TWO FACTOR AUTHENTICATION DOOR LOCK SYSTEM

Capstone Mentor Evaluation

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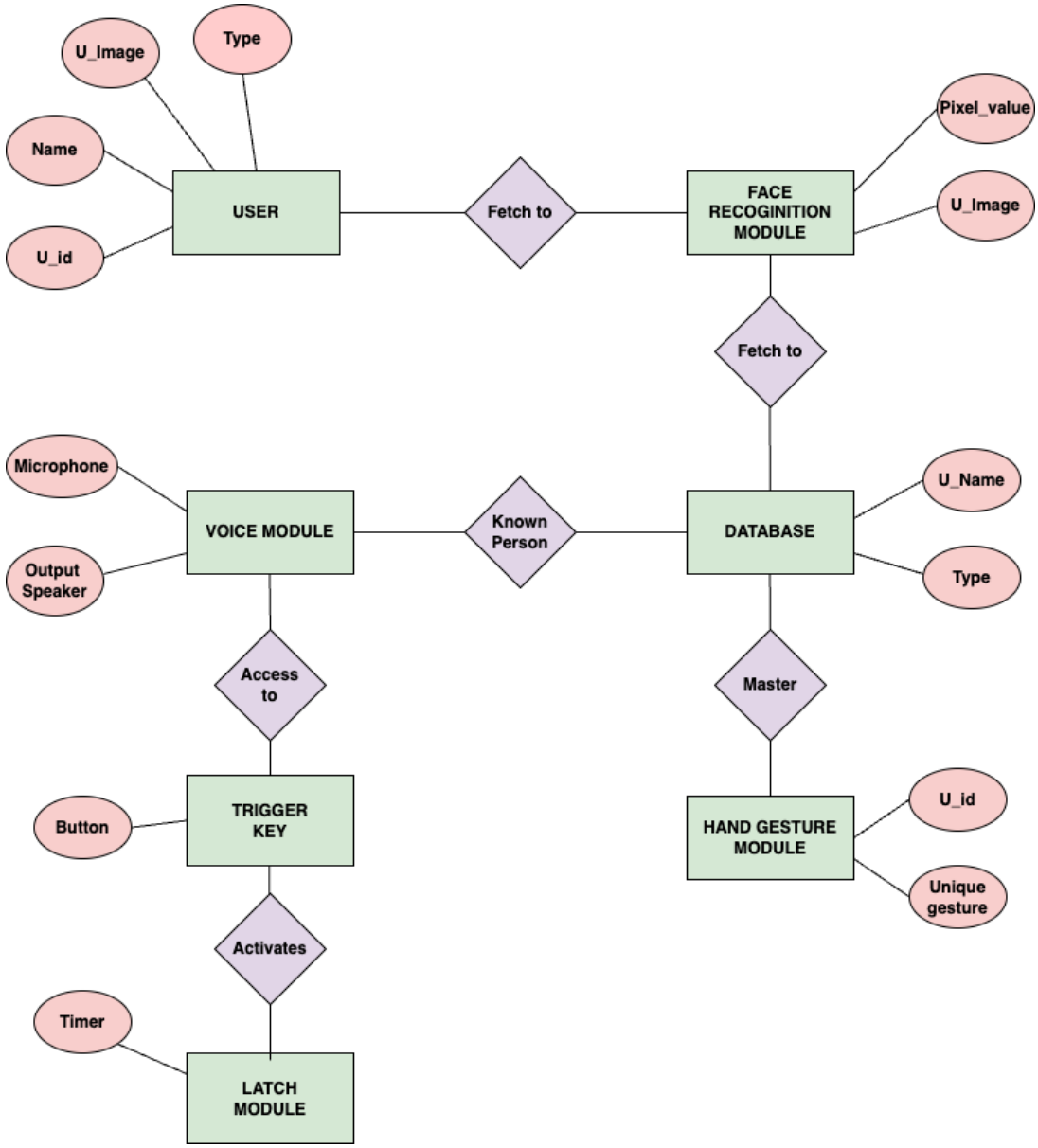
Product perspective

