Sound Energy Harvesting System

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***Abstract*— The goal of the research project "Sound Energy Harvesting and Converting Electricity (SEHCE)" is to develop a more efficient and effective method of using sound to generate more clean and renewable energy. The project was designed to identify and investigate novel methods of generating an alternative energy source rather than to be compared to existing established sources of electricity like heat, wind, sun, and hydroelectric. The project will go through a number of procedures, including planning, building, testing, and assessment. This will allow the researcher to determine whether sound energy can be transformed into electrical energy.**

Key Terms- Piezoelectric material, sound waves, Energy conversion, Ac output.

I. INTRODUCTION

This project is about generating electricity using sound energy. "Creation of a system for capturing sound energy." We often notice places that are very loud, and this noise can lead to pollution. "But sometimes we can't control it, so let's find a way to use it." By using this sound energy, we can create an output voltage ranging from 220 volts to 230 volts. The rising worldwide need for renewable energy has caused a rise in research aimed at finding new and sustainable solutions. Sound energy is a plentiful and widely available resource that we have not fully used yet. This project looks into whether we can turn sound waves into electrical energy by using piezoelectric materials and technology. Using electronic devices, we transform sound energy into electrical energy.

II. OBJECTIVES

- To make a use of sound energy.
- To take benefit of noise pollution.
- To create 230v of output.
- To fulfil single phase application demand.
- To use sound energy efficiently.
- To generate electricity ecofriendly.

III. BLOCK DIAGRAM

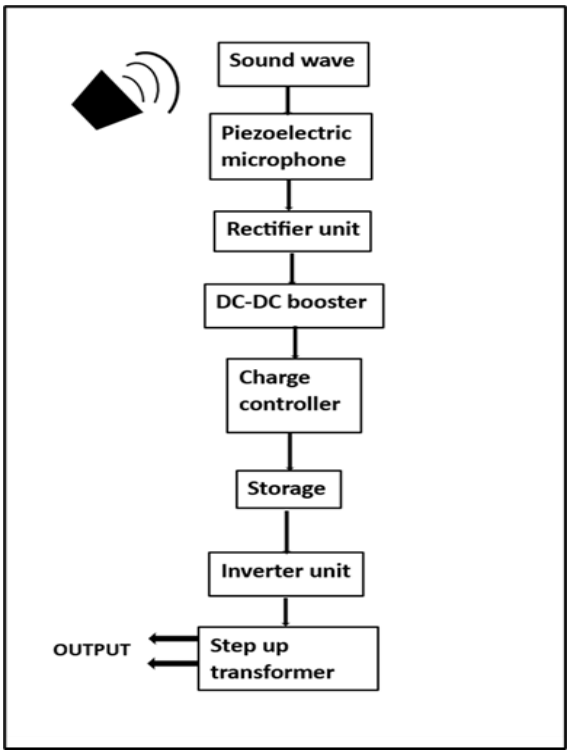

Fig.no 01 Block Diagram

- firstly, the input is given to the sound transducer connected at initial state which produces AC output this output of the transducer is then given to the Bridge rectifier circuit as shown in fig.
- The output produce by the sound transducer is of low voltage level hence it gets boost by DC booster unit
- Output of the DC booster unit is then getting store to battery; one terminal of battery is connected to Arduino which is used as control unit here

- Further this DC supply is get converted into AC by inverter circuit
- Even though the supply isn't sufficient so UPS transformer is get used in a reverse direction which means as a step of Transformer as shown in the circuit diagram
- Lastly the output from Step Up transformer is now can use as a single face AC supply (value is up to 220 to 230v) according to our low power application

IV. METHODOLOGY

The method of the Sound Energy Harvesting System focuses on using sound energy and changing it into electrical energy. "Here are additional details about the project." Piezoelectric medium: This is a material that changes incoming sound energy into alternating current (AC) electrical energy.

Rectifier unit: This circuit changes AC signals into direct current (DC) and uses a filter to create a cleaner DC output.

Booster circuit: The output from the microphone is often not enough, so a DC-DC boost converter is used to increase the output. Voltage Regulator: Even when filter units are used, voltage changes can still happen. To manage this, a voltage regulator is needed.

Storage: To use energy when it is required, it must be stored in batteries. Therefore, a 12V DC battery is used. Inverter unit: Since we need a single-phase 230v AC supply, we can get the needed output of single-phase AC by using an inverter unit. This way, we achieve the desired single-phase AC supply with the help of electronic components.

