# AI INTEGRATED INTELLIGENT DOOR LOCKING SYSTEM

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**Abstract**

The AI-Integrated Door Locking System leverages AI algorithms to revolutionize the way we secure our physical spaces. It employs facial recognition, fingerprint scanning, voice recognition, and behavioural analysis to identify and authenticate users. This multi-modal biometric authentication process ensures a high level of security and accuracy, reducing the risks associated with traditional lock-and-key systems and keypad codes allowing users to remotely control and monitor their doors through a smartphone app , thus enhancing convenience and accessibility. The AI-based installation utilizes computer vision algorithms for facial recognition, voice recognition, or gesture recognition, enabling seamless and secure access control. Additionally, machine learning algorithms continuously analyse access patterns to detect anomalies and prevent unauthorized entry attempts. The system is designed to be flexible, allowing for remote access control via mobile applications and integration with smart home ecosystems. Through rigorous testing and evaluation, our AI-based door locking system demonstrates superior performance in terms of security, user experience, and adaptability compared to conventional methods. This research contributes to the advancement of intelligent security solutions and opens avenues for further exploration in the field of AI enabled access control systems.

*Keywords: AI Integrated Intelligent Door System, Arduino Board, Sensors, Motor Driver, Image of Front View Of AI Door Locking System*

**Introduction:**

As a result, the safety and security extending to personal social security to protect every individuals personal information, valuable things, and their day to day activities. Hence, the personal security services moving towards to integration of video surveillance, door lock access control system based on authorization information to avoid the access conflicts in personalized monitored areas [1, 2]. The personal authorization solution can be operated in the form personal computer (PC) based authorization or network based remote authorization or smart devices based local authorization, or printed documents based authorization and so on to minimize the illegal access risk in the building facility. In recent days, the network based centralized electronic access control system developed for security gate control and door access control in smart buildings with different user authorization interfaces like near-field communication (NFC), radio-frequency identification (RFID), fingerprint recognizer, and face recognizer, etc. [3-7] to limit the physical access of the people in the buildings or assets.

The building facility localized electronic access control system receives the user specific authentication and authorization information from a centralized access control system server and performs the automatic gate or door lock open or close control for the specific individuals to access building facility area using NFC or RFID Tag or fingerprint features or facial features, etc. The most available access control system user authentication interfaces are subject to the security compromising by exposing the password or digital keys to strangers. Also, the RF-based available user interfaces are vulnerable to security threats. However, the cost of the access control system installation is high, and the network interface has the weakness with access distance, security and network access efficiency issue. The rapid development in smart devices and visible light communication (VLC) technologies set forth the new automatic door lock access control solution design and development. The advent of smart devices processing power and mega pixel feature support enable the optical camera communication (OCC) features can able to provide the personalized wireless data security.

Fig. 1 AI Integrated Intelligent Door System

Fig. 2 Arduino

**INTRODUCTION TO ARDUINO IDE:**

IDE stands for Integrated Development Environment. Pretty fancy sounding, and should make you feel smart any time you use it. The IDE is a text editor - like program that allows you to write Arduino code. When you open the Arduino program, you are opening the IDE. It is intentionally streamlined to keep things as simple and straightforward as possible. When you save a file in Arduino, the file is called a sketch – a sketch is where you save the computer code you have written. The coding language e that Arduino uses is very much like C++ ("see plus plus"), which is a common language in the world of computing. The code you learn to write for Arduino will be very similar to the code you write in any other computer language – all the basic concepts remain the same – it is just a matter of learning a new dialect should you pursue other programming languages.

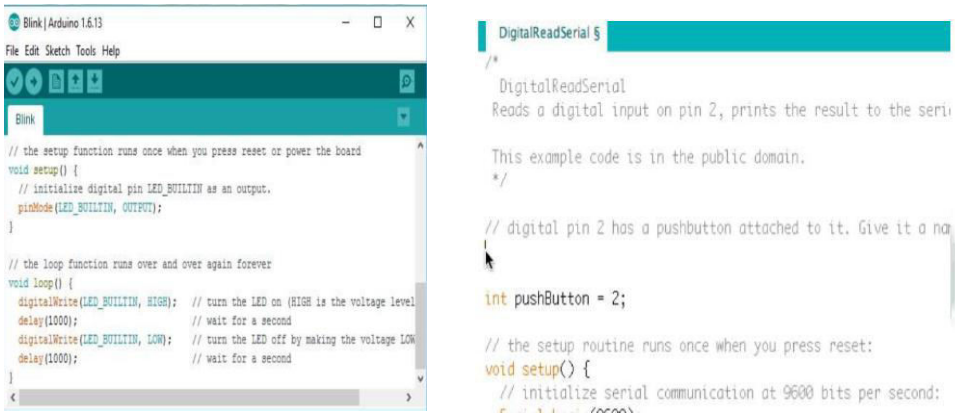


Fig. 3 common language in the world of computing

**HARDWARE REQUIREMENTS:**

1. Hardware Components of this project are
2. Arduino Uno
3. 18650 Battery
4. R307 Fingerprint Sensor
5. 4x4 Keypad
6. L298n
7. Solenoid Lock