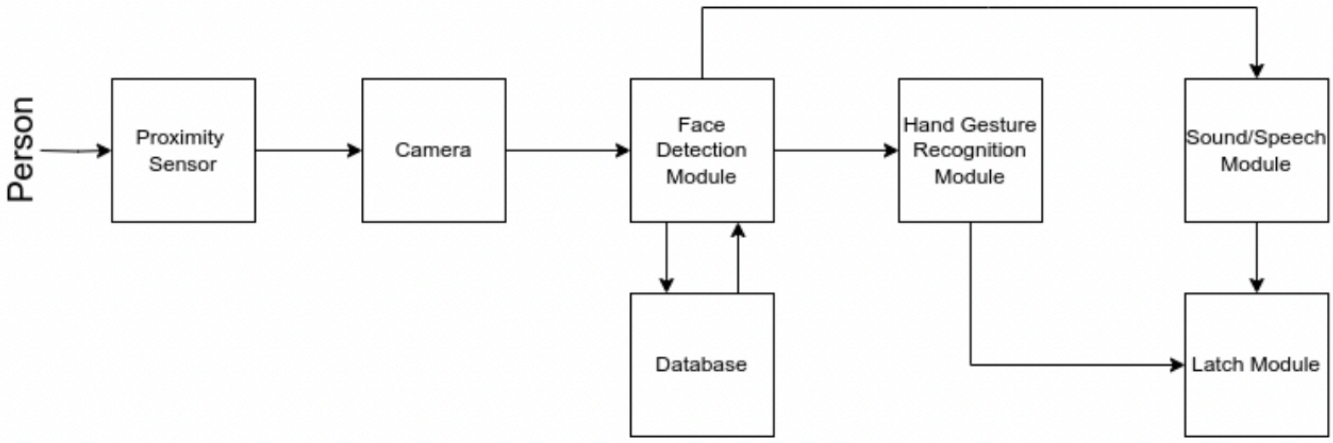
The system will be activated on detecting the human presence in the vicinity. The user would be able to register himself/herself as a master user by capturing face images and subsequently entering a sequence of gestures as the new security key. The system will also allow storing face images of some known faces to the master user, in a database. The user's face is detected by the camera on the lock for face recognition and the user is identified. If the face is recognized as a master, then the hand gesture pattern is applied for further authentication; otherwise if recognized as a known user, the sound module will announce the person.

The pattern performed by the master user is detected by the system camera and accordingly identifies the precise correct unlocking pattern to trigger the lock. Upon accurate hand gesture and pattern recognition, the lock will be triggered and will accordingly be unlocked. A graphical user interface (GUI) will be developed to execute the set, reset and register facilities provided by the lock.

