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Building A Face Authentication System Using Face API In The Data Center System

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Abstract – In the era of strong development of technology along with artificial intelligence, face recognition algorithms are more and more accurate and widely applied to life. Researchers began to spend a lot of time studying facial recognition technology. The project building a face authentication system using Face API in the data center system is done through research on how Windows 10 IoT Core operating system works on Raspberry Pi 3 and experimenting with the Face API service toolkit for authentication and face recognition. Since then, the project has brought some results with highly practical applications such as bringing problems from theory to practice, specifically the face recognition door system with the accuracy on the physical door system model to be 90%; which makes opening or closing doors more secure; The product can be applied to the company, enterprise: exit and entrance to data center room, machine room, classroom, office...; Apply facial recognition technology to different purposes easily.

Keywords – Artificial intelligence; Raspberry Pi 3; Face API; Physical door system

I. INTRODUCTION

In today's modern society and especially industry 4.0 with the worldwide trend of IoT being increasingly developed, it requires organizations and businesses to gradually transform themselves to be able to integrate and develop [1-3]. A technology product capable of facial recognition will always be a solution that organizations and businesses are interested in.

Facial recognition technology is also the field that is in the trend of the industrial revolution 4.0 [4, 5]. In order to keep up with that trend along with the desire to create a product capable of supporting people in facial recognition and helping the author to access the IoT technology platform, the author has implemented a project called: “Building a face authentication system using Face API in the data center system”.

A. Research objectives

The project is implemented with the following objectives:

- The door system recognizes the user's face.

- Issue a notification when the user authenticates the face in front of the door.

- Integrate alarm software into the door system when intrusion is detected.

B. Research subjects

- Windows 10 IoT Core operating system [6].

- Raspberry Pi 3 [7].

- Security door system.

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- Face API service for face authentication [8, 9].

C. Research Methods

- Research on how Windows 10 IoT Core operating system works on Raspberry Pi 3.

- Researching reports and articles on face recognition methods

- Experimenting with the Face API service toolkit for authentication and face recognition.

II. BUILDING A FACE RECOGNITION DOOR SYSTEM USING FACE API

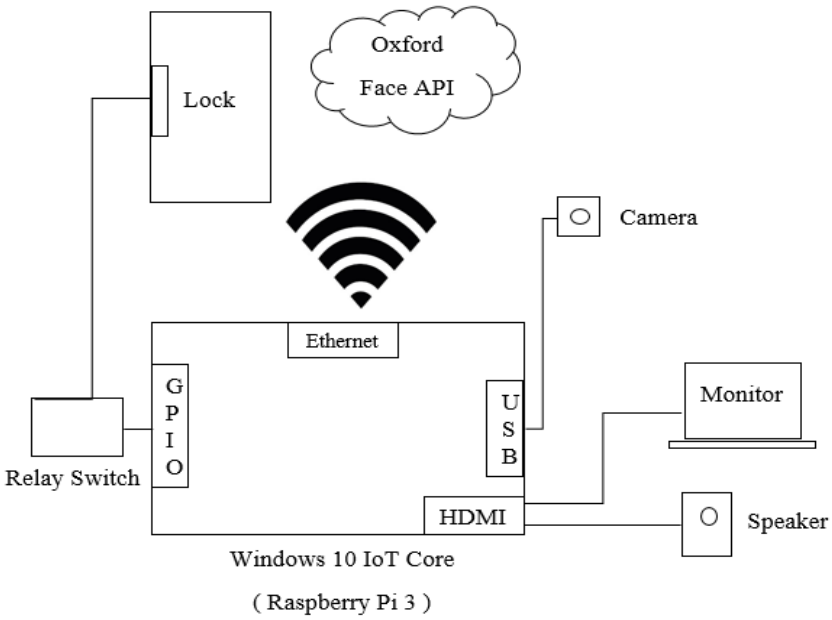

Fig. 1. Diagram of the face recognition door system

Figure 1 shows an overview of the project. The door system has a layout that includes hardware and software.

In the project, the author registers an account on Microsoft Azure [10]. Account registration needs to be confirmed by Visa or Master Card with a balance of at least 1 USD to register to use, after successful confirmation, about 1 week later Microsoft Azure will return the fee of 1 USD.

After registering an account on Microsoft Azure, the author can get a free Face API key indefinitely, the Face API key is linked to the author's Microsoft Azure account and allows access to the Face API Endpoints.

