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Generation of Electricity by Locomotives using Piezoelectric Plates

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Abstract: *Our project will help in this period of expanding energy costs and diminishing supplies of non-renewable energy sources, it has become necessary to set up renewable energy based local power sources for shopping malls, different large institutions, factories, airports, railway stations rather than depending on national centralized power grid. This project reviews some recent experimental research and then provides a proposal to supply electricity for railway stations using piezoelectric materials as a source of renewable energy. Consideration of three different aspects in this proposal ensures highest amount of piezoelectricity supply for the energy demand of a railway station preparing every station as energy self-dependent in near future.*

Keywords: *Electricity, Railway station, Piezoelectricity*

I. INTRODUCTION

Indian Railways is India's national railway system operated by the Ministry of Railways. It manages the fourth-largest railway network in the world by size, with 121,407 kilometers of total track over a 67,368-kilometre route. Forty nine percent of the routes are electrified with 25 KV AC electric traction while thirty three percent of them are double or multi-tracked. IR runs more than 20,000 passenger trains daily, on both long-distance and suburban routes, from 7,349 stations across India. In the freight segment, Indian Railways runs more than 9,200 trains daily.

The average speed of freight trains is around 24 kilometers per hour. As of March 2017, Indian Railway's rolling stock consisted of 277,987 freight wagons, 70,937 passenger coaches and 11,452 locomotives. The Indian Railways owns locomotive and coach-production facilities at several location in India. The world's eighth-largest employer, it had 1.308 million employees as of March 2017. In the year ending March 2018, Indian Railway's carried 8.26 billion passengers and transported 1.16 billion tons of freight.

In this, passenger safety is more important but now days, most of the accidents in railway station occur between the railway platform and train. To avoid these accidents that the Indian government come with an indicative to increase the height of the platform. But it is not easy task to increase the height. At the time of working we cannot access the platforms. By applying our project it is easy to avoid the accidents as well as we can use the platform too. When the human fell down between the platform and the train can be totally avoided. Mechanical platform edge extensions known as platform gap fillers may be used to bridge the gap between platform and vehicle.

These stop gaps require careful alignment of the vehicle upon arrival, and careful synchronization to avoid serious damage caused by departure of the vehicle before the extenders are fully retracted. Moving all active components of the system to the train instead of the platform allows maintenance to be performed in a shop, rather than in the field. The wide gap between platforms and train footboard at several suburban railway stations is putting the elderly and persons with disabilities at risk. The platform floor and coach floor are of the same height at all metro stations in Chennai.

Railway norms stipulates the minimum of 15 cm (150 mm) gap between platform edge and train coach floor for suburban section Majority of Chennai sub urban stations has the gap of about 30 cm to 40 cm EMU trains stops only for 30 to 40 seconds Suburban section platforms to be heightened at 840 mm from the rail track Recently railway board authorized to increase it up to 920 mm in selected sections Operational wing of railways falls, if the platform height increased at Egmore and Chennai Park, the speed of the trains would be reduced to 15 to 10 km, thereby affects punctuality Chennai suburban section caters about 10 lakhs passengers a day in four suburban sections with 580 services a day Platform floor and coach floor is on the same height at all metro stations in Chennai According to 2011 population census, the state has nearly 71 lakhs population is in the age of 60 and above There were about 16 lakh disabled in the state in 2011.

The Western Railway has raised the height of 56 platforms across 28 stations on the suburban local network here as part of its ongoing efforts to increase passenger safety during train travel. There are total of 144 platforms, whose height will be raised up to 920 mm from the current 840 mm for safety of passengers.

II. OBJECTIVE

- A. Generate electricity with a load attained on locomotives.
- B. Locomotive load is directly concentrated only on plates.
- C. There is no excess load required to generate electricity.
- D. Use the required load on the track and generate electricity.
- E. Vibration and pressure required on track has been used as source for electricity generation.
- F. Electricity generation is easy.
- G. There is no external source required to produce electricity.
- H. Implementation cost of piezoelectric plates are less.
- I. Produced electricity is used for various uses in railway stations.
- J. There will not be more losses while applying load on the piezoelectric plates.
- K. Reduce non renewable energy production method.
- L. There is no pollution during energy production.
- M. Its also be an renewable energy resource.
- N. There is no need of fuels and alternative source for energy production.
- O. Its improves renewable energy production rate.
- P. This energy can be produced contionusly while there is an load on track .

