

Embedded Systems

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Secure Door Lock System

- This presentation details the development of a secure, low-cost, password-protected smart door lock system utilizing Arduino.
- We will explore the system's design, components, working principles, and potential enhancements, highlighting its practical applications in various settings.
- With intuitive design and reliable components, it blends affordability, efficiency, and enhanced security in one solution.





Problem Statement: Enhancing Security

Vulnerability of Traditional Locks

Conventional mechanical locks are susceptible to picking, bumping, and forced entry, posing significant security risks.

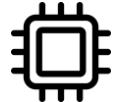
Loss or Theft of Keys

Physical keys can be easily lost, stolen, or duplicated, compromising access control and requiring costly lock replacements.

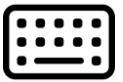
Lack of Access Control

Traditional locks offer limited control over who enters and when, making it difficult to manage access for multiple users or temporary visitors.

Requirements



Arduino Uno
Microcontroller
board for
processing logic.



4x4 Keypad
For entering the
password.



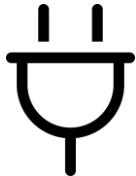
16x2 LCD
For displaying
user prompts and
status.



Servo Motor
Actuator for
locking/unlockin
g the door.



Buzzer
For audible alerts
and feedback



Wires
For electrical
connections.



Tinker CAD
For simulating
and testing the
circuit without
physical
hardware.



Resistor
to limit current
and protect
components.

Hardware Components Explanation



➤ Arduino Uno:

A microcontroller board that acts as the brain of the system. It reads keypad inputs, processes logic, and controls output devices. All decision-making and timing are handled by the Arduino.

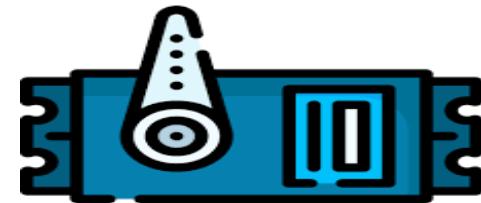
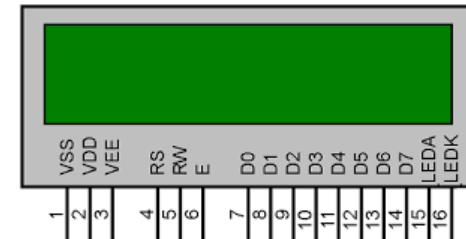


➤ 4x4 Keypad:

A matrix-style input device used to enter a numeric password. Each keypress is detected and sent to Arduino for verification. Ensures secure and user-controlled access.

➤ LCD (16x2):

A two-line display used for showing system messages. Displays prompts like “Enter Password” and results like “Access Granted”. Provides real-time feedback to the user.



➤ Servo Motor (SG90):

A small motor that rotates to lock or unlock the door. Controlled by Arduino when the correct password is entered. Moves precisely between 0° and 90° positions.

➤ Buzzer:

