to build an Android application that helps the people, who used to live alone at home, in case of fall, the main feature of our system is to detect fall and inform relatives of the fallen about the fall incident, so that in time help can be provided to fallen.

c. Gym and Workplace

Some researchers are also working on the idea of utilizing the vibrations caused from the machines in the gym. At workplaces, while sitting on the chair, energy can be stored in the batteries by laying piezoelectric crystals in the chair. Also, the studies are being carried out to utilize the vibrations in a vehicle, like at clutches, gears, seats, shock- up, foot rests.

VIII. CONCLUSION

As India is a developing country where energy management is a big challenge for huge population. By using this project we can drive both A.C. as well as D.C loads according to the force we applied on the piezo electric sensor. 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 suitable. 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. As a fact only 11% of renewable energy contributes to our primary energy. If this project is deployed then not only we can overcome the energy crises problem but this also contributes to create a healthy global environmental change.

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