POWER GENERATION BY USING REVOLVING DOOR

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ABSTRACT

A need of saving conventional energy sources leads to use of a new energy sources. As the world is advance in various fields like research and development, conservation of energy is very important aspect. To conserve energy we have taken the step and introducing a new concept of electricity generation with the help of revolving doors. As the world facing hazardous challenges from global warming due to liberation of green house gases during power generation by conventional sources, the projects provides eco-friendly power generation by human force to push the door. Prototype of Power Generating Revolving Door is specially planned to design and fabricate for utilizing the available non-conventional energy source. So, objective of this project is to use human effort for generating electricity. By this arrangement, the minimum power output obtained is 0.024 watts at 1 Revolution per 5 seconds and maximum power obtained is 0.2 watts at 1 Revolution per 2 seconds. The maximum and minimum rotations of the door observed are 30 RPM and 12 RPM.

Keywords: Energy conservation, Revolving mechanism, Generator

INTRODUCTION

The idea of power generation from revolving door leads to avail the electrical energy sources for various appliances. Now a days whole world is trying to save our conventional energy sources and using non-conventional energy like solar energy, wind energy as well as available energy to make ecofriendly power generation. Door based power generation is specially planned to design and fabricate the conversion unit for utilizing the available non-conventional energy sources.In current research studies, the power obtained from this source is having low intensity but can be enhance in the future with use of more smart energy generating devices.

Use of revolving doors concept is new and ecofriendly which makes use of human effort to produce energy. This method of generating electricity is not a major source but the low intensity operated device can be run for longer time. This concept takes the world in direction of non-conventional energy power generation and renewable energy.The stored power from this source into the batteries can be used in operating low intensity device in hospitals,airports,malls,banks etc. For the study about this concept of power generation, we have taken reference of following research papers.

Door based Power Generation System and Automatic Opening of Door (MIT College of Engineering, India, March 2016), this paper discuss on the concept of conserving the energy though power generation with the help of revolving door.The Revolution Door and Electrical component are of two prototype devices with mechanical/electrical systems that harnesses human motion and redistribute it as electricity. This source of power can be used at the offices, colleges or Hotels and most likely by the Hospitals door operating system. The working of the project is that when men coming on the path apply the impact force or thrust on the projected mechanism. This impact pressure energy can be utilized to operate the rack and pinion gearing and through the train of pulleys can operate the fly wheel, which stores the energy and utilizes it for continuous rotation of the generator operating pulley and belt transmission system. This machine converts reciprocating motion in to rotary motion. The rotational power is stored in flywheel & flywheel rotate alternator that generate electricity.

Development of Energy Harvesting System Using Rotation Mechanism of Revolving Door (Universiti Teknologi Petronas, Bandar Seri Iskandar, Tronoh, Malaysia, November 2015), this study is to show that the ambientenergy in the surroundings can be utilized to generate electricity. In this project, the energy used to open a revolving door is being converted into electrical energy. Accordingly, a revolving door prototype is designed, fabricated and tested. The test results show that 15.67 Joules can be produced from one push of the door. A carbon comparison case study is carried out based on the results. This prototype can be further optimized in terms of size to generate more electrical energy.

An Investigation into Energy-Generating Revolving Doors (University of British Columbia, November 30, 2010), as per study the conclusion came from this study is that this report analyzes the possibility of implementing energy-generating revolving doors in the new Student Union Building (SUB) at the University of

British Columbia by making a triplebottom-line assessment. This is done by investigating the impact on the economy, society and environment. The economic impact results in a net savings in the operational costs of the building.Furthermore, because revolving doors limit air leakage, they prevent the fluctuation of building temperature that occurs with the use of swinging or sliding doors. Therefore, less energy is consumed by the air conditioning units and heating units, which respectively cool and heat the building to maintain an optimal room temperature. By using less energy, the new SUB would be producing less greenhouse gases. The report also recommends the number of revolving doors that should be installed, taking into consideration the need for a good balance of triple-bottom-line aspects. Ultimately, this report shows that the energy-generating revolving door is a favorable renewable energy source for the new SUB. Each door saves over 75% of the energy consumption from building heating and cooling, as compared to traditional doors. They generate nearly 4600 kWh of energy while reducing ten tonne of greenhouse gas emissions per year, and they inspire people to think of how and why practicing sustainability is paramount in the building of a strong future.

