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Double Security Door Lock System

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ABSTRACT:

This project is about modern security systems, The project is called "Double Security Door Lock System, which uses ESP 32 CAM for better user authorization. This project provides a two-layer security system that enhances security by using two layers of protection: face detection using an ESP 32 camera, and a keypad lock. If the face doesn't match with the enrolled data, it gives an alert as unauthorized. If the face matches with the enrolled data, it permits the opening of the keypad lock slide. the integration of digital technologies with traditional locking mechanisms has become increasingly prevalent. This abstract presents the conceptual framework and implementation outline of a Double Security Lock System that uses the ESP32-CAM microcontroller module and password authentication in conjunction with physical keys.

Key Components: ESP32-CAM Module, Electronic lock Mechanism, **Password Authentication.**

I. INTRODUCTION

In the era of smart technology, security systems have evolved beyond traditional locks and keys. One innovative solution is the implementation of a Double Security Lock System, combining electronic components with advanced authentication methods. In this project, we utilize the ESP32-CAM module, a powerful microcontroller with a built-in camera, to create a strong security system that not only requires a password but also incorporates visual verification.

II. EXISTING HARDWARE

In a double security lock system using an ESP32-CAM and password authentication, several hardware components work together to provide robust security features. Here are the existing hardware components commonly found in such a system:

1. **ESP32-CAM Module:**
    - The core component of the system combines an ESP32 microcontroller with a camera module.
    - Capable of capturing images, processing data, and communicating over Wi-Fi.
2. **Physical Lock Mechanism:**
    - A mechanical lock or actuator that physically secures the access point, such as a door lock or latch.
    - Controlled electronically by the ESP32-CAM to lock or unlock based on authentication.
3. **Input Device for Password Entry:**
    - A keypad, touchscreen, or similar interface for users to input passwords.
    - Allows users to authenticate themselves digitally through password entry.
4. **Power Supply:**
    - Provides electrical power to the ESP32-CAM module and other components.
    - Can be a battery, power adapter, or another power source depending on the system's requirements.
5. **LEDs or Display:**

- Provides visual feedback to users regarding system status, authentication success, or errors.
- LEDs can indicate whether the system is ready for input, locked, or unlocked.

6. **Sensors (Optional):**
    - Additional sensors such as motion sensors, proximity sensors, or biometric sensors can enhance security.
    - Used for detecting unauthorized access attempts or providing additional layers of authentication.
7. **Microcontroller Interfaces:**
    - GPIO pins, SPI, I2C, UART, etc., for interfacing with peripherals such as the keypad, sensors, and electronic lock mechanism.
8. **Enclosure:**
    - A housing or enclosure to protect the hardware components from environmental factors and tampering.
    - Ensures the system's integrity and longevity in various operating conditions.
9. **Connectivity Module (Optional):**
    - Additional hardware for enabling remote monitoring and control, such as a Wi-Fi module or Ethernet shield.
    - Allows the system to communicate with external devices or servers for logging access attempts or receiving remote commands.
10. **Power Management System:**
    - Circuitry or components for managing power consumption and ensuring reliable operation.
    - May include voltage regulators, power switches, or battery charging circuits depending on the power source used.

These hardware components work together to create a double security lock system that combines physical and digital authentication methods to secure access points effectively. Depending on the specific requirements and design choices, additional components or features may be incorporated to enhance the system's functionality and security.

III. WORKING METHODOLOGY

To implement a two-layer door security system with face identification using an ESP32 camera and password authentication, you'll need to combine facial recognition technology with traditional password-based authentication. Here's a step-by-step working methodology for such a system:

1. Initialization:

- The system initializes upon power-up, with the ESP32-CAM module booting up and initializing its peripherals.

2. Face Identification:

- The ESP32-CAM captures an image of the person standing in front of the door.
- Facial recognition algorithms analyze the captured image to detect and recognize faces.
- If a face is recognized and matches one of the authorized users' faces stored in the system, proceed to the next step. Otherwise, deny access.

