

# Design of Foot Step Power Generation System

## An Investigation on Generation of Electricity Using Foot Step

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### ABSTRACT

As the demand of energy is increasing day by day, so the ultimate solution to deal with these sorts of problems is just to implement the renewable sources of energy Humans are using the renewable energy which are solar, wind etc. but we still could not satisfy our power needs, because of that we have to generate electricity through each and every possible ways. The objective of this work is to produce power through footsteps as a source of renewable energy that we can obtained while walking or standing on to the certain arrangements like footpaths, stairs, plate forms and these systems can be install specially in the more populated areas. In this project the force energy is produced by human foot step and force energy is converted into mechanical energy by the rack and pinion mechanism. electricity is produced by DC generator. We are suppose to study existing methods of foot step power generation that are rack and pinion arrangement and piezoelectric crystals and supposed to modified the existing system.

**Keywords:** Footpaths, Stairs, Plate forms, and Footstep power generation system.

### INTRODUCTION

This project includes number of simple setup and component that is installed under the walking or standing platform.. When person walk or stand on this platform their body weight compresses the setup of system which tends to rotates a dynamo and current produced is stored in dry battery And while the power producing platform is over crowded with moving population, energy is produced is high. More movement of people will generate more energy. This whole human foot energy being wasted, if it can be made possible to use this energy, it will become great power producing platform and will be very useful energy sources in crowded places. This method generates the electricity without polluting environment. The source of energy is continuous and renewable.

### LITERATURE REVIEW ANALYSES

According to T.R.Deshmukh paper deals with design and modeling of parts of the model of the foot step power generation system using 3d modeling software creo. This process consist number of simple setup that is installed under the walking or standing platform. Project system works on the principle of converting the linear motion because to pressure of foot steps into rotating motion by rack and pinion arrangement. This mechanism fails if there is any occurrence of variable load leads to balancing type problems Power is not generated during return movement of rack.[1]

Sasank shekhar Panda's paper is based on crank shaft; fly wheel, and gear arrangement .This type of footsteps power generation system are eligible to be installed in crowded places and

rural areas. Thus this is a very good technology to provide effective solution to power related problems to affordable extent. This will be the most acceptable means of providing power to the places that involves difficulties of transmission. Maintenance and lubrication is required time to time.[2]

Miss. Mathane state that Piezoelectric materials having crystalline structure. They can convert mechanical energy in the electrical energy and vice versa. The produced electrical energy from piezoelectric crystal is very low in the order of 2-3 volts and is stored in battery to charge controller, since it is not possible to charge 12v battery through crystal output. To increase the voltage, the boost converter circuit is used. Comparison between various piezo electric material shows that PZT is superior in characteristics. Also, by comparison it was found that series- parallel combination connection is more suitable. The weight applied on the tile and corresponding voltage generated is studied and they are found to have linear relation. It is especially suited for implementation in crowded areas.[3]

Jose Ananth Vino state that project using simple drive mechanism which include rack and pinion assembly and chain drive mechanism. The conversion of the pressure or force energy in to electrical energy. The power generation is very high but The initial cost of this system is high. There is no need of power from the mains and these system is eco friendly. It is very useful at the crowded places and on all roads and as well as all kind of foot step which is used to generate the electricity. Maintenance and lubrication is required time to time. Power is not generated

during return movement of rack.[4]

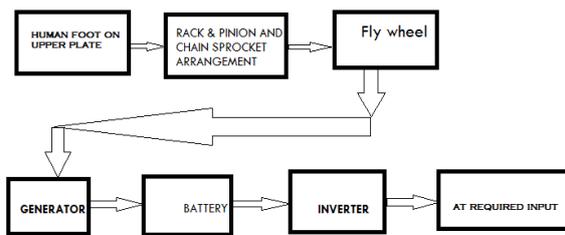
### PROBLEM SUMMARY

Electricity is one of the daily requirement of life. It is required to increase as much as sources of renewable energy. This system can be used for utilization of waste energy of foot step to provide electricity during the cut-off of electricity in some places like gym or any crowded places. For example, there is cut-off of electricity because of that , gym members are not able to measure their weight on weighting scale and in the night , visibility is disappear due to cut-off of electricity. This system can be used with different techniques like use with weighting scale etc.

