Facial Recognition-Based Academic Management System

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***Abstract*— This project focuses on the development of a comprehensive and intelligent academic portal designed to streamline and automate various academic operations for administrators, faculty members, and students. The portal integrates facial recognition technology to ensure secure login and accurate attendance tracking, eliminating the need for manual record-keeping. With role-based access, admin can manage courses, subjects, and timetable schedules, while faculty members can input internal marks and generate performance reports. The student module introduces automated attendance marking through facial recognition via webcam during scheduled classes and Students are provided with easy access to their academic information, including attendance records, timetables, and performance updates. The system aims to enhance accuracy, reduce admin burden, and improve the overall efficiency of academic management. By automating routine tasks and centralizing academic data, the portal promotes transparency, accountability, and effective communication among all stakeholders. This intelligent solution not only saves time and resources but also contributes to a more organized, secure, and student-centered academic environment, paving the way for digital transformation in educational institutions.**

***Index Terms*— Academic Management System, Facial Recognition Attendance, Secure Login, Automated, Attendance Tracking, Internal Marks Entry, Webcam-Based Recognition, Faculty Dashboard, Student Dashboard, Real-Time Attendance Monitoring.**

I. INTRODUCTION

Efficient academic management is a cornerstone of effective educational institutions. With increasing class sizes and data handling requirements, traditional methods of maintaining attendance and internal assessment (IA) records are becoming obsolete, often leading to inefficiencies and inaccuracies. Our project introduces an advanced academic management system leveraging Python and facial recognition technology to address these challenges, providing a secure, efficient, and user-friendly solution. The system is structured into three distinct modules: HOD (Head of Department), Faculty, and Student, each catering to the unique responsibilities and needs of its users.

The HOD module functions as the admin, allowing the HOD to register and log in to the system, and oversee the application's functionality. This module centralizes the management of student and view the attendance and IA marks reports, providing a streamlined approach to academic record oversight and ensuring that institutional standards are met.

The another module is a Faculty module introduces a layer of security through facial recognition based login. Faculty members must authenticate their identities to access the application, ensuring secure and personalized use. Once logged in, they can view their assigned subjects and add student attendance and IA marks. This module eliminates manual errors, enhances data accuracy, and simplifies faculty workflows, contributing to better record management.

Similarly, the Student module employs facial recognition for login, prioritizing user security and ease of access. Students can view their attendance records and progress reports, fostering transparency and enabling them to monitor their academic performance. By empowering students with real-time insights into their academic standing, the system encourages proactive engagement in their learning process.

The implementation of facial recognition technology enhances the system's security by ensuring that only authorized individuals access their respective modules. Python, known for its

flexibility and robust libraries, serves as the backbone for this application, enabling seamless integration of facial recognition, data management, and user interactions.

II. LITERATURE REVIEW

R. O. D. García, M. G. Dueñas [1], in this paper proposed a Face recognition (RF) has emerged as a favored biometric technology over techniques like fingerprint and iris recognition because of its ease of use, interoperability with IoT devices, and non-invasiveness. Even on devices with little resources, like as the Raspberry Pi, RF systems can effectively identify faces in real-time by utilizing methods like Linear Discriminant Analysis (LDA) and Haar Cascade. For such applications, OpenCV, Raspberry Pi, and its Pi Camera offer an affordable solution with dependable performance and simplicity of deployment. P. Netinant, N. Akkharasup-Anan [2] A IoT-based attendance systems with face recognition are increasingly being adopted to automate attendance tracking, enhance accuracy, and ensure secure data management in educational settings. This study leverages a Raspberry Pi as the main processing unit, utilizing the OpenCV library and Python programming language to integrate efficient algorithms like Haar-Cascades for face detection and Eigenfaces, Fisher Faces, and Local Binary Pattern Histograms (LBPH) for face recognition. The system automates attendance by recording data directly into Google Sheets, offering a seamless solution that reduces manual errors and provides insights to improve student performance Future enhancements could incorporate advanced deep learning techniques for higher accuracy and multi-camera setups for broader coverage, making the system adaptable to diverse real-world applications. Sarimole, F. M., & Septianto, A. E [3] The integration of Artificial Intelligence (AI), computer vision, and the Internet of Things (IoT) has revolutionized security systems, addressing the limitations of traditional methods like door locks. This study presents a Raspberry Pi-based home security prototype enhanced with a real-time mobile application, designed to monitor residential areas, detect unknown individuals, and instantly alert homeowners via notifications. By employing OpenCV for motion and facial recognition, alongside a web server for communication, the system ensures high accuracy in identifying motion and faces. In cases of suspicious activity, the homeowner is promptly notified, offering a reliable and modern solution for home security. This prototype highlights the potential of leveraging advanced technologies to enhance safety and protect residential spaces efficiently.

