Volume 3, Issue 1 (2022)
e-ISSN: 2716-666X

The Asian Journal of Professional and Business Studies

Please cite this article as:

Zulkifli, M. Z. A., Ahmad, A., Othman, N., & Abd Samad, N. H. (2022). Facial Recognition Smart Security Door. The Asian Journal of Professional & Business Studies, 3(1), 1–14. https://doi.org/10.61688/ajpbs.v3i1.4

FACIAL RECOGNITION SMART SECURITY DOOR

Muhamad Zul Afiq Zulkifli*[1], Ahmad Airuddin[2], Norreha Othman[3], Nor Hafiza Abd Samad[4]

[1,2,3,4]*Kolej Universiti Poly-tech MARA, Malaysia.*

Corresponding author: zlafqzlkifli@gmail.com,
Received 1 April 2022, Accepted 1 June 2022, Available online 30 June 2022

ABSTRACT

A computer lab is a place that offers computer services to a specific population. Normally, colleges and universities give many computer labs to their students. It was an important space for individuals to attend lectures and enhance their computer skills. It often has very valuable computers and items. However, sometimes the security elements of a computer lab for some unauthorised employees may not be up to standard and are easy to break. Hence, the idea is to create an advanced security system named "Smart Security Door Using Facial Recognition" for the computer labs in Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM). The system will have three different users: Admin, Lecturer, and Students. Admin would be able to access the database of the system to register faces of authorized personnel and access the logs of users that access the computer labs. Meanwhile, the lecturer and students would only be able to access the computer labs during lectures. In conclusion, this facial recognition system would help to enhance security and protect the computer labs from thieves or unauthorised personnel.

Keywords: Smart door, Security, Facial recognition, Security

1 INTRODUCTION

It isn't easy to imagine one's life without advanced technology in this world of the modern age. This is because computers have become one of the main facilities for promoting students' learning processes. Computer labs have been configured to support teaching and learning in learning institutes such as Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM). It also has students who enrolled in IT courses offered by the college. Learners can use the software as well as computers to finish coursework tasks and learn new applications. Therefore, it is a must to ensure the design, security, and configuration of computer labs can help students be successful.

The ICT Unit staff of the IT Department are responsible for maintaining and ensuring the condition of each computer lab within a learning institution that has multiple computer labs. These staff are responsible for keeping the data of people who use the computer labs, which are lecturers and students. The data is kept and written down in a logbook before the lecturer can receive the key to the computer lab. This method can cause problems because it is manually kept. It can be lost or cannot be copied or extracted easily. Hence, a system can be developed with a proper database, rather than relying on a manual method. This can surely help to ease the daily work of these staff.

Additionally, each computer lab contains a wealth of valuable hardware and software. A computer laboratory, for instance, has many computers worth thousands of dollars. These are assets that need to be very safe and secure. It also has various software that lecturers and students use for their courses. With better data management and enhanced security measures, a system can be developed.

1.1 Project Background

Technology has become a major necessity for education in the 21st century. The new technology advancement model means computers are on demand throughout educational courses. Lecturers and ICT staff at every learning institute, particularly Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM), face the task of creating a technology solution that makes the most efficient and effective use of the computer hardware available to them. The computer lab will be the center of learning for most students, particularly IT students. However, because of the valuable items stored in computer labs, it can be of interest to some irresponsible individuals to steal them.

This study aims to develop an internal system for Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM) that will enhance security in the college's computer labs. A facial recognition system based on Arduino and MySQL will be developed to achieve this purpose. The development tools were chosen to benefit the system. Additionally, all necessary components of the facial recognition system will be investigated and tested. The observation will reveal if the project meets the user and system requirements that can benefit and be helpful towards the learning institute. The project also focuses on making it convenient for the users.

This system, named "Smart Security Door Using Facial Recognition", will have three different users: Admin, Lecturer, and Students. Each user belongs to a different category, which has distinct functions and authority within the system that are tailored to their needs. The main purpose of this security system is to enhance the security of the computer labs in Kolej Universiti Poly- Tech Mara Kuala Lumpur (KUPTM). It will also consist of features such as a database and alert system.

