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AUTHCORE: SMART ATTENDANCE MANAGEMENT SYSTEM

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ABSTRACT-- The traditional attendance management process in educational institutions and organizations is often manual,

time-consuming, and prone to errors such as proxy attendance and incorrect data entry. To address these challenges, this paper presents *AuthCore*, a Smart Attendance Management System that leverages face recognition and QR code technologies to automate and secure attendance track

ing. The system is developed using Python Flask as the backend framework, with HTML, CSS, JavaScript and Bootstrap for the frontend interface, and SQLite for database management.

AuthCore includes modules such as staff registration, face enrollment, QR/face-based attendance marking, dashboard analytics, AI assistant integration, and report generation. The system ensures real-time attendance tracking, improves accuracy, and reduces administrative workload. Experimental results show that the system significantly enhances efficiency and reliability compared to traditional methods.

KEYWORDS-Smart Attendance System, Face Recognition, QR Code, Flask, AI Assistant, Automation.

I. INTRODUCTION

Attendance management plays a critical role in institutions and organizations for monitoring participation, productivity, and compliance. Traditional methods such as manual registers or basic digital systems are inefficient and vulnerable to manipulation.

With advancements in artificial intelligence and computer vision, automated attendance systems have become feasible and reliable. AuthCore is designed to utilize these technologies to provide a robust solution for attendance tracking.

The key objectives of AuthCore include:

- Eliminating manual attendance processes
- Preventing proxy attendance
- Providing real-time data access
- Enabling intelligent insights through AI
- Generating automated reports.

The system integrates multiple modules into a unified platform, making it scalable and adaptable to various institutional needs.

II. LITERATURE SURVEY

Attendance management systems have evolved from manual methods to automated digital solutions.

Traditional systems are time-consuming and prone to errors such as proxy attendance. To address these issues, biometric systems like fingerprint recognition were introduced, offering improved accuracy but requiring physical contact and dedicated hardware.

RFID-based systems provide a contactless approach, but they are vulnerable to misuse since cards can be shared. With advancements in artificial intelligence, face recognition systems have become popular due to their non-intrusive and secure nature. These systems use computer vision techniques to identify individuals, though their performance can be affected by environmental conditions.

QR code-based systems are another simple and cost-effective solution, allowing users to scan codes for attendance. However, they depend on user cooperation and may lack strong authentication. Modern systems often combine multiple technologies to improve reliability and efficiency, leading to the development of hybrid attendance solutions.

Ref.no	Author & year	Title	Method used	Key contribution
1	Parkhi et al.,2015	Deep Face Recognition	Face Recognition	Introduced deep learning for

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				accurate face detection
2	Schroff et al.,2015	FaceNet	Face Recognition	Developed embedding model for face matching
3	Cao et al., 2018	VGGFace2 Dataset	Face Recognition	Large dataset improving recognition accuracy
4	Deng et al., 2019	ArcFace	Face Recognition	Improved accuracy using angular margin loss
5	Prakash et al., 2017	QR Code Attendance System	QR Code	Digital attendance using QR scanning
6	Kumar et al., 2019	Smart Attendance using QR	QR Code	Efficient and low-cost attendance system
7	Sharma et al., 2019	Face Recognition Attendance	Face Recognition	Automated attendance using biometrics
8	Singh et al., 2020	Automated Face Attendance	Face Recognition	Improved reliability using AI models
9	Nguyen et al., 2018	IoT Attendance System	IoT + QR	Integrated IoT for real-time tracking
10	Patel et al., 2023	Hybrid Attendance System	QR + Face	Combined QR and face for better security

Face recognition-based systems using OpenCV and face_recognition have been widely adopted due to non-intrusive verification. However, combining QR codes with face recognition improves identification speed and prevents proxy attendance.

III. RELATED WORK

Several attendance systems have been developed using face recognition and QR code technologies. Face recognition-based systems use image processing techniques to automatically identify individuals and mark attendance, providing high accuracy but facing challenges such as lighting variations.

QR code-based systems are widely used due to their simplicity and low cost, but they are prone to misuse if codes are shared. Some hybrid systems combine multiple methods to enhance reliability and reduce errors.

