PRESSURE-INDUCED FOOTSTEP POWER GENERATOR FOR BIOMETRIC SECURITY

ABSTRACT

In a world increasingly focused on sustainable solutions, there is a growing need for self-sufficient power systems to support biometric security devices. Traditional biometric sensors rely heavily on batteries or direct wiring, which limits their deployment in remote areas and creates challenges with ongoing maintenance and power outages. This project proposes an innovative solution: a Pressure-Induced Footstep Power Generator designed to provide on-the-spot power for a fingerprint biometric security system.

This device utilizes the mechanical energy generated when someone steps on a custom-designed platform with pressure-sensitive components. Each step is converted into electrical energy through piezoelectric transducers, which then charge a 12V battery. This stored energy powers a fingerprint sensor, enabling reliable biometric security without the need for traditional power sources. This approach is not only sustainable but also reduces dependency on batteries and electrical grids, making it a compelling solution for locations without steady power infrastructure. By merging renewable energy with security needs, this technology showcases the practical applications of green energy in everyday security solutions.

THE FIELD OF INVENTION (SECURITY AND ENERGY HARVESTING)

This invention occupies a unique place in both the security and energy-harvesting fields. Traditional security systems often rely on batteries or wired power connections, which may not be feasible or reliable in certain environments. This device introduces a renewable power option, suitable for high-traffic areas or places with limited access to traditional power sources. Beyond typical security setups, this technology has potential applications in public infrastructure, smart buildings, and other security-sensitive environments that could benefit from a renewable energy solution. Additionally, it aligns with the shift toward greener energy practices, showing how sustainable technology can be adapted for security needs.

Mr. Katta Narasimha Prasad

Mr. Kovi Sai Ganesh

Dr. Clement Raj C

BACKGROUND OF THE INVENTION

Today, biometric security is critical across various sectors, from government facilities to private organizations. However, the current reliance on either battery-operated systems or direct power sources is problematic. Batteries have a limited life span, require frequent replacements, and generate environmental waste. Wired power sources, on the other hand, restrict flexibility as they are confined to areas with consistent access to electricity. Alternative power solutions like solar panels are effective in certain outdoor conditions but are unsuitable for shaded or indoor areas, leaving gaps in power availability.

This device addresses these limitations by transforming mechanical energy from footsteps into a continuous power source, offering a versatile, eco-friendly, and cost-effective solution. By capturing and converting kinetic energy from everyday actions, this footstep generator powers fingerprint sensors on demand, providing a sustainable, stand-alone security solution that does not rely on traditional energy grids.

SUMMARY OF THE INVENTION

The Pressure-Induced Footstep Power Generator is an innovative, self-sufficient power source for fingerprint biometric systems. Using a spring-loaded platform equipped with piezoelectric cells, the system captures and stores energy every time someone steps on it. The generated power is stored in a 12V battery, which supplies electricity to a fingerprint sensor for identity verification. The system is designed to be flexible and adaptable to a range of settings, from indoor spaces to remote outdoor locations. It's an environmentally friendly option, eliminating the need for batteries and reducing maintenance demands, making it ideal for diverse applications in security technology.

Mr. Katta Narasimha Prasad

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Dr. Clement Raj C

SPECIFICATION

The primary components of the Pressure-Induced Footstep Power Generator are as follows:

- **Arduino Uno**: This microcontroller serves as the core processing unit, handling data from the piezoelectric cells and managing the power flow to the fingerprint sensor. The Arduino board enables real-time control, making sure that the fingerprint sensor is activated only when there is sufficient power generated from foot pressure.
    - **Features**:
        - Microcontroller: ATmega328P
        - Operating Voltage: 5V
        - Input Voltage (recommended): 7-12V
        - Flash Memory: 32KB
        - SRAM: 2KB
        - EEPROM: 1KB
    - **Application**: Biometrics, automated control in low-power systems
- **Piezoelectric Cells**: These cells leverage the piezoelectric effect, where pressure on the material creates an electric charge. Each cell produces roughly 0.2V, with a current of 5-10mA, which accumulates to a usable voltage in the 12V battery over repeated footsteps.
    - **Features**:
        - Low cost and durable
        - Converts mechanical energy to electrical efficiently
    - **Application**: Used in sensors, energy-efficient systems, and devices requiring low-level power sources
- **LCD Display**: This alphanumeric display provides real-time feedback, showing system readiness, battery levels, and user authentication status. It's connected to the Arduino, displaying information on the functionality of the fingerprint sensor.
    - **Features**:
        - Input Voltage: 5V
        - Compatibility with various microcontroller boards
        - Straightforward coding interface
    - **Application**: Monitoring, display interface in microcontroller projects

DESCRIPTION

The Pressure-Induced Footstep Power Generator leverages a unique concept in energy harvesting by using footsteps to generate power. When a person steps on a specially designed platform, piezoelectric cells inside the platform capture this mechanical energy and convert it into electrical energy. The energy is stored in a 12V battery and can be used to activate a fingerprint sensor for biometric security. This self-contained system offers a practical and green solution for powering security systems, even in locations without a conventional power supply. The device is suitable for both indoor and outdoor use and offers a highly adaptable solution for high-traffic areas where sustainable power and security are essential.

