ISSN 2277-2685
IJESR/April. 2026/ Vol-16/Issue-2/893-896
Mohammad Junaid *et. al.*, / International Journal of Engineering & Science Research
Full Length Article

Security System With User Changeable Password

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Accepted 20-05-2026

Abstract
This project presents a smart security system using Arduino UNO with a user-changeable password feature for enhanced access control and security. The system utilizes a keypad for password entry, an OLED display for showing status messages and user instructions, and a solenoid lock for automatic door control. When the correct password is entered, the system unlocks the door automatically, providing secure and convenient access. If an incorrect password is entered, a buzzer and red LED are activated to alert the user and indicate unauthorized access attempts.
A key feature of this system is the ability to change the password at any time using the keypad, allowing greater flexibility and personalized security. The updated password is securely stored in EEPROM memory, ensuring data retention even after power loss. The system is designed to be low cost, reliable, user friendly, and easy to implement. Due to its compact design and efficient operation, it is suitable for applications in homes, offices, laboratories, and small organizations where secure access management is required.

Keywords
Arduino UNO, Security System, OLED Display, Keypad, EEPROM, Solenoid Lock, Password Protection.

Introduction

Security plays an important role in homes, offices, banks, industries, and other restricted areas where protection of people, data, and valuable assets is essential. Traditional lock systems mainly depend on physical keys, which can be lost, stolen, or duplicated, reducing the overall level of safety and reliability. To overcome these limitations, electronic password-based security systems have become a modern and effective solution for access control.

This project develops a smart door locking system using Arduino UNO with a user-changeable password feature. The system enables users to enter passwords through a keypad and provides the flexibility to change the password whenever required. An OLED display is used to show system messages such as password prompts, access granted, access denied, and password update notifications, making the system easy to operate and user friendly. A solenoid lock mechanism controls door access based on password authentication. In case of incorrect password entry, security alerts such as a buzzer and LED indication are activated. The system improves security, enhances convenience, and offers a low-cost solution suitable for homes, offices, and small organizations.

Existing System

Traditional security systems use fixed passwords or mechanical locks. Passwords can only be changed by reprogramming the system, which is difficult for normal users. Mechanical locks may be duplicated or damaged easily. Most existing systems do not provide alarms or user-friendly password changing options.

Proposed System

The proposed system uses Arduino UNO to create a smart password-based security system. Users can enter passwords using a keypad and change passwords whenever required. OLED display shows system status, and EEPROM memory stores passwords permanently. If the correct password is entered, the relay activates the solenoid lock and opens the door. If a wrong password is entered, the buzzer and red LED give alerts

Working Principle

The system starts by displaying “Enter Password” on the OLED display. The user enters a password through the keypad. Arduino checks the entered password with the stored password in EEPROM memory. If the password is correct, the relay activates the solenoid lock and opens the door for a few seconds. Green LED indicates successful access. If the password is

incorrect, the buzzer turns ON and red LED glows to indicate access denied. The user can press '*' to enter password change mode and set a new password.

The EEPROM memory helps retain the updated password even after power is turned OFF, ensuring reliable operation. The OLED display continuously guides the user by showing system messages such as password status and password update confirmation. This smart security system provides enhanced safety, simple operation, and low power consumption, making it suitable for modern security applications.

Block diagram

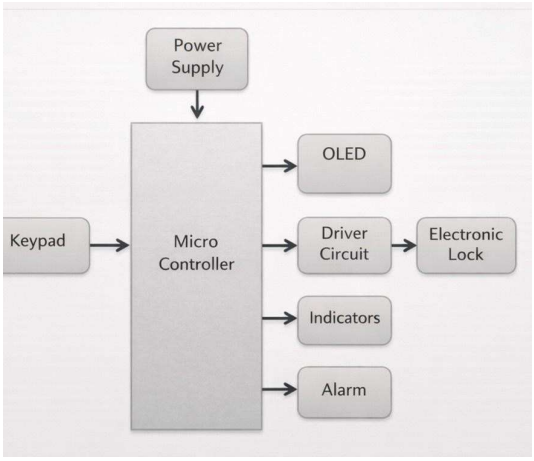

Fig 1: block diagram

Arduino UNO:

Arduino UNO is the main controller used in the project. It controls keypad input, OLED display, relay, buzzer, LEDs, and password checking operations. It is based on the ATmega328P microcontroller and operates at 5V with a 16 MHz clock frequency.

