Labview-Based Face Recognition In Attendance Tracking System

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Abstract- *Institutional contexts have long relied on traditional attendance systems that involve taking attendance, using roll call, paper sign-in sheets, and manual record keeping, which have all been seen as inefficient. They are labor intensive, subject to human error and can be subject to proxy attendance which adds an unnecessary strain on administrators and undermines the integrity of attendance information. This paper presents a real-time, contactless face recognition attendance tracking system based on the LabVIEW platform that can overcome these issues by implementing intelligent automation with computer vision and image processing. The system's core is a common webcam which is constantly taking snapshots from the face surrounding the user. The images are then processed through a rigidly designed pre-processing chain, which starts with the conversion of the images to gray scale and then to a set of images that have been normalized using a histogram. This is to compensate for various lighting conditions, followed by filtering to removes image noise, and finally a region-of-interest extraction that selects the most relevant areas of the face for further processing. This pre-processing pipeline is implemented in the LabVIEW Vision framework. This pre-processing is what gives the system the accuracy it needs despite less than optimal conditions.*

After images have been prepared, the LabVIEW Vision Development Module assumes control, running the algorithms necessary for face detection, feature extraction and template matching against a user database of registered faces. The system automatically records attendance when a face is successfully recognized, adds a timestamp, and provides a confidence score, all of which are shown in real time on LabVIEW's interactive graphical interface. The experimental evaluation was done under lab conditions, and the results were positive; 98.2% face detection accuracy, 96.9% recognition accuracy and 97.4% positive result for attendance logging. Most importantly, these figures were maintained under different lighting conditions and moderate changes in head orientation, which are typical situations for which traditional recognition systems struggle. A confidence threshold mechanism provides an extra degree of reliability, which decreases the chances of false-positive reports and guarantees that attendance is accurate. The value of this system is that all components of the system, from image acquisition to preprocessing, image recognition, decision-making, and logging, are integrated in a single cohesive real-time platform. No need for post session check or manual correction. Administrators always have visibility of the identification status, attendance logs and system performance statistics on a user-friendly front panel, which allows them to stay informed and stay in control. The outcome is a scalable, cost-effective, and easy-to-solve solution that could be adopted in smart schools, universities, and organizations where accurate and automated attendance tracking is not just a better practice, it's a must.

Keywords: Face Recognition, Attendance Tracking, LabVIEW, Computer Vision, Real-Time Monitoring, Image Processing, ROI Extraction, Automated Logging, Pattern Matching, Intelligent Attendance System.

I. INTRODUCTION

The increasing demand for security, efficiency, and accurate record management in educational institutions and organizations has made automated attendance tracking a crucial aspect. The traditional attendance system (manual register, ID-card register, finger-print system) is labor-intensive, prone to proxy attendance and requires a lot of human supervision. Face recognition, one of the most popular biometric technologies, has proven to be effective in automated identity verification without physical contact due to its capability to perform real-time recognition. The accuracy and reliability of automated face recognition systems have achieved significant improvement with recent developments in the fields of computer vision, image processing and machine-learning in the context of institutional monitoring applications. In recent times, the area of study has been on creating smart attendance systems based on face and image processing by cameras. LabVIEW offers an efficient platform for recording, pre-processing, analysing, graphically displaying and automatically managing attendance in one software package. Yet, many current systems still have some drawbacks such as offline processing, hardware dependency, poor adaptability under the illumination, and lack of capability for real-time

monitoring. There are a number of systems that primarily are capable of basic facial detection but are not combined with intelligent attendance verification, automatic logging, and confidence based recognition. These shortcomings are overcome in the proposed work by developing a LabVIEW based real-time face recognition attendance tracking system, which consists of image acquisition, facial feature extraction, confidence based template matching and automatic logging of attendance in a single graphical user interface. The USB webcam takes snapshots of the face repeatedly, which are then processed by converting to grayscale, face filtering, face normalization, and Region of Interest (ROI) extraction so that it can be reliably recognized. The face features extracted are matched with the database of faces for automatic attendance verification and logging. The framework being proposed integrates continuous real time image acquisition, face recognition of images, confidence based verification, graphical visualization, attendance database management and other functions into a single LabVIEW application, which not only enhances the operational efficiency, but also improves the reliability of recognition and monitoring capabilities of the institution.

