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Electronic Clearance System Using Facial Recognition System: A Case Study Of Tikrit University

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Abstract

Administrative systems necessitate a focus on computer use, technology development, and information technology in various administrative fields in general, and dealing with student data in particular, as it organizes and maintains student data, to ensure that the college continues to operate efficiently and without interruption. Maintaining the organization of the workflow and the Clearance system for students is critical to the institution in terms of the speed with which data is sent to students and the monitoring of activities that occur inside the system, such as (input, deletion, and modification, etc.) It works with a big amount of data and is still accredited by the college. The manual method relies on paper files to record information, which is susceptible to damage and loss. Face detection and recognition have gotten a lot of attention in the last decade, and it's still one of the most important studies in the fields of image processing, pattern recognition, and computer vision, attracting a lot of attention from academic and industrial researchers because of its wide range of practical applications. The requirement for identification in the domains of security and surveillance systems has made the facial recognition system one of the most essential biometric techniques used in identifying an individual. Based on multiple algorithms for the purpose of face detection and real-time excellence: Haar Cascade facial detection algorithm and Local binary patterns facial recognition algorithm. The proposed system was applied to students and employees of the College of Computer Science and Mathematics at Tikrit University, and results were obtained with an accuracy of 97%.

I. Introduction

The quick development of electronic management systems has made administrative functions more efficient and effective by saving information in digital form. Graduating students and staff can use the electronic clearing system to achieve their final year clearance swiftly and conveniently[1]. Clearance is an important compulsory document giving permission to the students who have graduated from their respective schools or universities[2]. Clearance refers to the status granted to individuals, particularly military personnel, school and university students, government employees, private-sector workers, and their contractors[3]. Both students and employees are consuming a long time and effort to sign their clearance documents from many departments and faculties (Registry, Library, Hostel unit, Sport unit, Accounting, Storage unit, Health center, Dean Office ...etc.) in the universities. Only students who have finished the

clearance procedure able to graduate certification. Employees who have retired or whose has been transferred from one institution to another should finish the clearance process[4]. Employees working on the clearance form undergone confusion and fatigue as a result of students arriving at the same time to complete the form manually. The electronic clearance system will assist students and employees in the process of clearing pending dues or belongings after graduation or employee disengagement[2].

II. Related Work

As of now, there have been a variety of clearing system designs and implementations with varied features and major standards. Through design studies or actual implementations, certain researchers have made major contributions to the existing clearance system. In this section, we'll look at a few notable articles in this area.

Ifeanyi, Ojukwu Emmanuel in 2013 [5], The software will serve as a more dependable and effective means of completing student clearance, reducing all delays and stress while also helping you to grasp the laws and how to complete your clearance online.. PHP, CSS, APACHE, and MYSQL for the database were used during the implementation of this system.

Furthermore, Agbo-Ajala, O and Makinde, OE in July 2015 were designed online clearance system using PHP and MySQL that reducing the time of manual process as well as creates a centralized database for students to be cleared. It will be implemented as a web-based application that will serve as a student clearance database.

A new approach was presented by Idachaba F.E, Mbeh K.E, Oshin O. I. And Oni O. O, Member, Iaeng, organized the clearance student system. This web portal system is built to allow authorized officers to access a student's clearing page and clear the student without the student having to contact the officer[6].

A group of researchers developed an electronic clearance system for facilitating and stamping the clearance document. This study makes the clearance process fast and allows the student to access the system online. The researchers were used PHP programming language and MYSQL for creating databases[7].

Clearance management system was proposed by Nneji et al., 2018, By removing paperwork, this study article intends to reduce procedure time, document loss, and physical presence, making it more efficient, safe, and dependable. Front-End To design and implement the proposed system, HTML is used to generate web pages, CSS is used to style web pages, JavaScript is used to program web pages, Sublime Text 3 is used as a code editor, PHP is used for the back-end, MySQL is used for the database, and the XAMPP servers are utilized[8].

Online clearance system in Taif university building by Alroobaea, Roobaea in 2018 for helps the students and staff of university by reducing the consuming time and efforts for complete clearance process.

