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Power Generation using Foot-Step and P.V. Panel

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Abstract: *Man has needed and used energy at an increasing rate for the substance and well - being since time immemorial. Due to this a lot of energy resources have been exhausted and wasted. 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 where the railway stations, temples, etc., are overcrowded all round the clock. Now days energy and power are the one of the basic needs in this modern world. Energy demand is increasing day by day. On the other hand, the many energy resources are getting exhausted and wasted. Millions of people move around. This whole energy is wasted. If this energy made possible for utilization, then it will be a great invention. In this project we are converting non-conventional from just walking foot step into electrical energy. This project uses simple drive mechanism such as rack and pinion assembly. The control mechanism carries the rack pinion; D.C generator, gears, shafts, plates and multi-meter to show output. We have discussed the various applications and further extension. Non-conventional energy system is very essential at this time to our nation. Non- conventional energy using foot step needs no fuel input power to generate the electrical power. In this project the simple drive mechanism such as rack and pinion assembly mechanism is used for generating power by utilization of force which is obtained during the walking on steps is converted in to electrical energy with the help of mechanical systems. We have discussed its various alternate applications with extension also. The power generation is much worthy but it has little initial cost-effective factors.*

Keywords: P. V. Panel

I. INTRODUCTION

As the availability of conventional energy declines, there is need to find alternate energy sources. All most all the state electricity departments in our country, they are unable to supply the power according to the demand. The power produced by these companies is not even sufficient for domestic utilities; in such critical situation it is very difficult to divert the energy for other public needs. There by an alternative source must be discovered, many people propose for solar energy, but it is going to be a costliest affair, moreover availability of solar energy is poor particularly in rainy winter seasons, as a result it is not dependable. Hence an alternative cheapest method must be determined for few applications; consequently, this project work has been taken up, which is aimed to generate electricity from footsteps mechanism. Out of the many alternative energy resources, this technology described in this project report is the ultimate source of all known forms of energy. It is clear, safe, and free, does not pollute the environment and thus will be an extremely viable alternative in the days to come. As there is a tremendous increase in the crowd, the load applied on the footsteps by the people, it generates nonstop energy, which can be stored and utilized to energize the street lights. Here the concept is to convert the mechanical energy in to electric energy. 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. 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. This whole human energy being wasted if can be made possible for utilization it will be great invention and power producing platform will be very useful energy sources in crowded countries.

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I] Convention Sources Of Energy
- Commercial
  - Coal
  - Petroleum
  - Electricity
- Non – Commercial
  - Fire Wood
  - Straw
  - Dried Dung

Ii] Non – Conventional Sources Of Energy
- Bio – Energy
- Solar Energy
- Wing Energy
- Tidal Energy
- Energy From Urban Waste

II. PROBLEM STATEMENT

Question that every time comes before every country i.e., the need of non-conventional energy sources or systems. Why we need these systems and the answers are the growing consumption of energy has resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil gas. Rising prices of oil and gases and their potential shortages have raised uncertainties about the security of energy supply in future, which has serious repercussions on the growth of the national economy. The main factor is increasing use of fossil fuels also causes serious environmental problems. Hence there is primary need to use renewable energy sources like solar, wind, tidal, bio-mass and energy from waste material.

III. OBJECTIVE

In this project we are converting Mechanical energy into Electrical energy. And also using the PV panel to convert the solar radiation or direct sunlight into useful electric energy. We are trying to utilize the wasted energy in a useful way. By using Rack and Pinion arrangement we are converting to and fro- motion of the steps into rotational motion of the dynamo. In first step we are using rack and pinion arrangement directly to rotate the dynamo. But in second step we are using gear mechanism to obtain better efficiency. Through Dynamo the rotational energy is converted into electrical energy. This electrical energy output will be shown by Glowing the LEDs or showing the output in a multi-meter. The output power is expected to be 3V to 4V or slidely more in prototype. Depending upon the above Literature Survey of different papers we have decided to moved forward to take this project in practical means. For this purpose, we have aimed to construct a prototype for footstep mechanism by using rack and pinion motion.optimization.

IV. FUTURE SCOPE

1. Electricity generation for streetlights through speed breaker
2. Security check in platform converted into in this mechanism at various places work┐ ing of x – ray machines conventionally.
3. A particular model could be sell to common people for using it at home as well the company making these models can help in employment of various officials.
4. Using of Solar radiation is from very long time but we not relay on fully so, we have to change this prospective by intalling as possible as PV panel on roof-top of houses, building etc.

