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Automatic Attendance Recording System Using Facial Recognition

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ABSTRACT

The student attendance is collected either manually or digitally through an RFID card. Recently, some of the institutions adopted the use of dynamic QR codes for attendance monitoring. However, these systems are challenging to maintain and time-consuming. The student can easily manipulate signatures for attendance monitoring. Moreover, the QR code system requires the application on both the lecturer and student sides. The lecturer needs to set up the QR code while using the mobile app to use the system. Therefore, it is time-consuming and sacrifices several minutes at the beginning of each class. The student also sometimes has difficulty in using the app leading to manual data insertion. Therefore, this project aims to solve this issue by using the facial recognition system on a lecturer's laptop to collect the attendances. This project requires the use of a webcam and MATLAB to perform facial image recognition. This work utilizes face detection algorithm in the MATLAB image processing toolbox to build a system that will detect and recognize the frontal faces of students in a classroom. Firstly, several images of students will be recorded in a database. Then, a GUI-based application automatically identifies a face and matches it with the database created. Lecturers will use the GUI on their laptops, and students will show their faces to the web camera for their attendance to be taken. The system was tested successfully where student face was successfully recognized and recorded in the attendance monitoring system. Only registered user faces will be detected.

1. INTRODUCTION

The student's attendance is collected either manually or digitally through an RFID card. Lately, some of the institutions adopted the use of dynamic QR codes for attendance monitoring. Yet, these systems are difficult to maintain and time-consuming. The students can easily manipulate the use of signatures for attendance monitoring. Moreover, the QR code system requires an application on both sides, from the lecturer and student. The lecturer needs to set up the QR code while using the mobile app to use the system. Therefore, it is time-consuming and sacrifices several minutes at the beginning of each class. Students also sometimes have difficulty in using the app leading to manual data insertion. Hence, this project aims to solve this issue by using the facial recognition system on a lecturer's laptop to collect the attendances.

There are many facial recognition methods that has been used. D.G Ganakwar presented various methods of face recognition which are commonly used, also presents descriptions of representative methods in each category [1].

C. S. Patil, et al. proposes face recognition and authentication using GSM based web cam where different control points are identified within this recognition [2]. Moreover, A. Raghuwanshi discusses and compares the methodologies for an automated attendance program using face recognition based on video where the face identified from the database developed [3]. Meanwhile, Mantri Shamlaet al. proposes to label a SOM to measure image similarity. To manage this function, the facial images associated with the regions of interest feed to the neural network feed [4]. F. N. Jawad Nagi et al. introduces a new technique for identifying a human face. The key advantage of this approach is its high-speed processing power and low computational requirements, both in terms of speed and memory usage [5]. D. Maia et al. explain the application of face detection and recognition algorithms in colour images under MATLAB [6].

Additionally, C. Zhang et al. explores three common methods for face dection using PCA, LDA, and EBGM approaches. The efficiency of the algorithms is evaluated on three separate datasets [7]. A. Guru Sai Sasidhar et al. develop

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a face tracking and recognition using MATLAB and Arduino [8]. J. Joseph et al. proposes a system consisting of a digital camera with high resolution for monitoring the classroom or office space [9]. M. Arsenovic et al. proposes a new Deep Learning Face Recognition program. The primary objective of this project was to use these state-of-the-art deep learning techniques in the field of face recognition [10] M. S. Keil highlights various gaps between humans and machines when it comes to facial recognition [11]. K. S. Selvi et al. developed an efficient module which includes face recognition to manage attendance [12] R. Nandhini et al. create a system to record the student's video, to convert it into images and to mark the attendance [13]. S. Sawhney et al. shows a model to develop an integrated attendance management framework for class students using facial recognition methods [14]. V. Bruce et al. described a facial recognition functional system, in which a variety of components are differentiated [15].

This project aims to develop an automatic attendance monitoring system using facial recognition. The system requires the use of a webcam and MATLAB to perform facial image recognition. This work will implement algorithms for face detection and recognition in the MATLAB image processing toolbox to build a system that will detect and recognize the frontal faces of students in a classroom. Several images of students will be recorded in a database. This GUI-based application automatically identifies a face and matches it with the database created. Lecturers will use the GUI on their laptops, and students will show their faces to the web camera for their attendance to be taken. Python libraries were used in the image processing alongside MATLAB. SQL database was used to store the student details and all the records of attendance. Meanwhile, WAMP was used as the local host to host the SQL database and PHP web dashboard, where it shows the output reports generated in the database.

