International Journal of Engineering Research in Electronic and Communication Engineering (IJERECE) Vol 3, Issue 5, May 2016

Convertion of Available Sound Energy to Usable Electric Power

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***Abstract*— We all know everywhere there is huge scarcity of energy and for running most of our appliances and to carry out daily work we need electricity. It's really very difficult to imagine our life without electricity, our life would really stop so there is high need, to produce electricity at faster rate and find some other feasible method to produce electric energy. On the other hand we see that in this modern world there is lot of noise pollution in roads, airports, industries. Just think if we would be able to convert this noise pollution to electric energy....??? Yes this could be made possible let's see how. There will be many ways of converting the sound energy to electric energy but mainly we are concentrating on piezoelectric transducers in this paper. A small 9 volt DC battery was found to be fully recharged within half an hour from fully discharged stage using medium sound source through the proposed conversion circuit. In this way, random sound energy from numerous sources around us can be stored as electric energy which can be used later to deliver electric power to drive compatible small loads. The proposed idea can give a new source of green energy and can contribute in global search for renewable energy.**

Keywords-piezoelectric material, electric power, sound, super capacitor

I. INTRODUCTION

Sound is a mechanical form of energy which travel in the form of wave, mechanical wave that is an oscillation of pressure this pressure created by the sound could be used to convert it into electric energy or other form of energy. Also according to law of thermodynamics mechanical energy could be converted into electricity. Piezo material converts mechanical strain into electric energy this property of piezo material could be used to make a device which would be able to sustainably convert the sound energy to electric energy as piezo material convert sound energy to electric energy. Transducer is also used to convert mechanical energy to electric energy i.e.it can convert sound to electric energy the simple e.g. of use of transducer to convert sound to electric and vice versa is in speakers, headset also it could be converted into electric energy by other methods which we will see in the paper. in this 21st century electric power has very deeply indulged in our society can you imagine your life without your computer mobile lights and other daily used appliances ,it is really very hard to imagine our life without these electric appliance and all these appliances required electricity to operate. and as fast as these world population is rising and also due to the drastic progress of mankind day by day the electric consumption is increasing drastically on the other hand the production of electric power is limited it is not increasing to that extent due to which there is scarcity of electricity not only in india or particular region but across the whole world as development is taking place in a very high rate according to the METI long term vision ,proposed in 2005 ,the final energy will be mainly supplied by electricity towards 2050 for a low carbonated society. actually today, the demand of electricity is continuously growing in this world and set to be doubled by 2030.So it is necessary to increase the supply of electric power for that it is very essential for us to find other alternative methods to produce electric-energy...when we think of another method we think of solar energy, wind energy, hydro energy but we forget sound energy.in this century the most common thing we encountered everywhere (roads, airports, industries...) is noise pollution... so a point comes in our mind whether is it possible to convert sound energy to electricity??? And this waste form of sound could be converted and used for some productive purpose. Scientists are desperately searching for renewable and green sources of energy to produce electric power[9-10]. Till now, fuel is serving as the main source of electric power. Fuel combustion produces heat which in turn produces electricity through an electro-mechanical process. Minerals like coal, gas, diesel and uranium are commonly used as fuels as per fuel combustion chamber. These mineral sources are limited in earth and hence these sources are decreasing day by day because of using it extensively. So, searching is on for renewable sources of electric power that can meet the demand of future. Sunlight and air have already been proved as potential sources for

electric power and contributing in power generation through solar cell and windmill [1-3]. These two sources depend directly on nature and may not suit with weather of all regions. A relatively ignored and less discussed source is available sound energy around us in the form of noises which can be considered as a source for electricity if it can be effectively converted into electric power.

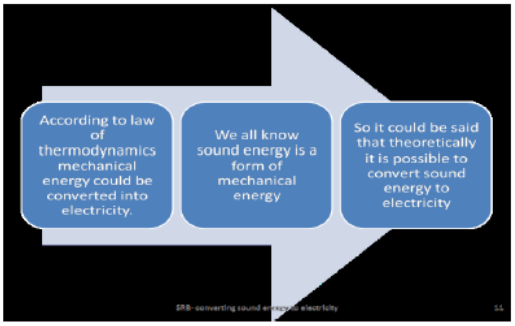

FIG I (a) converting sound energy to electric energy

So it could be seen that theoretically sound energy could be converted into electricity as shown in above fig I (a). Now let us see how it could be made possible.

II PRACTICALLY HOW IT COULD BE ACHIEVED

METHOD 1 -Suppose we create a very thin curtain like Diaphragm which will get fluctuated by the oscillation and pressure created by the sound wave and a conductor will be attached to it which will be placed between magnetic bars these fluctuation in the curtain will create a movement in conductor which will affect the magnetic field of the magnet this will generate motional EMF and will generate voltage across it. As per faradays law generated EMF is given by

Generated voltage = EMF =velocity of conductor X magnetic field X length of conductor.

Thus the oscillation created by the sound wave could be converted into electricity and as the frequency is high the movement will be fast due to it we will get appreciable amount of electric energy [6-7]. It would work similar as the working of turbine this type of device could be made, But its limitation will be that it will be efficient only in the place where high decibel of sound is available .for example nuclear power plant, industries using huge and noisy machines. The placing of conductor is shown in fig II (a).

