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A DESIGN OF PIEZOELECTRIC BASED MOBILE CHARGER USING SOUND ENERGY

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Abstract: In this project, a relatively less explored source of green energy that is sound energy is proposed. Random sound energy around us can be treated as a source of electric power after their efficient conversion using suitable transducer. An efficient method of producing usable electric power from available random sound energy is presented here. Piezoelectric transducers are used for conversion of sounds into electric energy. Piezoelectric is used to describe the materials that accumulate a charge as a result of piezoelectric effect. The resultant electric power was used to charge a mobile. By converting sound into electrical energy with the help of piezoelectric sensor a mobile can be fully charged. In the current condition only 11% of renewable resources are being used. Due to this project use of renewable sources would increase and the problem of charging a mobile in our day to day life will decrease.

Keywords: Piezoelectric material, Mobile charger, noise

I INTRODUCTION

In the current situation the need of renewable energy is rising. Until now, majority of power needs of the world relies upon the use of the non-renewable fuels. However recent estimates put the use of oil and coal up to 2030, after which the world will need to foster the need for a more efficient and widespread use of technology. The search for a renewable source of energy that can satisfy our growing need of energy is to be searched. Solar & wind energy have already been used as a source of renewable source of energy and are now being widely used as one of the replacement for non-renewable energy. However a largely ignored and more readily available source of energy is available in the form of sound energy. Sound as an alternative source of energy has a huge potential that has been left largely untapped as we further progress further towards using renewable and sustainable sources of energy converting the sound waves into electrical energy. The creation of energy through sound can thus be used in generation of electrical energy by one of the most readily available form of pollution. Piezoelectricity means producing electricity from sound or pressure. Piezoelectric effect is result of internal charge from vibration of sound.

In our project we have used the principle of piezoelectric sensors, PIC microcontroller, battery charging circuit, LCD display. By using piezoelectric sensor we can convert sound

energy into electrical energy. PIC is used to display which sensor is actively in use through LCD display. Extra additional photovoltaic cell is used for additional voltage requirement. The proposed method generates electrical energy through readily available sound energy. This technique not only helps in generating electrical energy from noise but also helps in reducing pollution. Electricity production with the help of noise as a source is a new concept. The generation of this energy can be done at airports, railway station at concerts where noise pollution is more. Therefore the production of energy from this available sound source can prove to be useful. This idea probes into the use of clean and readily available source of energy.

II RELATED WORK

One of the first to achieve this was the researchers from Los Alamos National Laboratory in collaboration with the Northrop Grumman Space Technology, USA [1]. They built a compact generator which used the movement of helium gas to generate sound waves that drives a piston to move a coiled copper wire [1]. However, as the sound in this case was artificially created to generate electricity, it does not transform naturally available or already available sounds and noises present in the environment into electricity. Also the use of a non-renewable source is not used in this case [2]. Another technique was the use of piezoelectric transducers to

convert sound into electrical energy. In this case, the sound generated by various sources was converted into electrical energy and stored in a 9V DC battery. However the use of piezoelectric material is costly and economically unviable for the purposes of generation. The technique used was noise filtering, and therefore there were excessive loss [1]. Table I highlights the literature survey about the various techniques of sound energy to electric energy conversion.

TABLE I Literature Survey

Sr. No	Paper	Author's	Technology used	Work done	Remark
1.	Converting sound energy to electric energy.	Shalabh Rakesh Bhatnagar	Piezomaterial, transducer, diaphragm	Sound energy is converted to electrical energy	Amount of conversion is very small and we require large amount of energy to convert it.
2.	Generation of Usable Electric Power from Available Random Sound Energy.	G.R. Ahmed Jamal, Hamidul Hassan, Amitav Das, Jannatu Ferdous, Sharmin A. Lisa	Piezoelectric transducers and super capacitors	Sound energy is converted by vibrations into electrical energy	The capacity of piezoelectric materials to receive any vibration and to convert that into electric signal
3.	Generation of Electrical Energy from Sound Energy	Mehul Garg, Devyani Gera	Compact Generator, Transformer	Sound energy is generated by using diaphragm and converted to electrical energy	This technique not only helps in generating electrical energy from noise but also helps in reducing pollution

Another technique that was used was using diaphragm. In this technique diaphragm was used to convert the available sound energy into electrical energy. In this technique as the sound falls on diaphragm it starts to vibrate. This creates a varying magnetic field which creates energy. The minimum

sound that was required to convert sound into electrical energy was around 87db.

Below figure 1 shows the block diagram of conversion of sound to electric energy conversion using diaphragm.

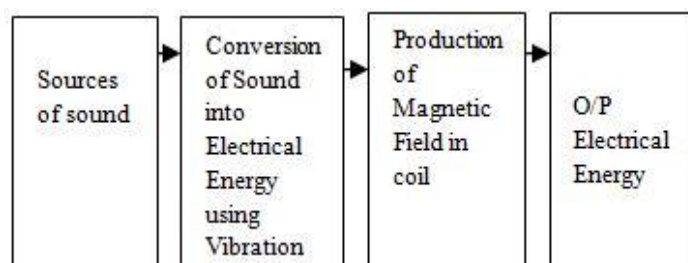


Figure 1 – Sound to electrical using diaphragm

III PROPOSED MODEL

In this method a piezoelectric sensor is used. This piezo electric sensor is used for converting the sound to electricity. Similarly two other renewable sources like wind and light are used. A wind turbine is used for converting wind energy to electricity and solar panel for converting light energy to electricity. Electricity can be generated directly from sound energy by piezoelectric effect. Figure 2 below is the block diagram which shows the conversion of sound energy into electric energy using piezoelectric material.

