



A Review Paper on Study of Power Generating Pavement by using Kinetic Footfall (PAVEGEN TECHNOLOGY) for JCOET Campus, Yavatmal.

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Abstract: The consumption of energy has always been in exponential growth and also there is always an increasing demand in the requirement of energy in some way or the other. So, there is a need to search for energy availability from alternate sources of energy. The utilization of waste energy of foot power with human locomotion is relevant. To address the requirement on the entrance gate of the Jagadambha College of Engineering and Technology Yavatmal. (JCOET) Campus, enhancing the visual appeal of the campus. This paper deals with the generation of alternate Sources of energy through piezoelectric materials. The result is the creation of Kinetic Paving material technology that when students step on it will produce electricity. This is an update that should have been implemented. When natural resources are getting low and energy prices are getting higher, we need all these reforms.

IndexTerms – Piezoelectric, Electricity, PAVEGEN technology, kinetic footfall, JCOET.

I. INTRODUCTION

The Pavegen Technology. It is also known as kinetic footfall. In civil construction field, introducing an energy conserving technology as a replacement for tiles. Therefore, we need Technology that can create its energy. To produce electrical energy, the easiest method is the result of the transformation of kinetic energy into the electrical energy. For an alternate method to generate electricity, there are a number of methods by which electricity can be produced, out of such methods footstep energy generation can be an effective method to generate electricity.

The human energy in walking can be used as kinetic energy which will be a source of electrical energy with quite a large number of young people. Youth tend to have more outside activities than other groups. So that at some point the place is quite active with the activities of this young man this can be an advantage in terms of creating electrical energy from kinetic energy. The existence of this research is expected to be able to help supply electricity for facilities to the surrounding buildings. And with the existence of kinetic paving, it is expected that young people will be more active in walking which will affect electricity energy income and as a science and invitation to apply the concept of future health for each individual.

In the case of Jagadambha College of Engineering and Technology, Yavatmal there arose a need to implement such technique on entrances, in JCOET Campus, which seems Aesthetics. The technique aims to utilization of waste energy of foot power with human locomotion is converting the kinetic energy in Electrical energy by walking on the pavement.



Fig. 1.1 Kinetic footfall

2. OBJECTIVE

- To Develop the Power generating pavement, in entrance of JCOET campus for generating the large amount energy.
- To study different components of Piezoelectric tiles
- To introduce the power generating pavement which is pollution free technique in the Jagadambha College of Engineering and Technology's Campus.

3. DESCRIPTION OF THE ENERGY BENEFITS OF KINETIC PAVING

To complete this research, literature studies from national and international reference books as well as journals are also used with related discussions on paving, energy, and energy saving.

3.1. PAVING BLOCK

Paving blocks with kinetic footfall technology are designed to generate electricity through the pressure and movement caused by people walking or stepping on them. When someone walks on these blocks, the pressure and mechanical stress created by their footsteps are converted into electrical energy, which can be used for various applications, such as lighting, charging devices, or powering sensors. Kinetic footfall paving blocks are typically used in pedestrian areas, sidewalks, plazas, and other high-traffic locations where they can capture the energy generated by people's movements to contribute to sustainable energy solutions and reduce the environmental impact of urban infrastructure.

The Installation is quite easy and has aesthetic value so that the paving block is always an alternative to outdoor floor coverings.



Fig.3.1. Paving block

3.2. PIEZOELECTRIC MATERIAL

Piezoelectric materials are at the heart of kinetic footfall systems, enabling the conversion of human movement into usable electrical energy, contributing to sustainable and energy-efficient urban infrastructure. Piezoelectric is a material in the form of crystals and consists of many chemical elements contained in it,

These materials have the unique property of generating an electric charge when subjected to mechanical stress or pressure, such as the force generated when someone walks or steps on them. A commonly known piezoelectric material is quartz. The mechanism involves development of electric charge due to movement of electron upon application of stress.

There are several materials that we have known for some time that possess piezoelectric properties, including bone, proteins, crystals (e.g. quartz) and ceramics (e.g. lead Zirconate Titanate).

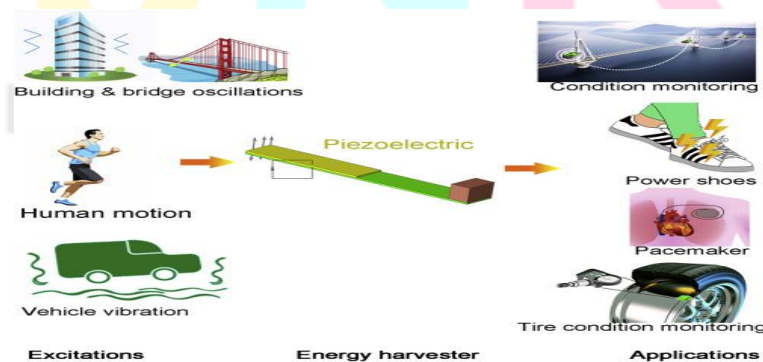


Fig.3.2.Piezoelectrics

3.3 KINETIC PAVING

Kinetic paving, refers to a technology that captures the energy generated by people walking or moving on a surface and converts it into electrical power. The energy is stored or directly channelled to something that requires energy around the kinetic paving. This technology typically involves the use of special materials or mechanisms installed in walkways, floors, or other high-traffic areas.