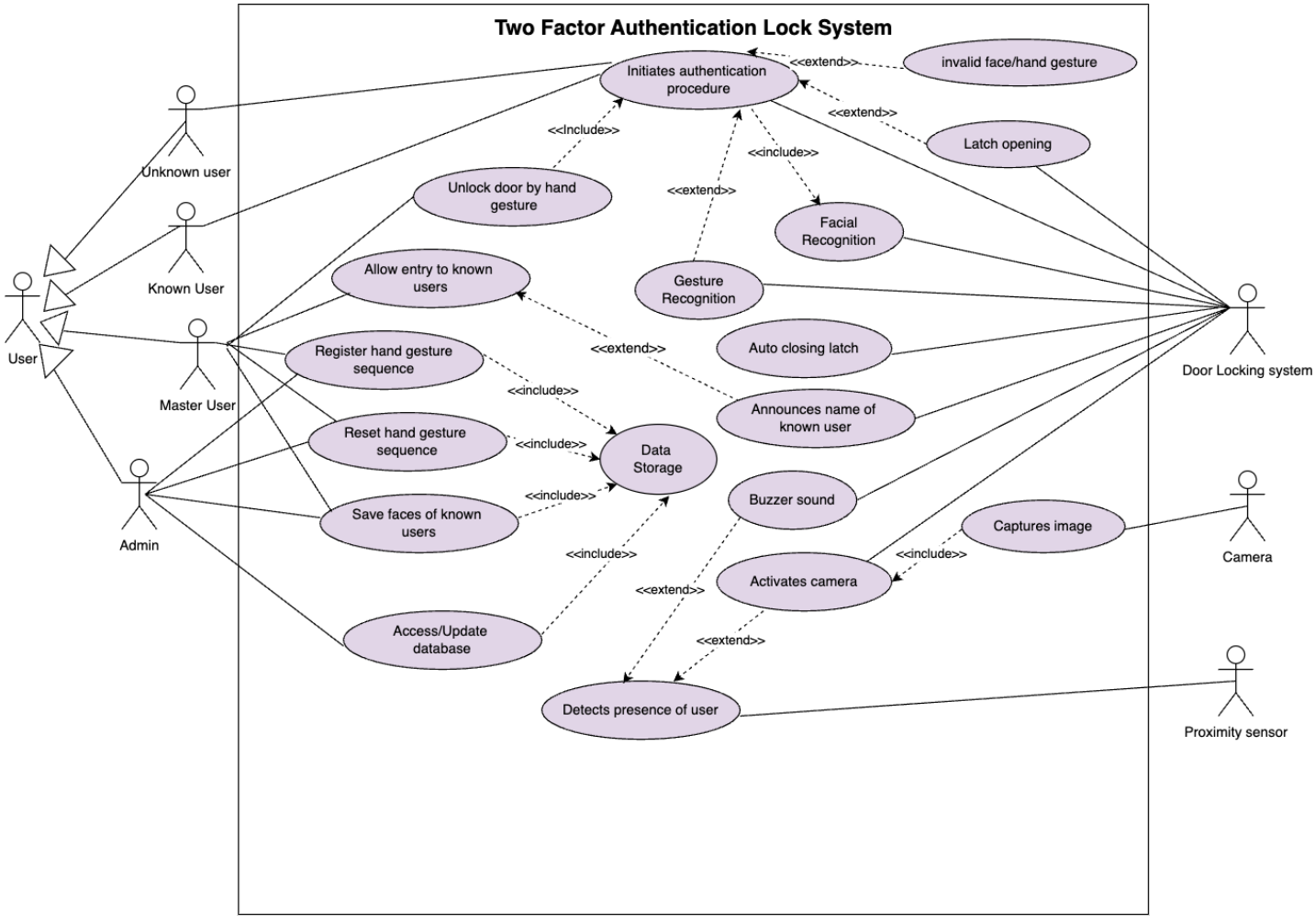
ER Diagram



Block Diagram



Use Case Diagram

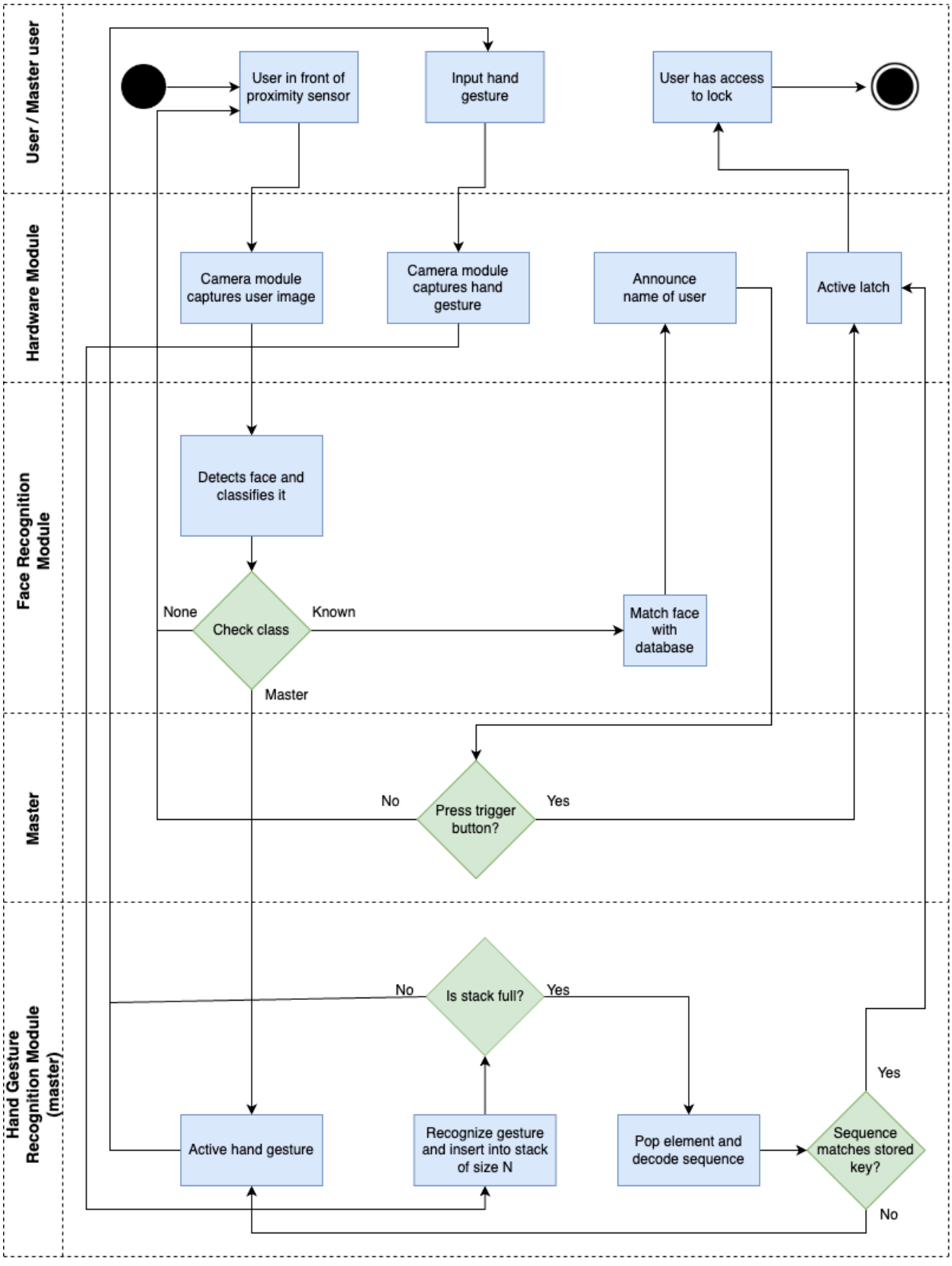


Use Case Template

Use Case Title	User entry through the door
Use Case ID	UC-01
Description	To elaborate how a user will gain entry through the door, which will open automatically subject to completion of the two factor authentication procedure.
Primary Actors	User (master user, known user, unknown user)
Secondary actors	System Admin
External h/w	Proximity sensor, camera
Precondition	1. The system has been installed by the technicians 2. The owner of the house has been registered as the master user and the known users are stored in the database 3. The user is in the vicinity of the door system
Postcondition	1. The system latch goes back to the deactivated state 2. Door remains closed 3. Master user gets the final say for allowing entry of others.
Normal Flow	1. The user is in the range of proximity sensor 2. The proximity sensor detects the presence and the camera module is turnedon 3. The camera captures the face of the user 4. The system verifies the image to confirm if this is the master user 5. The master user then inputs the hand gesture sequence 6. The system stores the sequence and verifies it with the stored passcode 7. The system then activates the latch 8. The door is opened and the user can enter
Alternative Flows	In step 4 of the normal flow, if the user identified is not the master user then, The system matches the image with those in the database 1. If an image is found, then the system classifies the user as a known user and announces his/her name 2. The master user will authorize the entry of this user 3. Use case resumes at step 7 of the normal flow