Web-based attendance systems using frameworks like Flask provide centralized data management and user-friendly interfaces. However, many existing systems focus only on attendance recording and lack advanced analytical features.

The proposed system, AuthCore, integrates face recognition and QR code technologies with an AI assistant to provide accurate attendance tracking and intelligent insights, making it more efficient and reliable than existing systems.

IV. SYSTEM ARCHITECTURE

A. Overview

AuthCore follows a modular architecture consisting of frontend, backend, and database layers. The system is designed using Flask, enabling efficient routing and server-side processing.

B. Modules Description

1. Home Module

Acts as the central interface providing navigation to all features. It ensures user-friendly interaction with the

system.

2. Staff Registration

This module collects staff details such s:

- Name
- Staff ID
- Department
- Contact information

The data is validated and stored in the SQLite database.

3. Face Enrollment
This module captures multiple facial images using a webcam. These images are processed and stored for training the recognition model. Multiple samples improve accuracy under varying conditions.

4. QR/Face Attendance

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Attendance can be marked using:

- QR Code scanning
- Face recognition

The system verifies the identity and logs the attendance with a timestamp.

4. Dashboard

Displays real-time statistics such as:

- Total staff
- Present/Absent count
- Staff directory

5. View Attendance

Provides detailed records with filtering options (date, department, staff ID).

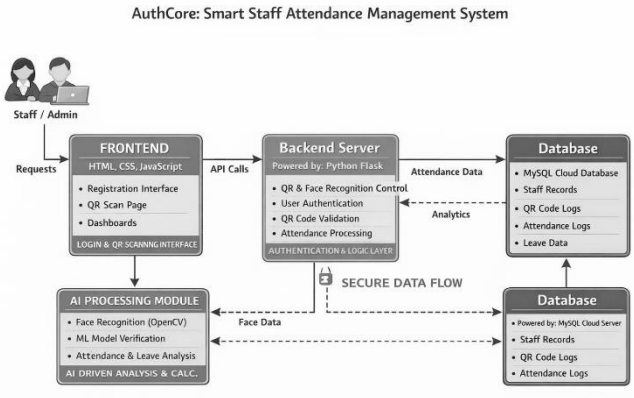
6. AI Assistant

Analyzes attendance data and provides insights such as:

- Frequent absentees
- Attendance patterns
- Suggestions for improvement

7. Reports Module

Generates downloadable reports in formats like PDF and Excel for administrative use.



V. METHODOLOGY

The proposed system follows a structured methodology to ensure secure, accurate, and automated attendance management. Initially, staff registration is performed by collecting essential details such as staff ID, name, department, and contact information. A unique QR code is generated for each staff member, which acts as a primary identification token. Simultaneously, face enrollment is carried out by capturing multiple facial images using OpenCV and encoding them with face_recognition for future verification.

A. Technologies Used

- **Backend:** Python (Flask)
- **Frontend:** HTML, CSS, JavaScript, Bootstrap
- **Database:** SQLite
- **Computer Vision:** OpenCV

B. Working Process

- User registers staff details
- Face images are captured and stored
- Attendance is marked via QR or face
- Data is stored in the database
- Dashboard and reports are updated

C. Face Recognition Algorithm

- Image capture using webcam
- Preprocessing (grayscale conversion, resizing)
- Feature extraction
- Matching with stored dataset

D. QR Code Workflow

- Unique QR generated per staff
- Scanner reads QR
- System verifies ID and marks attendance

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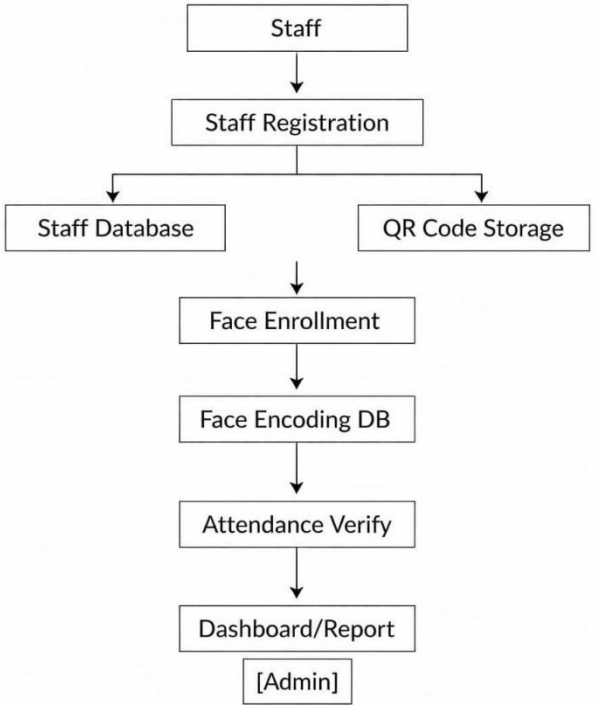


