DESIGN & FABRICATION OF MECHANICAL FOOTSTEP POWER GENERATION SYSTEM

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PRESENTATION OUTLINE

- Introduction
- Objectives
- Methodology
- Required Instrument
- Work Flow Diagram
- Block Diagram
- Working Principle
- Hardware Implementation
- Complete Project prototype
- Efficiency Calculation
- Project outcome
- Advantage
- Disadvantages
- Application
- Conclusion

INTRODUCTION

The Footstep Power Generation System is an innovative renewable energy solution that converts human foot pressure into electrical energy. Using a rack and pinion mechanism connected to a generator, it captures mechanical energy from footsteps and stores it in a battery. This eco-friendly system is ideal for crowded public areas like stations, malls, and sidewalks.

OBJECTIVES

- To study, design & develop a mechanical footstep power generator.
- To fabricate and assemble a working prototype of the footstep power generator.
- To evaluate the performance of the system

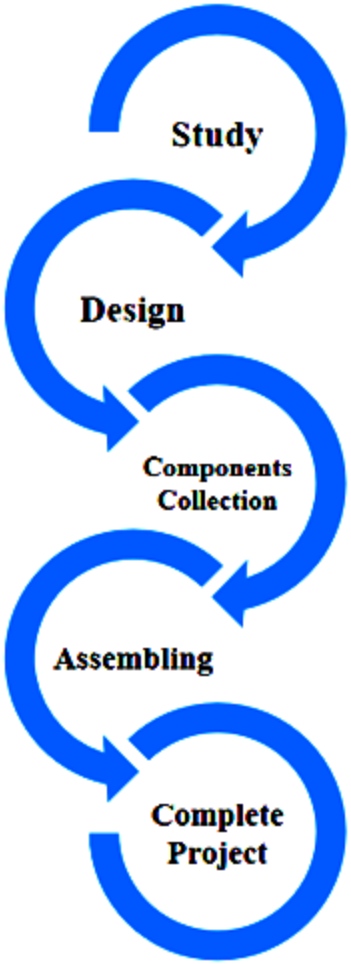
METHODOLOGY

- Develop the concept and create a block diagram showing the mechanical components like rack and pinion, gear, springs, and generator to understand the working flow.
- Collect all mechanical parts and fabricate the footstep platform. Assemble the rack-pinion mechanism with the generator to convert mechanical motion into electrical energy.
- Connect the generator output to a rectifier and battery circuit. Test the system by applying foot pressure and analyze voltage/current output for performance evaluation.