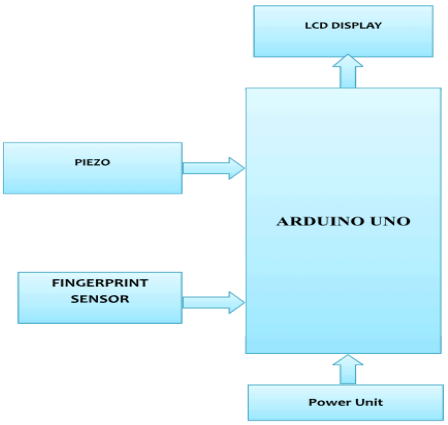

Figure 1. BLOCK DIAGRAM

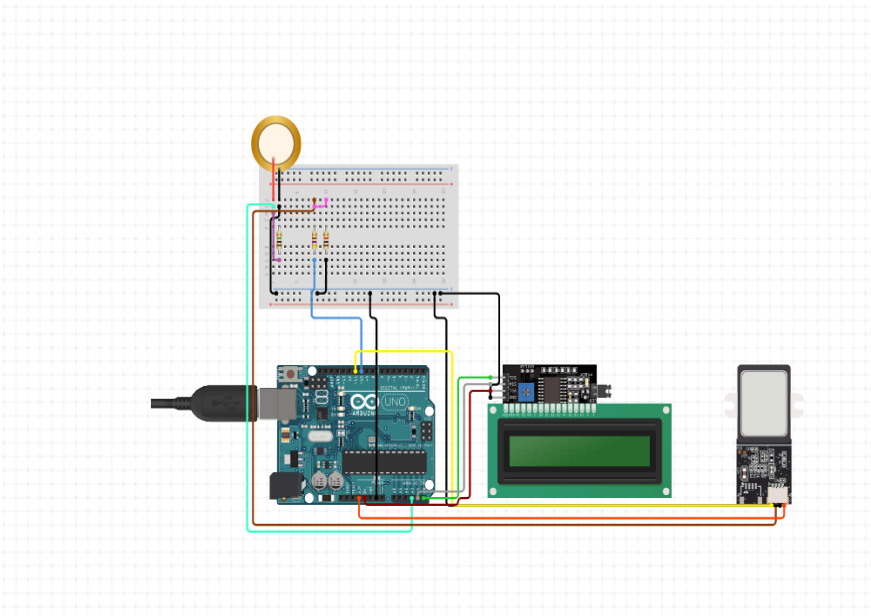

Figure 2. CIRCUIT DIAGRAM

Mr. Katta Narasimha Prasad

Mr. Kovi Sai Ganesh

Dr. Clement Raj C

Figure 3. PRODUCT IMAGE

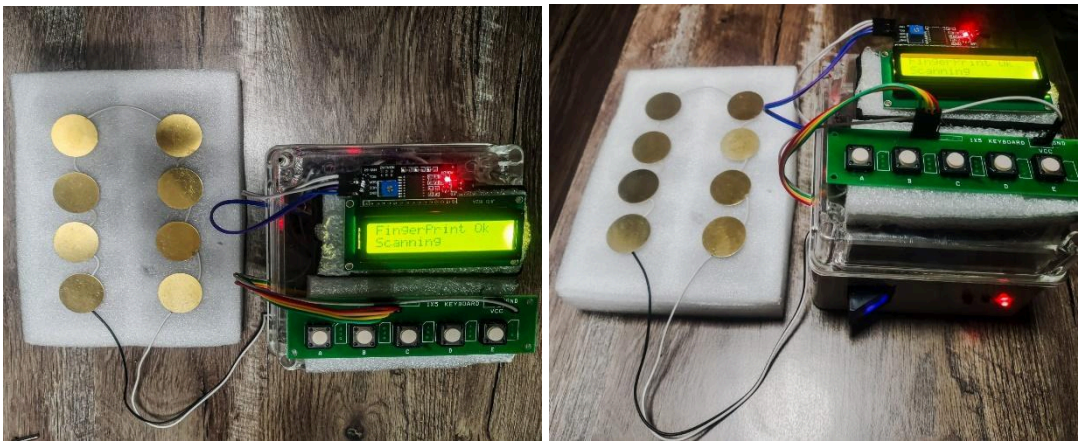

Figure 4. INTERIOR IMAGES OF THE PRODUCT

Mr. Katta Narasimha Prasad

Mr. Kovi Sai Ganesh

Dr. Clement Raj C

WE CLAIM

1. **Claim**: A footstep-driven energy harvesting system that provides a reliable, sustainable power source for biometric applications.
2. **Claim**: A method to enable independent power generation for security devices, making them functional in locations without accessible power sources.
3. **Claim**: An eco-friendly energy generation process that minimizes reliance on disposable batteries, reducing environmental waste.
4. **Claim**: A versatile, location-independent power system adaptable for various biometric security applications.
5. **Claim**: A system that effectively combines renewable energy generation with modern security needs, demonstrating a commitment to sustainable technology in security solutions.

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Mr. Kovi Sai Ganesh

Dr. Clement Raj C