Advancing Attendance Monitoring using Facial Recognition Technology for Seamless Tracking

Ajmeera Kiran[1], Vikram Neerugatti[2], Rudrapati Mounika [3] , Rajermani Thinakaran[4] , J.Somasekar[5] , Navin Patidar [6]

[1]Department of Computer Science and Engineering, MLR Institute of Technology, Dundigal, Hyderabad, Telangana, India- 500 043.

[2,5, 6] Department of Computer Science and Engineering, Jain (Deemed-to-be University), Bangalore, Karnataka, India-562 112.

[3]Department of Computer Science and Engineering, Malla Reddy Engineering college, Hyderabad, Telangana, India-500 100.

[4]Faculty of Data Science and Information Technology, INTI International University, Malaysia.

***Abstract*—In this digital age, face recognition is used in many industries. It is one of the most popular biometric solutions for detection and recognition. Although it is less accurate than other biometric methods is still popular because it is non-intimidating and touchless. By automating attendance and eliminating manual procedures prone to proxy attendance, face recognition technology can significantly improve attendance management in workplaces, universities, and schools. This solution is designed to create a attendance system using facial recognition technologies. The four primary components of the system are database creation, face detection technology identification of nearby individuals, facial feature comparison with database entries, and attendance record updating based on recognition outcomes. This will make it possible for the system to maintain track of who was where and when. To create the database, pictures of the class are taken. In this paper, we have employed SVM classifier in addition to CNN encodings for measuring the face images. Real-time face detection and recognition from live streaming video in the classroom is built into the system. The relevant faculty member receives an automated mail notification with the attendance information at the conclusion of the session.**

Keywords- Face recognition, Convolutional Neural Networks(CNNs), Deep Learning, Data Augmentation, Attendance Management System

I. INTRODUCTION

In [1], the most important tools used by educational institutions and organisations to monitor student attendance in class and staff or employee working hours is the attendance system. Human error can make manual attendance-taking procedures unreliable at times. The company will save money and time with an automated system. Many institutions are moving to an automatic attendance system using digital technology and biometric authentication. However, such biometric systems can only serve a single user. Face recognition models are constantly improving with the help of many deep learning algorithms. An attendance system feature could make use of these face recognition models. Numerous governmental and private organisations employ face recognition technology for a variety of purposes. It has numerous uses, including liveness detection, entry gate authentication, and crowd-based criminal identification. In[2], a face recognition model based on the "labelled faces in the wild" dataset—a collection of various faces with corresponding labels—is employed in the proposed system. The conventional approaches to attendance management are out of date and prone to mistakes in the fast-paced world of today. Facial recognition-based attendance systems have come together as a dependable and effective way to address these issues. To improve accuracy and performance, these systems make use of cutting-edge technologies like support

vector machine classifiers and convolutional neural network encodings.

