IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

ANTI-THEFT FLOOR MAT SYSTEM

J. Santhana Krishnan[1], Biju Balakrishnan[2]

II MCA Student, MCA, Hindusthan College of Engineering and Technology, Coimbatore, India[1]

Assistant Professor, MCA, Hindusthan College of Engineering and Technology, Coimbatore, India[2]

Abstract: The "Anti-Theft Floormat" project innovatively merges piezoelectric sensors with Arduino microcontrollers to transform ordinary floormats into intelligent security devices. By embedding sensors, it detects unauthorized access by converting footsteps into electrical signals. The Arduino acts as the central processor, monitoring sensor data and triggering an alarm when pressure exceeds a set threshold, alerting occupants in real-time. Power management is a focus, utilizing Arduino's sleep modes to balance responsiveness and energy efficiency, optimizing performance while conserving power during idle times. This project reimagines security systems, addressing vulnerabilities overlooked by conventional methods, offering a versatile and effective solution for homes and offices

Keywords: Anti-theft device, Piezoelectric sensors, Home security, Security innovation.

I. INTRODUCTION

1.1 PREAMBLE

In today's growing cities, security remains a top concern. This project offers a novel solution: an anti-theft floor mat powered by Arduino. Imagine a regular-looking doormat that silently triggers an alert when stepped on by an unwelcome visitor. This innovative system utilizes piezo sensors, similar to those in guitar pickups. Embedded within the mat, these sensors detect pressure changes, ideal for triggering an alarm against unauthorized entry.

Arduino, a popular open-source electronics platform, acts as the brain of the operation. Programmed to interpret sensor signals, the Arduino board can trigger an alarm or send an IoT notification, keeping you informed of potential threats. This project represents a significant advancement in home security. By harnessing cutting-edge piezo sensor technology, our anti-theft floor mat not only safeguards your valuables but also paves the way for a new era in residential and potentially even vehicle security.

1.2 ANTI-THEFT FLOOR MAT

The "Anti-Theft Floormat" project stands as a pioneering venture that remains traditional security paradigms. Rooted in the synthesis of advanced sensor technology and the programmable versatility of Arduino microcontrollers, this project introduces a novel and unobtrusive solution to fortify homes and offices against unauthorized access. Security, a concern as ancient as civilization itself, has witnessed remarkable technological evolution. However, as we tread further into the digital age, our conventional methods of safeguarding spaces often fall short of addressing nuanced vulnerabilities. It is in this context that the Anti-Theft Floormat emerges—an embodiment of innovative thinking that transforms the mundane floormat into an intelligent sentry capable of discerning and responding to potential security breaches. At its core, this project relies on piezoelectric sensors strategically embedded within the fabric of a common floormat. These sensors, responsive to mechanical stress and pressure, serve as the vigilant eyes of the security system. As an individual steps onto the floormat, the piezoelectric sensors convert the resulting pressure into measurable electrical signals a phenomenon that forms the basis for intelligent threat detection.

1.3 PROBLEM DESCRIPTION

When the system detects pressure exceeding this established threshold, it orchestrates an immediate response a symphony of action that includes the activation of a buzzer or alarm. This auditory alert not only serves as an immediate deterrent but also notifies occupants of the potential breach, allowing for timely intervention. Leveraging the power-efficient sleep modes of the Arduino, the system optimizes energy consumption, ensuring that it remains vigilant without unnecessarily draining resources during periods of inactivity.

1.4 OBJECTIVE

Moreover, the Anti-Theft Floormat project explores the frontiers of connectivity. By contemplating the integration of GSM or Wi-Fi modules, the system opens avenues for remote notifications. Users can receive real-time alerts on their Smartphones or central monitoring systems, fostering a sense of control and awareness irrespective of their physical proximity to the secured space.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

As we delve into the intricacies of the Anti-Theft Floormat project, we uncover not merely a security apparatus but a testament to the transformative power of technology. This project transcends the mundane to offer a dynamic, responsive, and intelligent security solution one that mirrors the pulse of our digitally charged existence.

