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EduFace-Smart Identity for Educational Campuses

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Abstract: Nowadays, many educational institutions are dependent on manual attendance and basic ID checks, which are time-consuming, error-prone, and vulnerable to manipulation, leading to inefficiency and security risks. The proposed system - EduFace addresses these issues by using OpenCV and Dlib for realtime facial recognition, enabling automated attendance and secure access control. A Raspberry Pi–controlled motor system manages door access for verified users, while unauthorized attempts are flagged through the web interface. The system also sends WhatsApp alerts to parents via Twilio and provides administrators with a centralized dashboard for real-time monitoring. By reducing manual effort and preventing proxy attendance. EduFace also offers a modern, efficient and secure solution for campus management. In addition, the system currently does not integrate cloud-based scaling, resulting in attendance data and logs being stored locally, which can make management more challenging for very large institutions

Keywords: OpenCV, Dlib, Raspberry PI, Twilio

I. INTRODUCTION

Educational institutions today face increasing challenges in maintaining accurate attendance records and ensuring secure campus access. Traditional methods such as manual roll calls, ID cards, and fingerprint systems often result in delays, inconsistencies, and vulnerabilities like proxy attendance or lost identification cards. With growing student populations and rising safety concerns, there is a strong need for a system that is fast, reliable, contactless, and capable of integrating seamlessly with daily academic operations. Recent advancements in artificial intelligence, machine learning, and IoT technologies create new possibilities for automating these essential tasks with greater precision and transparency.
EduFace addresses this need by introducing a real-time Smart Identity, Attendance, and Access Control system that uses facialrecognition to verify students at the moment they enter the campus. The system captures live images, identifies students using facial embeddings, and automatically updates their attendance based on predefined time rules. Integrated IoT hardware, such as a Raspberry Pi–controlled motorized door, ensures that only authorized individuals gain access. Additionally, EduFace improves communication and accountability by sending instant WhatsApp notifications to parents and providing administrators with a centralized Flask–React dashboard for real-time monitoring and analytics. By combining intelligent recognition with secure automation, EduFace offers a modern, user-friendly solution that enhances both safety and efficiency in educational environments.

II. EASE OF USE

A. System Operation and User Interaction

The EduFace system is designed to ensure effortless interaction for students, faculty, and administrators. Once deployed, users are only required to stand briefly in front of the camera for automatic face capture and identity verification. The system manages all internal processes—such as facial embedding comparison, attendance marking, and door control—without requiring any manual input. This hands-free operation makes EduFace suitable for daily use in busy educational environments, reducing queues, delays, and technical dependency.

B. Maintaining Consistency and Automation in the System Workflow

All functional components of EduFace are integrated to perform seamlessly within a unified workflow. The automated attendance classification, IoT-based door mechanism, database logging, and WhatsApp notification features operate using predefined specifications Ensuring consistency and accuracy of the result. Since the system is already calibrated for real-world performance, users can rely on the default settings without needing to adjust technical parameters or internal controls. These standardized configurations help maintain system reliability, data integrity, and smooth operational performance within the campus environment.

III. LITERATURE REVIEW

[1] Wang, H., Liu, Y., Yang, J., and Li, J., "Design of Embedded Intelligent Face Recognition Access Control System," IEEE Access, 2021.this paper talks about an embedded face-recognition access control system that performs

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real-time detection and authentication directly on low-power hardware. The system's advantage lies in its fast, contactless operation and reduced reliance on external servers, making it suitable for secure access applications. However, the paper also notes limitations such as lower accuracy under poor lighting, difficulty recognizing partially occluded faces, and performance constraints due to limited processing power on embedded devices.

