English Section

A proposed Attendance Check System in the smart academic library Based on Deep Learning Face Recognition

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Abstract: The attendance check system is becoming a more challenging task in the real-time system. The process of checking the attendance of the candidates in huge halls is difficult, as they can contain large numbers of attendees. Many attendance management systems have been applied to the topic. However, the traditional attendance management systems still have various issues which motivate researchers to improve the attendance management systems. This paper presents the detailed implementation and application of the new attendance management system in academic libraries through the use of deep learning face-recognition technology and computer vision to address the drawbacks of traditional attendance check methods. The main idea of the system relies on a well-experienced module through the use of machine learning, a pre-trained model, and a database that contributes to the system's ability to identify the attendees and log in their names, identifications, dates, and times. The study relied on an experimental approach to help determine the extent of the ability of the proposed system to register beneficiaries' entry into the library efficiently and accurately without any problems occurring. The findings and experimental results show that the proposed system is accurate, fast, reliable and able to recognize up to four faces simultaneously without any technical issues. From the results of the proposed system's accuracy test, it was found that the accuracy of attendance checks when recognizing only one face of a beneficiary was 100%. The accuracy of the attendance checks when recognizing the beneficiary with or without a cap on the head was 100%. The accuracy of attendance checks when recognizing two faces at one time was 100%. The accuracy of attendance checks when recognizing four faces together at one time was 100%. The accuracy of the attendance checks when the beneficiary is facing forward was 100%. The attendance checks' accuracy when the beneficiary faces sideways is 95%. The accuracy of the attendance checks when the beneficiary is facing down is 100%, and when the beneficiary is facing up is 100%. Furthermore, the proposed system does not necessitate any expensive settings, the matter which makes it an appropriate choice for various educational institutions. The study suggests further future research to improve the efficiency of the proposed system, in addition to work on integrating the proposed access system with the automated system applied in the library, which contains a complete database of students and faculty members. This will contribute to producing reports through which various statistics can be obtained to analyze the library's performance, and to know the reasons for users' visits and the books they frequently read.

Keywords: Attendance Management; Smart Academic Library; Face Recognition; Deep Learning; Haar Cascade Classifier; VGG Model.

1. Introduction

Artificial Intelligence (AI) and other emerging technologies provide new methods and tools that can revolutionize the industrial and public sectors. The American Library Association has identified several technological trends that could have a potential impact on library services and functions, including AI, machine learning, blockchain, drones, cloud computing, big data, the Internet of Things, virtual reality and face recognition (Yoon et al, 2022), which enable libraries of all kinds to accomplish the required tasks, especially academic libraries. Among the activities and tasks of the library, is the attendance check of the beneficiaries of the library (Alias et al, 2022). All kinds of libraries rely on recording the identification information of various beneficiaries in a traditional method through the use of frequented people pads, and records. Others may use manual registration methods in dealing with frequent people on the machine's automated system. Such traditional methods are time-consuming, unreliable, and do not suit the large numbers visiting the library. To solve the issues associated with traditional attendance check methods, different types of automated attendance systems have been developed using different technologies. In this regard, face recognition techniques remain the most important technique that can help to solve this issue. Recent technological advancements have led to the recognition of human characteristics called "Biometrics" and adapted it to effectively recognize personal identities (al_galib et al, 2020). The term "Biometrics" refers to the identification or verification of a person based on their unique physiological, behavioral and morphological attributes (Wang et al, 2019). Biometric methods have been in continuous variation throughout time. Biometrics itself was essentially designed to identify people's distinctive features, including, but not limited to, their body features (i.e., height, weight, width, skin color, eye color, etc.). However, biometrics currently depends on fingerprints, facial features, handwriting styles, and hand geometry, not to mention voice, veins, retina, and iris scans (Shopon et al, 2021). However, the main issue of authentication systems pertaining to fingerprints, voice, iris, and DNA, is in the data acquisition process itself. During the image-capturing process, these characteristics necessitate the existence of special conditions and settings. On the other hand, acquiring a human face image is non-overlapping. Therefore, the face is the most acceptable and common biometric in recent authentication systems (Zhuang et al, 2020).

Technological developments, especially in AI and computer vision in facial recognition, create new solutions to detect someone's presence. Facial recognition technology is a safe system and is difficult to fake because the face is also a biometric sign, so it varies from person to person. Facial recognition can livelily identify many attendees at once without having to make direct contact. The two major phases of the general facial recognition process are (1) face detection and alignment and (2) feature extraction and matching. Therefore, there are two forms of face recognition applications:

1. Face verification/authentication process in which a query face image is compared with a single template of the face image (Bhattarai et al, 2022).
2. Face identification/recognition process in which a query face image is compared with a set of templates of face images sorted in the database (Bhattarai et al, 2022).

Accordingly, the methods which are used in face recognition can be sub-categorized into (1) template matching methods, (2) statistical methods, and (3) neural network methods (Xiang, 2022).

The objectives of this paper are (1) to develop a smart attendance system capable of attendance checks automatically using facial recognition technology, and (2) to analyze the accuracy of the attendance system with facial recognition technology in automatic attendance checks of the academic library.

The rest of the paper is organized as follows. Section 2 highlights the contribution of the paper. Section 3 presents a literature review. Section 4 discusses the problem statement and the objectives. Section 5 discusses Methodology**.** The technical details of the proposed system are described in Section 6. The experimental results and discussion are presented in Sections 7 and 8. Finally, Section 9 concludes the findings of the paper.

2. The Contribution of this Paper

The significance of this paper relies on the fact that it seeks to overcome the problems that libraries including academic ones suffer from about logging in to their visitors. Libraries in Egypt and the Arab world still rely either on traditional methods or on automated systems for logging in. Both methods consume time and effort to fulfil the necessary procedures. Therefore, this paper proposes the application of face recognition technology to help overcome these problems, which will encourage beneficiaries to visit the library and benefit from its multiple services. Additionally, this paper applies the VGG-16 model, which is one of the most popular pre-trained models for image classification. In comparison to other related works (Mansoora et al, 2021), (Nurkhamid et al, 2020), (Prangchumpol, 2019), the proposed model shows distinctive better performance characterized by high accuracy of attendance checks as follows. It was found that the accuracy of attendance checks when recognizing only one face of a beneficiary was 100%. The accuracy of the attendance checks when recognizing the beneficiary with or without a cap on the head was 100%. The accuracy of attendance checks when recognizing two faces at one time was 100%. The accuracy of attendance checks when recognizing four faces together at one time was 100%. The accuracy of the attendance checks when the beneficiary is facing forward was 100%. The attendance checks' accuracy when the beneficiary faces sideways is 95%. The accuracy of the attendance checks when the beneficiary is facing down is 100%, and when the beneficiary is facing up is 100%. It is also very quick, a resource-saver, and capable of recognizing multiple faces at the same time without facing any problems. Unlike some models used in previous studies, face recognition technology such as Linear binary histogram (LBH) was applied. This particular technology operates in real-time and depends on detecting and comparing at the same time, which usually consumes huge resources. In the case of multiple faces simultaneously, it would need much higher capabilities to recognize them, and hence it needs much more time. In addition, it is less accurate and less quick than the VGG which makes the matter superior to other models.

