

Password Based Door Lock

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Introduction

Security has become more and more important in today's world. It is very important to ensure the safety of our offices and homes. Based on this, the password based on door lock has become a very popular and effective option, since it can provide a simple and convenient way of securing our personal belongings. Our password-based door lock works by requiring a specific set of passwords to be entered to gain the entry. The code can be entered through the keypad. There is an LCD to display the instructions. After several tests, we realize some potential vulnerabilities that our product may have. Therefore, additional features should be implemented to improve the security of our prototype. We decided to add facial recognition as the advanced feature to enhance the security level of our design. The camera can also capture the intruders' faces if someone puts the wrong password three times and upload the pictures to the cloud. The benefits of using our product are numerous. It is very easy to install, user-friendly and requires minimal maintenance. It also provides a high level of security and can be quickly changed if the password is compromised. Another big advantage of our product is that it is relatively affordable and can provide a cost-effective method of entering users' houses.

The Benefits of Password Based Door Lock

- Eliminates the necessity of keys
- Higher security
- Enhanced Durability
- Customize features such as face recognition
- Random password generation
- Realtime phone + email notifications

System Flow Chart

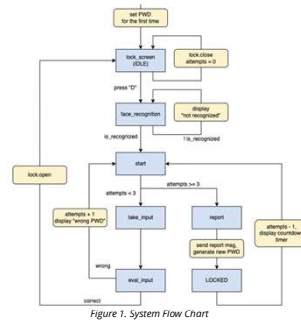


Figure 1. System Flow Chart

Objectives

- **Cost-Effective:** You only need to spend a little money cost, can have a very high security performance of the door lock.
- **High security:** Can automatically alert the police and attach a face photo when a suspect attempts to enter the door. When a suspicious password is entered, a new password is automatically generated and sent to the administrator.
- **Facial recognition:** With facial recognition function, can automatically identify persons who can enter the door.
- **Two-factor authentication:** Password and Facial Recognition complement each other. The combination of the two can make the door lock more reliable.



Figure 2. Final Product Prototype

Methods

Wanted to get a bulk of the project done over the first few weeks. This way we could make sure everything was working and focus on debugging and adding extra features at the end.

For the STM code we used an online library and the STM32 Discovery library to initiate the STM peripherals.

For each component that communicate with the RPI, we implement and test each component separately before putting them all together.

System Block Diagram

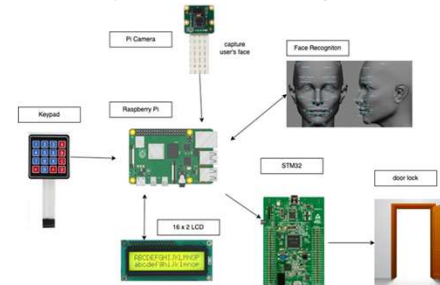


Figure 3. System Block Diagram

Results

- **The safety of the door lock is very good:** Our experiment proved that every time the wrong password is entered more than 3 times, the administrator can receive an alarm and a photo of the suspect. The servo will unlock the door only after it has been fully verified with the password and facial recognition.
- **Facial recognition is ideal:** Our experiment shows that the facial recognition was 92% accurate (Accuracy above 85% can be considered ideal). The recognition confidence interval of the recognized person is around 0 to 40. (A confidence value of 0 indicates perfect match.) The experiment also proved that recognition accuracy increased as the amount of input facial data increased.

FACIAL RECOGNITION ACCURACY

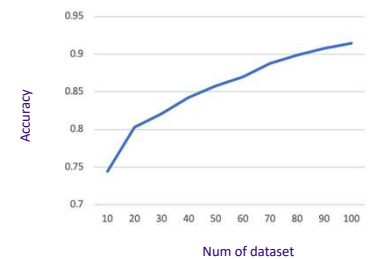


Figure 3. Accuracy of facial recognition model vs. Size of dataset

Conclusion

We have developed a secure and cost-effective password-based lock that is unique within the market.

The lock can provide physical safety for consumers and protect private personal information by keeping adversaries out, alerting the users, and facial recognition technology.

We can optimize the cost of our lock by evaluating the performance and durability required.

In the future, we plan to identify and resolve software and hardware vulnerabilities, improve security of information handling, and create a more advance user interface.

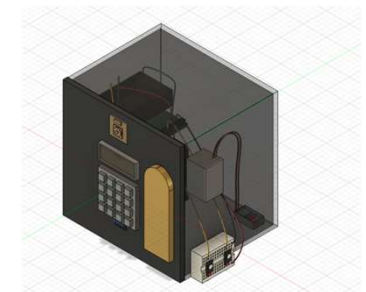


Figure 4. Product Prototype Design