# RFID-Based Smart Access Control System with Intruder Detection and Automated Door Mechanism

A project proposal submitted to the

Department of Electrical and Information Engineering

Faculty of Engineering

University of Ruhuna

Sri Lanka

On 07th November 2024

Of the module

EE5305 Sensors and Transducers

By

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# PROJECT OVERVIEW

The objective of this project is to design and develop an RFID-based smart access control system that provides secure entry for authorized users via RFID tags. Using a PIR motion sensor, the system will activate only when motion is detected, conserving power. An LCD display will show the access outcome, while a buzzer provides audio feedback for authorized and unauthorized access attempts. For enhanced security, a vibration sensor will detect forced entry attempts, and a servo motor will control the door movement. This system is ideal for monitoring access to restricted areas, storage units, or equipment in homes, offices, and secure environments.

## OBJECTIVES

- To build an energy-efficient access monitoring system using RFID, activated by motion detection.
- To design a microcontroller-based system that processes RFID data, manages access decisions, and provides feedback via display and audio alerts.
- To implement user-friendly feedback with a motion sensor, LCD display, and buzzer for clear access indication.
- To integrate a vibration sensor for intruder detection, allowing immediate alerts for unauthorized forced entry.
- To implement a servo motor to enable controlled door movement upon successful access.

## PROJECT SCOPE

The project will focus on:

- Configuring an RFID scanner with an Arduino Uno to read tags and verify authorized users.
- Programming the Arduino Uno to manage access control logic, with motion detection activating the RFID system only when needed.
- Integrating a vibration sensor to detect forced entry and sound an alert if tampering occurs.
- Using servo motor to control door movement, opening only for authorized users.
- Integrating an LCD display and buzzer to provide real-time feedback on access status.

# REQUIRED RESOURCES

Hardware :

- Microcontroller - Arduino uno

- RFID sensor - Reads RFID tags to identify users.

- PIR motion sensor - Detects motion and activates the system, enabling the RFID scanner only when someone approaches.

- Vibration sensor - Detects forced entry or tampering with the door.

- Servo Motor - Control the door's movement upon authorization

- LCD Display - Shows real-time information on the scan outcome.

- LED Indicators - Provides quick visual status (green for authorized, red for unauthorized).

- Buzzer - Sounds to indicate whether a tag is accepted (short beep) or declined (longer beep).

Software : Arduino IDE for coding and uploading to the microcontroller.

Testing Equipment : RFID tags for simulating authorized and unauthorized access attempts.

# TECHNICAL APPROACH

## 1. System Design:

The Arduino Uno will act as the central processor, handling data from the RFID scanner and PIR sensor. The system will remain idle until the PIR motion sensor detects motion, activating the RFID reader to scan for tags. Authorized RFID tags will be stored in Arduino's memory for verification.

## 2. Motion-Activated RFID and Access Control:

Upon motion detection by the PIR sensor, the RFID scanner will activate to read any nearby tags. Arduino will check if the scanned tag is authorized or unauthorized. Authorized access will be indicated through the LCD display, LED, and buzzer feedback.

## 3. Intruder Detection:

The vibration sensor will monitor the door for any forced entry attempts. If a strong vibration is detected, the Arduino will trigger an immediate alarm through the buzzer, alerting to a potential intrusion.

## 4. Feedback Mechanisms:

- LCD Display: Shows the result of the scan, displaying messages like "Access Granted" or "Access Denied."

- LEDs: A green LED lights up for authorized access, while a red LED lights up for unauthorized attempts.

- Buzzer: Provides a short beep if the tag is accepted and a longer beep if access is denied.

### 5. Software Development:

Code will handle RFID scanning, access logic, and feedback. The PIR motion sensor will trigger the RFID scanner, and the servo motor will control door movement based on access status. The vibration sensor will be programmed to alert the system of forced entry.

### 6. Testing and Calibration:

Testing will involve both authorized and unauthorized access scenarios, ensuring the system's accuracy. The PIR motion sensor will be calibrated to reliably trigger the RFID system, while the vibration sensor sensitivity will be fine-tuned to minimize false alarms. The servo motor's movement will be adjusted to operate smoothly.

## EXPECTED OUTCOMES

- An energy-efficient RFID access monitoring system that activates only when needed, thanks to motion detection.
- Clear visual and audio feedback to indicate access status using an LCD, LEDs, and a buzzer.
- Enhanced security with forced entry detection through a vibration sensor and controlled door movement via a servo motor.
- A user-friendly system that is easy to set up and suitable for various access monitoring applications.

## TIMELINE

| Task | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 |
|---|---|---|---|---|---|---|---|---|
| Research and Design | ■ | | | | | | | |
| RFID, PIR, Vibration Sensor and LCD Setup | | ■ | | | | | | |
| Circuit Assembly | | | ■ | | | | | |
| Arduino Programming | | | | ■ | ■ | | | |
| Testing and Calibration | | | | | | ■ | ■ | |
| Documentation | | | | | | | | ■ |