Other researchers were developed online open source clearance system. Using modern technology like as HTML, CSS, JavaScript, PHP, and MySQL, this has been successfully developed. The system makes it much easier and faster for students to complete their clearance document process[4].

The electronic clearance system proposed in this study manipulation both students' and employees' clearance document problem. A facial recognition system is a biometric technical used in our system for the identification in the areas of security and observation of an individual.

III. Theoretical Scenario Framework

In our case, the clearance electronic system includes two scenarios that must be processed.

A. The first scenario occurs when a student graduates or moves to a different university. Various departments and information units should clear the student. As shown in the diagram below:

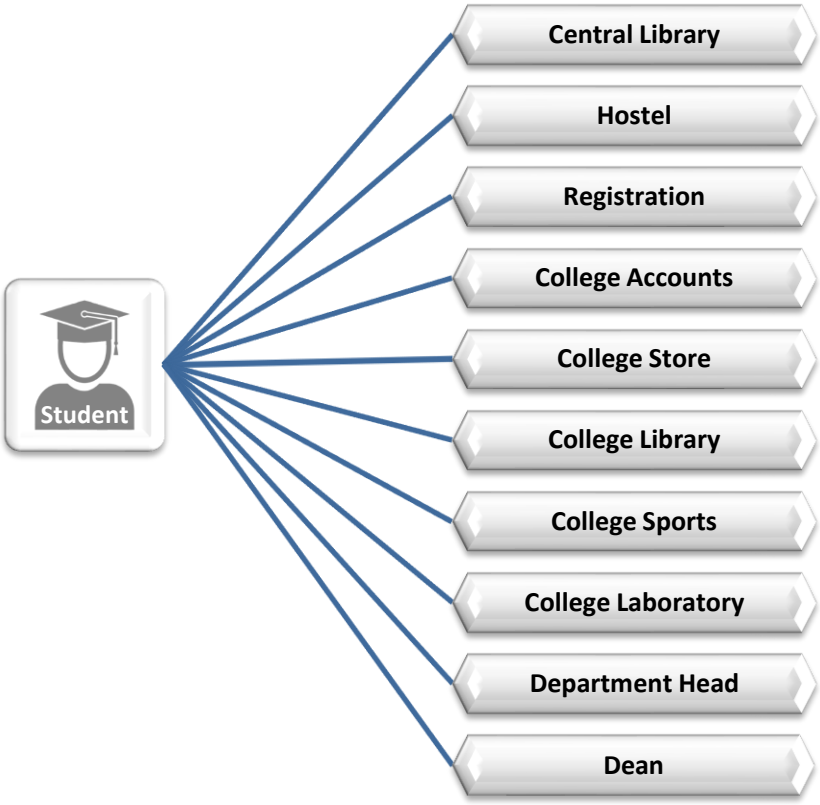


Figure 1 : Student clearance scenario

B. The second situation happens when an employee's position is terminated or when the individual is transferred inside or outside of the university. Many departments and information divisions require the staff person to be clear. As depicted in the following diagram:

(a) inside clearance

(b) outside clearance

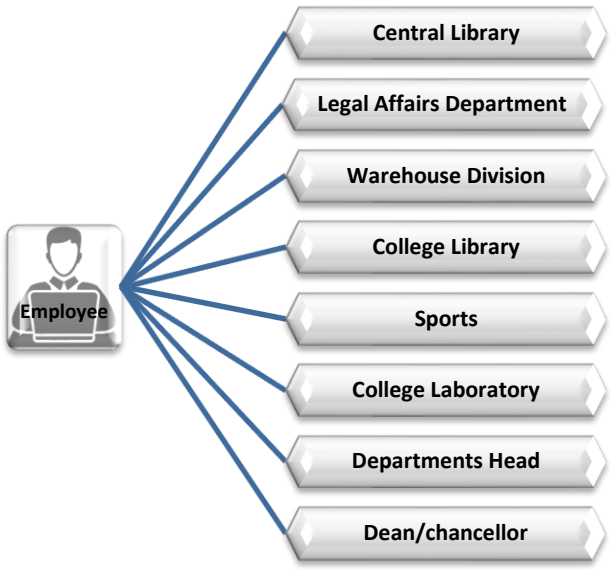


Figure 2: Employee clearance scenario

IV. Operational Framework

In this section of research, a system was designed based on multiple algorithms for the purpose of detecting faces and distinguishing them in real time, namely: the Haar Cascade algorithm for face detection and the Local binary patterns for facial recognition. The notion of designing (an electronic clearing system) arose as technology in the field of storage and information retrieval advanced.

