VIETNAM NATIONAL UNIVERSITY, HO CHI MINH CITY
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Multidisciplinary Project

Project

Face Recognition Door Locking System

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Member list & Workload

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1 Overview

One of the applications that is put into reality in this era of industrialization and modernization, and when people's security is now at the forefront, is the smart door. Smart doors are always a comfortable and easy-to-operate choice for security places such as companies, homes, and offices because AI and IoT can be combined for doors. Our team chose this issue because of its practicality as well as the fresh information about AI and IoT that we may gain from it. We know the pros and disadvantages of the problem, as well as how to expand the topic into a larger and better project, in addition to being able to detect problems relating to the topic. In short, this is a very worthwhile project and the results are something to be excited about.

2 Devices

Input devices: Touch button, Temperature sensor, Camera (self-prepared), magnetic switch.

Output devices: Buzzle (speaker for announce), LCD screen for printing status of system.

Device	ID	**Description**
ESP32 Camera	self-prepared	Capture person's face.
Buzzer	2	Speaker to announce .
LCD I2C	3	To display door status (locked or unlocked)
Touch button	5	Push to capture
DHT11	7	It can sense the room's temperature
Magnetic switch	8	It can detect whether the door is locked or not

3 Module

The project is divided into 5 modules:

- Module 1: Receives signal from magnetic switch and image from ESP32 Camera and display the notification in the LCD I2C device.
- Module 2: Process the image that was sent from the camera by using AI model to check if that people is trustful or not.
- Module 3: Microbit send the signal of action to the door.

- Module 4: Sever and Database connect to the devices. There function are storing data that was sent from devices and sending the result back to the admin.
- Module 5: Mobile app that receives feedbacks from Module 4. The administrator can retrieve check in records via Mobile app.

4 Requirement

4.1 Functional Requirement

Image capture module:

- Capture the image and send it to the smart-phone immediately when user pushes on touch button.
- Buzzer signals sound **once** when user pushes on touch button and the LCD screen will announce "Caturing...".
- Buzzer signals sound **twice** and the LCD screen will announce "Hello [User], Welcome home" when detects familiar persons, **3 times** and the LCD screen will announce "Stranger Detected, please recognize again! " when detects strange person.
- Camera automatically stops user from recognition when detects over 10 times (if no familiar face detected).

Server:

- Store user's information: set of images and other usual information(name, age, sex,...).
- Store User's manual (how to use the system).

Application:

- Data management: Users can manage all of data such as user's profile, recognition history.
- Recognition history: Admin can check the access history of all other users.
- The application can run in background's mode.

4.2 Non-Functional Requirement

- Total response time (from starting recognize to action that open the door or not) is not greater than 5s.

- Application can run on Android
- Usability: UI should be easy to use so that users can learn to use in five minutes.
- Security: The system will deactivate automatically if user enter wrong password five times consecutively.
- Recognition accuracy >= 90%
- Server can support and contain 100 users in the database.

