



# Embedded Lock Recognizer

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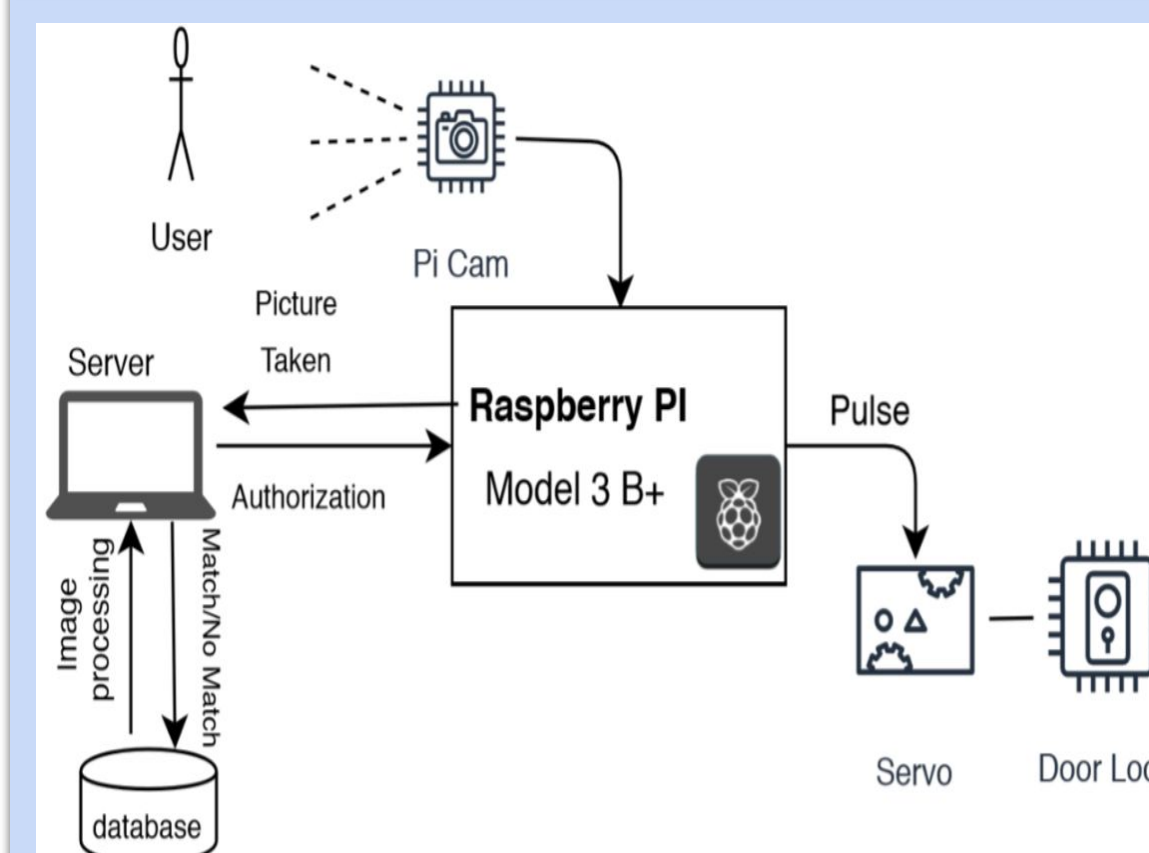
## Goal and Objective

Build an embedded IoT lock system able to detect, identify, and unlock for the people that are recognized as owners. This embedded device will be able to add security to any system. The secure lock system is based on image recognition and secured networking, and it provides reassurance to people and their belongings or homes by having authorization only for recognized owners. System will be designed so that it can work with any type of lock system (home door, locker, safe).

