Energy Generation Using Vehicular Movement and Vibrations

Agnish M. Shirodkar[1] Sandesh Sawant[2] Vishal Valaulikar[3] Vijayalaxmi Hiremath[4] Prof. Kimberly Morais[5]

Abstract— In the Current world, there is an endless need for power. This calls for an urgent need to develop a non-conventional and sustainable source of since our conventional sources are fast depleting. This paper focuses on providing with an option of energy generation using a type of scheme where in energy can be harvested from the Vibrations of vehicular movement or Carrier Freight at Railway gate crossing. The focus is on limiting the dependence of railways over other forms of conventional energy and save millions spent on Rail budget specifically on Electricity.

Key words: Power harvesting; Energy generation; piezoelectric sensors

I. INTRODUCTION

There is a pressing need to adopt alternate methods of energy generation. Cleaner, more sustainable forms of electrical power are needed in order to keep costs lower, to maintain positive, healthier environment for future generations. The use of piezoelectric devices installed across level gate crossing terminals will enable in the capturing of kinetic energy from foot traffic and vehicle traffic. The direct compressive strength of the footsteps is converted into electrical energy through the piezo electric installations. With more crowds and larger vehicular movement the energy generated will be much larger.This energy can then be used to offset some of the power coming from the main grid. Such a source of power can then be used to operate LED lighting systems, since LEDs use far less energy than more conventional (fluorescent and incandescent) bulbs. Also LEDs are about four times more efficient than conventional incandescent lights and more environmental friendly than compact fluorescent bulbs. This will bring down energy consumption and environmental impact even further.

II. LITERATURE SURVEY

According to How Stuff Works, piezoelectric materials create a positive and a negative end when work is done to deform their original shape. An electrical charge flows across the material once pressure is relieved from them. While they usually provide very low currents, they can generate extremely high voltages. Harvesting energy from piezoelectric flooring is said to be impractical in residential applications due to the high cost of implementation and small amount of electricity generated in these settings. Common piezoelectric materials include quartz, Rochelle salt, and some ceramics. It is also claimed that harvesting energy from piezoelectric materials is inefficient, converting only a small amount of kinetic energy into electricity. The Christian Science Monitor claims that a single footstep could potentially generate enough electricity to power two 60-watt incandescent bulbs for one second, while the International Herald Tribune claims that the technology were implemented in a busy train station that the energy captured could power 6,500 LED lights for an unspecified amount of time.

III. DESIGN

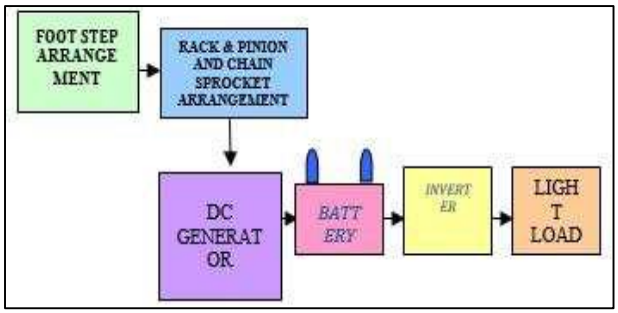

Fig. 1:

In the idea as suggested, we aim at using renewable energy for generating voltage. What we are largely focussing on is installing walking slabs on railway gate crossings. In this way both the vehicle moment when the gate is open as well as the train freight movements while the gate is closed can be smartly used to harvest electricity. Power would be generated by foot steps of crowd on the floor. Piezo plate scheme is located beneath the floor then the then there will be sheet covering the piezo plate and also spring will be there for vibration force on piezo. The piezo plate will be in chunks in the floor. This plate will generate power in the type of electric voltage. The system allows for a platform for placing footsteps. The piezo sensors are mounted below the platform to generate voltage from footsteps. The sensors are placed in such an arrangement so as to generate maximum output voltage. Thus we charge a battery using power from user footsteps. A bridge rectifier is used to provide linearity. The piezos are interconnected in serial and parallel manner.

First prototype: As of for the start we started with 4 piezo crystals of diameter 2.8cm. We got output of around 0.47V. The main reason for such a low output was because we used just 4 piezo crystals, the 4 crystals were placed very far from each other and also the crystals used were of small size. The human pressure was distributed and not fully applied to crystals and that led to a very low output.