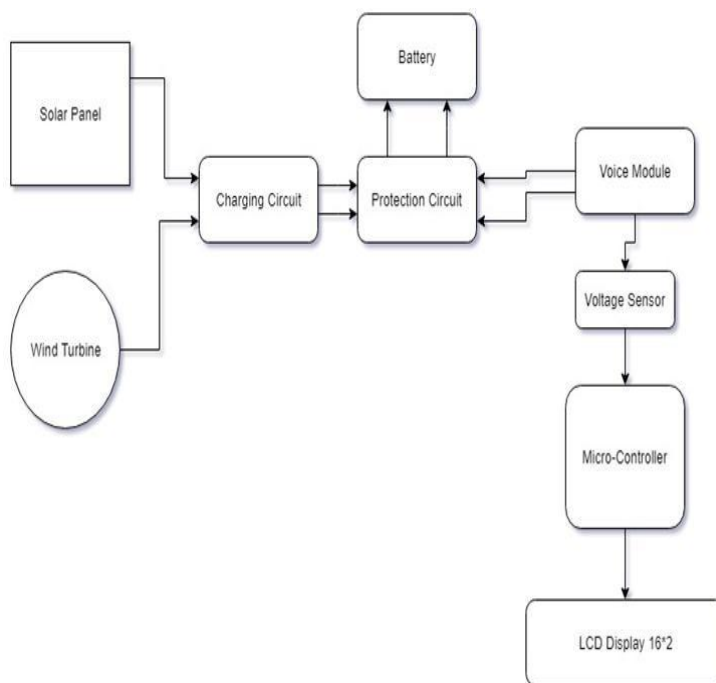


Figure 2 – Conversion to electricity using piezoelectric material, solar panel and wind turbine

In this project we are charging our mobile using sound, wind and light energy. The unwanted sound is the input for piezoelectric sensor. This piezo-electric sensor converts pressure

created by sound into electric energy. This energy is stored in the battery. Piezo sensor which is used in our project produces maximum voltage of 9V. The voltage varies with respect to dB level of sound. It senses the vibrations in sound and converts it into voltage. This generated voltage is displayed on the LCD. Further the generated voltage is then stored in battery. This is done by the battery charging circuit. It decides which input is selected on LCD display and respective voltage provided for charging the mobile.

Similar process is done with solar sensor. The solar panel takes light as input and converts it into electric voltage. Solar panel that we are using consists of 36 cells, where each cell produces 0.5 volts, so ideally we are generating 18 volts. The third source which is used is wind turbine. The wind turbine when rotates it generates electricity which is stored in the battery. When the wind turbine rotates LED glows. When the inputs are absent the mobile will be charged through this charged battery. This produced voltage is then stored in the battery. We can use the stored energy from battery to charge the mobile. When the battery is in utilisation mode the input provided generates electric voltage which is stored in battery and the mobile charges. For charging of mobile phone we need constant non-varying voltage and current therefore we used utilization mode in this project it simply supplies voltages that stored in battery. When the battery is in utilisation mode the electric energy is stored in the battery. PIC16F877A microcontroller is used in this project. PIC displays the name of project and the voltage which is produced. Choice of good piezoelectric sensor can reduce circuit complexity and it can give efficient output. We have taken readings of voltages from our project, with respect to different dB levels. As sound level varies continuously voltage produced also varies. When we tested our project we have considered four levels of sound. The voltage generated in busy traffic which is above 70db is 6v. The voltage generated due to loud music above 85db is 7v. The voltage generated above 95db due to diesel truck on highways is 8v. The voltage generated above 105db at concerts is 9v.

Table II Sound levels and Generated voltage

Sound level in dB	Voltage generated
72	6V
85	7V
96	8V
105	9V

IV ADVANTAGES

1. Does not require any external power supply.
2. Can store power in a battery.
3. Depending upon the generation it can charge the mobile.

4. Waste sound energy can be reused.
5. Even if the system charged excessively the system will not get affected.
6. Low cost system, providing maximum automation.
7. The system is more compact compared to the existing ones, hence is easily portable.
8. Low maintenance and low power consumption.

V DISADVANTAGES

1. Relatively more expensive.
2. More piezoelectric material is to be used.
3. Lots of work is to be done in this field.

VI APPLICATIONS

1. It can be used in remote place where electric supply is not available.
2. At public places like city traffic.
3. Charging any equipment.
4. The noise pollution in the road would be able to convert into electric energy and lights the street lighting signals and various other electrical appliances.
5. The noise in runway could be used to produce electricity.
6. The electricity produce in nuclear power station could increase as the sound produce during nuclear fission also could be used to get more electric energy.
7. The noise pollution in industries could be used to produce electricity and work certain low voltage machine.

VII FUTURE SCOPE

The electricity produced in nuclear power station during nuclear fission could be used to get more electric energy. The noise pollution in industries could be used to produce the electricity and work certain low voltage machine. The noise generated at airports and railway stations could be converted into electricity using the similar technique. It can give us a new source of renewable energy and can contribute in global search for renewable energy.

VIII CONCLUSION

Various types of sounds are produced around us from various sources. This noise produced is of no use. In this project we are utilizing this unwanted noise for producing electricity which can be used for charging of mobile phones with the help of piezoelectric sensors. Our project consist of small 12V battery that gets charged within 1 hour after fully discharged state. We tested our project in outdoor condition like city traffic, railway station and got the readings accordingly. Using the proposed method, 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 small apparatus. The sound energy is the unexplored source which has great potential to meet the future growing requirements of the electricity and serve as the eco-friendly and renewable source of energy. As sound

has enormous amount of energy with it, it could be used by converting it into electric energy for various purposes. In our project, we have used sound and light energy and wind to charge the mobile phone. Likewise we can also run the other appliances on this energy. 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 crisis problem but this also contributes to create healthy global environmental change.

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