VI. IMPLEMENTATION

The AuthCore system is implemented using a combination of web technologies and computer vision techniques to ensure efficient performance. The backend is developed using the Flask framework, which handles routing, request processing, and integration of different modules. The system uses SQLite as a lightweight database to store staff details, attendance records, and leave information.

For image processing and real-time video capture, OpenCV is utilized, while facial recognition and encoding are performed using the face_recognition library. QR codes are generated and scanned using dedicated libraries, enabling quick identification of staff members. The frontend is built using HTML, CSS, and templates to provide an interactive user interface.

The system integrates all modules, including staff registration, face enrollment, QR scanning, and attendance marking, into a unified workflow. Real-time verification ensures that attendance is recorded only when both QR and face data match. Additionally, features like dashboards and report generation are implemented to enhance usability and monitoring.

A. Backend Implementation (`app.py`)

The Flask application handles:

- Routing between pages
- Database operations
- Face recognition processing
- QR code validation

B. Frontend Templates

Each module is implemented as a separate HTML template:

- `home.html` – Navigation interface
- `staff_register.html` – Staff registration form
- `face_enroll.html` – Camera capture UI
- `qr_attendance.html` - Scanning
- face_verify.html – Authentication
- `dashboard_staff.html` – Analytics display
- staff_dashboard.html – Structured information
- view_attendance.html – Attendance visualization
- leave_ai.html – Ai leave calculation
- `reports.html` – Report generation

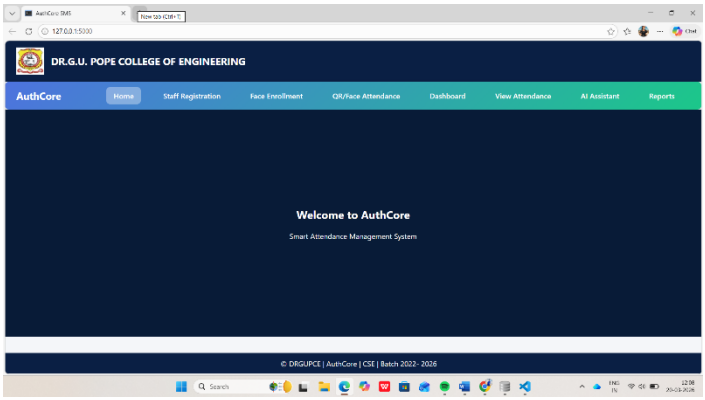
C. Database Design

Tables include:

- Staff Table
- Attendance Table

SCREENSHOTS:

- Home Page: Navigation buttons linking to all modules.