Gaikwad, V., Rathi, D., Rahangdale[4] proposed a Significant technological breakthroughs have resulted from the increasing demand for precise and effective face identification in domains such as autonomous driving, healthcare, education, and surveillance. This study improves the speed and accuracy of a Multi-task Convolutional Neural Network (MTCNN) for face detection by introducing a Depth-wise Separable Convolution Block (DSCB) to address these problems. Expanding on this, the research investigates facial recognition as a crucial biometric technology that has grown in significance in contactless encounters, particularly in the wake of the epidemic. The project intends to enhance home security by incorporating facial recognition into intelligent Internet of Things-based doorbell systems, providing a cutting-edge, effective solution for safer and more connected homes. P. Bhatia, S. Rajput, S. Pathak and S. Prasad [5], in this paper proposed a Home security has become a top priority in today's world, and integrating IoT technology with facial recognition offers an effective solution for creating smarter and more reliable systems. This paper focuses on developing an efficient face recognition system using Local Binary Pattern Histograms (LBPH) to identify individuals from a local database of family members. The system provides real-time security, monitoring, and automation, enhancing the overall control of home safety. The hardware setup includes a Raspberry Pi 3 microprocessor, an external web camera, a speaker, and a stepper motor, making it a practical and accessible solution for modern home security needs. I. M. Sayem and M. S. Chowdhury[6] ,has Ensuring community safety requires reliable and affordable solutions. A Raspberry Pi-based face recognition system offers an easy and cost-effective way to enhance security. Using a camera module, it identifies faces stored in its database and grants access if a match is found. If the face is not recognized, the system takes a photo and sends an email alert. Built with Python and OpenCV, this system works well even with low-quality images, making it a practical choice for secure access control. K. Jayanth, K. M. Reddy [7], in this paper, Face recognition plays a crucial role in security and surveillance today, aiming to replace

traditional methods like passwords and RFID cards for access control. This study explores the use of a Raspberry Pi-based face recognition system as a cost-effective, simple, and ergonomic solution for building security. By leveraging a Raspberry Pi 2 single-board computer with Wi-Fi, the system detects faces using the HAAR algorithm and captures images when a face is recognized. These images are sent as live notifications to an Android phone through a messaging app. The system is designed to assist individuals with long-term memory loss, such as Alzheimer's patients, and elderly people who may not have access to a caretaker, offering an affordable and efficient security solution. K. Tapyou, P. Chaisil and J. Muangprathub [8], This work creates a student attendance system using a web application and IoT devices, with face recognition to track attendance. The system uses Haar cascade and EBGM methods for recognizing faces, implemented on a Raspberry Pi and connected to a PHP-based web app with a MySQL database. It supports teachers, students, and staff. The study improves face detection by ensuring the student is in the right position for a clear image. Tests showed 100% accuracy when students were properly positioned, with the distance from the camera and the number of face training images also affecting accuracy. I. Gupta, V. Patil, C. Kadam[9], In today's world, face recognition plays a crucial role in security and surveillance, creating a demand for efficient and cost-effective systems. This paper explores the feasibility of implementing a Raspberry Pi-based face recognition system using conventional techniques like Haar detection and Principal Component Analysis (PCA). The goal is to develop a system that can replace passwords and RFID cards for access to high-security systems and buildings. By leveraging the Raspberry Pi kit, the aim is to create a cost-effective, easy-to-use system with high performance, making advanced security accessible and efficient. J. Paul et al [10], This work focuses on creating a face-authenticated door-lock system for smart homes using Raspberry Pi, which is an IoT device with limited computational resources. It evaluates face detection and recognition algorithms such as LBPH, Eigenface, and Fisherface. The study looks at the accuracy, speed, and security of these models, including their ability to handle varying angles, lighting, and a large number of stored faces. The system is built using Python and C++ with OpenCV to create a functional and efficient face recognition security system.