Exceptions	In step 4 of the normal flow, if the user is neither classified as the master user or aknown user, then: 1. The latch will remain deactivated 2. The door will not be opened under any circumstances.

Swimlane Diagram



Functional Requirements

1. User Interfaces

A web user portal to register to master users along with their data, i.e the passcode as well as their known users.

2. Hardware Interfaces

Hardware interfaces would include a web camera for capturing images of the user as well the gestures, a sound module to announce known users as well as for raising alarms, and finally the lock, which would contain a latch and servo motors.

3. Software Interfaces

For software, we are using Python for image processing and identification modules in our system, besides AWS for computing and storage resources.

Other Non-functional Requirements

1. Performance Requirements

1. Usability: The system should be easy to use and intuitive so that an average user has no difficulty using it. The learning curve should not be steep.

2. Speed: The system should have a fast response and information should be updated in real-time.

3. Minimum Delay: The system should not take long with the identification/ authentication procedures so that the user does not have to wait for a long time to enter.

4. Maximum security: There must be virtually no error in authentication, that is minimum false positives so that the user can be guaranteed maximum safety

5. Minimum false alarm: The number of false alarms should be minimum so that the user is not disturbed needlessly.

6. Cost effective: The solution should not be very expensive and should not have high deployment cost otherwise everyone will not be able to afford it.