1.5 SCOPE

The scope of the Anti-Theft Floormat using Piezo Sensor project is expansive, offering a promising array of features and applications. It primarily aims to detect unauthorized access or footsteps on the floormat through the integration of piezoelectric sensors. Real-time monitoring capabilities enable instant processing and analysis of sensor data, swiftly identifying potential security threats. The project's focus extends beyond mere detection, as it encompasses the development of a robust system capable of triggering alarms, notifications, or automated communication with security systems upon detecting intrusion. Seamlessly integrating with existing smart home systems, users can effortlessly monitor and control security features via their smartphones or other devices. Customizable alert settings add flexibility, allowing users to tailor sensitivity levels, activation times, and specific areas of concern on the floormat. Prioritizing power efficiency, the project implements mechanisms to extend the lifespan of components and minimize energy consumption. Versatility is key, with the floormat designed for deployment in diverse environments, including homes, offices, vehicles, and other security-sensitive spaces. The project architecture is engineered to be scalable, facilitating future enhancements and the integration of additional security features or sensors to adapt to evolving security needs.

II. SYSTEM SPECIFICATION

2.1 HARDWARE SPECIFICATION:

- Microcontroller - Arduino UNO
- Sensor - Piezo Sensor
- Other Components - Buzzer

2.2 SOFTWARE SPECIFICATION:

- Operating system - Windows OS
- IDE - Arduino IDE

III. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

The existing system for an Anti-Theft Floormat using the Piezo Sensor project typically revolves around conventional security measures, which may include basic alarms, motion sensors, or surveillance cameras. However, these traditional systems often lack the sophistication and specificity offered by piezo sensor technology. The basic anti-theft security systems that use sensors on walls or motion detection sensors can be avoided by using IR-blocking clothes, hiding behind objects, or simply identifying and disabling them

Disadvantages

- Limited Precision
- Delayed Response
- Dependency on Visual Confirmation
- Complex Installation and Maintenance
- False Alarms
- Intrusion blind spots.

3.2 PROPOSED SYSTEM

The Anti-Theft Floormat using Piezo Sensor project aims to overcome these disadvantages by introducing advanced technology that provides a more accurate, customizable, and user-friendly approach to detecting unauthorized access and enhancing overall security measures. Piezo sensors offer the advantage of detecting subtle pressure changes, allowing for a more accurate and targeted approach to identifying unauthorized access. Additionally, the project aims to enhance user control, integration with smart home systems, and overall security effectiveness, providing a superior alternative to existing systems. It introduces a state-of-the-art solution that leverages advanced technology to enhance security measures.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

Advantages

- High Precision Detection
- Customizable Sensitivity
- Swift Response Time
- Comprehensive Security Measures
- User-friendly Interface
- Energy-efficient Design
- Scalability and Future Enhancements
- Adaptive Security Measures

IV. PROJECT DESCRIPTION

4.1 BLOCK DIAGRAM

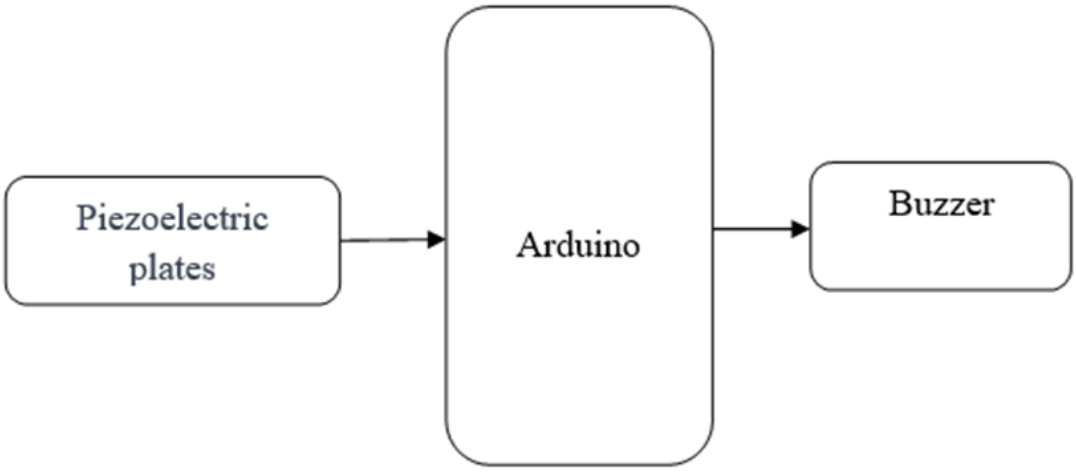

FIG 1. Block Diagram

4.2 PROJECT EXPLANATION

4.2.1. Piezoelectric Plate

Piezoelectric plates, often referred to as piezoelectric wafers or discs, are a type of electronic component that exhibit the piezoelectric effect. The piezoelectric effect is a phenomenon in which certain materials generate an electric charge in response to mechanical stress or pressures applied to them, and conversely, deforms or generate mechanical strain when an electric field is applied to them.