V. COMPONENTS

1. Piezoelectric Microphone

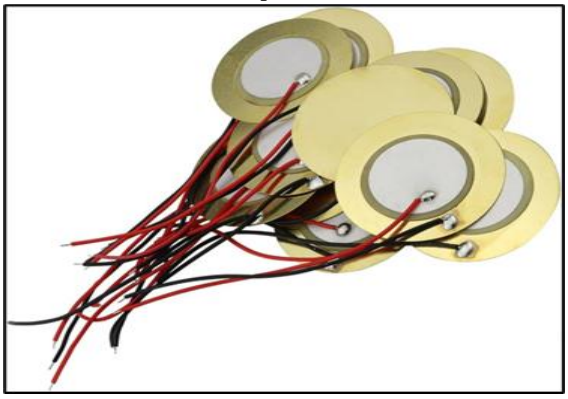

Fig.no.2 microphone

A piezoelectric sensor, which is sometimes called a piezoelectric transducer, is a device that measures changes in pressure, acceleration, temperature, strain, or force. It does this by using the piezoelectric effect to turn these changes into an electrical charge.

2. Rectifier and filter unit

Fig.no.3 Rectifier with filter

The bridge rectifier circuit is made of four diodes D_1, D_2, D_3, D_4, and a load resistor R_L. The four diodes are connected in a closed-loop configuration to efficiently convert the alternating current (AC) into Direct Current (DC).

3. Booster circuit

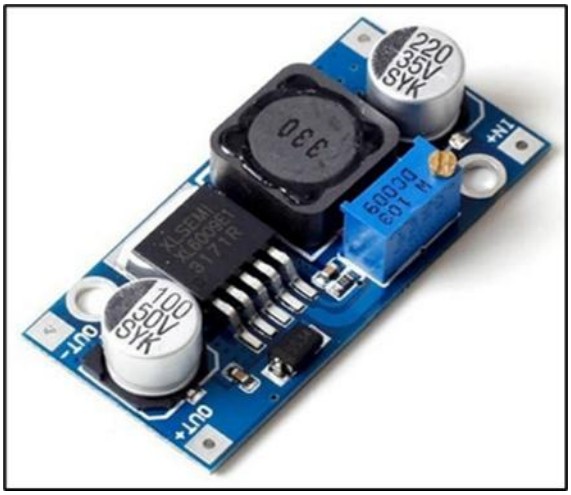

Fig.no.4 Boost converter

A boost converter or step-up converter is a DC-to-DC converter that increases voltage, while decreasing current, from its input (supply) to its output (load). Low-cost converter modules: two buck and one boost. Boost converter from a TI calculator, generating 9 V from 2.4 V provided by two AA rechargeable cells.

4. Voltage regulator

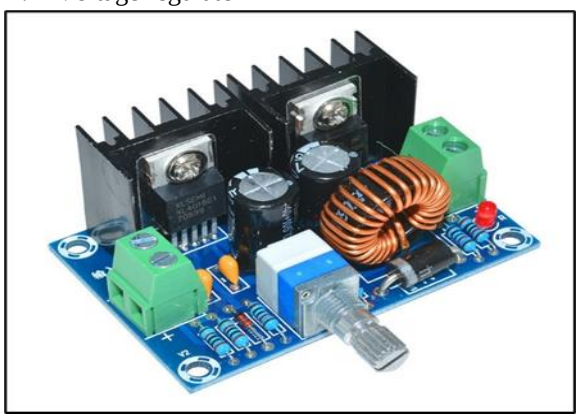

Fig.no.5 Voltage regulator

A voltage regulator is a circuit that keeps a steady output voltage, no matter how the input voltage or load conditions change. Voltage regulators (VRs) ensure that the voltages from a power supply stay within a range that works well with other electrical parts.

5. 12 v Battery

During charging or discharging, the oppositely charged ions move inside the battery through the electrolyte to balance the charge of the electrons moving through the external circuit and produce a sustainable, rechargeable system.

Fig.no.6 12v Battery

6. Inverter circuit

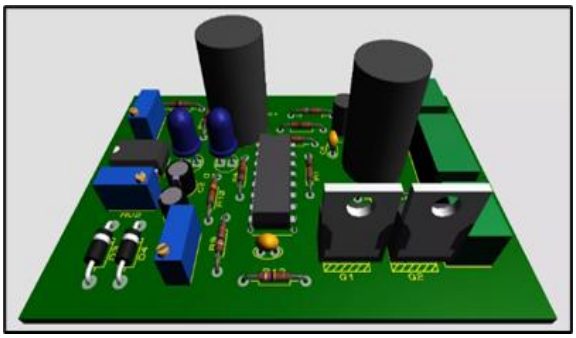

Fig.no.7 Inverter circuit

An inverter functions by quickly turning the DC input on and off, producing pulses of current that switch between positive and negative. The system uses capacitors and inductors to filter and smooth these pulses, creating a sine wave. This sine wave is the most common kind of alternating current (AC).

