Facial Recognition Door Lock

Project Specification

Aadish Rathore

Derek Lin

Kevin Gay

Zheng Tan

SFWRTECH 4FD3 | 26 Jan, 2019

Version: 1.0

**Introduction**

a Traditional key-style doors are still seen commonly. According to *The Conference Board of Canada*, Canada has over 500 burglaries/100k population in a year. With the introduction of smart devices, improvements to overall reliability and usability to facial recognition have been made. One section facial recognition still lacks is the usage for home security. For example, using facial recognition as a way to unlock your front entrance.

With the introduction of facial recognition door locks increases the security of a property. Physical bypass methods such as lockpicking are prevented. Additionally, it is common for people to forget or lose their keys. Using a facial recognition lock, keyless access is available and no physical keys are required. This would greatly benefit landlords for rental properties as changing authorizations would be easier with the lock’s setup; physical keys are eliminated.

The client will be able to set up authorized users with the lock. These locks will store all the faces of the occupants for recognition to a local database. If a person is in proximity of the lock while it is locked, it will scan the person’s face and decide to unlock or remain locked.

The benefits of this lock are includes:

1. Removes the need to carry physical keys for entry to the home (ease of use),
2. Makes many well known and practiced lockpicking techniques obsolete (security),
3. Removes the need for key control in the event of changing residents (convenience), i.e. renters, moving, maintenance, dog walkers etc.

**Objectives**

The objective of this project is to make and program a lock that without prior user input will be able to detect a face within the camera’s field of view and either grant access by opening the lock or deny entry, this will be determined based on the user’s face being a positive match or not.

**Solution**

To achieve the scope of the project, following are the tools/programs we shall use:

* Single board computer
  + Arduino or Raspberry PI
  + Camera
  + Proximity sensor
  + PIN pad
  + AC powered with backup battery
* Lock control
  + Motor
* Computer Vision AI
  + Python Back-end
* SQL Database
  + Store facial data and other system setting data
* User Interface
  + Javascript Front-end

Steps:

* Program the Arduino to control the lock’s motor
* Build Database to store data
* Build Facial Recognition PoC
* Train the AI for accuracy and efficiency
* Create/Program a front end application
* Build the prototype
* Validation

**Validation Strategy**

* Accuracy (Confusion Matrix : True/False Positive, True/False Negative)
* Efficiency (Response Time : Avg time to detect/process a face)
* Convenience (Distance/Setup : Leniency of face position/Time to set up/Unlock)

**Timeline:**

|  |  |  |
| --- | --- | --- |
| No. | Activity | Week # |
| 1 | Identify group members and finalize project scope | 1-2 |
| 2 | Create design document for peer review | 3 |
| 3 | Review feedback, incorporate agreed changes | 4 |
| 4 | Source hardware needed to start software development | 5 |
| 5 | Begin software development | 5 |
| 6 | Basic hardware setup complete | 6 |
| 7 | Tuning AI configuration | 7 |
| 8 | Complete software development | 8 |
| 9 | Prototype validation (hardware + software) | 9 |
| 10 | Documentation/runoff | 10 |
| 11 | Presentation | 11 |
| 12 | Final polish | 12 |

**Changes Made Based on Feedback:**

* Group 2:
  + Approach to facial recognition, heavier reliance on premade libraries.
  + Less emphasis on hardware.
* Group 3:
  + Incorporating secondary verification, tbd (pin pad/NFC/RFID/smartphone).
* Group 4:
  + Specified local storage for db, security precautions will be looked into.
  + Added a week to allow for work runoff (unfinished tasks).
* Group 5:
  + Secondary verification to help avoid pictures tricking the camera being a major security flaw.
* Group 6:
  + Backup-battery included in specification.
  + Proximity sensor added to specification.
* Group 7:
  + Will be looking into existing facial recognition systems to help aid us into developing our lock, we agreed starting from the ground up will be tough.
  + Secondary verification.
  + Javascript front-end.

**Works Cited**

https://www.conferenceboard.ca/hcp/Details/society/burglaries.aspx?AspxAutoDetectCookieSupport=1