[2] Al-Shebani, A., Premaratne, P., and Vial, P., "Embedded Door Access Control Systems Based on Face Recognition: A Survey," IEEE ICSPCS, 2013. this paper talks about various embedded facerecognition–based door access systems and analyze the techniques used for face detection, feature extraction, and real-time authentication on embedded platforms. The paper highlights advantages such as improved security, convenience, and the ability to integrate facial recognition into compact, low-power hardware. However, it also points out limitations including sensitivity to lighting variations, limited processing capability of embedded devices, and challenges in maintaining high accuracy in real-world environments. The survey emphasizes the need for more robust and efficient embedded recognition solutions.

[3] Kishan Kushwaha, Sakala Rahul, and Shaik Eliyaz, "Attendance Management System Using Face Recognition," IEEE ICOSEC, 2023. this paper talks about present a face-recognition–based attendance system designed to automate student presence recording through realtime image capture and identity verification. The system offers the advantage of reducing manual effort, preventing proxy attendance, and providing a contactless alternative to traditional methods. However, the study notes challenges such as performance drops in low-light environments, difficulty recognizing faces with accessories or occlusions, and increased processing load during multi-face detection. Overall, the work demonstrates the potential of facial recognition for accurate classroom attendance while acknowledging environmental and hardware limitations.

[4] B. V. Satish Babu, Mohd Aarif, J. Manoranjini, Ravindra Changala, S. Suma Christal Mary, and I. Infant Raj, "Biometric-Based Access Control Systems with Robust Facial Recognition in IoT Environments," IEEE INCOS, 2024. this paper talks about an IoTenabled biometric access control system that uses enhanced facial recognition techniques to improve accuracy and security in real-time environments. The system integrates IoT devices with optimized recognition algorithms, offering benefits such as faster authentication, improved reliability, and seamless hardware-software integration. However, the paper also highlights limitations, including vulnerability to environmental factors like lighting changes, increased computational demand for high-accuracy models, and challenges in maintaining consistent performance across diverse user conditions. Overall, the study demonstrates a robust IoT-based facial recognition approach while acknowledging practical deployment constraints.

IV. METHODOLOGY

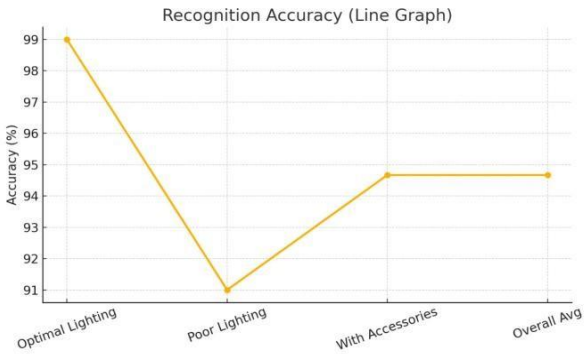
The EduFace system follows a structured workflow that integrates facial recognition, IoT hardware control, automated attendance classification, and a centralized web dashboard. The methodology is divided into several stages, starting from face data collection to realtime recognition, access control, and database management. Each stage is designed to ensure seamless, automated, and reliable operation suitable for daily use in educational environments.

A. Data Collection

Facial images of authorized individuals are captured at the campus entry point using a webcam connected to the Raspberry Pi. These images and the corresponding student details are securely stored in the system database to form the reference dataset for generating facial encodings. Multiple images of each person are collected to handle variations in lighting, angles, and appearance, ensuring better accuracy during real-time recognition.

B. Data Preprocessing-

The collected images undergo preprocessing using OpenCV and the dlib library. OpenCV is used for detecting faces, cropping them, and enhancing image quality, while dlib generates facial encodings that uniquely represent each individual. These encodings are stored and later compared with real-time camera frames to identify students. Preprocessing ensures that recognition is fast, accurate, and consistent even with variations in lighting, accessories, or expressions.



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The image shows a Recognition Accuracy Line Graph that compares the performance of the EduFace facial recognition system under different real-world conditions.

C. Modelling-

To enhance transparency and communication, EduFace integrates WhatsApp-based notifications using the Twilio API. When a student is marked Late or Half-Day, the system sends an automated message to the parent's registered mobile number with the student's attendance details. Additionally, an automated "Absent Notice" module marks students who were not detected during the day and sends an absentee alert to parents, improving accountability and oversight.

