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ELECTRICAL POWER GENERATION FROM VIBRATION

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Abstract - A system is proposed to convert ambient mechanical vibration into electrical energy for use in powering autonomous low power electronic systems. The energy is transduced through the use of a variable capacitor. Using microelectromechanical sys- tems (MEMS) technology, such a device has been designed for the system. A low-power controller IC has been fabricated in a 0.6- m CMOS process and has been tested and measured for losses. Based on the tests, the system is expected to produce 8 W of usable power. In addition to the fabricated programmable controller, an ultra low-power delay locked loop (DLL)-based system capable of autonomously achieving a steady-state lock to the vibration fre- quency is described.

Key Words: Delay-locked-loop, low-power design, low-power dissipation, mixed signal, performance tradeoffs

1.INTRODUCTION

The "law of conservation of energy" states that energy cannot be created nor be destroyed. Under the consideration of this law the technological giants have discovered numerous sources to extract energy from them and use it as a source of power for conventional use. The sound or noise in other terms is present all around us. So why not use it to satisfy our needs of energy. In our basic applications we see sound be converted in the electrical signals to travel over the media for communication purposes. For example the sound energy is converted into electrical signals using diaphragm present in the microphone and these signals then reach to the speakers and then converted back to sound. The electrical current generated by a microphone is very small and referred to as MIC-level; this signal is typically measured in millivolts. Application of sound energy as the source of electricity can be much beneficial for the human existence as compared to other sources. This is because the sound is present in the environment as a noise which forms an essential part of the environmental pollution. The concentration of noise to use it for power generation can lead to discovery of another hidden source of energy which can act as a boon to non-renewable sources such as coal, crude oil etc. Sound basically is mechanical wave that is an oscillation of pressure transmitted through some medium (like air or water), composed of frequencies which are within the range of hearing. Thus, considering sound as the wave we can imagine it as the flow of energy from one point to another with the help of a medium as air.

The basic idea is that sound is mechanical wave. When sound travels through any medium then it disturbs the particles of that particular medium and these disturbances caused by the sound can be used to produce electricity.

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2. Literature Survey

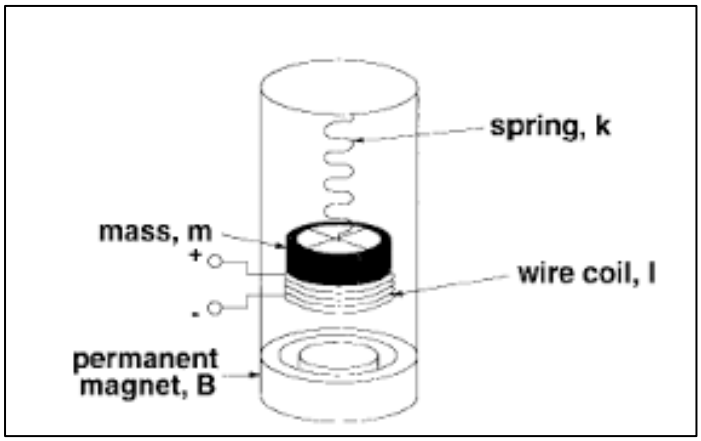
The use of sound to produce electricity is not a new concept. One of the first to achieve this feat was the researchers from LosAlamos National Laboratory in collaboration with the Northrop Grumman Space Technology, USA. They built a compact generator which used the movement of helium gas to generate sound waves that drives a piston to move a coiled copper wire. 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 piezoelectric material

3. Problem definition:

The generation of electric energy uses transducers to harness vibrations caused by sound and convert it into electrical energy. The circuit has be 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 can be 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. We used a transfer suitable for optimum results having strong magnetic field and appropriate length of the conductor.

Figure 1



4. CONCLUSIONS

There are multiple sources of sound which go unnoticed. Thus deciding major sources of sound pollution is important step of this research project. The use of transducers to convert sound waves (noise pollution) into energy demonstrates that noise can act as an alternative source of energy. Hence selection of optimized transducer which can give maxing energy conversion efficiency is second important step. It is noted that the values of sound level can be further enhanced as they can be taken from the various sources. This method further gives way to a here to fore largely unexplored source of clean energy. The final step is to validate the results with experimental setup

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