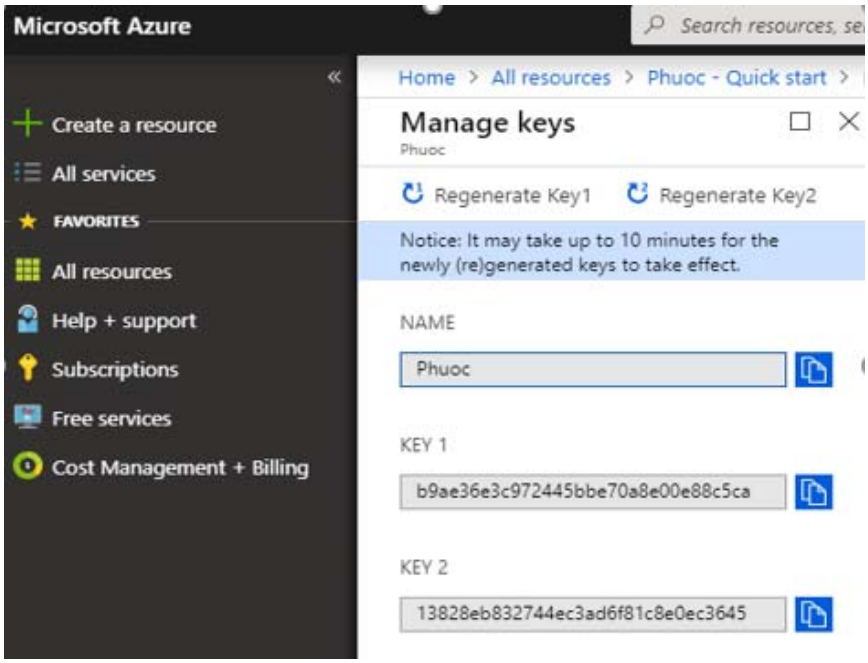

Fig. 2. Key Face API on Microsoft Azure

In addition to the Face API key, there is also an Endpoint which is a link to use the endpoints, which leads to the API documentation page with an input form used to provide required and optional parameters.

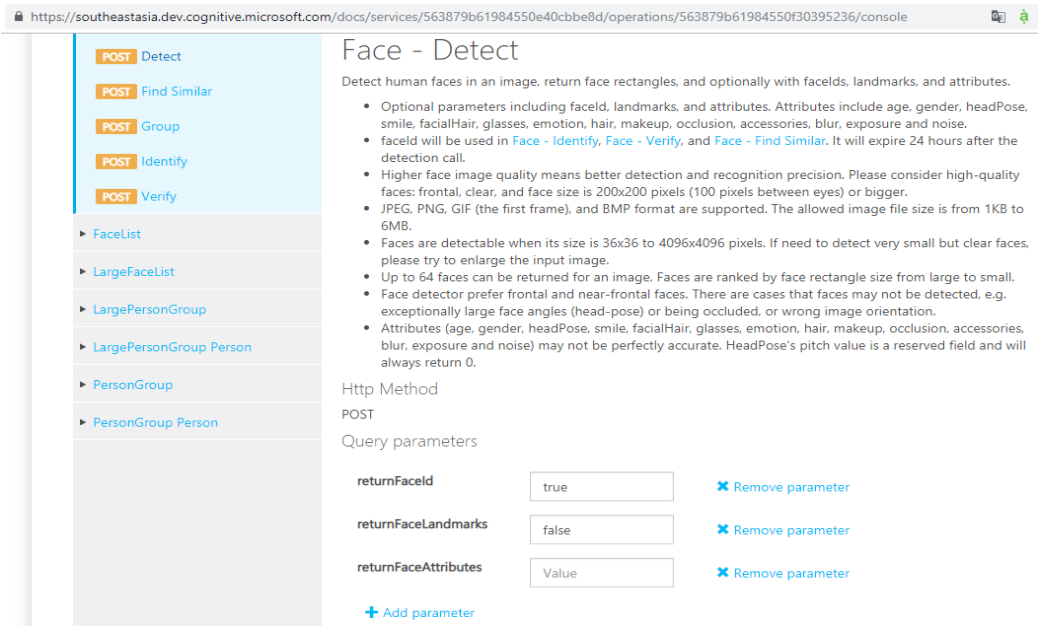

Fig. 3. Endpoint link using the endpoints of Southeast Asia region

With **returnFaceId** (returns Ids of faces), **returnFaceLandmarks** (returns positions of various landmarks on faces), **returnFaceAttributes** (returns attributes on faces). Since the author's door system only needs to recognize faces, the author only needs to return the Ids of the faces.

In the project, because the author created an account on Microsoft Azure and chose the region as Southeast Asia, the endpoint must also be Southeast Asia.

