

Fingerprint Door Automation

Fingerprint security system for lock and/or unlock doors.

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ABSTRACT

Smart security systems stand out as the most striking function of smart home systems that make your life easier. Smart security systems, which basically have options such as door / window sensors, security cameras, warning systems such as theft / fire / flood / gas leak, entry / exit control systems, can also be arranged according to your needs and demands. You can always be ready for unpleasant surprises thanks to the alarm system that warns you and the centers such as fire brigade and police against all dangers that may occur in your home. Fingerprint door automation system provides security and reliability in case of unpleasant surprises.

KEYWORDS

Smart Security, Internet of Things, Fingerprint, Authentication, Arduino

1 Introduction

Fingerprint door automation system is a "do it yourself" project developed as a solution to a problem and need. It prevents unauthorized opening of house or room doors with the help of microcontroller and fingerprint reader. Thanks to the Arduino and Adafruit fingerprint reader, only people with permission can open the doors and person who used or developed this system will not have to worry about locking the door. Because the door is unlocked for only 3 seconds and then locked it again.

2 Design

Various examples were examined on the internet for the design phase of fingerprint door automation. Hardware design was more challenging than software design phase.

2.1 Hardware

2.1.1. R307 Optical Fingerprint Scanner The R307 optical fingerprint module includes a fingerprint algorithm chip that includes functions including fingerprint input, image processing, feature extraction, template generation, template memory, fingerprint matching, and fingerprint search. It captures images at

500 DPI. Since it has low power consumption, small size and good performance, it can be embedded in various end things such as doors, boxes, suitcases. It has supply voltage: DC 4.2 - 6.0 V and can store up to 1000 fingerprints.

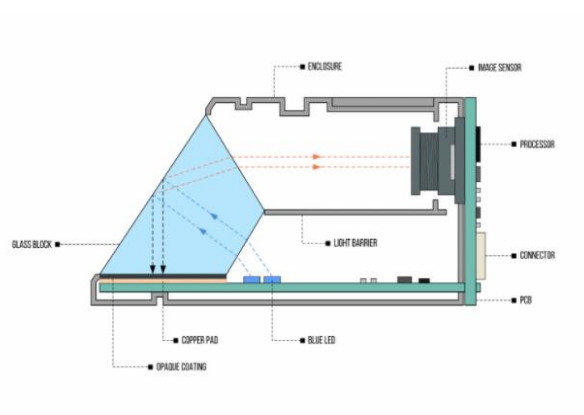


Figure 1: R307 Fingerprint Scanner Cross Section

2.1.2. Solenoid Lock Uxcell Electromagnetic Solenoid Lock works on DC12V, 1.1A. It is 11.4 mm and weighs 300 gram.

2.1.3. Arduino Uno R3 Arduino is a perfect microcontroller for school projects like this one. It has 14 digital input output pins, 6 analog pins, power jack, USB connection reset button etc. Only 6 pins were used for this project. 5v, 2 GND, digital inputs 2,3,13.

2.1.4. Relay Module 5V relay module to provide connection between Arduino and solenoid lock.

2.1.5. Power Source 12V power supply is used for powering solenoid lock. Since the solenoid lock is 12V, Arduino's 5V pin cannot be used to power this electromagnetic lock.

2.2 Hardware Connections

First, the power cable of the fingerprint sensor was connected to the 5v output of the Arduino, and the gnd cable was connected to the Arduino's gnd pin. Then, since pins with number 2 and 3 will be used, the TX cable of the fingerprint sensor was connected to the digital-2 pin of the Arduino and the RX cable to the digital-3 pin.

Then, the connection between the power supply, solenoid lock and relay module were made so as not to create a short circuit, and the relay module was connected to the Arduino digital pin-13 and the relay module's gnd to Arduino gnd.

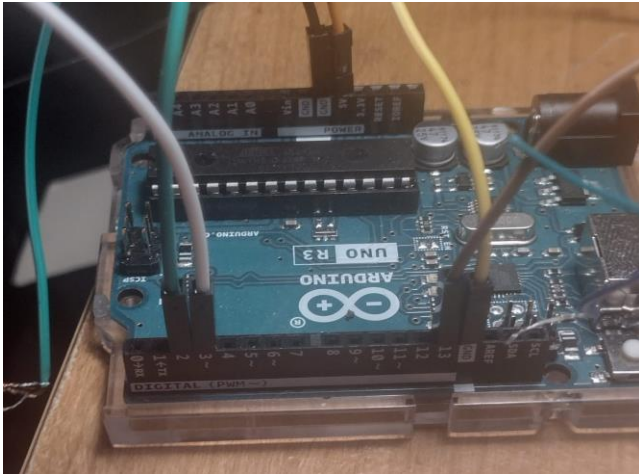


Figure 2: Arduino Connections

2.3 Control Flow Diagram

Following figure shows system's control flow diagram. There are two main processes in this diagram which is capturing fingerprint and unlocking door. When the person put their finger on sensor, sensor captures fingerprint then if fingerprint is authorized solenoid lock unlocks the door for 3 seconds.

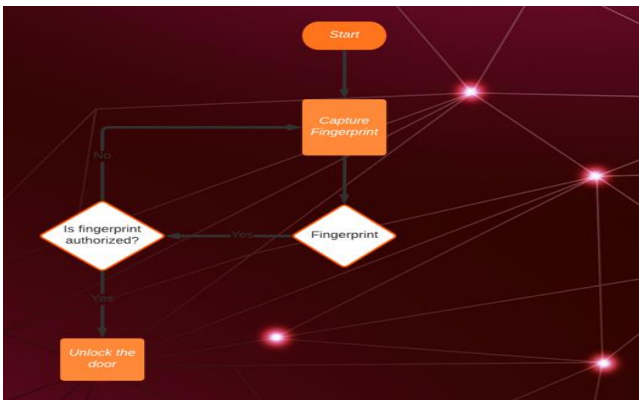


Figure 3: Control Flow Diagram

2.4 Software Tools

2.4.1. Adafruit Fingerprint Library This library needs to be installed to the Arduino IDE for the fingerprint sensor to work. Fingerprint enrollment and authentication operations are carried out with the help of the functions in this library.

2.4.2. Arduino IDE An IDE specially developed by Arduino to write code and load it on board. This software can be used with any Arduino board.

3 Implementation

After all hardware tools were connected, the implementation part started. Fingerprint door automation system has 2 different implementations. The first is to save the fingerprints in the database, the second is to scan the finger and unlock the lock if it is authenticated.

I have prepared two separate scripts using Adafruit fingerprint functions to perform these operations. The first of these scripts is responsible for assigning an ID to the fingerprint, saving it in the database and displaying some statistics of the sensor. The other script is responsible for scanning the database and matching the scanned fingerprint and opens the lock if a match is found on the database.

3 Conclusion

Intelligent security systems are not just commercial products manufactured by large companies. We can also produce our own smart security system at home, thanks to the hardware we purchase from the internet. In this project, I produced a solution to the security problem I encountered in real life by using various hardware and software.

ACKNOWLEDGMENTS

Before this project, I had no idea about IoT applications. That's why I panicked when my fingerprint sensor didn't work at first. This project taught me to look for the cause of my mistakes and find the best solution. I have never worked with Arduino before, but after that I am thinking of going as a hobby.

REFERENCES

- [1] <https://github.com/adafruit/Adafruit-Fingerprint-Sensor-Library>
- [2] <https://vishnumaiea.in/projects/hardware/interfacing-r307-optical-fingerprint-scanner-with-arduino/>
- [3] <https://www.safewise.com/home-security-faq/how-do-security-systems-work/>