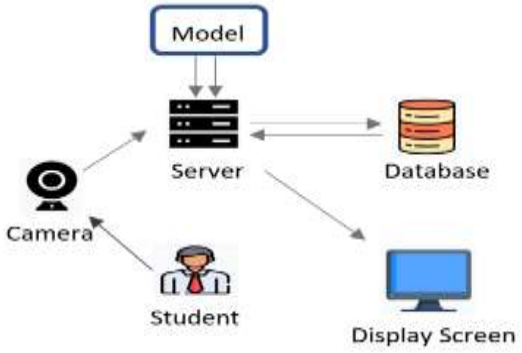


Fig. 1: Overview of the proposed application

II. LITERATURE SURVEY

1. In [1], Based on discriminant analysis, a method for creating compound features for face recognition is put forth. Compound features are derived from the most instructive characteristics, rooting integrative and unique features and measuring their discriminant information. The proposed approach performs better in face recognition trails than previous mongrel models using colourful face picture libraries. Both face recognition and pattern recognition performance could be improved by the system implicitly. In [2], The study suggests a novel deep neural armature hunt channel for face recognition that makes use of NAS technology and underlying literacy. Despite its relatively small size, the new system achieves impressive accuracy on standard face recognition datasets. Further testing on more diverse datasets including variations in colour, lighting, and ethnicity could improve performance and broaden its applicability. A variable exploration direction is the combination of colourful loss functions and the NAS strategy. In [3], To overcome the drawbacks of conventional manual attendance techniques, an RFID and face recognition-based attendance system is introduced. Compound authentication is used by the system to increase accuracy and dependability. It can be easily adjusted to different settings. Enterprises can transfer internal information more efficiently thanks to the system's high reliability and ease of use. In [4], investigated how well five different thermal face recognition methods handle changes in facial appearance over time. The researchers compared these techniques to a standard appearance-based method. According to the study's findings, the WLD, GJD, and LBP approaches successfully identify faces in thermal images, suggesting that the issue of temporal variation in face recognition may be resolved. Two new databases were created as a result of the study so that researchers could better examine the temporal issue in thermal images. It was discovered that the WLD-HI approach was the most effective for creating thermal face recognition systems. In [5], A new similar face dataset is gathered, and a robust face recognition technique that combines the face's internal and external features is presented. While the method increases the difficulty of training a model, it also improves recognition accuracy for very similar face images. Although the suggested end-to-end training mode makes model training easier, more research is still needed to increase efficiency. This article [6] presents an automated attendance system that is coded in PHP and Python for facial recognition and attendance management, and employs a Raspberry Pi for hardware. One of the system's prototype doors is controlled by a servo motor and only opens for authorized pupils.
2. 1.**Replacing manual sheets with digital records:** This paraphrase emphasizes the shift from paper to digital: "Educational institutions are ditching paper attendance sheets in Favor of a web-based system that stores attendance data in a MySQL database. This digital approach aims to improve accuracy compared to traditional methods."
3. **Accuracy focus:** This paraphrase highlights the accuracy benefit: "To improve the accuracy of attendance records compared to manual sheets, schools are turning to a web-based attendance system. This system stores data in a MySQL database and can be accessed through a web browser."
4. **Web accessibility:** This paraphrase emphasizes the online aspect: "An internet-connected web browser can now access attendance information stored in a MySQL database. This system aims to provide a more

accurate alternative to paper attendance sheets used in schools."

In [7], this work use visual data for emotional state identification that is sensitive to privacy. While attaining competitive performance in arousal recognition, the proposed CNN-LSTM network protects individually identifiable information. The work opens the door to the potential of a widely used, privacy-aware visual-based emotion identification system for HMI and other applications. In [8], A better face recognition algorithm with limited training samples and different poses is suggested. Two dictionaries are used by the FPPR and DD-SRC algorithms in the algorithm to better handle various poses. Promising results are obtained from experiments on the ORL and FERET databases, with the exception of cases where there are few training samples. Future work will focus on refining the training dictionary and expanding the algorithm's adaptability to a wider range of poses. In [9], This study investigates the classification of Arab sub-ethnic groups using a CNN model. The authors pretrained a ResNet50 model using three labels to create an Arab dataset, which they then used for classification. The results indicate that because of the labels' strong similarity, the model has trouble telling them apart. Using the RFW dataset, the authors also experiment with deep clustering and classify Arabs as a whole along with three other ethnic groups. Within the research. [10], The effectiveness of recent advancements in facial recognition technology is evaluated. It compares various face recognition algorithms and platforms, paying particular attention to processing accuracy and speed. The results show that algorithms based on neural networks are more accurate than those not based on neural networks. In addition, GPUs outperform other hardware accelerators in face detection and identification systems. On the other hand, FPGA-based solutions offer faster throughput and lower power consumption, particularly when utilising a smaller face data database. The paper proposes integrating the benefits of both approaches into a single chip and developing hardware-software tools that are easy to use and enable algorithm partitioning based on user preferences.

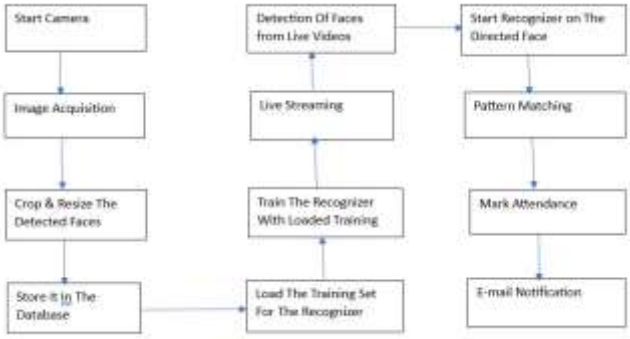
III. PROPOSED SYSTEM

Students must register for the suggested system by filling out their information and taking pictures that will be added to a dataset. During each class, a video camera will capture student faces. These faces will then be automatically matched against a database of student images to record attendance.