3. Literature Review

Many studies have examined the method of using facial recognition technology to record attendance, as follows:

The study by Xiaoli Huan, Hong Zhou relied on the HOG (Histogram of Oriented Gradient) algorithm to overcome the problem of the employee's/students' manual attendance marking system, which faces many problems and takes a lot of time. The study concluded that the proposed attendance management system using Cloud computing and face recognition technology is a low-cost and easy-to-implement system that generates face recognition results in CSV records without the need to install bundled programs, but it was not clear through the study the degree of accuracy of the proposed system in recognizing faces while looking up, down and up. aspects as were done in the current study (Huan & Zhou, 2021).

Qingdong Liang, Wenting Fang note that the efficiency of checking attendance by manual registration is not always satisfactory and is a source of inconvenience to the entire educational field. So, they used the Deep semi-NMF algorithm to create a system that addresses this matter, and the results showed that the proposed system using face recognition technology is effective, easy, simple and comfortable, and contributes to improving the efficiency of teaching (Liang & Fang, 2018).

Syed Mansoora, Giribabu Sadineni, Shaik Heena Kauser pointed out that Checking attendance in classrooms by traditional methods takes a long time, especially when it comes to open meetings, and it is also an insecure method of logging in, as it is easy to commit fraud. So, they used the FaceNet 128 algorithm to come up with a system that addresses this matter, and the study concluded that the results of the experiment with the proposed system for registering attendance using face recognition technology were positive, and the accuracy of the system reached 95% as long as the conditions for capturing the image were constant such as (light, face distance, and expression). The students also indicated, after polling their opinions about the system, that it is effective and that they like it (Mansoora et al, 2021).

Setialana Nurkhamid, Pradana Setialana, Handaru Jati, Ratna Wardani, Yuniar Indrihapsari, Norita Md Norwawi emphasized that recording the student's attendance manually in lectures is an inefficient method and leads to reducing the time of the lectures because it is done repeatedly in each meeting, Other technologies that researchers are trying to overcome the problems of manual registration, such as fingerprints, IoT devices, RFID-enabled cards, QR codes, and smartphones, are hardware-intensive and can also be costly. The researchers relied on the HOG (Histogram of Oriented Gradient) algorithm to come up with a system that addresses these problems, and the study concluded that The proposed smart attendance recording system using face recognition technology can recognize many people at the same time, and the accuracy of the system is 81.25%, provided that the student is facing forward, 75.00% in the case of the student facing the side, and 43.75% in the case of the student facing downward (Nurkhamid et al, 2020).

Dulyawit Prangchumpol also noted that the method of manual registration of student attendance wastes teaching time, and sometimes there is an error in verification, such as the teacher forgetting to check some students, students not hearing their names, or skipping the name given. He relied on the Android face recognition algorithm to design a proposed system for recording attendance, and the study concluded that the proposed system for recording attendance based on the OPEN CV library and cloud storage of data depends on the Android face recognition technology with deep learning, which contributed to achieving correct results. and helped increase the accuracy of the system in recognizing students' faces, which reached 97% (Prangchumpol, 2019).

Poltak Sihombing, Rudy Candra, Amer Syarif, Dahlan Sitompul, and Irham Taufik emphasized that using an automatic method removes the need to use common, manual, and time-consuming methods of recording the students' attendance in classrooms. Using face detection and recognition automated attendance enhances the way attendance is controlled, and hence it helps with increasing attendance management efficiency. They relied on the Learning Vectorization Quantization (LVQ) Algorithm to design a system for recording attendance, and the results concluded that Face recognition technology with vector quantization algorithms (LVQ) succeeded in accurately recording students' attendance by comparing the students' data in real-time with the data in the database. The proposed system for recording students' attendance was able to recognize more than one face in a relatively fast time, and registration takes 40 seconds for a total of 50 students. The system also succeeded in recording the entry and exit times of students according to the time their faces were (Sihombing et al, 2018).

The proposed system for logging in with face recognition technology was able to overcome some of the obstacles that were faced by previous attendance registration systems, which were represented in the inability to recognize faces when looking up, down, or on both sides, which is what the proposed system was able to implement with efficiency and high accuracy. The proposed system does not need a fixed and specific distance to capture faces, as in the systems proposed in previous studies, where the image can be captured from various distances without being bound by a specific and fixed distance each time. The proposed system is more accurate than the systems in the previous studies, as its accuracy reached 100% in the case of the student facing forward, 95% for the student facing both sides, 100% for the student facing downward, and 100% for the student facing upwards. In contrast, the accuracy of previously proposed systems was as follows: 81.25% for the student facing forward, 75% for the student facing both sides, and 43.75% in the case of the student facing downward, and then the current system outperformed the systems proposed in previous studies in terms of efficiency and accuracy in recognizing faces in any situation and any facial expression without problems or errors.

4. The Problem Statement and Objectives:

some libraries rely on traditional and common methods of registering visitors, such as registering in visitors' records and then registering them again on the library's automated system after the work is completed. Despite the simplicity of this method, it has become ineffective for many important reasons; the top of which is that it consumes a lot of effort, time, and papers. The attendance records can also be easily damaged due to the possibility of fraud, in addition to the possibility of the librarian forgetting to register some beneficiaries on the library's automated system. These shortcomings motivate us to find practical alternatives for registering libraries' visitors including the use of face recognition technology. Moreover, the face-recognition system is strong and cannot be tricked because each person has a set of unique and individual features related to that person and cannot be replaced or changed. This is what makes it unique in addition to the fact that if you are physically present in the facility your attendance will be logged and recorded.

The main objective of the study was to examine the effectiveness of the proposed face recognition system in registering users of the academic library efficiently and accurately. the sub-objectives of the study were to:

1- determine the requirements necessary to design the proposed system for registering beneficiaries in academic libraries.

