

Electricity Generation from Foot Steps With 555 Timer IC

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Abstract - We live in a world that runs on electricity. From the moment we wake up to the time we go to sleep, almost everything we do depends on it lighting our homes, powering our industries, and keeping our transportation systems moving. Yet, despite how essential electricity has become, the gap between how much we need and how much we can reliably produce keeps growing.

This is a problem that can no longer be ignored. Most of our existing power comes from non-renewable sources that are rapidly running out. At the same time, state electricity boards across the country are struggling to meet even basic residential demand, let alone the needs of public infrastructure. Generally, need smarter, cleaner, and more sustainable ways to generate power and we need them now.

That's exactly what this work is about. The idea is surprisingly simple: what if the energy wasted in our everyday movements like walking could be captured and turned into usable electricity? Every step we take produces mechanical energy that currently just disappears into the ground. With the right technology, we can harvest that energy instead

This paper explores how human footsteps can be converted into electrical energy using a dynamo mechanism built on the principle of electromagnetic induction. This concept falls under energy scavenging a field focused on capturing waste energy from routine human activity and putting it to productive use

Key Words: Energy harvesting, Footstep power generation, Electromagnetic induction, Renewable energy, DC gear motor, Sustainable energy.

1. INTRODUCTION

The rapid increase in global energy demand, coupled with the depletion of conventional energy resources, has created a critical need for alternative and sustainable power generation methods. Traditional sources such as fossil fuels are not only limited but also contribute significantly to environmental pollution. As a result, there is growing interest in renewable and unconventional energy harvesting techniques that can supplement existing power systems.

One promising approach is the generation of electricity from human activities, particularly footsteps. In crowded public areas such as railway stations, bus terminals,

shopping malls, and pedestrian walkways, a significant amount of mechanical energy is continuously generated but remains unutilized. Converting this wasted energy into usable electrical energy can provide an efficient and eco-friendly solution for small-scale power generation.

This paper presents the design and implementation of a footstep-based energy generation system using a DC geared motor and a 555 timer IC. When a person steps on the platform, the applied force causes mechanical displacement, which is converted into rotational motion. This motion drives the DC geared motor, functioning as a generator to produce electrical energy based on the principle of electromagnetic induction. The generated voltage is then regulated and processed using a 555 timer circuit for controlled output and efficient utilization.

The proposed system is simple, cost-effective, and suitable for low-power applications such as LED lighting, indicators, and sensor-based systems. This work aims to demonstrate the feasibility of harvesting energy from human motion and highlights its potential as a supplementary renewable energy source for sustainable development.

1.1 Objective

- 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 while rack moves in upward direction.

1.2 Need for the system

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 the roads, railway stations, bus stands, temples, etc. are all over crowded and millions of people move around the clock. This whole human/bioenergy being wasted if can be made possible for utilization it will be great invention and crowd energy farms will be very useful energy sources in crowded

countries. Walking across a "Crowd Farm," floor, then, will be a fun for idle people who can improve their health by exercising in such farms with earning. The electrical energy generated at such farms will be useful for nearby applications.

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Footstep Power Generation System

Fig.1 Electricity Generation system

2. LITERATURE REVIEW

According to T.R. Deshmukh described along with design and modeling of parts of the model of the foot step power generation system using 3d modeling software. This process consists number of simple setups that is installed under the walking or standing platform. Project system works on the principle of converting the linear motion because to pressure of footsteps 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.