In Kolej Universiti Poly-Tech Mara Kuala Lumpur, a "Smart Security Door Using Facial Recognition" will be constructed for computer labs (KUPTM). Staff and students are the target users of this system. This project is an additional improvement in security for the college and the management of computer labs. Access to computer labs for staff and students would be much simpler but secure. The main purpose of this system is to enhance the security of all KUPTM computer labs and improve the efficiency and effectiveness of data collected by IT staff. Every lecturer and the selected student will have to register their faces inside the system's database by the admin.

Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM) will use the program's execution as a primary security system. The Genuine Uno and Arduino UNO will be employed in the creation of this proposal. Next, the programming language and platforms used are Arduino IDE, Bolt IoT, and Face++.

User Objective

i) To create a facial recognition security system

This would make it easier and more convenient for users to access the door without needing to collect keys or access cards from the IT Department. Instead, they can use their physical features, such as their face, to obtain authorisation to enter the computer lab.

ii) To create a database for better data management

A database will be created to store all records and data, along with security management, to ease data management. Hence, all recorded data can be easily viewed and copied by authorised personnel. This will surely help to keep the data protected.

iii) To create an alert system for the door

Alert features in voice command will be developed to add more security measures for the computer labs. It can help to alert security guards who are on duty if the computer labs are being trespassed.

2 PROJECT SCOPES

The logical and physical design has been developed to satisfy the functional requirements of the proposed security system. Each user will have access to the system and can view and evaluate their functions.

2.1 Administrator

The administrator, who is the ICT staff of the IT Department, will hold the authority in the system by having access to recorded data. They also have the authority to allow or permit any individual to use computer labs in Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM). Every authorised personnel member's face would have to be registered.

2.2 Lecturer

The lecturers commonly use the computer labs for teaching students in courses that require the use of a computer. The lecturers no longer have to collect keys or fill out the logbook. Instead, they can use their face to access computer labs and proceed to teach.

2.3 Student

Many students in Kolej Universiti Poly-Tech Mara Kuala Lumpur (KUPTM) enrolled in courses under the management of the School of Computing. Therefore, they use computer labs as their platform to gain knowledge from the lecturer. Therefore, their features for this system are the same as the lecturers', and they can only access the computer labs using their faces. However, the only selected student who will be added to the system is the class representative.

The "Smart Security Door Using Facial Recognition" only allows the Administrator to access the system internally because only Admin holds the authority to allow or permit any personnel to use the computer labs. However, other users such as lecturers and students will have access to the system on the Guest Page, which is to verifying their faces to unlock the door.

3 METHODOLOGY

The Software Development Life Cycle (SDLC) approach is used to design the system, which consists of six steps in which a prototype is developed, evaluated, and then changed as required until a satisfactory prototype is produced. It will also serve as a foundation for the final solution.

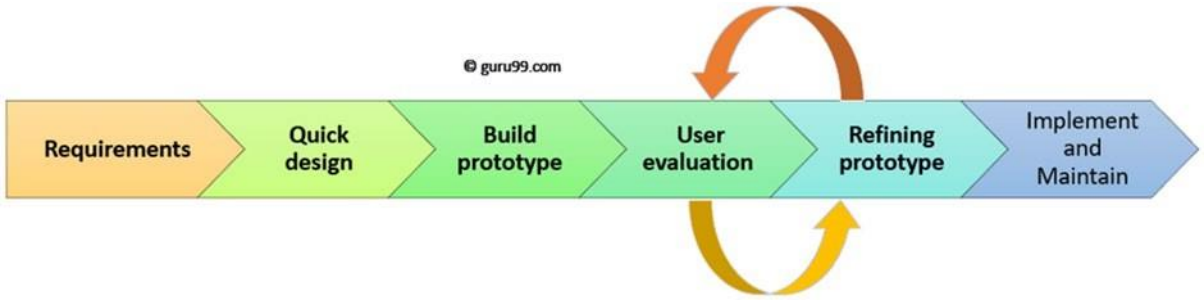

Figure 1: Model of the systems development life cycle

A model for prototyping starts with an analysis of requirements. In this phase, the system's needs are described in depth. Throughout the procedure, system users are asked to share their aspirations for the system. Additionally, questionnaires were distributed to KUPTM staff and students to gather relevant information for this project. The project's development should be based on user requirements. To compare user preferences between the current system and the proposed system, the results of the questionnaires will be used. Next, the second phase of SDLC

An initial design, sometimes known as a "Quick Design," is the second phase. During this phase, a basic system design is produced. It is, nevertheless, not a finished design. Instead, it provides the user with a quick overview of the system, the quick design aids in the development of the prototype in the subsequent phase.

