International Journal of Advance Research in Science and Engineering
Volume No. 12, Issue No. 06, June 2023
www.ijarse.com
IJARSE
ISSN 2319 - 8354

DESIGN AND FABRICATION OF PROTOTYPE FOOT STEP ELECTRICITY GENERATOR

A.Thirumalaikumaran[1], R.Amesh[2], S.Murugesan[3] and S.Saran[4]

[1]*Assistant Professor, Department of Mechanical Engineering, Builders Engineering College Kangeyam, Tamilnadu, India.*

[2, 3, 4] *Student, Department of Mechanical Engineering, Builders Engineering College Kangeyam, Tamilnadu, India.*

malaibemech@gmail.com, ameshrajamani2002@gmail.com,murugeshkhan87@gmail.com and saran91143@gmail.com

ABSTRACT

The modern world's basic necessities today include power and energy. Day by day, the world's need for energy rises. The numerous energy resources, on the other hand, are being wasted and depleted. In densely populated nations like India, where millions of people walk about daily and overcrowded spaces like roadways, train stations, bus stops, and temples, the proposal for utilising waste energy of foot power with human locomotion is quite pertinent. This unconventional technique, called the "Footstep Power Generation Mechanism," generates energy by having a person walk across a moving plate. A rack and pinion gear then transforms the physical energy into mechanical energy, which is then transformed into electric energy by a DC generator. The generated electricity is used to store in a lithium ion battery. This is one of the simple to build electricity-generating systems that is also small and effective.

Keywords: *Footsteps, Rack & Pinion, D.C. Generator, Battery*

1. INTRODUCTION

Electricity is the most practical and adaptable energy source, has a large demand, is growing more quickly than other energy sources, and is essential to both industrial and agricultural processes [1].A power plant's electromechanical systems, which are frequently powered by heat engines powered by combustion or nuclear fission but also by other methods including the kinetic energy of moving water and wind, are used to generate electricity. Solar photovoltaic energy and geothermal energy are additional energy sources [2]. Today, any country needs non-conventional energy more than ever. Walking is a typical daily activity that many individuals engage in. The weight transfer to the foot's surface during walking results in a loss of kinetic energy. As a result, the human energy contained in each footstep can be transformed into electrical energy. An appealing source of energy is human power. Footstep power generation is a non-conventional/renewable source of energy that promotes public health and minimises environmental pollution, such as air pollution from burning fossil fuels. This reduces early mortality from pollution and lowers associated medical expenditures [3]. A number of straightforward installations that are placed beneath the walking platform are required for this process. Walking on this platform

compresses the system, turning a dynamo or Sanyo coil, and the current generated is stored in a dry battery. A responsive subflooring system is put in place to lessen the external compression. Energy is also produced at higher levels despite the power plant's overcrowding from people moving about on it. More individuals moving around will result in more energy.

2. PROBLEM SUMMARY AND OBJECTIVE

2.1 Problem Summary: we all prefer non-conventional resources like solar and wind powered mechanisms but they are still an expensive matter for many. In addition, sunlight availability is poor especially in rainy & winter seasons, making it unreliable. Rising pollution levels in the atmosphere and the lack of electricity in various parts of the world, combined with a daily increase in demand for electricity, is driving all of us to do so. Therefore, it is necessary to develop a low-cost strategy for the production of electricity.

2.2 Objective: In crowded areas, an energy-producing platform can be a huge asset. As the population grows, the strain put on the footfall will produce an endless supply of power that can be stored and used for a variety of purposes.

3. METHODOLOGY

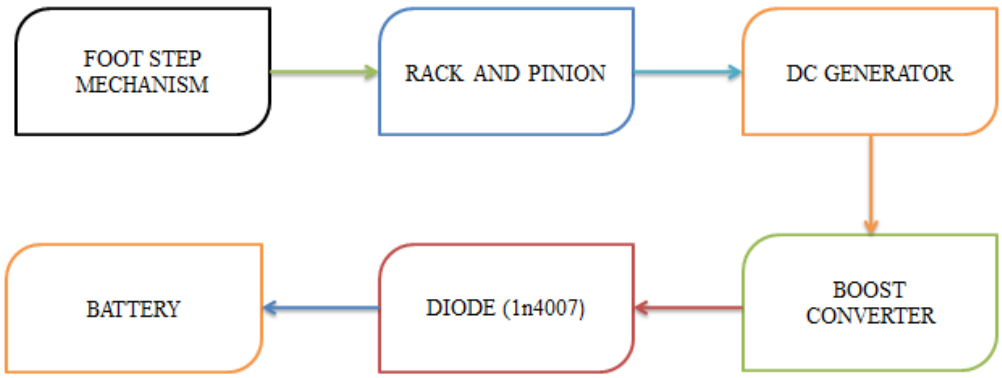

Figure 1 Methodology

4. EXPERIMENTAL SETUP AND MATERIALS

4.1. Frame: The system's primary structural component is the frame. The frame must support the entire human weight as well as maintain the position of the exploratory setup.