Md. Azhar, Zitender Rajpurohit, Abdul Saif, Nalla Abhinay, P. Sai Chandu, IJMETMR "Generation OfElectrical Energy From FootstepUsing Rack And Pinion Mechanism" (June 2017). 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 are a type of linearactuator 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 inthis source of energy. It is very useful to the places like all roads and as well as

all kind of footstep which is used to generate the non-conventional energy like electricity.[2]

From and the viewpoint of Shiraz Afzal, FarrukhHafeez, [3] 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 approx. twice by a single tile push ..The movement of the prevailing shaft turn thegearbox 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).[3]

From the perspective of Sasankshekhar Panda has described the based on crank shaft; fly wheel, and gear arrangement. This type of footsteps power generation system is 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. [4]

Jose AnanthVino described the 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 this 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. [5]

2.1 working principle

- The basic working principle of our project is based on the spring force that is used to convert mechanical into the electrical energy.
- This electrical energy will be stored in the 12V rechargeable battery connected to 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 loads

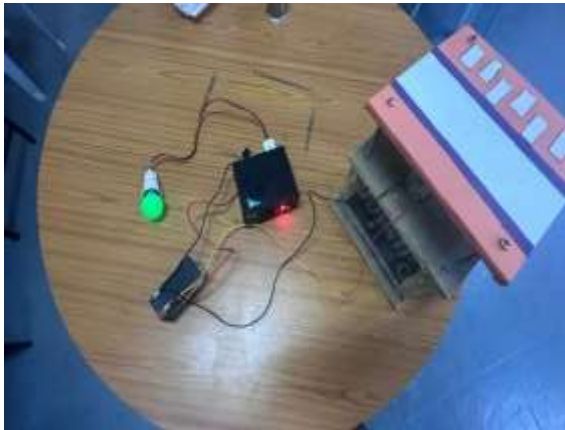


Fig.2 Final Model

2.2 working Model Of the system

The working of the Electricity Generation from foot steps with 555 timer ic is demonstrated.

- When force is applied on the plate by standing on plate the spring gets compressed.
- The rack here moves vertically down.
- The pinion meshed with the rack gear results in circular motion of the pinion gear.
- For one full compression the pinion moves 1 full circle.
- When the force is released from the plate pinion reverses and moves another circle and cause rotation of gear pairs.
- The generator attached to the last gear hence results in the dc power generation.

The power generated by the Electricity Generation from foot steps with 555 timer ic can be stored in an energy storing device. The output of the generator was fed to a 12 V lead acid battery, through an ac-dc converter bridge. Initially, the battery was completely discharged. Then, the FSEC was operated by applying foot load and energy was stored in the battery. A 100 W, 230V bulb was connected to the battery through an inverter. The

Fig.3 Block Diagram

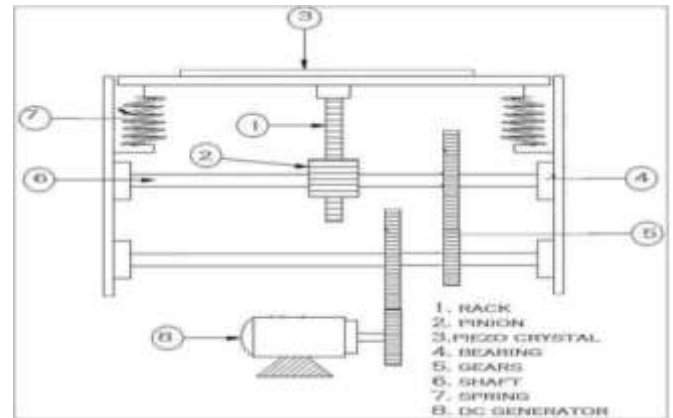
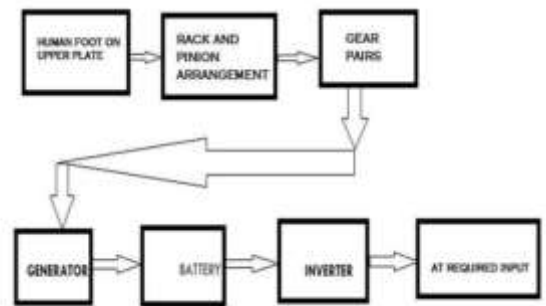


Fig.4 Line Diagram of the system

This is the line diagram of the system. It describes different components of the system in proper manner. In which rack moves downward as human weight applied which cause rotation of pinion. which is attached to the wooden column which is in contact with gear of dc gear motor.

