Mechanical Footstep Power Generator: Design and Fabrication

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Abstract-

Power and energy are currently among the necessities of life in the modern world. The need for energy is growing daily. However, the abundance of energy resources is running out and being squandered. The idea of combining human mobility with the waste energy of foot power is highly pertinent in densely populated nations like India, where millions of people travel through congested bus stops, train stations, roadways, and temples. All of this energy is squandered. It will be a wonderful innovation if this energy can be used. With this research, we're turning non-conventional energy like by walking into electrical energy. Simple driving mechanisms like a rack and pinion assembly are used in this paper. The D.C. generator and rack and pinion are carried to the output by the control mechanism. In this paper, we're using an unconventional approach of producing electricity just walking or running on the footprints. These days, non-conventional energy systems are vital to our country. Fuel input power is not required for non-conventional energy utilizing footstep to produce electrical power.

Keywords— *Footsteps, Conventional Energy, Non-Conventional Energy System, D.C. Generator, Rack & Pinion, Chain.*

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INTRODUCTION

The D.C. generator and rack and pinion are carried to the output by the control mechanism. In this paper, we're using an unconventional approach of producing electricity just walking or running on the footprints. These days, non-conventional energy systems are vital to our country. Fuel input power is not required for non-conventional energy utilizing footstep to produce electrical power. 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. Over the foot step, a force acts on the step. One can simply be amazed by knowing how much energy a person can have just by walking on the floor with normal speed. Whenever a person walks, manages to lose energy towards the floor by means Excess weight to the floor. That energy may be used and converted into electrical energy. The Mechanical energy (weight) is converted into electrical energy using drive mechanism, in this case rack and pinion. Generated energy can be stored in Batteries. Then the output of the battery is used to lighten the lamps in the room. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important. Man

has needed and used energy at an increasing rate for his sustenance and well-being ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by Eating plants or animals, which he hunted. Subsequently he discovered fire and his energy needs increased as he Started to make use of wood and other bio mass to supply the energy needs for cooking as well as for keeping himself Warm. With the passage of time, man started to cultivate land for agriculture. He added a new dimension to the use of Energy by domesticating and training animals to work for him. With further demand for energy, man began to use the Wind for sailing ships and for driving windmills, and the force of falling water to turn water for sailing ships and for Driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say that the sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable Sources of energy.

LITERATURE REVIEW

"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. "Generation of Electrical Energy from Foot Step Using Rack and Pinion Mechanism" by Md.Azhar, Zitender Raj purohit, Abdul Saif, Nalla Abhinay, P.Sai Chandu. In this research paper authors used regulated 5V power, 500mA power supply. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer. A rack and pinion is a type of linear actuator including a pair of gears which convert rotational motion into linear motion. The "pinion" engages teeth on the rack. In this paper, since the power generation using foot step get its energy requirements from Non-renewable source of energy. There is no need of power from external sources (mains) and there is less pollution in this source of energy. It is very useful to the places like all roads and as well as all kind of foot step which is used to generate the non-conventional energy like electricity. "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. The second invention provides 95 volts and 50 mA from one coil and this generated power can be used to light LED array and to run DC fan after rectifying the AC or can charge batteries. For high efficiency in the axel of the second gear, they fitted a strong magnet vertically, so that when the gear will rotate due to human body weight the magnet also rotate. The magnet is placed in a loop type copper coil. When the magnet start rotating according to the Faraday's law of electromagnetic induction, there will be induced emf in the coil. "Power generation through step" by Vipin Kumar Yadav1, Vivek Kumar Yadav1, Rajat Kumar1, Ajay Yadav In these research paper authors used equipment 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. "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 and if we install such type of 100 floors with this system then it can produce 1MegaWattAs a fact only 11% of renewable energy contributes to our primary energy. If this project is deployed, then not only we can overcome the energy crises problem but this also contributes to create a healthy global environmental change. In this paper a gear system is attached with flywheel which causes to rotate the dynamo as the tile on the deck is pressed The power that is created is saved in the batteries in addition we will be able to monitor and control the amount of electricity generated When an individual passes it push the tile on the ground surface which turn the shaft beneath the tile, turn is limited by clutch bearing which is underpinned by holders.

