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A Real Time Advance Automated Attendance System using Face-Net Algorithm

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Abstract -*Proposed system presents a pioneering "Real-Time Advance Automated Attendance System using Face-Net Algorithm" designed to alleviate the burdens associated with manual attendance-taking methods prevalent in educational institutions. Leveraging state-of-the-art facial recognition technology, the system automates the attendance tracking process, enhancing accuracy and efficiency.*

Proposed system encompasses the development of a robust system that incorporates facial detection and recognition algorithms, database management, and user interfaces tailored to the needs of educators and administrators. By capturing and processing facial data, the system enables real-time attendance recording while maintaining stringent privacy and data security measures.

Through rigorous testing and evaluation, the system demonstrated its effectiveness in diverse classroom settings, offering a practical solution for attendance management. This project seeks to contribute to the ongoing digital transformation of education, promoting streamlined administrative processes and allowing educators to focus more on their core teaching responsibilities.

The Face Recognition-Based Attendance System represents a forward-thinking approach to attendance management, aligning with contemporary technological trends and addressing the challenges posed by conventional methods. As educational institutions seek to optimize their operations, this system stands as a testament to the potential for technology to enhance administrative processes and improve the overall educational experience.

Key Words: Face-Net, Attendance System, Face Recognition

1.INTRODUCTION

In an era characterized by rapid technological advancement, the education sector continues to embrace innovative solutions that enhance learning experiences and administrative processes. One such innovation is the implementation of biometric-based attendance systems. This system endeavors to contribute to the educational landscape by presenting a cutting-edge "Real Time Advance Automated Attendance System."

Developed a Python-based face recognition attendance system whose data will be stored in the database. In the result, it is shown that it captures up to 4 faces accurately [1]. A CNN-based automated attendance system using the facial recognition domain has been developed [2]. A real-time, video-based dynamic face recognition system is developed [3]. Works propose a system in which Euclidian distance, eigen value, and eigenvectors are used. In PCA-based face recognition, OpenCV is used in the attendance system [4] [5] [6] [7]. The author has developed an attendance system based on the Haar cascade and local binary pattern histogram algorithm. However, most of these systems have respective limitations in portability, accessibility, authenticity, or cost [8].

The aim of developing this system was to detect multiple faces and recognize them in real time for effortless attendance marking. The main objectives of this system are as follows:

- Face Detection from Images: Efficiently detecting faces within images forms the foundational step of our system.
- Development of a Machine Learning Model: The creation of a robust machine-learning model, pre-trained on a comprehensive dataset of student faces, empowers the system to uniquely recognize individuals.
- Attendance Recording: The system directly records attendance for future reference ensuring reliable records.
- Excel Sheet Integration: Attendance data is efficiently marked on an Excel sheet, simplifying record keeping and data management.

The rest of the paper goes like this: We talk about what other people have studied and written about in Section II. In Section III, we explain how our system works. Section IV is where we show you what our system looks like on the computer screen. We talk about what we found out from our system in Section V. Finally, in Section VI, we finish up and wrap things up.

2. Literature Survey

In recent times, different methods, techniques, and image processing have been used to increase the accuracy and efficiency of facial recognition systems.

An enhanced face recognition method is proposed to develop an efficient student attendance system. PCA algorithm is used for developing the system. It extracts the facial features and performs the Haar cascade method [4]. In the face recognition stage, an enhanced local binary pattern (ELBP) is implemented by increasing the radius of the original local binary pattern (LBP) operator, and principal component analysis (PCA) is used to extract the features from facial images [6].

Concentrates on the implementation of an automated attendance system that uses face recognition algorithms like Haar cascade, LBPH, and OpenCV to record the attendance of the class and manage the class database [9] [8].

Development of a face recognition-based automatic student attendance system using Convolutional Neural Networks which includes data entry, dataset training, face recognition, and attendance entry[2]. The system can detect and recognize multiple people's faces from video streams and automatically record daily attendance [1].

Automated real-time attendance management system (AMS) using face recognition techniques to reduce human dependency and thereby save time [10]. A modified local binary pattern histogram (MLBPH) algorithm based on the calculation of based on pixel neighborhood gray median for extracting the significant features of the human face [11]. This paper develops a university classroom automatic attendance system by integrating two deep learning algorithms MTCNN face detection and Centre-Face face recognition [12].