### WORKING PRINCIPLE

The diagram of the foot step power generation system is shown below. Only one step is require to generate the power. The pushing power is converted into electrical energy by proper driving arrangement. The rack& pinion, spring arrangement is fixed. The function of spring is to return the step in same position by releasing the load. The pinion shaft is connected to the supporter by end bearings as shown in figure. The larger sprocket is also coupled with the pinion shaft, so that it is running at the same speed of pinion. The larger sprocket is coupled to the small cycle sprocket with the help of chain . This larger sprocket is used to transfer the rotation force to the smaller sprocket. The smaller sprocket is running same direction for the forward and reverse direction of rotational movement of the larger sprocket. The fly wheel and gear wheel is also coupled to the smaller

sprocket shaft. The flywheel is used to increase the rpm of the smaller sprocket shaft at different speeds. The gear wheel is coupled to the generator shaft with the help of another gear. The generator is permanent magnet D.C generator. The generated voltage is 12Volt D.C. This D.C voltage is stored to the Lead-acid 12 Volt battery. The battery is connected to the inverter. This inverter is used to convert the 12 Volt D.C to the 230 Volt A.C. This 230 Volt A.C voltage is used to activate the light, fan and etc. By increasing the capacity of battery and inverter circuit, the power rating is increased.



**Fig-1 shows block diagram for generation of electricity**

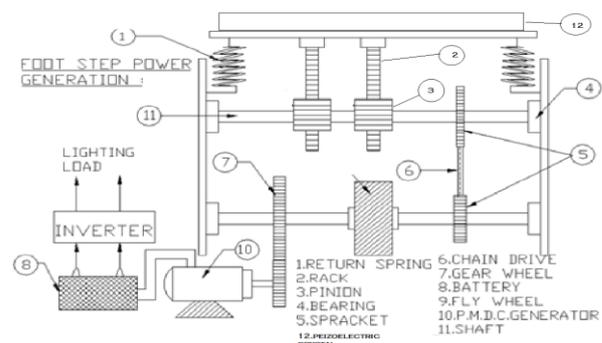
**Fabrication details:**

The frame structure for the total units fabricated using L-Angle frames and ordinary frames. These frames are made of mild steel. They are held to proper dimensions are attached to form a unit with the help of welding. Then the bearings which are of standard make are kept in place with their respective shafts through them and are welded to the frame structure. The shafts are also made of mild steel. A rack which are made up of mild steel is welded to the upper plate arrangement. A pinion which is also made up of mild steel and which has Thirty six teeth is fitted on the shaft initially, and welded. This pinion tooth is exactly made to mate with the

teeth of the rack. A bicycle sprocket and chain arrangement of standard make is fitted with the larger sprocket on the top shaft and its smaller sprocket on the bottom shaft. The sprocket wheels are welded to the shafts. A fly wheel that is made of cast iron is machined suitably to the precise dimensions in a lathe and is placed on the shaft with its axis coinciding with the axis of the shaft and is welded. A special stand arrangement is made to seat the 12v DC generator using frames. A 12v DC generator is placed within the seat and is held firm using bolts and nuts.

Wires are connected to the terminals of the DC generator and its other ends are connected to a Lead-Acid battery. Another wire is taken from these points on the battery and its other ends are connected to the positive and negative terminal of an inverter. An output wire from the inverter is sent to the required input.

In existing rack and pinion arrangement system, power is not producing during the return movement of rack so we can use rack and pinion with ratchet mechanism inside the pinion for obtaining power generation during return movement of rack as shown in figure.