Primary shaft is rotate 215approx... Twice by a single tile push. The movement of the prevailing shaft turn the gearbox shaft which builds it 15 times (1:15) then its movement is smoothen by the help of fly wheel which temporary store the movement, which is convey to the DC generator (it generates 12V 40 amp at 1000 rpm). "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 step. The usage of steps in every building is increasing day by day, since even every small building has some floors. A large amount of energy is wasted when we are stepping on the floors by the dissipation of heat and friction, every time a man steps up using stairs. There is great possibility of tapping this energy and generating power by making every staircase as a power generation unit. The generated power can be stored by batteries, and it will be used for slighting the building. "Electricity Generation from Footsteps; A Regenerative Energy Resource" by Tom Jose V*, Binoy Boban*, Sijo MT* In these research paper author manufactured a model made from stainless steel, recycled car tires and recycled aluminum, 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). The average square of pavement produces about 2.1 watts of electricity. And according to author, any one square of pavement in a high-foot traffic area can see 50,000 steps a day. Based on this data, only five units of pavement can be enough to keep the lights on at a bus stop all night.

POWER CALCULATION OF OUTPUT

Let us consider,

The mass of a body = 65 Kg (Approximately)

Height of spring = 8 cm

$\therefore$Work done = Force x Distance

Here,

Force = Weight of the Body

= 65 Kg x 9.81

= 637.65 N

Distance traveled by the body = Height of the spring

= 8 cm

= 0.08 m

$\therefore$Output power = Work done/Sec

= (637.65 x 0.08)/60

= 0.8502 Watts

(For One pushing force)

LAYOUT SYSTEM

When the mechanical setup is used as it is, every single setup will compress separately and give an awkward feeling while walking over that. To prevent this, a flooring system is installed over the mechanical setup. The purpose of installing this flooring system is to provide required compression and at the same time to prevent the people to feel uncomfortable when walking over it. As every block over the setup is connected to one another using hinge arrangement, the compression will not be felt as the weight of the person walking over that will be distributed. But the pressure required to compress the setup will be conveyed as the person's weight acts on the particular setup only depending upon the average weight over a locomotive area, the strength and number of hinges are used. For the area where average weight is more, the numbers of the hinges are increased. This along with the primary spring provides the required compression for the setup. This hinge arrangement distributes the weight of the person and prevents them from feeling the

compression. But about 95% of the pressure applied due to the weight is conveyed for the compression. Bhosale et. al., (2017) "Design of Foot Step Power Energy Generation Machine".

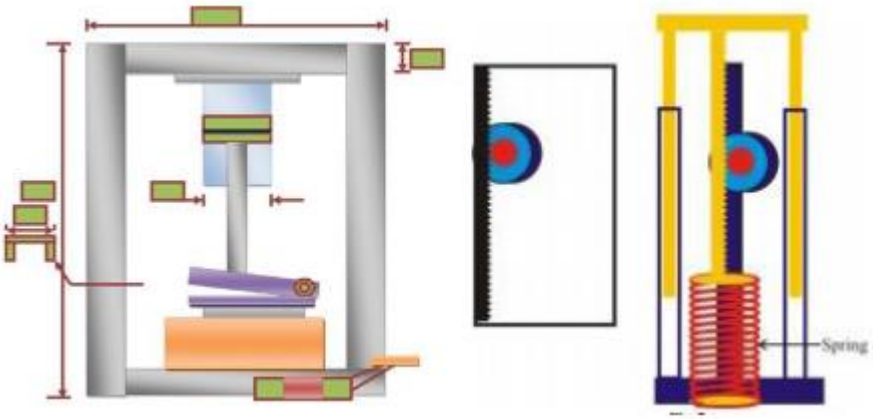

Figure 1- Flooring System

SR NO.	COMPONENT	DETAILS	COST in ₹
1.	*Base plate and upper plate*	*Mild steel - 300×300 mm (300×2)*	*1000*
2.	*Fixed Cylindrical pipes*	*M.S. pipes,30mm dia.-100mm length (100×4)*	*400*
3.	*Moving pipes*	*MS pipes,20 mm dia.100mm length (100×4)*	*400*
4.	*Springs*	*Alloy Steel Wire (100×4)*	*400*
5.	*Stair frame*	*MS l angle frame*	*1000*
6.	*Rack and pinion*	*Cast iron, module 1.5*	*1100*
7.	*DC motor*	*12 volt,60 rpm*	*250*
8.	*Fabrication*	*Cutting, welding etc.*	*600*
9.	*Assembly*	*Mounting, fixing motor shaft with pinion. Adjusting rack and pinion etc. and final welding*	*500*

Table 1- Cost Estimation Table

APPLICATIONS BASED ON PRINCIPLES

(i) Power Generating Shoe Munaswamy et al., (2017) Mechanical Footstep Power Generation

