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Hybrid Power Generation using Solar PV and Piezoelectric Transducer System

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Abstract: In this project, we are generating electricity by using hybrid renewable energy resources i.e. Solar (PV) and a piezoelectric transducer. A piezoelectric transducer is an electromechanical converter which undergoes mechanical vibrations due to pressure and produces electricity. This hybrid application of piezoelectric transducer and solar PV can be applied for a commercial application like railway stations, malls, etc.

Our main purpose is to charging of battery through DC output and then inverting into AC for normal usage of electricity. These types of designs can be very helpful to achieve the load demand at the commercial level.

Keywords: Piezoelectric transducer, Solar PV, Inverter.

I. INTRODUCTION

Now a day with increasing global warming and with increasing population and exhaustion of non-renewable sources so, it is most important to conserve these non-renewable energy sources for upcoming generations and future purposes by using renewable sources. So that we are generating energy by using solar PV and a piezoelectric transducer which, is some amount of energy generation contribute to energy demand. In this project, with the help of a non-conventional source, we are generating electric power methods by simply apply pressure on a piezoelectric transducer walking or running on the footstep on each footstep Piezo sensor tile pressed and convert mechanical energy i.e. (pressure and force) into electric energy. As a single piezoelectric sensor not enough to generate a sufficient amount of energy so we connect piezoelectric transducer in series and parallel combination and we are also added solar PV which converts solar radiation into electric energy. Both energy combination of piezoelectric transducer and solar PV it is called as hybrid energy. The generating energy is stored in the battery through the charge controller. Then pass to dc load and also it's inverting into AC for normal use of electricity and simultaneously show generated power status on display on LCD using Arduino board. This paper aims to utilize existing spaces to generate electricity without harming the planet. The solution is a hybrid prototype of piezoelectric tiles that can be utilized on bus stop sidewalks as well as solar panels that can be installed above a bus station and also applicable railway platform, crowded area, buildings, malls, etc.

II. LITERATURE REVIEW

- 1) JunHwi Park et.al (2019) designed a hybrid renewable power system using Photovoltaic(PV) and piezoelectric modules with battery for the continuous power supply. Furthermore, the buck-boost dc-dc converter for the PV and the piezoelectric modules are designed for the parallel connection of two power inputs. In the simulation and the experimental results show the effectiveness of the proposed hybrid power system using PV and piezoelectric modules. In the simulation and experiments, the proposed hybrid power system can supply continuous power to the grid in the wide input power conditions.[1]
- 2) Ramzi Saifan et.al (2019) presented an innovative electricity generation method by using solar panels and piezoelectric elements. Based on the tests and results they concluded that Smart Walk can deliver the desired output and proven to achieve its goals. Hence, the Piezo tile generated a feasible amount of power and with the support of the solar panel.[2]
- 3) Kajal Ladhe et.al (2019) presented a piezoelectric transducer, which is an electromechanical converter, undergoes mechanical vibrations and produces electricity. In this paper, they have concluded that these types of designs and techniques of power generating systems are very useful and handy to match the supply and demand for energy globally as well. It can be used for many applications in rural areas where power availability is less or total absence.[3]
- 4) Akshat Kamboj (2017) et.al calculated the various methodologies for footstep generation using piezoelectric sensors. In this paper, they concluded the design of power generation using footsteps based on available piezoelectric sensors. Where the streets, rail and, the bus station overpeopled and packed like sardines moving around the clock. So, they are using such concept the power they can be availed and deployed by converted mechanical energy to electrical energy. Their results have been discussed in terms of output voltages. They are plot between current and voltage shows the extent of power generated.[4]

- 5) Ms. Bhusari Priya Govind (2015) et.al investigated the feasibility of applying piezoelectricity to convert the mechanical vibrations of the roadway to useful electricity. In this paper, they are implementing an efficient way to power generation system, using solar power. Here, they are used piezoelectric-based energy harvesting technology is applied to generate electricity from mechanical stress (vibrations).[5]
- 6) K. Aneel Kumar (2017) et.al described that using the hybrid power generation i.e., solar power generation combined with power generation from the piezoelectric effect gave the conclusion that it provides a path for obtaining continuous power generation from renewable energy resources based on weather conditions. This project is based on the principle of using a hybrid mechanism of combining solar power technology with piezoelectric power technology. For sensing the sun, they are using an LDR and for detecting the rainfall they are using moisture sensors.[6]
- 7) Yatin Sharma (2017) et.al investigated and observed the feasibility of applying piezoelectricity for converting the mechanical vibrations of the roadway to generate useful electricity. In this paper, PV solar panels which are longer lasting and efficient energy producers, and the Piezoelectric Energy Harvesting system is done by using the piezoelectric effect.[7]
- 8) Kazi Saiful Alam (2012) et. al proposed a new model of the environment a friendly solar-piezoelectric hybrid power plant that solely uses renewable energy to generate electricity and is capable of being practically implemented in railway stations. They have taken Kamalapur Railway station, Bangladesh as a representative of a typical railway station. In this paper hybrid power generation system which can drive a load of 10 kW for 10 hours a day using piezoelectric materials and a PV panel as an energy source is developed.[8]
- 9) Rajendra Prasad P (2019) et. al proposed a working model, GPS tracking they have been added, and also streetlights switching technique comparing with the existing model. To produce energy to a large extent, in this model implementation of the piezoelectric sensor network along the footpath is carried out which is given to the lane of streetlights along with it the smart shoe is implemented for a small production that consists of GPS tracking.[9]
- 10) Ravisagar Mahajan (2017) et.al. proposed work model of the Hybrid Power Generation Utilizing Solar Panel and Piezoelectric Tangle” to run AC and DC loads have been successfully tested and, where they can be implemented which is the best economical, affordable solution to the energy hazard. Here in this paper, they have also added a solar panel with the footsteps power generation setup which will help us the needs for electricity in the future. So this hybrid system can be installed easily anywhere depending upon the need for electricity in that required region. Using this idea they can generate power up to 1MegaWatt with properly designed and specifications of the floor and the panel.[10]
- 11) Laukik Sanghavi (2016) et.al presented an idea of using vibration and solar energy together and generates electricity which is having low maintenance and also cost-effective. To get maximum efficiency they designed 1-D fuzzy logic-based sun-tracking solar panels. Also, they concluded that In the future, this system can be improved by making a dual sun-tracking solar system to increase the output.[11]
- 12) Yasser Alwokayan (2016) et.al established the feasibility of a roadside hybrid energy collection/recovery system that can then be used for running nearby street utilities such as lights/signals. Here the power generating board is connected through wireless communication using Zigbee protocol to transfer charging information to another board that would monitor the process of charging. This board will have an LCD that will display the information related to charging to the user.[12]

III. CONCLUSION

In this paper, we have presented a hybrid power generation system using a piezoelectric transducer and solar PV. We conclude that the smart walk can deliver the desired output and proven to achieve its goal. Above these hybrid power generation energy very useful and efficient way to use for commercial.

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