V. LITERATURE SURVEY

"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. [1]

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"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. [2]

"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. [3]

"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. [4]

"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 project 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). [5] **"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. [6]

"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 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. [7]

VI. WORKING PRINCIPLE AND THE COMPONENTS USED

- When force is applied on the plate by virtue on stamping on the plate the force spring gets compressed.
- Due to this the rack moves vertically down.

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- The pinion meshed with the rack gear results in circular motion of the pinion gear.
- For one full compression the pinion Moves one semicircle, when the force applied on the plate released the pinion reverses and moves another semi- circle. Step
- The intermediate gear with more number of teeth will rotate as a result of motion of pinion.
- The generator attached to the intermediate will obtain the rotating motion, hence results in the sinusoidal waveform (for single Generator). Step
- The obtained voltage is passed through Ac neutralizer in order to reduce the ripples that are produced due to uneven motion of generator.
- From here the power is stored directly in 12v lead acid battery. Step 9: So the 12v DC is connected to the inverter to convert it into 230AC. Step 10: Now the voltage obtained is used for small applications.
- The display unit takes signal from battery and converts it into digital signal by ADC and transfers its data to micro-controller.
- The voltage signal thus obtained will be displayed in LCD display about how much voltage of current is available.
- Solar plate is aslo inculded in the system which will be placed in the direct sun light to get the maximum output of it.
- We can charge the battery of 12v, 8A in about using solar panel.
- With combining both the mechanism Foot-Step and Solar the output can be increased.

6.1 Components

A. Rack and Pinion

Rack and pinion, mechanical device consisting of a bar of rectangular cross section (the rack), having teeth on one side that mesh with teeth on a small gear (the pinion). The pinion may have straight teeth, or helical (twisted) teeth that mesh with teeth on the rack that are inclined to the pinion-shaft axis.

If the pinion rotates about a fixed axis, the rack will translate; i.e., move on a straight path. Some automobiles have rack-and-pinion drives on their steering mechanisms that operate in this way.

If the rack is fixed and the pinion is carried in bearings on a table guided on tracks parallel to the rack, rotation of the pinion shaft will move the table parallel to the rack. On machine tools, rack-and-pinion mechanisms are used in this way to obtain rapid movements of worktables; the pinion shaft is usually rotated with a hand crank.

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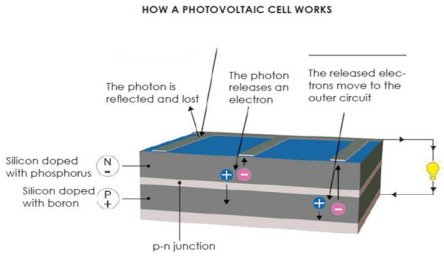
B. DC Motor

A machine that converts DC electrical power into mechanical power is known as a Direct Current motor. DC motor working is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. The direction of this force is given by Fleming's left-hand rule and magnitude is given by; F = BIL Newtons According to Fleming's left-hand rule when an electric current passes through a coil in a magnetic field, the magnetic force produces a torque that turns the DC motor. The direction of this force is perpendicular to both the wire and the magnetic field. Basically, there is no constructional difference between a DC motor and a DC generator. The same DC machine can be run as a generator or motor.

3. PV Panel

PHOTOVOLTAIC CELL (PV CELL) A photovoltaic cell (PV cell) is a specialized semiconductor diode that converts visible light into direct current (DC). Some PV cells can also convert infrared (IR) or ultraviolet (UV) radiation into DC electricity. Photovoltaic cells are an integral part of solar-electric energy systems, which are becoming increasingly important as alternative sources of utility power. The first PV cells were made of silicon combined, or doped, with other elements to affect the behavior of electrons or holes (electron absences within atoms). Other materials, such as copper indium diselenide (CIS), cadmium telluride (CdTe), and gallium arsenide (GaAs), have been developed for use in PV cells. There are two basic types of semiconductor material, called positive (or P type) and negative (or N type). In a PV cell, flat pieces of these materials are placed together, and the physical boundary between them is called the P-N junction. The device is constructed in such a way that the junction can be exposed to visible light, IR, or UV. When such radiation strikes the P-N junction, a voltage difference is produced between the P type and N type materials. Electrodes connected to the semiconductor layers allow current to be drawn from the device. Large sets of PV cells can be connected together to form solar modules, arrays, or panels. The use of PV cells and batteries for the generation of usable electrical energy is known as photovoltaics. One of the major advantages of photovoltaics is the fact that it is non-polluting, requiring only real estate (and a reasonably sunny climate) in order to function. Another advantage is the fact that solar energy is unlimited. Once a photovoltaic system has been installed, it can provide energy at essentially no cost for years, and with minimal maintenance.