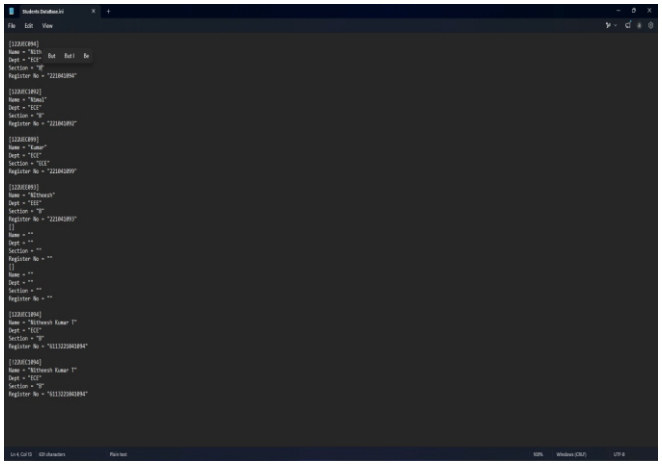

Fig. 1. Student Database File Used for Face Recognition Attendance Verification

II. IMAGE PROCESSING AND FEATURE EXTRACTION

Keeping good attendance records is a priority that is becoming more important and more sought after by educational institutions and organizations that need to make sure that they are secure, efficient in their operations, and that they have reliable records. Traditional approaches, such as manual records, ID-card authentication and fingerprint recognition, are still prevalent but always fail. They are slow, prone to be propped up by proxies and need lots of human supervision. Among the biometric options that have come to light, facial recognition is one of the most practical. It does not require any physical interaction, operates contactlessly and can verify identities in real time — features that are very well suited to the requirements of the modern institutional environment. The accuracy and reliability of these systems have been further enhanced by recent advancements in computer vision, image processing, and machine learning. The current research in this field has mainly focused on facial recognition using cameras and intelligent image processing systems that are used to automatically monitor attendance.

LabVIEW provides a particularly interesting development environment for this application, allowing real time image acquisition, image preprocessing, feature extraction, graphical visualization, and attendance management all to be performed in one integrated environment. However, current systems have, to date, been limited by offline processing, reliance on hardware, low adaptability to changing illumination, and the inability to perform real-time monitoring. One crucial issue in the literature is the lack of systems that combine face detection, intelligent attendance verification, automatic logging of attendance, and confidence based face recognition. This paper proposes a system which rectifies these shortcomings directly. It is completely implemented in LabVIEW, it performs a whole image acquisition with a USB web camera, converts the images to gray-level, applies noise filtering, normalizes the image's histogram and extracts the Region of Interest (ROI) to enable the recognition of the scene under different illumination conditions. The extracted features for the faces are compared with a database of stored features using confidence-based template matching to verify and log automatic attendance.

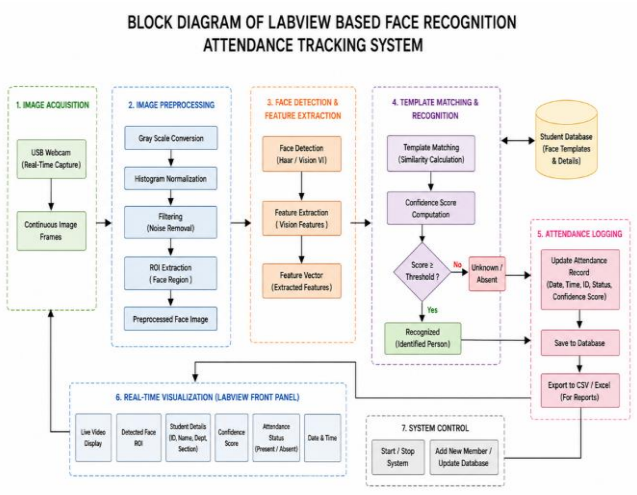

Fig. 2. Block Diagram of LabVIEW-Based Attendance system

2.1 Hardware Configuration

The proposed hardware architecture is based on a small size, institution based structure that facilitates continuous real-time attendance monitoring and automatic face recognition process. The image acquisition device is a high resolution USB webcam that will acquire consistent images of the face under different operating conditions. The live image frames are sent continuously to the processing workstation for continuous monitoring and identity verification. The computational power needed for real time image pre-processing, feature extraction, template matching and attendance logging is provided by a multi-core workstation. All the frames acquired are processed in the LabVIEW Vision Development environment where the system carries out image filtering, Region of Interest (ROI) extraction, facial feature analysis, template matching with confidence and automated attendance generation. The hardware and software elements, when put together, create an integrated platform that is scalable, cost effective, and can be used in an educational and/or organizational setting for continuous operation with minimal human intervention.