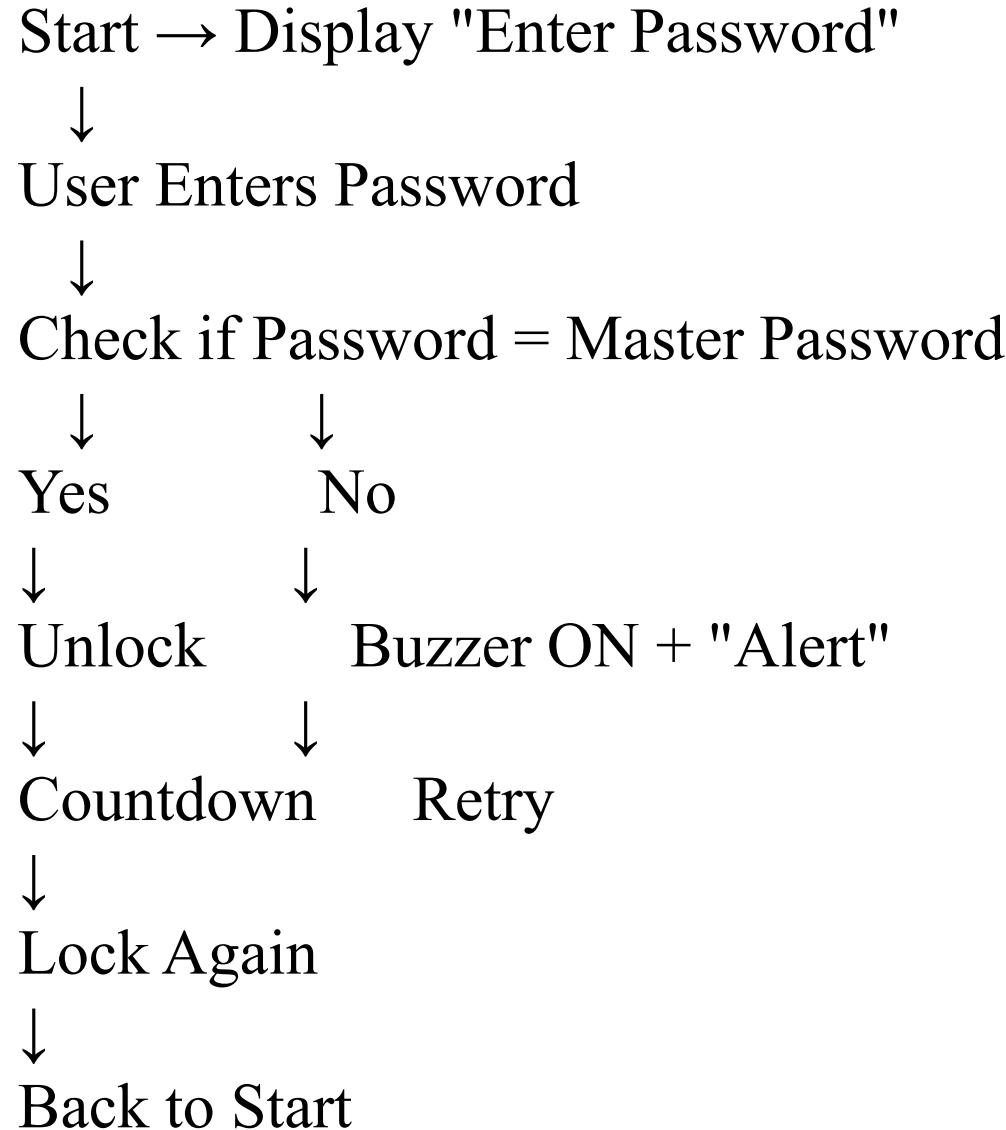
Produces audio feedback during system events. Alerts user when a password is wrong or access is granted. Enhances system interaction and security awareness.



➤ Wires:

Used to connect all components in the circuit. Enable communication and power flow between modules and Arduino. Essential for completing electrical paths.

Flow Chart





Working Principle



Keypad Input

User enters a password via the 4x4 keypad.



Password Verification

Arduino compares the entered password with the stored password.



Door Control

If correct, the servo motor unlocks the door; otherwise, it remains locked.



Audio Feedback

Buzzer provides distinct tones for successful access or incorrect password.

Software Flowchart



Start

Initialize system components.



Input Password

Read characters from keypad.



Verify Password

Compare input with stored password.



Correct?

Decision point: Yes/No.



