

# SOUND – A NEW FORM OF RENEWABLE ENERGY

**P.C Krishna Devi<sup>1</sup>, T Suganya<sup>2</sup>**

*<sup>1</sup>PG Scholar, <sup>2</sup>Assistant Professor, Computer Science and Engineering,  
SNS College Of Engineering, Coimbatore, Tamilnadu, (India)*

## ABSTRACT

*The lifetime of modern embedded systems and mobile devices depends on battery. It requires periodic recharging or replacement of these batteries for extending the working of such devices. Each time in order to charge these batteries an alternating current is necessary. Here we present sound as a new form of renewable energy for charging of these batteries to some extent. Sound energy can be converted to electric energy using piezoelectric material which exhibit piezoelectric effect. In our system we employ the direct piezoelectric effect.*

***Keywords – Alternating Current, Direct Piezoelectric Effect, Embedded System, Piezoelectric Material***

## I. INTRODUCTION

Due to the immense need of energy for various applications, researchers are mainly focusing on developing new and improved measures to meet this energy demand. Also with the invention of small and micro devices which need continuous supply of energy for its working, new measures to provide energy for satisfying their need is also an ongoing research topic. As a result energy harvesting from sound is a recent research trend. Sound to some extent can be used as a new energy. Charging of small embedded devices can be done to a certain extent using sound energy.

Renewable energy is generally defined as energy that comes from resources which are naturally replenished. Renewable energy sources exist over wide geographical areas in country to other energy resources. Rapid deployment of energy efficiency and renewable energy is resulting in significant energy security.

Sound energy when used as renewable energy makes large sound which is a nuisance for normal man a boon for him. Large amount of sound is produced around as daily. If this sound can be used for harvesting energy then at least one by fourth or 10% of the normal energy need can be met.

Renewable energy usually arises from natural sources that are constantly and sustainably replenished. The technology featured here will make the society healthier and secure. The prosperity of the human and their innovations will find a fast growing phase. Sound energy which is the upcoming trend in the energy world is a form of energy associated with vibrations or disturbance of matter. A sound is a mechanical wave and consists in oscillatory elastic compression and in oscillatory displacement in a fluid. Sound power or acoustic power is the measure of sound energy per time unit.

Since sound is the movement of energy through substances in longitudinal wave it is a form of mechanical energy. So in order to harvest sound energy some kind of piezoelectric materials need to be used. Piezoelectric material is another major concept behind sound energy harvesting.

## II. PIEZOELECTRICITY

Piezoelectricity is the electric charge that accumulates in certain solid materials in response to applied mechanical stress. The word piezoelectricity means electricity from pressure. The piezoelectric effect is a reversible process. In that materials exhibit the direct piezoelectric effect and also exhibit the reverse piezoelectric effect. Piezoelectricity is found in useful applications such as production and detection of sound.

The piezoelectric effect describes the relation between a mechanical stress and an electrical voltage in solids. The piezoelectric effect occurs only in non-conductive materials. The piezoelectric effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress. The unique characteristic of the piezoelectric effect is that it is reversible.

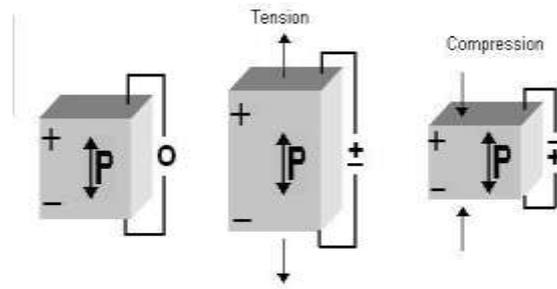
When piezoelectric material is placed under mechanical stress, a shifting of the positive and negative charge centers in the material takes place, which then results in an external electrical field. When reversed, an outer electrical field either stretches or compresses the piezoelectric material. The piezoelectric effect occurs only in non-conductive materials. The piezoelectric effect describes the relation between a mechanical stress and electrical voltage. It can be described as the link between electrostatics and mechanics.

A piezoelectric transducer is a device that transforms one type of energy to another by taking advantage of the piezoelectric properties of certain crystals or other materials. When a piezoelectric material is subjected to stress or force, it generates an electrical potential or voltage proportional to the magnitude of the force. These make the transducer ideal as a converter of mechanical energy or force into electric potential.