Face detection is an important role in many applications. Face detection overlapping is one of the important works in face-detecting applications. In this paper, the DRLBP algorithm is used to identify overlapped face detection. Initially, the face is detected from database images using DRLBP feature extraction. This feature extraction result is compared to our test images [3].

The proposed system uses Max- Margin Face Detection (MMFD) technique for face detection and the model is trained using the Inception-V3 CNN technique for the students' identification [13]. The IoT-based system in which the pin camera is associated with the raspberry-pi serial USB port catches of the researchers who are accessible inside the class for face location and system with CCTV implemented in [14][15].

The system is trained and tested by conducting experiments on the FEI face database. Each classifier is trained using face images of each student in seven different head poses and it is tested against six different poses [16]. RFID uniquely identifies the student based on the card number, and then an individual (Fast Adaptive Neural Network Classifier – FANNC) classifier is used to verify the face of each student exclusively [17].

Principle Component Analysis (PCA), Eigen face value detection, and Convolutional Neural Network (CNN) are the methods being used in this paper to create an automatic attendance management system [18]. Investigate its feasibility of mobile attendance systems for settings such as classrooms or other scenarios that require headcount or roll call. Real-time, attendance monitoring uses a web app that can be operated remotely by using a local server and Amazon Web Service (AWS) cloud recognition Application Programming Interface (API) [19] [20].

3. Proposed Methodology

A. System Overview:

The main objective of the system is to detect the faces of each student from an image and then recognize the faces by cross-referencing the detected faces with the ones stored in the system. This system also can detect and recognize multiple faces and when the faces are detected properly, it marks the recognized face attendance on the Excel sheet.

The system starts with storing the face data of different students or people with proper labels for creating a dataset.

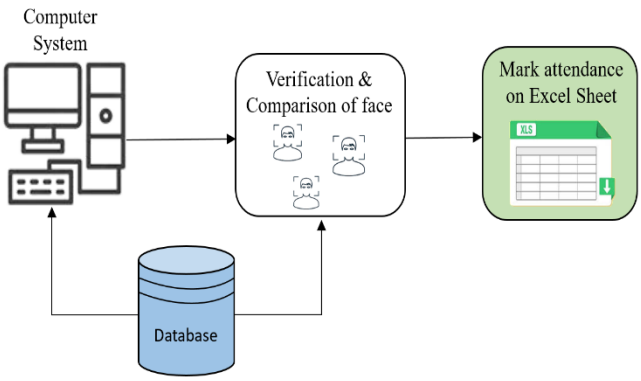

Fig-1: Block Diagram

These images will be used for comparing the faces present in the group image. For recognizing faces, the Face-Net algorithm is used. After the dataset is created the information of the student or the employee is added like ID, Name, Class, Branch, Department, etc. This data is then stored in the Excel sheet and if for any reason the entry of data gets wrong, it can be updated or deleted. The command to capture the image is given to the camera. The camera captures and stores the image and then compares the captured image with the dataset image of faces. The person whose face is matched, his or her name, and other details are marked in the Excel sheet.

B. Methodology

The different parts of the system can be group into four main stages. These are:
- Data Entry
- Dataset Training
- Face Recognition
- Attendance Entry

These stages are being discussed in the following section.

1) Data Entry:

The first step is to include the faces of the students in the system for creating a dataset For this, continuous photos of each of the enrolled students are taken by the system from a group photo, along with their names and IDs. It is preferred that the students have different head positions during this time to create a better dataset. The setting can be changed to increase the number of pictures taken to make a more accurate dataset. A folder for each student is created with the corresponding student's name and ID as the label. Each of the pictures of faces is then saved in that student's designated folder. Besides this process, previously taken pictures of the enrolled students can be added to the dataset to make it more diverse. In this case, the new photos will be saved in that student's previously created folder. After every data entry, the system is automatically trained using the currently available dataset. So, the system is already set to be used any time after the student's data has been entered.