Energy Generation from Revolving Door (International Islamic University Malaysia, Rajshahi University of Engineering and Technology, Rajshahi, May 2016)This study is based on design and fabrication of a prototype revolving door which can generate energy by amplifying the initial RPM of door shaft. Gear, pinion and motor mechanismare used as an energy generation part of the proposed revolving door. Different data are taken by applying various conditions despite the RPM in practice. The prototype can produce 4 volts and the total output depends on frequency of people passing through the door. By this arrangement, the minimum output power is obtained nearly 1.564 watts at RPM 13 and the maximum output power is found about 2.6 watts at RPM 23.The revolving door produces power by harnessing energy that dissipated by human during walked through the door. As people use the door, the integrated gears connected to the central axis of door revolve. Due to the gear ratio the rotation given to door has increased about 92 times, which is applied to the motor shaft. A DC motor coupled with the integrated gears produce electricity. A bridge circuit is used to filter current, and in one direction. A rechargeable battery is used to store the energy.

Working of New Design of Door Closer (October 2013), this paper gives the detail concept and mechanism for the new design of door closer which is tested on fabricating model. The design using various components like compressive spiral spring and simple gear train arrangement. To test the mechanism working a small model fabricated.The aim of the project was to construct and design a door closer which work on gear system that has practically needs minimum maintenance, was simple in erection and fulfilled the required specifications.Main objective is that to optimize the cost of product by run the product for long time.

Modifying Habits Towards Sustainability: A Study of Revolving Door Usage On the MIT Campus (MAY 25, 2006), this study focuses on a study of revolving door usage on the Massachusetts Institute of Technology campus. The study can be viewed as formation of habits (the use of the swing door over the revolving door) and how to modify them (how to get people to use the revolving doors).

DESIGN

The prototype design consists of four panel revolving door. Four panels are more efficient because it will rotate in 180 degree when a person pushes it. More rotation causes more torque which helps to generate more electricity through DC generator.The design of prototype is made by using AutoCAD as well as CreO software. We have chosen a material for prototype as aluminium for the frames and other clamping plates.And for the door panels the material selected is hard metal (Galvanized Mild Steel) having 1 mm thickness. Door material is considered as per the availability and to reduce vibration and increase the strength of whole setup. The door panels are centrally connected to main shaft of door. All the doors panels are made with small hard metal sheets having small holes over its surface and clamped with nut and bolts. To minimize the door weight and to increase its attractiveness the holes are made on the surface whole panels.