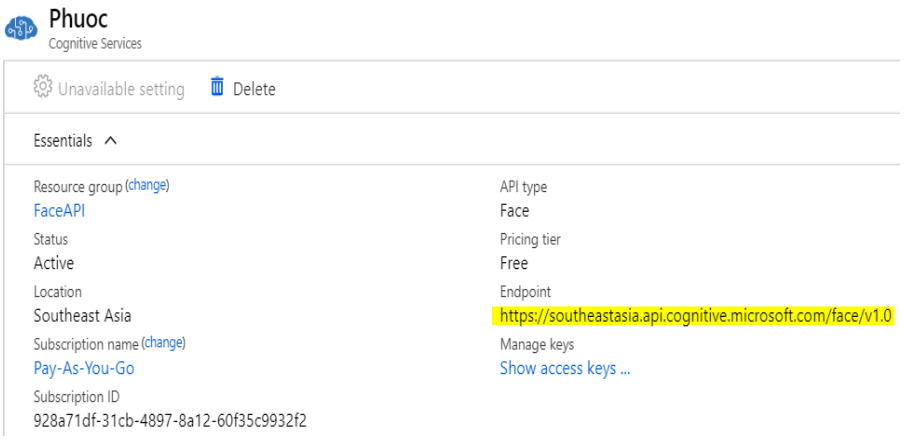

Fig. 4. Endpoint location path when registering

*** Add members to the facial recognition door system:**

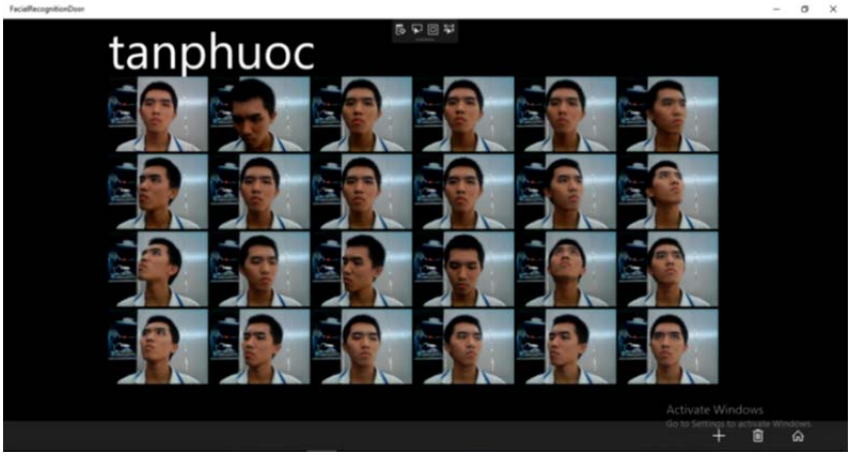

Fig. 5. User image is taken from laptop camera

Fig. 6. Use existing images

When the user recognizes the face in front of the door system, the camera will take a picture of the user and move it to the user folder containing the face image and to the Face API cloud, at which time Face API will match, calculate and process image of the face. Then Face API will return the user's face authentication result, if correct, the door system will announce: **"Welcome you go to Lac Hong University!"** + **Username** + **"! I will open the door for you"** and open the door, if not, the door system will announce: **"Sorry! I don't recognize you. So I am not open the door"** and lock the door.

Thus, the author has built a facial recognition system, from registering an account on Microsoft Azure to get the Face API key, Endpoint, building a face authentication program, and building a program to close/open the door when the system has recognized the user's face.

III. BUILDING A PHYSICAL DOOR SYSTEM FOR FACIAL RECOGNITION

A. Some types of door locks on the market today

* Ordinary mechanical door lock and code door lock [11]:

Ordinary mechanical door locks mainly use the key to open the door. Common types of mechanical door locks such as lever door locks, latch locks, and push locks...

The code door lock uses a numeric password to unlock it.

Fig. 7. Ordinary mechanical door locks (A) and code door locks (B)

* Fingerprint door lock and magnetic card lock [12]:

Fingerprint door locks are a type of lock that uses fingerprints to unlock.

Magnetic card locks are a type of lock that uses a magnetic card to unlock.

Fig. 8. Fingerprint door locks (A) and Magnetic card locks (B)

