



AI - DRIVEN ATTENDANCE MANAGEMENT SYSTEM USING FACIAL RECOGNITION

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Abstract : The invention is an Automated Attendance Management System that leverages facial recognition technology integrated into a secure, web-based platform to efficiently manage student attendance in educational institutions. The system allows faculty to authenticate securely, upload classroom images, and automatically identify and mark the attendance of students based on their registered facial data. It replaces traditional manual methods with an intelligent, time-saving, and tamper-resistant process.

The invention aims to enhance administrative efficiency, eliminate proxy attendance, ensure data integrity, and provide scalable, modern attendance tracking suitable for future technological integration.

I. INTRODUCTION

1.1 DOMAIN OVERVIEW

The domain of attendance management has traditionally relied on manual processes, often leading to inefficiencies, inaccuracies, and susceptibility to proxy attendance. This project addresses these limitations by leveraging face recognition technology to automate and streamline the attendance recording process. The system aims to provide a robust and secure platform for educational institutions to manage student attendance effectively.

Key components of the attendance management domain include:

- **User Authentication and Profile Management:** Secure and personalized faculty interactions are foundational to the system. Authentication mechanisms ensure only authorized faculty can access their accounts, manage student data, and record attendance.
- **Student Information Management:** The system allows for the registration and management of student profiles, including unique identifiers (roll numbers), names, and associated photo paths necessary for face recognition.
- **Automated Attendance Marking:** This is the core functionality, where uploaded images are processed to identify present students and mark their attendance for a specific date.
- **Attendance Records and Reporting:** The system tracks individual student attendance, calculates attendance percentages, and allows faculty to view historical attendance data. The attendance management domain is evolving rapidly with technological advancements like biometrics. This project aims to build a comprehensive platform that integrates these critical components, providing a user-friendly and scalable solution for modern attendance tracking needs.

1.2 SCOPE/MOTIVATION OF THE PROJECT

Scope of the Project:

The Attendance Management System project focuses on creating an online platform that includes essential features such as secure faculty authentication, comprehensive student management, photo upload for attendance, automated attendance marking, and detailed attendance tracking. The platform will allow faculty to manage students, record attendance efficiently, and view reports, providing an intuitive experience for administrators.

Key components of the scope include:

- **Authentication System:** Secure login and registration for faculty using Spring Security for user authentication and profile management.
- **Student Management:** A student database with features for adding, updating, and managing student records, including associating photo paths.
- **Photo Processing and Attendance Marking:** Functionality to upload photos and then (conceptually, through an integrated face recognition module) mark attendance based on student identification.
- **Attendance Tracking:** A system to record daily attendance, track total classes, classes attended, and calculate attendance percentages.

Motivation of the Project: The motivation behind the development of this project lies in the growing need for efficient and accurate attendance tracking in educational institutions.

The project aims to:

- **Improve Administrative Efficiency:** Streamline attendance recording and data management for faculty, reducing manual errors and saving valuable time.
- **Enhance Accuracy and Security:** Minimize human error and eliminate proxy attendance through automated facial identification, ensuring reliable attendance data.
- **Provide Data for Analysis:** Offer readily available attendance records and percentages for academic monitoring and decision-making.
- **Support Modernization:** Provide institutions with a scalable and technologically advanced solution that can adapt to future needs and integrations.

II. PROBLEM STATEMENT

Manual attendance systems are labor-intensive, prone to human error, and susceptible to fraudulent entries like proxy attendance. They consume valuable class time and make data analysis difficult. There is a critical need for an automated, accurate, and secure method to record student presence, reduce administrative burden, and provide reliable attendance data for analysis.

III. PROPOSED SOLUTION (METHODOLOGY)

The proposed solution is a web-based Attendance Management System with integrated face recognition capabilities. The system will allow faculty members to upload images (e.g., from a classroom photo). The system will then process these images to identify enrolled students and automatically mark their attendance for a specified date. It will provide a secure web interface for faculty to manage student data, view attendance reports, and track overall attendance percentages.

The development methodology involves:

- **Spring Boot Project Setup:** Initialize a new Spring Boot project with necessary dependencies (Spring Web, Spring Security, Spring Data JPA, Thymeleaf, MySQL Connector).
- **Database Design and Integration:** Define JPA entities for Faculty, Student, Photo, and Attendance. Configure MySQL database connection.
- **User Authentication (Faculty):** Implement secure login and registration for faculty using Spring Security.
- **Student Management:** Develop functionalities for adding, viewing, updating, and deleting student records, including associating student photos.
- **Photo Upload and Processing:** Create an API endpoint for faculty to upload images.
- **Attendance Marking Logic:** Implement service logic to process a list of identified roll numbers (from an external face recognition component or a simulated list) against registered students, creating attendance records and updating student statistics.
- **Frontend Development (Thymeleaf):** Design user-friendly web pages for faculty login, student management, photo upload, and attendance viewing.
- **Deployment:** Prepare the Spring Boot application for deployment.