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C. Bearings

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

D. Battery

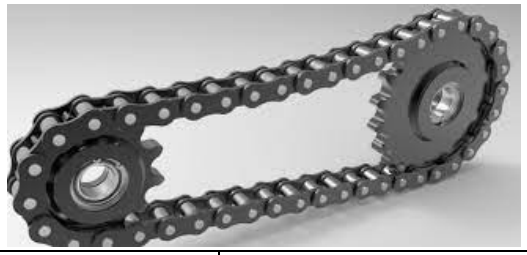
A lithium-ion battery or Li-ion battery is a type of rechargeable battery composed of cells in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge and back when charging. Li-ion cells use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode. Li-ion batteries have a high energy density, no memory effect (other than LFP cells) and low self-discharge. Cells can be manufactured to prioritize either energy or power density. They can however be a safety hazard since they contain flammable electrolytes and if damaged or incorrectly charged can lead to explosions and fires.

E. Sprocket

A sprocket, sprocket-wheel or chain wheel is a profiled wheel with teeth that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections 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 and pulleys are smooth except for timing pulleys used with toothed belts.

F. Chain

Chain and sprocket mechanisms perform the same task as a belt and pulley system, i.e. they transfer motion and force from one shaft to another. A belt can slip on a pulley but the teeth on the sprocket prevent the chain from slipping.



Sr. No.	Component	Details
1.	Base and Upper plate	Hard MS sheet 610mm * 228mm (L * B)
2.	Fixed Cylindrical hollow Shaft Qt-2	Iron Pipe, Inner Dia. - 18mm, Outer Dia. - 20mm, Length - 610mm
3.	Sprocket Qt-2	Teeth - 24, Inner Dia. - 20mm
4.	Rack and Pinion	Rack length – 304mm, Rack teeth – 46, Pinion Inner Dia. – 38mm, Pinion teeth – 16
5.	D.C motor	12V, 100 RPM
6.	Bearing (u-type) Qt-4	Ball bearing
7.	Spring Qt-2	Iron Wire, 177.8 mm Length, 46 mm, stiffness of the spring 1286.08 N/m
8.	Battery	12V, 8 Ampere, Rechargeable, Lithium ion battery
9.	Bulb (LED)	12V

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VII. METHODOLOGY

Calculations

7.1 Charging Time

The entire energy that is produced when the load is applied on the footsteps is stored in a storage device called BATTERY. So, it is taken as important criteria to determine the charging time taken by the battery.

Charging Time = Battery Rating/Charging current

7.2 Spring Stiffness

Hooke's law is a principle of physics that states that the force F needed to extend or compress a spring by some distance X is proportional to that distance.

That is: F = kX, where k is a constant factor characteristic of the spring: its stiffness, and X is small compared to the total possible deformation of the spring.

The spring constant K is measured in newtons per metre (N/m), or kilograms per second squared (kg/s) 2.

Now, to the matter:-

Find force exerted by the weights which you have. i.e., for example if you have a 20 Kg block of weight, then

F = (mass) X g

F = (20kg) X (9.8 m/s^{2}) = 196 N

Now use F=kX where X is the displacement produced in the spring when the weight is suspended.

The displacement in this case of our project work is 0.1524 m.

K = F/X

K = 196/0.1524

K = 1286.08 N/m

7.3 Theoretical Output

To determine the output power of the device it is essential to determine the force applied on the model. Let the force applied be calculated as,

Force = Weight of the body = m.g

Work done = Force X Displacement

Power = Work done / sec

Let the weight applied by the body is 20 kgs, then the maximum displacement of the spring can be noted as 0.05 m

Force = 20 x 9.81 = 196.2N

i.e, work done = 9.8/N

power = 0.981/60

i.e, power = 0.1635

7.4 Practical Output

Power can be calculated in terms of obtained voltage and current when the load is applied on the footsteps. The readings are noted by using the multi-meter.

Power = Voltage x Current

Here, when the foot is depressed due to the applied load on the footsteps the calculated power is as follows.

For one step of 20 kgs of load applied on the footsteps, the generated voltage is 2.6V and the average current produced is 12 milliamps.

