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AUTOMATED STUDENT ATTENDANCE MONITORING AND ANALYTICS SYSTEM FOR COLLEGES

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ABSTRACT- ***This paper presents an Automated Student Attendance Monitoring and Analytics System for Colleges that integrates Artificial Intelligence based face recognition with modern web technologies to provide a centralized, web-based platform for recording, monitoring, and analyzing student attendance. The system enables faculty to mark attendance automatically through real-time face detection and recognition, while students and administrators access attendance history, subject-wise percentages, and institutional analytics through role-based dashboards. The platform further integrates classroom management, exam-eligibility verification, online proctoring, and automated Excel/PDF report generation within a single application built using Flask (Python), HTML/CSS/JavaScript, SQLite, and OpenCV-based ONNX recognition models. The proposed system addresses the limitations of traditional manual, register-based attendance methods by eliminating proxy attendance, reducing administrative workload, and enabling real-time, data-driven academic decision-making.in this many uses there with the project developed by the computer vision and more security options.***

KEYWORDS: ***Attendance Automation, Face Recognition, Attendance Analytics, Flask, OpenCV, YuNet, SFace, Exam Eligibility, Online Proctoring, SQLite, Educational Technology.***

INTRODUCTION

In the modern digital era, the rapid growth of intelligent information systems has significantly transformed the way academic institutions manage administrative processes. Student attendance is one of the most important factors in evaluating academic performance, maintaining discipline, and ensuring compliance with institutional regulations. However, traditional attendance methods such as manual registers and paper-based records are time-consuming, prone to human error, and difficult to analyze effectively.

To address these challenges, this project develops an Automated Student Attendance Monitoring and Analytics System that provides a centralized, web-based platform for recording, monitoring, and analyzing attendance in real time. The system enables faculty members to record attendance digitally through AI-based face recognition, while students can view attendance history and subject-wise percentages, and administrators can access institutional analytics, manage records, and generate reports through a unified dashboard. The system is built using HTML, CSS, and JavaScript for the frontend, Flask (Python) for the backend REST API, and SQLite for data storage.

Integration with OpenCV, YuNet face detection, and SFace face recognition ONNX models enables automated identity verification, while Pandas and openpyxl provide downloadable Excel attendance reports.

LITERATURE SURVEY

Automated attendance and educational analytics systems have been extensively studied in recent literature. The core concept revolves around combining computer vision and artificial intelligence with structured attendance workflows to deliver accurate, efficient, and analyzable attendance records. Kumar, Gupta, and Sharma [1] presented an automated attendance system using face-recognition techniques and demonstrated that AI-based facial recognition significantly improves attendance accuracy, reduces manual effort, and minimizes proxy attendance compared to traditional methods. LeCun, Bengio, and Hinton [2] discussed the application of deep learning and computer-vision techniques for automated student identification, showing that convolutional neural networks can reliably recognize students under varying environmental conditions. Russell and Norvig [3] explored the broader application of Artificial Intelligence in educational automation, emphasizing that AI-based attendance systems improve classroom management through intelligent face recognition and real-time monitoring. Bradski [4] demonstrated real-time face detection using OpenCV.

RELATED WORK

Student attendance monitoring plays a vital role in educational institutions as it directly influences academic performance, discipline, and examination eligibility. Many researchers have proposed automated attendance systems using RFID, QR codes, biometric authentication, and face recognition. Among these approaches, AI-based face-recognition systems have gained significant attention due to their ability to identify students automatically without requiring physical contact or additional hardware.

Breiman [5] investigated the role of attendance analytics in improving academic performance and reported that analytical reporting helps institutions identify students with irregular attendance and supports informed academic decision-making. Moustafa and Slay [6] evaluated AI-based attendance systems integrated with facial recognition and automated reporting, concluding that intelligent attendance monitoring improves operational efficiency, reduces administrative workload, and enhances classroom transparency while maintaining high recognition accuracy. However, most existing systems rely on RFID cards or QR codes that can be misused through sharing, or focus only on attendance recording without providing analytical insight, examination-eligibility verification, or classroom-level monitoring.

EXISTING SYSTEM

The existing attendance-management systems available today primarily rely on manual registers or menu-driven digital forms that require a faculty member to individually call out or select each student's name. This process is time-consuming, consumes valuable instructional time, and is highly susceptible to human error and proxy attendance, where one student marks presence for an absent classmate. Once recorded, computing subject-wise attendance percentages, identifying students with chronic absenteeism, or compiling institution-wide statistics requires additional manual tabulation that is rarely performed in a timely manner. The major drawbacks of

existing systems include: lack of automated identity verification, absence of integrated analytics, no automated exam-eligibility checking, limited classroom or examination monitoring capability, and dependency on manual report generation.