2- Shedding light on the database used within the proposed system for logging in academic libraries and its contents.

3- Explain the workflow of the module and proposed system for registering beneficiaries in academic libraries.

4- Explain the efficiency of the system to log in one or more beneficiaries at a time, whether wearing a cap or without it.

5- Demonstrate the system's efficiency in logging in beneficiaries whether they look up, down, right, or left.

6- Clarify how the system deals with beneficiaries who are not registered in its database.

5. Design/methodology/approach:

The main idea of the system relies on a well-experienced module through the use of machine learning, a pre-trained model, and a database that contributes to the system's ability to identify the attendees and log in their names, identifications, dates, and times. The study relied on an experimental approach to help determine the extent of the ability of the proposed system to register beneficiaries' entry into the library efficiently and accurately without any problems occurring.

6. Proposed Automated Library Attendance System:

This research paper proposes an automated system which is capable of detecting and identifying attendees and logging the check-in and out date and time without any human interference. These can easily save all these data in a shared CSV database to easily manage and extract reports from it. The system is typically automated and supports running at massive scales due to its modular nature and dependency on a very unassailable and accurate pre-trained machine-learning model and algorithm.

6.1 System Requirements

Each platform necessitates specific requirements to run applications based on face recognition as follows:

6.1.1 Hardware requirement

- Processor: 7^{th} generation
- RAM: Minimum 4 GB
- Hard Disk: Minimum 500 GB
- G B. Camera: High-quality

6.1.2 Software specification

- Platform: Windows 10
- Linux language used: Python

- Frontend tools: Spyder environment
- Backend: CSV Comma Separated Values Database

The proposed automated attendance system as shown in Fig. 1 is divided into two main stages, each consisting of different modules and functions defined in the below section.

6.2 Stage One

6.2.1 Attendees Database Setup

This stage consists of two main modules: the first one is the main database that contains every single piece of information about each attendee (e.g., borrower ID, full name, faculty, department, and national ID, etc.). The second one is acquiring a short video of each attendee showing his face clearly and in different lighting conditions and different poses. These materials will be organized into folders named after each attendee to help the system Identify each attendee for the next implementation.

6.2.2 Building the Core Training Model:

After establishing the core dataset containing each attendee's captured video in a folder named after him/her, the library uses the most accurate well-known library VGG Face from Keras. The main advantage of this library is that it is accurate, fast, and can be easily modified to be deployable for our scope of work.

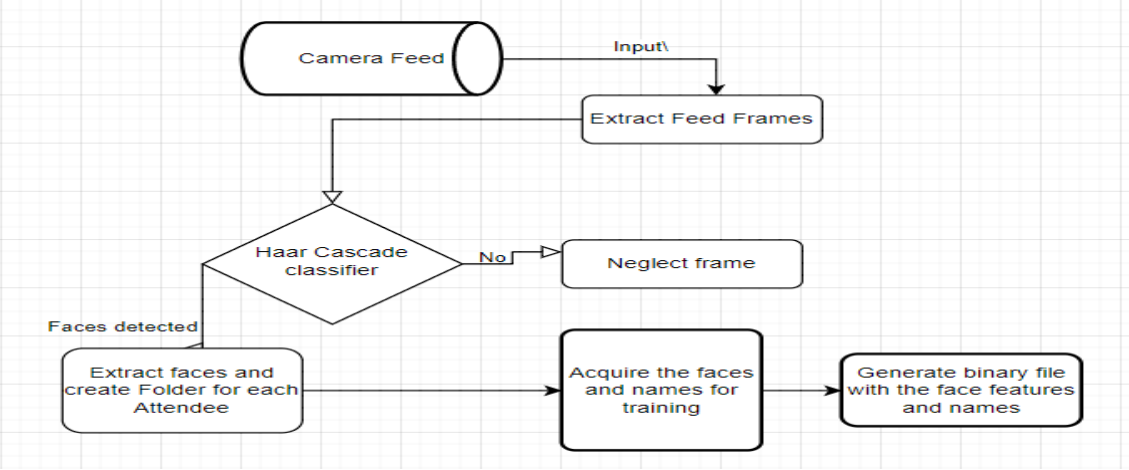


Fig. 1. The workflow of the module

The main workflow of this module is as follows:

1- Face Detection and Extraction:

- Image Capture: Feeding the system with the dataset of videos captured and organized in the previous stage.
- Pre-Processing: Converting the images from the RGB pattern to the Grayscale pattern and then scaling them down by a factor of 1.2.
- Face Detection: Face Detection consists of four stages:

A. Haar Features: Haar features are the same as convolutional kernels. They are used to detect the features in a given image. As shown in Fig. 2, there are different kinds of Haar features including line features, edge features, four-rectangle features, etc. Every single value represents one feature, and hence they are calculated by subtracting

the sum of pixels under the white rectangle from the sum of pixels under the black rectangle. Haar cascade algorithm makes use of 24*24 windows which ends up calculating 60000+ features in a window. The user then crops the faces only and creates a dataset of faces in different folders under every attendee's name.

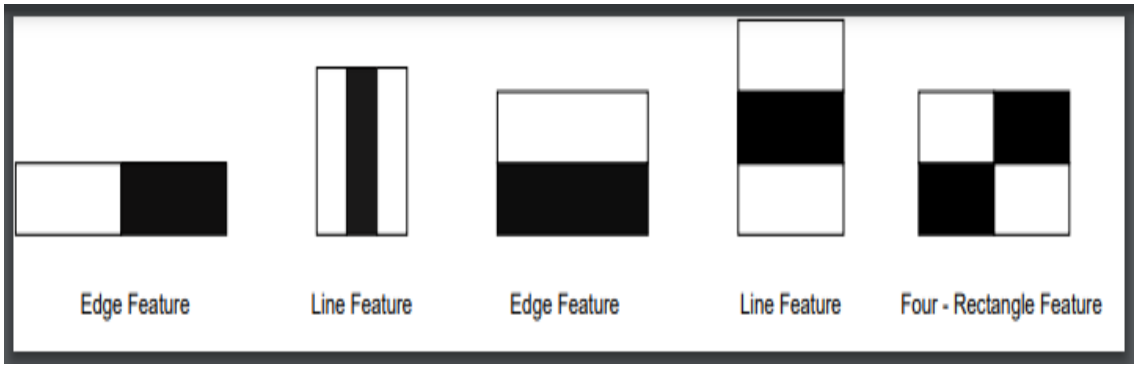


Fig. 2. Haar Features Extraction

6.2.3 VGG Face

The term (VGG-16) stands for Very Deep Convolutional Network for Large-Scale Image Recognition, which was proposed by K. Simonyan and A. Zisserman. It was originally developed at the Visual Graphics Group at the University of Oxford. The VGG-16 model shown in **Fig. 3** is one of the most popular pre-trained models for image classification. Introduced at the famous ILSVRC 2014 Conference, this model achieves 92.7 top-5 test delicacy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. It makes the optimization on AlexNet by replacing large kernel-sized filters (11 and 5 in the first and alternate convolutional subcase, independently) with multiple 3 × 3 kernel-sized filters one after another. VGG16 was put under training for weeks through the use of NVIDIA Titan Black GPU which was adopted by researchers and the industry for their image Classification Tasks (Woolf, 2018) (16). **Fig. 4 and 5** summarize the layers of the model.

