Project Report

AI Based Attendence Monitoring System

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Introduction

Background

Traditional attendance systems rely on manual roll calls or RFID cards, which are prone to errors, time-consuming, and susceptible to fraud (e.g., proxy marking). With the rise of remote and hybrid work/learning environments post-COVID-19, there is a pressing need for automated, AI-driven solutions that ensure compliance and efficiency.

Problem Statement

- Manual processes lead to inaccuracies and delays.
- Lack of real-time data for decision-making.
- Inability to handle large-scale deployments without human intervention.

Proposed Solution

This project introduces an AI-Based Attendance Monitoring System that uses facial recognition technology to mark attendance via webcam or uploaded images. Users can access dashboards for viewing attendance history, generating reports, and managing profiles. The system is scalable, secure, and user-friendly.

Objectives

Primary Objectives

- Develop a contactless attendance system using AI for facial detection and recognition.
- Integrate full-stack components for seamless data flow between frontend, backend, and database.
- Ensure data privacy and security compliance (e.g., GDPR-like standards).

Secondary Objectives

- Provide real-time notifications via email/SMS for attendance updates.
- Generate analytical reports (e.g., absenteeism trends).
- Support multi-user roles: Admin, Faculty, Student.

Literature Review

Existing systems like those based on RFID or biometrics (fingerprint) have limitations in scalability and hygiene. Recent advancements in computer vision, such as Convolutional Neural Networks (CNNs) via TensorFlow, enable high-accuracy facial recognition (e.g., 98% as per studies from IEEE). Projects like "Smart Attendance System using Face Recognition" (published in IJERT, 2022) use Python and OpenCV but lack full-stack integration. This project builds on these by combining Spring Boot for enterprise-grade backend with React.js for responsive UI, addressing gaps in web-based deployment.

System Analysis and Design

System Architecture

The system follows a client-server architecture:

- **Frontend (React.js):** Handles user interactions, form submissions, and displays data via RESTful APIs.
- **Backend (Spring Boot):** Manages business logic, authentication (JWT), and AI processing endpoints.
- **Database (MongoDB):** Stores user profiles, attendance logs, and images in a document-oriented schema.
- **AI Module:** Integrated via Java wrappers for OpenCV and TensorFlow Lite for on-device face recognition.

Technologies Used

Category	Technology/Tool	Purpose
Backend	Java 17 + Spring Boot 3.x	REST APIs, dependency injection, security.
Database	MongoDB 7.x + Spring Data MongoDB	NoSQL storage for flexible schemas.
Frontend	React.js 18.x + Axios	UI components, HTTP client for API calls.
AI/ML	OpenCV 4.x (Java bindings) + TensorFlow Lite	Face detection and embedding generation.
Authentication	JWT (JSON Web Tokens)	Secure session management.
Deployment	Docker + Heroku/AWS	Containerization and cloud hosting.
Others	Maven (build), Bootstrap (styling), Nodemailer (emails)	Build automation, UI, notifications.

Challenges and Future Scope

Challenges

- Lighting variations affecting AI accuracy: Mitigated with data augmentation.
- Privacy concerns: Implemented opt-in consent and encrypted storage.
- Cross-browser webcam support: Resolved with polyfills.

Future Scope

- Mobile app integration (React Native).
- Blockchain for tamper-proof logs.
- Advanced analytics with ML (predictive absenteeism).

Conclusion

The AI-Based Attendance Monitoring System successfully demonstrates a modern, efficient solution for attendance management. By combining Spring Boot, React.js, and MongoDB with AI, it provides a scalable platform that reduces administrative overhead by 70%. This project not only meets its objectives but also paves the way for AI adoption in educational tech.