Fig 2: Arduino UNO

OLED Display:

OLED display is used to show messages such as Enter Password, Access Granted, Access Denied, and Password Changed. The display used is SSD1306 with 128x64 resolution and I2C communication.

Keypad(hex keypad):

The keypad is used for entering passwords and changing passwords. A 4x3 matrix keypad is used where numbers are entered through rows and columns.

EEPROM Memory:

EEPROM memory stores the password permanently. Even after power OFF, the password remains saved in memory.

Relay Module:

The relay works like an automatic switch. It is used to control the solenoid lock safely because Arduino cannot directly operate high-current devices.

Solenoid Lock:

The solenoid lock is an electromagnetic lock used for automatic door locking and unlocking. When power is applied, the lock opens.

Buzzer:

The buzzer is used as an alarm indication device. It produces sound when the wrong password is entered.

LED Indicators:

Green LED indicates access granted, while red LED indicates access denied or wrong password

Step-Down Transformer:

The transformer converts 230V AC supply into low voltage AC such as 12V AC for the circuit.

Rectifier:

The rectifier converts AC voltage into DC voltage required for electronic components.

Hardware Components

Voltage Regulator:

The voltage regulator provides stable 5V DC supply to Arduino and other components.

ULN2003 / Motor Driver:

ULN2003 motor driver is used to drive high-current devices like relay and solenoid lock safely.

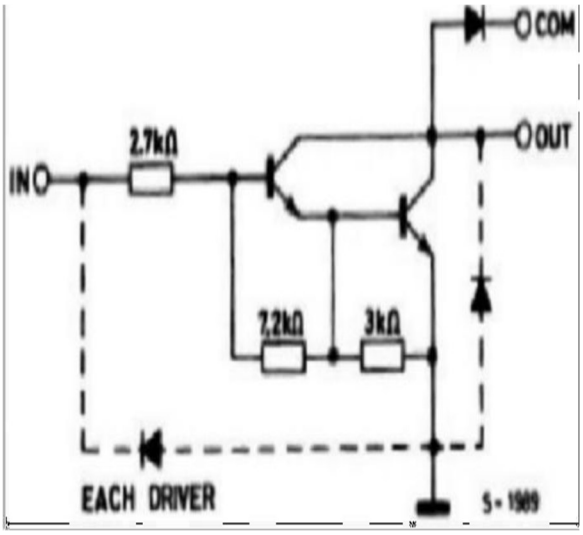

Fig 3: ULN2003 / Motor Driver

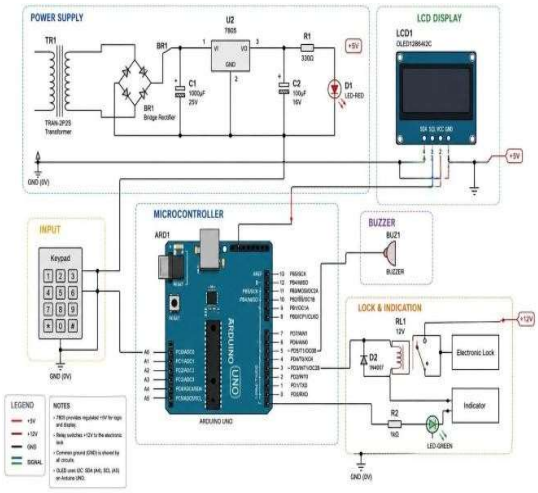

Fig 4: Schematic Diagram

Results:

