IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, April 2023

Harvesting Kinetic Energy of Footsteps to Generate Electricity

Shrushti Prakash Pande, Saloni Arvind Sangode, Pranay Ramu Lamture
Vrushank Sanjay Choudhary, Sarthak Gajanan Wankhde
Students, Bachelor of Electrical Engineering
Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India
An Autonomous Institution Affiliated To Rashtarsant Tukadoji Maharaj Nagpur University

Abstract: *Energy and power are the basic needs of this modern world. The Energy demand is increasing every day. On the other hand, a lot of energy resources are depleted and wasted. Suggestion for using the waste energy of leg power with a person movement is very important in populated countries like India where are roads, railway stations, bus stands, temples etc. crowded with millions of people moving around. This unit energy is wasted. If this energy allowed its use will be a great invention. In this project we convert unconventional from a mere pedestrian step into electrics energy. This project uses a simple drive mechanism such as rack and pinion assembly. The control mechanism carries rack and pinion and DC generator for output. In this project we generate electricity as an unconventional method simply by walking or running steps. A non-conventional energy system is very essential at this time to our nation. Unconventional energy using the foot step needs no fuel input to produce electricity Power supply. In this project, a simple drive mechanism such as a rack and pinion assembly and chain drive mechanism are used for the production of energy using the obtained power it converts to electric when walking up the stairs energy using mechanical L9 systems. Generated energy is stored using a battery and it is used for activation of connected loads. It is one of the compact and efficient systems for generating electricity that can be easily installed in many regions.*

Keywords: Footsteps, Conventional Energy, Non-conventional energy system, D.C. Generator, Rack & Pinion, Chain.

I. INTRODUCTION

Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China where mobility of its masses will turn into boon in generating electricity from its footsteps. In India, places like roads, railway stations, bus stands, are all over crowded and millions of people move round the clock. As a result large amount of power can be obtained with the use of this promising technology. This process involves number of simple setup that are installed under the walking platform. When people walk on this platform their body weight compresses the setup which rotates a dynamo or Sanyo coil and current produced is stored in dry battery. To reduce the external compression, a responsive subflooring system is installed. And while the power producing platform is over crowded with moving population, energy is produced at larger levels. Greater movement of people will generate more energy.

This method of electricity production can be divided into two parts. First, the conversion of waste energy, which is produced by man into useful mechanical energy and then mechanical energy to electrical energy. Pressure energy that is generated when walking or dancing on the floor is converted into mechanical energy using the stand and pinion mechanism.

Then rotational/mechanical energy is generated used to generate electricity using a dynamo. Firstpart of the energy conversion is the pressure energy generated walking or dancing people on the dance floor is converted to vertical movement of the dance floor with using springs and a stand is attached to the floor,which helps convert vertical linear motion to rotary motion with the help of a pinion attached to it.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, April 2023

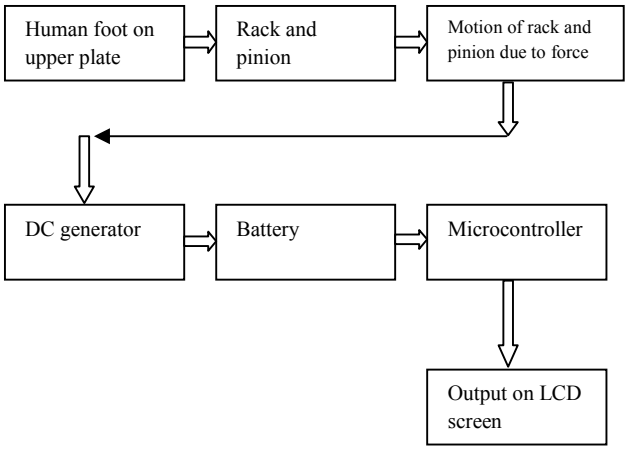

Fig. 1.1: General Block Diagram of Footstep Energy Generation by Rack and Pinion method.

II. COMPONENTS AND DESIGN

2.1 Wooden Frame

A frame is the most important support providing element in any system. A wooden frame is economical as well as effectively resistant to extreme climatic conditions. The frame is capable of enduring all the load of the setup.

2.2 Rackand Pinion

The rack and pinion mechanism is a device used to convert rotation motion to linear motion. Rack is a linear device consisting of teeth on one side of the surface which contributes towards linear motion. Pinion is a circular gear consisting of teeth all around its surface which contributes towards circular motion. Both the linear motion and circular motion simultaneously is used to generate energy.