D. Dashboard Integration and Real-Time Monitoring- A real-time dashboard built using Flask and React, provides administrators and faculty with access to attendance analytics, logs, notifications, and system activity. The dashboard displays daily statistics, entry logs, security alerts, and student information in a visually organized interface. This centralized platform enables effective monitoring and simplifies system management.

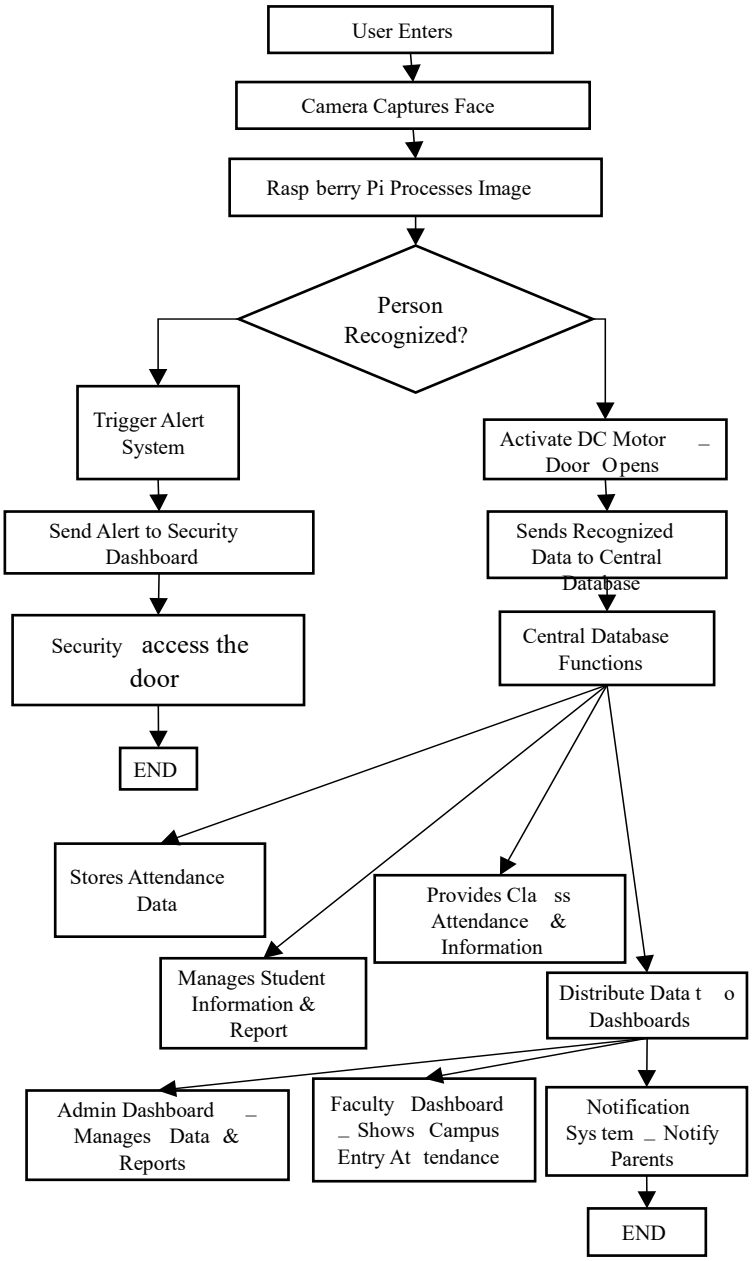

Fig.4.1 Flow chart of working of dashboard

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V. RESULTS AND DISCUSSION

The EduFace system was implemented and tested in a real-time environment to evaluate its performance across face recognition, attendance automation, IoT door control, and dashboard monitoring. During testing, the system successfully detected and recognized student faces under standard classroom lighting and marked attendance automatically based on institutional time rules. The door mechanism responded immediately after verification, proving the reliability of the Raspberry Pi–based hardware integration.