2) **Information Entry**:

In this section, the information of the individual is filled in

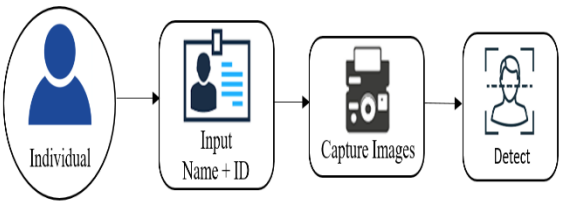

Fig-2: Data Entry

and stored in the database. Now if the label to an image is given as a person's name and while filling in the information the person fills in his name then when the face recognition process is performed the system will use the name that is stored in the database to recognize the image of that person. This is only possible when the image label is of a person's name. And then if the image is matched then based on that name other details are also marked in the database as attendance like ID and Roll-no. If in any case the detail of an individual is entered wrong then it can be immediately deleted or updated using the system.

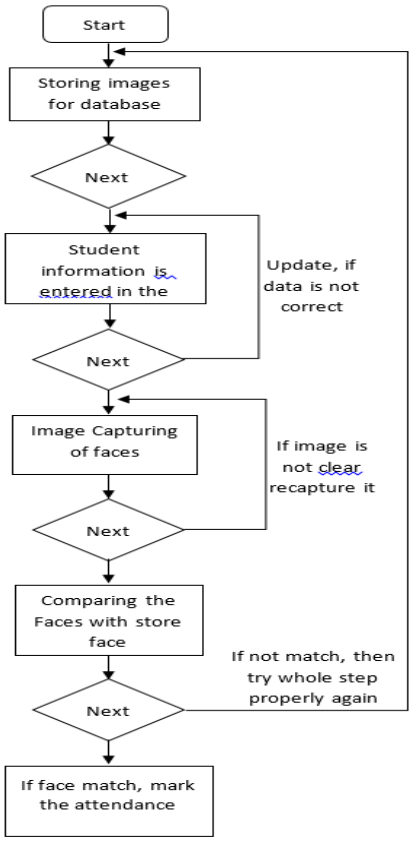

Fig-3: Flowchart

3) Face Recognition:

In this step, the system can be set up by putting a camera in a good position where it has a clear view of the students. The system can then detect the faces of the students from the group photo captured by the camera. The detected faces are then compared to the stored dataset. A confidence value is assigned to each of the matches. The match with the highest confidence is selected and the label, which is the name and ID of the student, is extracted. If there is not a match of a high enough accuracy, then the student is labeled as 'Unknown'.

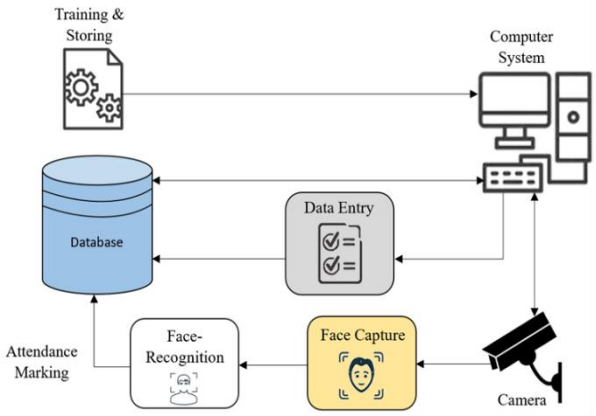

Fig-4: Overall Processing

4) Attendance Entry:
By taking the data from the captured image, the names and IDs of the recognized students are automatically logged on a daily attendance spreadsheet along with the date, time, and period name. Students can track their attendance daily. It marks attendance for a specific day or specific class using it the attendance-taking process makes it easier.

4. Implementation

The proposed system is developed using Python. With the help of Tkinter, is simple to use and comes included with Python, making it a popular choice for creating basic GUI applications. We have created the GUI (Graphical User Interface). The whole system lies around Idlib, Dlib is widely used in computer vision research and applications due to its high-performance capabilities and face recognition library which are used for recognizing and detecting faces. We have created different system for performing different tasks. The pages are presented next.