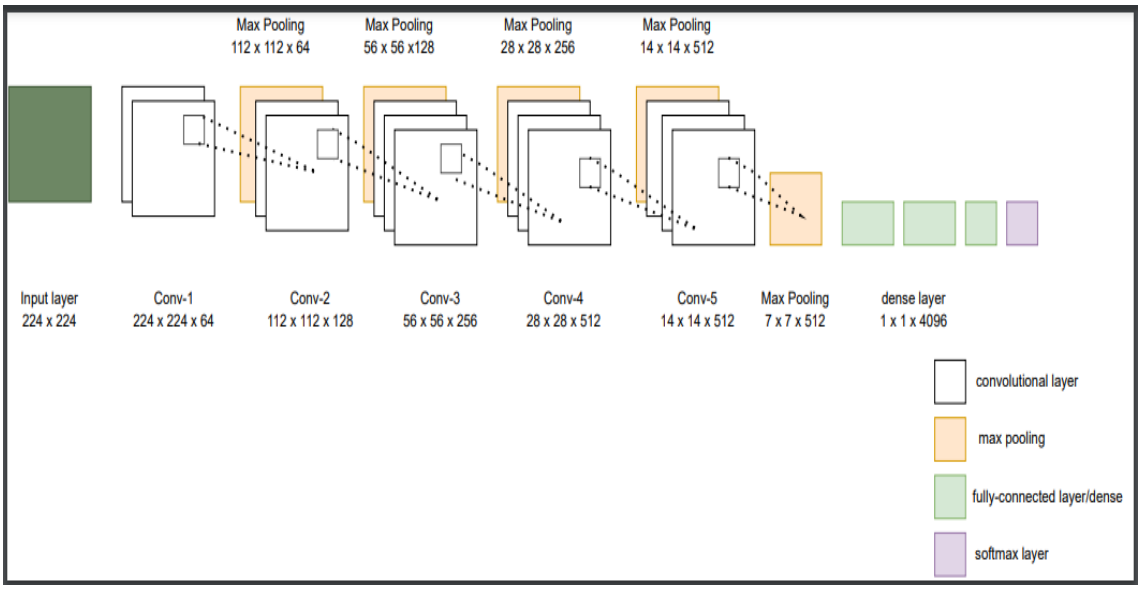


Fig. 3. An illustration of the architecture of the VGG-16 model

Convolutional layers	Consists of	13 layers
Max Pooling layers		5 layers
Dense layers		3 layers

Fig. 4 Main layers of the model

Input	
The dimensions of the input image (224,224,3)	
Convolution layer 1	
Conv 1 – 1	64 filters
Conv 1 – 2	64 filters and max pooling
The dimensions of the image (224,224)	
Convolution layer 2	
The dimensions of the image (112,112)	
Conv2-1	The filters increase to 128
Conv2-2	128 filters & max pooling
Convolution layer 3	
The dimensions of the input image (56,56)	
Conv3-1	we enlarged the filters to 256
Conv3-2	256 filters
Conv3-3	256 filters and max pooling
Convolution layer 4	
The dimensions of the input image (28,28)	
Conv 4-1	We doubled the filters again to 512
Conv 4-2	512 filters
Conv4 -3	512 filters and max pooling
Convolution layer 5	
The dimensions of the input image (14,14)	
Conv 5-1	512 filters (similar to conv 4)
Conv 5-2	512 filters
Conv 5-3	512 filters and max pooling
The dimensions of output now are (7, 7) At this time, we flatten the output of this layer to generate a feature vector	
Fully Connected/Dense layers	
FC1	consists of 4096 nodes, that generate a feature vector of size (1, 4096)
FC2	consists of 4096 nodes, that generate a feature vector of size (1, 4096)
FC3	consists of 4096 nodes, that generate 1000 channels for 1000 classes, then passed on to a Softmax activation function
Output layer	

Fig. 5 Details layers of the model

Table 1 shows the accuracy of the VGG face: It works as follows:

1- Collecting the face images for each attendee folder.
2- Calculating the mean features.
3- Saving the precomputed features as shown in **Fig. 7** in a binary file (a pickle file) to be used later in run time.

Table 1. VGG accuracy (Parkhi et al, 2015)

No.	Method	Training images	Networks	Accuracy
1	Fisher Vector Faces	-	-	93.10
2	DeepFace (Facebook)	4 M	3	97.35
3	DeepFace Fusion (Facebook)	500 M	5	98.37
4	DeepID 2,3	Full	200	99.47
5	FaceNet (Google)	200 M	1	98.87
6	FaceNet + Alignment (Google)	200 M	1	99.63
7	Ours (VGG Face)	2.6 M	1	98.78

