



Real-Time Face Detection Attendance Management System

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Abstract: The issue of human error, inaccurate and time-consuming of manual attendance system gradually magnified the inefficiency and obsolescence of the system. An automatic attendance management system with face detection will increase the efficiency, accuracy, and security of a system in attendance taking task. Real-Time Face Detection Attendance Management System is concerned in finding human faces through real-time with the attendance taken and saved as reference for future. Face detection system is implemented by using Haar Cascades Classifiers for the object detection. Attendance system is managed with a database management system called MySQL using SQL programming language. Real-Time Face Detection Attendance Management System able to detect front face and manage the attendance in real-time. A text box will display for the attendee to enter their name for the purpose of attendance taken when face is detected. The attendance list and image collection in the database will auto increment and update in MySQL. The accuracy of Real-Time Face Detection Attendance Management System is shown with the comparison between different front face condition in different illumination condition. The result is tested with 4 sets of the attendee's face in different illumination and different front face condition. 94.44% accuracy of the face detection system is shown from the result taken by the system. The image acquisition for every attendee is collected and saved in the right folder. The attendance is taken with the attendee's name, date and time in attendance database and image is save into face database. Some technology such as anti-spoofing measures, mask detection and deep learning concept are recommended to be added into the system for future improvement

Keywords: Attendance management, front face detection, haar cascades, real-time

1. Introduction

Face detection system is an Artificial Intelligence based computer technology for identifying human faces in digital images. Face detection commonly used in biometrics as the essential initial step of face recognition for security and authentication purposes. Smart face detection can be applied in various fields to provide surveillance and tracking of people in real-time. The involving of an automatic attendance management system with face detection will increase the efficiency, accuracy and security of a system in attendance taking task. The issue of human error, inaccurate and time-consuming of the manual attendance system can be solved with the integration of the latest technology into the system. Real-Time Face Detection Attendance Management System is design and implement based on machine learning under Python environment and MySQL environment. The main idea of the project is to implement a system that able to complete the attendance taken task and save into rightness database by detecting front face. Different illumination condition is tested with different front face condition for the accuracy of the system. Haar Cascade Classifiers, Histogram of Oriented Gradients and Convolutional Neural Networks are the most basic implementation for the face detection [1]. Real-time computer vision applications such as OpenCV [2], Microsoft Azure Face API [3] and Simple CV [4] are basically used for image classification, object detection, semantic and medical image analysis. MySQL, SQL, Comma Separated Values (CSV), Hypertext Preprocessor (PHP) and Excel are the methods that can be used for attendance record.

2. Related Work

This section presents a review of information or idea related to the face detection attendance management system. The summary of survey from the existing research are summarized in Table 1.

Table 1 - Summary of existing research

No.	Title [Ref no.]	Features
1	Faster face detection using Convolutional Neural Networks & the Viola-Jones algorithm [5]	Viola-Jones algorithm <ul style="list-style-type: none"> • High accuracy for frontally positioned faces • Longer computation time • Older, minimal memory Convolution Neural Network <ul style="list-style-type: none"> • Faster and more reliable than Viola-Jones algorithm • limits on computational memory and physical memory
2	Face Recognition for Attendance System Detection [6]	<ul style="list-style-type: none"> • Able to recognise and identify face in accuracy of 98.2% at distance of 40 cm from camera with 24 lux lighting intensity • System still in good accuracy between 40 cm to 90 cm with 7 lux lighting intensity • Maximum face detection angle of 30° • Size of detected box depend on size of face pixels. • Must work under WiFi coverage area and power bank
3	Facial Recognition Attendance System Using Python and OpenCv [7]	<ul style="list-style-type: none"> • Hold up to 2000 individual information • OpenCV library for recognition • CSV files for attendances collection
4	Real-time Smart Attendance System Using Face Recognition Techniques [8]	<ul style="list-style-type: none"> • Using feature-based and brightness-based face recognition • Using Viola and Jones algorithm as face detection and PCA as face recognition • Provides student database and attendance database
5	An Improved Face Recognition Algorithm and Its Application in Attendance Management System [9]	<ul style="list-style-type: none"> • Different face recognition methods with different face's datasets, orientations and conditions • LBP algorithm with Contrast Adjustment, Bilateral Filter, Histogram Equalization and Image Blending is the most accurate face recognition method
6	Real Time Automatic Attendance System for Face Recognition Using Face API and OpenCV [10]	<ul style="list-style-type: none"> • Using YOLO V3 algorithm, Microsoft Azure face API, CNN, Tkinter and SQLite3 • Training data with 20 pictures per student • Able to generate specific ID • Able to collect up to 600 students
7	Applying Artificial Neural Networks for Face Recognition [11]	<ul style="list-style-type: none"> • Learn, generalize, cluster and organize data based on parallel processing • Increases system's performance time • Create a complete hybrid system • Apply SVM, ANN and LBPH
8	Facial Recognition-Based Attendance System Using Python [12]	<ul style="list-style-type: none"> • Generate 128 measurements of captured faces for face recognition • Using CSV for attendance marking • Will autogenerated ID for new faces

3. Methodology

There are few processes to be involved for the implementation of Real-Time Face Detection Attendance Management System. Initially, investigation the research on existing projects and planning a suitable title for the project. Next, analysis the specification and requirement of the project according to the selected title. The output display on the system is designed and the overall system flow is presented in flowchart. After that, development and implementation of the project through selected platform. Inspection, demonstration, test and analysis of the system under verification. Lastly, problem correction, performance enhancement and accuracy of the system done under maintenance.

