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To Generate Electricity from Pavement: A Review

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ABSTRACT: The energy demand has increased rapidly year over year worldwide and with decreasing reserves of fossil fuel to overcome this issue it is necessary to develop a new way to harvest energy from non-conventional sources. The procedure of energy harvesting means to capture the energy, to convert the energy and to store the energy using various devices. Piezoelectric road means the waste energy due to footsteps or mechanical vibrations due to vehicles are converted into the electrical energy by using the piezoelectric material. Piezoelectric material has a self-tendency to convert the force, stress or vibrations into the electricity.

KEYWORDS: Piezo-electric Technology, Energy Harvesting, Clean and Green Energy, Smart Roads

I. INTRODUCTION

The lifeline of present-day civilization is electricity and its demand is very high and is increasing very rapidly. There are no more technologies that can generate pollution-free electricity. To fill the gap between demand and supply of electricity, dense traffic and demand of energy correlation inspire to design the road that would collect energy from the footsteps and vehicles passing over it. For this, piezoelectric material is fixed underneath the pavement. The piezoelectric road can give the magic of converting force exerted due to moving vehicles into electricity.

II. AIM

To design the piezoelectric pavement road out of the force applied on the pavement.

III. OBJECTIVES

- To study the various piezoelectric materials
- To suggest the effective one for piezoelectric pavement
- To find and design the appropriate base for economical piezoelectric pavement

IV. SCOPE OF STUDY

This research includes the study of various piezoelectric materials. The survey of number of footsteps and vehicles can be done to predict the amount of electricity generation.

V. LITERATURE STUDY

1. A preliminary study on the highway piezoelectric power supply system (By: - Hailu Yang, Linbing Wang, Bin Zhou, Ya Wei, Qian Zhao, 2016): In this study for piezoelectric roads the piezoelectric energy harvesters are used to convert the mechanical energy of vehicles into electrical energy. This paper mainly focuses on the theoretical model and laboratory tests. In this paper a stacked array type PEH is designed with a protection package which improves performance and service life of piezoelectric harvesters.

2. Analysis on piezoelectric energy harvesting small scale device – a review (By: - Pramod Kumar Sharma, Prashant V. Baredar, 2017)

This paper presents a way to harness the energy due to vibrations by using piezoelectric set up at a very low frequency range. Piezoelectric pulsation energy harvesters are used for low frequency range.

3. Design and Research of Constructive Features Of Paving Slabs For Power Generation By Pedestrians (By:- Antons Patlins , Andrii Hnatov , Shchasiana Arhun , Oleksandr Dzyubenko Fahrenheit or more," said K. Wayne Lee, May 2019) :In this study, the stepper motors are connect to an electromachine unit that's why the amount of generated electricity is increases by 3.9 times. 1.16W electricity is produced by one step. The electricity generation is not depends on the weight of the person but on how quickly the step is performed.

4.Using Pavements To Generate Electricity (By:- Khaled Shaaban , Karim Abdel-Waritha , John Haddock, May 2019) :They have studied, the concept of using thermoelectric generators to produce and supply the electricity using the temperature difference between pavement surface and it's underlying layers. In the presence of full spectrum lights a thermoelectric module placed within a hot mix asphalt pavement system and cement concrete pavement system in the laboratory and to measure the generated electricity.

5. Energy Harvesting from Roadways (BY:- A.T. Papagiannakis , S. Dessouky A. Montoya and H. Roshani , 2019) : This paper presents a review of an ongoing study to create an energy generating system according to traffic composition scenario to design and testing a number of prototypes in the laboratory it also involved numerical modeling and to prepare the economical analysis. The results suggest that the harvesting energy is used for powering LED traffic lights.

VI. MATERIAL

Piezoelectric plate –Piezoelectric plate working based on the principle of piezoelectricity i.e. The force , pressure or mechanical vibrations applied on it are converted it into electricity.

Cement- Throughout the course of the investigation ordinary Portland cement of 43 grade was used.

Asphalt- Asphalt is a composite material made up of mineral aggregate and bitumen associated with inert matter.

Aggregate- Main material in the pavement is the aggregate .The pavement strength depends upon the aggregate strength.

According to size there are mainly two types of aggregate

1. Fine aggregate- The aggregates which are less than 4.75mm is termed as fine aggregate.

2. Coarse aggregate- The aggregates which are greater than 4.75mm is termed as coarse aggregate.

Water- Potable drinking water is used for concrete mix having pH 6 to 8

VII. CONSTRUCTION PROCEDURE

1. The first course is the sub base which is laid with sand and fine gravel content which is supported to the sub grade
2. Then prepare a strong base for the transducers laid with a thin layer of asphalt.
3. To prepare the layer of concrete and piezoelectric transducer are placed on quick drying concrete as per the design.
4. To get collective output, all the transducers are wired in series.
5. To covering the piezoelectric transducer bitumen sheet is used to provide good adhesion of concrete to asphalt .
6. Finally, to prepare the wearing surface laid with thick layer of asphalt.

VIII. CONCLUSION

Power generation using footsteps and vibrations or stress applied due to the vehicles is the better alternative to fulfill the requirement of electricity. For choosing this alternative there are consider two important factors that is generating capacity and profitability. Power generation depending upon the force and mass according to this college area are very effective to generate the power. This power are used to lightening the stret LED's and further are saved into the battery for various applications.

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