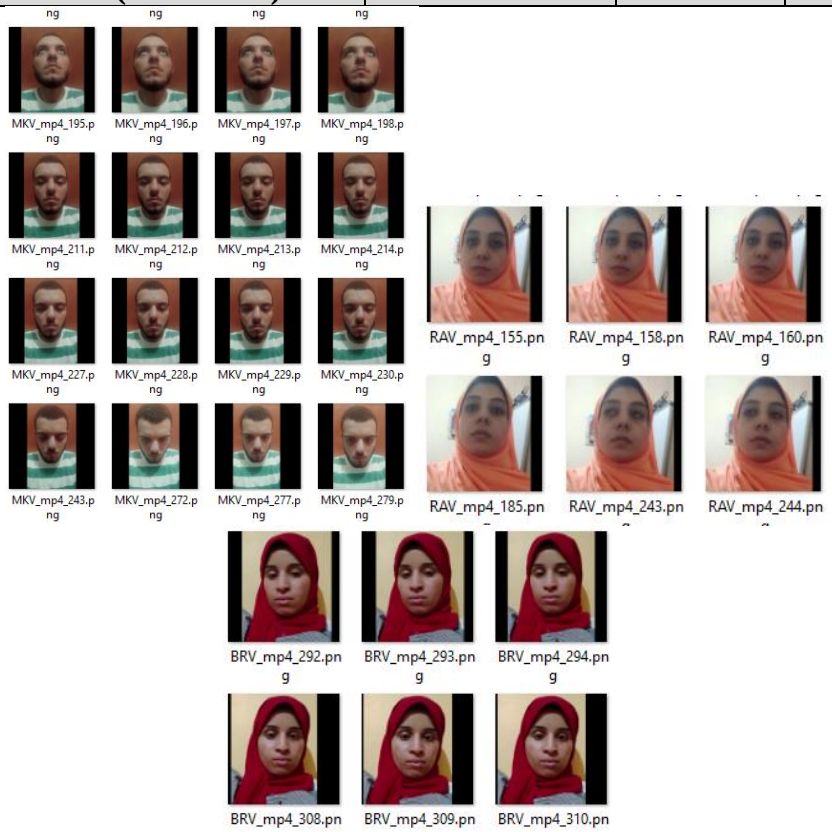


Fig. 6. Faces database.

The output of this stage is the main binary file which is exported as a pickle file to be easily handled by the main code while running in real time without any lag or the need for extra resources from the working machine.

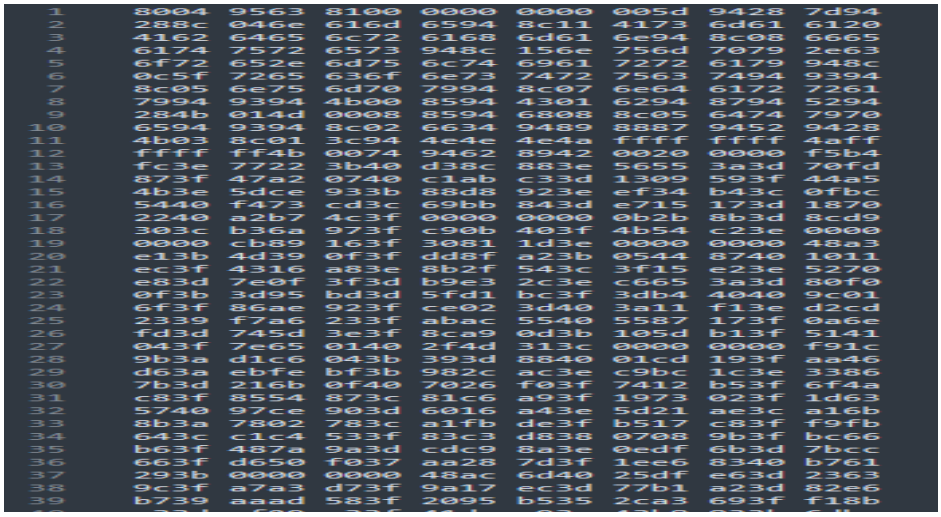


Fig. 7. Sample of the current pickle file

6.3 Stage Two

This stage consists of two main modules as shown in **Fig. 8**. The first one is establishing the database needed to log into the events and data. The researcher created two empty databases containing only the header row containing the title of the info it must log such as borrower ID, Name, faculty, department, date, and time. Each database is labelled as the state check-in and check-out.

The second module builds the running system as follows:

1- Acquiring the video stream from the main camera. During this step, the code accesses the main camera and acquires its video frames.
2- Detecting faces: the code uses the Haar cascade for capturing frontal faces to detect the faces in each frame.
3- Marking faces: the code draws a rectangle on the detected face to help track it in each frame for the viewer.
4- Identifying the attendee: the code accesses the pickle file which was generated earlier in the previous stage and starts comparing the face features matching the face feature data and identifying the attendee's name from his face.
5- Writing information in the current stats database: the code accesses the main database which contains all the attendee's data. The code passes the name to a function that searches in the main database for the information necessary to be logged in the current stats database. Therefore, it passes the visitor's name, ID, faculty, and department. Hence, it records all this information in the current stats database alongside the current date and time accurately.

This is applicable only if the user is already registered and identified by the system. In turn, in the case of an unregistered or unknown attendee, the system needs to detect the face and label it as UNKNOWN. Therefore, the system logs it as unknown and unregistered in the database fields respectively.

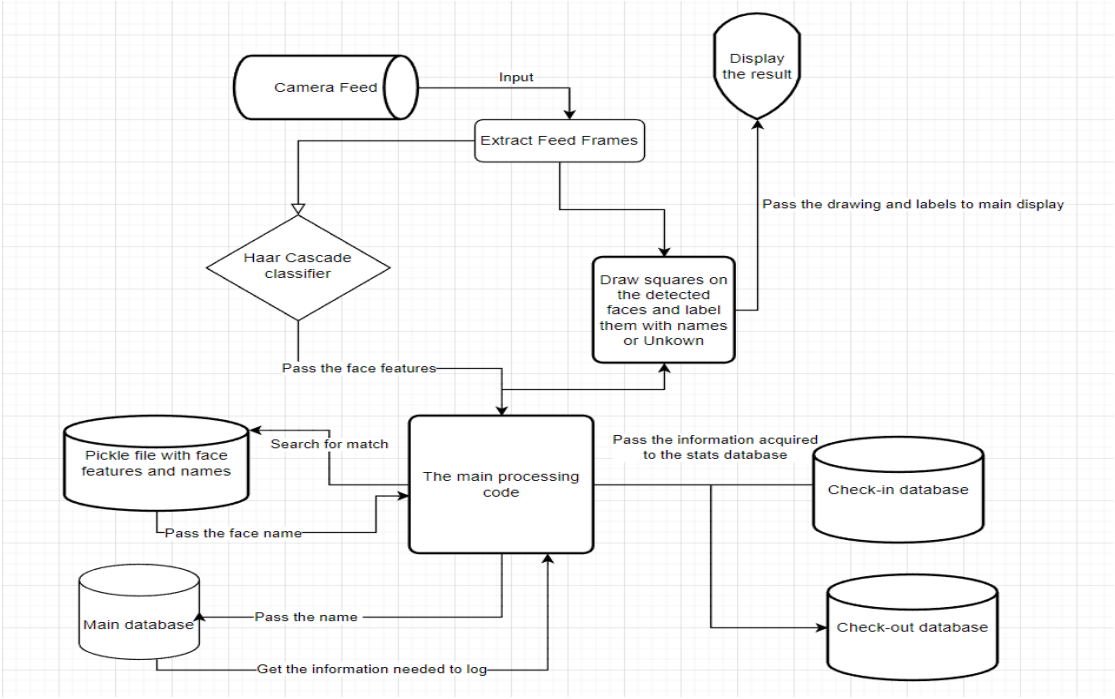


Fig. 8. Full system flow chart

7. Experimental Results

The author tested the proposed face recognition system on a group of attendees at the Faculty of Arts, Tanta University's Library. The proposed system accuracy was carried out on 5 attendees of Tanta University Academic Library. The test results can be seen in **Table 2.**

Table 2. The proposed system faces recognition test results.

