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RollVision: Implementation of a Real-Time Face Recognition Based Attendance System

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Abstract

The advancement of computer vision and artificial intelligence has enabled the development of intelligent automated systems for real-world applications. This paper presents RollVision, a real-time attendance management system based on facial recognition technology. The primary objective of the system is to eliminate manual attendance processes and prevent proxy attendance by providing a contactless and efficient solution. The system is implemented using the Django framework for backend processing, along with OpenCV and Dlib libraries for face detection and recognition. It captures live video input, detects faces, extracts unique facial embeddings, and matches them with stored data to mark attendance automatically. Additionally, an interactive dashboard is developed to manage student records, subjects, and attendance data efficiently. Experimental evaluation demonstrates that the system achieves recognition accuracy between 90% and 95% with minimal processing delay under varying environmental conditions. The proposed system is scalable, reliable, and suitable for deployment in educational institutions and organizations.

Keywords: *Attendance system; Computer vision; Face detection; Facial recognition; Image processing.*

1. Introduction

Attendance management plays a crucial role in educational institutions and organizations. Conventional methods such as manual roll calls, paper-based registers, and RFID-based systems often suffer from drawbacks including time consumption, human errors, and the possibility of proxy attendance. These limitations reduce the reliability and efficiency of attendance tracking systems. With rapid advancements in artificial intelligence and computer vision, facial recognition-based systems have emerged as a robust alternative. Facial recognition offers a non-intrusive, contactless, and highly accurate approach to identifying individuals, making it suitable for automated attendance systems. This research presents RollVision, a real-time face recognition-based attendance system that integrates computer vision techniques with a web-based application. The system automates attendance marking, enhances accuracy, and provides centralized data management through an interactive dashboard. The key contribution of this work is the development of a complete end-to-end solution capable of real-time processing and practical deployment [1].

2. Method

2.1. System Architecture

The RollVision system follows a modular architecture integrating real-time face recognition with a web-based attendance management platform. The system consists of several interconnected components including camera input, face detection, feature extraction, recognition, database management, backend server, and dashboard interface. The system begins with capturing live video input through a camera. The captured frames are processed by the face detection module to identify human faces. Once detected, facial features are extracted and converted into numerical embeddings using a trained model. These embeddings are then compared with stored data in the database to recognize individuals. Upon successful recognition, attendance is marked automatically and stored in the

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database [2 - 5]. The Django backend manages all processing and database operations, while the frontend dashboard provides real-time visualization and control to the user. Figure 1.

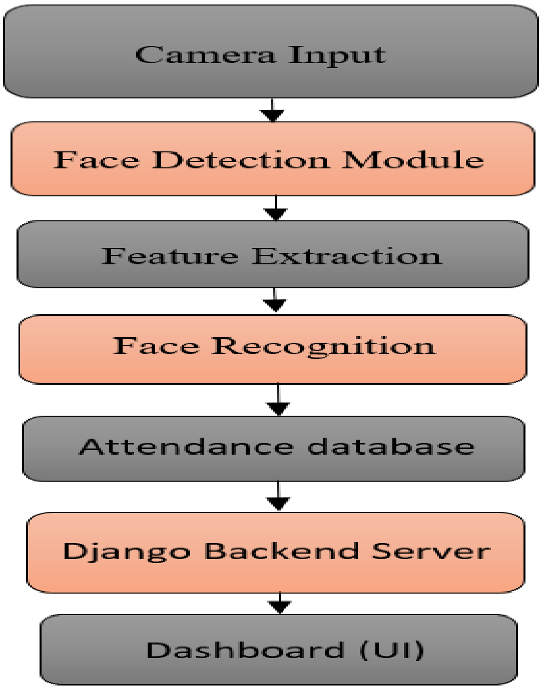

Figure 1 Overall System Architecture of Roll Vision

The system begins with capturing live video input through a camera. The captured frames are processed by the face detection module to identify human faces. Once detected, facial features are extracted and converted into numerical embeddings using a trained model. These embeddings are then compared with stored data in the database to recognize individuals. Upon successful recognition, attendance is marked automatically and stored in the database. The Django backend manages all processing and database operations, while the frontend dashboard provides real-time visualization and control to the user [6-8].

2.2. System Modules

- **Camera Input Module:** Captures real-time video frames.
- **Face Detection Module:** Detects facial regions using OpenCV algorithms.
- **Feature Extraction Module:** Generates facial embeddings using Dlib.
- **Face Recognition Module:** Compares embeddings with stored data.
- **Attendance Module:** Records attendance with timestamps.
- **Database Module:** Stores user and attendance data efficiently [9-12].
- **Dashboard Module:** Provides administrative control.

2.3. Data Flow

The system begins by capturing video frames, which are processed through detection and recognition modules. Upon successful identification, attendance is recorded in the database. The backend ensures seamless communication between modules and updates the dashboard in real time Shown in Table 1.