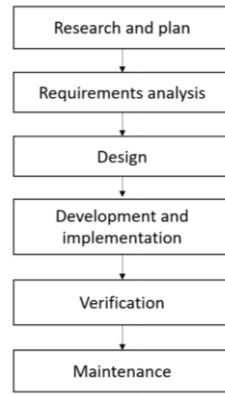


Fig.1 - Methodology of the project

3.1 Block Diagram

Real-Time Face Detection Attendance Management System is a system able to detect front face and management the attendance database through real-time. The block diagram illustrates the operation of the system for attendance collection through real-time using front face for detection.

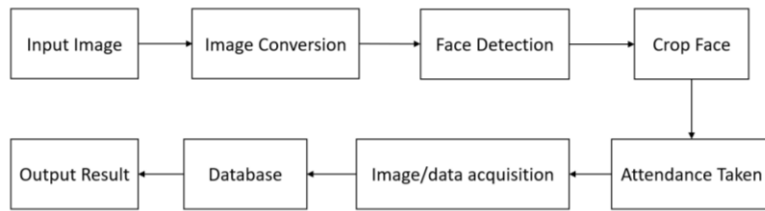


Fig. 2 - Block diagram of the project

3.2 Application Uses

Some software application and programming application are use in Real-Time Face Detection Attendance Management System. PyCharm Community Edition 2021.1, Python 3.9, MySQL Shell, MySQL Workbench 8.0 CE, OpenCV and Tkinter are the software application that used in the system. OS module, datetime module, shutil module, io module, base64 module, PIL module, NumPy module and MySQL Connector module are the programming application that used in the system.

4. Results and Discussion

The implementation and operation of Real-Time Face Detection Attendance Management System will be illustrated in this chapter. The efficiency of Real-Time Face Detection Attendance Management System is proposed with the result. The effect of different illumination and different front face condition is discussed.

4.1 Real-Time Face Detection Attendance Management System

A text box with current date and time will displayed when face is detected. Every attendee is required to enter their name into the empty entry for the purpose of attendance taken and pressed the button to the following step.

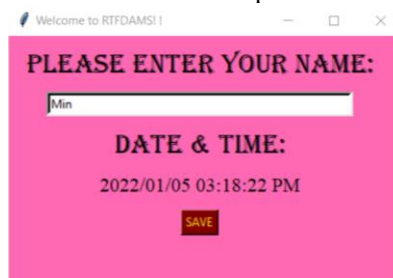


Fig. 3 - Text box for entering name

Message boxes will display to get confirmation from the attendee before recorded into the system.

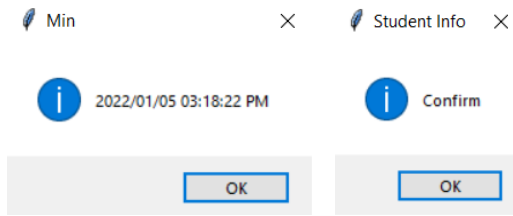


Fig. 4 - Confirmation message box

All detected face ROI is saved in gray scale with size of 224x224. Image will encode into binary form and save into database. A decode image will show after message boxes as proven of the image’s accuracy in the database.

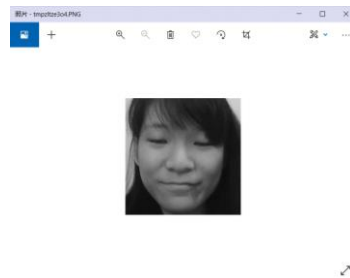


Fig. 5 - Decoding of image from database and display in the system

Attendance will be taken with attendee’s name, date and time. Real-Time Face Detection Attendance Management System will display and update the attendance record automatically during attendance taken process. Attendance will be overwritten starting from the first row of the attendance list when the list reached the maximum range of 21.

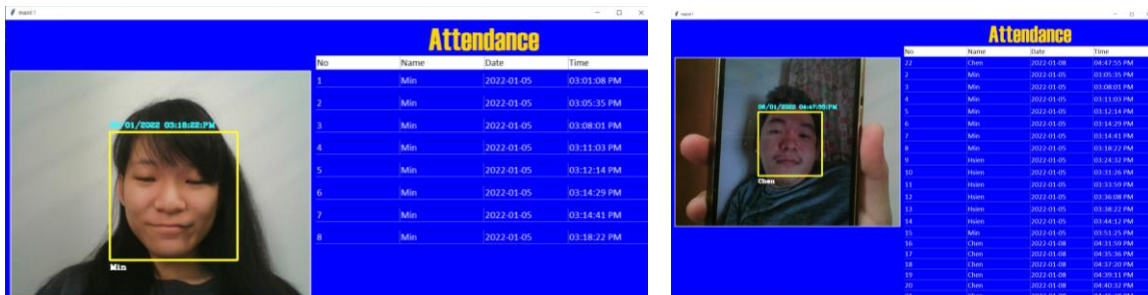


Fig.6 - Main System of Real-Time Face Detection Attendance Management System

Attendance list will be saved into the table named “attendances” in “attend_backup” database as backup. Image will be saved into the table named “faces” in “face_backup” database with attendee’s name as backup.