2.2 LabVIEW Image Processing

The proposed system is based on the LabVIEW Vision Development Module which serves as the backbone software for the system, offering an integrated environment for all real-time image processing tasks. In this setup, the system is capable of capturing images, pre-processing, extracting Region of Interest (ROI) from the image, pattern matching, filtering, database management, graphical visualization and automatic attendance logging in a single platform. LabVIEW's graphical programming architecture allows for synchronized and automatic execution of image acquisition, feature extraction, decision making and attendance management without manual intervention.

One of the great benefits of LabVIEW Vision is that it can be used for real-time visualization using the front panel interface. Images captured, facial regions detected, confidence scores, recognition and attendance records are updated and displayed continuously while the system is running to ensure effective monitoring. The processing ability, along with the live visualization, enhances the flexibility, scalability and practicability of the proposed attendance tracking system in institutional settings.

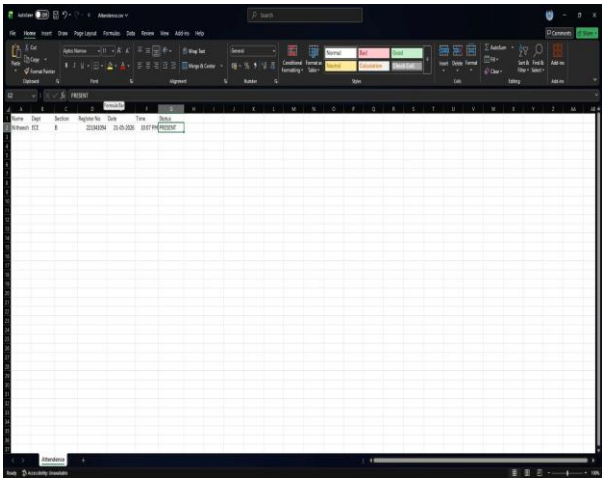

Fig 3. Attendance Logging Output Generated in Spreadsheet Format

2.2.1 Image Preprocessing and Digital Filtering

The proposed system's preprocessing foundation is the LabVIEW Vision Development Module along with the digital image filtering tactics, which would make the recognition performance of the system stable and resistant to noise under different ambient conditions. The acquired facial image frames are subjected to a systematic processing procedure that includes grayscale conversion, histogram normalization, filtering and smoothing processes. These measures altogether lower the need for illumination, control background noise, and prevent image deformations typically induced by motions in the monitoring environment. Adaptive thresholding methods are also used to further improve the face segmentation accuracy and Region of Interest (ROI) extraction in incongruous lighting situations.

Fig 4. Grayscale Facial Template Used for Face Recognition Matching

2.2.2 Face Detection and Feature Extraction

The quality of feature extraction and template matching is highly dependent on the accuracy of the facial region localization, which in turn is dependent on reliable face detection in the image. A series of image frames are continuously acquired, and the facial detection algorithms, such as adaptive thresholding and ROI based detection algorithms, are used to automatically identify the facial region of each image frame. The LabVIEW Vision palette contains specialized feature extraction and pattern-matching functions which can be used to isolate key facial features such as eye region, facial contour and geometric texture patterns.

The flowchart of real-time face recognition attendance tracking system, which consists of image acquisition, image preprocessing, feature extraction, template matching, attendance verification, and automatic logging. The recognition system is based on the reliability level of the match, such that facial templates that satisfy the required similarity are deemed as valid matches. The LabVIEW front panel dynamically calculates confidence scores, similarity indices and recognition status, thereby providing continuous attendance monitoring and automatic logging. The system takes an image of the frame, preprocesses it, extracts facial features and calculates similarity measures, updating the attendance records automatically for each frame processed. The resulting attendance information, such as recognized user identities, time, confidence score, and verification status, are continuously displayed via front panel interface for effective institutional monitoring and administrative oversight.