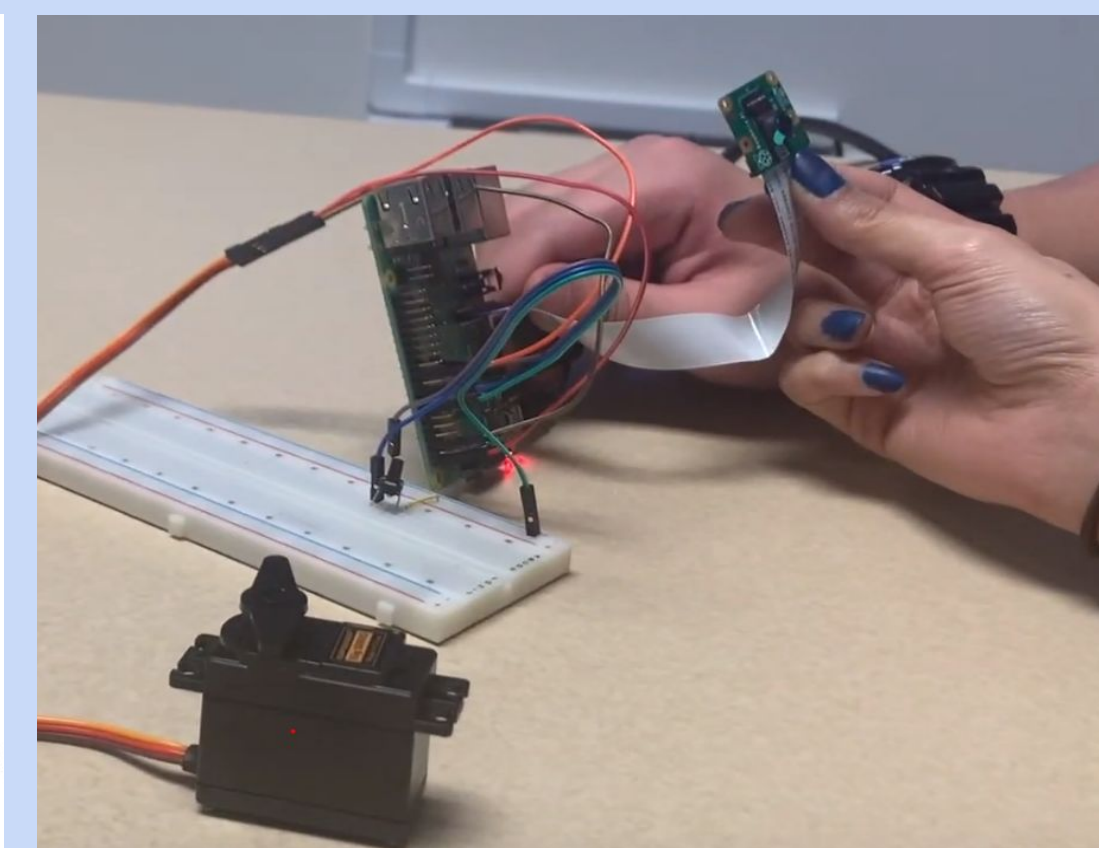
## Approaches

- Using a Raspberry Pi camera to capture a face image of the person who wants to open the lock.
- Using client-server networking to send images to a server to process the image and do image processing such as facial detection and recognition using OpenCV libraries.
- Server responding to the Raspberry pi client a signal to open the lock or keep it closed whether the person is recognized as the owner
- Creating a private key to secure communication through networking.
- Modelling the lock and key system 3D print.