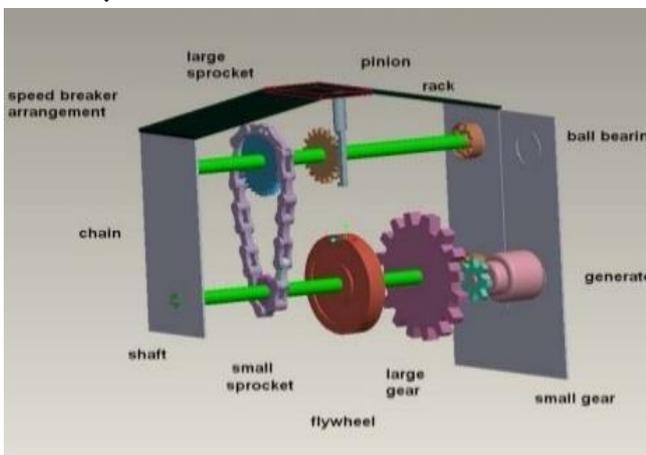
**Fig.2 Model of foot step power generation system**

In below figure gives 3D over view of existing system. In which rack moves downward as human weight applied which cause rotation of pinion on first shaft and rotation of chain sprocket and flywheel on second shaft. Generator is driven by gear mounted on second shaft. But during reverse or upward rotation of rack, power is not generated due to no rotation of second shaft. Second shaft remain idle during upward rotation of rack because of chain sprocket arrangement.

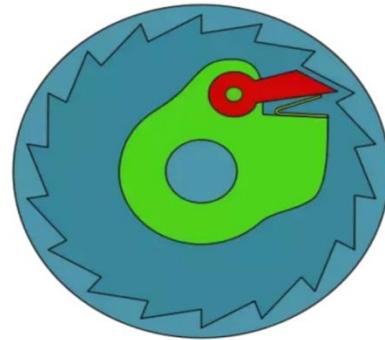
Figure describes the 3D view of new system.

In this system there are two rack and two pinion are used which are provided with ratchet mechanism. Ratchet mechanism allow the power generation during upward rotation of rack. This improve the power generation of the system and utilize the power generation during reverse movement. In this system first rack and pinion will cause the rotation of first and second shaft during downward movement of rack, during this second rack and pinion will not cause any rotation due to ratchet mechanism.

Same, during upward movement second rack and pinion will cause rotation of first and second shaft, during that first rack and pinion will not cause any rotation due to ratchet mechanism.



**Fig.3.2 Foot step power generation system**



**Fig 3 Ratchet mechanism**

Ratchet mechanism will allow the rotation in one direction so using it with two pinion, it will allow to produce electricity when rack moving upward.

### Components of system

#### 1. Rack and pinion:-

A rack and pinion gears system is composed of two gears. The normal round gear is the pinion gear and the straight or flat gear is the rack.

#### 2.Sprocket:-

The name "sprocket" applies generally to any wheel upon which are radial projections that engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth.

#### 4.Springs:-

A spring is defined as an elastic body, whose function to distort when loaded and to recover its original shape when the load is removed.

#### 5. Fly wheel

A flywheel is a rotating mechanical device that

is used to store rotational energy. Flywheels have a significant moment of inertia and thus resist changes in rotational speed.

#### 6. Inverter

An inverter is an electrical power converter that changes direct current (DC) to alternating current (AC). The input voltage, output voltage, and frequency are dependent on design.

#### 7. Voltage regulator

A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops.

#### 7. Dynamo

Dynamo is an electrical generator. This dynamo produces direct current with the use of a commutator.

#### 8. Battery

In our project we are using secondary type battery. It is rechargeable type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current.

#### 9. Piezo crystals

Piezoelectric crystals are another way of generating electricity by using human foot steps. Key concept of working of this system is capturing unused energy from surrounding any system and converting it into electrical energy. The piezoelectric placed under insulating material like hard rubber and pressure created by foot step and water fall pressure will produce electrical energy which can be stored and used for domestic purpose.

## OBJECTIVES

The main objectives of this project are:

- To generate the electricity through the human foot
- To provide electricity in rural area
- To promote the non-conventional energy source
- To save conventional energy sources
- To store the electricity for further use
- To produce electricity at cheapest cost
- To produce electricity from each piezoelectric crystal
- To produce electricity when rack move in upward direction
- To combine two methods for more output from one system

## CONCLUSION:

Project work based on the idea of electric power generation without polluting the environment. The waste energy in form of human walking is utilized in the system. It is very useful at crowded places to install this system to produce electricity. This system is smoother and less noisy in operation and provides flexibility in working. This system plays an important role for producing electricity at places where there are no sources of electricity like village areas. This energy source is renewable and continuous.

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