This system targets implementing the existing student record management system with an inbuilt facial recognition system. The system will first scan the student's faces upon registration to the class. Afterward, it will generate a set of coordinates which the algorithm can identify for a matching face. And next time a student is being scanned, it will add it to the record.

The proposed system has the following features,

- A database of several student faces.
- A face recognition algorithm to detect student's face.
- A GUI-based application automatically identifies a student's face and matches it with the database created.
- A web application to view the student's attendance records.

This project's scope is to provide a convenient and robust system to record student attendance to avoid any misconduct or any kind of cheating attempt, which is generally caused by the traditional student attendance systems. If a student scans a clear picture of other students' faces to the system, there might be a chance that it could be recognized as an entry. But this could only be done without lecturers' consent. MATLAB has its system delay due to the weight of the software itself. This might slow down the actions of the program.

This paper is structured as follow: Section discusses on the methodology such as hardware, software, block diagram and flow chart. Meanwhile, Section 3 presented the results and discussions. Finally, Section 4 summarizes the findings for this work.

2. METHODOLOGY

The project system consists of a Web Application, Webcam, Facial Recognition Algorithm, Facial Detection, Capture algorithm, and MATLAB graphical user interface. Figure 1 illustrates the system block diagram. From the back end, there is a SQL database that runs on a WAMP server. All the data from MATLAB when the user adds a new student will pass to the SQL database. Once the user enters the data and saves the new student data, it will present a Facial Detection window to capture new students' pictures. Those captured images will be stored in a local drive disk and will run the following program to convert them to an identifiable coordinate XML file in the same directory.

Figure 2 and Figure 3 shows the process to scan the faces of students to mark the attendance. For this, the facial recognition app will run, and it will detect faces in front of the camera and compare them against the saved data to identify matching faces. According to the similarities of the face, it will show the percentage of the match. If it is above a certain level, it will consider as a match. And then, it will get the matched id and pass that to the SQL database with the current date as a PRESENT attendance. Once the lecturer closes the scanning window, the program will get the rest of the class students' student ids from the database and mark them as ABSENT. From the PHP dashboard, the lecturer can see the percentages of the students and go to a detailed report by clicking the REPORT function. This will show each day of the semester that the student attended with PRESENT or ABSENT according to his recorded data.

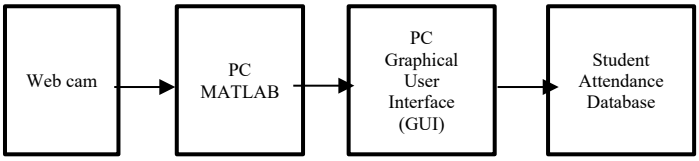

Fig. 1. Block Diagram

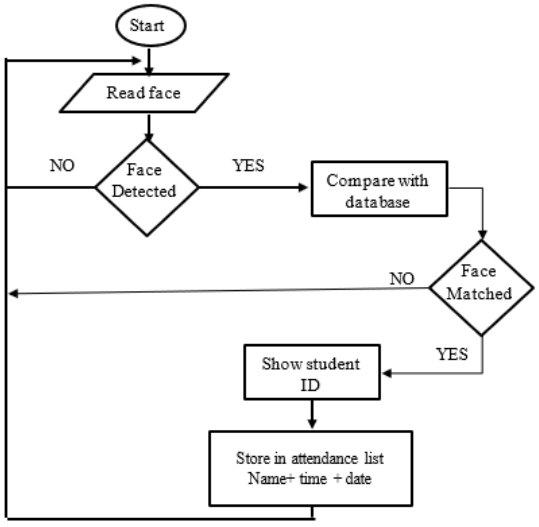

Fig. 2. Flow chart

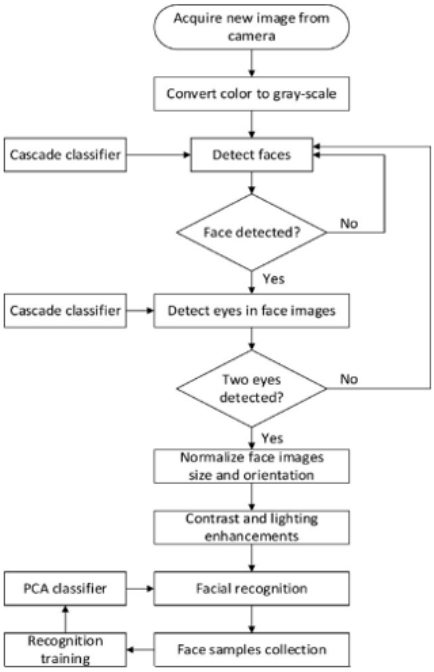

Fig. 3. Flow chart

3. RESULTS AND DISCUSSIONS

The facial recognition-based student attendance system was successfully developed. This section discusses on the working system. The system can be software can be categorized into facial recognition, dataset and a web dashboard.