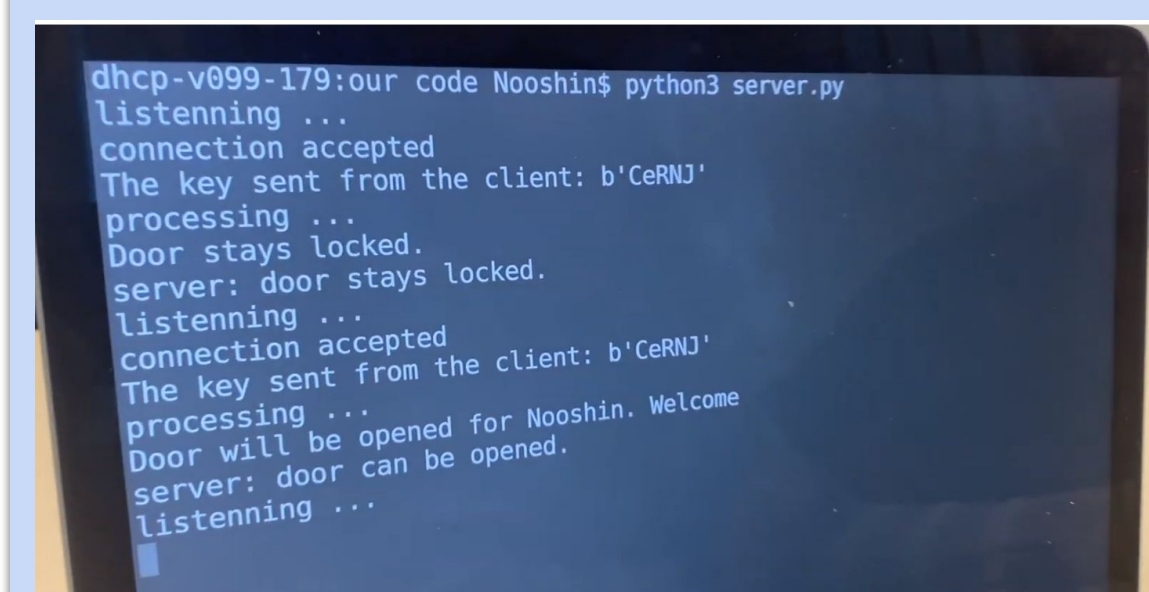
## Diagrams and Images



Hardware Architecture Design



Testing the Lock System

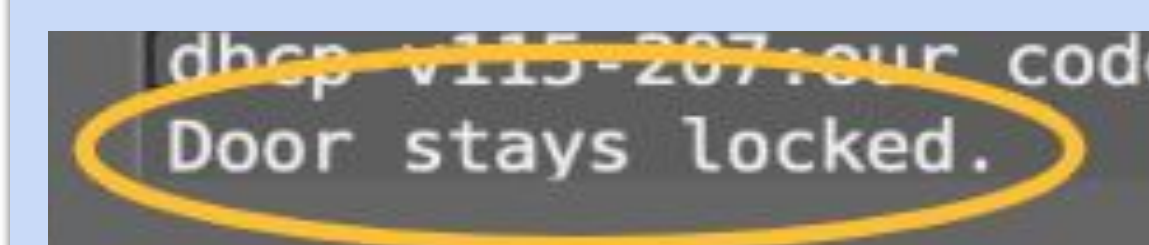


Sending and Receiving Responses

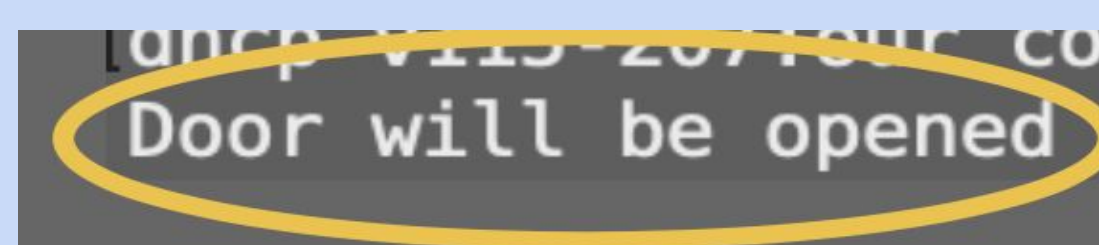
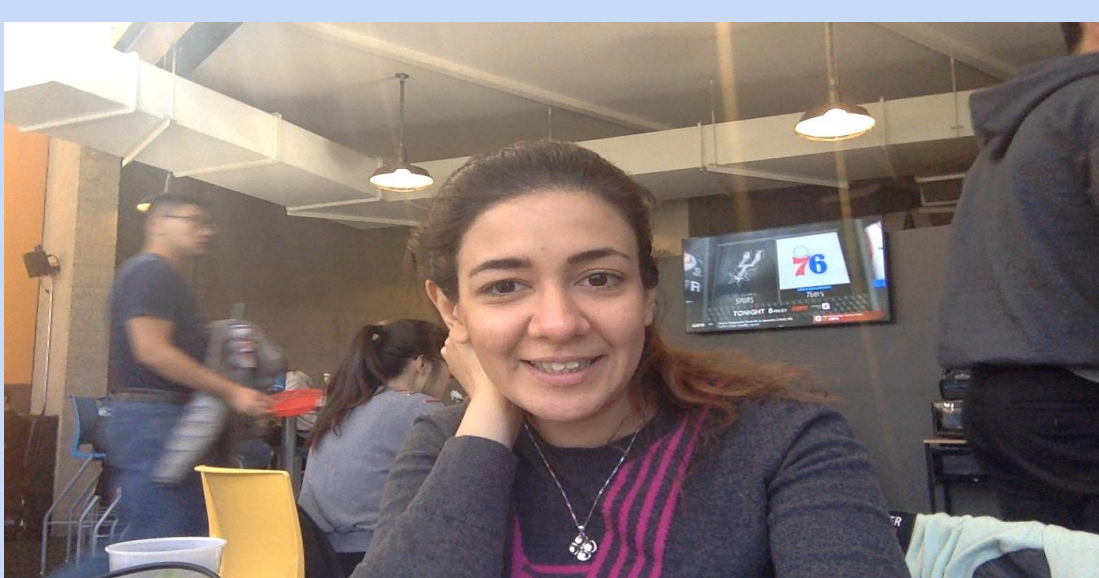


Prototype

### Unrecognized User



### Recognized User



Face Recognition and Authorization

## Progress and Challenges

- The raspberry pi, camera, servo, and laptop are connected and integrated together.
- The client pi can send images to the laptop server to process the images
- Face recognition software is implemented to process the images and recognize an owner.
- Signals are sent back from the laptop server to the client raspberry pi. This will ultimately unlock for a recognized owner or stay locked for an unrecognized owner.

## Future Work

- Be able to add ownerships in the user interface of the system.
- Improve portability such as adding charging and battery to the system.
- Improve the processing time, implement the design in lower level languages.
- Be able to add interchangeability to the system for better camera and quality.
- Be able to implement additional features such as fingerprint scanners.

### References Cited

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Socket - Low-level networking interface. (n.d.). Retrieved 2019, from <https://docs.python.org/3/library/socket.html>



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