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Piezo Based Visitor Sensing Smart Doormat With Counter.

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ABSTRACT:

This work shows how to create and use a smart door mat based on face recognition technology. This project aims mainly to improve user access by providing a hands-free entrance option and to strengthen home security by logging visitor data. The project emphasizes usability, reliability, and scalability, making it suitable for residential and commercial applications. The system combines a facial recognition algorithm written in Python using the OpenCV library with changes managed by an Arduino via serial communication.

INTRODUCTION :

Safety is a big issue in our everyday life. Every individual needs a feeling of safety. Our security system for doors is access control. Anyone can get access by breaching these locks; traditional locks are not as safe now as they once were. Our system has to support seven days a week, twenty-four hours a day. A smart door mat lets only authorized people into limited regions. A patented novel method meant to increase home safety and protection, the Piezo Smart Door Mat The Smart Mat may record the user's footstep and run a pre-programmed function like door unlocking and photo capture of the person standing in front of the door, so helping to create a completely efficient automated solution. The Smart Door Mat with Piezo Conversely, it can reach the designated group of people and is useful in contactless door opening. The concept behind this product is that once an image of a person is obtained, it is compared using the network database of authorized members on the server.
Should a match be found via assisted image capture, the door will effortlessly open without requiring touch. Such technology together with the application of sophisticated artificial intelligence guarantees that more improvements will transform doors in a smart house or business by the Piezo Smart Door Mat. On the other hand, the very basic purpose of the Piezo Smart Door Mat is to enable the doors of an office or home to speak or communicate for improved contactless interactions.

LITERACY SURVEY :

1. " Tannu Mate et al. (2023): This study, "Piezo-Based Visitor Sensing Welcome Mat,"
2. " Renuka Kshirsagar et al. (2023): In their paper "IoT-Based Visitor Sensing Smart Doormat,"
3. " Vinit Janbandhu et al. (2016): The paper "Design and Implementation of Smart Door Mat"
4. " Genta Yuandhana et al. (2021): In their study "Piezoelectric Mat as Door Bell,"
5. " Mohan K. Mallikarjun et al. (2022): The paper "Piezoelectric Door Mat"
6. " Anunay Kumar et al. (2021): Their work on "IoT-Based Visitor Sensing Doormat"

EXISTED SYSTEM :

A piezoelectric smart doormat offers real-time detection of visitors at the entrance. The moment someone steps on the mat, the piezoelectric sensor detects the pressure exerted, triggering a response (e.g., sending a notification to a homeowner’s phone or activating home automation systems like smart locks or lights). Home security is a priority for homeowners, and the ability to know who’s at the door instantly increases security. In cases of security threats or unauthorized visits, having early knowledge provides an advantage, especially when integrated with smart doorbell cameras or motion sensors.

PROPOSED SYSTEM :

The methodology for developing a piezoelectric-based visitor sensing smart doormat involves several key stages, from design to implementation and evaluation. This methodology outlines the steps for selecting components, integrating technologies, and testing the system to ensure it meets the project's objectives, including accuracy, energy efficiency, and user experience.Integrate the piezoelectric sensors with the microcontroller to convert the analog pressure signal into digital data. Implement a signal conditioning circuit to amplify and filter the signal from the sensors for better accuracy.Apply algorithms to process the sensor output, detecting the presence of visitors while minimizing noise from pets or other objects.A processing unit capable of real-time data acquisition, with filtered output from the piezoelectric sensors.Use a time-based window to detect and track the duration of pressure application on the mat.

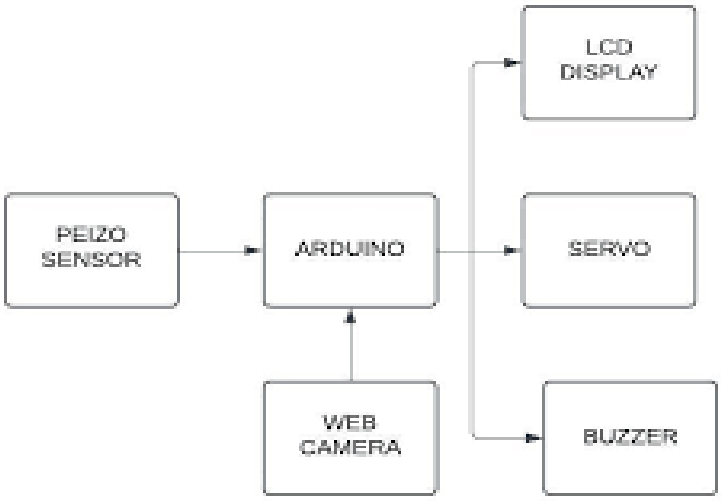

Fig 1: Block diagram of proposed system

Arduino Nano:

A piezo-based visitor-sensing door mat with Arduino is an interesting and innovative project! The most commonly used microcontroller in Arduino boards is the Atmel AVR series although other microcontroller architectures like ARM are also supported. Arduino boards typically include digital input/output pins, analog input pins, power pins, a USB interface for programming and communication, and additional features such as built-in LEDs, buttons, and voltage regulators. Arduino programming is based on a subset of C and C++ languages, with a few additional libraries and conventions specific to Arduino.

