

# Generation of Energy using Revolving Door

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**Abstract** - As the today's world requires a lot of energy in different phases to run their livelihood. So this idea describes about the conversion of muscular energy into mechanical energy which can be again converted into useful electrical energy. The renewable energy and some unconventional source of energy also provide the necessary amount of clean energy for climate stabilization and reduce the consumption of fossil fuel. The main goal of this paper is to designed fabricated of a miniature revolving door which can generate energy by amplifying the initial RPM of door shaft that harnesses human motion and change it as electricity.

**Key Words:** Energy Generation, Gear, Motor, Pinion, Revolving Door.

## 1. INTRODUCTION

Renewable energy such as solar energy, wind energy, energy generation from vibration by using piezoelectric materials are the best solution for overcome this problem. However, revolving door can be used as new energy sources of energy. Boon Edam developed an energy generated revolving door for the "Driebergen-Zeist" railway station in Netherlands. That not only saves energy, but also generates energy with every person passing the doors. The station has a daily capacity of 8500 commuters and a calculation for this particular situation that indicated an energy saving of around 4600 kWh per year a considerable saving compared to a conventional sliding entrance. The door uses a generator that harvests the kinetic energy when the door spins and a super capacitor to store the energy. The generator controls the rotating speed of the door for safety. The ceiling of the revolving door is made of safety glass and gives a clear view of the technology.

The concept of Energy harvesting is to avail the energy that is usually available in the surroundings and convert it into useful electrical energy [1]. Most people do not realize that there is a lot of energy that is formed around them all the time. Energy can be harvested from various sources such as vibrations, thermal and mechanical sources, etc. [2]. Currently, the energy harvesting makes little impact on the overall electricity consumption in a built environment. However, it does improve the overall consumption by a little margin and in the future; this margin will be magnified by the production and implementation of more and more energy harvesting products in the market [3]. The idea of using revolving doors to harness Energy is

relatively new in the market. This green energy solution makes use of an everyday occurrence to produce some electrical energy can be used for large range of low powered electronics [4]. Currently, research is being done on methods to improve the efficiency of the revolving door to obtain maximum output power. Although it is agreed that this method is not a major source of power production, it is definitely a step forward in the direction of renewable energy.

## 2. REVOLVING DOORS ENERGY HARVESTING

Energy harvesting revolving doors the basic mechanism of a revolving door typically consists of a centre shaft with three to four door panels hanging on it. The shaft rotates around a vertical axis within a round enclosure. The main purpose of revolving door is to reduce the heating or cooling required for the building. Harnessing energy from revolving doors will not impact the force applied by the user. It is because the currently used revolving doors are also applied with gearing and highly viscous fluid which dampens their spin. Kinetic energy is dissipated in these systems so the door spins within a relatively predictable range of speeds. The difference in this concept is that it would replace the existing mechanisms (fluid or gears) with the internal resistance of a generator. So the energy transferred by people into the door isn't dissipated. Rather, it is captured and converted into useful electrical energy. A revolving door designed and fabricated by Fluxxlab stands on a platform by the entrance [5]. The door harnesses the energy created by the movement of the door when visitors walk through it.

The harvested energy is utilized to power a sign that lights up as people pass through. The energy harvesting revolving doors are placed at a number of places in New York for the purpose of exhibition, each one a potential source of untapped energy. The design by the author in [4] is rather simple and the purpose of the research is to find the effect of torque on the output power. A simple prototype was fabricated in order to carry out the experimentations. With the rotation of door, the motion of shaft is converted into sufficient speed by a pair of gears for producing electricity through generator. The output voltage is regulated at a certain level and used to analyse the effect of torque by varying the panel length and applied force. The author also proposed to install a power management circuit and battery to store the energy produced by the door. The model consists of a revolving door, a gear reduction system, and a generator.

## 2.1 Design and fabrication

The revolving door is constructed by extract energy through gear, pinion and motor arrangement. So it divides the system into two parts. One is the typical revolving door part which is above the ground level and energy generation and storage part which is below the ground level. The advantage of the later part to stay below the ground level is minimizing the noise. Figure 1 displays the top view of the proposed revolving door.

In the experimental set up, three parts spinning door is used which is made of wood. The wooden parts are framed by thin MS bars and joined by a screw. These bars are welded to a rod acting as the central axis of the door. The spur gears are six in number and made of cast iron as shown in Figure 2. Gear 1 is attached to the door shaft and having 76 teeth. It is meshed with Gear 2 which has 19 teeth. Gear 2 and Gear 3 are in the same shaft. Gear 3 has 38 teeth and is meshed with Gear 4. Gear 4 and Gear 5 are in same shaft having 19 and 220 teeth respectively. Gear 6 containing 19 teeth is fixed to the motor shaft and meshed with Gear 5.



Figure 2. Spur Gear

Design of the prototype the design of the prototype was made using AutoCAD and is depicted in Figure-2. The material of the outer frame of the prototype is chosen to be hollow steel and the material for the revolving door is chosen to be Perspex with thickness 3mm. The purpose for material selection is to ensure that the frame is able to support the door by making the door lighter than the frame. Another reason for the material selection is the availability of the material itself. The compartment below the revolving door is designed as housing for the gear mesh and the generator.

## 2.3 Working Principle

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. Figure 3 illustrates the flow diagram of the system.