Table 2.1 Specification of Rack

Material	Silicon
Module	304.8mm
Cross Section	25X20mm
Length	400mm
Breadth	25mm
Height	15mm

Table 2.2 Specification of Pinion

Material	Silicon
Outside Diameter	35mm
Inner Diameter	6mm
Pressure Angle	45-30 degrees
Clearance Gap	0.6mm
Tooth Depth	1.24mm
Tooth Pitch	4.55mm
Circular Tooth Thickness	15mm

2.3 DC Generator

A DC generator is used to convert the mechanical energy into electrical power. A typical DC generator works on the principle of Faraday's Law of Electromagnetic Induction. Here Dc generator is used to convert the rotational energy of pinion to electrical energy. A DC generator of rating ranging between 12 Volts to 18 Volts is used in this experiment.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, April 2023

2.4 PIC Microcontroller

A PIC (Peripheral Interface Controller) microcontroller is an integrated compact device specifically used to govern a particular operation in any system.

Specification of microcontroller:

- 32 Kilobyte flash memory
- 10 bitsanalog to digital converter
- Requires 5 Volts for operation

2.5 Battery

Batteries are used to store chemical energy which is then converted to electrical energy to power devices. In this experiment lithium-ion battery is used. A lithium-ion battery is a form of rechargeable battery which uses lithium ions to store energy. The battery consists of two terminals anode and cathode. The anode of this battery is usually consists of graphite made up of carbon and cathode made up of a metal oxide.

Specification of battery:

- Battery Capacity – 12 Volts
- It is a rechargeable battery
- Current produced – 3 Ampere Hour

2.6 LCD Screen

LCD (Liquid crystal display) is a flat panel display screen. They are used to project the information on screen by using a backlight or a reflector to produce information or images in colour.

Specification of LCD Screen:

16 characters by 2 lines

2.7 Relay

RELAY USED SPDT

SPDT (Single Pole Double Throw Relay) is an electrical switch that consists of two switching positions. It consists of one common terminal and two contacts which is normally opened and normally closed. When there is zero voltage at the coil then one circuit receives current and other does not whereas when voltage is received the above phenomenon gets reversed.

2.8 Diode

Diode is a semiconductor device that is unidirectional in nature. It allows the current to flow in only one direction. Diode conducts in forward bias mode. Here p-n junction diode is used.

2.9 Voltage Regulator IC

A voltage regulator IC is a three terminal device which is used to provide a constant DC output voltage. A voltage regulator provides constant output voltage irrespective of input voltage, output load current and temperature.

2.10 Resistors

Resistor is an electrical component which restricts the flow of current through it. It is a passive device which is used to provide a particular voltage for an active device.

Table 2.3 Specification of Resistors

Quantity	Value
3	1 Kilo-Ohms
1	100 Kilo-Ohms

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, April 2023

2.11 Capacitors

Capacitors are passive electrical components that are used to store energy in the form of electrostatic field. Capacitors consists of two conducting plates which are usually separated by dielectric material.

Quantity	value
1	100 micro-farads
1	470 micro-farads

III. DESIGN

The actual assembly of the footstep power generator is shown below:
This is the actual model of Rack and Pinion mechanism for energy generation. In the diagram attached below one can easily observe that it needs very few components to build the model.
Hence this model is economical and easy to design.

Fig. 3.1 Basic model of Rack and pinion mechanism.

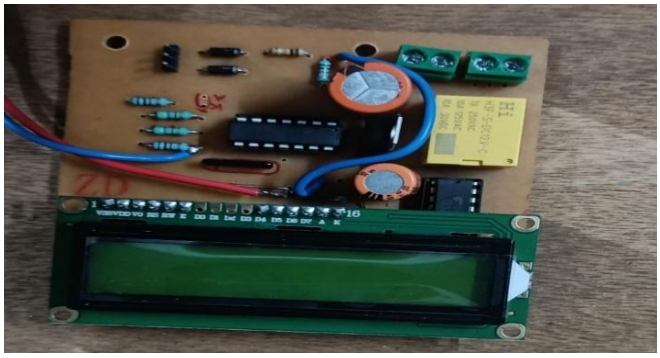

Fig. 3.2 Circuit board of Rack and pinion mechanism.

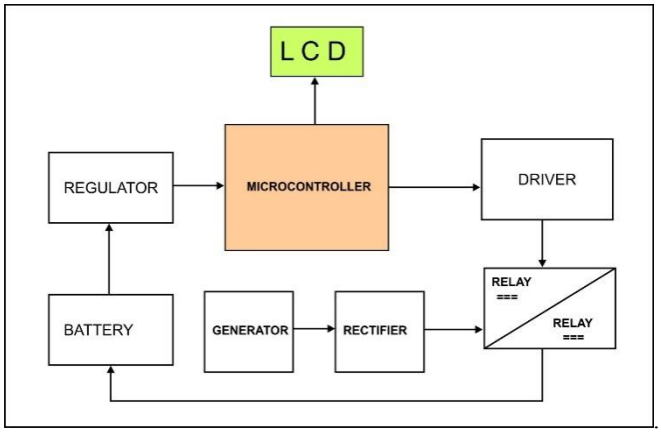

Fig. 3.3 Block diagram of Rack and pinion mechanism.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, April 2023