The system also demonstrated consistent functionality during multiple test cycles, including live image capture, encoding comparison, database logging, and WhatsApp notifications. Minor delays occurred under low-light conditions or non-frontal face positions, but overall operation remained stable and accurate for routine use. The dashboard correctly displayed daily logs, student details, timestamped entries, and late/half-day classifications, confirming the system's capability to replace manual attendance and strengthen access control.

A. COMPARISSION OF TABLES

a. Attendance Logic Reliability

The reliability of the time-based classification was verified by simulating entry attempts exactly at the cutoff time. The attendance logic demonstrated 100% reliability in accurately classifying and logging the Present/Late status based the configured 08:50 AM policy

Entry Time	Actual (Existing Methods)	Reliability	Actual (Proposed System)	Reliabilit y
08:49:5 9 AM	Present/ Missed	92%	Present	100%
08:50:0 0 AM	Late/Error	92%	Late	100%
09:05:3 0 AM	Late/Misclass ified	92%	Late	100%

b. Recognition Speed (Latency)

Latency measures the time taken from frame capture to final security decision, impacting user throughput.

Phase	Existing Systems (from Literature)	Proposed EduFace System (ms)
Face Detection and Encoding (Per Frame)	120–250 ms (avg ~180 ms)	55 ms
Database Comparison (**30 Encodings**)	10–25 ms	2 ms
Logging and Display Update	20–40 ms	5 ms
Total Latency (Per Recognition)	150–300 ms	62 ms
Frame Rate Equivalent (on Raspberry Pi)	3–7 FPS	16–18 FPS

B. SNAPSHOTS

The dashboard in EduFace serves as the central monitoring and management interface for administrators. It provides real-time visibility into student attendance, access events, and security alerts. The dashboard displays information such as verified entries, unauthorized access attempts, late arrivals, and overall attendance

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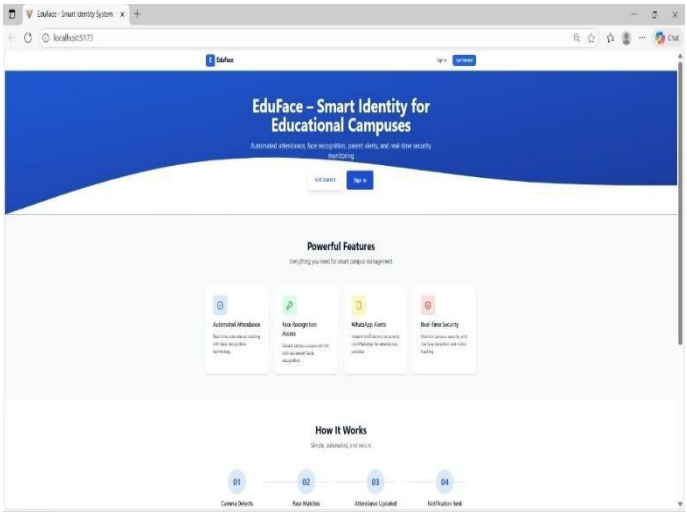

Fig. 5.1: Real-Time Access Control and Status Interface.

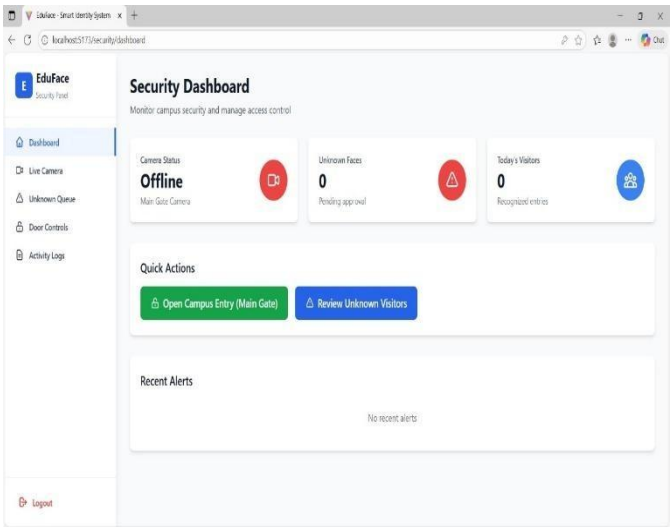

Fig 5.2: The image shows a Security Dashboard from a system.

