



CHITRAHI: AI-Powered Real-Time Face Recognition Based Attendance and Visitor Management System

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ABSTRACT

CHITRAHI is an AI-powered real-time identity recognition system designed to automate attendance monitoring and visitor management. Traditional attendance systems suffer from multiple limitations such as proxy attendance, manual errors, and lack of real-time tracking capabilities. These issues reduce the efficiency and reliability of attendance systems in educational institutions and organizations. To overcome these challenges, the proposed system utilizes computer vision and deep learning techniques for face detection, recognition, and gender classification. The system captures live video streams, identifies individuals using facial encodings, and automatically logs entry and exit data. A cooldown mechanism is implemented to prevent duplicate entries and ensure accurate data recording. Additionally, a user-friendly interface is integrated using the EEL framework, enabling non-technical users to operate the system effectively. The experimental results demonstrate that the system provides high accuracy, efficient performance, and reliable real-time monitoring, making it suitable for practical deployment.

1. Introduction

Artificial Intelligence (AI) and Machine Learning (ML) have brought significant advancements in identity verification and automation systems by enabling intelligent data processing and decision-making capabilities. Traditional attendance systems such as manual registers, RFID cards, and biometric fingerprint devices are widely used but suffer from several limitations, including proxy attendance, human errors, and lack of real-time monitoring [1]. These systems often fail to provide accurate and reliable data, especially in large-scale environments where tracking individuals efficiently becomes challenging.

With the development of computer vision and deep learning, facial recognition systems have emerged as a contactless and efficient solution for identity verification [2]. These systems analyze facial features and generate unique representations that can be used for accurate identification. Unlike traditional methods, face recognition eliminates the need for physical interaction and reduces the chances of misuse. The CHITRAHI system builds upon these technologies by integrating real-time face recognition, automated attendance logging, and gender classification into a unified platform. This integration enhances system efficiency and ensures reliable monitoring of individuals in real time [3].

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2. Literature Review

Facial recognition technology has evolved significantly over the past few decades, transitioning from traditional computer vision methods to advanced deep learning-based approaches. Early techniques such as Haar Cascades, Eigenfaces, and Local Binary Patterns (LBP) were widely used for face detection and recognition tasks [4]. These methods were computationally efficient and suitable for basic applications; however, they struggled to maintain accuracy under varying lighting conditions, facial occlusions, and different viewing angles [5]. The reliance on handcrafted features limited their performance and adaptability in real-world scenarios.

The introduction of deep learning revolutionized facial recognition systems by enabling automatic feature extraction and improved accuracy. Models such as FaceNet, VGG-Face, and ResNet-based architectures generate high-dimensional feature embeddings that uniquely represent facial identities [6]. These models are capable of handling variations in lighting, pose, and facial expressions, making them more robust and reliable. In addition to face recognition, Convolutional Neural Networks (CNNs) have been extensively used for gender classification, achieving high accuracy and efficiency [8].

Despite these advancements, many existing systems focus primarily on recognition accuracy and lack integration with user interfaces, automated attendance logging, and real-time usability features [9]. As a result, their practical deployment in real-world environments remains limited. The CHITRAHI system addresses these gaps by combining face recognition, gender classification, automated logging, and a user-friendly interface into a single deployable system.

3. Proposed System

The proposed CHITRAHI system is designed as a real-time identity recognition platform that integrates face detection, recognition, gender classification, and attendance logging into a unified framework. The system captures live video input from a camera and processes each frame using deep learning-based face detection techniques [2]. Once a face is detected, it is converted into a numerical representation known as a facial encoding, which captures the unique features of the individual. These encodings are then compared with a database of stored encodings using similarity measures such as Euclidean distance [6].

If a match is found, the system identifies the individual and automatically records their attendance. In cases where no match is found, the system classifies the individual as an unknown visitor and applies a CNN-based gender classification model to determine the gender [8]. This feature enables demographic analysis and improves monitoring capabilities. To maintain data accuracy, a cooldown mechanism is implemented to prevent duplicate entries within a short time interval [3].

The system also incorporates a graphical user interface developed using HTML, CSS, and JavaScript, integrated with Python through the EEL framework [10]. This interface allows users to control system operations such as starting the camera, registering new faces, and viewing attendance records, making the system accessible to non-technical users.

4. System Architecture

The architecture of the CHITRAHI system is designed in a modular and layered manner to ensure efficient real-time processing and scalability. The system begins with the input layer, where video data is captured using a webcam or surveillance camera. This data is then passed to the processing layer, which performs face detection, feature extraction, face recognition, and gender classification using deep learning models.