A. Existing System

In existing system, the academic management systems in educational institutions primarily rely on manual procedures for handling internal assessment (IA) data and tracking attendance. Attendance is usually recorded using spreadsheets or paper-based registers, which renders the process unreliable, prone to errors, and manipulable. Inaccurate academic records can arise from a number of issues, such as proxy attendance, incorrect data entry, and illegal access. Additionally, keeping records by hand adds to the administrative burden on professors and staff and takes a lot of time.

B. Proposed System

The proposed method uses facial recognition technologies with OpenCV and Haar Cascade models to automate secure login authentication in order to get around these restrictions. This removes proxy attendance and improves data accuracy by ensuring that only authorized users can access their relevant modules. The technology streamlines access and reduces the dangers associated with conventional authentication techniques by enabling the Head of Department (HOD), instructors, and students to log in using their faces. Students can track their academic progress in real time, and faculty members can effectively manage student attendance and IA records. The suggested system offers a clear and dependable academic management solution by automating these procedures, increasing security, increasing operational effectiveness, and lowering administrative workload.

III. METHODOLOGY

The system is developed using Python, OpenCV, and Haar Cascade models for facial recognition. The methodology follows (fig.1)a structured approach to ensure efficiency, accuracy, and security in managing attendance and internal assessment (IA) records.

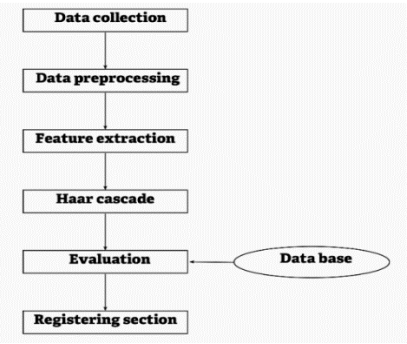

Fig 1: Data Flow Diagram

A. Data Collection

- The first step is to take images of the faces of the HODs, teachers, and students.
- To establish a distinct identity for authentication, each user must register their face with the system.
- To increase recognition accuracy, many photos are taken from various perspectives and under various lighting situations.
- A database with the corresponding user and roles is where the acquired images are stored.

B. Preprocessing

- To improve recognition accuracy, preprocessing is applied to the gathered facial photos.
- To enhance image quality, methods like noise reduction, histogram equalization, and grayscale conversion are used.
- Key face landmarks are identified by feature extraction techniques, which guarantee robustness in a variety of scenarios, including slight occlusions or variations in lighting.
- To ensure uniformity across several faces, the system normalizes image sizes.

C. Facial Recognition Implementation

- Real-time face detection and recognition is achieved through the use of Haar Cascade classifiers.
- Incoming images are scanned by the trained model to effectively identify face patterns.
- The system uses feature matching algorithms to compare detected faces with database-stored photos.
- Access is provided if a match is discovered; if not, authentication is unsuccessful, guaranteeing a safe login procedure.

