

Smart Energy Door Mat

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ABSTRACT

The Smart Energy Door Mat is an innovative system designed to generate small amounts of electrical energy from human footsteps. In this project, pressure sensors or piezoelectric sensors are placed inside a door mat to convert mechanical energy into electrical energy. Whenever a person steps on the mat, the pressure produces electrical energy which can be stored in a battery and used to power small devices such as LED lights or sensors. The main objective of this project is to utilize wasted mechanical energy and convert it into useful electrical energy. This system is simple, eco-friendly, and suitable for places with heavy foot traffic such as entrances of buildings, malls, and railway stations. The project demonstrates a practical approach to energy harvesting and promotes the concept of renewable energy.

Key Words: Energy harvesting, Smart mat, Piezoelectric sensor, Renewable energy, Footstep power.

INTRODUCTION

Energy demand is increasing day by day due to rapid industrial and technological development. Conventional sources of energy such as coal and petroleum are limited and cause environmental pollution. Therefore, there is a need to develop alternative and renewable energy sources.

The Smart Energy Door Mat is a system that converts the mechanical energy of footsteps into electrical energy. When a person steps on the mat, pressure is applied on sensors placed under the mat surface. These sensors generate small electrical signals which are then converted and stored in a battery. This stored energy can be used for small electrical applications such as lighting LEDs or charging low-power devices.

The main aim of this project is to demonstrate an efficient method of generating electricity from daily human activity.



Working Principle

The Smart Energy Door Mat works on the principle of piezoelectric energy generation.

When a person steps on the door mat, pressure is applied to the piezoelectric sensors placed inside the mat. Due to this pressure, the sensors produce a small amount of electrical energy (voltage).

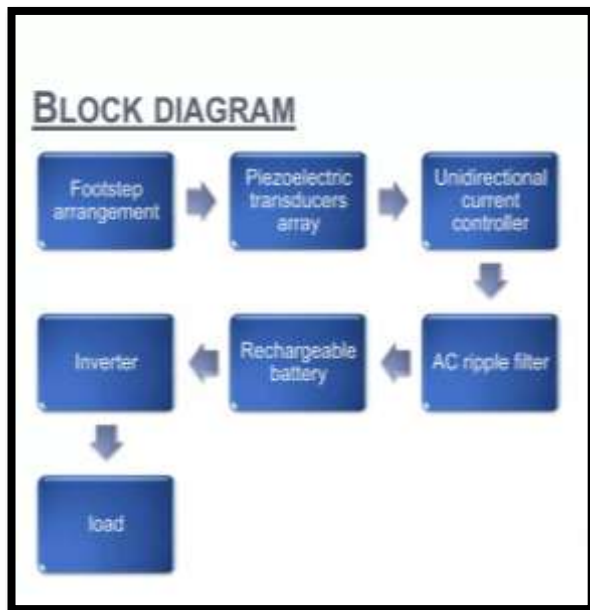
This generated AC voltage is then converted into DC voltage using a bridge rectifier. The DC power is stored in a rechargeable battery or capacitor.

Finally, the stored energy can be used to power small devices such as LEDs, sensors, or indicators..

Components Used

Sr no	Components	Function
1	Piezoelectric Sensor	Convert pressure into electrical energy
2	Bridge Rectifier	Convert AC to DC
3	Rechargeable Battery	Store generated energy
4	LED	Display output
5	Door Mat Bas	Platform for sensors

Block Dig & Explanations



I. Footstep Arrangement

The footstep arrangement is the mechanical setup where piezoelectric sensors are placed under a plate or tile on the floor.

When a person walks or steps on the plate, mechanical pressure is applied. This pressure produces mechanical vibrations or stress. The system is designed in such a way that the pressure from footsteps is efficiently transferred to the piezoelectric sensors.

This arrangement is usually installed in high pedestrian traffic areas such as railway stations, shopping malls, staircases, and sidewalks to generate electricity from human movement.

II. Piezoelectric Transducers Array

The piezoelectric transducer array consists of multiple piezoelectric sensors connected together.

The piezoelectric effect is the property of certain materials (like quartz or ceramic) that generate electrical voltage when mechanical stress is applied.

When footsteps apply pressure on the plate:

The piezo sensors deform slightly.

This deformation generates electrical voltage.

The generated voltage is usually AC (Alternating Current) and very small.

To increase the output power, multiple sensors are connected in series or parallel combinations forming an array.

III. Unidirectional Current Controller (Rectifier)

The output from the piezoelectric sensors is AC voltage, which changes direction continuously. However, batteries and most electronic devices require DC voltage.

The unidirectional current controller, also known as a rectifier circuit, converts AC voltage into DC voltage. This circuit typically uses diodes arranged in a bridge rectifier configuration. The rectifier ensures that current flows in only one direction.

Functions:

Converts AC to DC

Protects the circuit from reverse current

Stabilizes the direction of current flow

IV. AC Ripple Filter

After rectification, the DC output is not perfectly smooth. It contains ripples or fluctuations in voltage. The AC ripple filter is used to smooth the output voltage. This filter usually consists of capacitors and inductors.

Working:

The capacitor stores electrical energy when voltage rises.

It releases energy when voltage drops.

This process reduces voltage fluctuations and produces a more stable DC output.

A smooth DC output is important for battery charging and proper circuit operation.

V. Rechargeable Battery

The filtered DC power is stored in a rechargeable battery.

Since the energy generated from footsteps is intermittent and small, storing it in a battery allows the energy to be accumulated over time.

Commonly used batteries:

Lithium-ion battery

Lead-acid battery

Rechargeable DC battery packs

Functions:

Stores generated electrical energy

Provides continuous power supply even when no footsteps occur

Supplies power to the load when required

VI. Inverter

The energy stored in the battery is in DC form. However, many electrical appliances operate on AC power.

The inverter converts DC power from the battery into AC power.

Functions:

Converts DC to AC

Provides suitable voltage for AC loads

Enables the system to run standard electrical devices

Small inverters are used in prototype systems to power lights or small appliances.

VII. Load

The load is the device that consumes the generated electrical energy.

Examples of loads in this project:

LED lights

Street lights

Mobile charging units
Small electronic devices
In practical applications, this system can be used to power lighting systems in public places.

Advantages

- Utilizes wasted human energy
- Eco-friendly energy generation
- Low maintenance system
- Suitable for public places
- Renewable Energy Source
- Easy Installation
- Small Devices Power Supply

Applications

- Railway stations
- Shopping malls
- School and college entrances
- Smart buildings
- Public walkways
- Airports
- Temples

CONCLUSION

The Smart Energy Door Mat project demonstrates an innovative method of generating small amounts of electrical energy from human footsteps. By using pressure sensors or piezoelectric materials, the system converts mechanical energy produced when a person steps on the mat into electrical energy. This energy can be stored in a battery and used to power small devices such as LEDs, sensors, or indicators.

The project helps in promoting renewable and sustainable energy solutions by utilizing everyday human movement. It is simple, eco-friendly, and suitable for places with high foot traffic like malls, railway stations, schools, and offices.

Overall, the Smart Energy Door Mat shows that even small amounts of wasted energy can be captured and reused efficiently, contributing to energy conservation and smart technology development.

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