A. The main system:

The main system is shown in the figure. It contains different buttons which can perform different tasks. In the train data button, we can add the dataset images and after that, once we have added all the data, we can check how many faces data we have collected.
Now in fig4, it is shown that when the train data button is pressed the dataset which contains all the images is open. Here we can add and remove any image and we can also see the quality of the image and can also check the labels

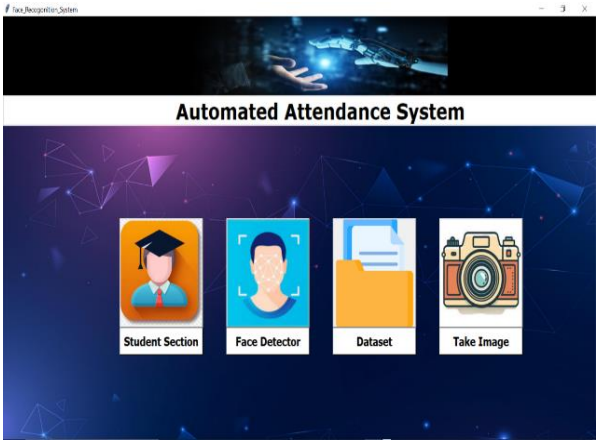

Fig-5: Main System

B. Adding data:

In this way, the individual can add their information and it will be saved on the database. If the individual filled wrong information due for some reason, then it can be deleted or updated using the two buttons.

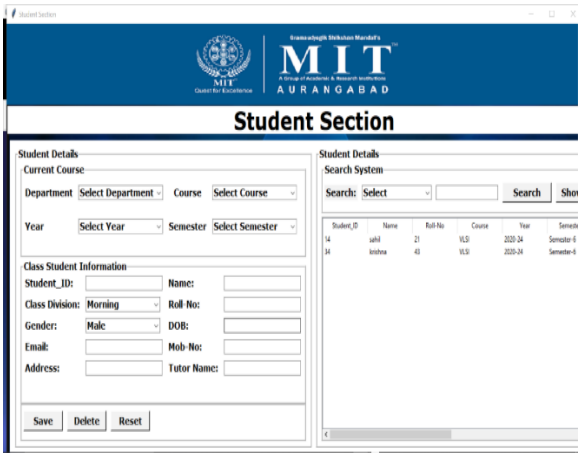

Fig-6: Student Section

C. Taking Attendance:

The capture image button is used to capture the group image. The camera is placed in the class and when the capture image button is pressed the camera present in the class captures the image of the students and saves the image on the system. After capturing the image, the face detector will compare the image faces with the dataset images and recognize them. And if the face is matched then it will show the faces with the label name. After capturing the image, the face detector will compare the image faces with the dataset images and recognize them. And if the face is matched then it will show the faces with the label name.

D. Showing Attendance

Fig-7: Taking Attendance

After taking attendance the faces, which are recognized their details are marked on the Excel sheet. Using the label name, also adds other all details to the database. The label name is preferred to add the individual name.

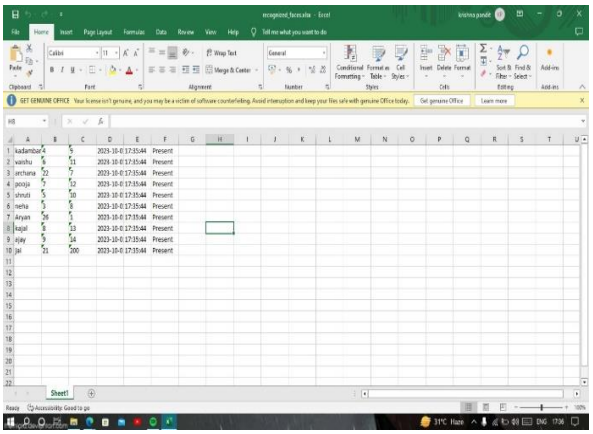

Fig-8: Showing Attendance

Equation:

$R^2A^2AS = \int (FNA \times RT)\, dt$ (Equation 1)

R^2A^2AS: Represents "Real Time Advance Automated Attendance System."

FNA: Represents the "Face-Net Algorithm."

RT: Represents "Real-Time."

∫: Represents integration, highlighting the continuous and dynamic nature of attendance tracking over time.

t: Represents time, indicating the temporal aspect of attendance management.