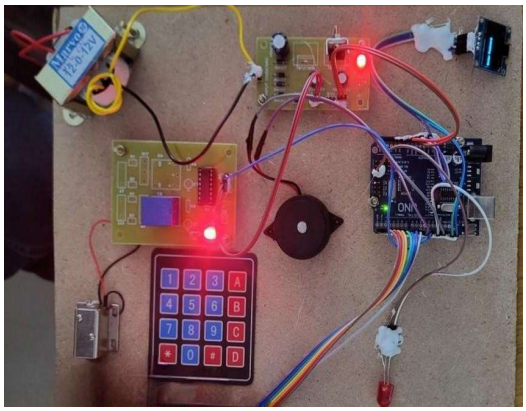

Fig: 5 Access Granted

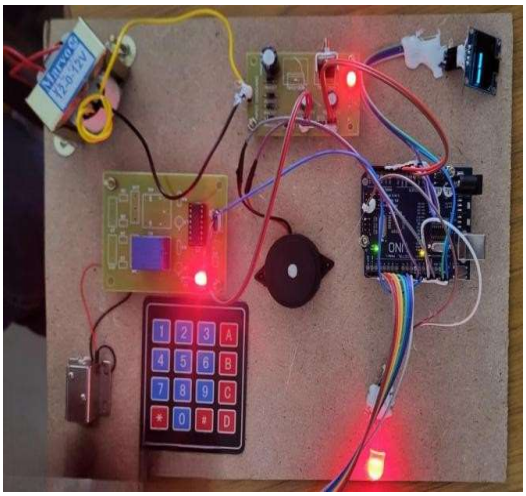

Fig: 6 Access Denied

Fig : 7 Access Granted

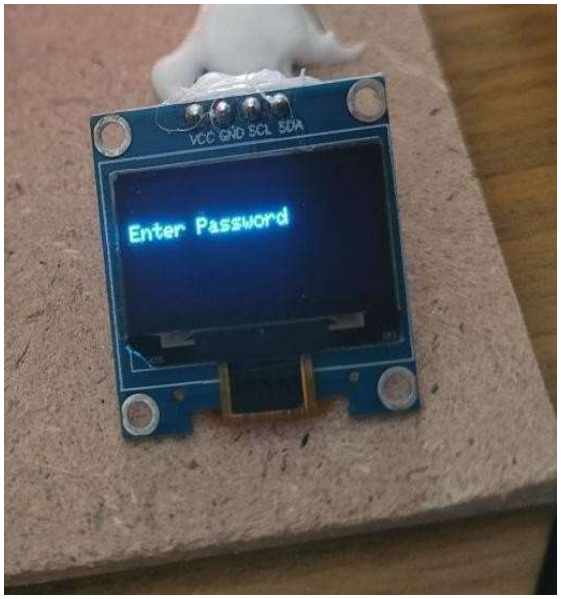

Fig: 8 Enter Password

Fig: 9 Access Denied

The developed smart security system using Arduino UNO successfully performed password-based door access control with reliable operation. The keypad enabled accurate password entry, while the OLED display clearly showed user instructions and system status messages. The solenoid lock opened automatically when the correct password was entered, and the green LED confirmed successful authentication. When an incorrect password was entered, the buzzer and red LED provided immediate security alerts, improving unauthorized access detection. The password change feature worked effectively, and the updated password was successfully stored in EEPROM memory even after power interruption. The system demonstrated low-cost implementation, user-friendly operation, fast response, and efficient security performance suitable for homes, offices, and small organizations.

Conclusion

The Security System with User Changeable Password provides a simple and effective security solution using Arduino UNO. It allows users to enter and change passwords easily for better safety. The system controls the door lock automatically and gives alerts for wrong passwords. This project is low cost, user friendly, and useful for homes, offices, and small security applications.

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