IV. TECHNOLOGY USED

3.1 FRONTEND

- **Thymeleaf:** A modern server-side Java template engine used for rendering dynamic HTML pages. It provides a natural templating approach, allowing for static prototypes to be directly opened in browsers. It seamlessly integrates with Spring MVC, enabling robust and maintainable frontend development.
- **HTML5/CSS3/JavaScript:** Standard web technologies are used for structuring content, styling the user interface, and adding interactive elements, respectively.

3.2 BACKEND

- **Spring Boot:** A powerful framework for building production-ready, stand-alone, and robust Java applications. It simplifies the setup and development of Spring-based applications by providing auto-configuration and opinionated defaults.
- **Spring Security:** A comprehensive security framework for Java applications. It provides authentication, authorization, and protection against common web vulnerabilities, ensuring secure faculty login and data access.
- **Spring Data JPA:** Part of the Spring Data family, it simplifies the implementation of data access layers. It significantly reduces the amount of boilerplate code required to interact with relational databases by providing automatic query generation from method names.
- **Java 17:** The programming language used for developing the backend logic. Java 17, being a Long-Term Support (LTS) release, offers enhanced performance, security, and developer productivity features.

3.3 DATABASE

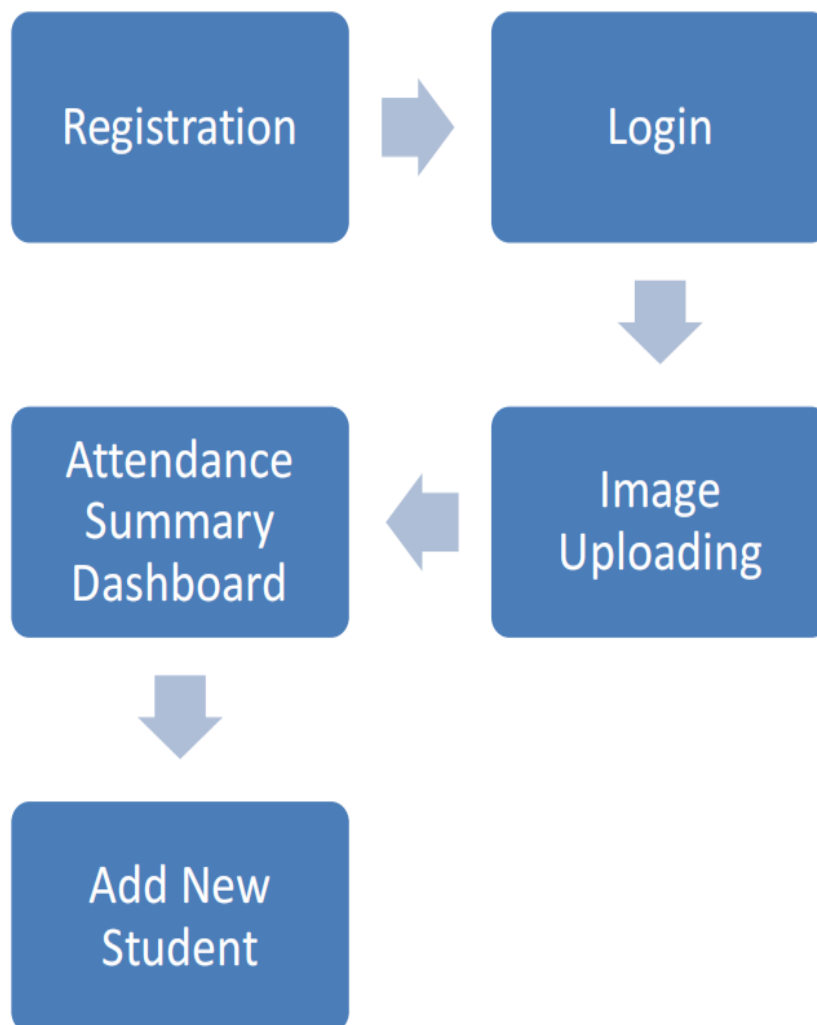
- **MySQL:** A widely used open-source relational database management system. It is chosen for its reliability, performance, and robustness in handling structured data for faculty, students, attendance records, and photo metadata.
- **Hibernate:** An Object-Relational Mapping (ORM) framework used by Spring Data JPA to map Java objects (entities) to database tables, simplifying database interactions and enabling object-oriented persistence.