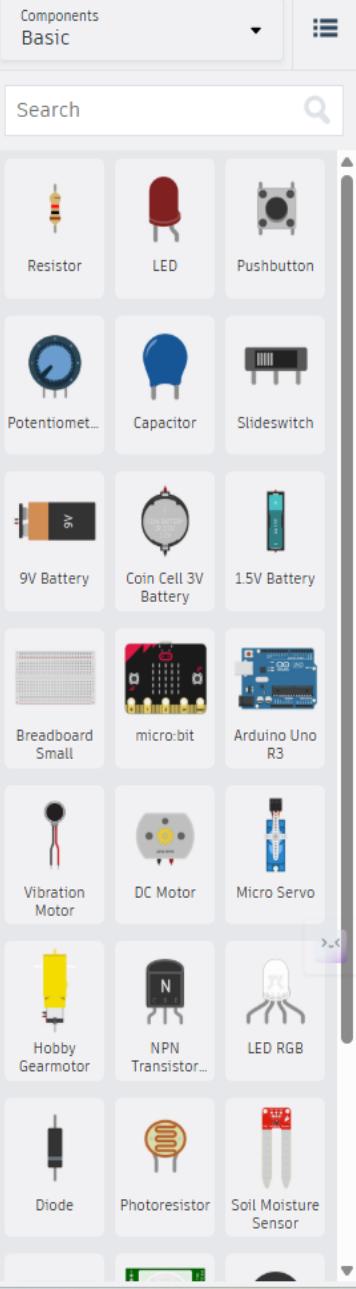
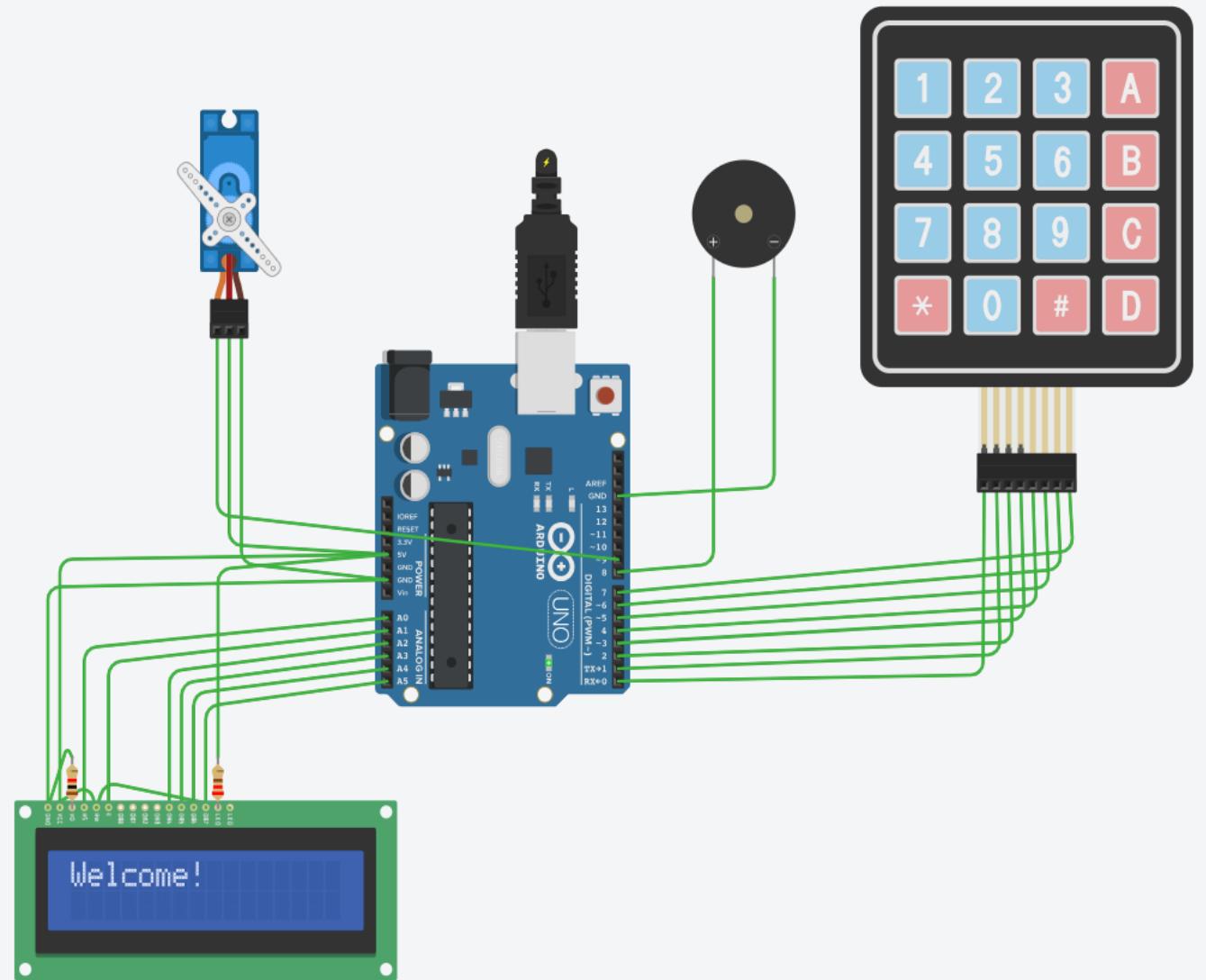
Open Door / Error