Piezoelectric plates are typically made from materials such as quartz, lead zirconate Titanate (PZT), or other ceramic materials. These plates are designed to be used in various applications where the conversion between electrical and mechanical energy is required.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

FIG 2. Piezoelectric Plate

4.2.2 Arduino UNO

Arduino Uno is a popular open-source microcontroller board, renowned for its versatility and ease of use in electronics projects. Featuring an ATmega328P microcontroller, it offers a range of digital and analog input/output pins, making it ideal for interfacing with sensors, actuators, and other electronic components. With a USB connection for programming and power supply, it simplifies the development process for both beginners and experienced makers. Arduino Uno supports a wide range of programming languages and development environments, enabling users to quickly prototype and deploy projects in various fields such as robotics, home automation, and IoT applications. Its affordability and vast community support make it a staple in the maker community.

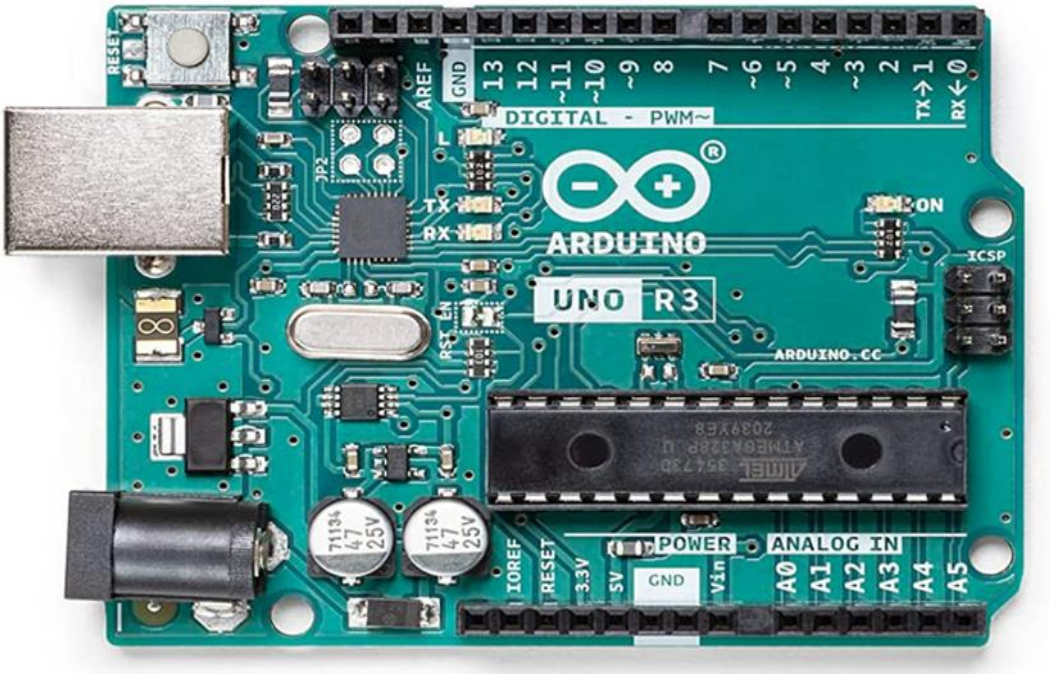

FIG 3. Arduino UNO

Digital Pins (0 - 13):
D0 (RX): Digital pin used for receiving serial data.
D1 (TX): Digital pin used for transmitting serial data.
D2: General-purpose digital input/output pin.
D3: General-purpose digital input/output pin.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

D4: General-purpose digital input/output pin.
D5: General-purpose digital input/output pin.
D6: General-purpose digital input/output pin.
D7: General-purpose digital input/output pin.
D8: General-purpose digital input/output pin.
D9: General-purpose digital input/output pin.
D10: General-purpose digital input/output pin. Also used as SPI SS (Slave Select) pin.
D11: General-purpose digital input/output pin. Also used as SPI MOSI (Master Out Slave In) pin.
D12: General-purpose digital input/output pin. Also used as SPI MISO (Master In Slave Out) pin.
D13: General-purpose digital input/output pin. Also used as SPI SCK (Serial Clock) pin.