The extracted information is then stored in the database layer, which maintains records of registered users, attendance logs, unknown visitors, and daily summaries. The system uses structured storage formats such as Excel files for easy data management and accessibility. The final layer is the user interface layer, which enables interaction between the user and the system. It allows users to control system operations and view outputs in real time. The complete workflow of the system is illustrated in Fig. 1, which shows how data flows from the camera input to final attendance logging and display.

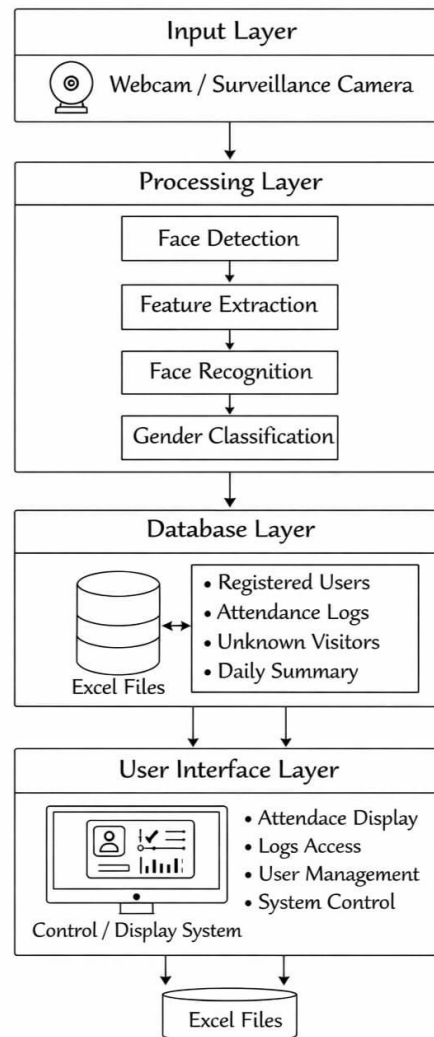


Figure 1: System Architecture of CHITRAHI

5. Methodology

The methodology of the CHITRAHI system defines the step-by-step process through which attendance is marked automatically using facial recognition. The process begins with capturing real-time video frames from a camera, which are then preprocessed to improve image quality and ensure consistency. This includes resizing the image and converting the color format to enhance detection accuracy [2].

Face detection is then performed using deep learning-based models, which identify and isolate facial regions within each frame. The detected faces are passed to a feature extraction module that generates facial encodings representing unique facial characteristics [6]. These encodings are compared with stored encodings in the database to determine whether the person is registered or unknown.

If a match is found, the system marks attendance automatically and records the corresponding time. If no match is found, the system classifies the face using a CNN-based gender classifier and logs the individual as an unknown visitor [8]. The entire process is executed in real time, ensuring smooth and efficient performance. The workflow of the system is shown in Fig. 2.

