

# Use of Piezo Electric Sensor for Generation of Power

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**Abstract:-** In today's era we must think on the renewable energy sources such as solar light, water waves, wind speed & heat. We must think on the gadgets used by human beings in the day today life such as mobile phone, laptops etc. So for such appliances we must produce the energy which we are wasting daily. In this paper mechanical force created by all human beings is used for the generation of the electrical energy by using Piezo Electric sensor. This paper proposes the use of power created by foot pressure due to movement of living organism. When the Piezo transducers is placed inside the shoes of human being, due to the force/pressure applied by human leg on the Piezo crystal the AC voltage is produced across the Piezo crystal. This AC signal is rectified by the bridge rectifier with a filter & energy is stored in the lithium battery, this stored energy applied as energy source to various application such as agriculture, mobile charger and road light illumination.

**Keywords:-** Piezo Electric Sensor, Rectifier Bridge, & Mobile.

## I. INTRODUCTION

The energy collected from the renewable energy sources, which is easily available in nature. This energy is regenerated on a human timescale, such as solar light, wind speed, water waves. Renewable power generated is frequently used in various areas such as electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services [1].

As the property of Piezoelectric material exhibits the piezoelectric effect. This piezoelectric effect states that, "when mechanical force is applied on the Piezo crystal, the AC voltage is produced across it". Also it exhibits the reverse Piezo electric effect called as Anti Piezo electric effect, in which when electric field is applied to it the vibration are produced in the device. When force us applied on Piezo crystal, a changing of the positive and negative charge centers in crystal takes place, which is the result of the strong electric field across it. When reversed, an outer electrical field either stretches or compresses the piezoelectric material.

- **Advantages:**
- Highly Sensitive & have high frequency response.
- Self powered no need of separate power supply.
- Easy to use in electricity generation

Barium titanate and quartz can be made in any desired shape and form. It also has a large dielectric constant. The crystal axis is selectable by orienting the direction of orientation.

The Piezo electric sensors are used in various applications that involve the creation and recognition of sound, production of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies [2]. It is also the basis of a number of scientific instrumental techniques with atomic resolution, such as scanning probe microscopes (STM, AFM, etc). The piezoelectric effect also has its use in more routine applications as well, such as acting as the ignition source for cigarette lighters.

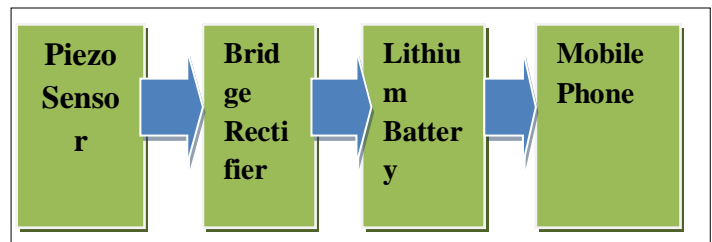


Fig 1:- Block Diagram Mobile charger

Piezoelectric ceramics is in the right place to the group of ferroelectric materials. Ferroelectric materials are crystals which are glacial without an electric field being applied. The piezoelectric effect is common in Piezo ceramics like  $\text{PbTiO}_3$ ,  $\text{PbZrO}_3$ , PVDF and PZT [4]. The project mainly consists of major device as Piezo electric transducer & rectifier. In this project it is important to select & use the number of Piezo crystal required for certain application, depends on the specification of the device which is to be operated. For this, I have done the an analysis on the 2 most commonly available piezoelectric material - PZT and PVDF, to determine the most suitable material was done.

## II. LITERATURE SURVEY

Mrinmoy Dey proposed Energy consumption is a key pointer of expansion of the world. In the modern world it is necessity of large amount of electrical power to fulfill the current requirements, on other hand the sources of conventional energy are losing ground due to excess use of

consumption of the energy. So, author Mrinmoy Dey has put the alternate source of energy which is non-conventional to provide the electricity by using Piezo sensor & keep the environment without pollution [1].

Dhananjay Kumar told the energy harvesting is an attractive field for the study now the universe is moving towards non-conventional energy source as an alternative for conventional. So author has mentioned in this paper the energy harvester prototype and the power conditioning circuit.[2]

Ashutosh Tiwari presented the research work on the crystal geometry of cantilever-based piezoelectric energy producing devices (EPD), which produce energy from pressure applied on the Piezo. The proposed system is based on the coupled piezoelectric-circuit finite element method (CPCFEM), previously presented by Dr. Zhu [3].