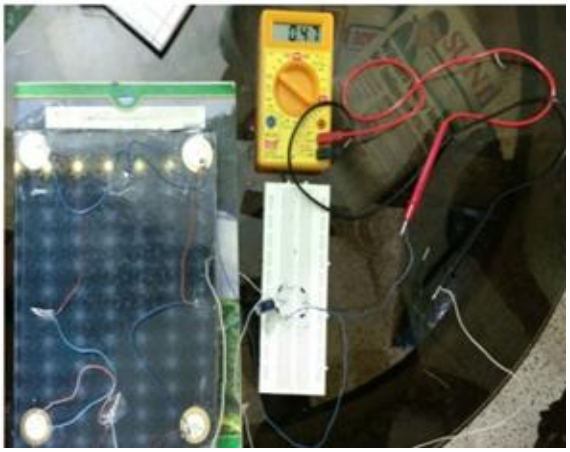

Fig. 2:

Second prototype: In order to overcome the drawbacks of the first prototype, we designed the second prototype with 20 piezo crystals of diameter 3.5cm , which were placed closed to each other with a placing of 1cm.This prototype gave a output of around 4V.The reason of getting jus 4V was due to mechanism used to generate human pressure wasn't wasn't very efficient. It didn't give maximum pressure out of the applied pressure on the crystals.

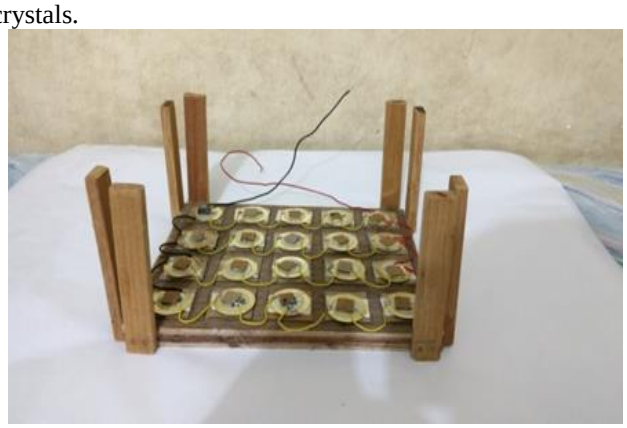

Fig. 3:

Third prototype: To overcome the drawbacks of the second prototype, we are in the process of making the third prototype. In this prototype we aim at making a better mechanism which will transfer maximum pressure to the piezo crystals and give a voltage of about 30V or even higher.

IV. INSTALLATION

The installation of the piezo devices requires the flooring to be removed. This process can be done as old, worn flooring is replaced or in certain high traffic areas as an experiment for determining feasibility in airport terminals. The piezo devices, due to their small thin shape, could be placed underneath floor tiles or carpet with few complications. In order to harness the power a capacitor could be used to store the electricity like in the train stations or inverters, like ones used to convert solar electricity from direct current to alternating current, could be installed in the terminals to convert the DC power from the piezo devices into AC power used in the lighting systems at airports. The power could then be routed directly to specific electrical devices such as lights or billboards or it could be sent to the main power grid at an airport in order to supplement the main power supply. There are many installation options and applications of these devices; the specific type of installation will depend upon the intended.

V. EXAMPLES OF CURRENT USES

The Piezoelectric installation has many applications. A city in china has adopted this means along its footpaths and a huge amount of energy per day is generated through these. It can also be used in night clubs where in all the foot stomping can effectively be converted into usable power source.

VI. FUTURE ASPECTS

This concept can be further developed to improve efficiency of the voltage per unit area output and can be set up in busy areas.

VII. CONCLUSION

This is a promising technology that will help in easing the current need of non renewable resources. It will be the most acceptable Means of generating power in remote areas using nothing but the vibrations of human footstep and vehicular traffic.

ACKNOWLEDGMENT

We acknowledge the advice of our beloved professors and those who previously worked on this concept. We also acknowledge the efforts of the critics of the journal for the modifications and suggestions to improve the quality of the paper.

REFERENCES

[1] C. M. Kacher, I. M. Weiss, R. J. Stewart, C. F. Schmidt, P. K. Hansma, M. Radmacher, And M. Fritz, European Biophysics Journal 28,Pp 611, 2000.
[2] Prabaharan ,Jayaramaprakash , Vijay Anand," Power harvesting by using human footstep "International Journal of Innovative Research in Science, Engineering and Technology,Vol. 2, Issue 7, July 2013.
[3] Monika jain, MohitDev Sharma, NitiRana, Nitish Gupta, "VIDYUT Generation via Walking : Analysis", International journal of engineering sciences and research technology, Feb 2013.
[4] "Hitachi's RFID powder freaks us the heck out". Engadget http://www.engadget.com/2007/02/14/hitachis-rfid-powderfreaks-us-the-heck-out. Retrieved 2010-04-24.
[5] Umeda, M., Nakamura, K., and Ueha, S. Energy Storage Characteristics of a Piezogenerator Using Impact Vibration. Japan Journal of Applied Physics, Vol. 36, Part 1,No. 5b, May 1997, pp.3146-3151.