**INTRODUCTION TO ARDUINO UNO:**

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programminglanguage (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of

thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

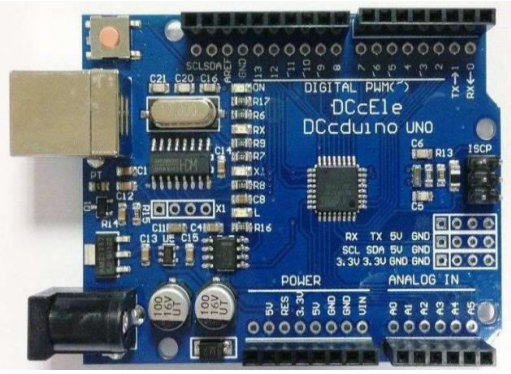


Fig.4 Arduino Board

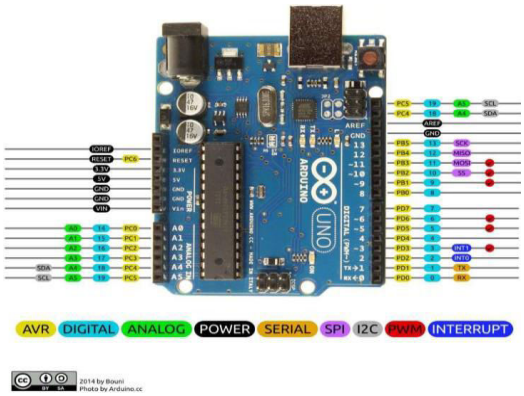


Fig. 5 Introduction To 18650 Battery

**FINGER PRINT SCANNER:**

There are four types of fingerprint scanner the optical scanner, the capacitance scanner, the ultrasonic scanner, and the thermal scanner. The basic function of every type of scanner is to obtain an image of a person's fingerprint and find a match for it in its database. The measure of the fingerprint image quality is in dots per inch (DPI) Optical scanners take a visual image of the fingerprint using a digital camera. Capacitive or CMOS scanners use capacitors and thus electrical current to form an image of the fingerprint. This type of scanner tends to excel in terms of precision. Ultrasound fingerprint scanners use high frequency sound waves to penetrate the epidermal (outer) layer of the skin. Thermal scanners sense the temperature differences on the contact surface, in between fingerprint ridges and valleys. All fingerprint scanners are susceptible to be fooled by a technique that involves photographing fingerprints, processing the photographs using special software, and printing fingerprint replicas using a 3D printer.

**KEY FEATURES:**

1. Ultra - thin design & ad adhesive backing provides easy integration to any project
2. Excellent price - performance ratio
3. Easy communication with any microcontroller
4. APPLICATION IDEAS
5. Security systems
6. Menu selection
7. Data entry for embedded systems

**KEYPAD SPECIFICATIONS**

A. Maximum Rating: 24 VDC, 30mA
B. Interface: 8 - pin access to 4x4 matrix
C. Dimensions: Keypad: 2.7 x 3.0 in (6.9 x 7.6 cm) Cable: 0.78 x 3.5 in (2.0 x 8.8 cm)
D. Operating temp range: 32 to 122 °F (0 to 50 °C)