(ii) Power Generation by Speed Breaker Through Gear Mechanism Dhinar et al., (2017) Footstep Power Generation System

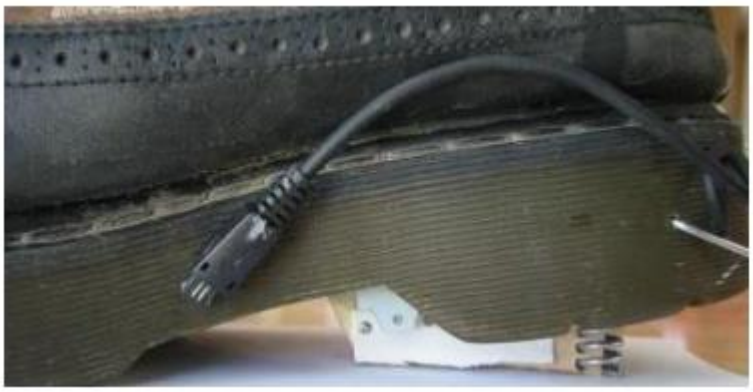

Figure 2- (a) View of arrangement in Power Generation shoe

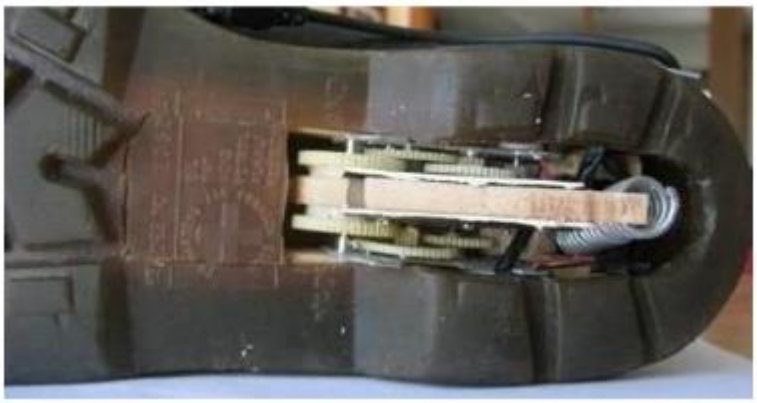

Figure 2- (b) View of arrangement in Power Generation shoe

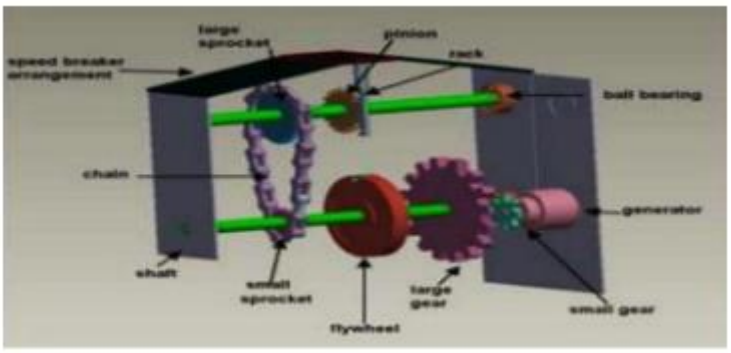

Figure 3- Model of Speed Breaker Mechanism

CONCLUSION

Through the use of energy lost when walking, the footstep power generating system generates electricity. The desired output is produced by integrating mechanisms such as rack & pinion with piezoelectric material. The only factors that affect the cost of producing power are the system's lifetime, maintenance costs, and starting cost. Installing this system in a very congested area will provide for maximum benefit. As the production of electrical power in this power generation project does not require the input of fuel. Therefore, it can also be said that this method of producing electricity is environmentally beneficial because no pollution is

produced when this kind of model is used to generate power. Because of these benefits, this system may be installed in any public area, including malls, busy sidewalks and train stations. By putting this system into place, we can quickly lessen our reliance on conventional energy sources, which makes it advantageous from that perspective. This paper may be expanded by employing the same layout and building footsteps or speed breakers to boost the pace of electricity production by mending roads, schools and universities, among other things. A footstep power generating system uses the energy that is lost when walking to generate electricity. To achieve the desired output, mechanisms such as rack & pinion and piezoelectric material are combined. The cost of producing power is only influenced by the system's lifetime, maintenance expenses, and startup cost. If this system is implemented in a heavily populated location, it can be used to its full potential.

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