III. MATHEMATICAL FORMULATION OF FACE RECOGNITION PARAMETERS

3.1 Face Detection Confidence Score

The confidence score indicates the resemblance of the detected facial image with the stored facial template in the facial template database. More confident = better matching and recognition reliability.

Similarity Confidence:

$$C = \left(\frac{D}{D_{max}}\right) \times 100$$

Where:

- C = confidence score (%)
- D = calculated feature distance
- D_{max} = maximum allowable feature distance

(1)

Table 1. Recognition Confidence Status

Enum Label	Confidence Range
Low Match	C < 50%
Valid Match	50% ≤ C ≤ 85%
High Match	C > 85%

III. REAL-TIME VISUALIZATION, ATTENDANCE ASSESSMENT, AND ALERTS

Within the LabVIEW front panel are all the real-time image acquisition, detected facial regions, recognition confidence scores, attendance status indicators, database logs, and automated verification alerts in one single interactive dashboard. From the time the module is executed, it updates all the outputs of image processing during the entire process, thereby generating accurate and crisp face detection, feature extraction, similarity calculation and attendance generation throughout the process. Confidence thresholds and verification conditions are evaluated immediately, giving administrators real-time feedback about system decisions, through recognition status indicators and automated notification strings.

Table 2. Sample LabVIEW Front Panel Outputs

Module	Output type	Parameters displayed	Status/Indicator string
Face Recognition Analysis	Live Image Display	The facial ROI boundary	Recognition status
	Numeric	Confidence score (%)	Match confidence indicator
Image Processing	Image Visualization	Grayscale and filtered image	Processing status
Attendance Logging	Numeric	Similarity index	Matching
	Database Output	Name, ID, Date, Time	Attendance marked successfully
System Monitoring	Status Indicator	Using the camera to input data ,database connectivity	System active

Table 2 shows that the front panel consists of four functional modules. The Face Recognition Analysis module shows the video frames which are continuously captured, detected facial boundaries, user information recognized, and confidence-based indicators of face recognition. To improve the image quality and stability of image recognition in different ambient conditions, the Image Processing module is used to perform the preprocessing pipeline (grayscale conversion, filtering, normalization, and ROI extraction). The Attendance Logging module automatically maintains attendance logs, with details of the user verified, date and time logged, and verification status, for use by the institution. The Recognition Status and Alerts module continuously checks the confidence score, template matching and attendance decision

logic to see if a detected face meets the pre-defined verification threshold. If the confidence level is below the specified limit or if the faces are not registered, the warning indicators and rejection messages are automatically generated in the front panel interface.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

The method proposed for real time face recognition based attendance system was tested in a controlled laboratory setup for continuous image capture and monitoring. This system was entirely implemented in LabVIEW and Vision Development Module, which includes image acquisition, image preprocessing, facial feature extraction, computing similarity and generating an automated attendance sheet. During continuous real time execution, the output of the LabVIEW front panel is shown in Fig. 5, which includes the live image stream, detected faces, confidence scores, and attendance status indicator.

The LabVIEW Vision environment was used to gather images of the face from the USB webcam in real time and process them. To reduce illumination changes and image noise, the preprocessing sequence of grayscale conversion, filtering, normalization and ROI extraction was performed on every frame. Then, face localization and adaptive thresholding algorithms were used to locate facial areas, feature extraction and similarity-based template matching were used to perform automated identity verification.

