Live Attendance System Using Face Recognition

2025 IEEE 7th International Conference on Computing, Communication and Automation (ICCCA) | 979-8-3315-6980-8/25/$31.00 ©2025 IEEE | DOI: 10.1109/ICCCA66364.2025.11325461

Manish Rajbanshi
Computer Science Engineering
Parul Institute of Engineering and Technology, Gujarat, India
rajbanshimanish23@gmail.com

Avinash Kumar Raut
Computer Science Engineering
Parul Institute of Engineering and Technology, Gujarat, India
avinashkumar9819855603@gmail.com

Avajit Kumar Kewrat
Computer Science Engineering
Parul Institute of Engineering and Technology, Gujarat, India
mandalavijeet12@gmail.com

Raju Kumar Sah
Computer Science Engineering
Parul Institute of Engineering and Technology
Gujarat, India rajusah981215@gmail.com

Pratik K. Patel
Department of Computer Science and Engineering,
Parul Institute of Engineering & Technology,
Parul University, Vadodara, India
pratik.patel2988@paruluniversity.ac.in

***Abstract*— Traditional methods of attendance are generally tedious and rife with errors. With the help of FaceNet, however, real-time attendance marking is possible. Images are captured from the webcam, aligned, and faces are detected to generate embeddings for recognition. This paper proposes an automated Live Attendance System through a simple face recognition procedure, in a real-time database-based GUI, and consequently stored in a database automatically by the system. The system reports high accuracy and has been proven to be an easily accessible, rapid, and contactless mode of attendance recording compared to the current manual processes. Attendance tracking is an important activity in educational institutions and workplaces since it has a direct influence on performance, assessment, punishment, and productivity. Traditional manual methods often result in errors, proxy attendance, and inefficiencies. To address these problems, this project introduces a Live Attendance System that utilizes Face Recognition based on FaceNet embeddings, integrated with a real-time database. The system captures facial images through a live video feed, detects faces using OpenCV, and accurately recognizes individuals with deep learning-based feature extraction. Attendance records are automatically saved in the database, eliminating the need for human involvement and enhancing reliability. Experimental evaluation indicates that the system performs well in real-time classroom situations, showing improved accuracy and resistance to spoofing compared to traditional methods. This work demonstrates how AI-driven face recognition systems can update and streamline attendance monitoring.**

Keywords—Face Recognition, Attendance System, FaceNet, Real-time monitoring, Deep Learning, OpenCV, Artificial intelligence, Image processing, Computer vision .

I. INTRODUCTION

By and large, the biometric technologies that are highly accepted involve face recognition because of certain factors which are considered accurate, reliable, and non-intrusive. For example, old techniques that are being applied to take attendance in educational institutions have shown themselves to be time-consuming, error-prone, and easily tampered with. A number of automated systems have been proposed that integrate computer vision with machine learning approaches. An approach implemented in [1] used the libraries OpenCV, dlib for real-time recognition, which reduced human effort in a great manner but was highly effective by noise from background lighting. Even when duplication errors were reduced in the database-driven System for Attendance in [2], two problems persisted: real-time accuracy and challenge. Similarly, in [3], liveness detection was majorly emphasized to prevent spoofing, though the approach led to high computational costs. Haar Cascade with LBPH was applied in [4] for recognition but showed weak performance under pose and illumination variations. The work in [5] adopted 128-dimensional dlib encodings, which showed the benefits of machine learning–based solutions but required large datasets and high-quality cameras. Though scalability was limited, that proposed in [6] was a low-cost implementation using OpenCV and Excel sheets; others were advanced systems, like the CNN-based approach in [7], showing improved robustness against illumination and pose variations while being characterized by heavy computational resources. For instance, [8], [9], [10] worked in the development of database-driven and lightweight solutions, all with their related challenges; [11] used image augmentation to have image recognition accuracy increased over controlled conditions. A CNN-SVM hybrid further boosted robustness in [12] while adding up an increment in the cost during training and deployment. These have indeed dramatically moved the field forward; however, some challenges persist because of varying illumination, pose changes, occlusion, and the computational needs of deep learning models. It should be noted that most systems are implemented under model SQL or NoSQL databases. This puts it to a level of complexity way to high to be used in a small institution.