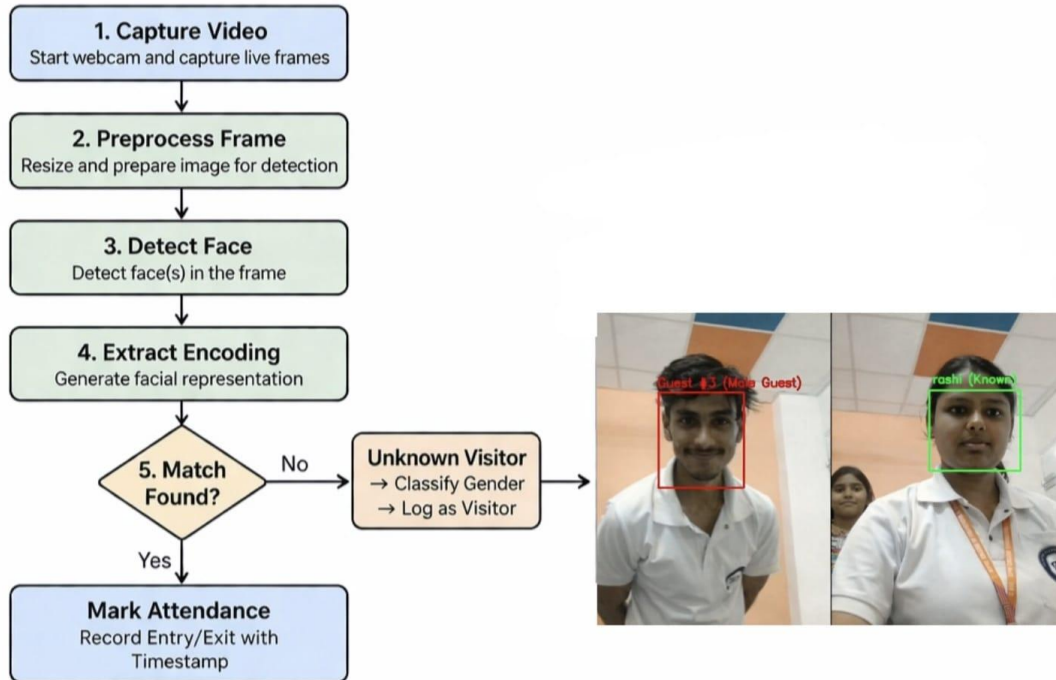


Figure 2: System Workflow

6. Results and Discussion

The CHITRAHI system was tested under controlled indoor conditions using a standard webcam to evaluate its performance. The system demonstrated high accuracy in recognizing registered individuals and successfully marked attendance without manual intervention. The implementation of the cooldown mechanism effectively prevented duplicate entries, ensuring clean and reliable data logging.

The gender classification module also performed accurately for unknown visitors, enabling the system to maintain demographic records. The user interface was found to be intuitive and easy to use, allowing non-technical users to operate the system efficiently. The real-time detection and recognition results are shown in Fig. 3, which illustrates how the system identifies individuals and displays their information on the screen.

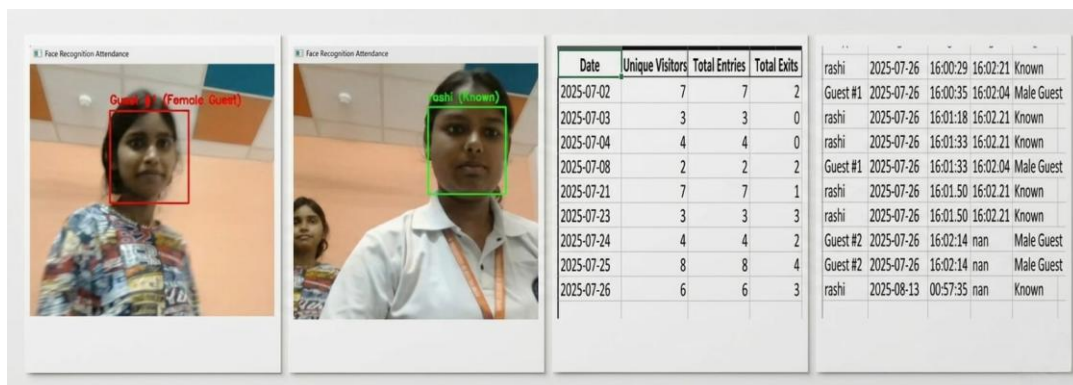


Figure 3: Detection and Recognition Output

7. User Interface and Visualization

The user interface of the CHITRAHI system is designed to be intuitive, user-friendly, and efficient, enabling smooth interaction between the user and the system. The interface ensures that even non-technical users can operate the system without any difficulty. The login module, as shown in Fig. 4, provides secure access to the system, where authorized users must enter their credentials before accessing the main functionalities.

After successful authentication, the user is redirected to the dashboard, as illustrated in Fig. 5. The dashboard acts as the central control panel of the system, allowing users to start the camera, monitor real-time face recognition, and navigate through different modules. It provides a clear and organized layout for efficient system operation.

The system also includes a comprehensive record management interface, as shown in Fig. 6, where users can view logs of recognized individuals, unknown visitors, and overall attendance data. This feature ensures transparency and easy access to stored information. Furthermore, the face registration interface, depicted in Fig. 7, allows users to register new individuals into the system. This module captures facial data and stores it in the database for future recognition, thereby enhancing system accuracy and usability.

In addition, the system provides a detailed view of attendance records, including both known and unknown individuals, as shown in Fig. 8. This section enables users to analyze attendance patterns and maintain proper records efficiently. Overall, the user interface plays a crucial role in ensuring the practical usability and effectiveness of the CHITRAHI system.