In the third phase, a real prototype is created by relying upon the knowledge gathered during quick design. It's a scaled-down version of the system that is needed. The prototype would next be put through its first user evaluation in SDLC's fourth phase. As a result, the suggested system is offered to the user for an initial assessment. It aids in deciding the operating model's resilience and fragility. The user provides comments and ideas which are forwarded to the developer. When the user is dissatisfied with the existing prototype, the fifth stage of the SDLC, Refining Prototype, comes into play; you must improve the prototype based on the customer's input and ideas. This phase will not be completed until all of the user's needs have been satisfied. Once the user is satisfied with the developed prototype, a final system is built in line with the accepted final prototype.

3.1 Hardware Requirements

All the physical part of a computer is hardware and technology which provides mechanical instructions for performing tasks. In addition, each computer requires certain hardware or other software assets components to be present on a system for successful use. Hence, in the completion of Smart Security Door Using Facial Recognition, hardware plays a vital part in the main features.

Figure 2: Arduino UNO rev3 microcontroller board

3.1.1 Arduino UNO

The Arduino Uno is an open-source microcontroller board designed by Arduino.Inc. and based on the Microchip ATmega328P microprocessor. The board has a number of analog and digital output/input pins that can be used to connect to expansion boards and other devices. The board contains 14 digital I/O pins (six of which can generate PWM output) and 6 analog I/O pins. It can be programmed using the Arduino IDE (Integrated Development Environment) through a type B USB cable. It supports voltages ranging from 7 and 20 volts and can be driven by a USB cable or an external 9-volt battery.

Figure 3: HP Pavilion 15-bc008tx laptop

3.1.2 HP Pavilion 15-bc008tx

The HP Pavilion 15-bc008TX is among the top laptops for entry-level gaming that we have reviewed this year. In almost every mission, it performs well. The laptop kept playable frame rates for nearly all the titles we played while playing. However, because the GTX960 is an entry-level gaming GPU, you may need to decrease the graphics for certain challenging players. However, this laptop will act as a platform to un the system. In addition, the laptop's webcam will be used to scan and authorize faces that have been registered to the system.

Figure 4: Image of type A to type USB cable

3.1.3 Type A male to type B female USB cable

This USB cable will link the Arduino UNO to the computer, allowing it to be configured and coded as needed for the project's completion.

3.2 Software Requirements

Specification of computer requirements is a comprehensive evaluation of specifications prior to the more complex phases of system design, and its purpose is to minimize subsequent redesign. It should also provide a rational basis for calculating the prices, risks, and timetables of the material. Used properly, specifications for software requirements can help prevent failure of the design.

Figure 5: Arduino logo

3.2.1 Arduino IDE

The Arduino Integrated Development Environment is a cross-platform application written in C and C++ functions. It is applied to create and upload programs to Arduino-compatible boards, as well as other product development boards that enable 3rd party cores support. This Arduino IDE is required because configuring using the Arduino UNO as specified on the hardware requirement.

Figure 6: Bolt IoT logo

3.2.2 Bolt IoT

Bolt IoT platform gives the capability to control devices computers, laptops, or phones and collect data from IoT devices such as Arduino UNO safely and secured.

