Piezoelectric Power Generation System: A Review

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Abstract -*Need of electricity is the one of the most important crises that we are facing across the globe. India has the largest energy generating capacity and also have largest increased energy consumption. As a result, shortage of electricity has been developed as a social demand. In order to overcome this crisis, we have to generate electricity as our own. Here we are introducing "Piezoelectric power generation ". i.e., the energy in the form of a mechanical pressure or force or acceleration is converted in to an electrical energy. Piezoelectric sensors are used here for this purpose. And the basic principlebehind the system is piezoelectric effect. Energy exerted by human movement or locomotion of vehicles are converted in to electrical energy. As the floor is design using piezoelectric tile and are connected in such a way that, maximum output voltage can be obtained. And the generated energy can the stored in a battery for future applications. No: of piezoelectric sensor are used in the system determines the output voltage. The system is renewable and cost effective.*

Key Words: Piezoelectric

I. INTRODUCTION

Electricity is the most commonly used energy source. Innovation of electricity have changed the entire world and it also become the most important part of the industrial world. Not only in case of home, it also provides a better support in the industrial development and had become a revolutionary part of our life. As a result, technologies and industrial development the demand for electricity has been increased. In current scenario, India is having the 5th largest electricity generating capacity all over the world, but also India is the 6th largest energy consumer for around 3.4% of global energy consumption. As the demand for electricity increased due to industrialization and increased living standard of humanity. So, we have to generate electricity as our own. We are using either renewable or non-renewable Forms of energy forms of energy generation technique. But, in current lifestyle renewable form of energy generation has to be improved in order to fill up the increased demand for electricity. For example, solar wind mill etc. are some of them. Here we are generating electricity in a renewable format, simply from one of our daily activities. i.e., here the energy exerted in the ground from human, vehicles, or from any other sources by walking or running on the floor is converted to an electrical energy. Is, the kinetic energy that is being exerted in to the ground by the locomotion of vehicles or human has been converted to an electrical energy. This is a non-conventional form of energy. And it can be implemented less costly and the generated energy can be used for many applications and doesn't cause any bad effects on the atmosphere.

II. LITERATURE REVIEW

Li Tianze, Zhang Xia, Jiang Chuan, Hou Luan [2009] proposed a paper on the basis of analysis of the characteristics of piezoelectric sensor and research of its application[1]. In this paper first describe the working principle, piezoelectric effect and working of piezoelectric sensors. Impedance matching circuit and impedance characteristics of the piezoelectric transducer are also analyzed in this paper. By designing the measurement circuit of the piezoelectric sensor give more paid attention when design the circuit and several important conclusions on the basis of analyzing the impedance characteristics and impedance matching circuit of the piezoelectric transducer. And finally give the analyzed and prospect of the application of piezoelectric sensors.

G. R. Ahmed Jamal Hamidul Hasan, AmitavDas, JannatulFird, Sharmeen A Lisa [2013]Proposed a paper on the basis of generation of usable electric power from available random sound energy [2]. Relatively low proposed source of green energy Exploration in this work. Using the appropriate transducer, we can have random sound energy around Treated as a source of electric power. Usable Available random sound electric power Energy is presented in this paper. Piezoelectric transducers used in this project Convert sounds into electrical energy. This Electrical energy produced from many Are deposited in piezoelectric transducers Many super capacitors. Then stored Energy is expressed and amplified through Voltage multiplier circuit and connector. And this Electric power is used for rechargeable chargingDC Battery. From the proposed conversion Circuit, using medium sound source Small 9-volt DC battery to be fully recharged with in a half hour from the stage fully discharged. Random sound energy from many Sources can be stored as electric power Drive compatible small loads using it way.

Anil.can Turkmen, SenkSelik, [2016] Proposed a paper based on energy Cutting with Piezoelectric Materials Integrated shoe [3]. Importance of electricity has increased

Energy efficiency is known by anyone. By it is possible to retrieve the developed technology energy consumption. Its main purpose is the project has to recover the energy transferred People have ground in their walk Daily life using piezoelectric materials. Piezoelectric materials are used to convert Mechanical energy into electrical energy. Service The only goal is designed for a single space various piezoelectric material. Humans The weights are inspected using computer software. Parametric analysis was performed50, 60, 70, 80 and 90 kg using PZT-5H andPZT-8H Piezoelectric Ceramic and FrameIs made using steel and aluminium Content. System of PZT-5HPiezoelectric Ceramic with Steel FrameIntegrated into a human shoe. A human shoe90 kg use showed 0.4%the applied force can be cut to 1.43mwElectric power.