No	Condition	Total	Number of Accurate Detections	Number of Inaccurate Detections	Percentage of Accuracy
1	Recognizing only one face of a beneficiary	20	20	-	100%
2	Recognition with or without a cap on the head	20	20	-	100%
3	Recognize two faces together at one time	20	20	-	100%
4	Recognizing four faces together at one time	20	20	-	100%
5	Beneficiary facing forward	20	20	-	100%
6	Beneficiary facing sideways	20	19	1	95%
7	Beneficiary face down	20	20	-	100%
8	Beneficiary face up	20	20	-	100%

The proposed system managed to recognize the face of each visitor separately as shown in Fig. 9. The visitor's name appeared above the face as shown in the figure below.

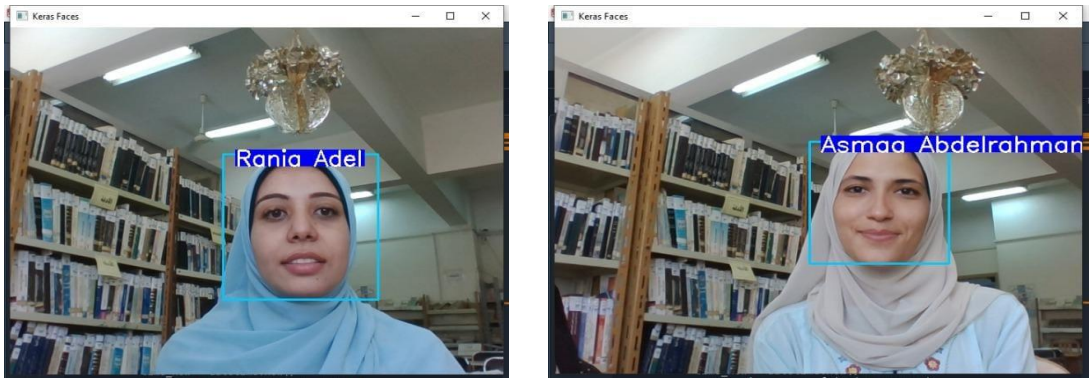


Fig. 9. Recognizing only one face of a beneficiary from the library using the proposed face recognition system

The proposed system also managed to recognize the extra features of the face of one of the visitors, i.e., whether he/she was wearing a cap or not as shown in Fig. 10, the matter which reflects the efficiency and accuracy of the system in recognizing faces and their particular.

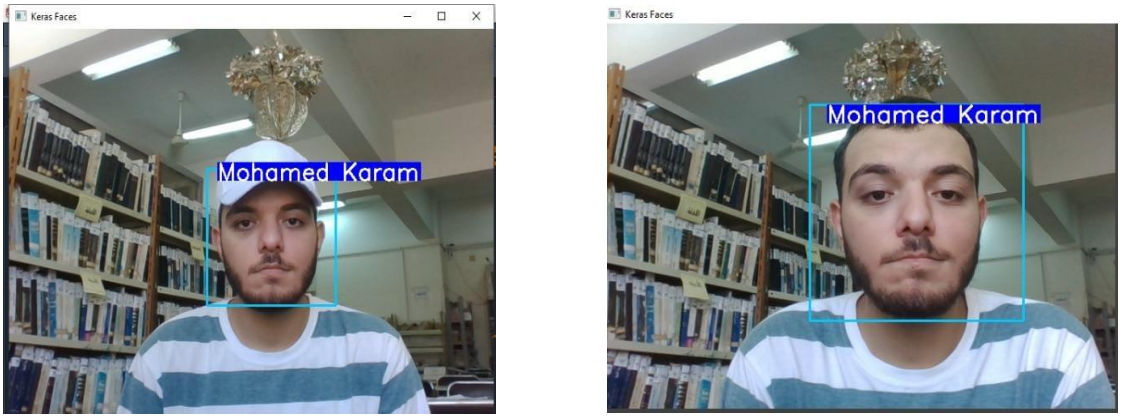


Fig. 10. Face recognition with or without a cap on the head

The proposed system managed to recognize the faces of two students simultaneously with high accuracy without any problems as shown in Fig. 11.

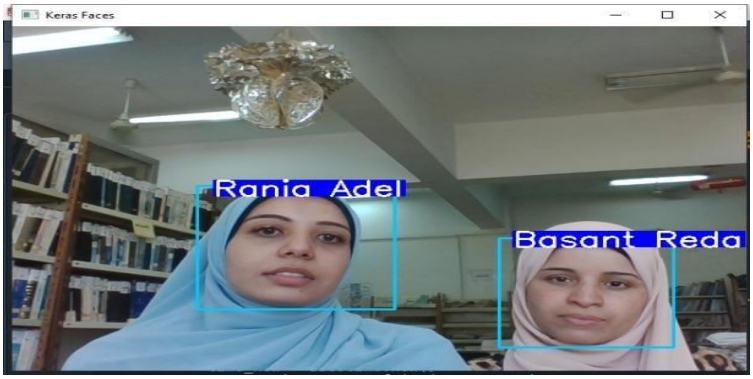


Fig. 11. Recognize two faces together at one time

The proposed system managed efficiently and accurately to identify the faces of four students simultaneously as shown in **Fig. 12**. Moreover, the proposed system also can accurately and efficiently recognize the face while looking up/down without any errors as shown in **Fig. 13**. The proposed system also was able to efficiently recognize the face of the students when looking at both sides, whether the eyes are open or almost closed and with different scarf roll for veiled girls as shown in **Fig. 14**. The word "unknown" appears at the top of the face in the case of recognizing new faces are not registered in the system database as shown in **Fig. 15.**