When people walk or apply pressure on these kinetic paving surfaces, it can create mechanical stress or movement, which is then transformed into electrical energy through piezoelectric materials.

Paving kinetic will be placed in crowded centre such as in stations, malls, Pedestrian ways or sports facilities that cover the floor using the Pavement.

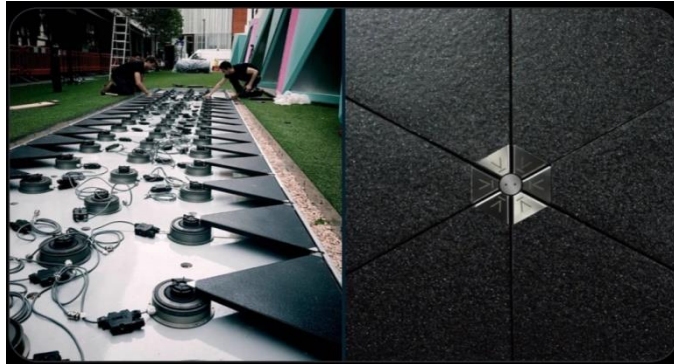


fig.3.3.Kinetic paving from pavegen technique

3.4 KINETIC ENERGY

Kinetic energy is a type of mechanical energy that depends on both the mass and velocity of the object in motion. In the case of a person walking or running, their foot gains kinetic energy as it moves, and this energy can be transferred to the surface upon impact.

The energy associated with the movement of a person's or object's foot as it impacts a surface or makes contact with the ground. The more movements, the greater the energy produced.

3.5. UTILIZATION OF KINETIC PAVING

The existence of this paving kinetic technology, the power from the footing is very meaningful because Of the source of kinetic energy for this technology.

The utilization of kinetic paving has the potential to contribute to renewable energy generation, smart city development, and sustainable urban planning while engaging the public in discussions about clean energy and environmental conservation.

Green Energy Generation: The primary purpose of kinetic paving is to generate electricity from the mechanical energy of footsteps.

Education and Engagement: Kinetic paving installations can serve an educational purpose by show casing renewable energy concepts to the public. Interactive displays or visualizations can be integrated into the pavement, engaging people and increasing awareness about sustainable energy sources



fig.3.4. Kinetic paving in the street

Sustainable Infrastructure: Kinetic paving can be integrated into urban infrastructure projects to promote sustainability. It aligns with smart city initiatives by providing an eco-friendly way to power various urban amenities.



Fig.3.5. Utilization of kinetic paving.

Paving kinetic is also a substitute for energy from non-renewable natural resources. Although not as a whole, minimizing will be better. So that CO₂ emissions will be reduced and air pollution will be reduced.

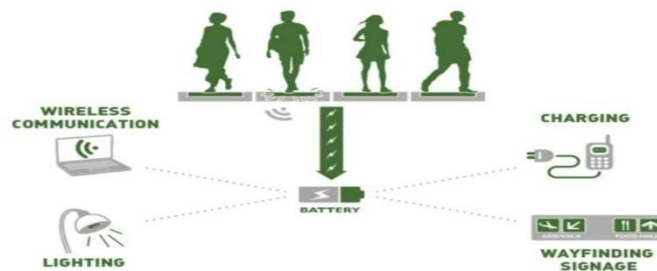


fig.3.6. Diagram of kinetic paving.

4. LITERATURE REVIEW

4.1. Henry A. Sadano, Daniel J. Inman, and Gyuhae Park, (2004): The author of this paper analysed harvesting power from vibration using a piezoelectric material. Various aspects of energy harvesting based on mechanical and electric components are investigated. With the advancements in technology harvesting, electricity with the help of piezoelectric materials will be more efficient.

4.2. S.S. Taliyan, B.B. Biswas, R.K. Patil, and G.P. Srivastava, T.K. Basu, (2010): In this paper, the author have discussed the basic engineering and operational mechanism of piezo crystal, engineering analysis of the model, working piezo crystal and energy generation through footsteps.

4.3. George Webster, (2011): In this paper the author studied the power generation method. Reviews of the public and studies introduction of an alternate source of energy in the market.

