

TO OPTIMIZE THE DESIGN AND FABRICATION OF FOOTSTEP POWER GENERATOR USING RACK AND PINION METHOD

A Review

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Abstract. This paper deals with the generation of electricity from footsteps which can be obtained while walking or running on certain arrangements like foot paths, stairs, platforms and this system can be installed anywhere. When a person walks, he losses energy to the ground in the form of impact, vibrations etc. This energy can be tapped by piezoelectric crystals and can be converted to a usable electrical form. This electrical energy can be stored in a battery for later use. A prototype of the system is built along with rack and pinion arrangement for meeting the load requirement. Here the paper explains the prototype development of the system and the hardware result was obtained.

Keywords: renewable energy, piezoelectric effect, rack and pinion arrangement.

INTRODUCTION

Many researchers have worked on the conversion of dynamic energy into electrical energy by human locomotion Jeff krupenkin and Ashley Taylor proposed a new technique which is called reverse electro wetting in which the motion of liquid on dielectric material coated. The conductive substrate will cause to create electrical energy, if there is any vibration on above platform due to human locomotion that will be cause to produce electrical energy. One of the scientists of Hull University worked on transferring the motion of man into electrical energy. so many experiments had performed by

this person in Japan also to harnesses the energy from footsteps.

They had installed flooring tiles on Tokyo in Japan at different bus stations. He observed that at the average weight of 60 kg 0.1 watt of power was generating in single second. On other hand with different mechanism for generation of electricity from foot step power generation process is given by Tom Jose V . The power which is produced that can be stored in batteries in this manner we can be able to monitor and control the generated power above Fig. 1 clearly explains. When pressure force is applied it pushes the tile on the surface of ground that rotate the shaft approximately up to twice by single tile push.

The movement of shaft turn the gear box which build up it 15 times (1:15) then its movement will be smooth by the help of fly wheel which temporary store the movement that is convey with DC generator that generate 12volt ,40A at 100 rpm. The generated energy will be stored in the batteries then using the inverters it can be utilized.

To determine optimum machining parameter settings for the chosen tool/work combination so as to minimize the tool wear and surface roughness. Now the gap between the demand and the supply of electricity made a path for the exploration of alternate sources of energy. The demand for the energy is increasing day by day as there is a tremendous increase in the human population. Since large amount of energy has been wasted there is a need for the alternate power generation. This drawback has been

removed with the help of the footstep power generation system. The main principle of this power generation technology is piezoelectric effect. The piezo electric effect makes the materials to produce an electric charge when pressure and strain is applied to them. Thus when the pressure is applied the electric potential is produced by the materials with the help of the piezo electricity.

let us come to its some working principle, this device if embedded in footsteps of railway platforms, city malls, city footpaths e.t.c. can convert the weight impact of people into electrical energy. When a pedestrian will step on the top plate of this device, the plate will go down and this downward motion results in rotation of the shaft of the alternator which produces electrical energy. After removal of force the top plate returns to its original position due to springs.

LITERATURE SURVEY ON ENERGY PRODUCTION PROCESS:

Mukthi Nath et al. [1] experimentally investigated on piezoelectric materials, solid materials (crystal and ceramics), biological matter (DNA, bone and proteins) and non-conducting materials to generate power. Mechanism of piezoelectricity is reconfiguration of the di-pole by reorientation in its polarization. Polarization can be depend on the following factors (i) The orientation of piezo with in the crystal, (ii) Crystal symmetry and (iii) The applied mechanical stress. The result from this experiment is the generation of 12500V from the 1cm³ quartz by applying 2KN mechanical load. The major problem of in this experiment is strong electric field can break the dipoles and depolarization of the piezoelectric material. This method is used in buzzer and solar system and also it is used in the tele communication system. Parthiba Arun V and Divyesh Mehta [2] experimentally tested piezoelectric (Quartz) dielectric hysteresis, stability, depolarization, Coupling factor, electrical depolarization, mechanical polarization, pyro electric effects and thermal polarization. In this testing method the

mechanical Q factor and dielectric loss factors are reversible to each other. In electrical depolarization a material temperature and static fields are concerned along with the 200 and 500 V/mm and also voltage production can be achieved under Curie point (0 °C) as well as coupling factor is used to measure.

Henry A et al. [3] mathematically established transverse of the vibration under full scale voltage range of ± 200 V. This analytical exploration proved that, to have proficiency of over 35%, more than three times greater than solar system, and also 8.4 watts of generated power from PZT mounted in shoe. The properties of the piezo is such as Modulus of piezoelectric is 63 GPa, Strain coefficient is -179×10^{-12} m/volt and density is 7700 kg/m³. effectiveness.. Experimental result of the quartz as dielectric constant is 4.5, coupling factor is 0.09, charge constant is 2.0, voltage constant is 50 and the quality factor is established transverse of the vibration under full scale voltage range of ± 200 V. This analytical exploration proved that, to have proficiency of over 35%, more than three times greater than solar system, and also 8.4 W of generated power from PZT mounted in shoe Kiran Boby et al. [4] theoretically reviewed on the generation of electrical power from piezoelectric crystal for the