4.2. Spring: A spring is characterised as a flexible body with the ability to twist when loaded and recover its distinctive shape when the load is released. There are many different kinds of springs, but in this case we used a helical compression spring, and we needed two of them shown in Figure 2.

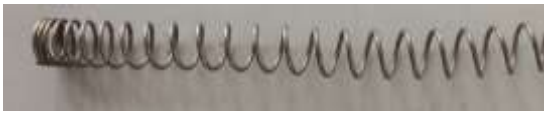

Figure 2 Spring

Specification

No of coil : 24

Wire Diameter : 1mm

Inner Diameter : 6mm

Outer Diameter : 8mm

4.3 Rack and pinion

A shaft's gear meshes with gear in a straight line both internally and outwardly. Rack and pinion gear is the name for this kind of gear. The circular wheel is referred to as a pinion, while the straight gear is known as a rack shown in Figure 3.

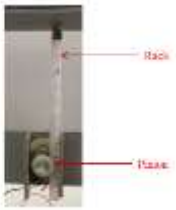

Figure 3 Rack and Pinion

Specification

Material (Rack and Pinion): Plastic

Outer diameter: 1.5mm

Tooth depth: 0.4 mm

Circular pitch: 1 mm

Teeth on rack calculated for: 112 mm

4.4 DC Generator

Electric power is produced by converting mechanical revolution into it. It is a device shown in Figure 4 that uses electromagnetism to convert direct current into electric power. It is based on the Faraday law. It converts mechanical revolution into pulsating direct current by use of a revolving coil of wire and attractive fields.

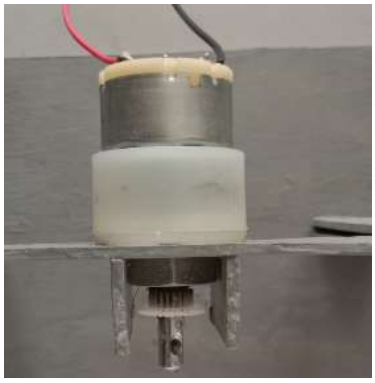

Figure 4 DC Generator

Specification

RPM: 1000 rating.

Operating Voltage: 12V DC

Gearbox: Attached Plastic (spur) Gearbox

Shaft diameter: 6mm with internal hole

Torque: 0.5 kg-cm

No-load current = 60 mA (Max)

Load current = 300 mA (Max)

4.5 Battery: A battery (shown in Figure 5) is connected via the wires to the dc generator which can store the electricity produced, and this stored power can be used in many applications.

Figure 5 Lithium ion battery

4.6 Boost Converter

A boost converter, (shown in Figure 6) also known as a step-up converter, is a DC to DC power converter that increases voltage from its input (supply) to its output (load) while reducing current. This type of switched-mode power supply (SMPS) has at least two semiconductors (a diode and a transistor) and at least one energy storage component, such as a capacitor, inductor, or both. Filters built of capacitors are typically added to such a converter's input (supply-side filter) and output (load-side filter) in order to eliminate voltage ripple.

Figure 6 Boost Converter

5. THE PROJECT WORKING PROCESS

The image of this project and mechanism is shown in Figure 7, the general design for the foot step power generating is shown. We use two phases in this arrangement. Under the steps is a fixed rack and pinion and spring assembly. Each step is supported by two springs. By releasing the weight, the spring is employed to bring the step back into place. The foot step and the rack are connected. When a person steps on a foot step power generating system, the plates move downward because of the force that is imparted to the plate as a result of the plate being impressed, which compresses the force spring. Here, the rack descends vertically. The pushing power is mechanical energy converted into electrical energy by means of driving arrangement. The pinion gear will rotate in a circular motion when the rack moves since it will have engaged with the DC generator. The pinion rotates one half circle for each full compression. Once the strain on the plate has been released, the pinion spins and moves another half circle. The DC generator creates waves with a sinusoidal shape. Then, the energy produced will be connected to a boost converter, which lowers current while increasing voltage from its input supply to its output load. A diode 1n4007 is a connected between battery and boost converter in which electric current travels in one direction. As a result, the energy generated will be stored on a lithium ion battery.