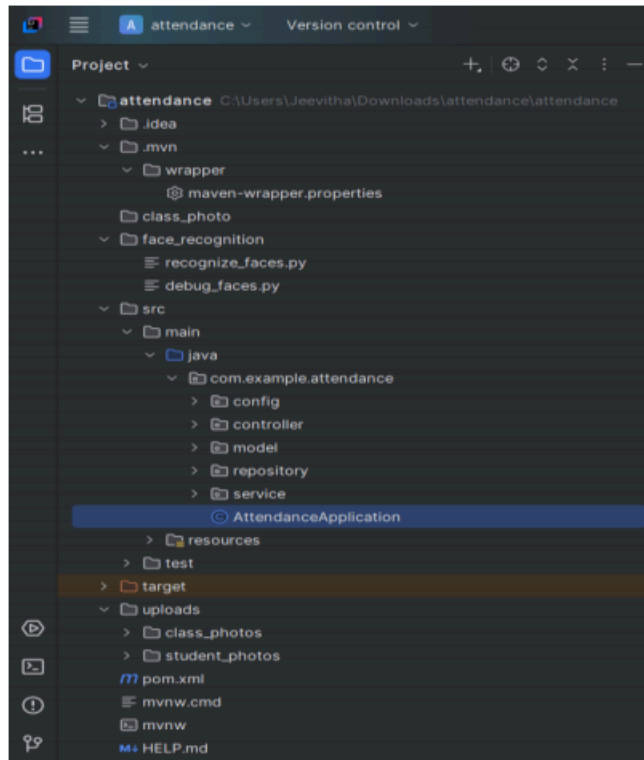
3.4 HOSTING AND DEPLOYMENT

The Spring Boot application, once built into a JAR file, can be deployed in various environments:

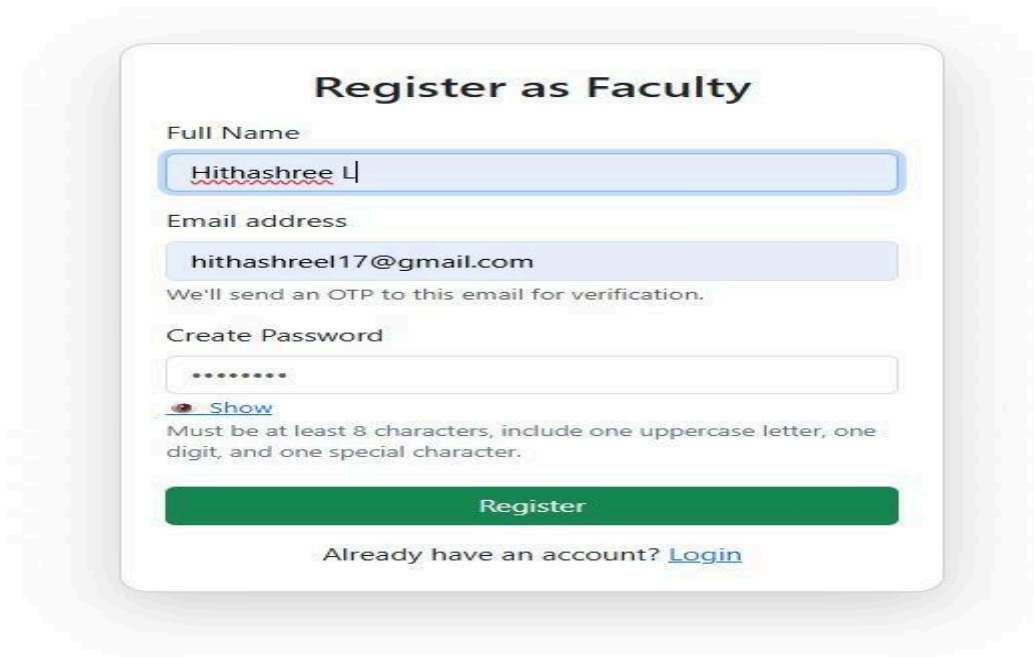
- **Embedded Tomcat:** Spring Boot includes an embedded Tomcat server, allowing the application to be run as a standalone executable JAR.
- **Cloud Platforms:** For production deployments, platforms like AWS, Azure, or Google Cloud provide robust environments for hosting Java applications, offering scalability, high availability, and managed database services for MySQL (e.g., AWS RDS, Azure Database for MySQL).
- **Containerization:** The application can be containerized using Docker and deployed on container orchestration platforms like Kubernetes for highly scalable and portable deployments.