This paraphrase keeps the core idea but uses simpler language:

- "Video streaming" is replaced with "a video camera" for clarity.
- "Subsequently" is replaced with "then" for a smoother flow.
- "Identify faces" is rephrased as "capture student faces" for better understanding.
- "Dataset's images" is simplified to "database of student images".

The matching student's attendance will be recorded if a match is discovered. A list of absent students will be emailed to the relevant faculty member at the conclusion of each session. The suggested system is graphically represented by this system architecture diagram.



Flow Chart 1: Process of Recognition.

1. *Dataset Creation*

First, pictures of the students are taken with a webcam. Once the video captures faces, they are separated from the background clutter. This is like cutting out a picture (cropping) to focus only on the important part (region of interest) - the student's face. To help standardise the images and facilitate comparison, the image is resized to a predetermined size in the following step. Ultimately, the photos are saved in a folder after being converted from RGB to grayscale. The students' identities and authentication

will be verified through the recognition process utilising these pre-processed images.

2. *Face Detection*

Using the OpenCV library, face detection is accomplished. An XML file called Haar Cascade Frontal Face Default is used in computer vision for object detection. Three parameters are required by the OpenCV detect Multiscale module: scale Factor, neighbours, and man-size. The system needs to find faces of all sizes, so it adjusts the image size a bit (controlled by the scale factor) to make sure it doesn't miss any. It also looks for groups of rectangles (like little boxes) overlapping each other on the image (controlled by the neighbours parameter). If there are enough overlaps (more than the minimum set by the neighbours parameter) and the rectangle is big enough (bigger than the minimum size set by the minimum size parameter), then it considers it a face. The scale factor and neighbours' parameters in this system have values of 1.3 and 5, respectively.

Fig 2: Face Recognition

3. *Face Recognition*

Face recognition training, this system employs three main techniques: first, it gives each image in the collection an integer marker. The facial recognition system makes advantage of the original double pattern histogram. The system starts with a list of face descriptions (like blueprints) converted into numbers. It then creates charts (histograms) to see which descriptions best match the current fashion trends. Finally, it compares these trendy charts to descriptions of faces it sees to identify a fashionable match.

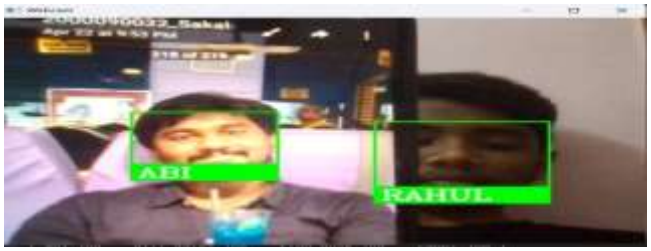


Fig 3: Recognizing multiple.

4. *Attendance Updating*

An Excel sheet will have identified faces marked as present by the face recognition process, and a list of absentees will be created and forwarded to the relevant faculties. In order to give parents and guardians a summary of their student's attendance history, the system will update the monthly attendance sheet at the end of each month.

	A	B
1	Name	Time
2		
3	RAHUL	22:01:37
4	ABI	22:01:57
5		

Fig 4: Attendance Sheet in Excel,

IV. System Architecture and Implementation plan

This system utilizes facial recognition technology to automate attendance marking for students or employees. Here's a breakdown of the architecture:

Hardware Components:

Camera: An HD camera to capture clear images or videos of individuals for face detection.

Processing Unit: A computer or a mobile device (if aiming for portability) powerful enough to run the face recognition algorithms.

Optional: Wi-Fi Module (for internet connectivity if storing data on a remote server or sending attendance reports via email)

Software Components:

Operating System: Standard operating system for the chosen processing unit (e.g., Windows, macOS, Linux, Android, iOS)