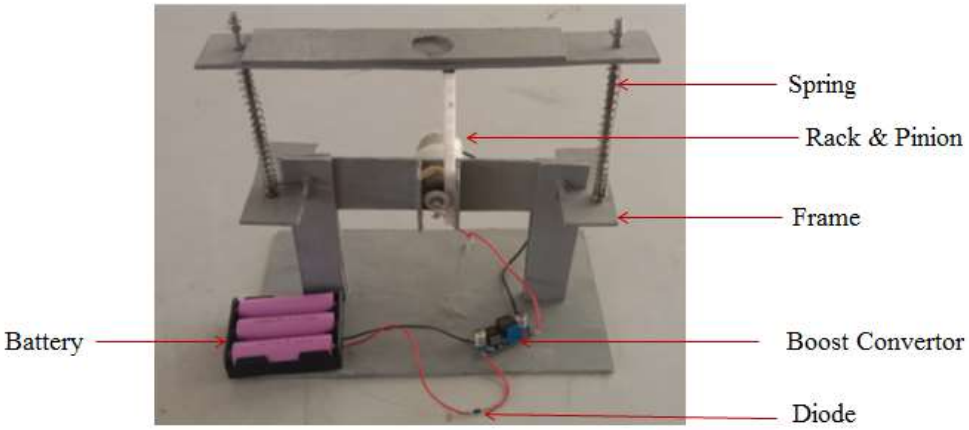

Figure 7 Prototype Power Generator

6. CONCLUSION

The "Power Generation using Prototype Foot Step" project, which is the best economical, accessible option for common people, has been successfully tested and implemented. Footstep power generating systems use the energy lost while walking to generate electricity. To provide the desired output, mechanisms like a rack and pinion and DC generator are incorporated. If implemented in an area with a large population density, this system offers the greatest benefits. It is advantageous from that perspective to implement this system since it makes it simple to lessen our reliance on conventional energy sources. This foot step power generation system is the greatest way to produce energy in nations that are experiencing energy crises, where the load shading of electricity is caused by

a lack of energy. The output of electricity production is raised by increasing the size of the foot step power generation system. This system costs less compared to other energy-producing systems.

REFERENCES

[1] O. A. Olugboji, I. Ohiemi, and C. Ajani. (2015). "Modelling and Design of an Auto Street Light Generation Speed Breaker Mechanism," no. January, 2015, doi: 10.12691/ajme-3-3-3.

[2] [S. Afzal. (2010). "Power generation," Filtr. Sep., vol. 47, no. 6, p. 1, 2010, doi: 10.1016/S0015-1882(10)70267-6.

[3] [Ohiemi, Israel Enema, Nnorum Choice Obundah, Ugwuoke Cornelius Chinoso, Israel Ojo Enock, Kolo Yetu Babazhitsu, Ayuba Elkanah Jatau, and Elvis Adam Alhassan. "Modeling and Design of a Prototype Footstep Power Generating Machine."

[4] Kamboj, Akshat, Altamash Haque, Ayush Kumar, V. K. Sharma, and Arun Kumar. "Design of footstep power generator using piezoelectric sensors." In 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), pp. 1-3. IEEE, 2017.

[5] Dhanalakshmi, G., T. Manjulai, M. Mirunalini, and S. Sangeetha Mary. "Footstep power generation system." Int. J. Eng. Comput. Sci 6, no. 04 (2017): 1214-1219.

[6] Nandan, Shivendra, Rishikesh Trivedi, U. P. Greater Noida, and India Greater Noida. "Design and Fabrication of mechanical footstep power generator." Int J Eng Appl Sci Technol 4, no. 5 (2019): 214-222.

[7] Ganesh, R. Jai, D. B. Shanmugam, S. Munusamy, and T. Karthikeyan. "Experimental study on footstep power generation system using piezoelectric sensor." Materials Today: Proceedings 45 (2021): 1633-1637.

[8] Munaswamy, B., Ch Prudhvi, V. Srikanth, B. Kirankumar, and E. Pradeep Kumar. "Mechanical footstep power generation." India International Journal of Engineering Trends and Applications (IJETA)–Volume 5 (2018).

[9] Gabriel, Sospeter. "Design of an Advanced Piezoelectric Footstep Power Generation System. A Case Study of Must–Basement Room." (2020).