M Pravin, Sundararajan proposed [2015] a paper based on generation of piezoelectric material for an open traffic control model and alternate routing for ambulance [4].Energy production base from Piezoelectric material for an open movement for control model and optional routing Patient vehicle. To implement traffic control there are embedded boards with interface modules Needed. Embedded board is used to replacea manual operation. Benefits of Embedded board can be easily carried, a real-time Operating, low cost and programmable. With the help of the operating system and There is a GPS module to connect to the Internet Used by users to operate it measuring system. It also provides Step-by-step tasks to help the user work, such as using traffic flow information Embedded measurement system. Traffic flow Expansionism is also a liquid crystal monitor Shown in this design. GPS used in this system Identifying vehicle state information. Vehicle will send state information Control section. By applying Mechanical Vibration, Piezoelectric. The crystal generates electrical energy for traffic Light. Piezoelectric is used to generate electrical energy. Piezoelectric material Placed on the side of the road; the vehicle passed more electricity will be generated on it. Wireless Transmission is used in this design.

M. VarzakezRodrigues [2011] proposed a method based on modelling piezoelectric harvesting materials in road traffic applications [5]. Modeling piezoelectric on Madrid harvesting material in road traffic applications show - green and green power generation is not only a challenge Transport, Urban and Commercial Areas, But also for microelectronic devices and Digital system. Recently, powering sensor Networks, Tracking Gadgets and Systems Belong to civil infrastructure Contribution of study to self-governed System. To get an electric Used as a model of piezoelectric materials Generator a test application in road traffic the bench was developed. In many cases, it is required to associate the response of Materials for an electronic circuit. To analyzeGenerated electricity, use off Conduction converters or adaptive circuits for remote application.

Muhammad Aamir Aman [2018] proposed a method of power generation from piezoelectric foot step technique [6]. generate electric energy by force applied by foot step, which can be applied over a highly populated area. The electro-kinetic energy plane is designed to convert kinetic energy into electrical energy. In this proposed system a piezoelectric sensor is placed between two wooden plates and a spring is placed above and below those plates. This paper mainly specifies the dynamo attached to the Rick and Pinion gear system with its own gear mechanism. And also, the electricity produced can be stored in a battery.

Md. AashiqurRehman Laskar [2017] only describes the power generation method for piezoelectricity: An energy source for future railway stations [7].It tells you how to cut power from various places in the railway station. Water piezoelectric materialrelieves energy when it is subjected to adeformation or stress. First, we areapplying these piezoelectric materialsRoads and Highways. PiezoelectricContent changes as paymentRoad, Vibration and SpeedVehicles produce electricity. As the vehicle speed increases, power also increases accordingly. The second method is set upElectric floor with piezoelectricComponents. An electric floorPiezoelectric in 35 millimetersWidth for circle, and molded parts Amplifiers. Vibration is received from the floor components of the person from walking. And by storing this induced electricity. To provide next piezoelectric material 2-3 km under rail tracks with railline near a station so we can harvestLightning.

Cyrell Sam Cherian [2019] proposed a method forfootstep power generation and wireless transmission [8]. This is a proposed system, Piezoelectricity is produced in a Unpublished approach. That is, piezoelectric material moves as a transducer and the load exerted by the moving object is converted into an electric current. And is stored wirelessly based on the principle ofelectromagnetic induction. When it comes toresults and analysis, output voltageIs generated through a piezoelectric sensorused to drive a DC load. DC voltage isIt was passed through the voltage regulator LM7808 to provide a regular 5 V DC. A dcBooster converter increase these 5V DCs to 30V.A rotary oscillator will replace the recipient30V DC in AC power with high power While the receiver coil at the end of the receiver Wireless transmission induces an AC voltWhile a flow is forming insideWireless Charger Receiver Coil. Again, Reformed and regulated to ensureDC.

Kyu-Han-Kim (2018) proposed a technique of wave power generation by piezoelectric sensor attached to a coastal structure [9]. Piezoelectric sensors are located on the edge of the present coastal structure. By putting a sensor into the structure, wave energy can be generated. It has been showed that the wavelength and voltage increase with the wavelength. During the experiment, a relationship between generation volume and wavelength became found.Since large-scale generators can be installed on particularly small and manageable piezoelectric sensors, it

is decided that this sensor can be implemented in a large-size structure. This new approach will be analyzedthrough the use of 2Dhydraulic model checks and numerical simulations. The two-dimensional cross-sectional hydraulic version constructs random and regular waveforms using frequency of experiments and spectrum auction. The surface of the water is made from tempered glass, designed to monitor not only the experimental segment however also the general trend of incident waves. This can growth and reduce the height of the set waves at some point of the test. As a result, the wavelength and voltage increased the wave energy, and a most of 7.75 kPa and 11.24 V were calculated under experimental conditions. In those cases, the power generated is set at 12.35 MW, which, while implemented in the actual ocean region, might enhance the super-compact rule, and it would play an essential role as an alternative to compost fuel.