Haar Cascade

It is one of the most important algorithms used to discover objects, and this algorithm relies on the use of several classifiers. This algorithm was proposed by Paul Viola and Michael Jones in their 2001 paper. This algorithm depends on training the machine to learn based on the approach, where the follower is trained on several positive and negative images. Then we use this trained function to detect objects in other images. If we want to utilize it to recognize people's faces. To train the classifier in face detection, we'll require several positive images (images of faces) and negative

images (images without faces). Then we'll have to figure out how to extract the features from it. So, we will use Haar features as shown in Figure (3). By subtracting the set of pixels beneath the white rectangle from the sum of the pixels under the black rectangle, each feature is given a single value[9].

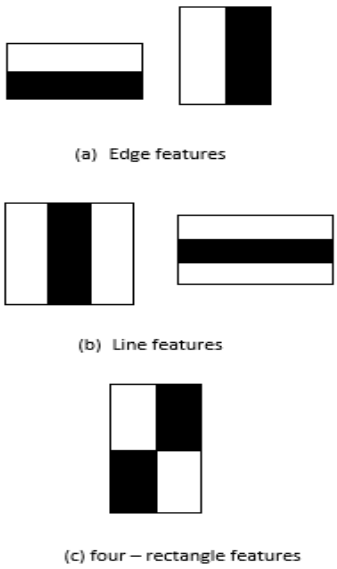


Figure 3: Haar Cascade Features

To calculate many features, all feasible sizes and locations for the mask will now be used, starting from the upper left corner and terminating the detection process when reaching the lower right corner.

The OpenCV (Open Source Computer Vision Library) was used in this paper. It focuses primarily on real-time image processing and includes a trainer that allows us to train an algorithm to create a classifier that includes a set of attributes that allow us to identify the object on which the algorithm is being trained, as well as a detector that allows us to detect the presence of objects such as cars, planes, insects, and animals. As a result, we can create a classifier for any object [10].

In order to detect the face of any person in OpenCV we use a method called detect Multi Scale which is used to detect objects in the image. To detect the presence of the face in the image, you will pass six variables to detect Multi Scale():

1. **Image**: The image in which we will search for the face is in the form of a gray scale image.
2. **Objects**: It is a vector of rectangles, and each rectangle contains the detected object. This vector is of the type Rectvector of the OpenCV library.
3. **Scale Factor**: Scale factor for the pyramid used to detect a human face (image pyramid) If we increase the scale Factor the speed of the detector will increase, but it can affect the detection accuracy. The more we decrease the scale Factor value, the speed of the detector will decrease, but the accuracy of the detector will increase. The detection rate of pseudo images may also increase.

4. **Min Neighbors:** To control the least number of surrounding rectangles detected in a certain area relative to the area that can be considered a human face. This parameter is very useful to reduce the rate of false image detection.

5. min Size: the minimum length and width allowed for the detected bounding rectangle of the face (150*150 used).

6. max Size: Maximum length and width allowed for the detected bounding rectangle of the face (500*500 used).

Local binary patterns (LBP)

It is an algorithm in the field of image processing to extract texture properties from images and use it to classify and segment images. This algorithm was first proposed in 1994 by computer scientists Oyala and Pettenkainen. Since then, this algorithm has been developed to include the extraction of texture properties from 3D images and video clips, and was used in face recognition and disease recognition in medical images[11]. This algorithm includes many parameters as follow:

- **Radius**: The radius represents the radius surrounding the center pixel and is used to generate the circular local binary pattern. Normally, it is set to 1.
- **Neighbors**: The number of sample points used to create the circular binary pattern locally. Keep in mind that the more sample points you use, the more expensive the calculation becomes. Normally, it is set to 8.
- **Grid X**: it represents the number of cells in the horizontal plane the more cells in the grid, the more exact it becomes, and the bigger the dimensions of the feature vector that results. Normally, it is set to 8.
- **Grid Y**: In the vertical direction, it represents the number of cells. The larger the dimensions of the generated feature vector, the more cells there are in the grid, and the more accurate the grid is. Normally, it is set to 8.
- **Threshold:** A threshold is a tool for forecasting. It returns -1 if the distance to the nearest neighbor is greater than the threshold.