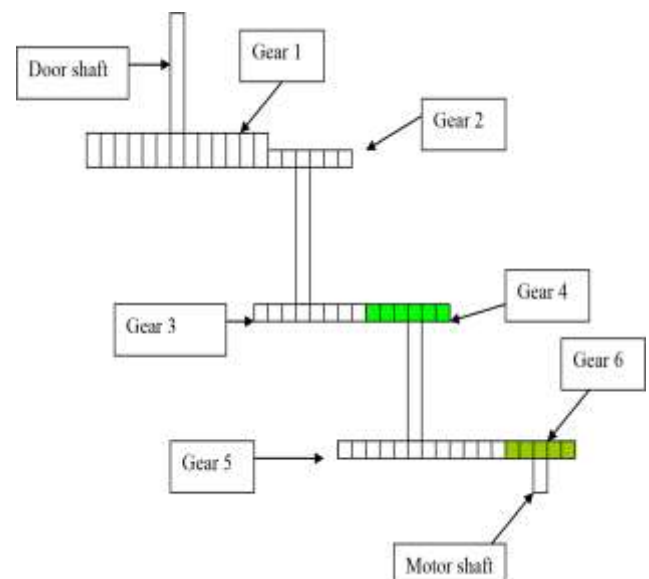


Figure 3. Gear Arrangement of Revolving door

Direction of rotation is often enforced by the door governor mechanism. The rotational kinetic energy stored in the revolving door is extracted by human pushing on a door increases the rotational kinetic energy of the door. This energy is a result of the inertia of the door and its angular velocity. The kinetic energy of the rotating door is calculated intern is used as a torque input to the GM-Motor. Speed of rotation of door is increased by gear assembly which is connected to bottom of the shaft. GM-motor of having rating of 12V, 10 rpm, 2 kg-cm is used and produce a 12V DC output that is stored in battery of having 12V, 7.2Ah, charge controller will helps in charging the battery.

## 3. CIRCUIT DESCRIPTION

A revolving door typically consists of three or four doors that hang on a center shaft and rotate around a vertical axis within a round enclosure. Revolving doors are energy efficient by eliminating drafts, thus reducing the heating or cooling required for the building. At the same time, revolving doors allow large numbers of people to pass in and out. Revolving door producing green power operates by when person passes through it. As door rotates geared pairs convert this motion of shaft into sufficient speed for producing electricity through generator. This is further stored in DC battery or used for LED. This revolving door designed in this seminar would help primarily to generate and conserve energy.

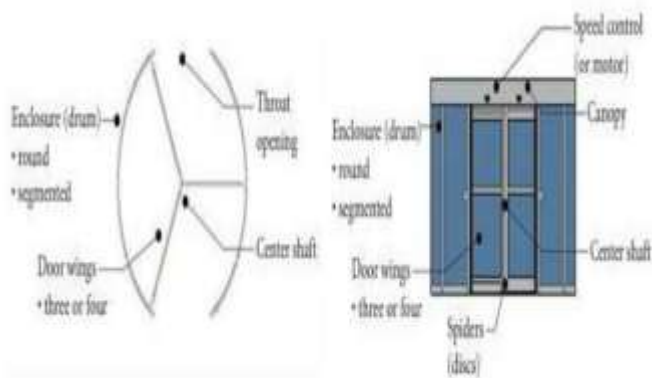
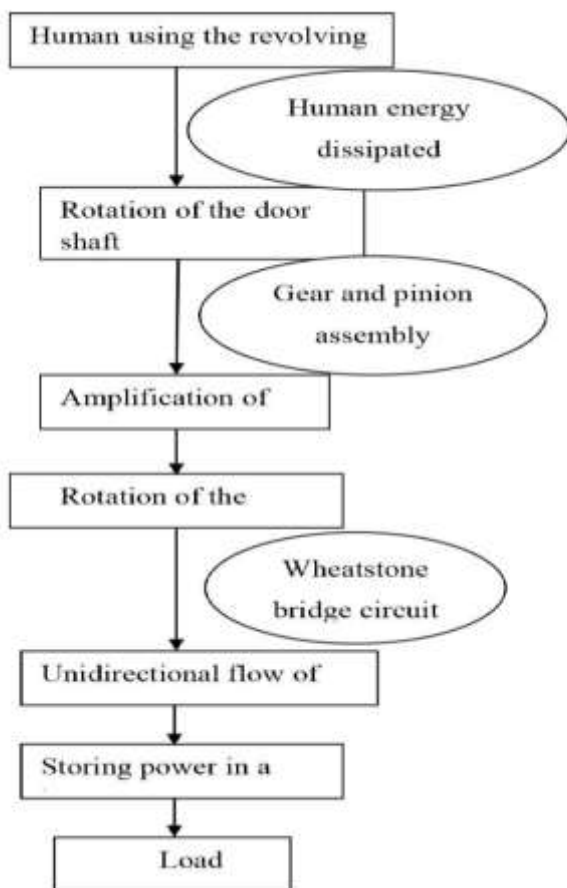


Figure 4. Circuit Diagram of proposed system

### 3.1 FLOWCHART



### 4. CONCLUSION

The energy which is going waste one or the other way can be utilized to generate power using simple mechanism. As today's world is completely dependent on different types of energies and these energies are going to disappear or exhaust one or the other day so we need to use free energy in order to run our basic appliances which require electricity for its working. The power generation of this designed revolving door depends on shaft RPM of the

door and frequency of people passing through the door. By this arrangement, the maximum output power is obtained about 4 volts at 23 RPM. If it is employed in places of high peoples movement with proper designing it is possible to generate sufficient power from it. Due to this system operation of door will make somewhat flexible, also the energy being absorbed by the generation system will be utilized to convert it in to electricity.

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