3.3 System Design

3.3.1 Main Page / Login Page

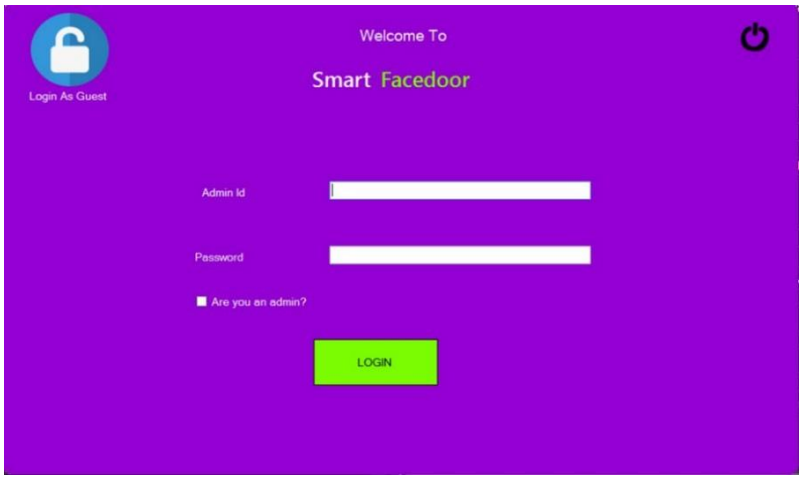

Figure 7: Screenshot of Main Page/Login Page

This is the login form and the main page for “Smart Security Door Using Facial Recognition”. It is automatically open and ready for Admin login. However, on the top left of the page, there is a button for another user (Lecturer & Student) to access the system. Next, on the top right of the page, a button is placed functional to shut down the system.

3.3.2 Login

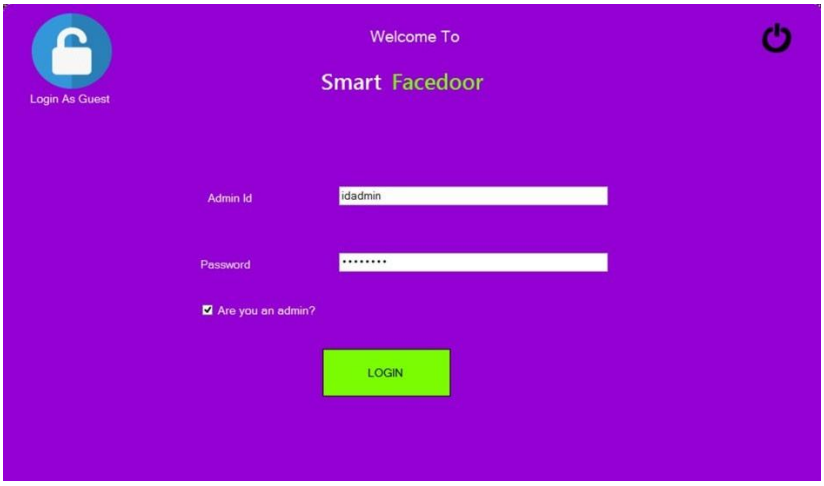

Figure 8: Screenshot of the login page

Admin ID: idadmin
Password for Admin: admin123
Tick the checkbox to make sure that the user login as Administrator.

3.3.3 Login Successful/Error

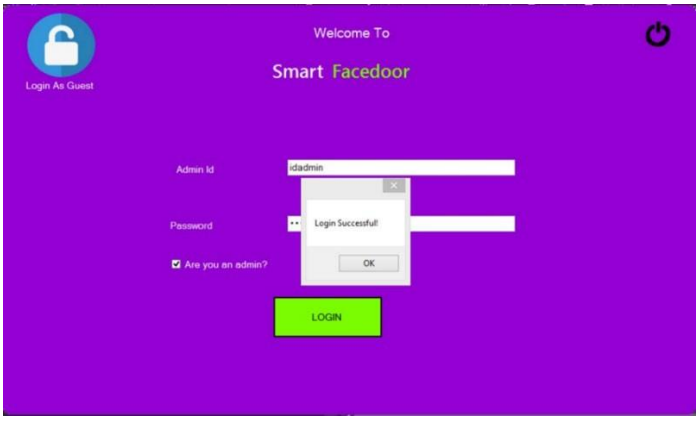

Figure 9: Screenshot of smart facedoor successful login

A message box 'Login Successful!' will appear if the login succeeds.