7. Scalability: The solution should be scalable to accommodate large number of users.

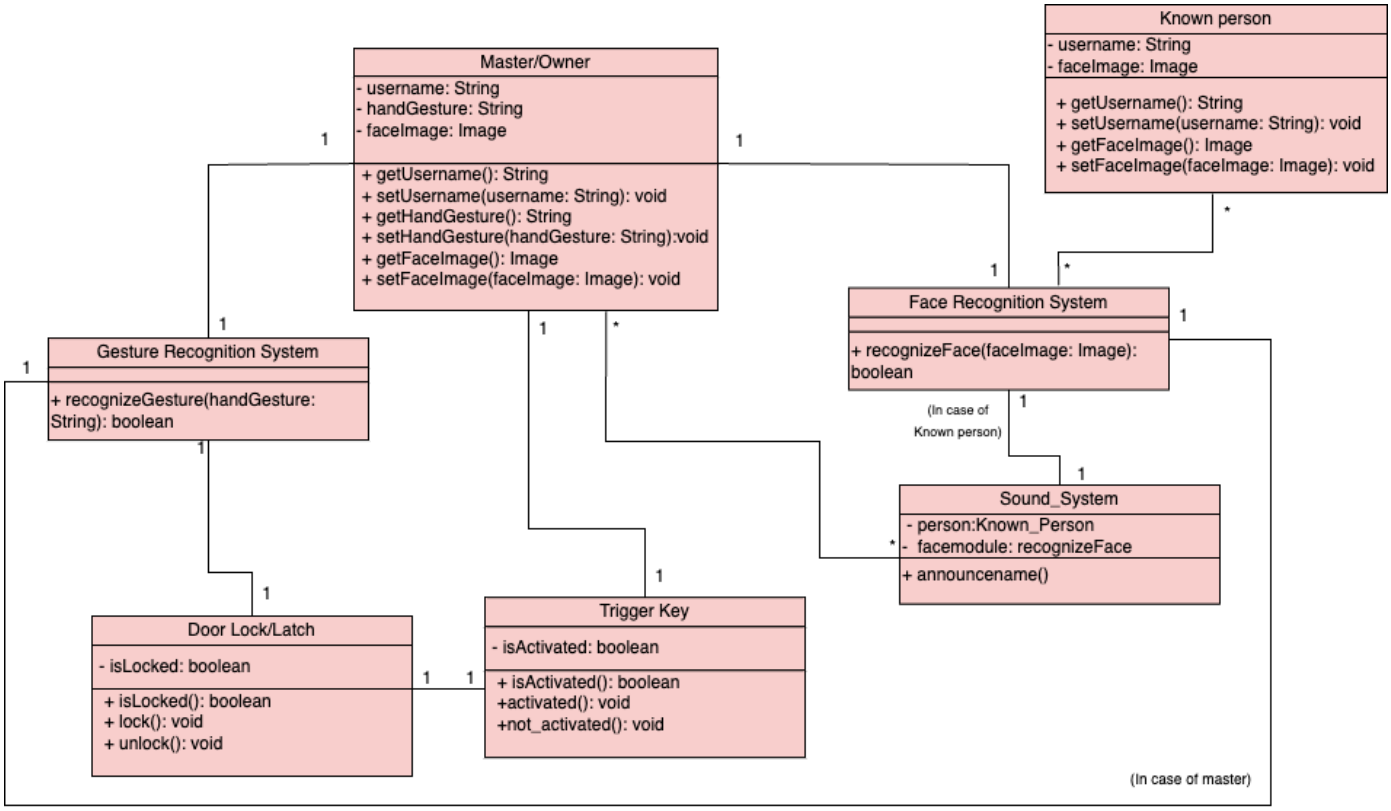
2. Safety Requirements

The lock system, mainly the latch, must not be exposed so that a person cannot gain entry forcefully by breaking it. System failures are a possibility, because of which automatic backups will be done at regular intervals to preserve users' face and gesture data.

3. Security Requirements

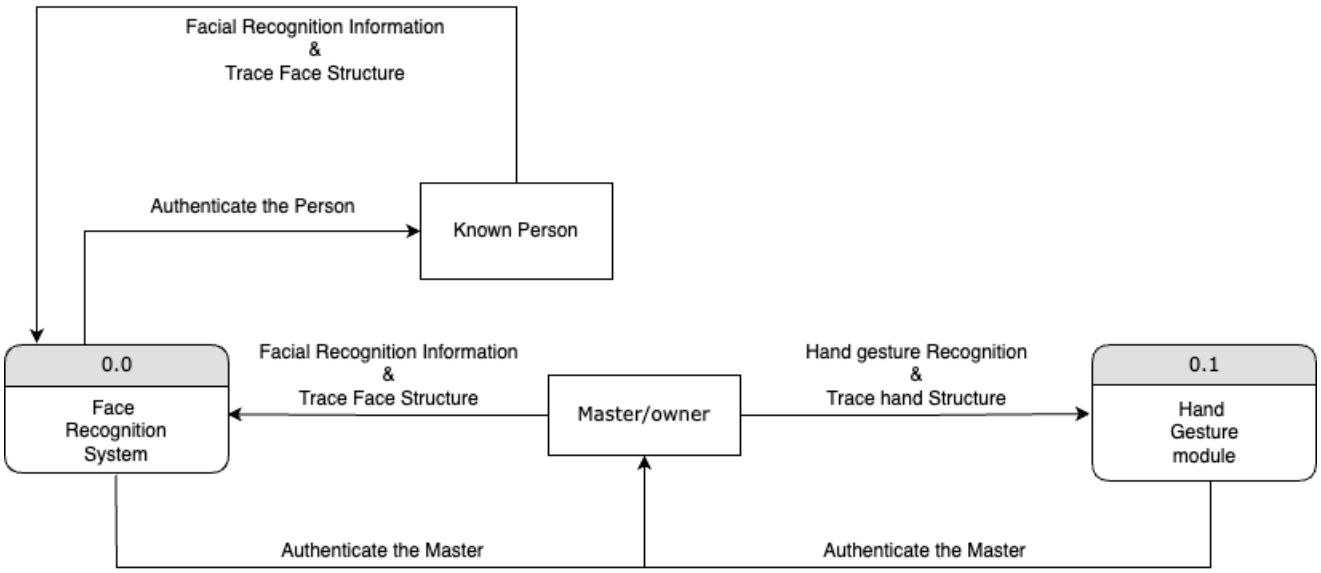
A user will gain entry only upon successful authentication by the system, otherwise, there will be no effect on the lock.