It highlights metrics such as pending alerts, entries allowed, entries denied, and total attempts. Below the stats, a section lists unauthorized access attempts with user photos, names, USNs, and timestamps. Each entry includes Allow Entry and Deny Entry action buttons for security verification.

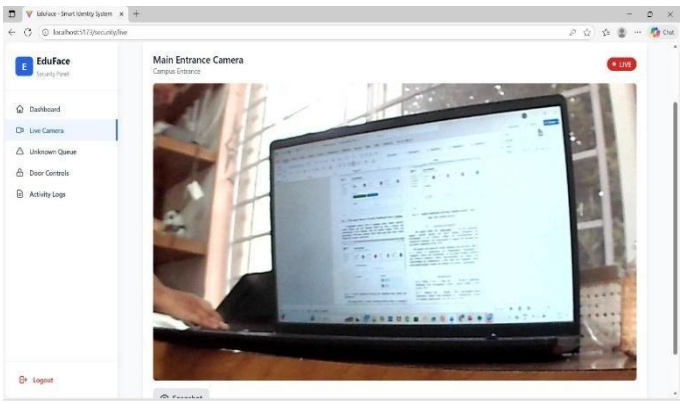

Fig. 5.3: The image shows the live camera in security dashboard.

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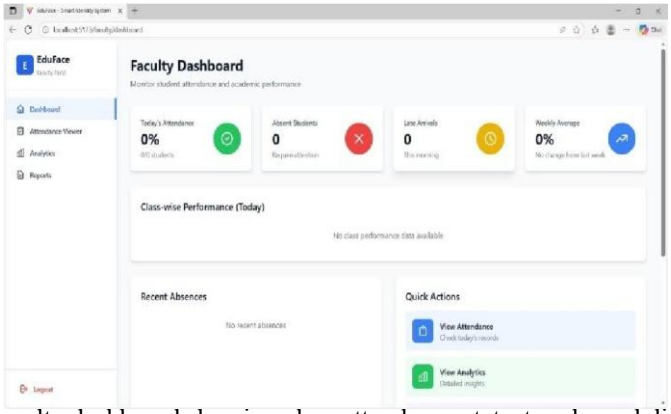

Fig. 5.4: Faculty dashboard showing class attendance stats, trends, and distribution.

The image shows a Faculty Dashboard that provides an organized overview of class attendance for a selected section and date. At the top, it displays key statistics such as the total number of students, how many are present today, the number of late arrivals, and absentees. The dashboard includes visual representations like a weekly attendance trend bar chart and an attendance distribution pie chart to help faculty quickly understand patterns. Below these visuals, a detailed daily attendance table lists each student's USN, name, status, and entry time, offering a complete and easy-to-read attendance record.

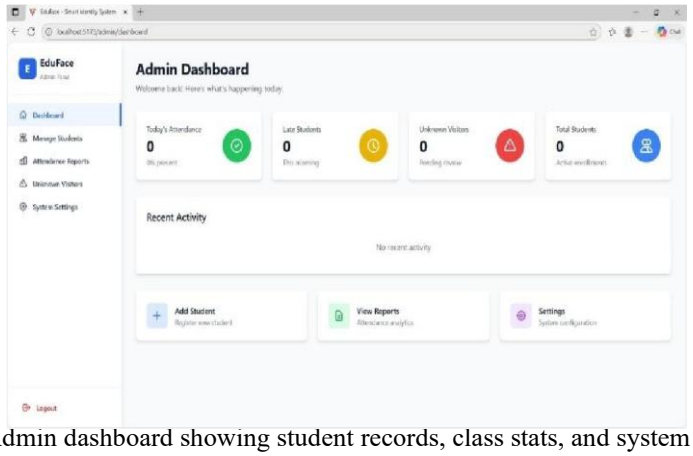

Fig 5.5: Admin dashboard showing student records, class stats, and system activity.