PROPOSED SYSTEM

The proposed Automated Student Attendance Monitoring and Analytics System addresses these limitations by combining AI-based face recognition, attendance analytics, exam-eligibility verification, and online proctoring into a single, unified web platform. The system uses Python Flask, OpenCV, YuNet Face Detection, SFace Face Recognition, and SQLite to automate attendance recording, identify students accurately, generate attendance reports, monitor classroom activities, and determine examination eligibility.

Instead of manual roll-calls, faculty and students interact with a webcam-based Live Attendance module that automatically detects and recognizes each student's face, marks attendance, and updates the database in real time. The system maintains complete attendance history, computes attendance percentages and engagement scores, and issues eligibility status and hall tickets for examinations. Key features of the proposed system include: secure role-based login; AI-based automatic attendance marking; real-time attendance analytics with Excel export; automated exam-eligibility verification with hall-ticket generation; and AI-powered online proctoring with malpractice logging.

SYSTEM ARCHITECTURE

The system architecture follows a multi-layered design consisting of the Presentation Layer, Application Layer, AI/Face Recognition Engine, Data & Files Layer, and Output/Reports Layer, ensuring modularity, scalability, and efficient communication among components.

The Presentation Layer is a responsive web frontend built with HTML, CSS, and JavaScript that provides interfaces for login, attendance capture, classroom management, analytics visualization, exam eligibility, and proctoring. The Application Layer is implemented using the Flask framework and comprises the Main App controller along with the Authentication Module, Attendance Analytics Module, Eligibility Module, and Proctoring Module, each communicating with the AI/Face Engine and the underlying data store. The AI/Face Engine performs face detection and recognition using YuNet and SFace ONNX models, returning identity matches to the application layer over an internal model interface. The Data & Files Layer uses an SQLite database together with static file storage to persist student records, attendance logs, classroom layouts, and uploaded face images. Finally, the Output/Reports Layer compiles attendance and analytics data into downloadable Excel and PDF reports for faculty and administrators.

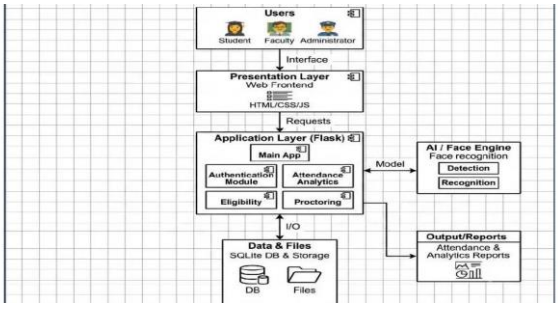


Fig 1: System Architecture

METHODOLOGY DESCRIPTION

The methodology of the system covers user authentication, face-recognition processing, attendance

recording, analytics generation, and exam-eligibility determination.

User Authentication: Administrators, faculty, and students log in through a secure session-based login screen. Credentials are verified against records stored in the SQLite database, and successful login redirects the user to a role-specific dashboard.

Face Recognition and Attendance Marking: During a live-attendance session, the browser captures a frame from the webcam and transmits it (Base64-encoded) to the Flask /api/process_frame endpoint. The backend decodes the image, applies YuNet for face detection and SFace for embedding extraction, and compares the extracted embedding against a cache of registered student embeddings loaded at application start-up. Upon a positive match, the recognized identity is returned to the client, and the /api/attendance/save endpoint inserts a new attendance record (student ID, date, time, period, status, engagement score) into the database, with duplicate-entry checks to prevent multiple log-ins for the same session period.

Analytics and Eligibility Computation: The Attendance Analytics module aggregates stored records to compute attendance percentages, monitor trends, and export a consolidated Excel report using Pandas. The Exam Eligibility module compares each student's computed attendance percentage against the institutional threshold (75% in the current prototype) to automatically determine eligibility and issue a printable hall ticket.

RESULTS AND DISCUSSION

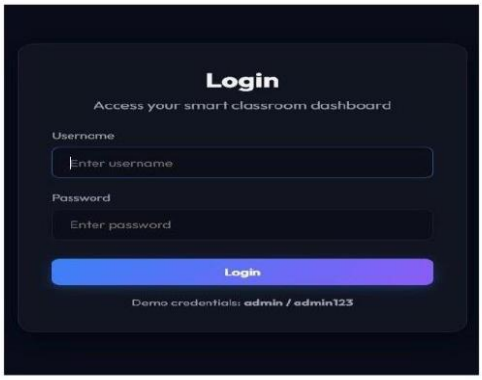


Fig 2: Login Page

The login page authenticates registered users using secure session-based credentials before granting access to the role-specific dashboard, with demo credentials provided for evaluation purposes.