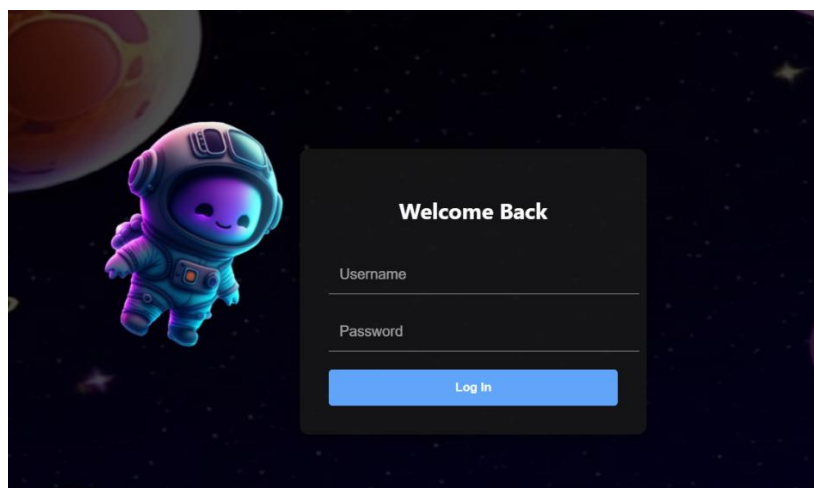


Figure 4: Login Page



Figure 5: The Dashboard of CHITRAHI

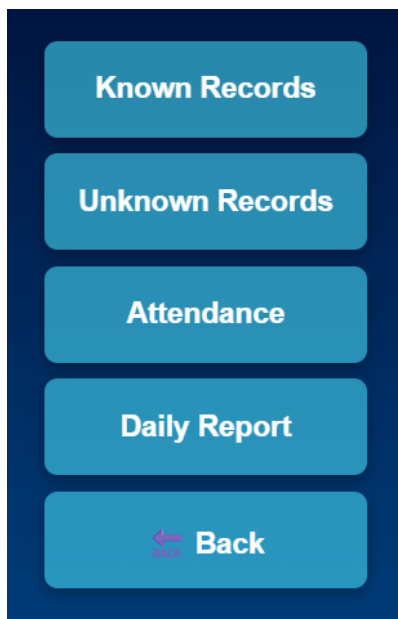


Figure 6: Records of Attendance and visitors

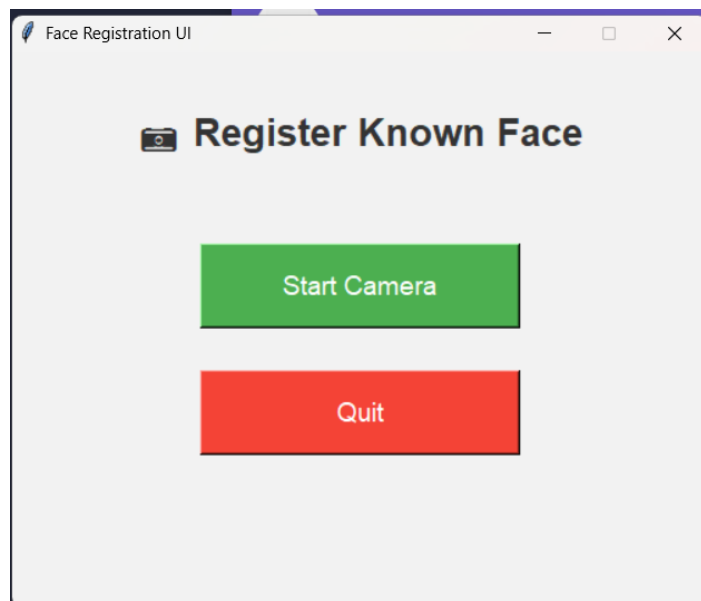


Figure 7: Face Register Interface

	A	B	C	D	E	F
29	Guest	2025-06-25		12:12:50	12:28:33	Guest
30	Guest	2025-06-25		12:15:50	12:28:33	Guest
31	Guest	2025-06-25		12:16:12	12:28:33	Guest
32	Guest	2025-06-25		12:16:47	12:28:33	Guest
33	Guest	2025-06-25		12:28:17	12:28:33	Guest
34	Vivek_sir	2025-06-25		12:29:04	nan	Unknown
35	dhiraj	2025-06-25		12:29:06	14:49:11	Unknown
36	Guest	2025-06-25		12:29:09	12:30:04	Guest
37	Guest	2025-06-25		12:29:48	12:30:04	Guest

Figure 8: The Records of Known and Unknow

7. Performance Analysis

The performance of the CHITRAHI system is evaluated based on recognition accuracy, processing speed, and system reliability. The face recognition module demonstrates high accuracy due to the use of deep learning-based facial encodings, which are capable of distinguishing between individuals even under moderate variations in lighting and facial expressions [6]. The system maintains low latency during real-time operation, ensuring that detection and recognition occur without noticeable delay.

In addition to recognition accuracy, the system's reliability is enhanced by the implementation of a cooldown mechanism, which prevents duplicate attendance entries within a short time interval [3]. This ensures that the generated attendance data remains clean and consistent. The gender classification module also performs effectively, providing accurate predictions for unknown visitors using a CNN-based model [8]. Overall, the system achieves a balance between accuracy, speed, and efficiency, making it suitable for real-time deployment in practical environments.