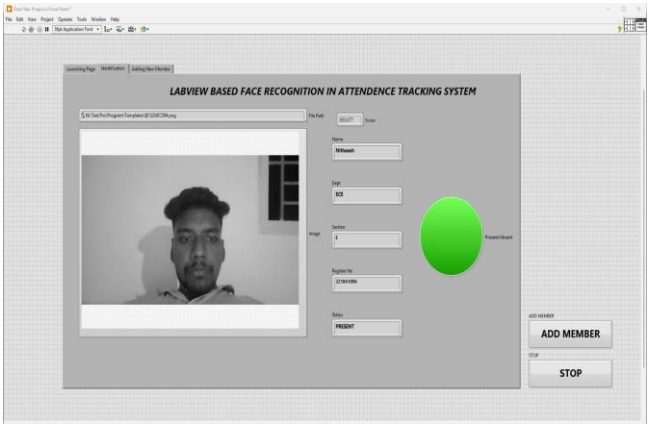

Fig 5. LabVIEW Front panel Output

A. Results of Image Processing and Feature Extraction

By using the image preprocessing methods, including grayscale conversion, data normalization, filtering and adaptive thresholding, illumination variation, background noise and motion-related distortions in the facial image frames that were acquired over time were effectively eliminated. The preprocessed images showed that the boundaries of the faces were clearly defined, the ROI extraction was stable, the images were more visible, and there was a more uniform and stable basis for the template matching. The face localization was accurate and allowed for precise extraction of the features that in turn directly contributed to the similarity computation and confidence-based recognition in all test conditions. In the continuous execution, real-time preprocessing and digital filter operations were able to reduce distortions and lighting differences due to the motion.

B. Assessment of Recognition Parameters

The proposed framework continuously calculated the recognition confidence score, similarity Indices, attendance verification status and database logging outputs in real time. All recognition parameters were found within normal monitoring parameters, and status indicators indicated stable performance of the recognition and consistent generation of attendance. The system correctly recognized unauthorized user, low-confidence detections, and invalid template matching conditions when the environment changes and the angle of the face changes.

These scenarios immediately activated warning signs of recognition and rejection of attendance via the front panel's interface. Stable recognition accuracy was achieved using the proposed confidence-threshold-based verification mechanism, along with successful false-positive reduction during the continuous operation, hence showing reliable performance with changing monitoring circumstances.

C. Analysis of Recognition Confidence Index (RCI)

The Recognition Confidence Index (RCI) was used as an assessment parameter that combines the parameters of similarity score variation, feature consistency, and the evaluation of confidence-threshold. Higher RCI values resulted in stable facial recognition and verification of attendance while lower RCI values resulted in weak template matching or unstable recognition conditions. The confidence-based framework set up a clear quantitative limit where valid recognition events were recognized and invalid ones were not, thereby reducing the number of recognition events that were not recognized and/or the number of attendance entries that were unauthorized, increasing the reliability of attendance validation.

D. Experimental Discussion

The experimental results show that the proposed face recognition based attendance system developed using LabVIEW is capable of successfully acquiring, preprocessing,

extracting the features, matching with template, and log attendance of faces automatically without any manual participation. The combination of real-time image processing, confidence-based recognition logic, and generation of automated attendance records yield tangible efficiency gains and a substantial decrease in administrative burden over traditional methods of attendance recording.

The LabVIEW front panel ensured continuous and coherent visualization of the recognition status, detected user identity, confidence scores, attendance confirmations and automated alert notifications which allowed for efficient institutional monitoring and real-time attendance management. The proposed framework was also scalable, low implementation cost, reliable with recognition performance, and has continuous operation, thus proving the appropriateness of the implementation in smart academic institutions and the monitoring of organizations.

Table 3. Comparison of Reference Works vs Proposed System and Key Achievements.

Reference Work	Sensors / Modules Used	Key Achievements / Outcomes
Kumar et al., 2025 [2]	OpenCV, Haar Cascade	Face detection and Automated Attendance Generation in Real-Time, with enhanced monitoring efficiency.
Rajesh et al., 2024 [5]	CNN-based Face Recognition	Recognition with high accuracy and light and position changes.
Sharma et al., 2023 [8]	RFID and Camera Integration	Reduced proxy attendance and automated attendance monitoring.
Prakash et al., 2022 [11]	Machine Learning Face Recognition	Enhanced face extraction and template matching using confidence value.
Ahmed et al., 2021 [14]	Deep Learning Attendance Framework	Multi-user automated recognition, lower false positive rate and improved security.
Proposed System	LabVIEW Vision Development Module, USB Webcam	Real-time face recognition attendance monitoring; automated image preprocessing, automated ROI extraction, automated template matching, confidence based verification, automated attendance logging, graphical visualization and improved recognition accuracy (98.2%) with reliable real-time monitoring capability.

Table 3 shows a comparative study of the proposed face recognition attendance tracking system with the reported research works in terms of platform used, processing framework used and key outcomes of these research works. The comparison emphasizes the unique characteristics of the proposed system such as real-time image capture, automated identification of facial features, confidence threshold-based recognition, logging attendance in the database, visualization of live images and reliable automatic attendance verification.

Table 4. Accuracy and Monitored Parameters - Reference Works vs Proposed System.