This paper addresses the challenges faced by earlier approaches toward a live attendance system based on face recognition and incorporating FaceNet embedding for accurate identification. This is different from the way the previous approaches directly recorded to the database the attendance at that time; this approach of ours is very lightweight and easy to deploy in a small to medium scale environment. The current framework captures live video through a webcam, detects multiple faces simultaneously, and recognizes them using the FaceNet embedding approach in real time to keep the attendance information. It logs each recognition with the corresponding name, ID, and timestamp into a storage model of

CSV. This will therefore eliminate proxy attendance and human-related errors from this process besides making it efficient in real time. The system involves greater recognition accuracy using CSV instead of the LBPH method due to successfully combining FaceNet's strength with the management.

II. Literature Review

Gowda et al. [1] introduced automatic face recognition-based attendance using OpenCV and dlib to live video streams for facial detection and recognition. The system raised the fact that manual entry is eliminated, giving the advantage of relieving humans from work, and results in high accuracy in controlled environments without any proxy issues. On this pretext, utmost consideration was given to some issues that may change due to lighting and background noise.

Tiwari et al. [2] proposed a live attendance system using face recognition along with databases to automatically register the attendance of the students. It reduced duplication errors and human intervention over other manual systems. Although the system is scalable, some improvements should be made in its accuracy under real-time class usage.

The work proposed by Sharanya et al. [3] detailed an online attendance system using facial recognition, where liveness detection was the only part that was not easy to cheat. The primary focus of this work is to reduce the attendance fraud of discriminating between the real human face and the 2D photos spoofed. They concluded that recognition accuracy was promising but still too costly in terms of computational time.

Banajawad et al. [4] recognized a face recognition attendance system based on stage-wise data development, preprocessing, recognition, and recording. Theirs was a real-time system in which the Haar Cascade algorithm was combined with the LBPH algorithm. However, the system was very likely to give poor performance when the authors stated that there was dramatic variation in light and pose.

The smart attendance monitoring system was designed by Sochima et al. [5] using the 128 facial encodings of dlib. The study looked at the advantages that machine-learning-based recognition would bring in real-world scenarios. Despite achieving great verification results, the authors have stated that high accuracy requires a lot of training data and consistently high camera quality.

Fasate and Kasat [6] gave the implementation of an attendance system through a Python program that captures and stores facial images in Excel sheets using OpenCV. Their system successfully proved that recognition could happen inexpensively and across minimal hardware. According to the findings of the research, the system has been found effective for small classes, although it would need database optimization upon deploying it on a large scale.

The machine learning-based approach of Gupta et al. [7] included CNN usage, which was performed through dlib in the smart attendance system's enrichment. His work was done with special attention to being robust against illumination and pose variation to expose how deep learning outperforms classical recognition methods. However, the major drawback to this usage is that it increases computational costs.

Siddiqui et al. [8] presented an automatic and cost-effective face recognition-based attendance system through Haar cascades realized in OpenCV, with data storage in MySQL. Their implementation is able to support the construction of a detailed report of students' presence. From their findings, it is shown that the system works robustly under different classroom conditions. However, in cases of occlusions and poor lighting, the accuracy reduces sharply.

The attendance system is developed by Ghonge et al. [9] using face recognition with the help of which the group photographs of students were able to process a bunch of students at a time. The system was programmed in Flask Python with OpenCV for Haar Cascade to detect and LBPH for recognition, including the feature of sending e-mail alerts to the students who had low attendance records. This could increase the scale factor in case of a large classroom, although the performance was highly impacted by occlusions and variant illuminations.

It covers an attendance system Dy Vyshnavi [10] which was developed based on facial recognition using OpenCV and a few basic ML methods. The model was cost-effective while being effective and hence ideal for small-scale institutions. However, the model is sensitive to light conditions, pose change, which leads to poor image recognition.

The attendance management system developed by Gill et al.[11] consisted of Haar Cascade combined with LBPH recognition and image augmentation techniques. A few augmentation techniques such as brightness adjustment, shear, and zooming did better to diversify the datasets for better accuracy within a system with strides going as high as 95% in a controlled environment.