3. Password Authentication:

- If facial recognition succeeds, or if it's not enabled or unsuccessful, the system prompts the user to input their password via a keypad or similar interface.

4. Password Verification:

- The entered password is compared against stored credentials by the ESP32, verifying the user's identity digitally.
- If the entered password matches the stored password, proceed to the next step. Otherwise, deny access.

5. Access Granting:

- If both face identification and password authentication are successful, the door security system grants entry to the user.
- The electronic lock mechanism is activated, releasing the door latch temporarily to allow access.

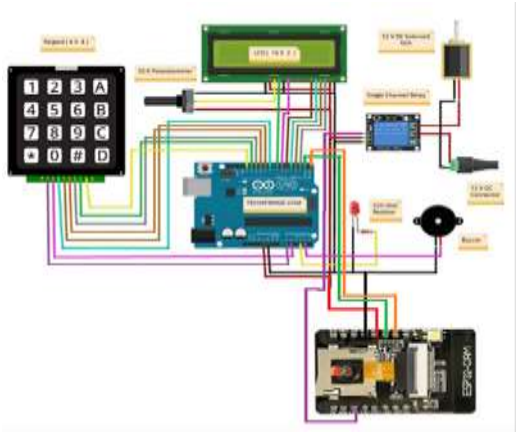

Figure 1. Block Diagram

IV. HARDWARE COMPONENT

1. **ESP32-CAM Module**

Using an ESP32-CAM module with a PIC microcontroller can provide a versatile platform for various applications, including IoT devices and surveillance system:

- The ESP32-CAM module integrates an ESP32-S chip and a camera module, making it capable of both WiFi communication and image capture.
- It can capture images, stream video, and communicate over WiFi, making it suitable for applications requiring remote monitoring or control.
- The ESP32-CAM module typically interfaces with other microcontrollers or systems through serial communication, such as UART or SPI.
- Overall, using an ESP32-CAM module with a PIC microcontroller provides a flexible and powerful platform for building custom IoT and embedded systems with image capture, processing, and wireless communication capabilities.

Figure 2.ESP32CAM Diagram

V. Aurdino Uuo R3

The Arduino Uno is a popular microcontroller board that is widely used for various electronic projects, prototyping, and DIY applications. It's part of the Arduino ecosystem, which includes a range of development boards, software IDE, and a supportive community. Here are some key features and aspects of the Arduino Uno:

- The Arduino Uno is based on the Atmega328P microcontroller, which is an 8-bit AVR microcontroller. This microcontroller provides a good balance of performance and features for many projects.
- The Uno has a total of 14 digital input/output pins, of which 6 can be used as PWM (Pulse Width Modulation) outputs. It also has 6 analog input pins, which can be used to read analog sensors or signals.
- The Arduino Uno can be powered via a USB connection or an external power supply. It has a built-in voltage regulator that allows it to be powered from a wide range of sources (typically 7-12V DC).
- Arduino Uno can be programmed using the Arduino Integrated Development Environment (IDE), which is based on the C and C++ programming languages. It's relatively easy to get started with Arduino programming.

Figure 2.Aurdino Uno R3 Diagram

VI. Keypad Password

Using a keypad for password entry is a common method of user authentication in various electronic systems, including security locks, access control systems, and digital safes.

- Connect the keypad to the Arduino Uno. Keypads typically have 12 buttons arranged in a 3x4 matrix. Connect the rows and columns of the keypad to digital pins on the Arduino.
- You may also need to connect a pull-up or pull-down resistor to the columns of the keypad to ensure proper operation.
- Optionally, you can connect an output device such as an LED or a buzzer to indicate successful or unsuccessful password entry.

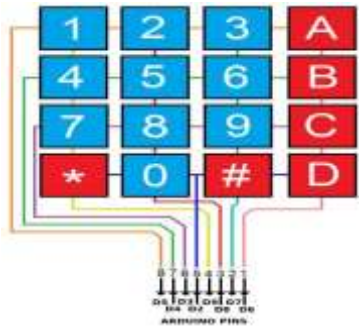

Figure 3.Keypad Password Diagram

VII. LCD (Liquid Crystal Display)

LCD stands for Liquid Crystal Display. It is a flat panel display technology commonly used in electronic devices such as televisions, computer monitors, smartphones, and various other gadgets. LCDs are popular due to their low power consumption, thin profile, and ability to display crisp images and text.