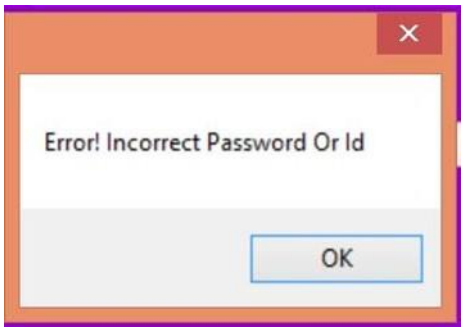

Figure 10: Screenshot of error and incorrect password or ID

This alert will appear if login failed, as well as incorrect Password or Admin ID

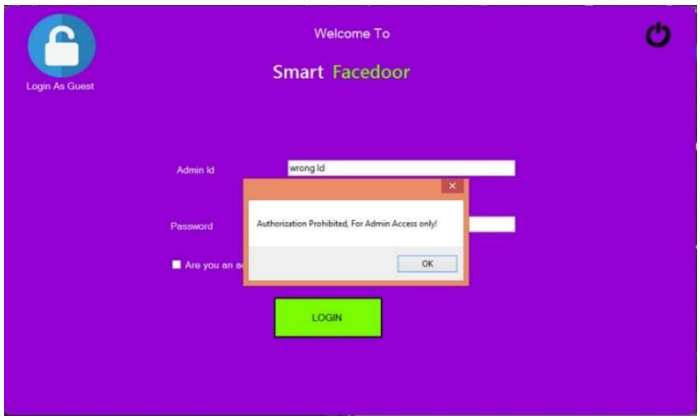

Figure 11: Screenshot of authentication failed

This message box will appear if Admin does not tick the checkbox.

3.4 Admin Page & Guest Page

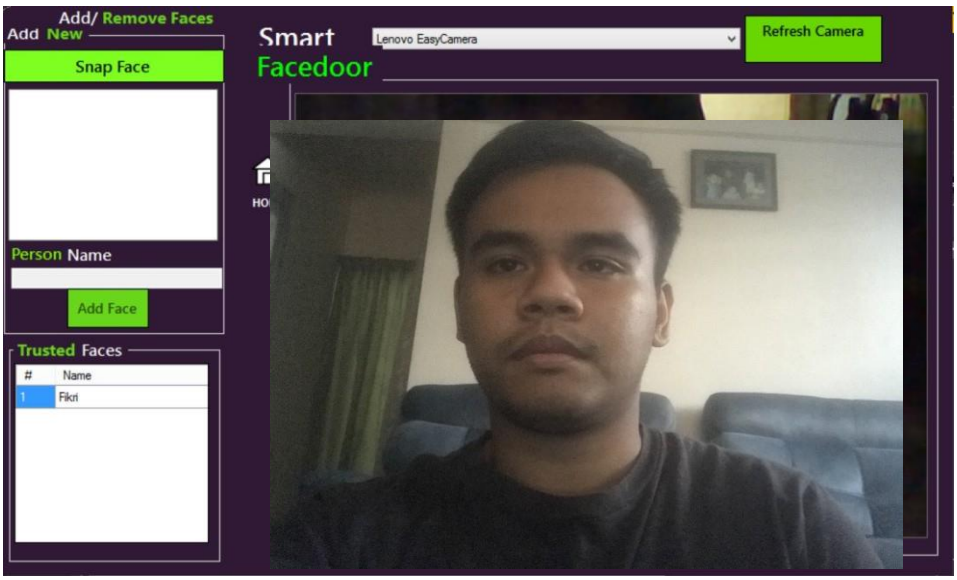

Figure 12: Admin page

Admin can add a face or remove lecturers and students by using the facial recognition system in this Admin Page. Only Admin has the authority to do this.