However, amongst these advancements, performance fell down when the environment was either heavily populated or dimly lit, needing deep learning methods. Kushwaha et al.[12] implemented a CNN-based attendance system using the SVM classifier after CNN encodings. The system handled real-time classroom scenarios to a great extent for accuracy and robustness. A further add-on was the autmoatic email facility to the faculty. However, the issue remains that the system, at both training and deployment levels, requires a vast amount of computational resources, thus hindering widespread application.

TABLE I. Comparison Table:

Author	Objective/focus	Methodology/tools	Key	Limitations
Gowda et al. [1]	Automatic attendance via face recognition in live streams	OpenCV, dlib	Eliminates manual entry, high accuracy in controlled environments	Sensitive to lighting & background noise
Tiwari et al. [2]	Live attendance with database integration	Database + FR	Reduces duplication errors, scalable	Accuracy issues in real- time class
Sharany	Online	FR	Prevents	High

a et al. [3]	attendance with liveness detection	+ Liveness detection	spoofing with 2D photos, promising accuracy	computational cost
Banajawa d et al. [4]	Real-time FR attendance with preprocessing	Haar Cascade + LBPH	Stage-wise recognition, real-time system	Poor performance under light/pose variation
Sochima et al. [5]	Smart monitoring using dlib 128 encodings	dlib, ML encodings	High verification results, ML advantages	Requires large training data & good camera quality
Fasate & Kasat [6]	Cost-effective attendance storage	Python, OpenCV, Excel	Works well in small classes, low hardware need	Not scalable, needs DB optimization
Gupta et al. [7]	ML-based robust FR system	CNN + dlib	Handles illumination & pose, deep learning > classical	High computational cost
Siddiqui et al. [8]	Automatic & cost-effective FR with reporting	Haar Cascade + MySQL	Detailed reporting, robust in classrooms	Poor under occlusion & bad lighting
Ghonge et al. [9]	FR for group photos + email alerts	Flask, OpenCV, Haar + LBPH	Can process multiple students, email feature	Sensitive to occlusion & illumination
Vyshnavi [10]	Low-cost FR attendance	OpenCV, ML basics	Effective for small institutions	Sensitive to light & pose variations
Gill et al. [11]	FR with dataset augmentation	Haar + LBPH + Augmentation	95% accuracy in controlled environment	Fails in crowded/diml y lit cases
Kushwaha et al. [12]	CNN + SVM-based real-time FR	CNN encodings + SVM	Robust in classroom, email to faculty	Needs vast computational resources

I. Existing Work

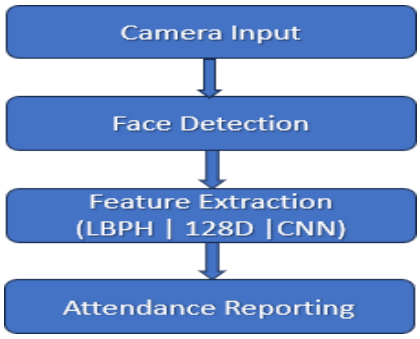

Fig. 1. Feature Extraction using LBPH | 128D | CNN

A number of investigations have been carried out for the implementation of a face recognition-based attendance system by using different techniques.

Old works employed Haar Cascade and LBPH to achieve a real-time and low-cost solution; however, they were troubled by lighting, pose, and occlusion issues.

Furthermore, systems with 128-dimensional encodings provided by dlib[1][5] were slightly more accurate in results, eliminated manual entry, but demanded large training data and good-quality cameras; hence, it was expensive in terms of computation. On the other hand, the liveness detection[3] reduced chances of spoofing at the cost of computational expenses.

A few recent approaches implemented deep learning techniques (CNN, CNN+SVM) techniques that could flex against changes in illumination and pose variations which remains the same: the cost in computational resources. In contrast, only a few systems were tightly connected with database and reporting tools[2][8][9] that would offer some opportunities for scalability and automatic alerting, but had a certain drawback on accuracy in crowded classrooms.