- The LCD can show the current status of the system, such as whether it's ready for authentication, waiting for input, or processing an authentication request.
- For example, it can display messages like "System Ready" or "Enter Password" to prompt the user for input.
- When the system requires a password for authentication, the LCD can provide a user-friendly interface for entering the password.
- It can display an on-screen keypad or prompt the user to enter the password using physical buttons or a touchscreen, depending on the system's configuration.
- During the authentication process, the LCD can provide feedback to the user, indicating whether the authentication was successful or unsuccessful.
- For example, it can display messages like "Access Granted" or "Access Denied" based on the outcome of the authentication.
- If an error occurs during the authentication process, such as an invalid password or communication failure, the LCD can display relevant error messages to inform the user.
- Additionally, the LCD can be used to display alerts or warnings, such as low battery warnings or system malfunctions, to ensure the user is aware of any issues.

Figure 4.LCD Display Diagram

VIII. Solenoid Lock

In a double security lock system, a solenoid lock can be used as a mechanism to physically secure access to a door or enclosure. Solenoid locks are electromechanical devices that operate by applying an electric current to a coil (solenoid), which generates a magnetic field to move a locking mechanism.

- A solenoid lock typically consists of a coil of wire wrapped around a core, a plunger or armature connected to the core, and a locking mechanism (such as a latch or bolt).
- When an electric current is applied to the coil, it creates a magnetic field that pulls the plunger or armature, thereby releasing the locking mechanism and allowing the door or enclosure to be opened.
- The solenoid lock is controlled by an electronic circuit, which includes components such as a microcontroller (e.g., Arduino Uno), a power supply, and transistors or relays to switch the current to the solenoid coil.
- The microcontroller controls the operation of the solenoid lock based on user input (e.g., password entry) or other authentication mechanisms (e.g., facial recognition).
- The solenoid lock is integrated with the authentication system of the double security lock system.
- After successful authentication (e.g., entering the correct password), the microcontroller sends a signal to activate the solenoid lock, releasing the locking mechanism and granting access.
- If authentication fails or an unauthorized access attempt is detected, the microcontroller prevents the solenoid lock from being activated, thereby maintaining the security of the system.
- The solenoid lock requires a sufficient power supply to operate effectively. The power supply must be capable of delivering the required current to the solenoid coil without causing voltage drops or fluctuations.
- Power-saving features may be implemented to minimize power consumption when the solenoid lock is not in use, helping to prolong the battery life or reduce energy costs.

Figure 5.Solenoid lock Diagram

IX. FINAL HARDWARE RESULT

X. CONCLUSION

In conclusion, the implementation of a double security lock system combining an ESP32 camera and password authentication provides a comprehensive and robust solution for securing access to various environments. By leveraging both facial recognition technology and traditional password-based authentication, this system offers enhanced security measures and flexibility. The ESP32 camera module captures images for facial recognition, allowing for advanced biometric authentication. Meanwhile, the password authentication mechanism offers an additional layer of security and convenience for users. The system's architecture integrates various hardware components, including the ESP32 development board, camera module, keypad or touchscreen display, and electronic lock mechanism. Through intelligent firmware programming, the system orchestrates the authentication process, image processing, and lock control. It ensures seamless integration between the different components while maintaining security standards. Encryption techniques may be employed to safeguard sensitive data and communication channels, enhancing the system's resilience against potential threats. the double security lock system utilizing an ESP32 camera and password authentication offers a comprehensive and effective approach to access control, suitable for various applications ranging from home security to commercial environments. Its integration of advanced biometric technology with traditional authentication methods ensures both security and user convenience, making it a valuable solution for modern security challenges.

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