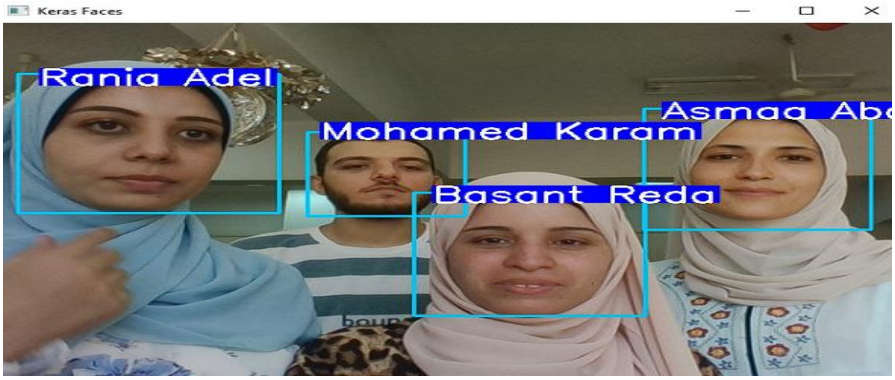


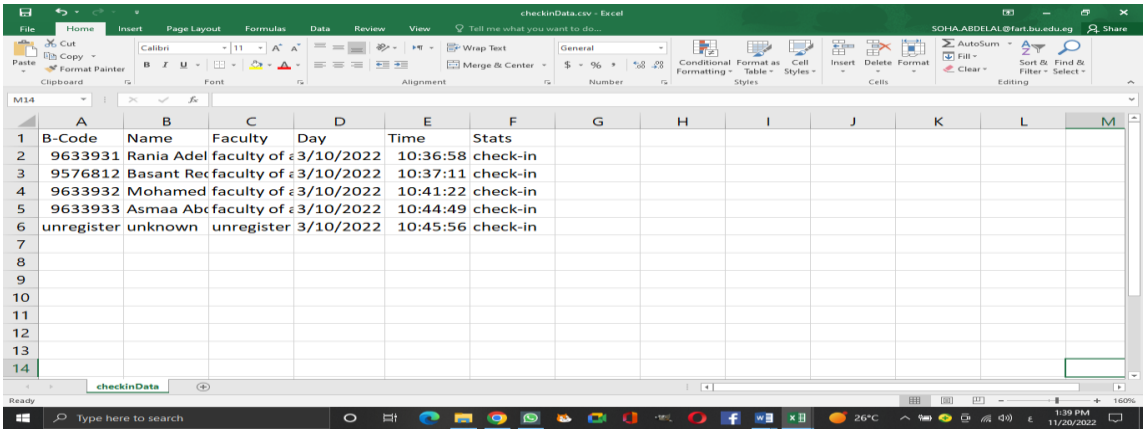
Fig. 12. Recognize four faces together at one time

Fig. 13. Recognize Beneficiary with face up/down

Fig. 14. Recognize Beneficiary facing sideways

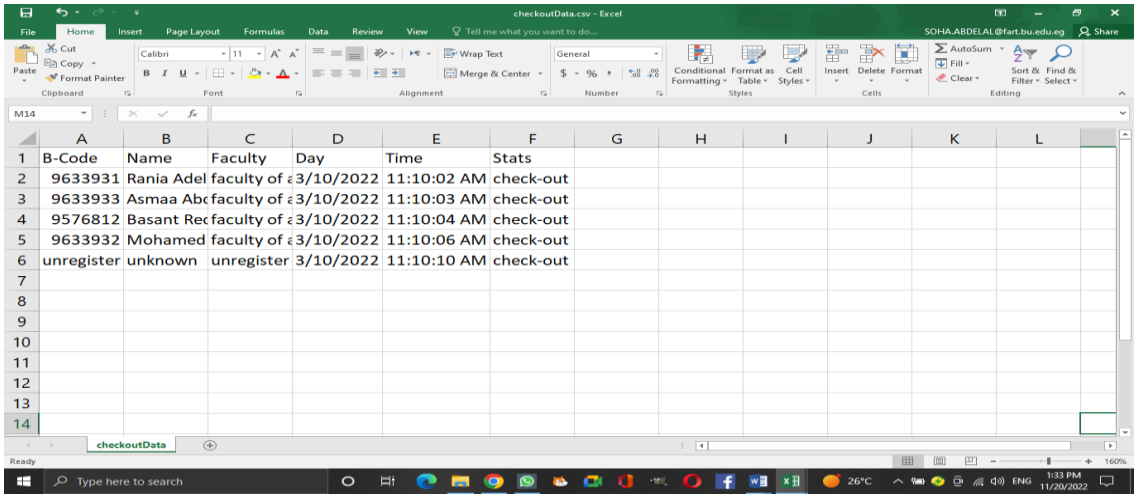
Fig. 15. A face not registered in the database of the proposed system

The facial recognition process for a group of patrons managed to generate a CSV report for the check-in and check-out process including the following data: [B-Code]-[Name]-[Faculty]-[Day]-[Time]-[Stats] as shown in **Fig. 16 and 17**.



	A	B	C	D	E	F
1	B-Code	Name	Faculty	Day	Time	Stats
2	9633931	Rania Adel	faculty of a	3/10/2022	10:36:58	check-in
3	9576812	Basant Rec	faculty of a	3/10/2022	10:37:11	check-in
4	9633932	Mohamed	faculty of a	3/10/2022	10:41:22	check-in
5	9633933	Asmaa Abc	faculty of a	3/10/2022	10:44:49	check-in
6	unregister	unknown	unregister	3/10/2022	10:45:56	check-in

Fig. 16. The report generated by check-in



	A	B	C	D	E	F
1	B-Code	Name	Faculty	Day	Time	Stats
2	9633931	Rania Adel	faculty of a	3/10/2022	11:10:02 AM	check-out
3	9633933	Asmaa Abc	faculty of a	3/10/2022	11:10:03 AM	check-out
4	9576812	Basant Rec	faculty of a	3/10/2022	11:10:04 AM	check-out
5	9633932	Mohamed	faculty of a	3/10/2022	11:10:06 AM	check-out
6	unregister	unknown	unregister	3/10/2022	11:10:10 AM	check-out