**III. WORKING METHODOLOGY**

It is based on human pressure and trotter movement of human ankle, mechanical stresses and voltages are used to generate power via the piezoelectric transducers which can be placed in shoe. With ankle movement during walking, the force is applied on the Piezo electric sensor kept in the shoes & due to this force AC electrical energy produced by a sensor. Then this AC signal across Piezo crystal is fed to a rectifier which will produce pulsating DC voltage required for mobile charging. The filter circuit is used for converting pulsating DC signals to pure DC form. Once we get Pure DC, then the current is magnified about 20 times with the help of current booster circuit. Finally with the help of voltage regulator 7805, the circuit will maintain constant voltage of 5V.

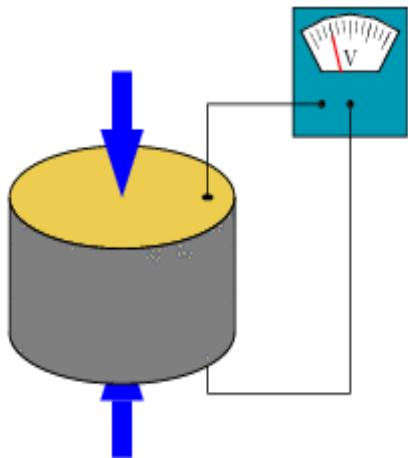


Fig 2:- Constructive view of Piezo Crystal

The series or parallel combination of Piezo crystal is connected as per our power supply requirement. To enhance a

current requirement I have connected the 10 Piezo crystals in parallel form & I used current booster.

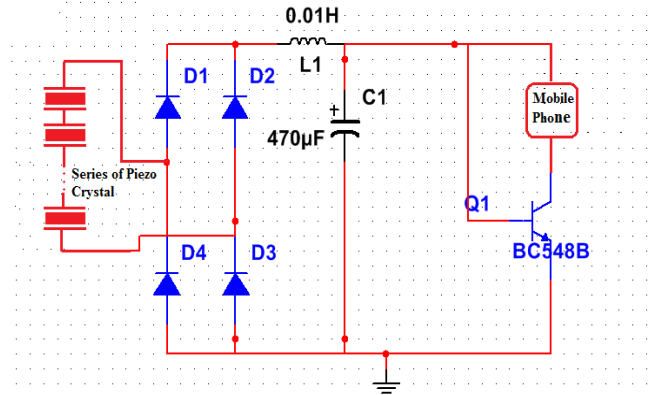


Fig 3:- Circuit Diagram Mobile charger

The output voltage produced by above figure 3 is efficient to charge the mobile phone or light the Led lamp in home.

**IV. EQUATIONS**

Voltage developed

$$\text{Voltage} = F * K * C$$

Where F = Force applied on Piezo, K= Dimensions of the Piezo and C = Piezo rating

**V. RESULTS**

Table 1: Voltage produced by Piezo Crystal PZT 51 connected 10 in parallel form & pressure applied in terms of Weight by keeping T and C constant.

Sr.No	F Pressure or Force (Kg)	K Thickness of the Piezo(µM)	C Piezo rating	Voltage Produced (V)
1	45	260	250	2.925
2	50	260	250	3.25
3	60	260	250	3.9
4	70	260	250	4.55
5	75	260	250	4.875

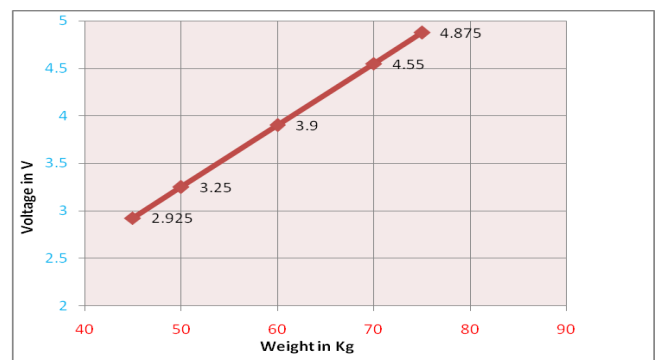


Fig 4:- Graph of voltage produced by Piezo Vs Weight applied

The 10 Piezo sensors are inserted into pair of shoes, which generates the power for each step & given by  
 Least voltage=1 V per step  
 Highest voltage=7.5 V per step

By understanding the average weight of person is 60 Kg, the force exerted due to 60Kg weight on Piezo produces the 1V charge in battery in 700 steps. So to charge battery of 12V it requires  $12 \times 700 = 8400$  steps.

## VI. CONCLUSION

This paper is effectively experimented & implemented for charging the mobile phone with the help of Piezo based shoes, which produces average voltage of 5V & current of 700 microampere. So this device is cost-effective to provide energy source for the human beings. Also this device is utilized by farmers while doing daily work they can charge their mobile phones also they can used to glow torch in night work.

## VII. FUTURE SCOPE

Power generated by Piezo electric generator can be transmitted wirelessly by using wireless power transfer (WPT). These devices works on the RF inductance method.

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