Class Diagram

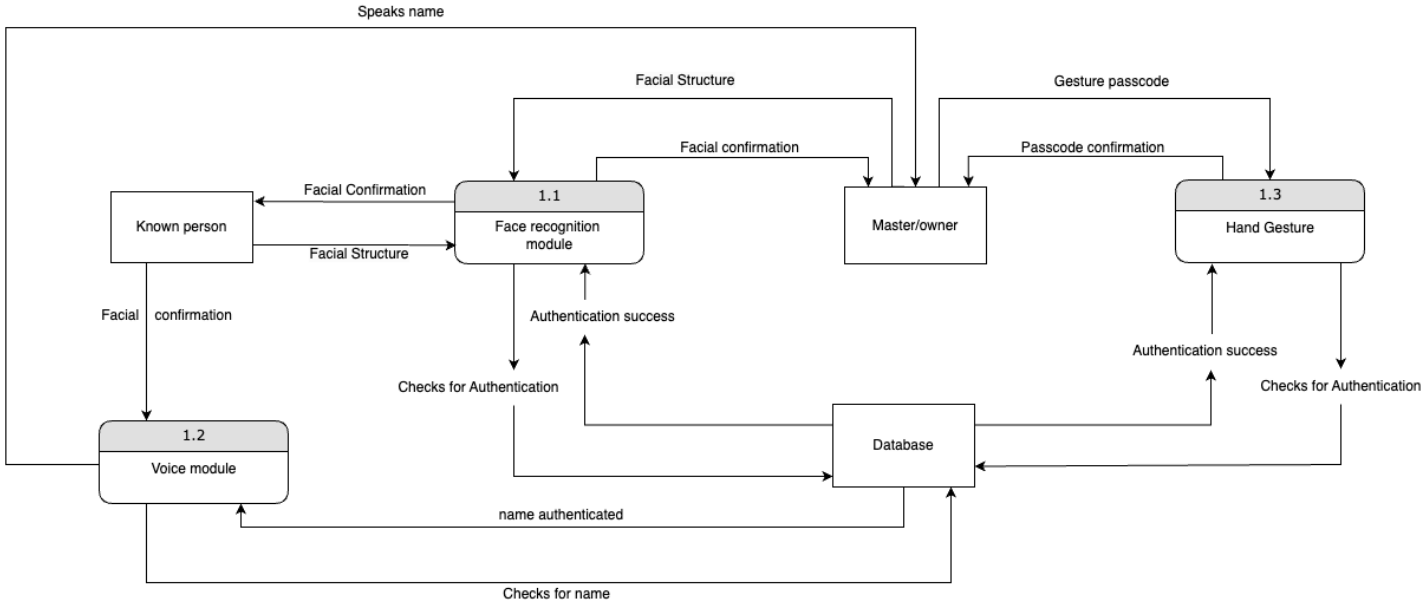


Data Flow Diagrams

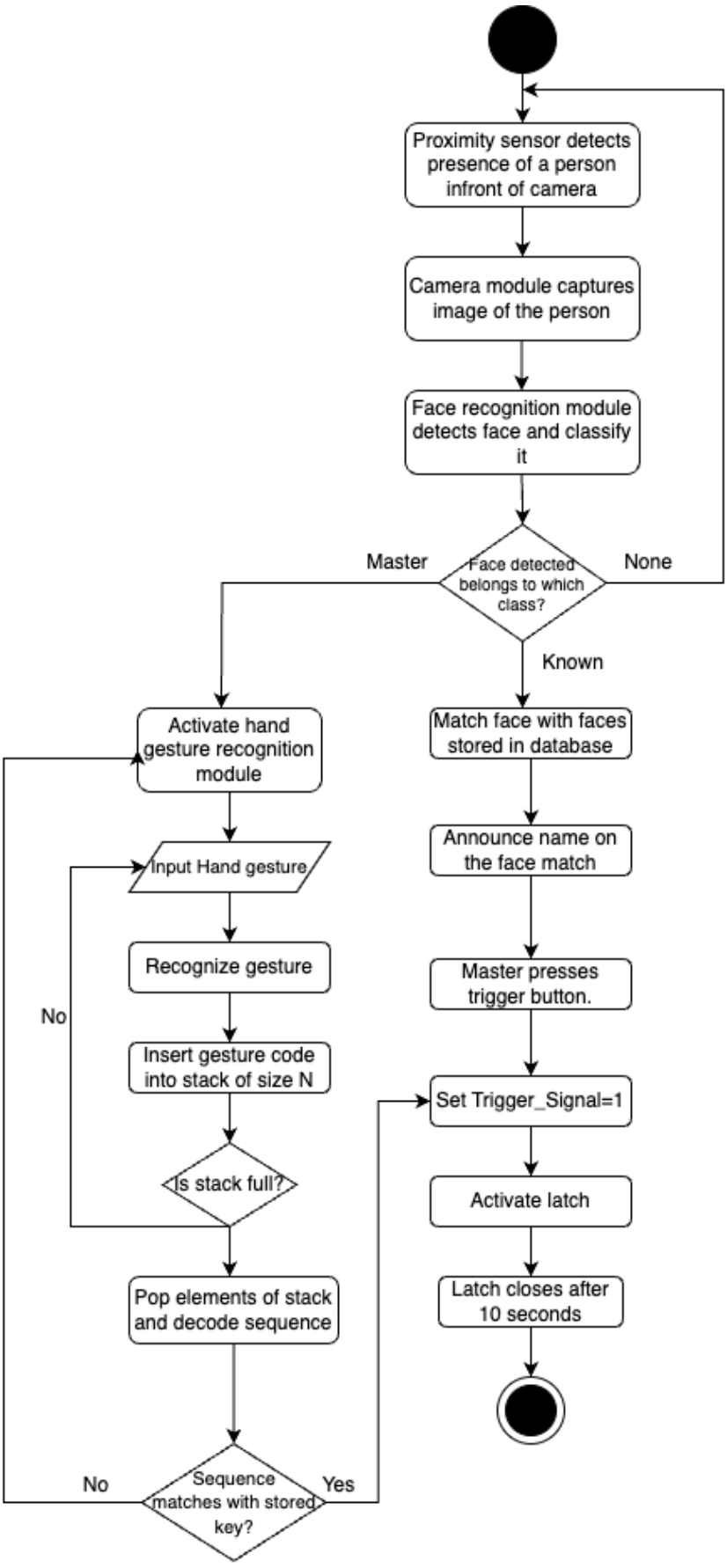
Level 0



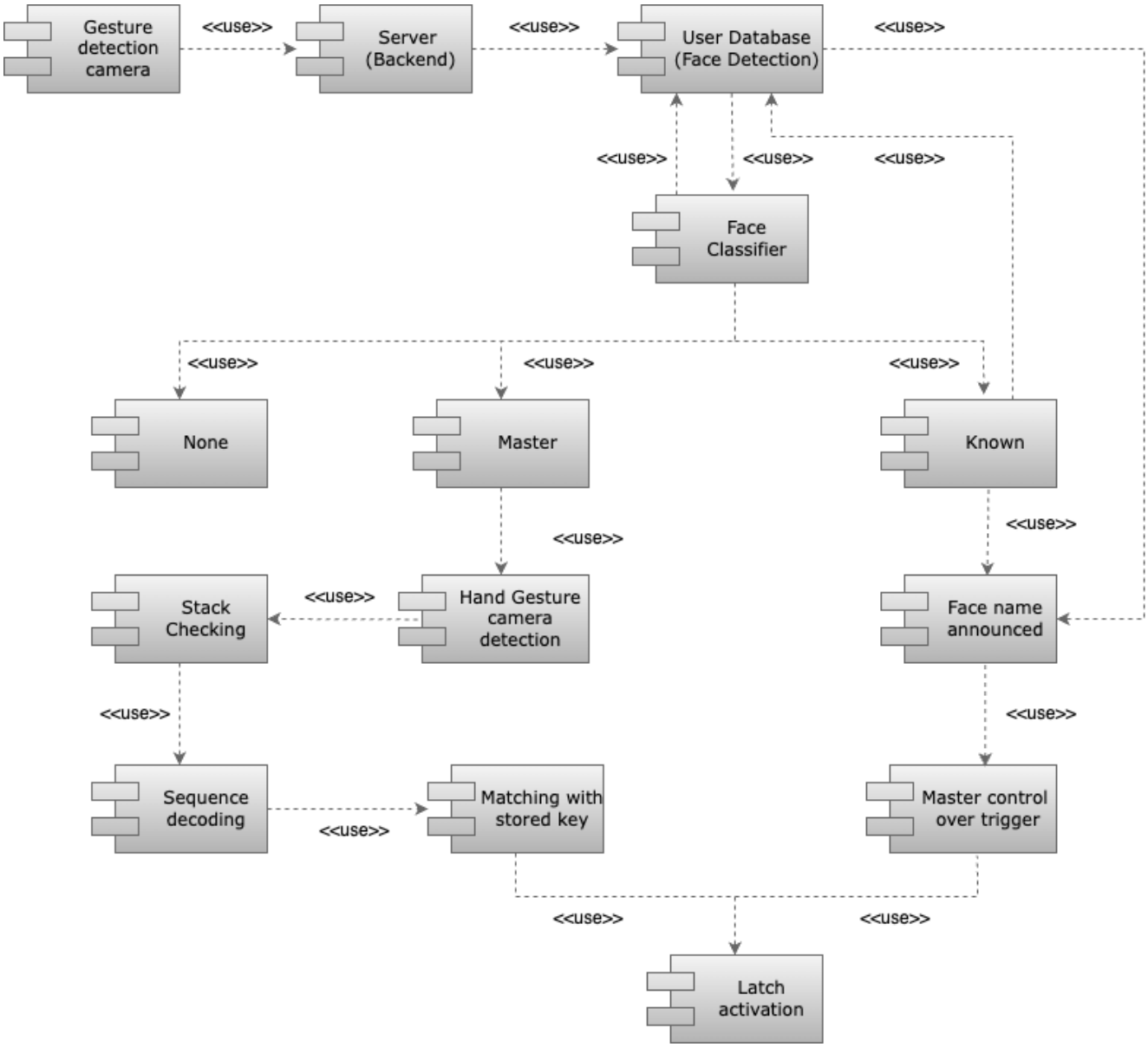
Level 1