agriculture application, home application, and street lighting applications. Amod Kumar Pandey et al. [5] experimented that the electrical energy is generated from the speed breakers due to the motion of the vehicle by using the rack and pinion arrangement. The roller attached with gear arrangement will rotate when a vehicle moves over it. A. Padma Rao et al. [6] investigated the generation of electrical energy from the kinetic energy of the moving vehicle. In this paper it is mainly focused on the conversion of potential energy into electrical energy. Aniket Mishra et al. [7] described in this paper that the kinetic energy of the moving vehicle can be converted into mechanical energy of the shaft through the rack and pinion arrangement. Pankaj D. Jagtap et al. [8] investigated experimentally on the three methods of power generation from the kinetic energy of the moving vehicle. They are rack and pinion, roller and the air piston methods. Qihui Yu et al. [9] made investigation on generation of power by using piston mechanism. In this mechanism the compressed air engine (CAE) is used to convert compressed air power into mechanical energy. Chih-Yung Huang et al. [10] investigated on the compressed air as

mechanical energy for generating electricity. The generated power of 0.96 W at the pressure of 5-9 bars in 9.9 Nm of torque. B.K.Ravivarma et al. [11] proposed the energy generation methods using air piston mechanism. The renewable source of energy from vehicle bumpers can be utilized. This paper describes about the hydraulic piston mechanism to generate electricity. Mikalson and Rosekilly [12] numerically designed and simulated the free piston diesel engine generator. It is proved that the change in design parameter will vary many operational parameters. Rajesh Kannan Megalingam et al. [13] experimentally states that dynamo or alternator is used for conservation of energy produced during riding of bicycles. Both dynamo and alternator are used to convert mechanical energy into electrical energy. Antonin Stribrsky et al. [14] experimentally states that linear motor is fitted in the suspension system for power generation. During the sprung and unsprung of the shock absorber linear motor is actuated thus it converts vehicle vibration caused by road disturbances into electrical energy. B. Santhosh sarma et al. [15] experimentally investigated on roller mechanism that is mounted on speed breaker and generator so that when a vehicle passes over the speed breaker it rotates the generator. The output voltage is generated during the vehicle passing through the speed breaker. Junzhi Zhan et al. [16] made experimental investigation with motor generator that is fitted with the power train of the front and rear wheel of the vehicle to generate electrical power. [17] "Power Generation in Automobile Suspension System" by C.Nithiyesh Kumar, K.Gowtham, M.Manikandan, P.Bharathkanna, T.Manoj Kumar

In this research paper author studied three methods of foot step power generation namely piezoelectric method, rack and pinion method and fuel piston method comparatively and found that the rack and pinion mechanism is more efficient with moderate cost of operation and maintenance. [18] "Generation of Electrical Energy from Foot Step Using Rack and Pinion Mechanism" by Md.Azhar, Zitender Rajpurohit, Abdul Saif, Nalla Abhinay, P.Sai Chandu

In this research paper authors used regulated 5V power, 500mA power supply. [19] "Electrical Power Generation Using Foot Step for Urban Area Energy Applications" by Joydev Ghosh,

Amit Saha, Samir Basak, Supratim Sen. In this research paper authors used 80 volts and 40 mA from one coil have been generated from a prototype model as first invention. [20] "Power generation through step" by Vipin Kumar Yadav1, Vivek Kumar Yadav1, Rajat Kumar1, Ajay Yadav In these research paper authors used equipments with following specification: Motor Voltage:10 volt Type: D.C. Generator, RPM:1000 rpm, Gear 1-Mild Steel, No. of teeth:59(big gear), No. of teeth:36(small gear), Type: Spur Gear, No. of gear used:2 Spring 1-Load bearing capacity:60-90 kg, Mild Steel, Total displacement:5 inch, Bearing 1- Type: Ball bearing, Bearing no.N35, Shaft 1-Diameter: 15 mm-Material: Mild steel author concluded that with these method energy conversion is simple efficient and pollution free. [21] "Power Generation Footstep" by Shiraz Afzal, Farrukh hafeez This paper is all about generating electricity when people walk on the floor if we are able to design a power generating floor that can produce 100W on just 12 steps, then for 120 steps we can produce 1000 Watt. [22] "POWER GENERATION FROM STEPS" by Ramesh Raja R, Sherin Mathew This research paper attempts to show how energy can be tapped and used at a commonly used floor steps. The usage of steps in every building is increasing day by day, since even every small building has some floors. [23] "Electricity Generation from Footsteps; A Regenerative Energy Resource" by Tom Jose V*, Binoy Boban*, Sijo M T* In these research paper author manufactured a model made from stainless steel, recycled car tires and recycled aluminium, also includes a lamp embedded in the pavement that lights up every time a step is converted into energy (using only 5 percent of the generated energy).

CONCLUSION:

The objective of this paper is to harvest the energy from footsteps. By continuous stress on the crystal and the rack and pinion arrangement the voltage and current developed is enough to charge a lead acid battery. The rechargeable battery charged can be used later, and can be

converted into ac as per the load requirement. As a future work the system can be implemented in play grounds or in roads where frequent human or vehicles interaction occurs.

FUTURE SCOP:

Where the rack gear is assembled under the dome and the entire This Project can be further employed in speed breakers. mechanism is constructed below the road. This concept can also apply at the crowdie areas and output measure per hour, per week or per month.

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