5 Use case Diagram

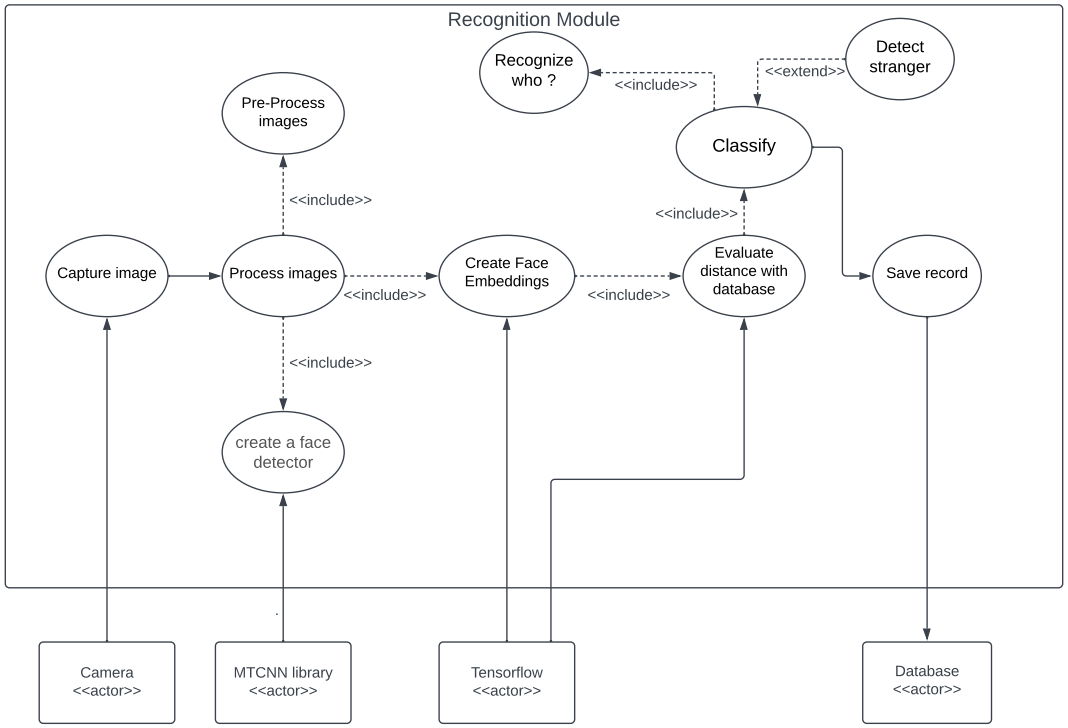

Figure 1: Use case diagram - Face recognition

6 Use case Details

Author	Hoàng Nhật Quang
Use case ID	1
Use case name	Login
Description	This use case allows users to login to the application.
Actor(s)	User
Pre-conditions	None
Post-conditions	Admin/User will be logged in to the application
Normal flow	1. Use case begins when admin/user open the application. 2. The system displays a form for the user to input their login credentials • Username • Password 3. Users clicks on "Login". 4. The system will check with if the details are correct.
Exception flow	Exception 1: Wrong login credentials at step 4. 4a. This module comes back to step 1, user has to input their information again.

Author	Hoàng Nhật Quang
Use case ID	X
Use case name	Logout
Description	This use case allows users to logout to the application.
Actor(s)	User
Pre-conditions	User must be logged in to the application.
Post-conditions	Admin/User will be logged out of the application
Normal flow	1. Use case begins when admin/user clicks on "Logout". 2. The system will move the user session and the user is logged out.
Exception flow	None

Author	Hoàng Nhật Quang
Use case ID	X
Use case name	View profile
Include use case	Login
Extend use case	View profile
Description	This use case allows users to view their information.
Actor(s)	User
Pre-conditions	User must be logged in to the application.
Post-conditions	None
Normal flow	1. Use case begins when admin/user clicks on their profile image. 2. The system displays all information of the user.
Exception flow	None

Author	Hoàng Nhật Quang
Use case ID	X
Use case name	Edit profile
Include use case	None
Extend use case	None
Description	This use case allows users to edit their information.
Actor(s)	User
Pre-conditions	User must be logged in to the application and viewing their information.
Post-conditions	The user's profile will be changed.
Normal flow	1. User click on "Change" button on the right of each information. 2. Users inputs the new information in to the box. 3. Users clicks on "Confirm" button. 4. The system will change the information requested by the user.
Exception flow	Exception 1: At step 3: Users clicks on "Cancel" button. 3a. Use case ends.

Author	Hoàng Nhật Quang
Use case ID	X
Use case name	View trustful people list
Include use case	Login
Extend use case	Edit trustful people list
Description	This use case allows admin to view the list of trustful people.
Actor(s)	Administrator
Pre-conditions	Administrator must be logged in to the application.
Post-conditions	None
Normal flow	1. Administrator click on "Trustful List" button. 2. The system displays the list of all trustful people.
Exception flow	None

Author	Hoàng Nhật Quang
Use case ID	X
Use case name	Edit trustful people list
Include use case	None
Extend use case	None
Description	This use case allows administrator to edit the trustful people list.
Actor(s)	Administrator
Pre-conditions	Admin must be logged in to the application and viewing the list of trustful people.
Post-conditions	The trustful people list will be changed.
Normal flow	1. Administrator click on "Add" button on the end of the list. 2. The system displays a form for the admin to input the new information. 2. Administrator inputs the information of the new face. 3. Administrator clicks on "Confirm" button. 4. The system will add the new face profile.
Exception flow	Exception 1: At step 1: Users clicks on "Delete" button on the right of each profile. 1a. The system displays a warning box. 1b. Administrator clicks on "Confirm" button. 1c. The system will delete the new face profile that requested by the admin.

Author	Nguyễn Minh Hùng
Use case ID	2
Use case name	Face Recognition
Description	Receive image, process and send the result to output devices
Actor(s)	Recognition module
Pre-conditions	Camera is active
Post-conditions	The module send the recognition's result to controlling module corresponding to images captured
Normal flow	1. This module receives images from camera. 2. This module perform image pre-processing. 3. This module creates a face detector. 4. This module creates face embeddings and evaluate distance then classify. 5. This module send result to controlling module.
Exception flow	Exception 1: at step 3, detect missing face. 3a. This module comes back to step 1, user has to capture images again.

Author	Nguyễn Văn Quang
Use case ID	X
Use case name	Check access history
Extend use case	Filter name and date
Description	Allow users to check access history
Actor(s)	Users
Pre-conditions	Users must be logged in the application.
Post-conditions	Users can see the access history or
Normal flow	1. Users choose the history button. 2. User type name or time. 3. Users choose search. 4. The system will display the access history base on time and name
Exception flow	Exception 1: at step 3. system can not find the name in access history 3a. This module comes back to step 2. user has to type the name or leave the box blank.

Author	Nguyễn Văn Quang
Use case ID	X
Use case name	Send and receive data
Include use case	None
Extend use case	None
Description	Input device send data to server and output device receive data from server
Actor(s)	I/O device
Pre-conditions	I/O device and MQTT server must be ready.
Post-conditions	Output device is displayed and data is saved on the database.
Normal flow	1. Input device as camera and magnetic lock send data to MQTT Server. 2. Save data to database. 3. Recognition module analyze data from the server. 4. MQTT send data to output device.
Exception flow	None