Activate servo or display error and sound buzzer.

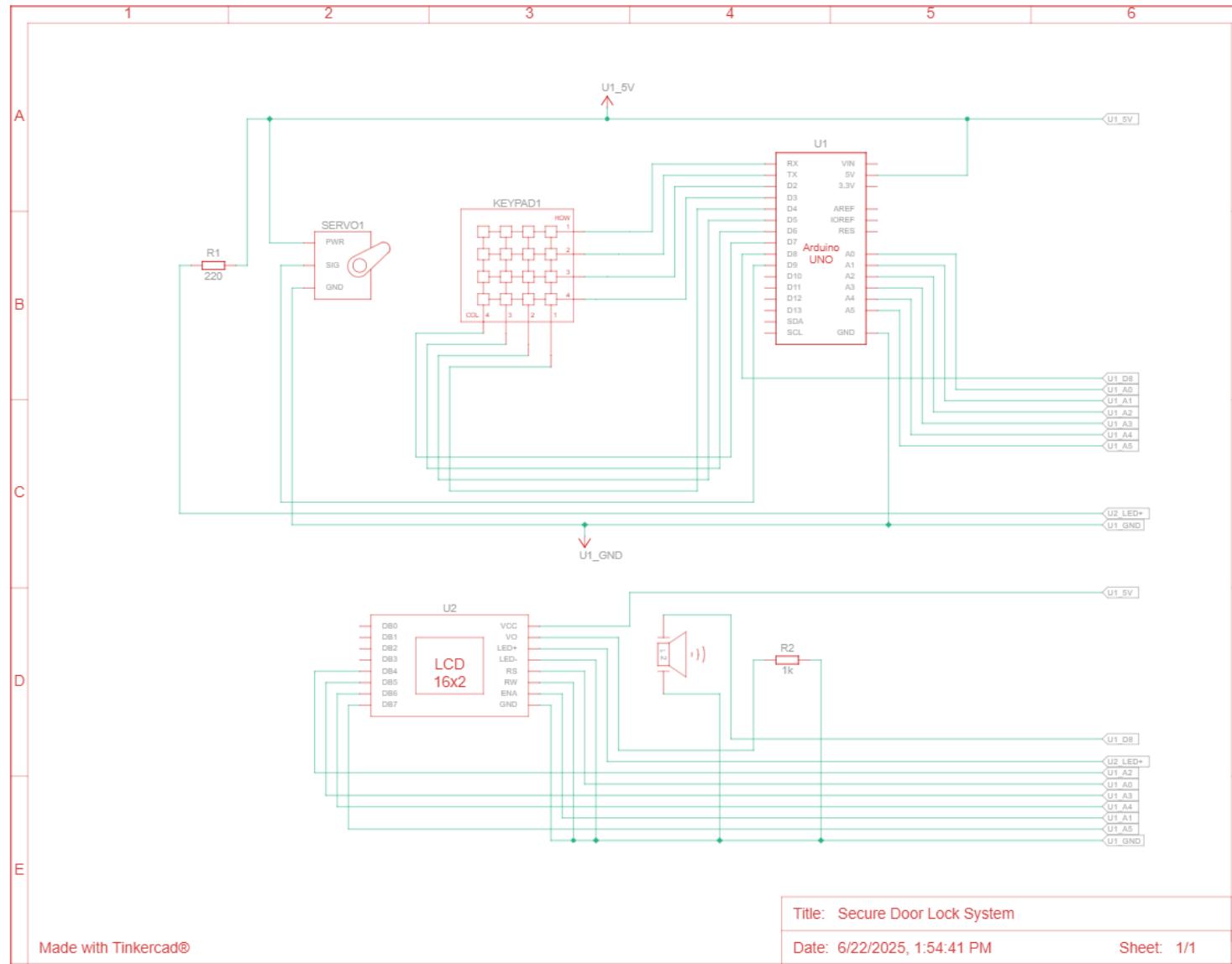




Simulator time: 00:00:00

Code Stop Simulation Send To

Schematic Diagram



Code Highlights

➤ Password Check Logic

```