8. Comparison with Existing Systems

Traditional attendance systems such as manual registers, RFID cards, and biometric devices have several limitations, including susceptibility to proxy attendance, lack of real-time monitoring, and dependency on physical interaction [1]. These systems are often inefficient and fail to provide accurate and automated tracking of individuals.

In contrast, the CHITRAHI system provides a contactless and automated solution using face recognition technology. Unlike traditional systems, it does not require physical interaction and eliminates the possibility of proxy attendance. The integration of real-time processing and automated logging improves efficiency and reduces human effort [2]. Furthermore, the inclusion of gender classification and visitor tracking provides additional analytical capabilities that are not present in conventional systems [9]. This makes CHITRAHI a more advanced and practical solution for modern attendance management.

9. Advantages and Limitations

The CHITRAHI system offers several advantages over traditional attendance systems. It provides a contactless method of attendance marking, reducing the need for physical interaction and improving hygiene and safety. The use of real-time face recognition ensures accurate identification and eliminates proxy attendance issues. Additionally, the system includes automated logging and reporting features, which reduce manual effort and improve efficiency [3]. The integration of a user-friendly interface further enhances usability, making the system accessible to non-technical users [10].

However, the system also has certain limitations. The performance of face recognition depends on environmental

factors such as lighting conditions and camera quality. Extreme angles or occlusions may reduce recognition accuracy [5]. Additionally, the system requires computational resources for real-time processing, which may affect performance on low-end devices. Despite these limitations, the system performs effectively under standard conditions and can be further improved with advanced hardware and optimization techniques.

10. Conclusion

The CHITRAHI system presents an effective and intelligent solution for automated attendance marking by leveraging artificial intelligence and deep learning techniques. Unlike traditional attendance systems that rely on manual input or physical interaction, the proposed system provides a contactless and automated approach using real-time face recognition [1]. This significantly reduces issues such as proxy attendance, human error, and inefficiency, thereby improving the overall reliability of attendance management systems.

The integration of facial encoding techniques enables accurate identification of individuals, while the implementation of a CNN-based gender classification module enhances the system's capability to analyze and manage unknown visitors [8]. Additionally, the use of a cooldown mechanism ensures that duplicate entries are avoided, resulting in clean and structured attendance data [3]. The system also incorporates a user-friendly interface, allowing non-technical users to operate it easily without requiring programming knowledge [10].

Experimental observations indicate that the system performs efficiently under standard conditions, providing high accuracy and real-time responsiveness. The combination of automation, accuracy, and usability makes the CHITRAHI system suitable for deployment in educational institutions, offices, and secure environments. Overall, the proposed system successfully bridges the gap between theoretical research and practical implementation by delivering a scalable and efficient attendance management solution.

11. Future Scope

The system can be further enhanced by integrating cloud-based storage to enable remote access and centralized data management. The development of a mobile application can improve accessibility and usability. Additionally, features such as multi-camera support, emotion detection, and voice recognition can be incorporated to extend the system's capabilities and make it more intelligent and scalable.

References

- [1] G. Bradski, "The OpenCV Library," *Dr. Dobb's Journal of Software Tools*, 2000.
- [2] A. Geitgey, "Face Recognition Library," GitHub Repository, 2018. [Online]. Available: https://github.com/ageitgey/face_recognition
- [3] S. Kumar, R. Singh, and A. Verma, "AI-Based Automated Attendance System Using Face Recognition," *International Journal of Computer Applications*, vol. 174, no. 15, pp. 20–25, 2021.
- [4] P. Viola and M. Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features," in *Proc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR)*, 2001, pp. 511–518.
- [5] T. Ahonen, A. Hadid, and M. Pietikäinen, "Face Recognition with Local Binary Patterns," *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 28, no. 12, pp. 2037–2041, 2006.
- [6] F. Schroff, D. Kalenichenko, and J. Philbin, "FaceNet: A Unified Embedding for Face Recognition and Clustering," in *Proc. IEEE CVPR*, 2015, pp. 815–823.
- [7] K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning for Image Recognition," in *Proc. IEEE CVPR*, 2016, pp. 770–778.
- [8] A. Krizhevsky, I. Sutskever, and G. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," *Communications of the ACM*, vol. 60, no. 6, pp. 84–90, 2017.
- [9] H. Yaqoob, T. Abbas, and M. Khalid, "Vision-Based Attendance Monitoring Using Face Recognition," *IEEE Access*, vol. 9, pp. 10262–10274, 2021.
- [10] C. B. Williams, "EEL: A Little Python Library for Making Simple Electron-like Offline HTML/JS GUI Apps," GitHub Repository, 2017. [Online]. Available: