

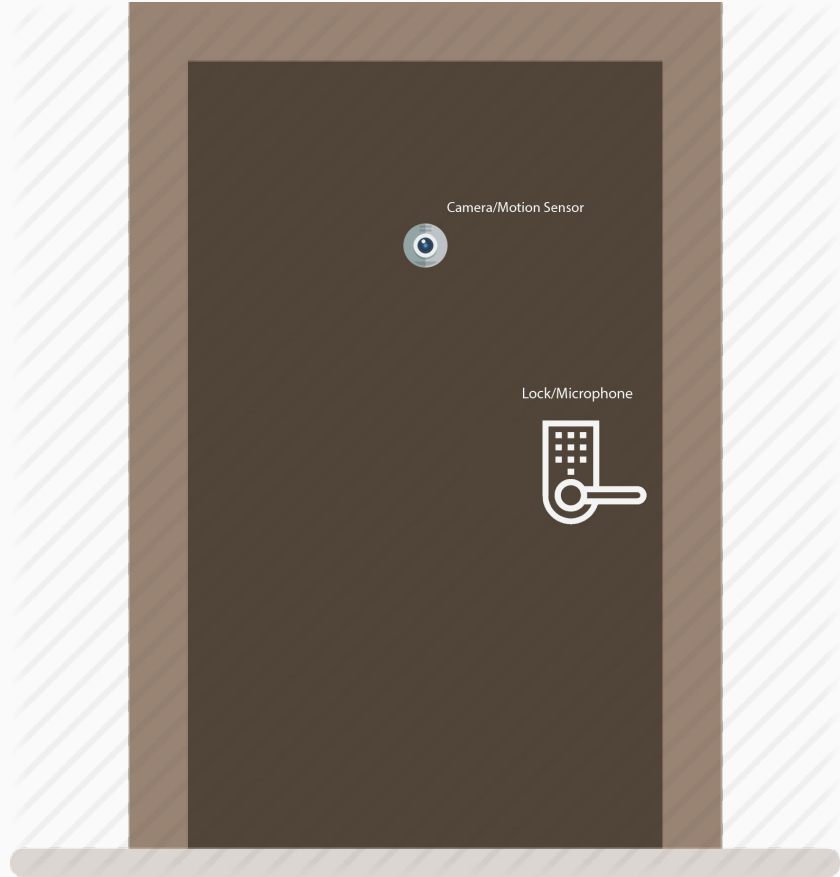
Problem Statement

- Locks are boring, facial recognition isn't!
- Aim to make unlocking a door easier with facial profiles
- Smart lock technology
 - Motion Detector
 - Microphone
 - UI



Proposed Solution

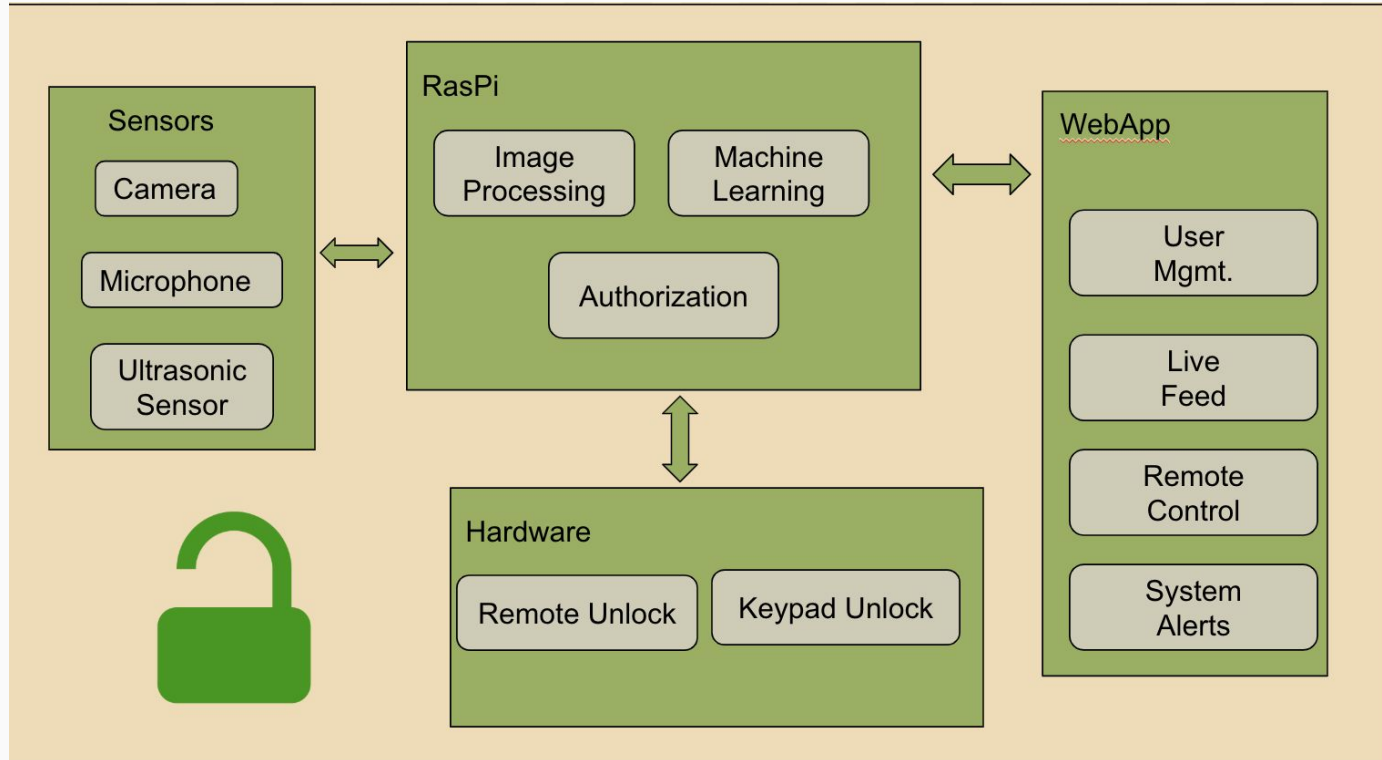
- Camera triggered by motion sensor
- Raspberry Pi verifies faces
- Unlocks magnet lock when face verified or user requests from UI
- Keypad for manual override
- Microphone for interacting with guests



Requirements

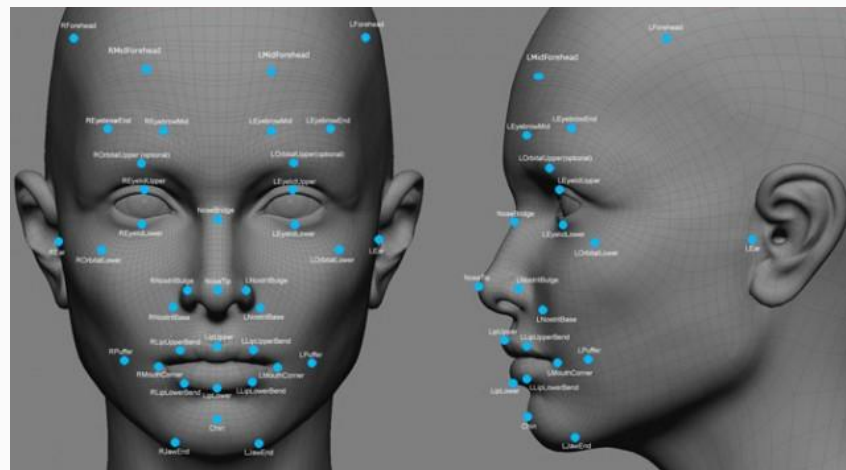
- Camera Vision & Machine learning Algorithm
 - will correctly classify faces with less than 10% error rate
- Automatic locking mechanism
 - Magnetic Lock that unlocks and locks door within less than a 500ms of receiving signal
 - Lock that can remotely be unlocked without any manual assistance.
- Web application
 - Notifications whenever a failed attempt to open door within 3 seconds.
 - Ability to manually lock/unlock door from web app within 5 seconds.