Fig 1: Arduino Nano

LED Display:

A 16x2 LCD display is a common alphanumeric liquid crystal display with a grid of 16 columns and 2 rows, allowing for the display of 16 characters per row. Each character is typically a 5x8 dot matrix, providing a readable interface for text-based information. These displays often use the HD44780 controller, simplifying interfacing with microcontrollers. The 16x2 LCDs have a backlight for visibility in various lighting conditions.

Relay:

A relay can be used in a visitor sensing doormat to activate or control an electronic system (like a light, alarm, or doorbell) when a visitor steps on the mat. Here's how it typically works. The microcontroller or detection circuit processes the signal and triggers a relay. A relay is an electrically controlled switch, meaning that it can control higher voltage or current devices (such as lights or alarms) based on the low-voltage signal from the sensor.

Preset:

A 10K preset (also known as a 10K potentiometer) is a type of adjustable resistor that can be used to change the resistance in a circuit. It consists of a resistive track, a wiper, and three terminals. The preset is commonly used in electronics for tasks where you need to manually adjust the resistance, such as controlling volume, brightness, or sensitivity in various circuits, including sensors like piezoelectric sensors.

Fig 4: Preset

Piezo Electric Cell:

piezoelectric cell, also called a piezoelectric sensor or piezoelectric element, works based on the piezoelectric effect, which is the generation of an electric charge in response to mechanical stress or pressure. The piezoelectric effect occurs in certain materials that can convert mechanical energy (such as pressure, vibration, or force) into electrical energy (voltage). The core working of a piezoelectric cell can be explained through the piezoelectric effect, and vice versa

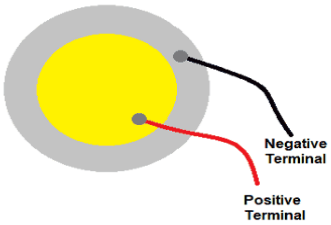

Fig 5: Piezo Electric Cell

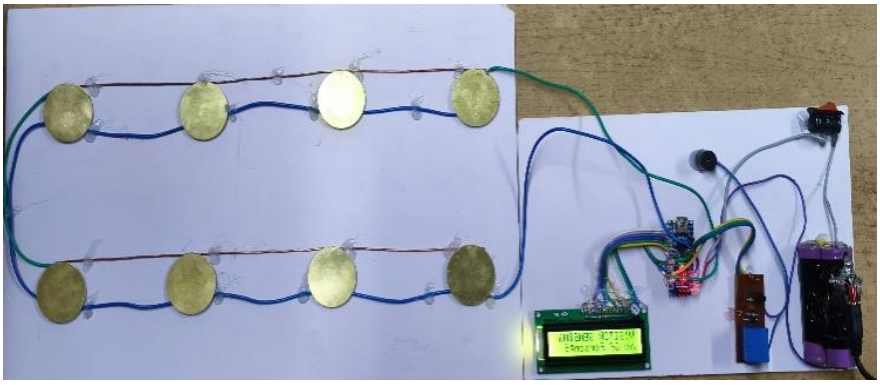

Fig. Hradware Design

VI. SYSTEM METHODOLOG :

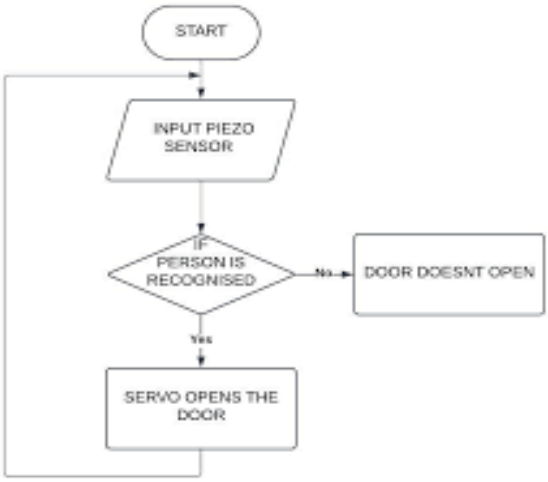

Fig 6: Flow of system operation

VII. EXPERIMENT AND ITS RESULT

A piezo-based visitor sensing smart doormat can yield a variety of results depending on the configuration and how it's integrated with other systems. Here are the typical outcomes or results you'd expect from using such a mat. As soon as someone steps on the doormat, the piezoelectric sensors generate a signal that indicates the presence of a visitor.

VIII ADVANTAGES

1. Reliable Visitor Detection.
2. Improved Security.
3. Enhanced User Experience
4. Integration with Smart Home Systems.

APPLICATIONS :

1. Home Automation & Smart Homes.
2. Security & Surveillance.
3. Commercial Spaces (Retail and Hospitality).
4. Events & Conferences.
5. Smart Delivery Management.

CONCLUSION :

In conclusion, a piezo-based visitor sensing smart doormat offers a unique and innovative solution for detecting and interacting with visitors or people at entry points. It combines the benefits of pressure-based detection, energy efficiency, and seamless integration with modern smart home or business systems. Here are some key takeaways.

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1. Prof. Genta Yuandhana et al., “Piezoelectric Mat as Door Bell,” Indonesian Journal of Multidisciplinary Research, 2021.
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3. Mohan K. Mallikarjun et al., “Piezoelectric Door Mat,” International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 2022.