III. WORKING PRINCIPLE

We are implementing these piezoelectric crystals on the metal plates which are attached to the sleepers beneath railway tracks. We are implementing on the metal plates because we don't want to disturb the sleepers by any chance. By using the metal plates the entire vibration on the sleepers will be transferred onto the plates, which would be then converted and used. So we are placing the piezoelectric crystals on these metal plates in such a way that the maximum vibration energy is converted into equivalent electrical energy. This energy which is converted is stored in the batteries and thus used for various purposes. The energy generated will be used in the nearby railway stations. This energy will be thus useful for the working of all the electrical appliances used in the stations. Thus the concept will be able to provide energy at cheaper rate as of now. The energy created can also be used for the nearby farms if it is required. The best benefit of the usage of the energy nearby is the less transmission loss and less storage problems. The entire generation of energy can be directly used for various purposes without any much loss and the energy generated is pollution free. The piezoelectric crystals will generate charge which cannot be stored in a battery for future use. For this purpose we can use a charge amplifier. This charge amplifier will give a voltage output which can be stored in batteries for future use. These piezoelectric plates are placed under the railways track to get more load on the plates. When load is increased on plates generation electricity is high and these load can be transferred to inverter to convert it and store in battery. Electricity has been generated when the train moves over the tracks which are placed with piezoelectric plates to generate electricity with pressure on the plates. And these electricity can be used for various uses on nearer areas.

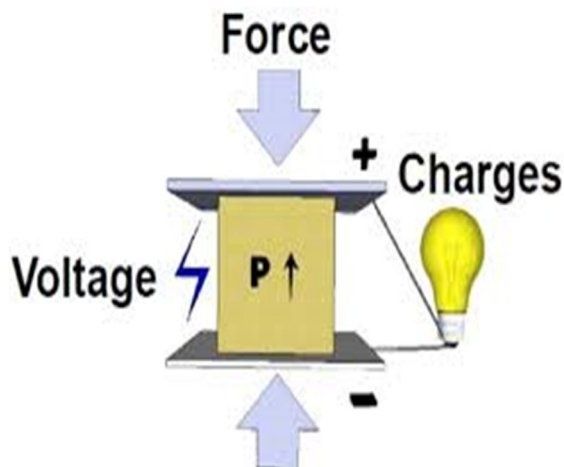


Fig 3 Working Principle

A. Flow Chart

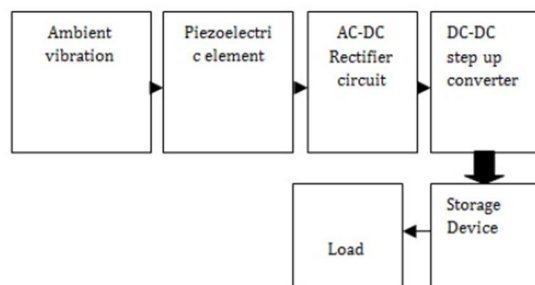


FIG 3.1 FLOW CHART

IV. ADVANTAGES

- A. Electricity generation is easy and simple.
- B. Cost of implementation is less.
- C. There is no excess load is required on producing of electricity
- D. Power generation is fast .
- E. Pressure can converted into electricity.
- F. Load applied on the plates are transferred into electrical energy.
- G. There will be an continuous load on piezoelectric plates while moving locomotives.

V. CONCLUSION

This project is a proposal of energy harvesting utilizing piezoelectric materials for railway stations has been exhibited. It is another way to deal with lead the world into executing greener advances that are gone for ensuring the earth against environmental pollution. While this paper demonstrates a good potentiality of energy harvesting from piezo-electricity in railway station, many opportunities for extending the scope of this research remain. The possible produced electricity will not be sufficient to make a station completely self-energy dependent. There is a future scope to work on the efficiency improvement of our described methodologies. Apart from that, incorporation of other types of clean energy such as solar and wind energy with piezoelectricity might be a new direction of this present works.

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