



e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 10, Issue 7, July 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.282



9940 572 462



6381 907 438



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Generation of Electricity using Noise Pollution

**Prof.Vishal.M.Joshi ¹, Miss.Gaikwad Dipali Sopan ², Miss.Jadhav Pooja Sopan ³,
Master.Pawar Shubham Sanjay ⁴**

Professor, Department of Electrical Engineering, Adsul's Technical Campus, Ahmednagar, Maharashtra, India¹

UG Student, Department of Electrical Engineering, Adsul's Technical Campus Ahmednagar, Maharashtra, India²

UG Student, Department of Electrical Engineering, Adsul's Technical Campus Ahmednagar, Maharashtra, India³

UG Student, Department of Electrical Engineering, Adsul's Technical Campus Ahmednagar, Maharashtra, India⁴

ABSTRACT: Noise (sound) energy can be converted into viable source of electric power by using a suitable transducer. This can be done by using a transducer by converting vibration caused by noise into electrical energy. An application is proposed for the same, in which a Transducer and a Transformer are used to convert noise produced by industrial machines into electrical energy. The vibrations created by noise can be converted into electrical energy through the principle of electromagnetic induction. The received signal was stepped up using a transformer. A similar setup was placed at distance of 1 meter from the working generator or a induction motors .The demonstrated ideas probe into a clean and readily available source of energy

KEYWORDS: Vibration, Transducer, transformer

I. INTRODUCTION

The need for an alternative source of energy is rising fast. Until now, majority of power needs of the world relies upon the exploitation of the non-renewable fossil 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 wide spread use of technology. The search for a renewable source of energy that can satisfy our ever growing needs is the need of the hour. Solar & wind energy have already been tapped as a source of renewable source of energy, and are now being widely accepted as one of the replacements for fossil fuels. However their availability and adherence to natural factors such as weather conditions. 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 progress further towards using Renewable and sustainable sources of energy. This paper takes a step forward in this direction, using sound as source of energy to provide a viable electronic source in a vehicle, converting the sound waves into electrical energy. The creation of energy through sound can thus translate into creation of electrical energy by one of the most readily available form of pollution. Sound waves are a form of mechanical energy. As per the law of thermodynamics, oscillations of mechanical waves can be converted into electrical energy. We have used the principle of electromagnetic induction, using transducers to convert mechanical into electrical energy. The proposed technique 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. Production of electricity from available noise pollution as a source is a relatively new concept. The generation of noise pollution, objectionable though it may be, is mostly unavoidable in most circumstances. Therefore, the production of energy from this available sound source can prove to be useful.

II. LITERATURE SURVEY

The use of sound to produce electricity is not a new concept. One of the first to achieve this feat was the researchers from Los Alamos National Laboratory in collaboration with the Northrop Grumman Space technology, USA. 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. 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 nonrenewable source of energy to create a comparatively less efficient energy source is not a feasible output. 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 losses as the sound was not completely channelized through the



Piezo electric material. A method which has taps mechanical energy from the vibration of vehicular movement and converted it into electric energy by piezoelectric effect. However, this technique does not foresee all possibilities, including that the piezoelectric material may be destabilized due to overload.

III. OBJECTIVE

A. Motivation

The Noise Pollution, i.e. the least of all types of pollution is ignored by most people which can be recycled and turn into electricity sources. Noise is an effective source of electricity just like sunlight. Noise (sound) energy can be converted into viable source of electric power. There are multiple sources of sound which go unnoticed, one of them is the noise generated by industries. The conversion of sound waves (noise pollution) into energy proves that noise can act as an alternative source of energy.

B. Objective

This research aimed to design and develop a device that has the ability to convert noise into electricity and store it for emergency use. The specific objectives were as follows:

- └ To determine the components needed to develop the noise pollution based power bank in terms of Hardware and 6 Software.
- └ To describe the noise pollution based power bank circuitry and design architecture.
- └ To determine the noise or decibels to be harvested to create power; process the noise into power as source of electricity.
- └ To determine how much electricity do the noise pollution based power bank will generate voltage, current, and resistance.
- └ To determine the efficiency of the Noise Pollution Based Power Bank when tested using different mobile gadgets.