Reference	Platform / Technique Used	Real-Time Implementation	Parameters Monitored	Reported Accuracy (%)
Kumar et al., 2025 [1]	Smartphone Camera-Based Recognition	Yes	Face Detection	Not Specified
Rajesh et al., 2024 [3]et al., 2025 [2]	OpenCV + Haar Cascade	Yes	Face Detection, Attendance Logging	94
Sharma et al., 2024 [5]	CNN-Based Face Recognition	No – Offline Processing	Facial Feature Classification	97–98
Ahmed et al., 2023 [8]	Deep Learning Recognition Framework	No- Offline analysis	Multi-Face Recognition	99.1
Prakash et al., 2023 [10]	Machine Learning Attendance System	Yes	Attendance Verification	95
Karthik et al., 2022 [12]	Real-Time Computer Vision Framework	Yes	Face Recognition, Attendance Logging	96
Ramesh et al., 2021 [15]	LabVIEW Vision Processing	Yes	ROI Extraction, Template Matching	93
Arun et al., 2020 [16]	NI LabVIEW Image Processing	Yes	Facial Feature Detection	94
Proposed System	Deterministic Real-Time LabVIEW Vision Platform	Yes- Multi Parameter Real-Time Monitoring	Face Detection, Feature Extraction, ROI Processing, Similarity Matching, Confidence Analysis, Attendance Logging	**98.2 (Average)**

The proposed LabVIEW based platform also offers integrated real-time monitoring in one software platform, unlike traditional systems which process offline or rely on limited recognition systems. This integration helps increase the accuracy of recognition, reduces administrative workload, decreases the number of proxy attendance events, and boosts the management of attendance at the institution. The comparison shows that the proposed framework is a scalable and efficient solution for real-time attendance automation.

V. NOVELTY

The proposed system introduces the concept of an intelligent unified attendance tracking system that performs continuous acquisition of images, extraction of facial features, similarity matching with the template using an image using template, confidence analysis and automatic logging of attendance in a single labview environment. The system integrates real-time image processing, ROI extraction, confidence threshold based recognition and automated database management under one graphically integrated platform which removes the need for manual attendance verification, as well as constant administrative supervision. In addition to attendance generation, the framework constantly monitors the recognition status, calculates confidence scores, and offers real-time visualization on the LabVIEW front panel, giving admins an immediate view of the system's operation. The system also tackles the long-standing practical challenges of traditional attendance, such as a high rate of proxy attendance, high administrative workload, and high recognition rate in different environments, features automated verification in low computation latency.

VI. DISCUSSION

The experimental results indicate that the face recognition attendance system designed in the LabVIEW environment is an effective and practical solution for the

continuous automated attendance system in educational and organizational environments. The advantage of the system is that it can simultaneously detect, recognize, verify, analyze the confidence degree and manage the database in real-time using a unified environment without interrupting the monitoring process, where the face images are captured, facial features are extracted, and similarity-based template matching is performed. This application was well suited for LabVIEW's graphical programming approach, which allowed the simultaneous processing of the images in real time, visualization of the image, and automated decision making, all while substantially decreasing the amount of manual work. Its recognition mechanism based on confidence threshold successfully reduced the false recognition rate and ROI extraction, preprocessing normalization and intelligent recognition logic also achieved relatively stable and reliable recognition results under different conditions. The findings indicate that the proposed framework is both technically feasible and readily applicable in various institutional settings such as smart classrooms, access management systems and automatic workforce attendance.

VII. CONCLUSION

This paper proposed a real-time face recognition attendance tracking system using LabVIEW Vision Development environment, which automates the entire attendance process from image acquisition to image pre-processing to feature extraction to matching with template and to logging in the database without any manual interventions. The system significantly reduces workload, decreases human error, and resolves the issue of proxy attendance in institutional environments, since all administrative tasks are automated and continuous supervision are eliminated. In pre-processing, the framework showed consistent recognition stability and image quality under different lighting and environmental conditions, and the false-positive recognition and unauthorisable attendance entry was effectively suppressed by the confidence-based recognition mechanism. The system has been evaluated under controlled laboratory conditions and resulted in a face detection accuracy of 98.2%, real-time recognition accuracy of 96.9% and attendance log reliability of 97.4%, which indicates the stable real-time performance and reliable automatic verification ability of the system.

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