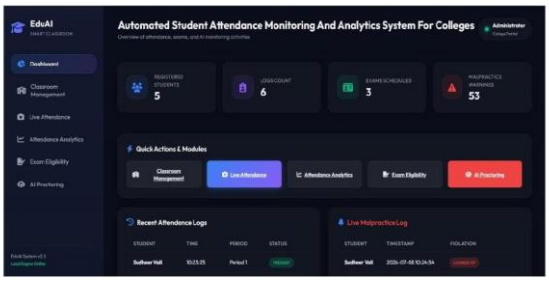


Fig 3: Administrator Dashboard

The dashboard presents live counters for registered students, attendance logs, scheduled exams, and malpractice warnings, along with quick-action links to Classroom Management, Live Attendance, Attendance Analytics, Exam Eligibility, and AI Proctoring, and recent attendance/malpractice activity logs.

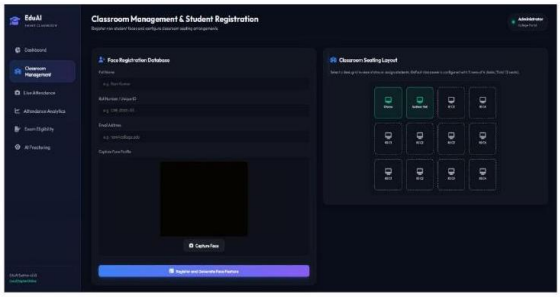


Fig 4: Classroom Management and Face Registration

The Classroom Management screen allows administrators to register new students by capturing

their facial profile and to configure the classroom seating layout used during monitoring.

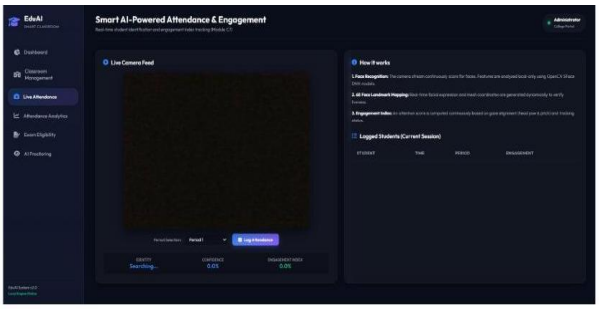


Fig 5: Live Attendance System

The Live Attendance screen streams the webcam feed and performs continuous face detection, recognition, and engagement-index tracking, logging attendance automatically for the selected class period.

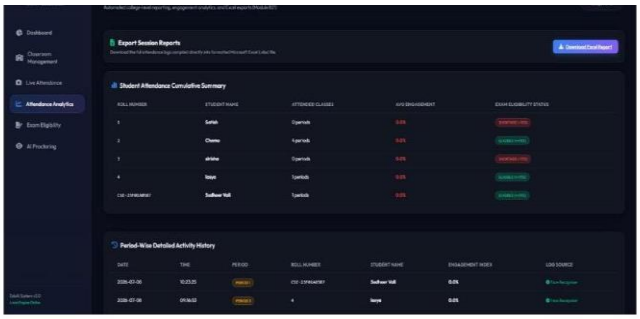


Fig 6: Attendance Analytics Dashboard

The Attendance Analytics screen presents a per-student cumulative summary of attended periods, average engagement, and exam-eligibility status, along with a period-wise activity history and a one-click Excel export of the full attendance log.

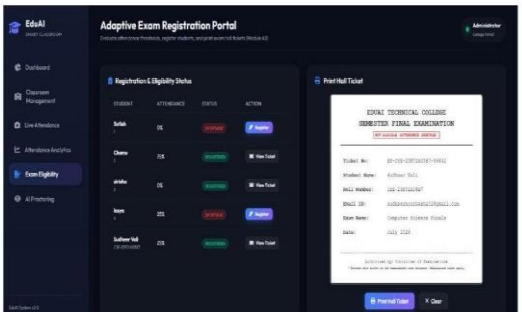


Fig 7: Exam Eligibility and Hall-Ticket Generation

The Exam Eligibility screen automatically computes each student's attendance percentage, flags eligibility against the institutional threshold, and generates a printable hall ticket for eligible students.

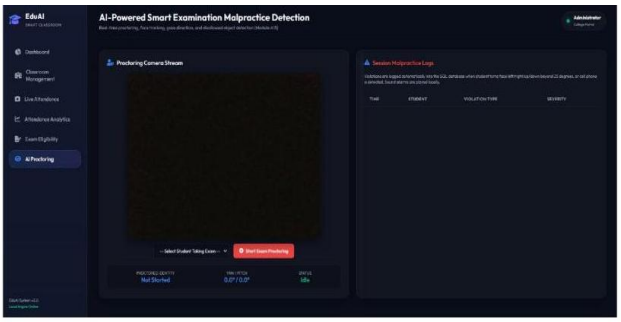


Fig 8: AI-Based Online Proctoring

The AI Proctoring screen streams the camera feed during an online examination and automatically logs malpractice events, such as looking away or unauthorized device use, to a session malpractice log for later review.