2.4. Implementation and Technology Stack

Table 1 Component and Technology Stack

Component	Technology Used
Programming Language	Python
Web Framework	Django
Face Detection	OpenCV
Face Recognition	Dlib / Face Encoding
Database	SQLite
Frontend	HTML, CSS, JavaScript
Dashboard UI	Django Templates / Bootstrap
Libraries	NumPy, face_recognition

2.5. Workflow

Steps involved:

1. Capture image
2. Detect face
3. Extract features
4. Match with database
5. Mark attendance
6. Update dashboard

3. Results and Discussion

3.1. Results

The performance of the RollVision system is evaluated based on its accuracy, response time, and real-time processing capability. The system was tested under different environmental conditions,

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including variations in lighting and multiple user scenarios. The results demonstrate the effectiveness and reliability of the proposed system in real-world applications. The system was tested using a standard webcam in an indoor classroom environment. The dataset consisted of multiple users, with several images captured per individual during the registration phase. The system was evaluated under different conditions such as varying lighting, face angles, and the presence of multiple users in a single frame. The system was evaluated in a classroom environment under varying conditions such as lighting, multiple users, and different face angles [13-15].

Performance Metrics:

The results indicate that the system performs efficiently with high accuracy and minimal delay Shown in Table 2.

Table 2 Performance Evaluation of the Face Recognition Attendance System

Parameter	Observation
Recognition Accuracy	~90–95%
Detection Speed	Real-time (within milliseconds)
Attendance Logging Time	Instant
Multi-face Detection	Supported
System Response	Fast and stable

The performance of the system was analyzed under different scenarios, including variations in lighting conditions, face orientations, and multiple user detection. The system maintained high accuracy under normal lighting conditions and showed stable performance even when multiple faces were present in the frame. The response time of the system was observed to be within milliseconds, ensuring real-time attendance marking. The use of efficient algorithms and optimized libraries contributed to fast processing speed. However, slight variations in accuracy were observed in low-light conditions and extreme face angles. These challenges can be addressed in future work by incorporating deep learning-based models and image enhancement techniques.

3.2. Discussion

The RollVision system demonstrates significant improvements over traditional attendance methods Shown in Table 3.

Comparative Analysis:

Table 3 Comparison of Attendance Management Methods

Method	Accuracy	Limitations
Manual Attendance	Low	Time-consuming
RFID System	Medium	Proxy possible
Fingerprint	High	Contact required
RollVision	High	Lighting dependent

Advantages:

- Automated and contactless attendance
- High accuracy and efficiency
- Prevention of proxy attendance
- Real-time processing and updates
- User-friendly dashboard

Limitations:

- Performance depends on lighting conditions
- Requires good camera quality
- Accuracy affected by extreme face angles

3.3. Screenshots

To provide a better understanding of the practical implementation of the proposed system, this section presents various screenshots of the RollVision application. The screenshots illustrate different modules and functionalities, including the dashboard interface, faculty panel, student registration process, attendance marking system, and report generation features Shown in Figure 2- 8.