4.4. Zhen Liang Seow, Song Tao Chen, and Nor Bainin Khairudin, (2011): The authors provided an idea of commercialization of the piezoelectric based energy production in a live scenario.

4.5. Zack Mester and Guilherme Tamassia, (2012): In this research paper discussed the economic aspects of piezoelectricity, drawbacks of piezo electricity and other innovative techniques of piezoelectric generation. Also studied how to minimize the potential drawbacks of piezoelectricity and improve the efficiency of energy generated.

4.6. S.S. Taliyan, B.B. Biswas, R.K. Patil, and G.P. Srivastava, (2013): The author of this research paper focused on the possibility of the generation of electricity from footsteps. Working model of the footstep-based energy generator. The article has given a detailed working model and functioning of the footstep-based electricity generating system. This is an energy-efficient way of producing electricity as walking is one of the most common things, we do in the day to day life.

4.7. Julius Evans, (2015): The author has studied the various parameters related to consumer behaviour and adaptability of the tiles.

4.8. Nathan Sharpes, Dusan Vuckovic and Shashak Priya, (2016): In this research paper, the author have focused to present the details about designing and optimum structure of the piezoelectric product. Also proposed a suitable structure for product design for commercialization and design of outer shell circuit design and structure.

4.9. Lukai Guo, Quing Lu, (2017): In this paper the author discussed the cost-effectiveness analysis of energy harvesting pavement technologies. It estimates electrical energy generation from a pavement network by two technologies cost calculation and estimating needs. Cost analysis and estimation of energy production based on piezoelectric technology.

4.10. Adnan Mohamad Mahmoud Yousif, (2017): The author of this paper, state the feasibility of piezo electric tiles in the interior of buildings is studied. Analysis of energy transformation with the help of piezo electric tiles is done. Also studied the

feasibility of energy-generating tiles in the interior of buildings and also at low pedestrian spaces like apartment case by using harvesting floor tiles in a different way to generate and save energy.

4.11. Xiaochen Xu, Dongwei Cao, (2017): This paper states that utilizing piezoelectric technology in road energy harvesting is feasible and has a bright future. It defines the working mechanism in detail and the use of piezoelectric in energy harvesting.

4.12. Fatima Zahra Bouzidy, (2017): This paper carries out a detailed STEEPLE analysis of piezoelectric energy.

4.13. S.S. Taliyan, B.B. Biswas, R.K. Patil, and G. P. Srivastava, (2013): This paper presents of piezoelectricity, and also analyze the unit cost of electricity under piezoelectric.

4.14. George Webster, (2011): This paper studies the power generation method. Reviews of the public and studies introduction of an alternate source of energy in the market.

4.15. Zack Mester and Guilherme Tamassia, (2012): In this paper author discussed the economic aspects of piezoelectricity, drawbacks of piezo electricity and other innovative techniques of piezoelectric generation. Also studied how to minimize the potential drawbacks of piezoelectricity and improve the efficiency of energy generated.

4.16. Naresh, K. A. Balaji, M. Rambabu, and G. Nagaraju. (2018): "Practical Oriented Foot Step Electric Power Generation by Using Piezo Material and Microcontroller in Campus." International Research Journal of Engineering and Technology"

4.17. Tom Jose V,(2013): The author of this paper focused on future aspects we can use this principal in the speed breakers at high ways where are rushes of the vehicles too much thus increase input torque and ultimate output of generator. If we are used this project at very busy stairs palace then we produce efficient useful electrical for large purposes.

4.18. Sangram K L et.al (2017): The author tells about the working principal is, when pedestrian steps on the top plate of the device, the plate will dip down slightly due to the weight of the pedestrian. The downward movement of the plate results in the compression of the piezoelectric material fitted in the device, to produce electrical energy

4.19. Pushpendra Chouhan et.al (2017): When the flooring is engineered with piezoelectric technology, the electrical energy produced by the pressure is captured by ground sensors and converted into an electrical charge by piezo transformers, then stored and used as an energy source.

CONCLUSION

After studying these reviews, we concluded that the Piezoelectric Technology i.e power generating pavement is suitable to construct in Entrance of the Jagadamba College of Engineering and Technology, Yavatmal (JCOET) Campus. This is because the concept has been successfully tested and has proven to be the most cost-effective and accessible energy Alternative for the general public. This can be utilised for a variety of applications in urban settings that require greater Electricity. Kinetic paving is also an educational Medium for the cloud community regarding energy conversion and material technology. And it one of the best source of power generation by power generating pavement, because it is a eco friendly it can't cause the pollution in the JCOET Campus, and can not damage the surrounding area of the Campus. This positive evolution has Contributed to the binding state objectives aimed at Increasing the percentage of energy from renewable Sources, The use of kinetic paving is very useful in producing electrical energy Which is an alternative energy for facilities and buildings.

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