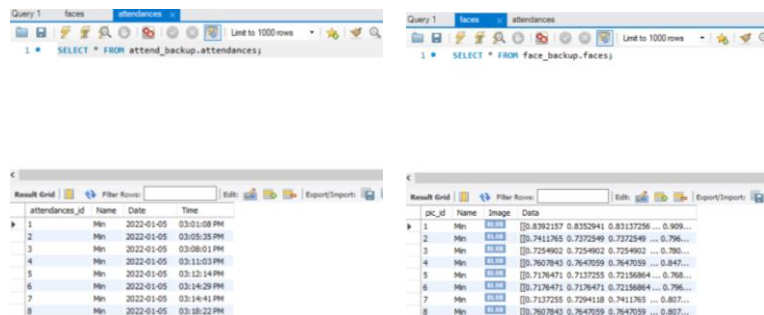


Fig. 7 - Database in MySQL

Image acquisition of the attendees able to refer from PyCharm or driver as Figure 6.

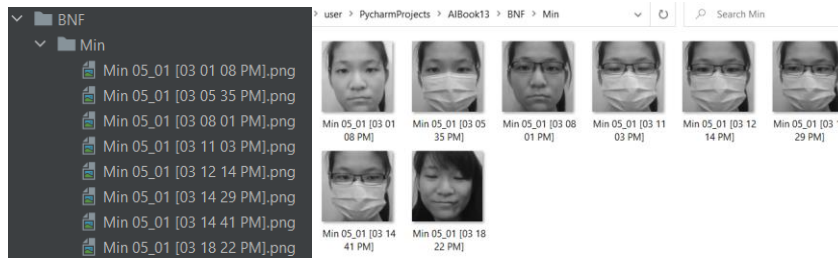


Fig. 8 - Image acquisition from PyCharm and driver

Real-time video will be captured and recorded into AVI file named “output_{}”.



Fig. 9 - Video capture of the system

4.2 Detection of Front Face in Different Illumination Condition

Haar Cascade object detection algorithm is an algorithm that used Haar-like features in identifying the present of the faces. Edge features, line features and four-rectangle features are the 3 basic types of Haar-like features which use the black and white bars in classifying the object. White bars represent the part of image that closer to the light source while black bars are the opposite of the white bars [13]. Face detection under different illumination condition will influence the performance of Real-Time Face Detection Attendance Management System. The comparison of the performance in different illumination condition with different front face condition can be seen through Table 1.

Table 2 - Performance of real-time face detection in different illumination condition with different front face condition

	Illumination Condition	
	Light	Dark
Front face		
Front face with any hand style		
Front face with spectacles		
Front face with mask		
Front face with both spectacles and mask		

The efficiency of the system will be affected when the illumination is too light or too dark. This is due to the sensitivity of the face detection system to the illumination. System may not be able to detect the present of the faces and extract features well. The increase of the contrast will cause the changing of textual value and original pixels of face during illumination normalization [14]. This will influence the speed of the detection and accuracy of system. Low resolution of images will be produced when the detection is happened under unsuitable illumination condition. Therefore, variety of illumination condition will make the face detection more challenging and complexity. To avoid low efficiency of the system, Real-Time Face Detection Attendance Management System should operate under suitable illumination condition.

In addition, 4 sets of attendee's face are tested and collected with different front face condition in different illumination condition. The system shows the accuracy of 94.44% for the face detection system. 1 of the images in light condition and 1 of the images in dark condition are not detect the face well. Both unsuccessful images are tested with a cover front face. From the result, an empty front face detection is faster than a cover front face detection. A cover front face will cause the detection system harder in finding the present of faces. The more the cover area of the front face, the more the false acceptance rates of the algorithm, the slower the system in identifying present of face.

5. Conclusion

Real-Time Face Detection Attendance Management System is a machine learning based system developed under Python environment. Databases in MySQL function as the backups for the system. Real-Time Face Detection Attendance Management System able to detect and mark attendance automatically. The optimization technique will increase the efficiency and accuracy of the system. Therefore, a suitable technique is selected in the implementation of the system from the several techniques of the research.

Real-Time Face Detection Attendance Management System should be improved with the deep learning for face recognition in verification an individual's identity. Anti-spoofing measures can be added into the system to attack only 3D facial not both 3D and 2D facial. Besides, mask detection with the accuracy of the mask wearing system can be inserted into the system. A body temperature and gender detection system can be added into the system for future improvement.

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