Algorithm Training:

First, we must train the algorithm. To do so, we'll need a dataset of the people we're seeking for facial pictures. We also need to give each image a unique identifier (such as a number or a person's name) so that the algorithm can recognize it as input and return a result. The same ID must be used in all photos of the same person. With the training set that has previously been produced.

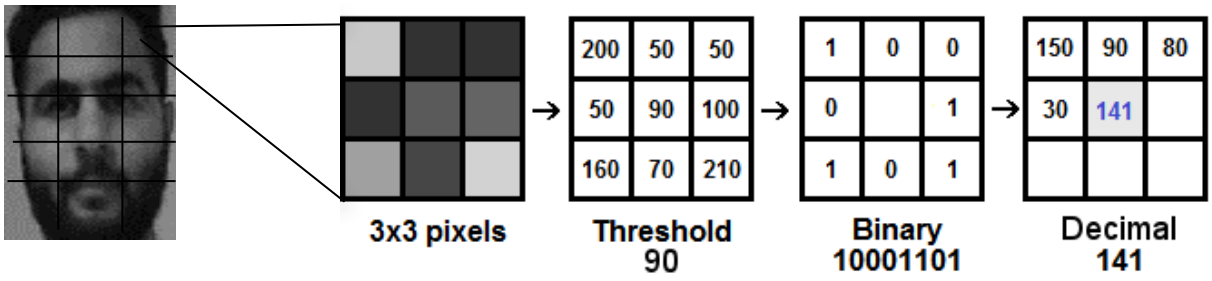


Figure 4: Create an intermediate image

Face Recognition

Face recognition was implemented using the OpenCV library. Based on the Haar Cascade algorithm and the Local binary patterns (LBP) algorithm, as shown in the figure (4) below:

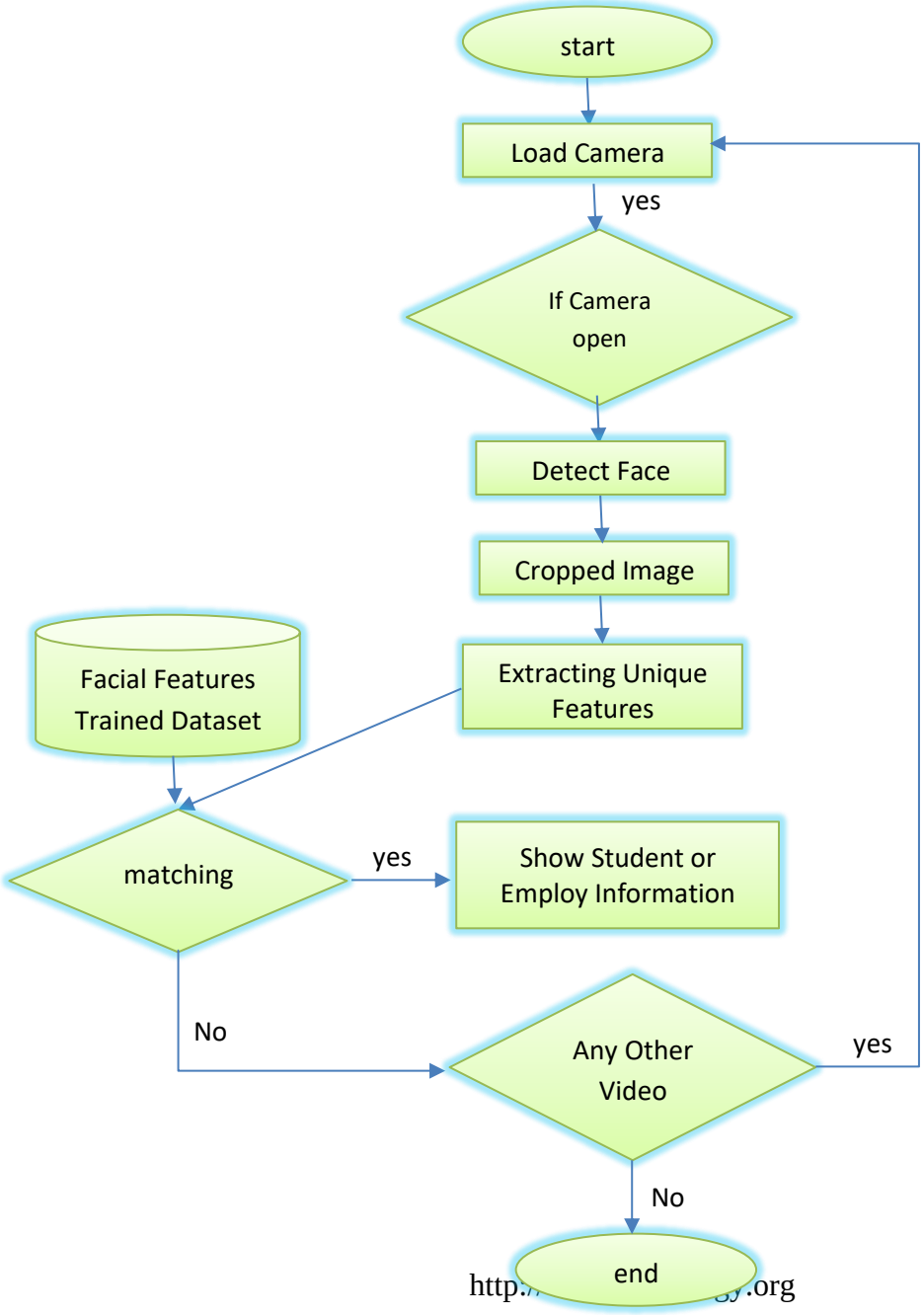
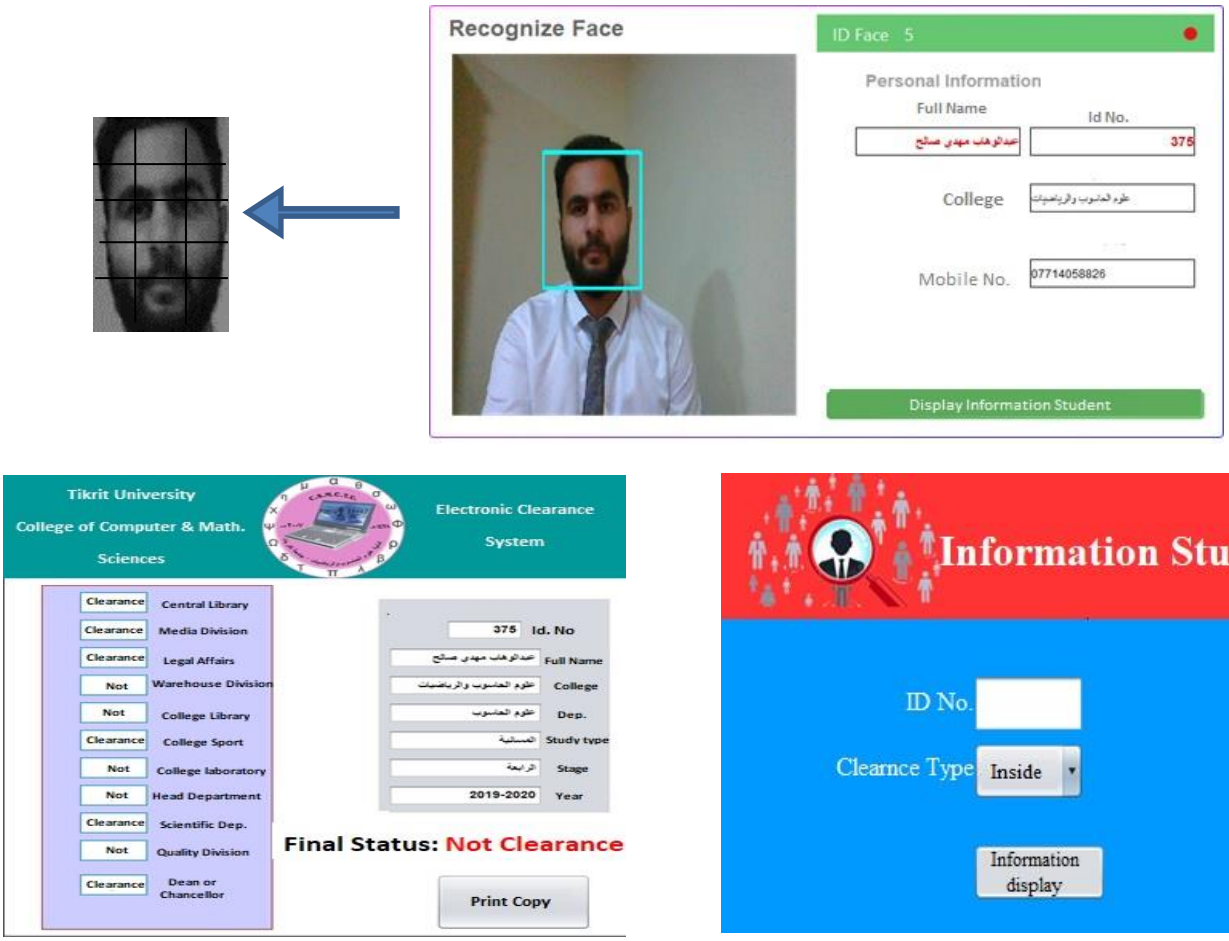