3. Components used

Springs: A coil spring, also known as a helical spring, is a mechanical device which is typically used to store energy and subsequently release it, to absorb shock, or to maintain a force between contacting surfaces. They are made of an elastic material formed into the shape of a helix which returns to its natural length when unloaded.



Fig.5 springs

Dc gear motor



Fig.6 Dc gear motor

Due to the principle of electromagnetic induction, the rotation of the motor shaft within the magnetic field induces an electromotive force (EMF) across its terminals, thereby generating electrical energy. The presence of gears in the motor helps increase torque at lower speeds, which is essential because footstep motion produces slow and intermittent input. This ensures effective energy generation even under low-speed conditions. Additionally, the geared mechanism helps maintain a more consistent rotational output, improving the stability of the generated voltage. The electrical energy produced is then supplied to the rectifier and control circuit (555 timer IC) for further processing and utilization.

Battery



Fig.7 Battery

In our paper 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. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy.

Rack & Pinion



Fig.8 Rack & Pinion

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. A rack and pinion are types of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. The circular pinion engages teeth on a linear "gear" bar which is called the "rack".

Inverter



Fig.9 Inverter

An inverter is an electrical device that converts direct current (DC) to alternating current (AC); the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits

The DC power produced by the DC geared motor (after rectification and storage) is stored in a battery or capacitor. However, most household appliances and certain devices operate on AC supply. The inverter circuit converts this stored DC power into AC power of required voltage and frequency

4. Experimental Investigation

4.1 Input Energy Table

Trial No	Mass(kg)	Force (m*g) (N)	Displacement (mm)	Input Energy(j) (E = $\frac{1}{2} F * x$)
1.	15	147.1	10.24	0.753
2.	20	196.2	13.66	1.340
3.	25	245.2	17.08	2.094
4.	30	294.3	20.50	3.016
5.	35	343.3	23.91	4.104
6.	40	392.4	27.33	5.362
7.	45	441.4	30.72	6.775
8.	50	490.5	34.16	8.377
9.	55	539.5	37.58	10.137
10.	60	588.6	41.0	12.066
11.	65	637.6	44.41	14.157
12.	70	686.7	47.83	16.422
13.	75	735.7	51.25	18.852
14.	80	784.8	54.67	21.452
15.	85	833.8	58.08	24.213
16.	90	882.9	61.50	27.149

From the above table it is observed that input energy as well as force is increased as the mass increased. The displacement of the spring can be calculated by using the below formula

$$\delta = \frac{8WD^3n}{Gd^4}$$

Input energy = the energy stored in the spring

so

$$\text{Input energy} = \frac{1}{2} F * x$$

Where x = deflection of the spring when the load is applied.

Using the above relation data in the table is calculated.

For a maximum load of 90kg the displacement observed is 61.55mm and the corresponding input energy is 27.149J.

4.2 Output Energy Table

Trial NO	Voltage(v)	Current(A)	Time (sec)	Output Energy (V*I*t)
1.	0.37	0.078	1	0.028
2.	0.62	0.131	1	0.081
3.	0.86	0.182	1	0.157
4.	1.16	0.29	1	0.336
5.	1.41	0.3	1	0.423
6.	1.69	0.359	1	0.607
7.	1.85	0.393	1.10	0.799
8.	2.02	0.429	1.15	0.996
9.	2.20	0.468	1.18	1.214
10.	2.45	0.521	1.21	1.544
11.	2.57	0.546	1.23	1.725
12.	2.73	0.580	1.25	1.979
13.	2.87	0.610	1.27	2.223
14.	3.05	0.648	1.30	2.569
15.	3.21	0.682	1.32	2.889
16.	3.35	0.712	1.35	3.220

From the above table it is observed that system can Produce a maximum voltage of 3.35 under a load of 90kgs. Voltage values are obtained from the multimeter.