IV. BACKGROUNDS & CHALLENGES

There are many ways of generating alternative energy coming from sound energy wherein a primary source of electrical energy of the Noise pollution based power bank, one example is through a transducer called the piezoelectric crystal that generates electric charges on its surface when mechanical strain is applied to it and the pressure and sound is transformed in the same manner, as the sound is in a form of vibrations that will be harvested on the piezoelectric material that will be converted into electricity. Piezoelectric materials, strengthen the urge for the proponent to think of a way to make use of noise pollution wherein as an environmental hazard and how this type of waste needed recycling to be a useful material for it is available in most of the areas of our developing country .This noise from different locations such as spots near public places, factories, and industries where the sound is clamoring.

The idea of using the power bank as a main device, as it is one of the accessories of cellular phones which is a necessity of today's generation as described about cellular phones being one of the necessities in the present generation and how short the battery life affects the usage of this gadget for communications and entertainment, added to that he introduces the use of power bank as a device which can help give our phones a longer usage span that explained briefly the use of power banks an addition to the accessories of phones that gives extra life to the gadget. It is now being used as the phones nowadays are evolving, having a much wider screen, faster processor and multitasking capabilities, which requires the larger amount of electricity as it is discharging while being used .The possibility of the renewable energy as the power bank's source other than the electricity coming from the convenience outlet. Most of the projects that have been conducted earlier used solar energy until made a phone charger that used pressure as a source of energy with the help of piezo material to produce electrical energy. The sound can also be a source of energy. This is feasible by the use of some components and equipment that can turn sound or acoustics to mechanical (pressure) and finally produce electrical energy.The process of piezoelectric material and how it can make energy from one form to another.

V. PROPOSED SYSTEM

The proposed technique uses transducers to harness vibrations caused by sound and convert it into electrical energy. The circuit was installed at the source of the noise. In this circuit, sound waves fall on a diaphragm, which is connected to an induction coil placed in front of a permanent magnet. As the sound waves reach the diaphragm, it starts to vibrate. When the diaphragm vibrates, the coil moves along with it. The movement of coil creates a varying magnetic field around it. This varying magnetic field induces a current into the coil. As per Faradays law of Electromagnetic Induction, a varying magnetic field produces electromotive force(emf) across a conductor, if the conductor circuit is in



a closed loop then an induced current will also circulate through it. The voltage drop across the coil is measured using a digital multimeter in volts (V). The sound is measured through a sound level meter in decibels (dB). This voltage produced across the coil was stepped up using a transformer. Thus according to Faradays law, the generated electromotive force (emf) depends on velocity of relative motion between coil and the magnet, strength of magnetic field and length of conductor. In order to convert the maximum available sound energy coming through the car horn and the silencer, the sound was passed through a channel made up of a sound insulating material. Noise/Decibel is a product of pressure in the air and its normal state measure 43-44 dB for normal noise or not polluted which no specific amount of noise/decibel that is needed to create power as long the transducer catches sound waves; most likely it will keep on converting its input to electricity. The charging of the battery varies from how low or high the pressure caught in a measure of time. The stronger the pressure the shorter the charging time. But since the measure of a sound wave traveling through air is not consistent, the time of converting/charging will be different each time the battery charges.

Table 1 shows the results of sound harvested to produced electric voltage, The highest voltages harvested using the Noise Pollution based power bank is 12,589mV (79-82 dB) at comedy bars and closed spaced karaoke bars, followed by voltage harvested of 8192 mV (79dB) at public transport. The lowest voltage harvested were from Houses and Schools Classrooms and canteens wherein the harvested voltage ranging 282mV to 501mV (49-74 dB)