if(password== correctPassword)
{ //GrantAccess
} else {
// Deny access
}
```

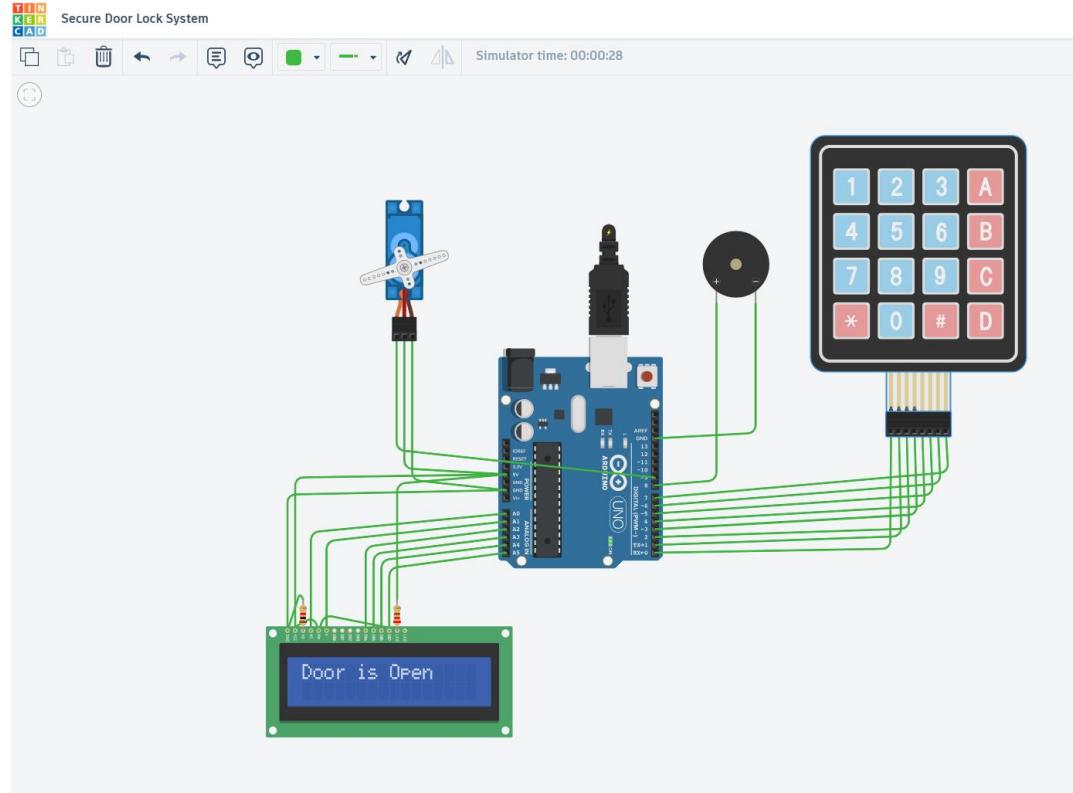
➤ Servo Motor

```
void ServoOpen() {
myservo.write(90);
// Open
}
void ServoClose() {
myservo.write(0); //
Close }
```

