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A review on Sound to Electric Energy Conversion

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ABSTRACT: The world of Technology has made Human beings are totally dependent on systems running on electricity. This has resulting in scarcity of electricity running, out of coal, black outs. So renewable energy is always the most in demand for alternative way of generating electricity. Solar energy is one of the most abundant source of renewable energy followed by wind energy. But we in this paper have made a study of sound to electricity conversion. Sound to electric conversion is the area where a lot of research is going on.

I. INTRODUCTION

The study on alternative source of energy is always the need of hour a Noise is one of 4 environmental pollutions. But capturing the noise and converting into a useful and renewable energy will become a boon to mankind. The sound is a mechanical form of energy that can create pressure. As sound travels in the form of waves, we can get oscillations of pressure and is these waves can be converted to electrical form then there is a possibility of converting the sound signal to electrical signal.

So the sound or sound waves can be converted to electrical energy to charge mobile, lights on street etc, specifically noise form vehicles on roads and highways. Sound energy can also be generated from the voice captured from human beings.

2. What is Sound?

The sound we hear are the signals in the audio range. The energy content can be captured as they travel in waves, create pressure on substances and objects [1]
Sound energy is the result when a force, either sound or pressure, makes an object or a diaphragm vibrate. Sound waves have kinetic mechanical energy as they moves through the different media and substances in the form of waves[2] Through liquid and gas state sound is transmitted as longitudinal wave which created pressure deviation from the equilibrium pressure. It causes compression and rarefaction of waves. In case of solids the waves move in both transverse wave and longitudinal manner [2][3]. The sound wave displace back and forth between the potential energy of compression or lateral displacement strain of the matter and the kinetic energy of the oscillation. So we could see

that sound is a form of mechanical energy and according to third law of thermodynamics mechanical energy could be converted into electric energy[1][2][3].

Sound to Electricity Conversion Techniques :

A) Working Principle of condenser microphone [1]

The condenser microphone has two parts i.e. a thin metal diaphragm and a metal electrode places near the metal diaphragm. This pair forms a capacitor as they are mutually insulated. In order to compensate for the pressure changes, a small hole is punched on the microphone wall . When sound falls on the diaphragm of the microphone it vibrates alternatively because of the pressure by the waves. The sound pressure created is proportional to the sound pressure and the diaphragm's area. Due to this the capacitance changes. The change can be transformed into an alternate voltage signal, which realizes acoustic-electric transition. The energy can be stored in battery with wires connected to two pole. [1][6][7]

B) Traveling-wave thermoacoustic heat engine [3]

In the paper[3] an work on sound to electricity conversion has been done. Traveling-wave thermoacoustic heat engine has been discussed. It is a device which can convert external heat to acoustic work with high reliability and potential efficiency. By coupling with a linear alternator. It is developed a new kind of electricity generator called the traveling-wave thermoacoustic electrical generator [3].

C) Converting sound energy to electricity by piezo electric material

Piezo electric materials convert mechanical strain to electric energy. Pierre and Jacques Curie discovered this phenomena in 1880. It was found that some materials like crystals and ceramic, can produce electrical potential when mechanical stress is applied. Piezoelectric effect is of two types:direct piezoelectric effect and converse effect. Direct Piezoelectric effect the material tends to transform mechanical strain into electrical charge. In converse effect electrical potential is converted into mechanical strain and reacts as an actuator. In the paper [5] piezo electric transducers are used to convert mechanical vibrations into electrical energy and mobiles keypad vibrations generated while messaging and the sound energy produced during speech are also converted into mechanical vibrations by exposing sound to some oscillating material.A design of a proposed self charging system for mobile phones is presented in some research paper [5].

Conclusion:

There is huge importance to the conversion of sound to electric energy as it is abundant , less carbon foot print and a good alternative source of energy. More research can be done to improve the efficiency of the system.

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