Power = 2.6 x 0.012 = 0.0312

Power generated per hour is 0.0312 X 3600 = 112.3 watts

Thus the obtained power for continuous load applied on the footsteps for one hour is watts.

NO. OF FOOT-STEPS	DURATION OF LIGHTENING OF A9 WATT (S), 220V- 240V	TOTAL ENERGY (9)	ENERGY/ STEP(J)
250	6	600	2.4
500	12	1200	2.4

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750	18	1800	2.4
1000	25	2500	2.5

FOOT-STEP OUTPUT

Time (Hrs)	With Tracking		
	Voltage (V)	Current (A)	Power (W)
9 am	12.2	0.23	2.8
10 am	13.5	0.25	3.4
11 am	14	0.28	3.92
12 am	14	0.3	4.2
1 pm	15	0.3	4.5
2 pm	14	0.3	4.2
3 pm	13	0.26	3.38
4 pm	10	0.25	2.5

PV PANEL OUTPUT

VIII. CONCLUSION

The project work "POWER GENERATION USING FOOT-STEP AND PV PANEL" is designed and developed successfully, for the demonstration purpose a proto type module is constructed with lower ratings of devices, & results are found to be satisfactory. As it is a demo module it cannot be used for real applications, but the concept is near to the real working system, to make it more realistic, higher rating power generator with suitable gear mechanism is essential to produce more energy.

This concept falls under the subject of non-conventional energy resources, out of the many alternative energy resources one dependable source is solar energy, but it is quite costliest affair. Therefore, alternative cheapest source is to generate electricity from foot step. This technology proven here is the ultimate inexpensive source of all known forms of energy. When it is implemented practically, depending up on the size & traffic flow, each foot step may produce tens of kilowatts power every day, this power can be utilized for many applications. If we are used this project at very busy stairs palace then we produce efficient useful electrical for large purposes. One important advantage of producing energy through this technology is that it does not pollute the environment. Hence this foot step can be altered with this technology, there by all the street lights belongs to a particular city can be energized.

The purpose of this project was to improve the college entrance fountain and to give it a unique look. And then we discussed with our project guide. The main aim to choose this project was to learn about finding an alternative of energy which can be use any time conveniently anywhere at the places where the electricity supply are the major places, and also must be installed at the location with crowded. The project also helped to know about solar automatic sensor which we learned and handled firstly time. The learned that how it works and sense the signal. This project also taught us that how to work with team also how to treat with each other. Actually, we understand the responsibility. We really loved to handle learning of open well motor. We also enjoyed the painting of fountain and decoration of fountain. And finally, we touched to success of project and completed it.

REFERENCES

[1]. Bhosale Prof. P.A., Shinde Mr.Harshal, Tahade Mr.Rohit, Valani Mr. Meet, Wallalwar Mr.Rohan, (2017) "Design of Foot Step Power Energy Generation Machine", 0International Conference on Ideas, Impact and Innovation in Mechanical Engineering (ICIIIME 2017), ISSN: 2321-8169 /943 – 948, Volume: 5 Issue: 6

[2]. Munaswamy B., Prudhvi Ch., Srikanth V., Kirankumar B., Kumar Er. Pradeep, (2018) Mechanical Footstep Power Generation, India International Journal of Engineering Trends and Applications (IJETA) – Volume 5 Issue 2, Mar-Apr 2018

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[3]. V. Jose Ananth Vino, (2011) Bharath University, Power Generation Using Foot Step, International Journal of Engineering Trends and Technology (IJETT) – Volume1 Issue2 – May 2011 .

[4]. Dhimar Mrs. Krupal, Patel Krishna, Patel Zeel, Pindiwala Nisha, (2017) FOOTSTEP POWER GENERATION SYSTEM International Research Journal of Engineering and Technology Volume: 04 Issue: 04 | Apr -2017.

[5]. Shiraz Afzal, Farrukh hafeez, (2014) Power Generation Footstep* . International Journal of Advancements in Research & Technology, Volume 3, Issue 4, April-2014 ISSN 2278-7763.

[6]. kumar Shubham, kumar Pankaj, kumar Rishav, (2016) Power Generation Footstep International Journal of Mechanical Engineering and Technology (IJMET) Volume 7, Issue 2, March-April 2016, pp. 187–190, Article ID: IJMET_07_02_020.

[7]. Motey Yogesh, Dekate Pooja, Dekate Madhushri, Aswale Jayashree, (2017) Footstep Power Generation System, International Journal of Innovations in Engineering and Science, Vol. 2, No.6.