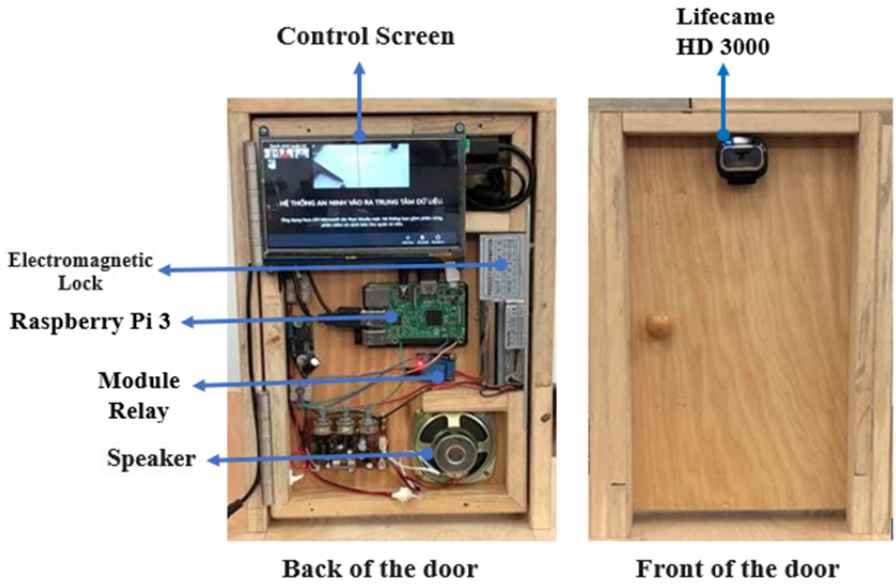

Fig. 9. Model of physical door system for face recognition

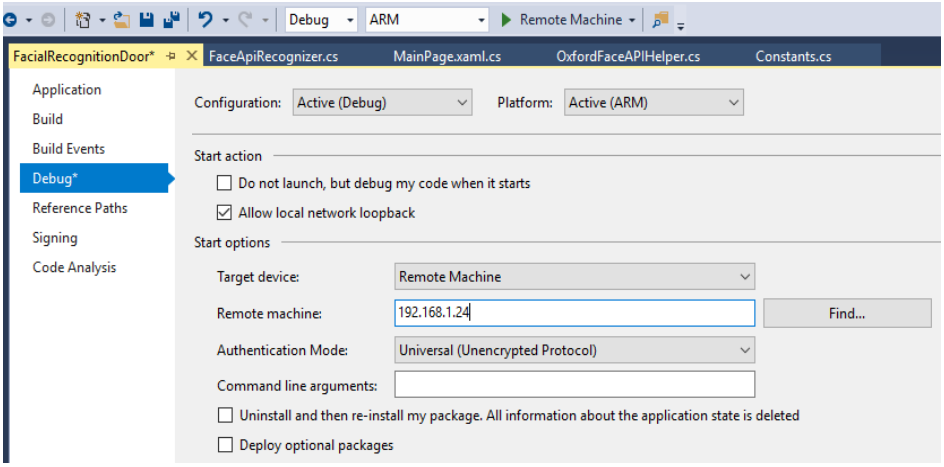

Fig. 10. The Properties interface of the program

B. Accuracy of the physical door system for face recognition

TABLE I. USER DATA INFORMATION IS SAVED IN THE SYSTEM

No.	User name	Number of recognitions	Correct	Incorrect	Correct ratio
1	Hau	10	10	0	10/10
2	Trinh	10	9	1	9/10
3	Khanh	10	9	1	9/10
4	Khu	10	8	2	8/10
5	Phuoc	10	9	1	9/10

From the results of TABLE I, after conducting the test, the author evaluates the accuracy on the physical door system model to be 90%.

Fig. 11. User testing on physical door model

TABLE II. USER DATA INFORMATION IS NOT IN THE SYSTEM

No.	User name	Number of recognitions	Correct	Incorrect	Correct ratio
1	Hieu	10	2	8	2/10
2	Nam	10	2	8	2/10
3	Thuan	10	0	10	0/10

From the results of TABLE II, the author found that the accuracy rate of identifying strangers who are not in the system is 13%.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

After researching the topic “Building a face authentication system using Face API in the data center system”, the author has achieved some results as follows:

- Understand basic specifications of Raspberry Pi 3 Model B+, understand and operate on Windows 10 IoT Core operating system.

- Several methods of collecting user face data from the camera and from the available images have been implemented.

- Applying the results of some articles on face recognition to the project.

- Train user face image data and recognize faces using Microsoft's Face API service.

- After learning the Face API service, the author can give a way to evaluate the accuracy of user face recognition. Based on that, the author can also compare Face API with some other face recognition technologies.

- In the end, the author applied the previous research and created an application product of the Windows 10 IoT Core operating system and the Face API service. It is a model product of a physical door system that recognizes faces.

B. Recommendations

Future development direction:

- Find a solution to integrate more warning software for users when an intrusion is detected on the system.

- Collect more facial images of many people in different time and space to have a large enough face dataset, and delve deeper into the algorithm in Face API to improve accuracy in face recognition.

- Improve the product for greater accuracy in the user's facial recognition.

- The results of the research will be applied to the creation of practical products: placing the face recognition door system in the data center room, classroom, meeting room, ... and other places where it needs to be ensured security.

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