VI. SCHEME OF IMPLEMENTATION

The process flow of the noise pollution based power bank. Noise is harvested by transducer in the form of sound wave or signals. The diaphragm of the transducer moves up and down that makes converts the signal to electrical current. The converted current in alternating form will pass through the bridge rectifier to make it into direct current and store it to the capacitor before transferring it to the battery. The current from the battery is supplied to three different sections of the device: battery level indicator, USB port and ATMEGA 328P board. The battery indicator shows the status of the battery, and the USB port produce 5v output that can be used to charge phone. ATMEGA 328P supplies power to the LCD and sensor to run, then the sensor capture samples for the display of the LCD. Transducer is a type of transducer that converts one form of energy to another. Inside this device is the diaphragm which is commonly made up of plastic, paper or aluminum. Attached to it is a magnet enclosed in a coil that produces the energy. As the transducer catches sound (acoustic energy) that is in the form of vibration that travels through air or other medium, the diaphragm moves and the electrons flow through the copper coil. Thus, this process creates electrical signal or current that is passed to the desired output, and in this research case, the battery. But since the current from the transducer is alternating, the proponent made a bridge rectifier to convert the current to direct before storing it to the capacitor and to the battery.

Table 1: Results

Noisy Places	Decibels (dB)	Voltage Gain(mV)
House:		
Normal (Sunny)	44-49	282mV
Rainy	44-55	562mV
School:		
Canteen	44-54	501mV
Class Room	44-74	501mV
Hall Ways	44-66	1995mV
Malls/Market:		
Mall1	44-58	794mV
Mall2	44-75	5623mV
Mall3	44-70	3162mV



Publicmarket	44-74	5011mV
Street/Along:		
National Road	44-75	5623mV
RoadIntersection	44-75	5623mV
Karaoke:		
Closed	44-83	12589mV
Open	44-75	5623mV
Moviehouses	44-73	4466mV
PublicTransports	44-79	8192mV
Restaurants:		
Restaurant 1	44-76	158mV
Fast food chain	44-75	158mV

VII. SYSTEM OVERVIEW

The proponent used ATMEGA 328P as the main operator IC of the embedded system of the device. It is responsible for displaying the decibel measured on site; LCD or Liquid Crystal Display shows the information gathered by the microcontroller. It displays the decibel reading and its corresponding voltage; Sound Detection Sensor is being used to gather input. nevertheless, the information from the sensor is the basis of the display on the LCD wherein, transducer collects the sound waves or acoustic energy to be used and convert the raw source to electricity subsequently, Lithium Ion battery that is connected in series parallel is used as the storage of electric charge for the ATMEGA 328P and external devices so therefore, The 10k potentiometer connected to the LCD and ATMEGA 328P for the

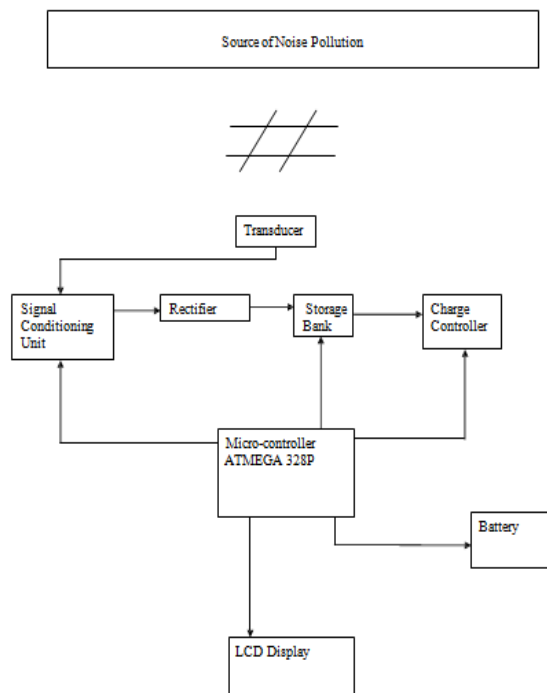


Fig 1: Block Diagram of our proposed system.



contrast adjustment and then the Voltage Regulator is used to maintain a steady amount of voltage output supplied for the external devices connected to the power bank and so, the Capacitor serves as the temporary storage of electricity from the transducer before forwarding to the battery and finally, the diode leads the electricity to flow in one direction also keeps the current from alternating when arranged as a bridge diode.