3.1 Facial Recognition Software

Figure 4 shows the facial recognition window when it scans students with their id numbers. It will try to identify any number of faces shown up in front of the camera. First, it will detect the faces using a square, and then if a look is available, it will run against the Dataset and find the match. In case of finding a matching face, it will apply the ID tag on the face and start indicating it above the face detection areas.

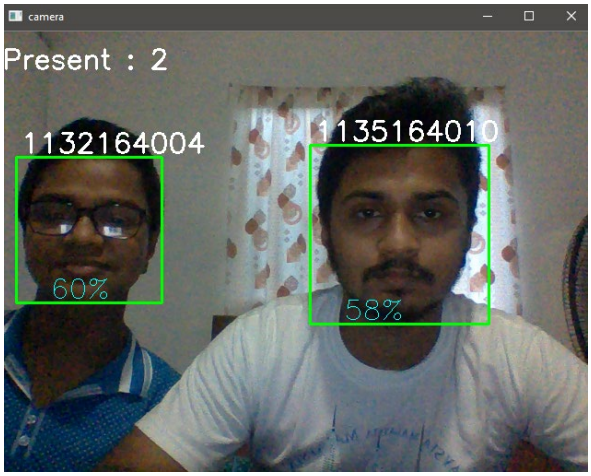

Fig. 4. Facial Recognition

3.2 Facial Recognition Dataset

Figure 5 illustrates the database of the recorded faces. This data set is generated by the script called face capture. This will identify the face and capture N number of times to take the pictures from different angles, where N determined as the writing of the script. (N=30). These pictures will be stored in Dataset's folder to generate a coordinated XML file for recognition purposes. These faces will be converted into the grayscale to make the coordinates simpler during the identifying process. Once a new face is captured, there is no longer need for the individual pictures after the new XML picture identifier generation. Figure 6 shows the student attendance list.

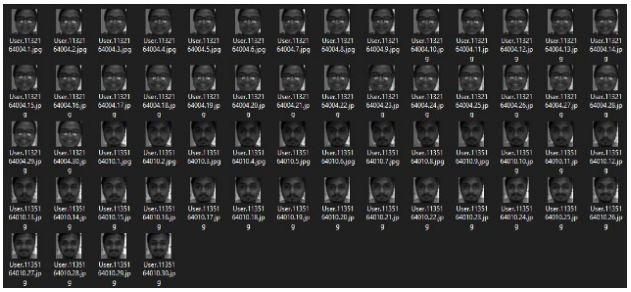

Fig. 5. Face Database

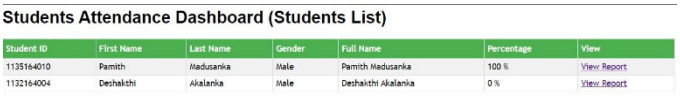

Fig. 6. Students List

3.3 Web Dashboard

Figure 7 shows the dashboard that provides details of each student that fetched from the SQL database, such as Student ID, Name, Gender, and Attendance percentage. On top of that, it shows the URL to generate a detailed report with the dates and status of the attendance for each student.

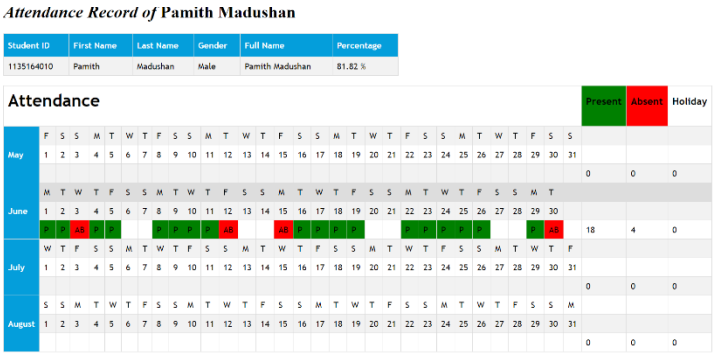

Fig. 7. Students Detail Report of Attendance

4. CONCLUSION

In conclusion, this system was successfully tested based on multiple user inputs. Their attendance was successfully recorded in the attendance monitoring system. This system is designed to work in a local host system hosted using a WAMP server. The system can be integrated into online platform where the student data will be stored in an online database. This system can also be used to any environment that required the us

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