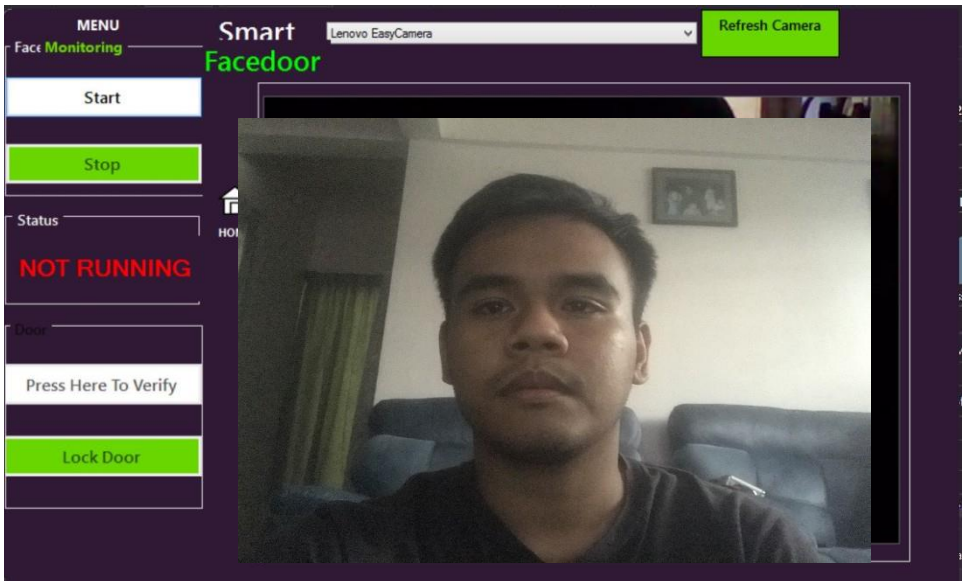

Figure 13: Guest page

This is the Guest Page, where registered faces can be verified to unlock the door and enter the computer lab. All of the authorized personnel faces are stored in the Admin's page database.

3.4.1 Run System (Standby Mode)

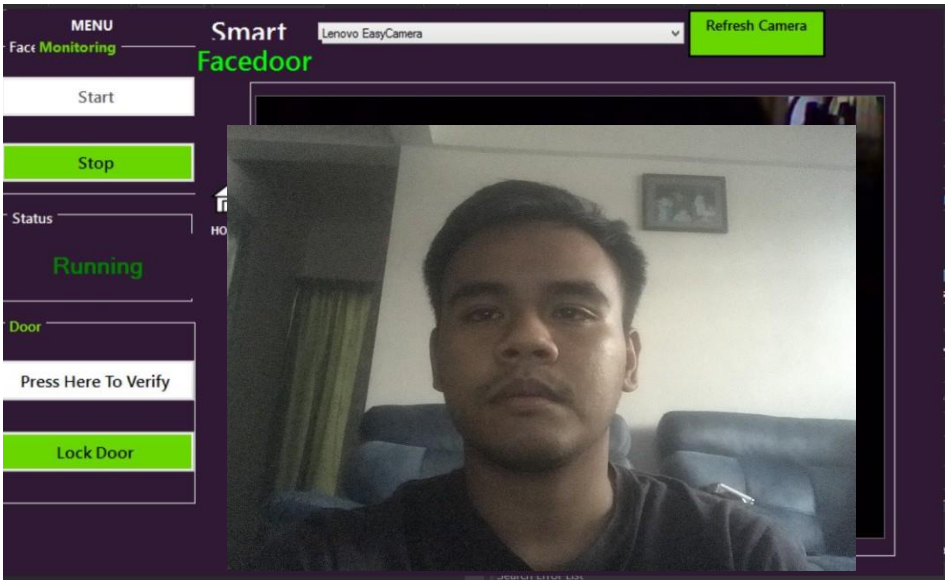

Figure 14: Standby mode

To put the facial recognition system in standby mode, a user simply needs to click on the **Start** button to launch into standby mode; the status will show "**Running",** ready to capture a face.