Quantify the accuracy of face detection using the ratio of true positive (TP) detections to the total faces detected (TFD):

Accuracy % = (TP / TFD) × 100. (Equation 2)

Calculate the attendance percentage by dividing the real-time attendance by the total class duration (T):

Attendance % = (RAAS / T) × 100. (Equation 3)

4. Result and Discussion

The ultimate aim of this system is to revolutionize attendance management in educational institutions by introducing an advanced Camera-Based Attendance System that not only automates the process but also enhances the overall learning experience. By seamlessly integrating cutting-edge technology, data security measures, and user-friendly interfaces, our system aims to set new standards for efficiency, accuracy, and convenience in attendance tracking, ultimately contributing to the advancement of educational practices worldwide.

The overall accuracy of proposed system is as follow:

Trial No	Input per person	Result				
		Total Faces	Correct Recognition	False Recognition	Accuracy	Average Accuracy(%)
1	1	5	5	0	100%	100%
2		5	5	0	100%	
1	1	6	6	0	100%	100%
2		6	6	0	100%	
3		6	6	0	100%	
1	1	8	8	0	100%	100%
2		8	8	0	100%	
3		8	8	0	100%	
1	1	10	9	1	90.00%	90%
2		10	8	2	80.00%	
3		10	10	0	100%	

Table.1. Accuracy

The representation of comparison of total faces out of how many correctly recognized and how many falsely recognized are shown below which indicates 100% accuracy by recognizing all the faces correctly.

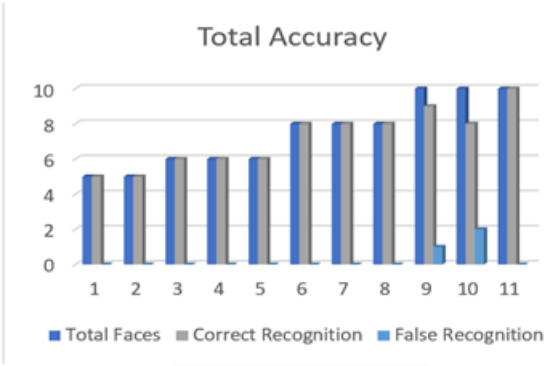

Fig-9: Accuracy

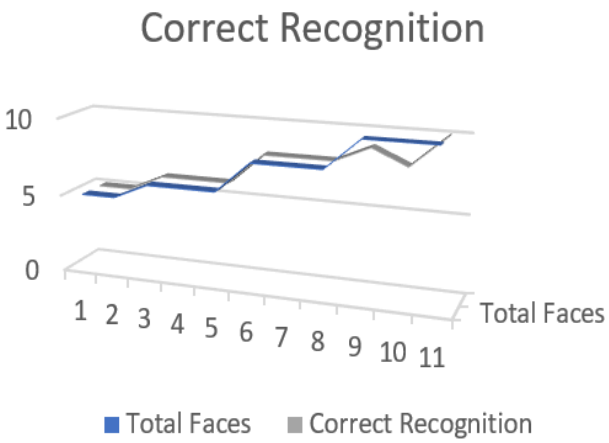

Fig-10: Correct Recognition of total

The representation of comparison of total faces out of how many falsely recognized are shown in which indicates 100% accuracy by not showing single false recognition.

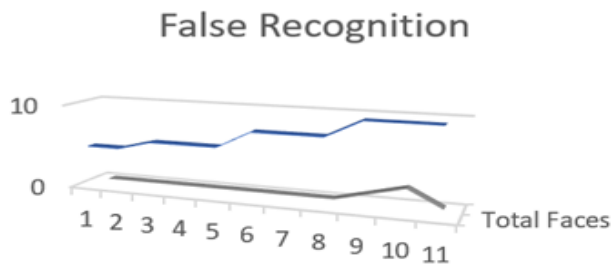

Fig-11: False Recognition of total

Fig.11. False Recognition of total faces

CONCLUSION

The Face Recognition-Based Attendance System for Classroom Environment marks a notable milestone in the ongoing digitization of education. By seamlessly integrating facial recognition technology, database management, and Excel integration, this system provides a comprehensive solution that stands to benefit educational institutions seeking to optimize their administrative processes while maintaining a strong commitment to data privacy and accuracy. This system serves as a testament to the transformative power of technology in enhancing educational practices and administrative efficiency.

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