

**ST JOSEPH ENGINEERING COLLEGE, VAMANJOOR,
MANGALURU**



SYNOPSIS

On

Smart face recognition attendance system

By

SHREYA

USN: 4SO24MC097

**Department of Computer Applications
St Joseph's Engineering College Mangaluru-575028
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ABSTRACT

Description of the proposed system

The Smart Face Recognition Attendance System is an innovative Android application that leverages artificial intelligence, facial recognition technology, and GPS-based location tracking to automate attendance marking. By capturing live images of students through the mobile camera, verifying their identities, and logging attendance in real-time within designated geofenced areas and timeframes, this system aims to enhance transparency, eliminate manual processes, and improve attendance management efficiency. Notifications are automatically sent to absent students once the attendance window closes, ensuring accountability and timely communication.

Problems in existing work

Traditional attendance methods like manual registers, ID swipes, or fingerprint scanners are known to be time-consuming, error-prone, and vulnerable to proxy attendance. Even existing face-recognition systems often lack critical features such as geolocation verification, time-bound validation, and liveness detection, leading to potential misuse and inaccurate attendance tracking. Challenges persist in enforcing location and time restrictions, as well as in providing automated notifications for absenteeism in current systems, highlighting the need for a more robust and comprehensive solution.

Solution provided by the proposed system

The proposed Smart Face Recognition Attendance System addresses these shortcomings by integrating facial recognition, geofencing, time-window-based attendance verification, and live-photo verification on the Android platform. By utilizing GPS to authenticate student locations within specified boundaries, ensuring the use of real-time images for fraud prevention, and recording attendance only during scheduled times, this system offers a reliable and secure solution. With automatic notifications for absent students and secure cloud-based attendance data storage for real-time monitoring and analytics, this system represents a smart and efficient approach to digital attendance tracking.

Introduction / Background

Attendance management is a critical administrative task in educational institutions and organizations. Traditional methods are inefficient and prone to manipulation, while modern face-recognition systems often lack mobility, geolocation awareness, and real-time verification. The proposed *Smart Face Recognition Attendance System* overcomes these challenges by integrating AI-based facial recognition, GPS-based geofencing, and time-based access control on a mobile platform.

Recent research supports this technological direction:

- Bramesh S. M. et al. (IMRJR, 2025) developed a *Smart Attendance System with Facial Recognition and GPS Verification*, proving that integrating GPS improves attendance authenticity.
- H. S. Reddy et al. (ResearchGate, 2024) proposed a *Geofenced Intelligent Attendance System Featuring Facial Recognition*, introducing real-time GPS boundaries and accuracy improvements.
- Rahman et al. (ResearchGate, 2023) presented a *Mobile-Based Student Attendance System Using Geo-Fencing with Timing and Face Recognition*, emphasizing time-controlled attendance and liveness validation.

These studies establish that combining face recognition with GPS and time-based logic increases reliability and efficiency. The proposed system builds upon these findings and adds new functionalities such as automatic login, live-photo validation, and push notifications.

Problem Statement

Existing attendance systems rely on manual input or semi-automated technologies that lack reliability and timeliness. Manual registers are susceptible to errors and proxy attendance, while biometric and card-based systems necessitate physical contact and lack location authentication. Current face recognition systems permit the use of static images and attendance from unauthorized areas, failing to ensure live verification, location-based validation, time constraints, and immediate notifications. The absence of a cohesive system that combines live authentication, geolocation validation, time limitations, and instant alerts contributes to inefficiencies and inaccuracies in attendance monitoring.

Objectives

1. Develop an Android application utilizing automatic facial recognition and login functionality for attendance tracking.
2. Ensure geofencing through GPS-based location validation to restrict attendance marking within specific authorized boundaries.
3. Implement time-window attendance control, permitting attendance only during designated session durations.
4. Incorporate live-photo detection for liveness verification to prevent the use of static or spoofed photo uploads.
5. Enable automatic notifications for absent students once the attendance window concludes.
6. Establish secure storage and analysis of attendance data on a cloud backend, granting access to faculty and administrators for monitoring and analytics purposes.

Scope of the Project

Included:

Development of an Android-based smart attendance application for student use.

- Integration of live photo capture and AI-driven facial recognition technology.
- Implementation of GPS verification and geofencing features for enhanced security.
- Enforcement of time-window restrictions for attendance marking.
- Inclusion of notification alerts and auto-login functionalities.
- Utilization of cloud-based data storage and creation of real-time dashboards for faculty access.

Excluded:

- Integration with institutional ERP or LMS systems, reserved for future expansion.
- Attendance marking for offline or remote users located outside the campus premises.
- Deployment at multiple campuses or organizations, with the prototype focusing on a single campus setup.

Methodology / Approach

Requirement Analysis & Design:

- Analyse existing systems, identify challenges, and define software requirements.
- Design application architecture and database model.

System Development:

- Develop Android app using Java/Kotlin.
- Integrate OpenCV, TensorFlow Lite, MobileFaceNet for facial recognition.
- Implement GPS-based geofencing using Android Location APIs.
- Implement time-based validation logic for attendance sessions.
- Incorporate liveness detection (blink/motion-based) for live-photo verification.
- Configure Firebase for authentication, cloud storage, and real-time data updates.

Testing and Validation:

- Conduct unit testing for recognition, GPS, and notification modules.
- Field testing in a real classroom environment.
- Measure accuracy, latency, and user experience.

Deployment & Evaluation:

- Deploy prototype in an educational institution.
- Evaluate system effectiveness and collect user feedback.

Tools and Technologies

Programming Language:

- Python 3.11+ – easy to develop, lots of libraries for face recognition

Frameworks / Libraries:

- OpenCV 4.7+ – webcam access and image processing
- face_recognition 1.3+ – accurate face detection & recognition
- Tkinter (built-in) – simple GUI for desktop app
- NumPy 1.25+ – numerical operations for image processing
- Pandas 2.1+ – storing/exporting attendance data (Excel/CSV)

Database:

- SQLite 3+ – lightweight local database for attendance records

Development Environment / IDE:

- VS Code (latest) – lightweight and flexible IDE

Hardware / Software:

- PC or Laptop – Windows, Linux, or macOS
- Webcam (built-in or USB) – capture faces
- Python runtime environment – execute the application

Expected Outcomes

- Implementation of an accurate and real-time face recognition attendance system on Android.
- Attendance validation constrained by location (geofence) and specified time frame.
- Automated login process and live-photo detection to deter proxy attendance.
- Push notifications to inform and remind students about attendance status.
- Secure cloud-based data storage with real-time analytics for faculty access.
- Enhanced accuracy, transparency, and reduced administrative workload.

Work Plan / Timeline

Phase	Activities	Duration
Phase 1	Literature survey, requirement gathering, and architecture design	1 week
Phase 2	UI/UX design (Tkinter GUI) and local database (SQLite) setup	1 week
Phase 3	Face recognition implementation with OpenCV and face recognition library	3 weeks
Phase 4	Attendance logging, report generation (Excel/CSV), basic notifications	2 weeks
Phase 5	Testing, debugging, optimization	1 week
Phase 6	Documentation and final deployment	1 week

References / Bibliography

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3. A. Rahman, K. Senthil, P. Rajesh, “*Mobile-Based Student Attendance System Using Geo-Fencing with Timing and Face Recognition,*” **ResearchGate**, 2023. Available at: https://www.researchgate.net/publication/361553012_Mobile_Based_Student_Attendance_System_Using_Geo-Fencing_With_Timing_and_Face_Recognition

APPENDIXB

COMPONENT DIAGRAM

