Chapter 2
Literature Review

1. Introduction

Attendance management is a key task in every school. Traditional methods like manual entry and roll call often cause errors, delays, and even proxy attendance. With the rise of artificial intelligence and mobile technologies, automated systems are now making this process faster, more accurate, and contactless.

The Smart Face Recognition Attendance System aims to address the issues of traditional methods by using AI-based face recognition, GPS-based geofencing, and cloud data storage. This system ensures that only the correct student marks attendance from the right location and at the right time.

The main goal of this literature review is to explore various existing attendance systems, the technologies they use, and the gaps that still exist. This will help clarify how the proposed project improves accuracy, security, and usability.

2. Thematic Review of Literature

2.1 Existing Systems or Approaches

Earlier systems used manual registers, RFID cards, or fingerprint scanners for attendance. These methods were often slow and could be misused easily.
Recent studies by Rahman et al. (2023) and Reddy et al. (2024) introduced face recognition for attendance. However, many of these systems do not check the student's location or real-time presence, allowing for fake attendance.
Integrating face recognition with GPS and time checks has become an effective modern solution.

2.2 Algorithms, Models, and Technologies Used

Most recent systems use AI and deep learning algorithms like Convolutional Neural Networks for face detection and recognition. Libraries like OpenCV and frameworks such as TensorFlow Lite or MobileFaceNet help with faster processing on mobile devices. The proposed system uses:

- OpenCV for image capturing and face detection
- TensorFlow Lite for efficient AI processing
- Firebase for real-time database and authentication
- Android Location API for geofencing and GPS tracking

This combination helps achieve quick, accurate, and secure attendance marking.

2.3 Tools, Frameworks, and Platforms

Most research and student projects in this field use tools like:

- Android Studio / VS Code for development
- Python for backend logic
- Firebase for cloud storage and push notifications
- SQLite for local data storage

These platforms make it easier to design Android applications with cloud connectivity and real-time updates for both students and teachers.

2.4 Strengths and Limitations in Existing Literature

Strengths of previous systems:

- Automated and faster attendance recording.
- Reduced manual effort.
- Improved accuracy using facial recognition.

Limitations identified:

- Lack of liveness detection, which allows for photo or video spoofing.
- No GPS-based verification.
- Limited scalability, as it works only for small groups.
- Dependence on a strong internet connection.

The proposed system addresses these issues by adding geofencing, liveness detection, and cloud synchronization. This makes it more reliable and suitable for real classroom use.

3. Comparative Analysis Table

Author(s)	Year	Study Focus	Technology Used	Key Findings	Limitations / Gaps
Rahman et al.	2023	Mobile-based attendance using face recognition and GPS	Face Recognition, Geo-fencing	Improved accuracy and location validation	No real-time cloud storage
Reddy et al.	2024	Geofenced attendance with AI recognition	AI, GPS	Reduced proxy attendance	No liveness detection
Bramesh et al.	2025	Smart attendance using facial recognition and GPS verification	AI, Firebase	Integrated cloud and geofencing	Limited to one campus
Sharma & Patel	2022	Automated attendance using OpenCV	OpenCV, Python	Simple and contactless	Lacked GPS check
Ahmed & Khan	2018	Biometric attendance using fingerprint sensors	Fingerprint Sensor	Accurate and easy to use	Required physical contact

4. Research, Implementation Gap

The literature shows that while many systems use facial recognition or biometric methods, very few combine them with location verification and liveness detection. Additionally, most systems are not

set up for real-time syncing with cloud databases. There is a need for a smart, contactless, GPS-based attendance system that is accurate, secure, and scalable. The proposed system closes this gap by using AI, GPS geofencing, and Firebase integration.

5. Summary, Conclusion of Literature Review

The studies reviewed demonstrate a clear shift from manual attendance methods to smart, AI-driven systems. However, current systems still struggle with issues related to security, scalability, and live validation. The Smart Face Recognition Attendance System stands out because it merges facial recognition, geofencing, and cloud connectivity into one Android app. This approach makes the attendance process quicker, safer, and more reliable, providing a complete solution for today's educational settings.

6. References

1. Ahmed, S., & Khan, R. (2018). *Biometric Attendance Using Fingerprint Sensors*. International Journal of Computer Applications.
2. Sharma, D., & Patel, R. (2022). *Automated Attendance Using Face Recognition*. International Journal of Smart Computing.
3. Rahman, A., Senthil, K., & Rajesh, P. (2023). *Mobile-Based Student Attendance System Using Geo-Fencing with Face Recognition*. ResearchGate.
4. Reddy, H. S., Gupta, M. K., & Nayak, A. S. (2024). *Geofenced Intelligent Attendance System Featuring Facial Recognition*. ResearchGate.
5. Bramesh, S. M., Arun, P., & Deekshith, H. R. (2025). *Smart Attendance System with Facial Recognition and GPS Verification. IMRJR Journal*.