These results confirm that the integration of AI-based face recognition with a modular Flask/SQLite backend provides a functionally complete solution for automated attendance recording, analytics, eligibility verification, and examination monitoring, while remaining lightweight enough to run on standard laboratory computers.

CONCLUSION

The Automated Student Attendance Monitoring and Analytics System for Colleges has been successfully designed and implemented to provide a smart, efficient, and user-friendly platform for automating student attendance and monitoring academic participation. The system combines modern web technologies with AI-based face recognition to simplify attendance management, reduce manual effort, and improve the accuracy and reliability of attendance records.

By integrating attendance monitoring, classroom management, analytics, exam-eligibility verification, and online proctoring into a single application, the system enhances the efficiency of academic administration. The implementation of AI-powered face recognition enables automatic identification of students during attendance sessions and online examinations, eliminating manual attendance marking and minimizing proxy attendance.

The system is developed using HTML, CSS, and JavaScript for the frontend, Python (Flask) for the backend, and SQLite for data storage. Testing results demonstrate that the system performs reliably across authentication, face recognition, attendance recording, analytics, exam-eligibility verification, online proctoring, and report-generation modules, delivering a smooth and consistent user experience.

FUTURE SCOPE

The Automated Student Attendance Monitoring and Analytics System provides a strong foundation for intelligent, automated attendance management. Future versions of the system can integrate cloud-based deployment to enable centralized data management and remote access across multiple campuses, along with a dedicated mobile application for anytime-anywhere access to attendance records and notifications.

The system can be enhanced with advanced Machine Learning algorithms to predict attendance trends, identify at-risk students, and provide early academic intervention. Additional features such as QR-code-based attendance, biometric authentication, real-time SMS/email notifications, liveness detection to resist spoofing, and integration with Learning Management Systems (LMS) can further improve automation, usability, and institutional adoption.

In conclusion, the system offers significant opportunities for future growth. With the integration of advanced AI technologies, cloud services, and additional monitoring capabilities, the platform can evolve into a fully intelligent, comprehensive smart-campus attendance solution capable of meeting the growing demands of modern educational institutions.

REFERENCES

[1] D. P. Harini, “Electronic Health Record Stage Identification using Principal Component Analysis,” *Machine Intelligence Research,* vol. 18, no. 01, pp. 864- 873, 17 8 2024.

[2] D. P. Harini, “Two Level Intrusion Detection For Detecting Intruders in Multitier Web Applications,” *International Journal of Engineering & Science Research,* vol. 3, no. 9, pp. 472-478, 2013.

[3] D. P. Harini, “Analyze and Predict of Human Cyber Attackers using Artificial Neural Network,” *Journal of Basic Science and Engineering,* vol. 21, no. 1, pp. 1529 - 1536, 8 7 2024.

[4] G. Bradski, Real-Time Face Detection Using OpenCV. ACM Digital Library.

[5] L. Breiman, Attendance Analytics for Academic Performance Monitoring. Springer, 2020.

[6] N. Moustafa and J. Slay, Intelligent Student Attendance Monitoring Using Face Recognition. IEEE, 2018.

[7] G. Bradski and A. Kaehler, Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library. O'Reilly Media, 2017.

[8] R. Szeliski, Computer Vision: Algorithms and Applications, 2nd ed. Springer, 2022.

[9] A. Krizhevsky, I. Sutskever, and G. E. Hinton, ImageNet classification with deep convolutional neural networks. Commun. ACM, vol. 60, no. 6, 2017.

[10] M. Grinberg, Flask Web Development, 2nd ed. O'Reilly Media, 2018.

[11] SQLite Documentation. Available at: https://www.sqlite.org/docs.html

[12] OpenCV Documentation. Available at: https://docs.opencv.org/

[13] ONNX Runtime Documentation. Available at: https://onnxruntime.ai/docs/

[14] Flask Official Documentation. Available at: https://flask.palletsprojects.com/

[15] Python Software Foundation, Python 3 Documentation. Available at: https://docs.python.org/3/

[16] Mozilla Developer Network (MDN), HTML5 Documentation. Available at: https://developer.mozilla.org/docs/Web/HTML

[17] Akinapalli, S. (2026). An Ai-Powered Data Trust And Quality Scoring Framework For Enterprise Decision Intelligence Systems. International Journal of Data Science and IoT Management System, 5(1), 946-950.