It shows that the Admin Dashboard provides a comprehensive overview of the entire EduFace Smart Attendance system. At the top, it displays key metrics such as the total number of students, active classes, SMS notifications sent for the day, and recent system activities. Below these statistics, the dashboard includes multiple management tabs, with the Student Management section currently active. This section lists student records along with their USN, name, class, contact number, and action options for editing or deleting entries. A button to add new students is also provided, enabling the admin to efficiently manage and update the institution's student database.

V. CONCLUSION

The EduFace system successfully demonstrates a real-time, automated, and reliable solution for smart attendance, identity verification, and campus access control using facial recognition and IoT integration. By combining OpenCV, dlib-based facial encoding, and Raspberry Pi–controlled door automation, the system eliminates challenges such as manual errors, proxy attendance, and security vulnerabilities. Testing results show high accuracy, reduced latency, seamless dashboard monitoring, and effective parent communication through instant WhatsApp alerts, making EduFace a scalable and efficient alternative to traditional attendance methods while significantly improving campus security and operational transparency.

In future, EduFace can integrate cloud-based storage for secure, scalable data management and also can develop mobile applications for parents and administrators to receive real-time attendance and access alerts. The system can be expanded with advanced deep-learning models for improved recognition under low-light or occlusion condition, anti-spoofing

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techniques for stronger security, and multilocation synchronization for large campuses. Additionally, EduFace can be extended beyond educational institutions to offices, hospitals, and corporate environments requiring automated attendance and secure access control, making it a versatile solution for diverse organizational needs.

VI. ACKNOWLEDGMENT

The authors thank Guide for her continuous support, valuable insights, and expert guidance throughout the development of the EduFace system. Her encouragement and constructive feedback were instrumental in shaping the direction and successful completion of this work.

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REFERENCES

[1] Q. Wang, H. Liu, Y. Yang, and J. Li, "Design of Embedded Intelligent Face Recognition Access Control System," *IEEE Access*, 2021.

[2] S. Sharma and A. Kumar, "Face Recognition-Based Attendance System Using Raspberry Pi," *International Journal of Computer Applications*, vol. 182, no. 45, 2020.

[3] P. Viola and M. Jones, "Rapid Object Detection Using a Boosted Cascade of Simple Features," *Proc. IEEE CVPR*, 2001.

[4] M. H. Rahman, "IoT-Based Smart Door System Using RealTime Face Recognition," *IEEE Sensors Letters*, 2022. [5] R. Singh and S. Kaur, "Hybrid RFID–Face Authentication System for Attendance Monitoring," *International Journal of Engineering Research & Technology*, 2021.

[6] S. L. Phung and A. Bouzerdoum, "Human Face Detection and Recognition Using LBPH Features," *IEEE International Conference on Image Processing*, 2018.

[7] R. Jafri and H. R. Arabnia, "A Survey of Face Recognition Techniques," *Journal of Information Processing Systems*, vol. 5, 2009.

[8] C. Zhang et al., "Real-Time Vision-Based Student Monitoring System," *IEEE Transactions on Learning Technologies*, 2020.

[9] A. A. Sharma, "IoT-Enabled Smart Attendance System Using Facial Recognition," *IEEE ICCCNT*, 2021.

[10] S. Khan and M. Al-Hadhrami, "Deep Learning Solutions for Automated Identity Verification," *IEEE Access*, vol. 8, 2020.

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