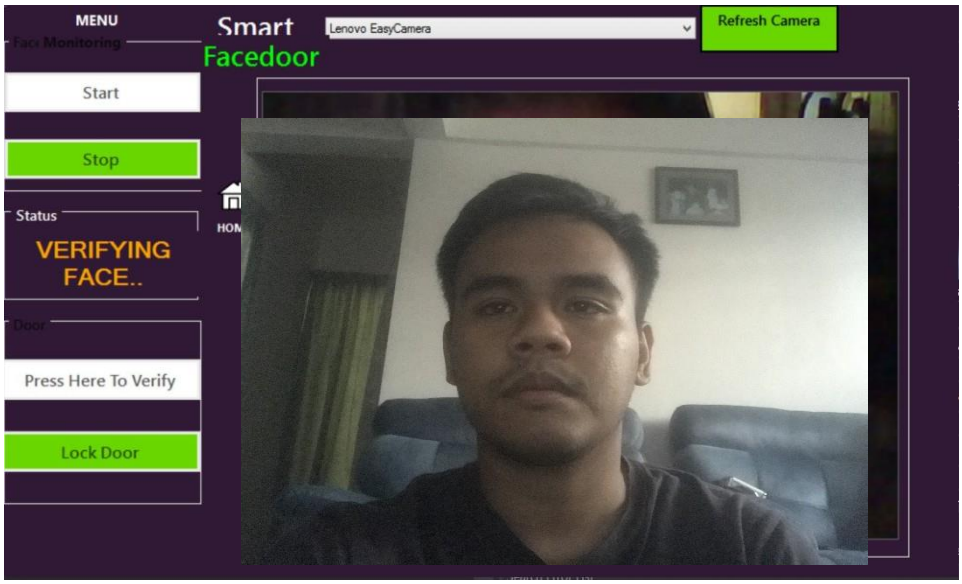

Figure 15: Verifying face

To unlock the door and enter the computer lab, the user needs to click on the button "**Press Here to Verify**" to verify a face, and the status will show "**Verifying Face...**"

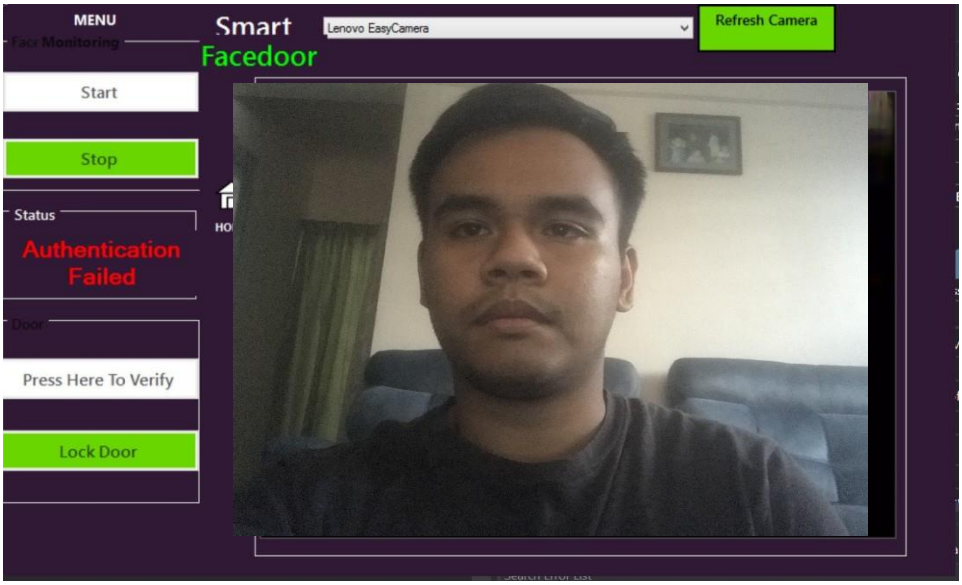

Figure 16: Authentication failed

Suppose an unauthorized face tries to access/unlock the door and enter the computer lab. In that case, the system will give an alert by automated voice command asking to step away from the door and show an "**Authentication Failed**" status on the page.