Figure 5: Face recognition steps

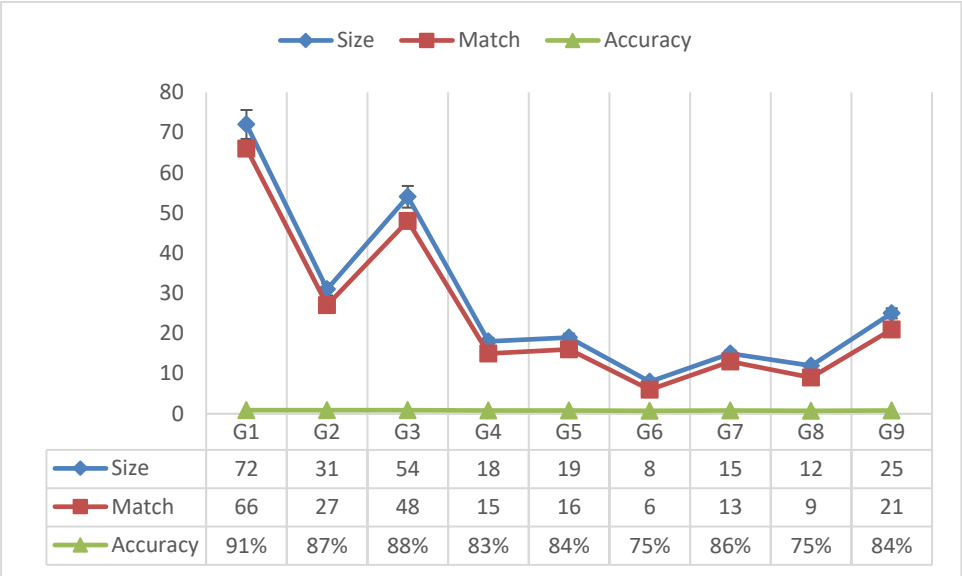
Results and Discussions

The system provides the feature of identifying the student or employee by recognizing the face or by entering his identity number and showing the full data and the status of his acquittal (innocent, not innocent). The required feature is selected through the interface shown in the figure below. Show it in a special interface as in the following figure. The system allows printing a copy of the student's data on paper or obtaining a digital copy, as shown in Figure (5).



When the electronic clearance system is triggered, it will call the camera to work where the face of the person, whether he is a student or an employee, is identified using the Haar Cascade algorithm. After that, the recognized face is cut to obtain an image of the face only in order to extract the unique features after dealing with them and perform some calculations through the Local Binary Patterns (LBP) algorithm. The extracted features are saved if the student or employee is registered for the first time, but if the information is saved in the system database, it will be matched and displayed to know the status of the person who has been identified, whether he is innocent or not.

