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POWER GENERATING TILES

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Abstract : In the modern era, the escalating demand for energy underscores the need for groundbreaking innovations. This paper seeks to capitalise on this necessity by transforming non - conventional energy generated through the simple act of walking into a sustainable source of electrical power. The Electricity Generator Tiles, a novel and eco - friendly energy harvesting system, is designed to leverage human motion for power generation. Two 12V DC motors, integrated into the mechanical structure beneath a walking surface, efficiently convert the mechanical energy from footsteps into electrical energy. The generated power is stored in a compact and lightweight 3.7V LiPo battery for convenient storage. Visualising the power generation process is facilitated by the incorporation of two LEDs, providing a real - time display of electricity generation. This portable solution presents a practical means of harvesting energy from human movement, holding promise for diverse applications requiring off - grid power sources. With its innovative design, the Electricity Generator Tiles stands as a sustainable solution to address the ever - growing global energy demand, especially in areas where traditional power sources are limited or unavailable.

Keywords: Harvesting,Conventional , Sustainable , Inovative

1) INTRODUCTION

In our contemporary society , the indispensability of energy and power is more pronounced than ever. As the global demand for energy continues its upword trajectory, the depletion and westage of numerous traditional energy resources pose significant challenges. Addressing the concern, there is substantial merit in proposing a paradiam shift towards harnessing the overlook energy generated from foot power during human locomotion. This proposition gains particular significance in densly populated nations such as India, where high-traffic locations like roads, railway stations, bus stands, and temples consistently witness overcrowding, with millions of people in perpetual motion. Despite the vast potential inherent in this kinetic energy source, it currently goes untapped, making it a prime candidate for a transformative invention.

The Electricity Generator Tiles emerges as a pioneering solution, introducing a fresh perspective on sustainable energy by capturing the kinetic energy produced through human footsteps. Employing two 12V DC motors ingeniously integrated into the system, this technology adeptly converts mechanical energy generated during walking into a valuable source of electrical power. The harnessed energy finds a home in a lightweight 3.7V LiPo battery, while the incorporation of two LEDs offers a visually compelling real - time display of the power generation process. This innovation, with its portability and efficiency, not only advocates for eco - friendly practices but also establishes itself as a viable off - grid power source—empowering individuals to contribute to energy production through the simple and everyday act of walking.

2) SYSTEM DESIGN.

The tiles are fabricated and supported by compression springs. These elements are placed in such a way that they can withstand high mechanical loads, ensuring durability under constant foot traffic. The tiles' surface is designed to endure wear and tear while offering effective energy conversion. The dynamo motor is connected to the piezoelectric tiles through mechanical linkages that convert the energy generated by footfalls into mechanical motion.
Dc motor with 1000 rpm is used for generation which are coupled with gearing system, this system consists of rack and pinions used to increase the input energy provided to the motor and which helps to improve the output generated by the motor these output is stored into 6V rechargeable batteries.

3) WORKING PRINCIPLE

In this paper, we developed Electricity Generator Tiles that convert human motion into electrical energy. The system will utilize pressure - sensitive mechanisms embedded in the walking surface, which trigger two 12V DC motors upon each step. These motors will efficiently convert the mechanical energy from footsteps into electrical power. The generated electricity will then be directed to charge a 3.7V LiPo battery, serving as an energy storage unit for convenient use. Additionally, visual feedback will be provided through integrated LEDs to indicate the ongoing power generation process. Through this innovative approach, we aim to provide a user - friendly and sustainable solution that encourages environmentally conscious practices and active participation in clean energy generation.

4) OBJECTIVES

Objective of the project is to develop a prototype model of power generating tiles to utilize the energy created through the foot traffic at over crowed place like railway station air ports and other public places as a non-conventional and efficient energy resource. To reduce the use and dependability over the conventional energy sources and to support eco friendly environment

5) METHODOLOGY

1. Conceptualization

1.1 Core Working Principle

- The tiles will have a dynamometer to convert mechanical energy (from footsteps) into electrical energy.
- The energy is stored in a battery or directly used to power nearby applications.
- The efficiency depends on the number of footsteps, pressure exerted, and conversion mechanism.

1.2 Requirements & Constraints

- Material Selection: Durable, weather-resistant, and efficient in energy transfer.
- Power Output: Estimate power per step (~1-5W per tile).
- Cost Efficiency: Optimize manufacturing and installation costs.
- Safety & Durability: Anti-slip, waterproof, and high load-bearing capacity.

2. Design

2.1 Mechanical Design

- Tile Structure: Layers include a protective surface, mechanical compression system, dynamometer, and base support.
- Dynamometer Integration: Converts mechanical force into rotational motion to generate electricity.
- Compression Mechanism: Uses springs or hydraulic systems to optimize force distribution.

2.2 Electrical & Energy Storage Design

- Generator Type: Select an efficient small-scale dynamometer-based generator.
- Energy Storage: Supercapacitors or lithium-ion batteries.
- Load Management: Convert AC to DC, voltage regulation circuits, and storage integration.

3. Prototype Development

- Build a small-scale prototype to analyze power output per step.
- Test efficiency under different loads, weights, and environmental conditions.
- Optimize design based on real-world data.

4. System Efficiency

Efficiency depends on how effectively mechanical energy (footsteps) is converted into electrical energy.