IV. WORKING

- When a person moves from a foot step power generation system the plates move horizontally frontwards direction due to force is applied on the pedal by virtue of impressing on the pedal there is motion generated between rake and pinion.
- The rack here moves horizontally frontwards.
- When the rack moves pinion will have engaged with the rack gear results in circular motion of the pinion gear.
- For one full compression the pinion moves 1 half circle.
- When the force will have removed on the plate the pinion reverses and moves another half circle.
- The Generator attached to pinion Generates The electricity.
- The micro-controller used in the model will help to get the readings generated from the process.It will help us to take notations of amount of electricity generated per the force applied.
- A battery in the model will help to store the amount of electricity generated for future use.
- Now the LCD screen will show the output voltage generated.
- Then, in this result energy produced will be stored in battery for use.

V. OBSERVATION

- Voltage generated for weight (50KG) – 12 Volts.
- Voltage generated for weight (80-90KG) – 18 Volts.
- Power generated per hour – 7.2 Watt/hr.
- Voltage generated for 1 full cycle – 2.4 Volts.

VI. LITERATURE SURVEY

Table 6.1 Comparison between Piezoelectric and Rack and pinion mechanism.

PIEZOELECTRIC MECHANISM	RACK AND PINION MECHANISM
The piezoelectric generation by footsteps has only 75% efficiency.	The generation using rack and pinion mechanism has efficiency up to 97%.
Piezoelectric crystals are not durable.	This mechanism is robust in construction.
This mechanism is costly.	This system is economical.
The output obtained is up to 3-4 volts.	The output obtained is up to 10-15 Volts.

The above comparison table shows that Rack and Pinion mechanism is more economical and feasible method of energy generation.

VII. ADVANTAGES AND APPLICATIONS

Advantages

- Simple in construction.
- Pollution free.
- Reduces transmission losses.
- Highly efficient in more crowded places.
- Depending upon the power generator and number of them, power output is very high

Applications

- Railway, subway stations
- Roads
- Temples
- Bus stands, air ports
- Music halls, auditoriums
- Markets

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, April 2023

VIII. CONCLUSION

This project can be handled in various ways to make the best use of it. There is many more extension that can be made to this project. Generators of more load capacity can be used to get more power. Although the power generation is little less in this project. It tries to make use of the energy wasted to generate electricity.

The power generation using footsteps get its energy requirements from the Non-renewable source of energy. There is no need of power from the mains and there is less pollution in this source of energy. It is very useful in the places like railway stations, shopping complex etc

REFERANCES

[1]. NicharasThanach-Issarasak Department of Instrumentation and Control Engineering School of Engineering King Mongkut's Institute of Technology Ladkrabang Bangkok, Thailand, 2021 International Conference on Power, Energy and Innovations (ICPEI 2021) October 20 -22, 2021, NakhonRatchasima, THAILAND

[2]. SubhawatJayasvasti Department of Instrumentation and Control Engineering School of Engineering King Mongkut's Institute of Technology Ladkrabang Bangkok, Thailand, 2021 International Conference on Power, Energy and Innovations (ICPEI 2021) October 20 -22, 2021, NakhonRatchasima, THAILAND

[3]. PhonexaiYingyong Department of Instrumentation and Control Engineering School of Engineering King Mongkut's Institute of Technology Ladkrabang Bangkok, Thailand, 2021 International Conference on Power, Energy and Innovations (ICPEI 2021) October 20 -22, 2021, NakhonRatchasima, THAILAND

[4]. Don Isakson Department of Instrumentation and Control Engineering School of Engineering King Mongkut's Institute of Technology Ladkrabang Bangkok, Thailand, 2021 International Conference on Power, Energy and Innovations (ICPEI 2021) October 20 -22, 2021, NakhonRatchasima, THAILAND

[5]. Thitinan Jonatan Department of Mechanical Engineering, Chulalongkorn University, Bangkok 10330, Thailand; Griselda Honchoing, Smart Mobility Research Unit, Chulalongkorn University, Bangkok 10300, Thailand, Surapong Swankier, Department of Electrical Engineering, Chulalongkorn University, Bangkok 10330, Thailand; Chanut U-wingchair, This paper is an extended and revised article presented at the International Conference on Sustainable Energy and Green Technology 2019 (SEGT 2019) on 11–14 December 2019 in Bangkok, Thailand; "Design of Kinetic-Energy Harvesting Floors" , 18 September 2020; Accepted: 12 October 2020; Published: 16 October 2020