Analog Pins (A0 - A5):
A0: Analog input pin for reading analog voltage levels.
A1: Analog input pin for reading analog voltage levels.
A2: Analog input pin for reading analog voltage levels.
A3: Analog input pin for reading analog voltage levels.
A4: Analog input pin. Also used as I2C SDA (Serial Data) pin.
A5: Analog input pin. Also used as I2C SCL (Serial Clock) pin.

Special Function Pins:
RESET: Pin used to reset the microcontroller.
5V: Provides regulated 5V power output.
3.3V: Provides regulated 3.3V power output.
GND: Ground pins for providing reference voltage.
AREF: Analog reference voltage pin. Used to set the reference voltage for analog-to-digital conversion.

Communication Pins:
TX (Transmit) and RX (Receive): Pins 0 and 1 for serial communication (UART) with external devices like computers.
I2C Communication:
SDA: Serial Data Line for I2C communication.
SCL: Serial Clock Line for I2C communication.
SPI Communication:
MISO: Master In Slave Out for SPI communication.
SCK: Serial Clock for SPI communication.

4.2.3. Buzzer

Buzzers are commonly used in various applications such as alarms, timers, electronic devices, and more, to provide auditory feedback or alerts. They are often used as simple sound generators due to their compact size, low power consumption, and ease of use. The working principle of a passive buzzer, such as a piezoelectric buzzer, involves utilizing the piezoelectric effect to produce sound.

FIG 4. Buzzer.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

4.3 CIIRCUIT DIAGRAM

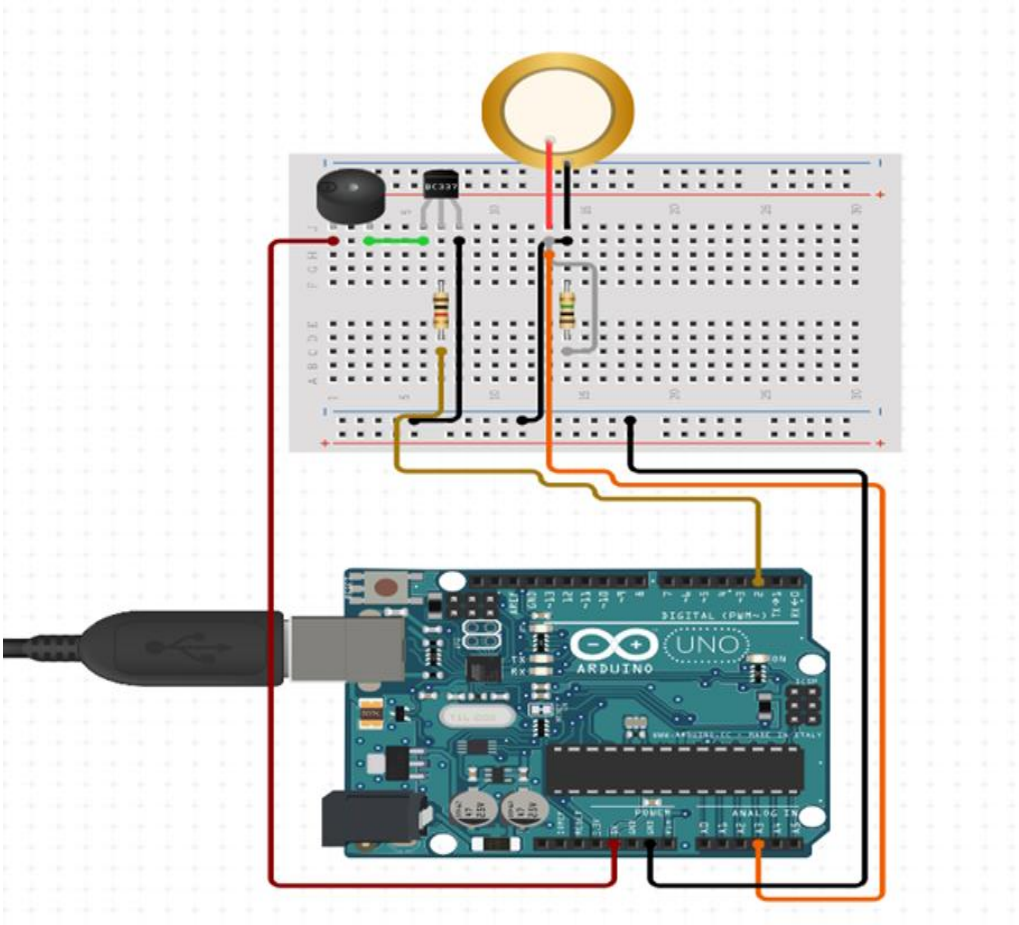

FIG 5. CIRCUIT DIAGRAM

V. IMPLEMENTATION

5.1 STEPS TO CONNECT:

Components Needed:

- Arduino UNO
- Piezoelectric plates
- Jumper wires

Identify Pins:

Identify the pins on your Arduino UNO, which typically include VCC, GND, AO (Analog Output), and D0 (Digital Output).