The high sensitivity of piezoelectric transducers makes them useful in microphones where they convert sound pressure into electric voltage. They are also used in non-destructive testing, in the generation of high voltages, and in many other applications requiring the precise sensing of motion or force. The voltage generated by piezoelectric transducers can be quite high, often in thousands of volts, but is brief, occurring only when the material is initially deformed.

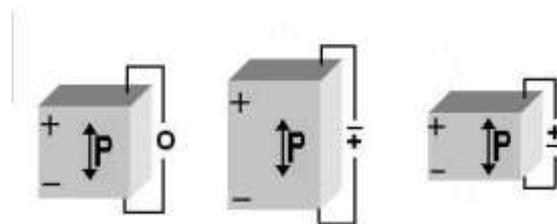
Piezoelectricity means “Electricity from pressure”. The so called “direct effect” means that piezoelectric materials develop charge if deformed by mechanical stress. The inverse effect in piezoelectricity is production of deformation due to the application of an electrical field.

When a crystal is mechanically strained, or when the crystal is deformed by the application of an external stress, electric charges appear on certain of the crystal surfaces; and when the direction of the strain reverses, the polarity of electric charge is reversed. This is called the Direct Piezoelectric Effect, and the crystals that exhibit it are classified as piezoelectric crystal.



**Fig. 1- Direct Piezoelectric Effect**

When a piezoelectric crystal is placed in an electric field, or when charges are applied by external means to its faces, the crystal exhibits strain, i.e. the dimension of the crystal change. When the direction of the applied electric field is reversed, the direction of the resulting strain is reversed. This is called as converse piezoelectric effect.



**Fig. 2- Converse Piezoelectric Effect**

The piezoelectric effect describes the relation between a mechanical stress and an electrical voltage in solids. The piezoelectric effect occurs only in non-conductive materials. Piezoelectric materials can be divided in 2 main groups: crystals and ceramics. The most well-known piezoelectric material is quartz ( $\text{SiO}_2$ ).

### III. PROPOSED WORK

Use of Renewable energy in charging battery is not a new concept. Recent advances in energy conversion have shown a great hope in this measure. Many researchers proposed solar, wind and heat due to their availability. Here, we propose a new source of energy namely sound or air pressure which can be easily used to charge batteries in embedded system

The proposed work is to present an effective method for producing useful electric power to charge the conventional battery from available sound energy around us from noises. Piezoelectric material is one of the most effective sound sensors. The way it works is that the mechanical energy of sound or air pressure is applied directly to a crystal with strong piezoelectric characteristics. The piezoelectric crystal will generate a small amount of voltage in response to the application of mechanical energy. If more number of piezoelectric materials is serially connected they can produce more amount of energy. So the amount of energy produced can be used for charging small devices. In order for the effective charging of small devices continuous supply of noise is needed. In our proposed system we are implementing a system so as to charge a cellphone when sound reaches the system from any means.

## VI. CONCLUSION

Energy harvesting or scavenging, which harvests or scavenges energy from a variety of ambient energy sources and converts into electrical energy to recharge the batteries and power electronic devices, has emerged as a promising technology. A new form of renewable energy i.e. sound is proposed as the new solution for the energy needs that arise in the developing world of technology.

## REFERENCES

- [1] SujeshaSudevalayam, PurushottamKulkarni, “Energy Harvesting Sensor Nodes: Survey and Implications”, Dec. 19, 2008.
- [2] Y. C. Shu and I. C. Lien, "Analysis of power output for piezoelectric energy harvesting systems", *Smart Materials and Structures* 15 (2006), pp. 1499-1512
- [3] Allen, J. J. & Smits, A. J. (2001). Energy harvesting eel, In: *Journal of Fluids and Structures*, Vol.15, pp. 629-640, ISSN 0889-9746
- [4] Guilar, N.; Chen, A.; Kleeburg, T. and Amirtharajah, R. “Integrated solar energy harvesting and storage.” *In: International symposium on low power electronics and design – 2006 (ISLPED '06)*, Tegernsee, Germany, pp. 20-24, 2006.
- [5] John JohnTherampilly, *Energy harvesting from multiple sources for Battery charging*. March 2012.
- [6] T. Dikshit, D. Shrivastava, A. Gorey, A. Gupta, P. Parandka, S. Katiyal, “Energy Harvesting via Piezoelectricity” , *proceedings of the 4<sup>th</sup>National Conference; INDIACom-2010*, 25 – 26 February, 2010.