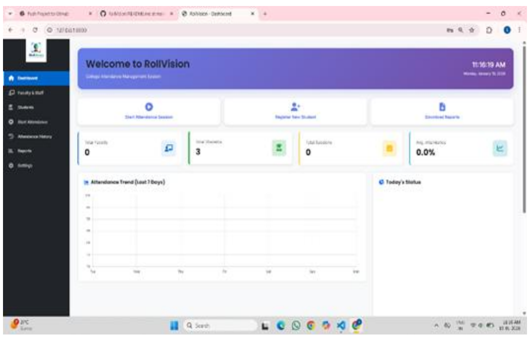

Figure 2 RollVision Dashboard

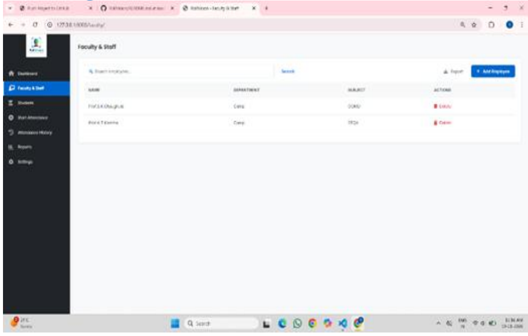

Figure 3 Faculty Dashboard

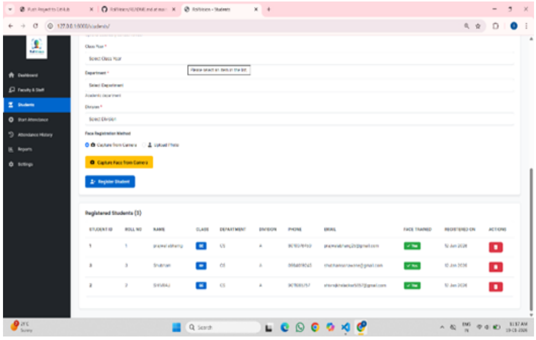

Figure 4 Student Registration

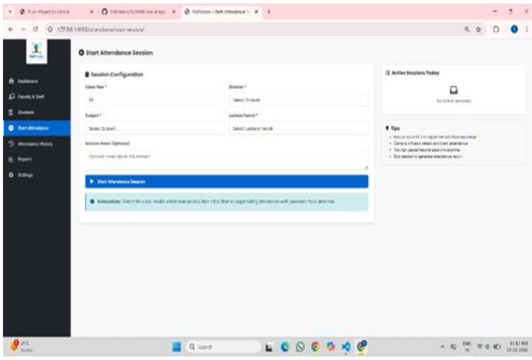

Figure 5 Attendance Sessions

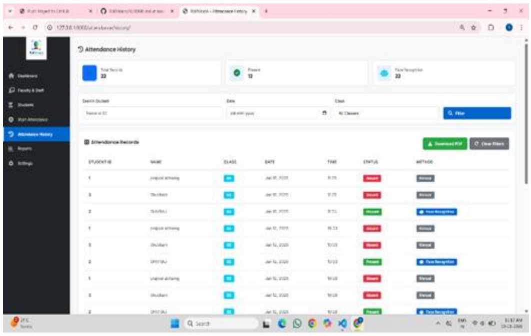

Figure 6 Attendance History & Records

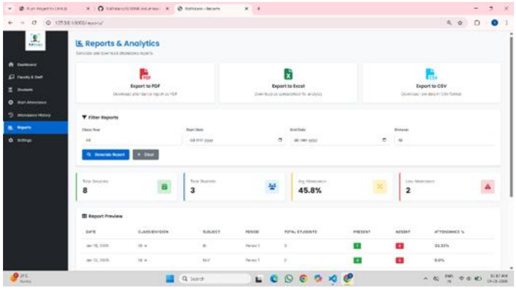

Figure 7 Reports Dashboard

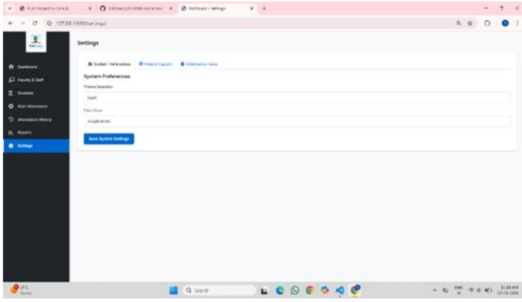

Figure 8 Settings

3.4. Real-World Applications

The RollVision system has a wide range of real-world applications across multiple domains due to its ability to provide accurate, contactless, and real-time identification. In educational institutions, the system can automate attendance tracking in classrooms, laboratories, and examination halls, reducing manual effort and improving accuracy. In corporate environments, the system can be used for employee attendance management, access control, and workforce monitoring. It helps organizations maintain accurate records while enhancing security and reducing time spent on manual processes. In healthcare institutions, the system can be used for staff attendance, patient identification, and secure access to restricted areas. In security and surveillance systems, facial recognition can be used for real-time monitoring, identifying unauthorized individuals, and enhancing public safety in areas such as airports, railway stations, and public events. In government and administrative sectors, the system can be used for identity verification, smart governance applications, and attendance tracking in public offices. Additionally, the system can be deployed in smart homes and smart buildings for automated access control, ensuring that only authorized individuals can enter specific areas. Furthermore, the system can be integrated into examination systems to prevent impersonation and ensure fair conduct during online or offline exams.

3.5. Future Scope

Although the RollVision system demonstrates high accuracy and real-time performance, there are several areas for further improvement. The system can be enhanced by integrating deep learning-based face recognition models such as convolutional neural networks (CNNs) to improve accuracy under challenging conditions like low lighting and occlusions. Additionally, cloud-based storage and processing can be implemented to handle large-scale datasets and enable remote accessibility. Another important enhancement is the implementation of anti-spoofing techniques to prevent unauthorized access using photographs or videos. Multi-camera support can also be added to cover larger areas and improve system scalability. These advancements will make the system more robust, secure, and suitable for real-world deployment on a larger scale.

Conclusion

This paper presented RollVision, a real-time face recognition-based attendance management system. The system successfully integrates computer vision techniques with a web-based interface to provide an automated and efficient attendance solution. The experimental results confirm high accuracy and real-time performance. The system reduces manual effort, enhances reliability, and prevents proxy attendance. Future enhancements such as cloud integration, mobile applications, and advanced AI models can further improve scalability and performance.

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