Fig. 17. The report generated by check-out

8. Discussion

Artificial Intelligence (AI) and deep learning techniques contribute to solving problems in various fields such as business, administration, medicine and the army. The application of these technologies has extended to include library and information science as well. Traditional activities and services within the library take a long time, and then technology must be used to increase efficiency and effectiveness. AI and deep learning are more accurate, faster, efficient and the process of intelligent automation may lead to the replacement of workers and the change of jobs (Asemi et al, 2021). The American Library Association states that AI will become an indispensable tool for librarians, suggesting that the role of libraries will become more complex and that future librarians may require a higher level of critical, creative, and innovative thinking to exploit AI and deep learning in completing the tasks that take place within the library, including registering the attendance of beneficiaries to save time and effort for both the library specialist and the beneficiaries and to achieve high accuracy in the tasks that are accomplished using these technologies (Huang, 2022). The proposed model in this paper uses the technique of deep learning and face recognition to record the attendance of the beneficiaries from the library. In comparison to other related works (Mansoora et al, 2021), (Nurkhamid et al, 2020), (Prangchumpol, 2019), the proposed model shows distinctive better performance characterized by high accuracy of attendance checks as follows. It was found after testing the proposed system that its

accuracy when recognizing only one face of the beneficiary was 100%. The accuracy of attendance checks when identifying a beneficiary with or without a head covering was 100%. The accuracy of attendance checks when recognizing two faces simultaneously was 100%. The accuracy of attendance scans when recognizing four faces simultaneously was 100%. The accuracy of attendance checks when the patron was facing forward was 100%. The accuracy of attendance checks when a patron encounters collateral is 95%. The accuracy of attendance checks when confronting the patron is 100% and when confronting the patron reaches 100%.

9. Conclusion and Future Work

The proposed system is characterized by accuracy, quickness, and reliability. Throughout the trials and tests, the system managed to detect up to four attendees easily without any lag or error whatsoever. This is attributed to the main module of VGG Face and the modular system design which led to implementing the remaining steps easily and without any additional hardware. This helps much in saving time and effort. From the results of the system's accuracy test, it was found that the accuracy of attendance checks when recognizing only one face of a beneficiary was 100%. The accuracy of the attendance checks when recognizing the beneficiary with or without a cap on the head was 100%. The accuracy of attendance checks when recognizing two faces at one time was 100%. The accuracy of attendance checks when recognizing four faces together at one time was 100%. The accuracy of the attendance checks when the beneficiary is facing forward was 100%. The attendance checks' accuracy when the beneficiary faces sideways is 95%. The accuracy of the attendance checks when the beneficiary is facing down is 100%, and when the beneficiary is facing up is 100%. The proposed system does not need any exorbitant costs for its application, and therefore it is a suitable solution for application in academic libraries and any other type of libraries to overcome the problems of manual registration that educational institutions face. Although the proposed system’s attendance checks accuracy level is acceptable, it still needs to be improved so that the proposed system can detect more accurately in various conditions. The proposed system has not been tested under different lighting conditions and various camera qualities. Future research to improve the efficiency of the proposed system will be investigated as follows. An integration can be made between the proposed login system using face recognition technology with the automated system applied in the library, which contains a complete database of students and faculty members. This will contribute to extracting reports through which it is possible to obtain various statistics to analyze the performance of the library, to know the reasons for visiting the beneficiaries, and the books that they frequently read. Moreover, through cameras installed in the library, the proposed system can capture logged-on faces to know the accumulation points of students in which there is crowding, and then expand these places, and also these cameras can detect more shelves and specializations that are accepted by library visitors, and then increase the number of copies to reduce crowding.

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نظام مقترح لتسجيل الحضور في المكتبة الأكاديمية الذكية بالاعتماد على تقنية التعلم العميق للتعرف على الوجوه

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المستخلص:

لقد أصبحت عملية تسجيل الحضور مهمة أكثر صعوبة في الوقت الحالي، وبخاصة فى القاعات الضخمة والتي تشتمل على عدد كبير من المستفيدين، وبالرغم من تطبيق العديد من أنظمة تسجيل الحضور، إلا أنها لا تزال تواجه العديد من المشكلات، وتقترح الدراسة الحالية نظاما لتسجيل الحضور في المكتبات الأكاديمية من خلال استخدام تقنية التعلم العميق، للتعرف على الوجوه واستخدام الرؤية الحاسوبية للتغلب على نقاط الضعف الموجودة في نظم تسجيل الحضور التقليدية، ومن الجدير بالذكر، الفكرة الرئيسية للنظام المقترح تعتمد على التعلم الآلي، ونموذج مدرب مسبقًا، وقاعدة بيانات تساهم في زيادة قدرة النظام على تحديد الحضور، وتسجيل الدخول بأسمائهم وهوياتهم، ولقد اعتمدت الدراسة على المنهج التجريبي للمساعدة في تحديد مدى قدرة النظام المقترح على تسجيل دخول المستفيدين إلى المكتبة بكفاءة ودقة دون حدوث أية مشكلات، وتوصلت الدراسة إلى: النظام المقترح دقيق وسريع وموثوق به، ويتعرف على الوجوه دون وقوع أية مشاكل فنية، كما تبين أيضا أن دقة النظام فى عملية تسجيل الحضور عند التعرف على وجه واحد فقط للمستفيد كانت 100%، وكانت دقة النظام عند التعرف على المستفيد سواء مرتديا كاب على الرأس أو بدونه 100%، كما بلغت دقة النظام عند التعرف على وجهين في وقت واحد 100%، وبلغت نسبة الدقة 100% أيضا عند التعرف على أربعة وجوه معًا في وقت واحد، ونسبة 100% فى حالة المستفيد المتجه للأمام، ونسبة دقة بلغت 95% فى حالة المستفيد المتجه لأحد الجانبين، ونسبة 100% للمستفيد المتجه لأسفل أو لأعلى، علاوة على ذلك فإن النظام المقترح لا يتطلب أية إعدادات باهظة الثمن، مما يجعله خيارًا مناسبًا للمؤسسات التعليمية المختلفة، وتقترح الدراسة إجراء المزيد من الأبحاث المستقبلية لتحسين كفاءة النظام المقترح، بالإضافة إلى العمل على دمج نظام تسجيل الحضور المقترح مع النظام الآلي المطبق في المكتبة، والذي يحتوي على قاعدة بيانات كاملة للطلاب وأعضاء هيئة التدريس، وهو ما سيساهم فى إنتاج تقارير يمكن من خلالها الحصول على إحصائيات مختلفة لتحليل أداء المكتبة، ومعرفة أسباب زيارات المستخدمين والكتب التي يكثرون من قراءتها.

الكلمات المفتاحية: إدارة الحضور ؛ المكتبة الأكاديمية الذكية ؛ التعرف على الوجوه ؛ التعلم العميق ؛ تصنيف Haar Cascade ؛ نموذج VGG .