4.3 Theoretical Input Power

To determine the input energy, it is essential to determine the force applied on the model. Let the force applied be calculated as,

Force = weight of the body = $m \cdot g$

Workdone = $\frac{1}{2}$ Force $\times$ displacement.

Power = workdone / sec

Let the weight applied by the body of 90kg, then the displacement of the spring can be noted as 0.0615m

Force = $90 \times 9.81 = 882.9\text{N}$.

Workdone = $\frac{1}{2} 882.9 \times 0.0615$

i.e = 27.149J

power = 27.149/60

= 0.452 W.

4.4 Practical Output Power

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 Multimeter.

Power Voltage $\times$ Current $\times$ impact time

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

For one step of 70kg of load applied on the footsteps, the generated voltage is V and the current produced is 0.712 A.

Work done = $3.35 \times 0.712 \times 1.35$

= 3.22 W.

Power = 3.22/60

= 0.053 W.

4.5 Efficiency of the set up

$$\eta = \frac{\text{practical power output}}{\text{Theoretical power input}} \times 100$$

$$= \frac{0.053}{0.452} \times 100$$

$$\eta = 11.7 \%$$

4.6 Average Energy per step

$$E_{\text{avg}} = \frac{22.79}{16} = 1.42 \text{ J.}$$

Maximum energy per step = 3.22 J.

Minimum energy per step = 0.029 J.

4.7 Average energy per one revolution

$$E_{\text{avg}} = \frac{\text{sum of all energies}}{n} = \frac{22.79}{16} = 1.42 \text{ J.}$$

3. CONCLUSIONS

The project "ELECTRICITY GENERATION FROM FOOT STEPS WITH 555 TIMER IC" is successfully tested and implemented which is the best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absent. Since India is a developing country where energy management is a big challenge for huge population. By using this project, we can drive D.C loads. It is especially suited for implementation in crowded areas. This can be used in street lighting without use of long power lines. It can also be used as charging ports, lighting of pavement side buildings.

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REFERENCES

1. B. L. Theraja and A. K. Theraja, Electrical Technology vol. 1. New Delhi, India: S. Chand Publishing, 2005.
2. V. K. Mehta and R. Mehta, Basic Electrical Engineering New Delhi, India: S. Chand Publishing, 2010.
3. R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 11th ed. New Delhi, India: Pearson Education, 2013.
4. D. Roy Choudhury and S. Jain, Linear Integrated Circuits. New Delhi, India: New Age International, 2018
5. "Design and Implementation of Footstep Generation System," International Journal of Engineering Research & Technology (IJERT)
6. Baswaraj Gadgay, D. C. Shubhangi, H. Abhishek, "Foot Step Power Generation Using

- Piezoelectric Materials”–December2021
7. Joydev Ghosh; Supratim Sen; Amit Saha; Samir Basak, IEEE, “Electrical Power Generation Using Foot Step for Urban Area Energy Applications”–August2013
 8. P. Hema Chandu; A.Venkata Vinay; K.N.D. Jagadeesh;S.S.V.Kanaka Raju;V.G.ManiSharan, Raju;V.G.ManiSharan, IEEE, FootStep Micro-Level Power Generation–December2022
 9. Sanjit V K; Nirmitha S; Remya Jayachandran; Vijayadurga P; Yashaswini GY,IEEE,“Parametric Power Generation System”–December 2022
Analysis Of Piezoelectric-Sensor Array In Foot Step
 - 10.RajeshKumarDatta;SazidRahman,IEEE,“Power GeneratingSlabs:LostEnergy Conversion of Human Locomotive Force into Electrical Energy” – December2014
 - 11.P.A.HarshaVardhini;MattaHarshaSriVishnuSai; BhargaviMatta,IEEE,“HumanFoot Step Harvesting Systems Using Piezoelectric Technology.