4.1 Factors Affecting Efficiency

Factor	Impact & Optimization Strategies
Energy Conversion Efficiency	Dynamometer efficiency typically ranges from **50-80%**. Choose high-efficiency mechanical-to-electrical conversion mechanisms.
Tile Compression Mechanism	Use an optimized **spring-loaded system** to ensure maximum energy transfer without excessive mechanical loss.
Power Loss in Conversion	Minimize energy loss in rectification (AC to DC) using **high-efficiency diodes and regulators**.
Energy Storage Efficiency	Use **supercapacitors** for short-term storage and **lithium-ion batteries** for long-term storage to reduce power dissipation.
Load Distribution & Foot Traffic	Design tiles to **engage only when necessary**, preventing unnecessary mechanical fatigue and power waste.

4.2 Expected Power Output Calculation

The power generated depends on the force applied and tile efficiency.

- Average weight per person = 70 kg
- Step force (F) = mg = 70 × 9.81 = 686 N
- Tile displacement (d) = ~5 mm (0.005 m)
- Work done per step = F × d = 686 × 0.005 = 3.43 Joules
- Assume 60% efficiency in conversion → Useful energy per step = 2 Joules
- Power output per step (~1 step/sec) = 2W per tile

5. Future Improvements

5.1 Efficiency Enhancements

- Hybrid Power Generation: Combine dynamometer + piezoelectric + electromagnetic induction to increase output.
- AI-Based Smart Management: Use AI and IoT for real-time energy monitoring & optimization.
- Wireless Energy Transfer: Explore inductive coupling to reduce wiring needs.

5.2 Scalability & Adaptability

- Customizable Tiles: Adaptable designs for roads, public transport stations, and industrial spaces.
- Integration with IoT Systems: Smart cities can monitor foot traffic patterns for better energy utilization.
- Modular Design for Easy Upgrades: Future improvements (e.g., more efficient generators) can be retrofitted without replacing entire tiles.

6. Block Diagram

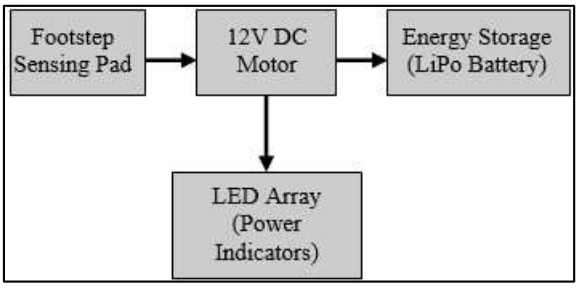

Fig 6.1: Block diagram

7. Flow Chart

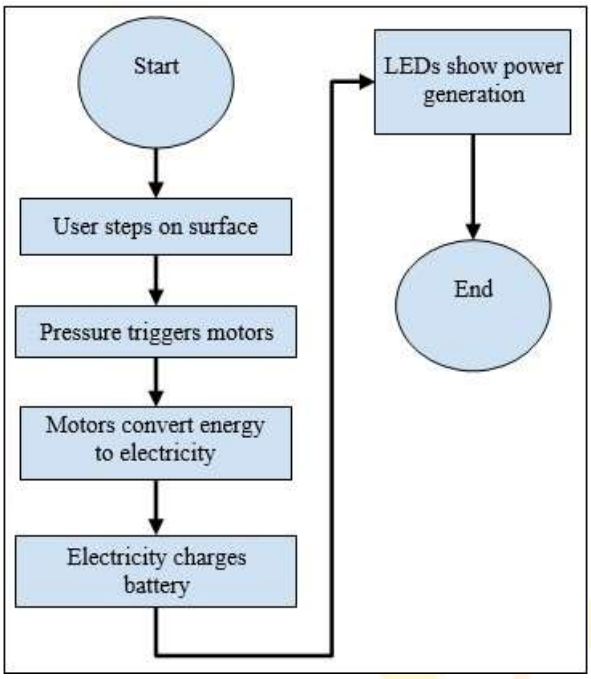

Fig 6.2: Flow chart

Key components

1) 12V DC Motor
2) 3.7V Li - Po Battery
3) LED
4) Racks and pinions

6) RESULT

The results of implementing the Electricity Generator Tiles reveal a promising advancement in sustainable energy generation technology. Through the innovative integration of pressure - sensitive mechanisms and DC motors, the system effectively harnesses human motion to produce electrical power. The successful conversion of mechanical energy from each step into usable electricity, stored in a LiPo battery, demonstrates the feasibility of incorporating renewable energy sources into everyday activities. Moreover, the inclusion of visual indicators, such as LEDs, offers real - time feedback, enhancing user engagement and promoting awareness of energy conservation efforts. Overall, these findings underscore the potential of the Electricity Generator Tiles to not only contribute to environmental sustainability but also to foster a culture of active participation in clean energy generation among individuals.

7) CONCLUSION

Non - conventional energy system is very essential at this time to our nation. Non - conventional energy using foot steps needs no fuel input power to generate the electrical power. The Electricity Generator Tiles presents a promising solution for sustainable energy harvesting, utilising the kinetic energy from human footsteps. This innovative system seamlessly converts mechanical motion into electrical power through strategically placed 12V DC motors, storing the generated energy in a 3.7V LiPo battery. The incorporation of LEDs not only enhances user engagement but also serves as a visual indicator of the ongoing power generation. By offering a practical and interactive means of harnessing energy from everyday activities, this eco - friendly solution contributes to the broader goal of promoting clean and renewable energy sources, making it a compelling option for applications requiring off - grid power generation.

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