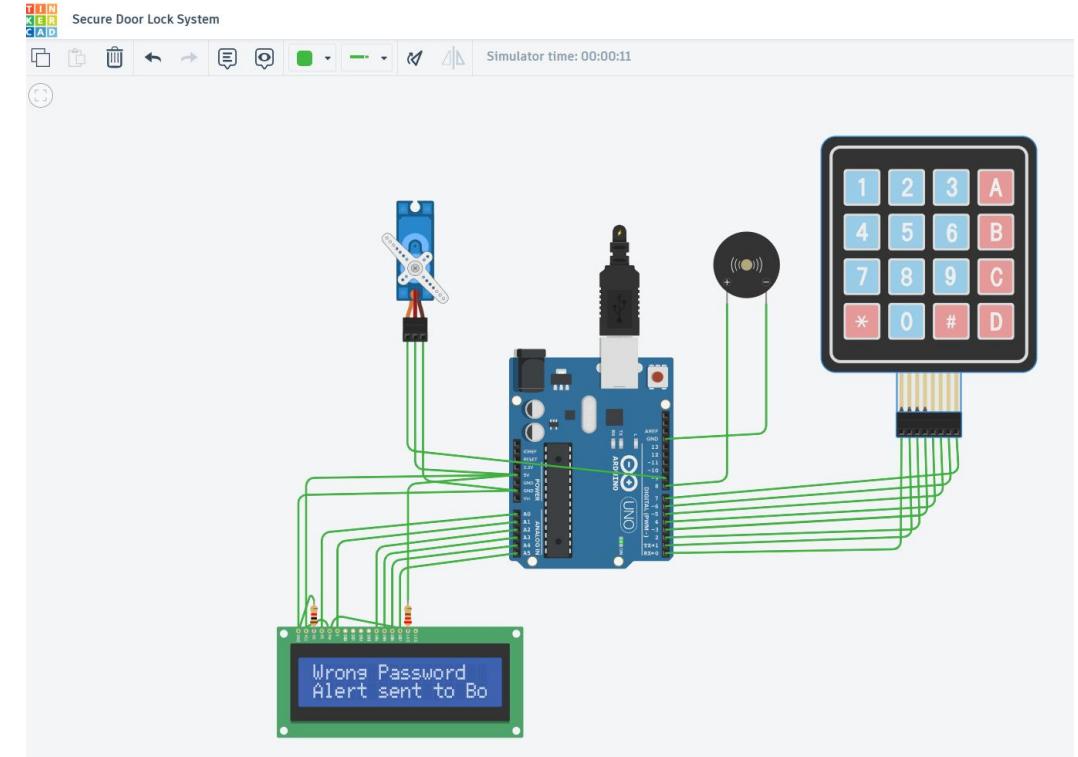
➤ Buzzer

```
tone(buzzerPin, 1000);
// Success
delay(200);
noTone(buzzerPin);
tone(buzzerPin, 500);
//Fail
delay(500);
noTone(buzzerPin);
```

Outputs



Correct Password - Door is Opened



Incorrect Password - Alert Sent & Stay Closed

Advantages

- Enhanced Security
- User-Friendly Interface
- Low-Cost Implementation
- Scalable Design
- Low-Power Consumption
- Customizable Logic

Applications

- Smart Homes
- Educational Institutions
- Server Rooms/Data Centres
- Warehouses and Stores

Conclusion

- The Secure Door Lock System was successfully developed using Arduino and basic electronic components.
- It provides reliable, low-cost access control with password-based authentication.
- The system is easy to use, energy-efficient, and scalable for future upgrades.
- Both simulation and hardware testing confirmed its effectiveness.
Overall, it serves as a practical and educational solution for smart security.

Thank you!