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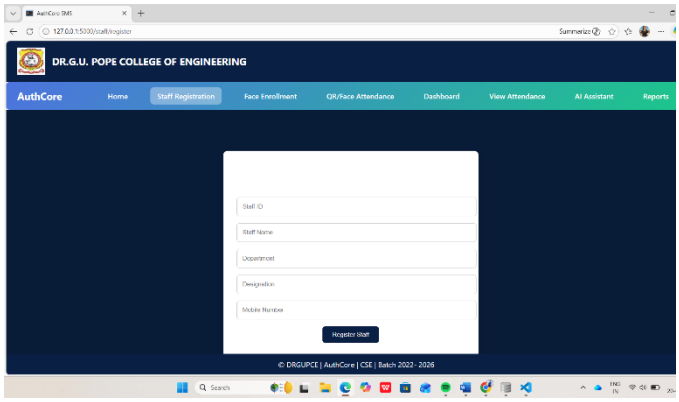
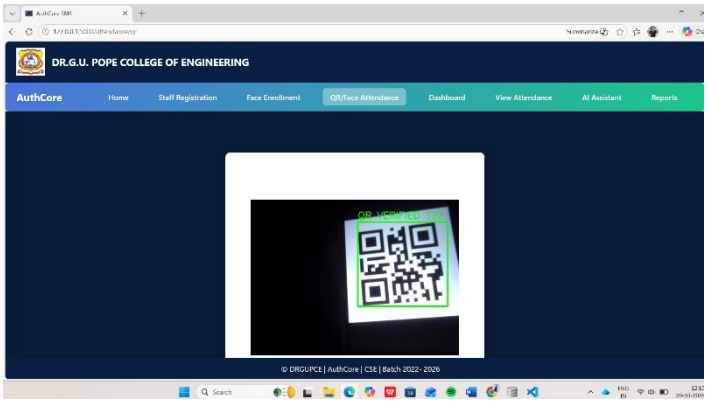
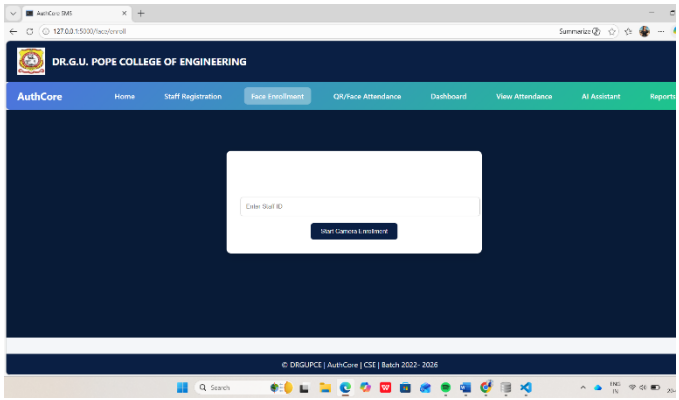
- Staff Registration Page: Input validation, data stored securely.

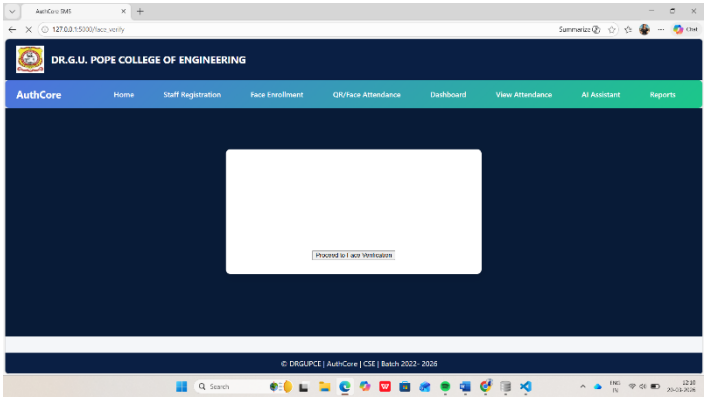




- Face Recognition Page: Encoding the face for the verification.

- Face Enrollment Page: Webcam capture, multiple frames per staff





- QR attendance Page: Scanning for verification.

- Staff dashboard Page: Real-time attendance updates and staff profiles.