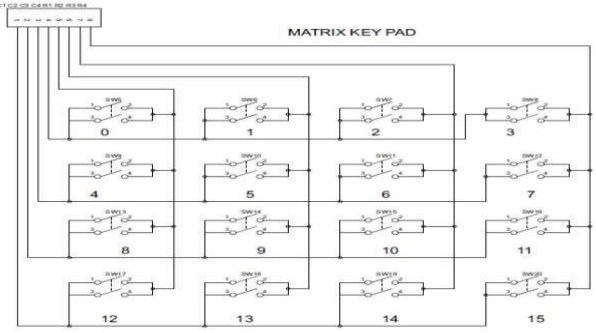


Fig. 6 Matrix Keypad Interface Logic

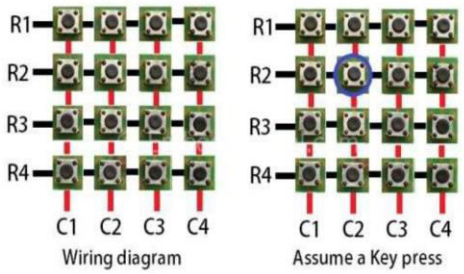


Fig. 7 Pins connected to columns of the keypad

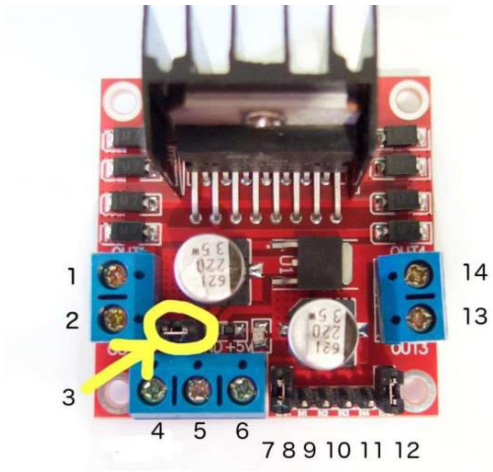


Fig. 8 Motor Driver

**PIN DESCRIPTION:**

- DC motor 1 "+" or stepper motor A+
- DC motor 1 " - " or stepper motor A -
- 12 V jumper - remove this if using a supply voltage greater than 12V DC. This enables
- power to the onboard 5V regulator
- Connect your motor supply voltage here, maximum of 35V DC. Remove 12V jumper if
- >12 V DC
- GND
- 5 V output if 12V jumper in place, ideal for powering your Arduino (etc)
- DC motor 1 enable jumper. Leave this in place when using a stepper motor. Connect to
- PWM output for DC motor speed control.
- IN1 IN2
- IN3 IN4
- DC motor 2 enable jumper. Leave this in place when using a stepper motor. Connect to
- PWM output for DC motor speed control.
- DC motor 2 "+" or stepper motor B+
- DC motor 2 "-" or stepper motor B-

**CONTROLLING DC MOTOR:**

To control one or two DC motors is quite easy. First connect each motor to the A and connections on the L298N module. If you're using two motors for a robot (etc) ensure that the polarity of the motors is the same on both inputs. Otherwise, you may need to swap them over when you set both motors to forward and one goes backwards! Next, connect your power supply - the positive to pin 4 on the module and negative/GND to pin 5. If you supply is up to 12V you can leave in the 12V jumper (point 3 in the image above) and 5V will be available from pin 6 on the module. This can be fed to your Arduino's 5V pin to power it from the motors' power supply. Don't forget to connect Arduino GND to pin 5 on the module as well to complete the circuit.

Now you will need six digital output pins on your Arduino, two of which need to be PWM (pulse-width modulation) pins. PWM pins are denoted by the tilde ("~") next to the pin number, for example: Finally, connect the Arduino digital output pins to the driver module. In our example we have two DC motors, so digital pins D9, D8, D7 and D6 will be connected to pins IN1, IN2, IN3 and IN4 respectively. Then connect D10 to module pin 7 (remove the jumper first) and D5 to module pin 12 (again, remove the jumper). The motor direction is controlled by sending a HIGH or LOW signal to the drive for each motor (or channel). For example for motor one, a HIGH to IN1 and a LOW to IN2 will cause it to turn in one direction, and a LOW and HIGH will cause it to turn in the other direction. However the motors will not turn until a HIGH is set to the enable pin (7 for motor one, 12 for motor two). And they can be turned off with a LOW to the same pin(s). However if you need to control the speed of the motors, the PWM signal from the digital pin connected to the enable pin can take care of it.

Fig.9 DC Motor

Fig.10 Implementation of Door Locking System

**CONCLUSION:**

The fingerprint cum keypad-based intelligent door lock system stands as a testament to the evolution of security mechanisms in the contemporary world. By combining the reliability of fingerprint recognition with the accessibility of keypad entry, this technology addresses the limitations of conventional locks. The convenience of keyless entry, coupled with the heightened security afforded by biometric verification, makes this system a formidable safeguard for homes, offices, and various other spaces. As technology continues to advance, intelligent door locks will likely become even more sophisticated, offering enhanced features and seamless integration with other smart home systems. Embracing such innovations not only ensures the safety of our physical spaces but also paves the way for a future where security and convenience coexist harmoniously.

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