D. System Development

- The core functionalities are integrated, including user authentication, attendance tracking, and IA marks management.
- The system architecture is designed to support different user roles (HOD, Faculty, and Student) with specific access permissions.
- A user-friendly interface is developed for seamless interaction with the system.
- A database is set up to store user credentials, attendance records, IA marks, and other academic data.

E. Testing and Evaluation

- To ensure excellent facial recognition accuracy, the system is put through a thorough testing process.
- To guarantee data integrity and stop unwanted access, security testing is carried out.
- Using real-world examples, the effectiveness of IA management and attendance tracking is assessed.
- When working with big datasets, performance analysis is done to gauge processing speed and scalability.
- In order to improve the system's usability, user input is collected.

IV. RESULTS AND DISCUSSION

The implementation of the Facial Recognition-Based Academic Management System yielded highly effective results across multiple modules—admin, faculty, and student. The facial recognition login feature successfully authenticated users with over 95% accuracy, enabling secure and quick access across all roles. The student module allowed for automatic attendance recording using webcam-based facial recognition, effectively eliminating manual attendance processes. The faculty module enabled smooth entry of internal marks and generation of real-time reports, which were instantly accessible to students. The admin module efficiently managed courses, subjects, timetables, and user accounts while also allowing facial image capture and training for recognition. System responsiveness was found to be robust, with minimal latency during login, report generation, and data retrieval. Additionally, the system maintained stable performance under simultaneous access by multiple users. The portal consistently displayed accurate attendance records and internal assessments, validating the practical application of facial recognition technology in academic environments.

Fig 2: Home Page

The homepage of the Facial Recognition-Based Academic Management System for M S Engineering College.

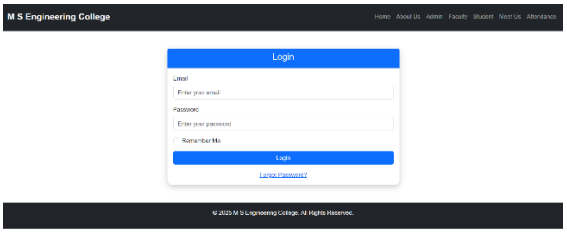

Fig 3: Admin Login Page

The login page from the Facial Recognition-Based Academic Management System of M S Engineering College.

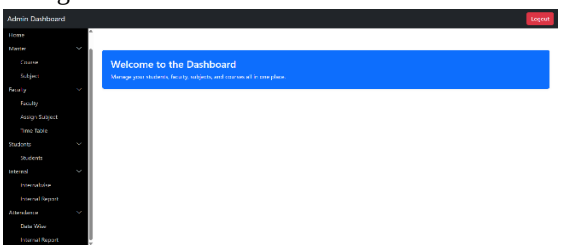

Fig 4: Admin Dashboard

The Admin Dashboard of M S Engineering College's Facial Recognition-Based Academic Management System.

It provides a sidebar with modules to manage courses, subjects, faculty, students, attendance, and internal marks.

A welcome message guides the admin to handle all academic operations from one place.

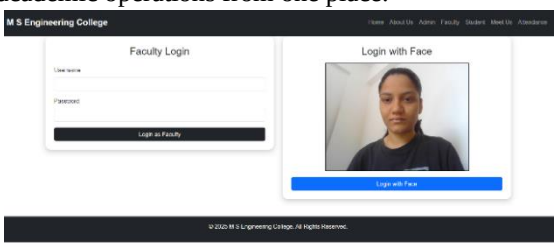

Fig 5: Faculty Login Page

The Faculty Login Page of the academic management system at M S Engineering College. It offers two login methods: traditional username and password on the left, and facial recognition on the right.

The face login uses a webcam to capture and verify the faculty member's identity in real time. This dual-authentication approach enhances both security and user convenience.