The low-cost solutions were good for small-class environments but lacked scalability. The control- environment accuracy can reach up to ~95% through data- augmentation techniques; however, even this is very ineffective in real-world conditions.

Summary: The existing systems are highly promising for automatic attendance with high accuracy more than the manual method; however, they still lack in some parameters, such as lighting sensitivity, high computational cost, non- scalable, and less real-time functionality.

III. Proposed Work

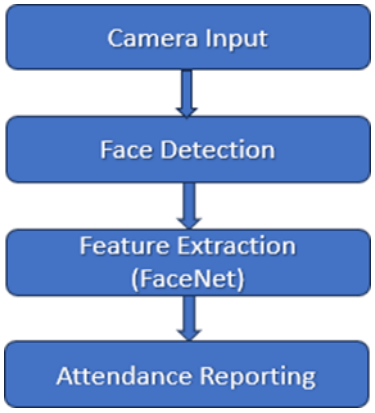

Fig. 2. Feature Extraction using FaceNet

The system presented is an enhancement to the traditional approaches by incorporating FaceNet for highly accurate face recognition. With the learning mechanism of embedding and continuous face representations, it is obviously more reliable than traditional approaches, say LBPH, or Haar models.

The workflow is as follows:

- **Face Detection:** Real-time multiple student face detections.
- **Embedding Extraction:** By running FaceNet, it converts each face into unique embeddings.

- **Recognition and Marking:** The embeddings would have been properly matched with the registered data, this would reflect exactly who it is.
- **Datasets:** Taken more than 100 students faces for model training.
- **CSV Attendance Logging:** Attendance records are directly stored in CSV files which ensures the portability and simplicity of databases.

IV. Benefits:

- More accuracy, if at all, than the methods of LBPH/Haar.
- Attendance is automated and proxy-proof
- CSV logs make sharing and analysis simple

Thus, this proposed work presents a very simple, robust, and scalable FaceNet-based attendance system that has efficient storage using CSV.

V. Methodology

The proposed system is designed to automate the attendance marking by real-time face recognition. The methodology consists of four major stages: data acquisition, preprocessing, training, and recognition with attendance marking.

A. System Architecture

The system consists of a modular architecture:

1) Data Acquisition

Student images are captured using a webcam. Several samples per student are taken and stored in a well-structured dataset.

2) Preprocessing

- The detected faces will be further cascaded in accordance with the MTCNN or Haar Cascade.
- Detected faces should be aligned to the eye centers and resized to input dimensions as required.

3) Model Training

- Each face is aligned and passed through the FaceNet model to produce a 128- dimensional embedding vector.
- These embeddings are normalized and stored in a database, mapped to the corresponding student ID.

4) Recognition and Marking of Attendance

- At the time of operation, an analysis is done of the live video feed.
- New embeddings have to compare with ones using Euclidean or Cosine distance.
- The following distances guarantee a match: 0.9–1.2
- The student's name appears on the GUI, and his/her attendance is automatically updated with the CSV/Excel file with date and time.

5) Graphical User Interface(GUI)

- Tkinter has been used for developing the GUI through which the user can:
    - Register a new student.
    - Train/Update model.
    - Take live attendance.
    - Export attendance reports.

B. Workflow of the system

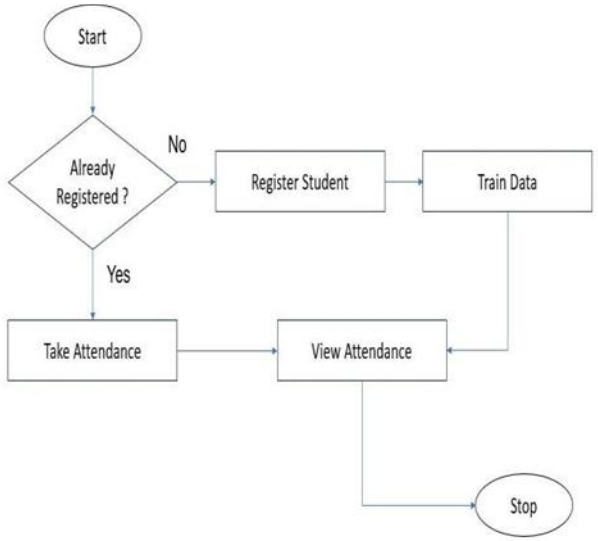

Fig. 3. workflow of the system

VI. Implementation and Results

A. Implementation

In the implemented system, it was used Python version 3.8 and the following libraries:

- **FaceNet:** for generating the embeddings.
- **MTCNN/Haar Cascade:** for detection and alignment of faces.
- **OpenCV:** Face recognition, preprocessing images.
- **Datasets:** Taken more than 100 students faces for model training.
- **TKinter:** For the GUI.
- **NumPy & Pandas:** Data handling; management of student attendance records.
- **CSV/Excel:** Saving attendance reports stored.

B. Results

Testing of the system was conducted using a classroom dataset of registered students. The following observations were made:

- **Accuracy:** Between 94-97% of the given images were correctly identified under normal lighting and face frontal conditions.

- **Speed:** The time taken by each recognition per frame is much less than 1 second, hence facilitating real-time performance.
- **Robustness:** FaceNet embeddings showed more robustness to illuminating changes and pose against traditional LBPH methods. Nevertheless, performance deteriorates if a face is heavily occluded or under low lighting.
- **Scalability:** The structure of the database has been designed in such a way as to add new students without affecting its performance.

*1) **User Experience:** The GUI had easy-to-use operations related to registration, recognition, and report creation.*

C. Screenshots

Fig. 4. Home page of the system

Fig. 5. Registration of the students

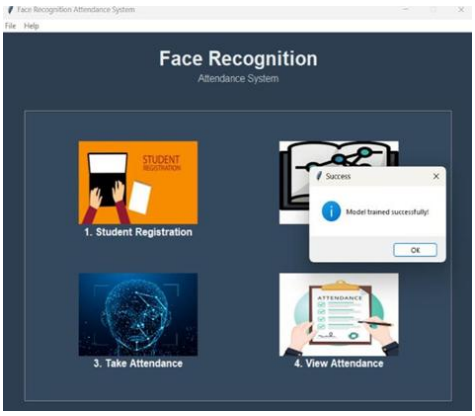

Fig. 6. Model Trained

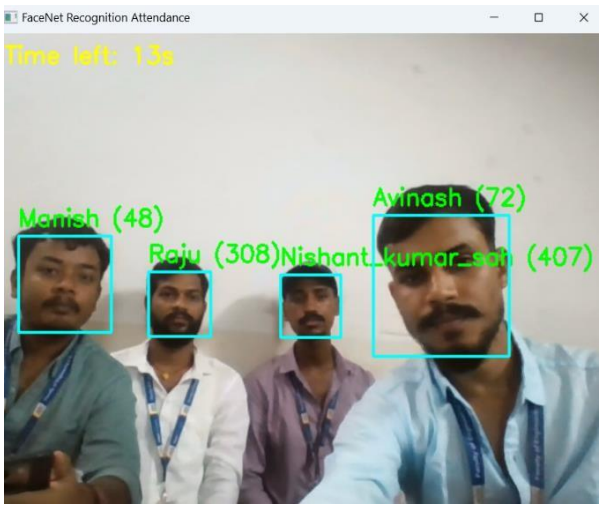

Fig. 7. Face Recognition of students

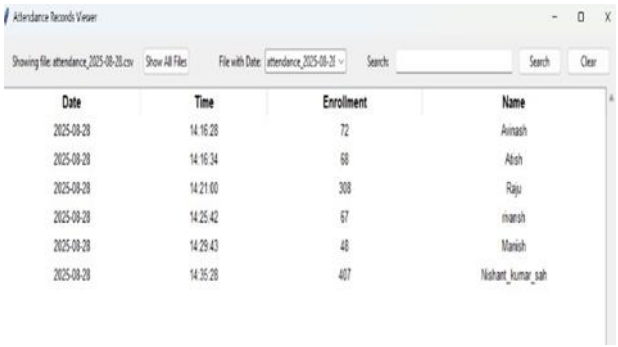

Fig. 8. Attendance Record of the student

VII. Conclusion and Future Work

A. Conclusion

The proposed **Automated Attendance Tracking Using Deep Face Embeddings with FaceNet** provides full automation for attendance marking with high accuracy, along with deep learning embeddings that are a little better than conventional recognition methods.