7. Step up transformer

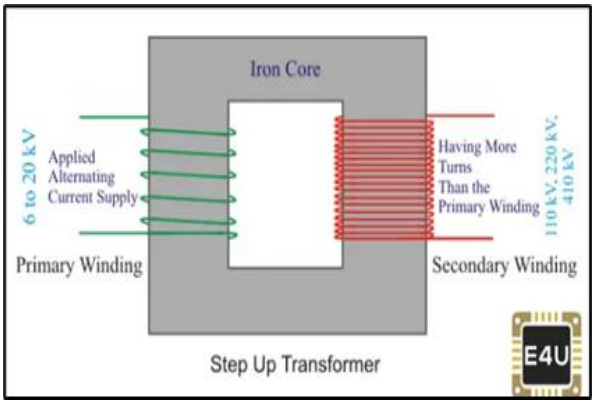

Fig.no.8 Step up Transformer

A transformer that raises the voltage from the primary side to the secondary side, which has more turns of wire on the secondary winding than on the primary winding, is known as a step-up transformer. On the other hand, a transformer made to do the opposite is known as a step-down transformer.

V. CIRCUIT DIAGRAM

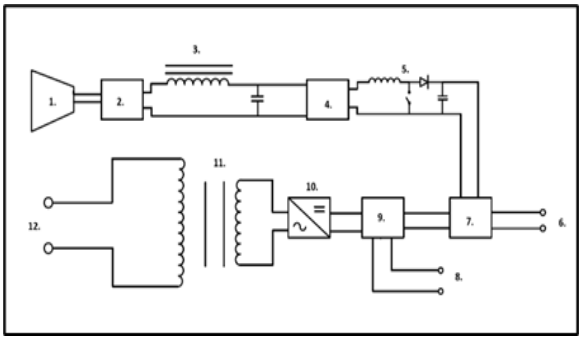

Fig.no.9 Circuit Diagram

1.Piezoelectric microphone
2.Rectifier circuit
3.Filter circuit
4.Voltage regulator
5.DC-DC booster
6.Additional renewable energy input
7. Charge Controller
8. Usage for DC application

9. Storage batteries
10. Inverter circuit
11. Step up Transformer
12. Last 220v to 230v output

1. A sound energy harvesting system captures and converts acoustic energy (sound) into usable electrical energy. Here's a brief overview of how it works:
2. Sound Waves Detection: The system uses a microphone or a piezoelectric material to detect sound waves, which are mechanical vibrations in the air.
3. Vibration Conversion: The sound waves cause vibrations in the material, like a diaphragm in a microphone or a piezoelectric element. These vibrations correspond to the frequency and amplitude of the sound waves.
4. Energy Conversion: The vibrations from the sound are then converted into electrical energy. As it's in AC it has to convert into DC having purpose of storage. In this case rectifier circuit is get used
5. Energy Storage: The generated electrical energy is stored in a capacitor or a battery for later use.
6. Power Management: A power management system regulates the output to ensure the energy is stable and usable, typically converting the energy into a form suitable for low-power devices.

This process allows the system to harvest ambient sound energy, which can be useful for powering small, low-energy devices in environments with consistent noise, such as urban areas or industrial settings

VI. CONCLUSION

This system includes a piezoelectric microphone, a rectifier and filter unit, a boost converter, a voltage regulator, a storage battery, an inverter circuit, and a step-up transformer. This system gathers sound with a piezoelectric microphone. It changes alternating current (AC) to direct current (DC) using a diode, controls the power, and finally saves the energy in a battery. Additionally, we tested the proposed system unit by using sounds like an air cooler, a DJ, a car horn, and more. Testing the system shows that the voltage increases with the sound level (dB). The system suggested in this research creates a peak output of around 15 mV at 114 db. In general, this technology is cheaper than any other sources of electrical energy. It offers more benefits for the environment compared to other renewable and non-renewable sources.

VII. APPENDIX

A Sound Energy Harvesting System is a neat method to convert sound into electricity. It operates by using microphones or piezoelectric sensors to gather sound waves and turn them into electrical energy. The system typically has a sound sensor, a rectifier circuit that converts AC to DC, a battery or capacitor to store energy, and a boost converter to make the voltage usable. It takes random sounds, like traffic or people chatting, and converts them into energy for small electronic devices. Although it may not be very strong, it's a creative method to turn regular sounds into usable energy.

VIII. ACKNOWLEDGMENT

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IX. REFERENCES

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