The Main Function of the components are:-

- ⌊ Transducer:-To Sense the source of noise & convert it into Electrical signals which can be sensed by signal conditioning unit.
- ⌊ Signal Conditioning Unit:-The Transducer converts Non-electrical signals into electrical but it is unable to differentiate between fundamental frequency & higher as well as lower bandwidth frequency hence to make them convert in a form that they can be useful we are using this unit. The signal Conditioning units smoothens the peaks transients hence plays a vital role.
- ⌊ Rectifier:-The Rectifier unit performs the function to convert these signals because we all know that AC supply cannot be stored as compared to DC supply.
- ⌊ Storage Bank:-This unit acts as a primary unit for storage of supply because the charging process of battery is only possible if the charger supplies either constant current or constant voltage.
- ⌊ Charge Controller:-The battery chargers are mainly designed for either constant current or constant voltage driven. Hence to make battery charge with adequate voltage & current we are using this unit.
- ⌊ Micro-controller 328p:-It acts as a Heart of the system providing necessary condition. The Micro-controller sets a reference when it receives a bounded input & thus controls overall operation of the system. It also protects all the control process by safeguarding smooth operation. Also the LCD display is driven due to its source codes.
- ⌊ Battery:-It acts as a secondary storage element by storing all the charge & power generated.
- ⌊ Power supply:- Provides necessary power supply to the circuit components. Uses rectifiers, filters and voltage regulators to ensure the input voltage between safe operative condition.

In continuation, the LED or light emitting diode is used as the indicator of battery level while Green LED means the battery is used for charging, and Yellow LED means the battery is needed to be charged, also the Red LED means the battery is starting to drain. The resistors are used to limit the flow of electrical current to the desired amount that is needed whereas, The proponent used 2 toggle switch to be used in that locations that are higher part is for the LCD and the other one is for the power bank. So, therefore the ATMEGA 328P software to run the assembled hardware and the software or codes loaded in the microcontroller is essential for the device to perform its purpose.

VIII. CONCLUSION

There are multiple sources of sound which go unnoticed, one of them is the noise generated by industries. The use of transducers to convert sound waves (noise pollution) into energy demonstrates that noise can act as an alternative source of energy. It is noted that the values from the motorcycle can be further enhanced as they were taken after the muffling effect of the exhaust pipe.

This method further gives way to a here to fore largely unexplored source of clean energy. The results show that as the noise level increases, the corresponding voltage that was measured at the multimeter also increased. The results further show that there is a non-linear relation between sound energy and the developed voltage. This relationship can be furthered using higher quality equipment. This shows that through a sustainable amount of time, the methods adopted can be used to createsufficient electrical energy that can be successfully stored in a DC battery

IX. ACKNOWLEDGEMENT

A seminar work of such a great significance is not possible without the help of several people, directly or indirectly. First and foremost I have immense happiness in expressing my sincere thanks my parents then my guide, Prof. Mr. V.M. Joshi for his valuable suggestions, co-operation and continuous guidance. I feel a deep sense of gratitude to project co-ordinator and It's my pleasure to thank Dr. C. V. Ghule, Principal, who is always a constant source of inspiration.



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BIOGRAPHY



Miss.Gaikwad Dipali Sopan 2 :-

My Higher studies were done in Government Polytechnic Ahmednagar and the UG is from Adsul’s Technical Campus. The trend I am will be intrested is Electrical Engineering.My Ambition is to work in R&D(Research & Development) Department.



Miss.Jadhav Pooja Sopan 3 :-

My Higher studies were done in Government Polytechnic Ahmednagar and the UG is from Adsul’s Technical Campus. The trend I am will be intrested is Electrical Engineering. My Ambition is to work in Product Development Department.



Master.Pawar Shubham Sanjay 4 :- My Higher studies were done in K.B.P. Polytechnic, Kopargoan and the UG is from Adsul’s Technical Campus. The trend I am & will be intrested is Electrical Engineering. I also wish to complete my PG in MBA operations or IT. My Ambition is to work with RDSO.



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Impact Factor: 7.282



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