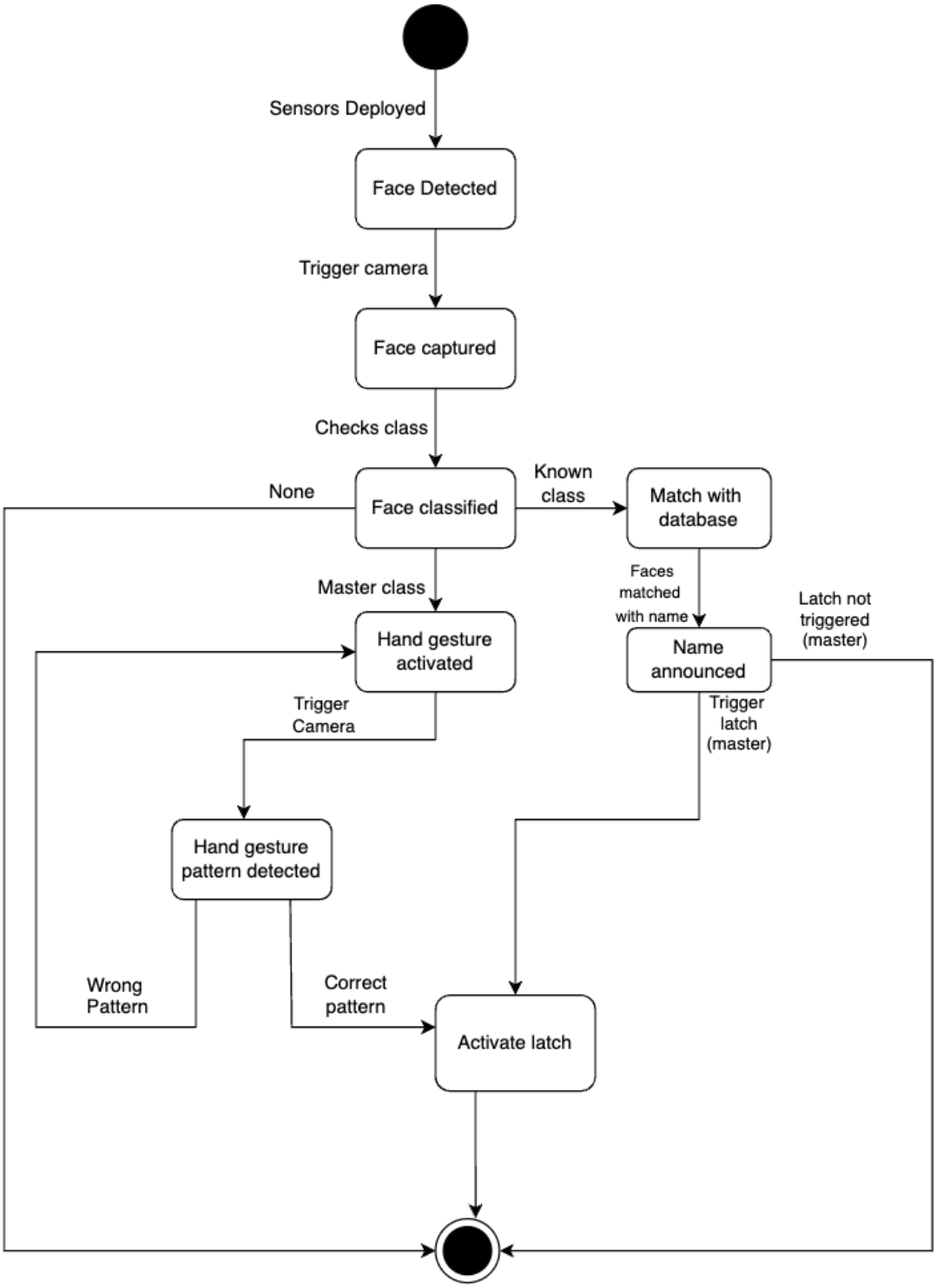
Activity Diagram



Architecture Design -Component Diagram



State Diagram



Cost Analysis

Excluding the cost of raspberry pi which is being provided by the college

Item Name	Cost
Raspi Camera	418
AC DC power Supply Module	600
Electric Latch	500
RF Relay	699
Proximity Sensor	149
Jumper Wires	191
Breadboard	134
5 V 1 Channel Relay Module	50
Buzzer	80
Misc Cost	500
Total	3321