Connections:

- Connect Piezoelectric plates Sensors between them.
- And then make a connection with the Arduino Board.
- Connect the buzzer with the Arduino Board.

Upload and Run:

- Write a simple program using the Arduino IDE or another preferred development environment.
- Use the appropriate analog or digital pin in your code to read the sensor's output.

5.2 WORKING

The Anti-Theft Floormat project is designed to detect unauthorized access to a secured space using piezoelectric sensors and Arduino technology. The system operates on the principle that when pressure or vibrations are applied to the piezoelectric sensors embedded in a floormat, the resulting signals are processed by an Arduino microcontroller.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

Upon detecting pressure exceeding a predefined threshold, the system triggers an alarm, alerting occupants to potential theft or unauthorized entry.

Piezoelectric Sensor Detection:
The core sensing component of the project is the piezoelectric sensor plate embedded within the floormat. Piezoelectric materials generate a voltage in response to mechanical stress, such as footsteps or movement. As an individual steps on the floormat, the sensor detects and converts this pressure into electrical signals.

Arduino Processing:
The electrical signals from the piezoelectric sensor are directed to an analog input pin on the Arduino board. The Arduino, functioning as the central processing unit, continuously monitors these analog signals. The program running on the Arduino sets a threshold value for the analog input.

Threshold Comparison:
The Arduino compares the measured analog input from the piezoelectric sensor with the predefined threshold. If the measured pressure exceeds the threshold, it indicates a substantial force on the floormat.

Alarm Activation:
Upon exceeding the threshold, the Arduino triggers the activation of a buzzer or alarm. The buzzer is connected to a digital output pin on the Arduino. The activation of the buzzer serves as an audible alert to notify occupants of the security breach.

VI. RESULT ANALYSIS

Result analysis for the Anti-Theft project involves evaluating the performance
e and outcomes of the system. Here's a breakdown of the key aspects to consider in result analysis:

- Response Time
- Energy Efficiency
- Affordability and Accessibility
- Scalability and Future Enhancements

By thoroughly analyzing these aspects, you can gauge the success of the Anti-Theft Floormat using the Piezo Sensor project and identify areas for potential improvements or optimizations. The ultimate goal is to ensure a reliable, user-friendly, and effective security solution that meets the needs of the users.

VII. CONCLUSION

In conclusion, the Anti-Theft Floormat project redefines security by ingeniously integrating piezoelectric sensors with Arduino technology. Transforming a simple floormat into an intelligent security layer, this project offers a cost-effective and unobtrusive solution for detecting unauthorized access. By leveraging the power of real-time signal processing and innovative sensing, it showcases the potential to fortify our living and working spaces with an intelligent, responsive, and energy-efficient security system. The Anti-Theft Floormat not only addresses the shortcomings of traditional security measures but also heralds a new era of proactive and accessible security solutions.

VIII. FUTURE ENHANCEMENT

The Anti-Theft Floormat using project can evolve and stay ahead of the curve by incorporating future enhancements. Here are some ideas to consider for advancing the project:

- Machine Learning Integration
- Multi-sensor Fusion
- Voice Command Integration
- Blockchain Security
- Environmental Adaptability
- Surveillance camera with servo motor.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 5, May 2024