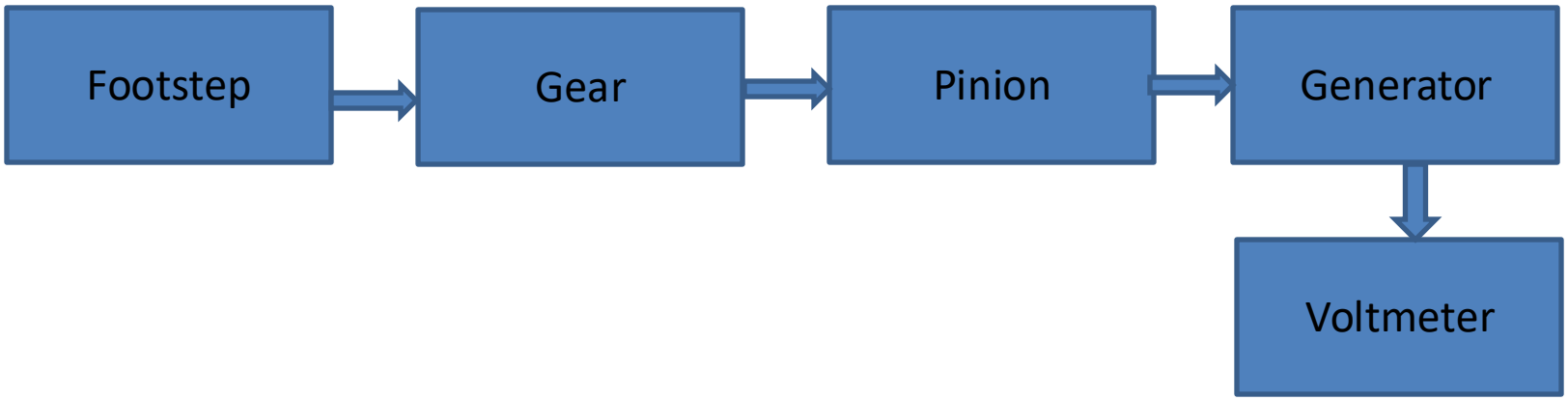
REQUIRED INSTRUMENT

- Generator Motor
- Battery
- Voltmeter
- Rack & Pinion Mechanism
- LED

WORK FLOW DIAGRAM



BLOCK DIAGRAM



WORKING PRINCIPLE

When a person steps on the platform, their foot pressure pushes a rack downward. The rack moves a pinion gear, converting linear motion into rotational motion. This rotates the shaft of a generator, producing electrical energy. The generated power is used in LEDs and monitored through a voltmeter for small-scale energy applications.

HARDWARE IMPLEMENTATION





COMPLETE PROJECT PROTOTYPE





Efficiency Calculation

A) INPUT POWER:

GIVEN DATA:

Let's assume the following:

Average weight of a person = 50 kg

Gravity (g) = 9.81 m/s^2

Displacement of platform (step compression) = 0.03 M (3 cm)

STEP 1: Calculate force applied

force (f) = mass × gravity = 50 × 9.81 = 490.5 N

STEP 2: Calculate work done per step

[let, 1 step = 1 seconds]

Work (w) = force×displacement = 490.5 × 0.03 = 14.71 J/S

SO,

INPUT POWER = 14.71 WATT

B) OUTPUT POWER:

TAKEN DATA:

Generator voltage output = 2.5v dc

per led rated current = 50 mA (0.05 A)

total led = 3 pcs

STEP 1: Calculate the led current (for parallel connection):

$\mathbf{i_t} = i_1 + i_2 + i_3$

$= 0.05 + 0.05 + 0.05$

$= 0.15$ A

STEP 2: Calculate the power

$p = v \times i$

$p = 2.5 \times \mathbf{0.15} = 0.375$ watt

SO,

OUTPUT POWER = 0.375 WATT

C) EFFICIENCY:

STEP 1: **CALCULATE THE EFFICIENCY**

$$\mathbf{Efficiency} = \frac{\mathbf{output\ power}}{\mathbf{input\ power}} \times \mathbf{100}$$

$$= \frac{\mathbf{0.375}}{\mathbf{14.71}} \times 100$$

= 2.55 %

PROJECT OUTCOME

- The system successfully generated electricity when pressure was applied through footsteps.
- The generated power was sufficient to light up LEDs.
- The voltage output was displayed in real-time through a voltmeter.
- Power generation was consistent and repeatable during multiple footstep cycles.
- The system proved to be cost-effective and energy-efficient in crowded zones.

ADVANTAGES

- No consumption of any fossil fuel.
- No manual work necessary during generation.
- Eco-friendly.
- 24 hours applicable.
- Low installation cost.
- Low maintenance cost.
- Simple in construction.
- Less space is required.
- Pollution free power generation.
- Energy available all year round.
- Maximum utilization of energy.

DISADVANTAGES

- Low power output per footstep.
- Depends on continuous human movement.
- Installation may be slightly complex.
- Less efficient without proper design.
- No extra power supply

APPLICATION

- Street lights.
- Lighting of the check post on the highways.
- Lighting footpaths and corridors.
- Use in schools and malls.
- Smart city renewable energy.

Conclusion

The Footstep Power Generation system is a simple, eco-friendly method to convert human motion into usable electricity. Though the power output is limited, it effectively promotes renewable energy use in high-footfall areas. This low-cost, sustainable solution supports small applications like lighting and mobile charging, making it ideal for smart cities and energy-conscious infrastructure.


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THANK YOU