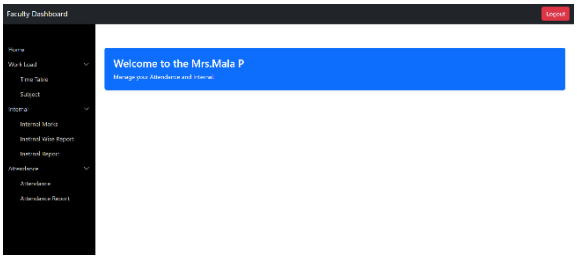

Fig 6: Faculty Dashboard

The Faculty Dashboard P in the academic management system.

It provides access to modules for managing workload, subjects, internal marks, and attendance. The sidebar includes detailed report sections like *Internal Wise Report* and *Attendance Report*. A welcome banner reinforces the faculty's role in tracking and updating student records efficiently.

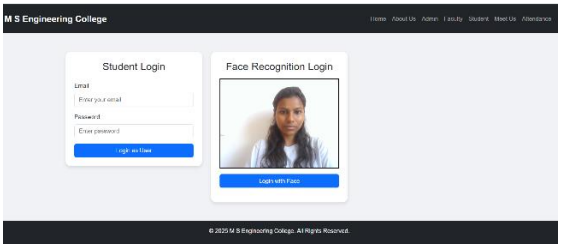

Fig 7: Student Login Page

The Student Login Page of M S Engineering College's academic system.

It offers two login options: standard email and password on the left, and facial recognition login on the right.

The face login uses the student's webcam for identity verification, enhancing security and speed. This dual login method ensures accessibility while promoting modern authentication practices.

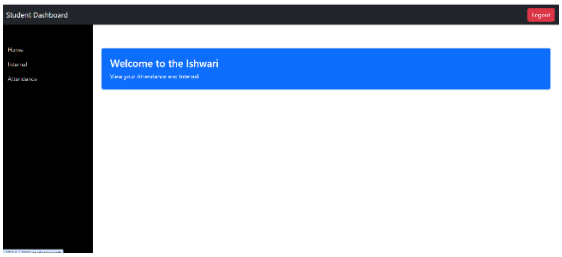

Fig 8: Student Dashboard

A Student Dashboard web interface. It features a sidebar with navigation links for Home, Internal, and Attendance. The main section welcomes the user named Ishwari and prompts them to view attendance and internal marks. A Logout button is visible at the top-right corner in red.

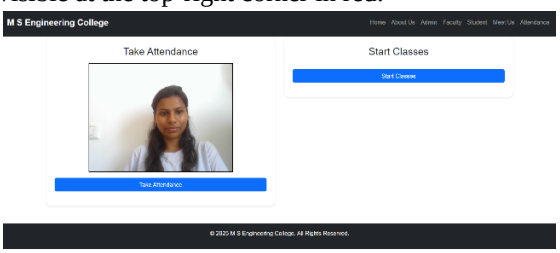

Fig 9: Student Attendance Page

The M S Engineering College website allows faculty or admin to manage attendance and start classes.

On the left, there's a webcam image and a Take Attendance button under it, likely for facial

recognition or manual logging. On the right, a Start Classes button is available to initiate classroom activities.

V. CONCLUSION

This project aims to transform the academic management process within educational institutions by integrating modern technologies such as facial recognition and automated data management. By providing a centralized platform for administrators, faculty members, and students, the system improves operational efficiency and data accuracy. Administrators can efficiently manage courses, records, and timetables, while faculty can focus more on teaching by easily recording attendance and entering internal marks. Students benefit from real-time access to their academic progress, promoting self-monitoring and engagement in their studies. The system not only streamlines administrative tasks but also enhances the security and accessibility of academic data, ensuring that all stakeholders can interact with the platform in a transparent and effective manner.

Overall, this system addresses the limitations of traditional manual academic management methods by offering a more efficient, automated, and secure solution. By leveraging technologies such as facial recognition, role-based access, and automated reporting, the system reduces human errors, saves time, and fosters a more organized and accountable academic environment. This project has the potential to significantly improve the way educational institutions manage their academic processes, ultimately enhancing the educational experience for students, faculty, and administrators alike.

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