DOI: 10.17148/IARJSET.2024.115105

IX. WORKING IMAGE

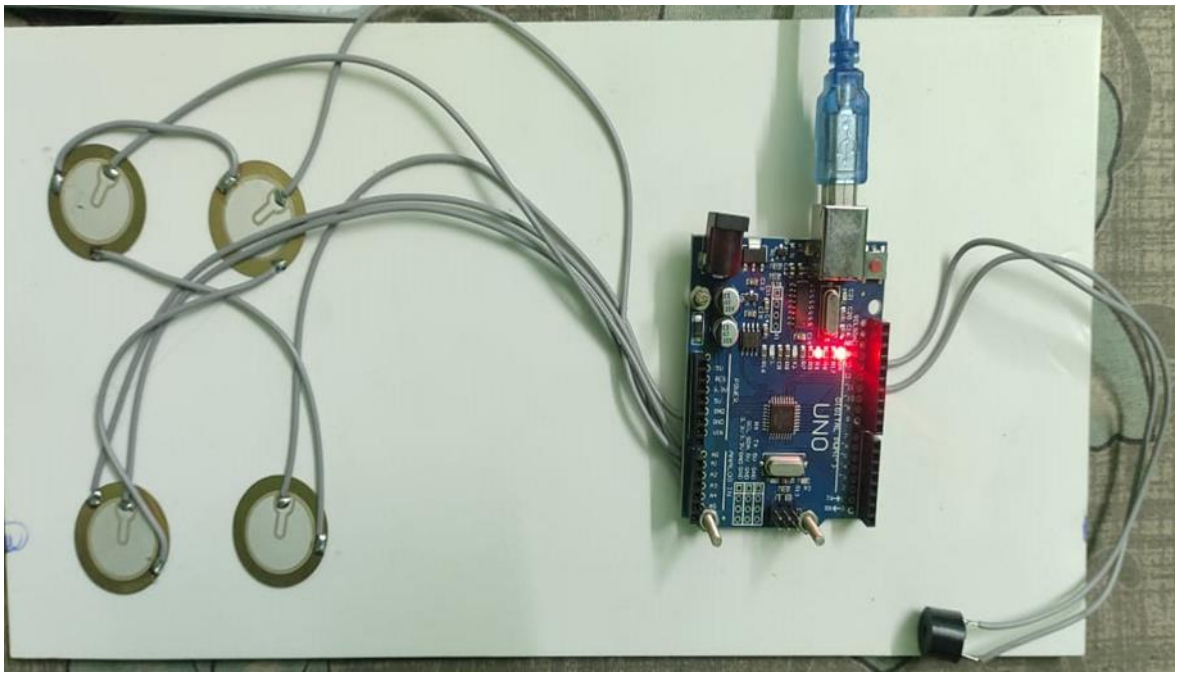

FIG.6 SENSOR CONNECTION

REFERENCES

[1]. "Smart Home Security System with Theft Detection and Notification" - R. Gupta, S. Verma, et al. - International Conference on Computing for Sustainable Global Development, 2018.
[2]. "Wireless Sensor Network-Based Home Security System with Mobile App" - P. Kumar, R. Singh, et al. - 6th International Conference on Computing for Sustainable Global Development, 2019.
[3]. "A Comprehensive Review on Smart Home Security Technologies" - N. Gupta, A. Jain, et al. - International Conference on Inventive Research in Computing Applications, 2018.
[4]. "Design and Implementation of a Low-Cost Smart Home Security System" - S. S. Kumar, A. K. Goyal, et al. - International Conference on Advances in Computing, Communications and Informatics, 2017.
[5]. "Smart Home Security System using IoT and Image Processing" - P. R. Kumar, S. K. Das, et al. - 4th International Conference on Inventive Systems and Control, 2020.
[6]. "A Review on IoT-Based Home Security Systems" - A. Sharma, R. Chauhan, et al. - 2nd International Conference on Innovations in Electronics, Signal Processing and Communication, 2019.
[7]. "Implementation of Smart Home Security System using IoT" - M. A. Ansari, M. R. Siddiqui, et al. - International Conference on Power, Instrumentation, Control and Computing, 2018.
[8]. "Intelligent Home Security System Using IoT and Machine Learning" - S. Meena, S. Singh, et al. - 3rd International Conference on Advanced Technologies in Electrical, Electronics, Instrumentation and Control, 2019.
[9]. "Development of a Smart Home Security System using IoT" - R. S. Tomar, S. S. Kumar, et al. - International Conference on Electrical, Electronics, Communication, Computer Technologies and Optimization Techniques, 2018.
[10]. "IoT-Based Home Security System with Face Recognition" - S. Patel, A. Jain, et al. - International Conference on Electrical, Computer and Communication Technologies, 2020.
[11]. "Smart Home Security System with IoT and Cloud Computing" - A. Mishra, S. Agarwal, et al. - 2nd International Conference on Advances in Electronics, Computers and Communications, 2019.
[12]. "A Survey on Smart Home Security Systems" - R. S. Kushwaha, S. S. Sharma, et al. - 3rd International Conference on Computer and Communication Systems, 2018.