Architecture



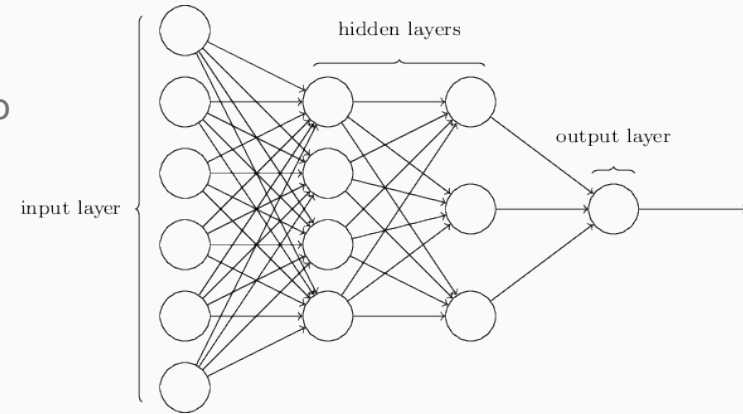
Component #1 - Computer Vision

- 3 Steps for facial recognition
 - Detection
 - Determining the presence of a face
 - Tracking
 - Continually follow face until complete
 - Identification
 - Real time computation using ML



Machine Learning

- Test multiple ML algorithms to find most accurate
 - Neural Networks
 - Using pattern recognition and classification to perform feature extraction using neural networks.
 - Principal Component Analysis
 - Performs a dimensionality reduction by extracting the principal component of multi-dimensional data.

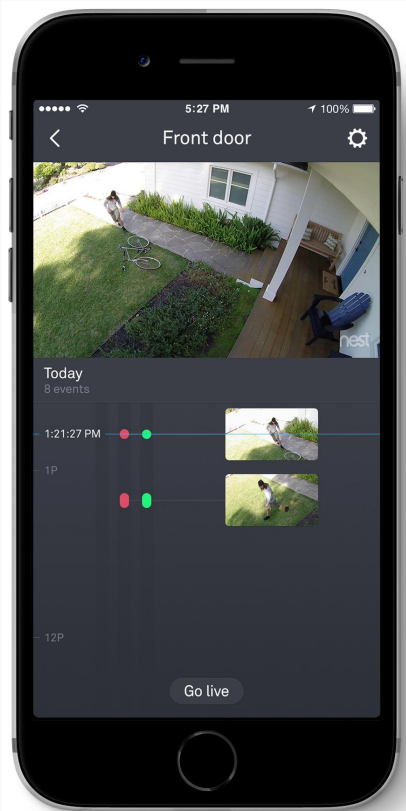


Component #2 - Locking Mechanism

- Voltage-triggered lock connected to Raspberry Pi
- Pi receives HTTP Request
 - If verified, unlocks lock



Component #3 - Web App




- Unlock/lock remotely
- See who's at the door (notifications)
- Speak to guests through microphone

Testing, Verification and Metrics

- **Testing**
 - Test System using real people as test subjects
 - Ensure Algorithm recognizes all residents
 - Track speed/resources of each component
- **Verification**
 - All Web App features fully tested
 - Given controls, ensure system behavior is deterministic
 - Robust to various scenarios (multiple persons, poor lighting)
- **Metrics**
 - Unlock Time from Face Recognized to Unlock Mechanism
 - Accuracy of Facial Recognition

Minimum Viable Product / Stretch Goals

- 90% facial accuracy (single face)
 - Functional lock without microphone
 - Minimal UI
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- High accuracy w/ various situations (multiple faces)
 - Microphone PA system
 - Robust UI w/ analytics