The system was applied on the students and employees of College Computer and Mathematics Sciences in Tikrit University. We divided them on groups stand for (G1, G2, G3, G4, G5, G6, G7, G8, G9) according the following diagram in figure (6):

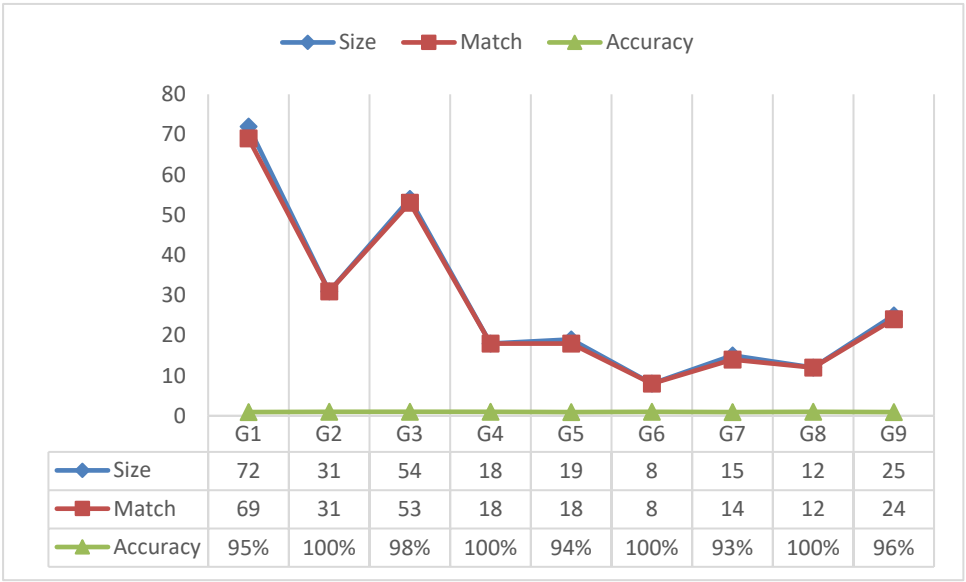


	G1	G2	G3	G4	G5	G6	G7	G8	G9
Size	72	31	54	18	19	8	15	12	25
Match	66	27	48	15	16	6	13	9	21
Accuracy	91%	87%	88%	83%	84%	75%	86%	75%	84%

Figure 6: Training Diagram

The first three groups (G1, G2, and G3) represented the undergraduate students of the computer department (morning and evening study) and the mathematics department. Postgraduate students (Master of Computer Science) are denoted by (G4) and Postgraduate (Master / Doctorate of mathematics Science) are denoted by (G5, G6). The last three groups (G7, G8, and G9) are used for representing the employees of the deanship, computer, and mathematics departments. The accuracy of the first-round ranging from 75% to 91% because of the bad of computer camera which used in the system.

In the second round we utilized the technology of image processing for increasing the accuracy of results by enhancing the resolution of the images. This operations make the results More accurate and increase the efficiency of the proposed electronic clearance system, as shown in the diagram in Figure (7).



	G1	G2	G3	G4	G5	G6	G7	G8	G9
Size	72	31	54	18	19	8	15	12	25
Match	69	31	53	18	18	8	14	12	24
Accuracy	95%	100%	98%	100%	94%	100%	93%	100%	96%

Figure 7: Training Diagram with image processing technique

The problems that appeared in the system were addressed by adding the option to identify the person by the ID number, whether he was a student or an employee. This means the person whose face cannot be identified; whose identity number is used to complete the electronic declaration procedure for him.

Conclusion

The electronic clearance method presented in this work manipulates the clearance documentation issue for both students and employers. A facial recognition system is a biometric technical used in our system for the identification in the areas of security and observation of an individual.

This system was used to deliver sufficient information to personnel and students at the University of Tikrit, allowing them to do all of their tasks quickly, precisely, and efficiently using advanced facial recognition technology to identify persons (student/employee) in real-time.

The most important feature of this system is ease of use, flexibility in dealing and reducing the effort that a person (student, employee) makes to complete the clearance document. In addition to the high efficiency and accuracy in accomplishing the functions for which it was designed.

Acknowledgment

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