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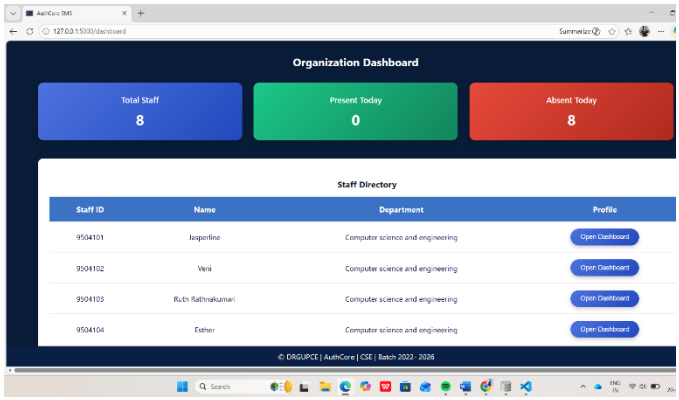
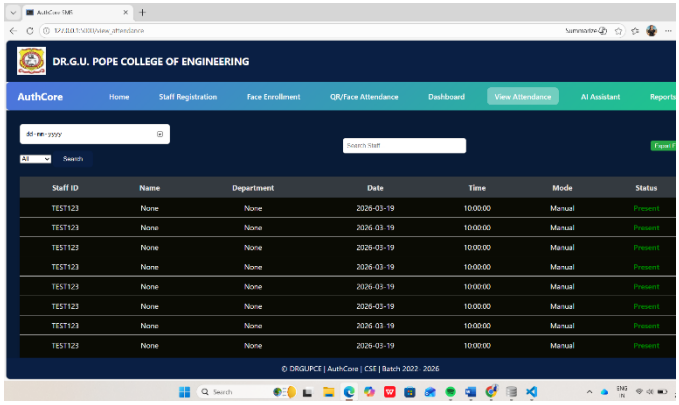
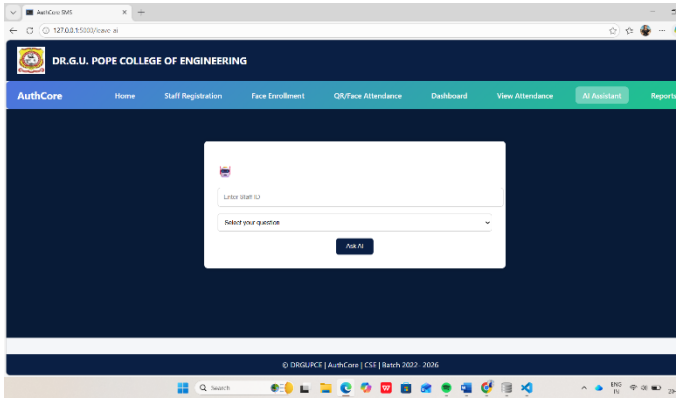


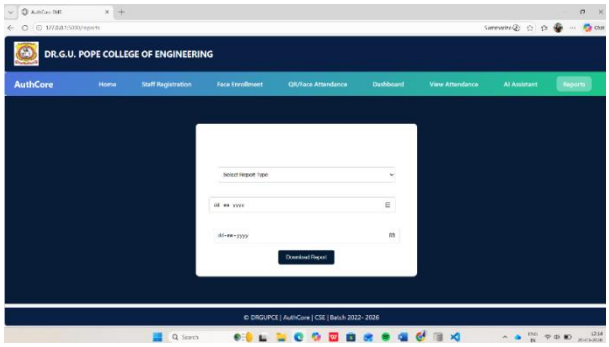
- View attendance Page: To View the attendance.



- AI leave calculation Page: Analyse from the database and response.



- Reports Page: Export as PDF/Excel.



VII. RESULTS AND ANALYSIS

The system was tested in a simulated institutionalenvironment.

1) Observations:

- Face recognition accuracy: ~90–95%
- QR scanning success rate: 100%
- QR is faster, Face is more secure
- Database structure simplifies processing
- User interaction is minimal
- Reduced attendance time significantly

2) Advantages:

- Fast and automated
- Dual Authentication Reliability
- Reduced Proxy Attendance
- Automated Data Management
- Low Implementation Cost
- High accuracy
- User-friendly interface

VIII. DISCUSSION

AuthCore successfully integrates multiple echnologiesinto a single system. The dual attendance mechanism ensures reliability even if one method fails.

However, certain limitations exist:

- Face recognition depends on lighting conditions
- Requires initial setup and training
- Hardware dependency (camera)
- Database Dependency

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Future enhancements may include:

- Cloud database integration
- Mobile application support
- Advanced AI analytics
- Payroll integration

X1. CONCLUSION

AuthCore: Smart Attendance Management System provides a simple and effective way to manage attendance using QR code scanning and facial recognition. By combining these two methods, the system improves accuracy and helps prevent proxy attendance while reducing manual work. The use of Flask and SQLite makes the system lightweight, easy to implement, and suitable for real-world use in institutions. The straightforward database design also helps in managing data efficiently. Overall, AuthCore offers a practical and modern solution for attendance tracking, with the possibility of future enhancements such as improved security, analytics, and cloud support.

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