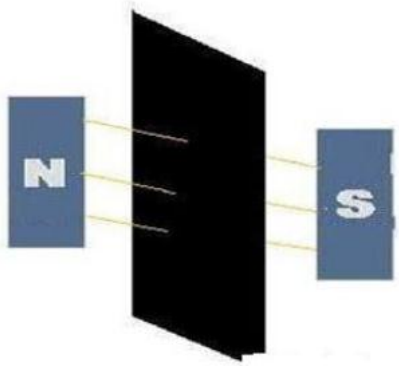

FIG II (a) conductor placed between magnets

METHOD 2- In this method we could convert sound energy to heat energy as sound wave travel by oscillating the particles of the medium so when sound energy travel through the medium it will disturbs the particle of the medium these disturbance created by sound will be used to convert it into heat energy as when the particles of the medium will be pushed by the sound wave it will collides with adjacent particle of the medium this collision will result in production of heat energy the production of heat energy will be more in the denser medium so for more heat production we will need a material with very high density. This heat energy will be converted into electricity. Conversion of energy is shown in fig II (b).

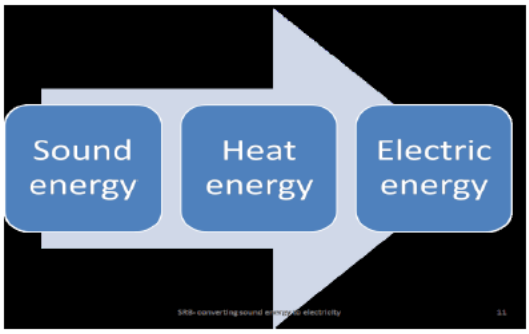

FIG II (a) convertion of sound to electric through heat energy

This method is less efficient due to more energy losses taking place while conversion of sound energy to heat energy and then heat energy to electric energy then the other methods. As here the conversion is done two times .you may think that according to Newtown's law energy can't be created nor destroyed it could be only converted from one form to another…so how there could be an energy loss. So while converting sound energy to heat energy there will be some loss of sound energy as some of the sound energy would be converted into another form also while converting from heat energy to electric energy all energy wouldn't be converted into electric energy some of the heat energy would get converted into another form of energy. And here as our main focus is to convert sound

energy to electric energy so conversion into other form of energy is loss of energy for us.

METHOD 3-Converting sound energy to electricity by piezo electric material (piezo electric materials are the crystal which convert mechanical strain to electric energy). Piezo electric materials are transducers its crystals could convert mechanical strain to electricity, The crystals are formed naturally e.g. quartz, bone, dna .whereas artificially ZnO , lithium niobatet Lead Metaniobate the sound energy could be converted into electricity using piezo electric material. Let us see the properties of piezo electric material. Below fig II (c) shows the piezoelectric material.

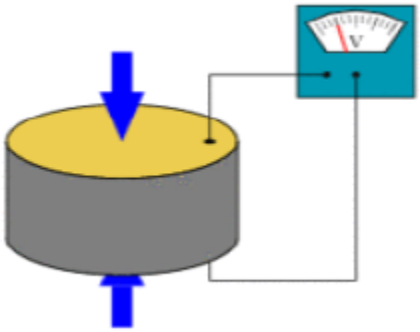

FIG II (c) piezoelectric material.

III METHOD AND RESULTS

A number of piezoelectric transducer acoustic-electric guitars (as shown in Fig. conversion of sounds into electric energy. piezoelectric transducers are small enough voltage across the transducer using medium also very small. In this experiment, a small sound source which was operated by a sinusoidal wave. The sound produces around 200 mV across the transducer. As this generated voltage is in ac form and noisy in nature, so a 1 farad super capacitor is used in parallel to the piezoelectric transducers for both filtering and storing the produced electric energy, as shown in Fig. III(a). The super capacitor also known as Electrical double-layer capacitor technology . Super capacitance values per unit energy density compared with high capacitance values, super between capacitors and battery 100F of charge storage, are batteries in applications delivery trumps that of total feature of super capacitor is, whereas discharge slowly because the farad value is greater than conventional value.

utilized in our proposed method Figure III(a). Full circuit set up for sound Figure III (b). Charging a rechargeable 9 V power from sound at the output of piezoelectric disk as used in this work for this work. or (EDLC) is a relatively new capacitors have the highest volume and have the greatest other capacitors. With their capacitors are bridging the Supercapacitors with up to emerging as an alternative to the importance of power energy storage. One important can be charged very quickly of their much larger value .This feature will be for producing electric power.