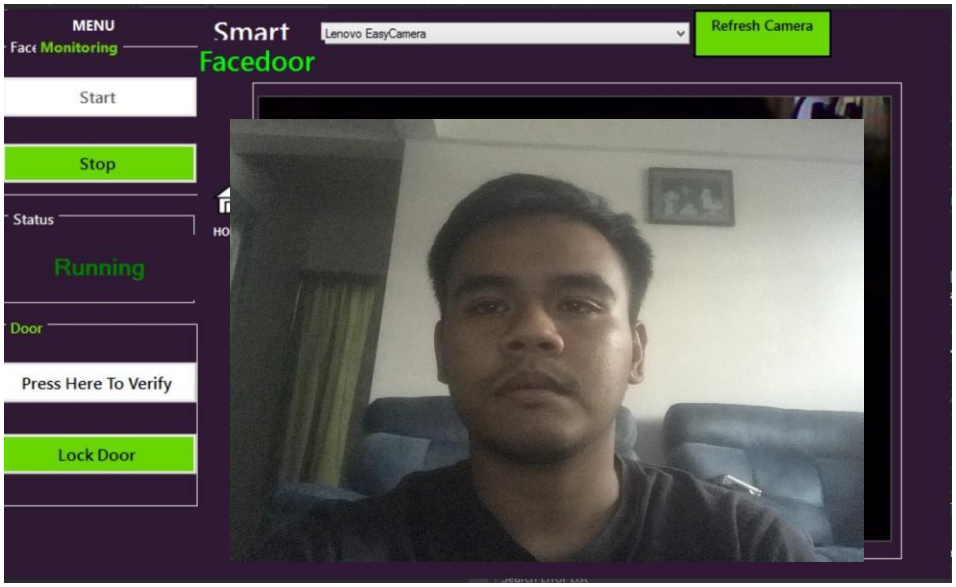

Figure 17: Authorized user manage to access

If authorized user access manages to access/unlock the door and enter the computer lab, the system will welcome the user by automated voice command and open the door lock. Once you enter, don't forget to click on "**Lock Door**" for security measures.

4 CONCLUSION

The project must relate to the techniques and processes needed in establishing a new information system or improving a current system to satisfy increasing user demands to finish the Smart Security Door Using Facial Recognition. Lastly, the design of the project necessitates identifying and conducting a detailed investigation in order to comprehend the issue with the current system. Therefore, the methodology chosen is the Software Prototyping Model, which consists of analysis, quick design, building a prototype, evaluation, refining the prototype, implementation, and maintenance.

However, those steps are necessary to fulfil all the users' requirements. It has been helpful from the beginning of this project's development, which will be used by KUPTM staff, lecturers, and students. The user must be satisfied with the system development, which will be completed within the given time frame, and all the users' requirements for this system must be met.

Other than that, a developer must know how to use the time given and learn how to adopt all the steps that will be used. The developer is required to communicate with their supervisor, which is the best methodology for developing their project. The developer is also required to communicate with the users, specifically with the KUPTM lecturers and students, to know the problems and what needs to be achieved.

In a nutshell, the "Smart Security Door Using Facial Recognition" can contribute to the improvement of security in computer labs at academic institutions, especially KUPTM. This project is still available for future enhancements. Additionally, the system development may need to be adjusted in the future to accommodate further aspects of the system's operations. As a result, the progression of this system will be monitored to optimise it.

5 ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Kolej Universiti Poly-Tech MARA for providing the resources and support necessary to complete this study. We would also like to thank all participants who contributed their time and insights to this research. Special appreciation is extended to colleagues and peers who offered valuable feedback during the development of this manuscript.

REFERENCES

Gunawan, T. S., Gani, M. H. H., Abdul Rahman, F. D., & Kartiwi, M. (2017). Development of face recognition on Raspberry Pi for security enhancement of smart home system. *Indonesian Journal of Electrical Engineering and Informatics (IJEEI), 5*(4), 317–325. https://doi.org/10.11591/ijeei.v5i4.361

Kak, S. F., Mustafa, F. M., & Valente, P. (2018). A review of person recognition based on face model. *Eurasian Journal of Science & Engineering, 4*(1), 157–168. https://doi.org/10.23918/eajse.v4i1sip157

Mathew, D. (2020). *Smart door with face unlock @Apache-2.0* [Online]. https://create.arduino.cc/projecthub/divinsmathew/smart-door-with-face-unlock-273e06

Wikipedia. (2021, September 29). *Arduino Uno* [Online]. https://en.wikipedia.org/wiki/Arduino_Uno