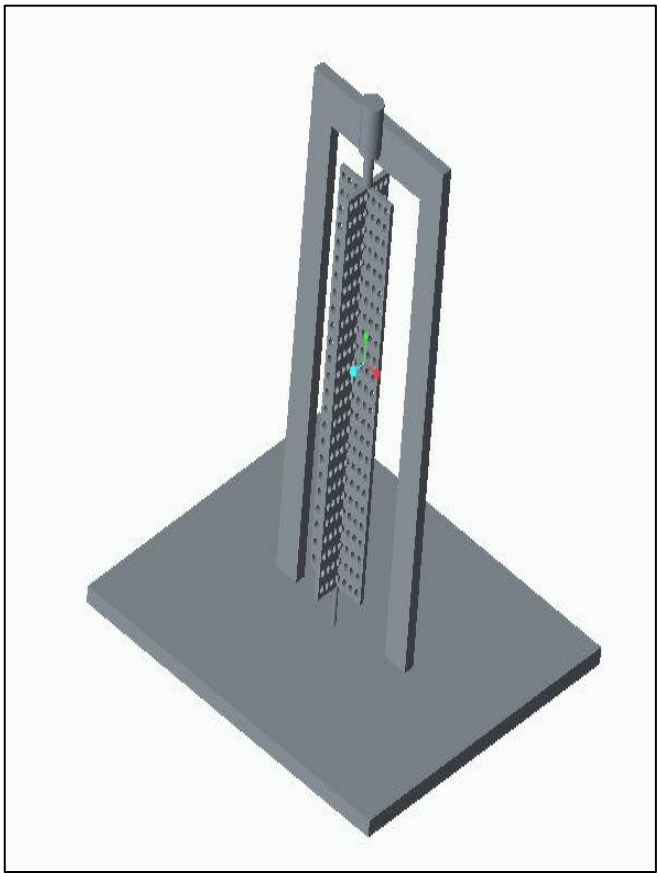

Fig. 1(a):- CreO Model of Prototype

Fig. 1(b):- CreO Model of Prototype

FABRICATION

After the accomplishment of designing of prototype,the fabrication was done as per the parameters considered in design. In the first stage of fabrication, we have taken three bars of aluminium and made a frame.The frame was having good strength as it was clamped to heavy plywood piece. The bars are clamped to ply piece with nuts and bolts. In second stage, door panels of material Galvanized Mild Steel are made. The sheets of MS were cut into dimension as considered and then the holes are drilled over it to balance its weight. After the door's fabrication, the assembly is done. For showing the application of power which is stored in the battery, we made DC motor operated Escalator by using belts, pulleys, shafts and aluminium bar. In the last stage of fabrication, we fitted the DC generator over the door, in which the central shaft of door panel was first coupled to the gear mechanism and then the other shaft from same gear mechanism was coupled to DC generator. Hence the devices are coupled in series manner (Door panel shaft, Gear mechanism, DC generator). The final fabricated prototype is shown in figure.

Table 1: Specification of gears

Sr. No.	Parameters	Gear	Pinion
1	No. of teeth	12	6
2	Ratio	2	1
3	Module	3 mm	3 mm
4	Pitch Circle Diameter	36 mm	18 mm
5	Material	Steel	Steel

Table 2: Specification of Door and Frame

Sr. No.	Parameters	Door	Frame
1	Height	480 mm	600 mm
2	Width	125 mm	50 mm
3	Thickness	1 mm	25 mm

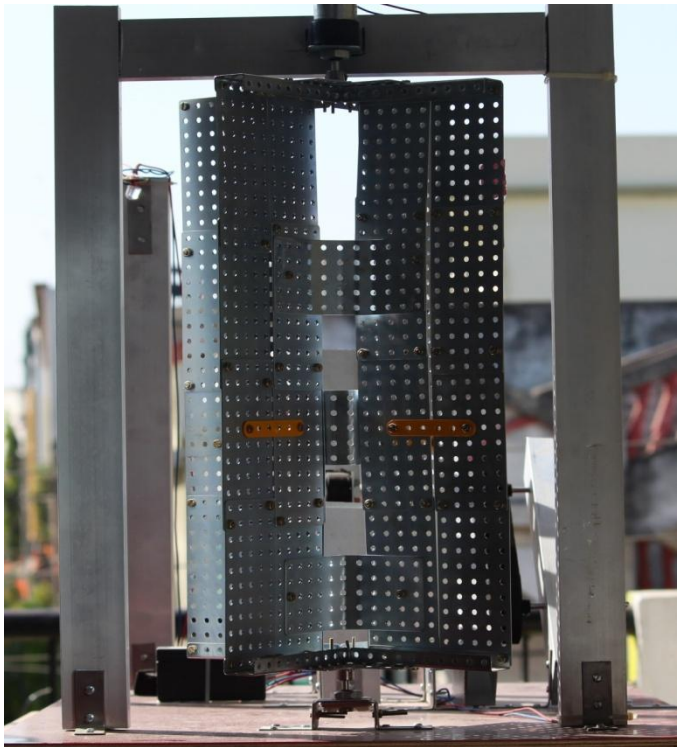

Fig. 2(a):- View of Prototype

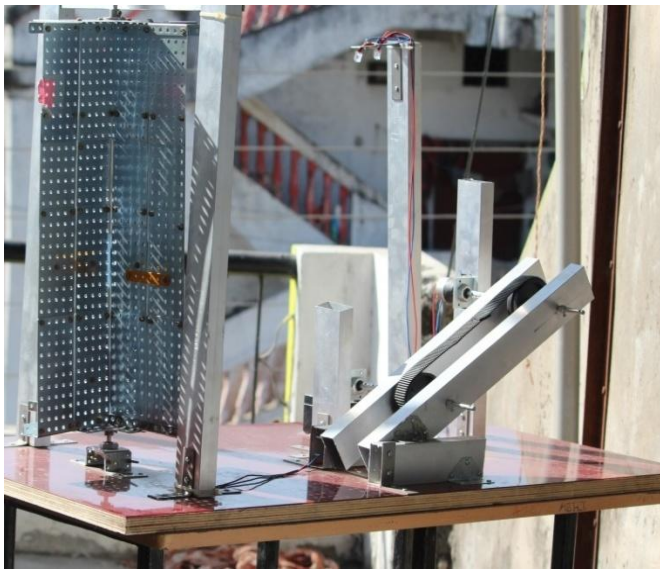

Fig. 2(b):- View of Prototype

WORKING OF PROTOTYPE

The proposed prototype is worked on principle that energy can neither be created nor be destroyed; it can be transform from one form to another. The human effort to open the door is converted into electricity generation with use of electro-mechanical system.