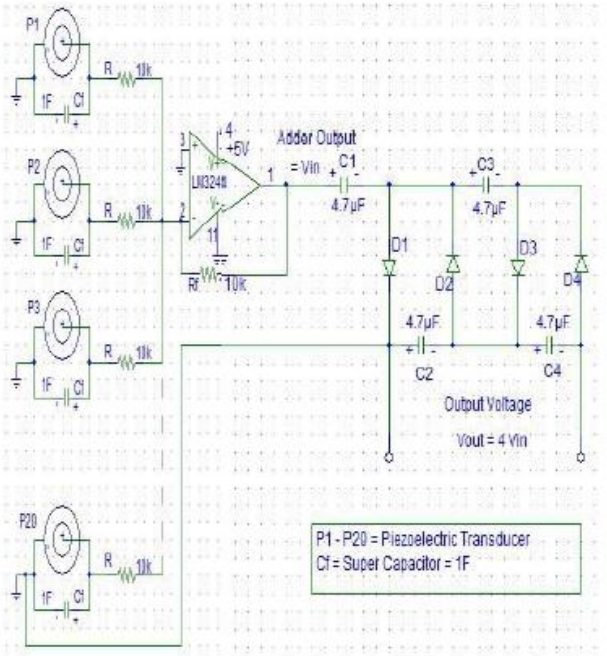

FIG III(a) circuit setup showing the conversion of sound energy to electric energy

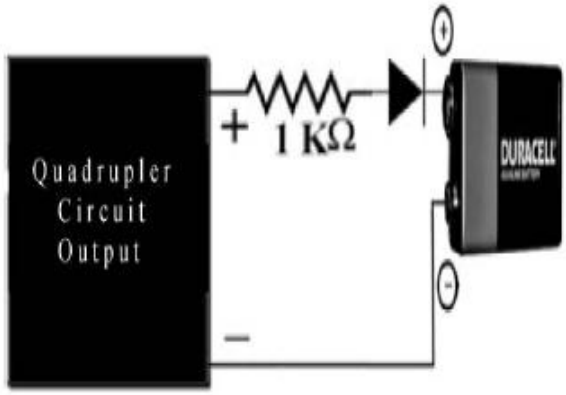

FIG III (b) Charging a rechargeable 9 V

Power from sound at the output of Quadupler circuit

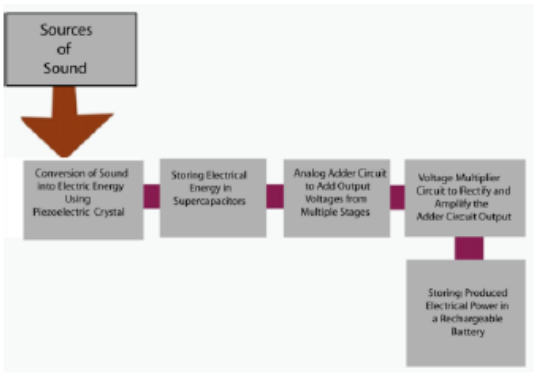

FIG III(c) block diagram of proposed system.

From sound energy. Due to its quick charging characteristics, super capacitor can effectively store momentarily produced electrical energy through piezoelectric material from available sound energy. Due to its slow discharging characteristics, it can hold this stored electric energy for a longer time than usual capacitors, hence output from multiple super capacitors can be added easily. In our proposed method, at first, sound energy generated from buzzer was used to produce small electric energy at the terminal of piezoelectric transducer. A 1 farad super capacitor of 5.5 volt is placed in parallel to the terminal of piezoelectric transducer to store this small energy. A number of this transducer-super capacitor parallel set up was constructed and their output voltages were added using a LM 324 Op Amp adder circuit, as shown in Fig. III (b). Measured output voltage for 20 transducers-super capacitors parallel set up was found to be around 4 volt which was solely the result from sound energy, More transducers-super capacitors parallel set up could be used but in that case the added output will exceed the highest saturation voltage of LM 324 Op Amp, as defined by the biasing voltage VCC = 5 V that we applied in our experiment. The output of the adder circuit was then fed to the input of a voltage multiplier (here, Quadrupler) circuit in order to increase the produced voltage level. The resultant voltage at the output of the Quadrupler circuit was measured to be around 12 volt which can now be used to charge a suitable rechargeable DC battery, as shown in Fig III (b). Here, a small 9 volt DC rechargeable battery was used as a test case. It was observed that the battery got fully recharged within half an hour from fully discharged stage through the proposed conversation circuit using only the buzzer sound. It was also observed that the Quadrupler output voltage varies with the frequency of the ac signal used to operate the buzzer. This is not surprising as piezoelectric materials are frequency sensitive and maintain a frequency range for their smooth operation. The complete circuit set up is shown in Fig III(C). The overall conversion process can be summerized in the block diagram.

IV CONCLUSION

- As sound has enormous amount energy with it, it could be used by converting it into electric energy for various purposes.
- Sound energy is a mechanical energy so according to law of thermodynamics mechanical energy could be converted into electric energy
- Sound energy could be converted by different Methods 1-by creating apparatus using curtain (diphagram) magnet and conductor.
- Methods 2-by converting Sound energy>heat energy and then heat energy>electric energy or
- Method 3-by using transducers such as piezo electric material which converts mechanical strain>electric energy and vice4 versa
- Piezo electric crystals are the crystals which converts mechanical strain to electric energy
- The strain applied to piezo electric material by sound energy could be converted into electricity
- In this aspect lot of research is to be done but on a positive note this could surely be done which could solve the energy problem of the entire world.

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