B. Future Work

- **Anti-spoofing:** The emphasis is more on the integration of liveness detection techniques, including blink detection or depth sensing, which can prevent proxy attendance in the class.
- **Deep learning enhancement**: Increasing the accuracy of models with more advanced ones, like ArcFace or VGGFace2.
- **Edge Optimization:** Deployment to low-power devices by model quantization and ONNX/TensorRT optimization.
- **Cloud Integration:** Easily scale up to the entire institution with the help of cloud-based databases.
- **Multimodal Biometrics:** Hiding face recognition in voice or fingerprinting to add an extra layer of trust.

ACKNOWLEDGMENTS

We would like to thank our project guide, **Dr. Pratik k. Patel,** for his guidance, suggestions, and encouragement throughout the project. We are also grateful to the faculty members for providing the resources and support needed for the successful completion of this project.

REFERENCES

[1] D. Gowda H. L., K. Vishal, K. B. R. Keertiraj, N. K. Dubey, and P. M. R., "Face Recognition Based Attendance System," *International Journal of Engineering Research & Technology (IJERT)*, vol. 9, no. 6, pp. 761–765, Jun. 2020.

[2] H. Tiwari, S. Goyal, R. Agrawal, and M. Pawar, "Live Attendance System via Face Recognition," *International Journal for Research in Applied Science and Engineering Technology (IJRASET)*, vol. 6, no. 4, pp. 3891–3895, Apr. 2018.

[3] S. T., S. P., U. Kasturi, T. Mahesh, and D. V., "Online Attendance using Facial Recognition," *International Journal of Engineering Research & Technology (IJERT)*, vol. 9, no. 6, pp. 202–207, Jun. 2020.

[4] V. Banajawad, N. Shetty, P. Shekar, and A. Kumar, "Face Recognition Attendance System," *International Research Journal of Engineering and Technology (IRJET)*, vol. 9, no. 6, pp. 1394–1397, Jun. 2022.

[5] E. P. Sochima, O. E. Taylor, and F. B. Deedam, "Smart Attendance Monitoring System Using Facial Recognition," *International Journal of Computer Techniques*, vol. 8, no. 2, pp. 1–7, Mar. 2021.

[6] R. Fasate and K. Kasat, "Face Recognition Attendance System Using Python," *International Journal of Creative Research Thoughts (IJCRT)*, vol. 11, no. 6, pp. 223–228, Jun. 2023.

[7] V. Gupta, M. Kashyap, V. Gupta, and P. Singh, "Smart Attendance System Using Face Recognition: A Machine Learning Approach," *International Journal of Research Publication and Reviews*, vol. 5, no. 3, pp. 932–939, Mar. 2024.

[8] M. H. Siddiqui, H. Pednekar, P. Sakat, Q. A. Qadir, and P. Manke, "Facial Recognition-Based Attendance System," *ResearchGate*, Apr. 2024.

[9] P. Ghonge, V. Rane, B. Bhavar, S. More, S. Raul, and P. Yadav, "Face Recognition Based Attendance System Using Group Photos," International Research Journal of Engineering and Technology (IRJET), vol. 11, no. 3, pp. 1048-1052, Mar. 2024.

[10] V. Ms, "Facial Recognition Based Attendance System Using OpenCV," Journal of Computational Science and Engineering, vol. 2, no. 3, pp. 1-5, May 2024.

[11] S. Gill, N. Sharma, C. Gupta, and A. Samanta, "Attendance Management System Using Facial Recognition and Image Augmentation Technique," in Proc. Int. Conf. Intelligent Technologies for Smart and Secure Societies (ITSSS), Pune, India, 2021, pp. 56-61.

[12] K. Kushwaha, C. Reddy, S. Rahul, A. K. Amarendra, and S. Eliyaz, "A CNN-Based Attendance Management System Using Face Recognition," International Journal of Computer Applications, vol. 14, no. 2, pp. 45-50, Feb. 2023.