As shown in the prototype, the door is coupled with DC generator through some gear mechanism. When a person pushes the door it transfers it rotations to gear mechanism which then increases the torque. Increase in torque directly causes the high power generation; if the width of the door increases more than power generation rate alsoincreases. The power generated in a single push is not a very high but a constant rate of input can generate a high power which can be stored into the batteries. The power generated from dynamo is used to charge the DC batteries and over which a pair of LED lights and a DC motor operated escalator model works.

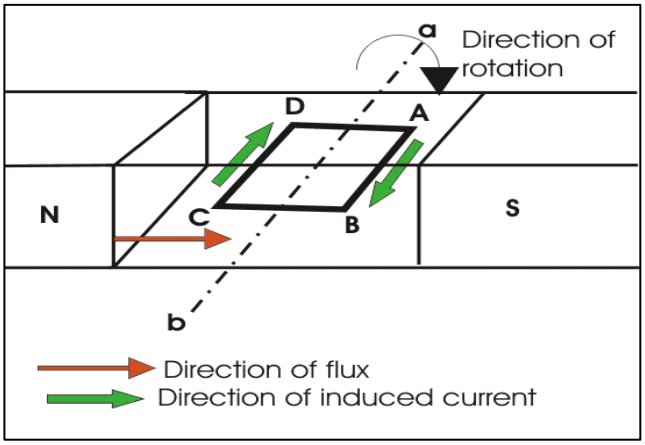

Fig.3 (a):- DC Generator Working

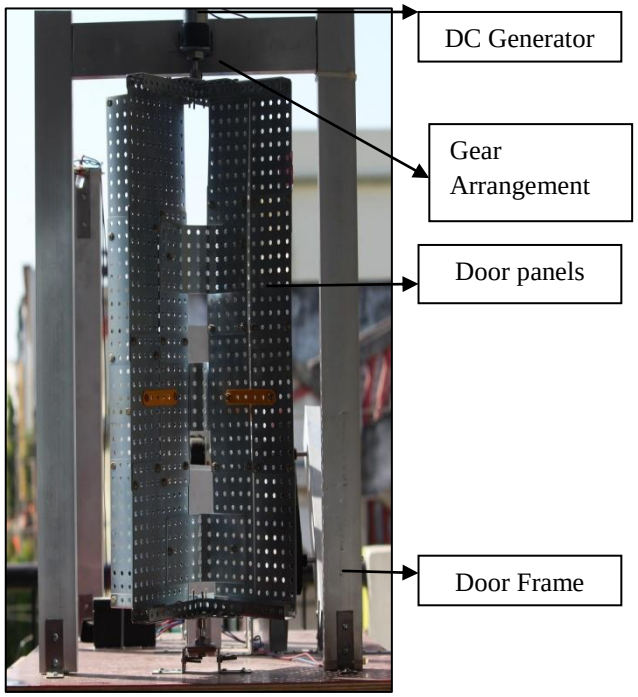

Fig.3 (b):- Components of Prototype

RESULTS

The testing of model is done on the basis of rotations and average time of person to enter into any building or a place where revolving door is established. The study shows that power obtained from this prototype model is initially very low but it can be reach to a great extent by making the door design proper and using the efficient devices.

In our prototype, a basic concept or habit of any person to open the door is taken into consideration. When a person pushes a door, it will open by 90 degrees or little more. For a 90 degree revolution, we are getting an average output of 0.94V and 0.06A, so ultimately the power output is 0.06 watt. If we considered that
Second person will push the door after 5 sec then in 1 minute, 12 people will push the door and they will generate 0.72 watt in one minute.

As 1 min. is corresponds to 0.72 watt then in 1 hr. (60 min.), the door has to develop 43.2 watt. The power obtaining is just on the basis of what prototype generating at average level of performance. The installation of this prototype is possible only where there is crowd is obtained such as malls, airports, railway stations, banks or any other public places.

At maximum revolution of door, it gives 5.3 watt at 30 RPM which are obtained on the basis of calculations of 1 revolution per sec. which generates average of 0.3V.

CONCLUSION

From the experimentation of this prototype,we can make conclusion that this prototype can generate low intensity power which is sufficient to lighten the small area. As the most of the countries fails to provide sufficient electricity to their respective villages and those villages still facing power cutting problems, so this small

initiative will help to resolve their problem at good level. This prototype is capable to generate 2 volts at 30 RPM observed at minimum level of performance. By increasing the parameters and making the proper design, this model can generate sufficient power, if it is installed at a place where more people movement occurred.

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