Rishi Sikka (2019) presented the work of a piezoelectric-based wireless charger [10]. Devices can be charged through the motion of electrical power using piezoelectric sensors. The electricity generated by walking and running is because of mechanical pressure. When the piezoelectric crystal is heavy, it forms a negative cast on the prolonged aspect and a positive coast on the adjacent side. When the load is light, an electric current flow from the top of the material. In a wireless energy distribution system, electricity is transferred from an energy supply to battery storage or without physical attachments such as recharging the battery. Therefore, energy is accumulated from human movements and hastily dispersed with the capacity to switch wireless power and is used to measure cellular batteries. The principle of common access among two coils is used to conduct electricity without the usage of wires. The AC power generated by the motion of the shoe is then transformed to DC. Bridge rectifiers are used to transform pulsating AC power generated by piezoelectric generators into P power. This power is used to charge the battery of a mobile or any other electrical device.

Linbing Wang (2017) carried out a preliminary study on an IoT-based pavement monitoring platform based on piezoelectric cantilever beam-powered sensors [11]. Supply power supply is a major trouble for large-scale engineering applications of sensors. One of the simplest crops harvesting techniques is to apply piezoelectric materials as components of paving materials. IoT-based pedestrian monitoring platform Based on the piezoelectric self-power sensor designed above, the primary IoT-based pavement monitoring platform states that this based pavement monitoring is designed in three parts: self-designing sensing nodes, gateway nodes, And cloud platforms. The device uses piezoelectricity to supply power to the sensor node. Gateway nodes enhance data transmission performance in complicated environments and understand remote control, device management, temperature, and humidity monitoring functions. The power of the piezoelectric cantilever vibration energy series system can attain 1.68 MW. Acknowledgments This paper supports China's National High Technology Research and Development Program (Program 863).

Wonseop Hwang and their research group (2018) provided a work of watts-level road- compatible piezoelectric energy harvester for a self-power temperature monitoring system on an actual roadway [12]. Piezoelectric energy harvesting technology can be used for numerous purposes through the design of road energy harvesters. The roadways piezoelectric energy harvester (RPEH) advanced here is prepared with a piezoelectric energy harvester (PEH) at each end to increase the bearable load. Developed a durable module against harsh highway environments using aluminum plates, steel plates, and polypropylene bars. Roadways Piezoelectric Energy Harvester (RPEH) is designed for the highway environment. The 50 cm 20 cm RPEH module generated a maximum output power of 830 MW. An experiment was carried out with a fast car on a real road. The power generated through RPEH was examined for sensor application.

Rajendra Prasad P [2019] propose a method ofpower generation through footsteps using piezoelectric sensors along with GPS tracking [13]. The basic principle behind the system is piezoelectric effect. Here this principle is used to generate electricity in order to provide it to the lane of street lights and also consist of GPS for tracking a person. Here the Piezoelectric sensors are placed on the footpath when a person walking on it, certain amount of energy is generated and that energy is used to light the street lights. so, a PIC microcontroller is used to make the output. The output of the piezoelectric material isn't a gentle one. Battery is connected to store the generated charge by the motion of the people through it and an inverter is used to connect it to the AC load. Along with this a GPS is used to track the position of a person. UART, is used to Interface GPS along with the PIC microcontroller. In datetime the intensity of the light is very high and the street lights are turned off even during in the presence of human. In night time, the intensity of the light is low and the street lights are turned on while a person walking over it. Otherwise, it is turned off in night. If there is a presence of a person, intensity of light is high and a light turns on and in the absence of a person the light automatically turns off. Corresponding voltage variations will be displayed on the LCD display and a piezoelectrically powered shoes are provided with GPS tracking.

Tarik Bin Abdhin Akiba, Hasabmzzaman Mehedi, M D. Nazamuschayadat [2019] proposed a paper based on electrical energy harvesting from foot stress on Foot overbridge using piezoelectric tile [14]. This is implemented in a way which is different from previously discussed systems, i.e., electricity is generated from foot over bridge using piezoelectric tile, which is made of using piezoelectric transducers. Installing piezoelectric tile in

foot overbridge can achieve a huge amount of power which is of about 7 watts from a single tile, by placing a number of piezoelectric tiles, they are discussed of generating a large amount of energy. Apart from other reference papers, here they are using a PID controller, in order to make the system more stable and for increasing the accuracy of piezoelectric transducer. And the generated energy can be used for a wide range of applications. Electrical energy harvesting from foot stress on foot over bridge using piezoelectric tile

III. CONCLUSION

By concluding, we have analyzed different types of piezoelectric power generation techniques and their various level applications. In most of the cases the energy that is wasted from human foot step is converted to a usable form of electrical energy and that energy is used for various kinds of applications. As above mentioned, the number of piezoelectric sensors determine the end their output voltage. Relatively a high voltage output can be obtained by using a large number ofpiezoelectric sensors. Since there is an increased demand for low power and portable energy sources due to the development and the mass consumption of portable electronic devices. In this scope, piezoelectric materials had become strong candidate for energy generation and storage in future applications. The system is economical and an affordable energy solution for common people. Can be used for many applications in crowded areas. Renewable form of energy generation, and eco-friendly and pollution free.

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