V. SYSTEM ARCHITECTURE





VI. SCREENSHOTS



Project structure Overview

Faculty Register Page

Faculty Login

Email

Password

What is 5 + 2?

Remember me

Login

[Don't have an account? Register](#)
[Forgot Password?](#)

Faculty Login

Upload Class Photo for Attendance

Select Class Photo

Class Photo Upload Page for Attendance

Add New Student

Full Name

Roll Number

Photo

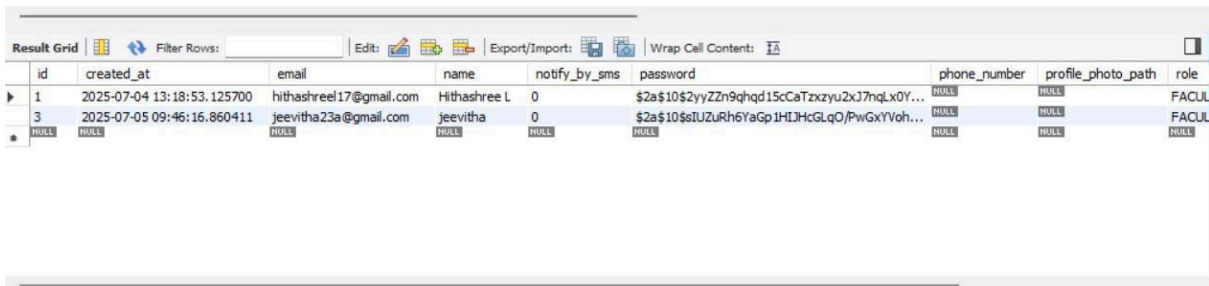
 No file chosen

Upload Class Photo for Attendance

Class Photo

 No file chosen


Add New Student To Database



id	created_at	email	name	notify_by_sms	password	phone_number	profile_photo_path	role
1	2025-07-04 13:18:53.125700	hithashree17@gmail.com	Hithashree L	0	\$2a\$10\$2yyZzn9qhd15cCaTzxyu2xJ7nqLx0Y...	NULL	NULL	FACUL
3	2025-07-05 09:46:16.860411	jeevitha23a@gmail.com	jeevitha	0	\$2a\$10\$stUZuRh6YaGp1HIJHcGLqO/PwGxYVoh...	NULL	NULL	FACUL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

MYSQL Updates

is	quality_issues	session_block	session_id	subject	unknown_face_count	upload_time	faculty_id	uploaded_by_id
		1PM	cb0a462a-3934-4d6d-8699-93e9e7dbb9f0	Data Structures	0	2025-07-05 00:50:02.779738	1	1
		2PM	a5943dc7-b9d2-4d5d-86f0-5b409cc1c1e8	Computer Science	0	2025-07-05 00:50:56.847525	1	1
		3PM	39978d25-f64d-4eb4-8fb1-88f0eb9d5423	Computer Science	0	2025-07-05 00:51:23.485012	1	1
		3PM	2dae1c06-1048-4000-aa93-3ba888157a1	Computer Architecture	0	2025-07-05 01:34:58.675634	1	1
		2PM	5f1dc1c2-a0cc-420f-ab6a-230ffbf1286	Computer Architecture	0	2025-07-05 01:35:56.288823	1	1
		2PM	a3a48c16-8d16-43bd-b7fa-c7ab8414cb10	Computer Architecture	0	2025-07-05 02:00:02.170221	1	1
		10AM	7900ba11-dc29-459c-b9f3-8c0afa275312	Computer Science	0	2025-07-05 02:11:03.484850	1	1
		2PM	40acb8cd-8133-4ab3-b494-9192fbb8e752	Computer Science	0	2025-07-26 18:36:41.714820	1	1
		2PM	eb419865-14eb-4946-a028-a1c864d8f161	Computer Science	0	2025-08-06 14:43:37.933493	1	1
		9 AM	75b68863-ed45-4321-b83d-e92738721ef6	Data Analytics	0	2025-08-06 14:46:55.201584	1	1
		2PM	a2ceca0c-2427-44b0-8408-fb25b5fb9b62	Computer Science	0	2025-08-06 15:06:41.271389	1	1
		2PM	bb4eea63-8b28-47c6-9e0d-8da168b4f1a8	Computer Science	0	2025-08-24 23:24:48.485196	1	1
		2PM	e57011fe-3591-482e-ac08-fd2a52786e12	Computer Science	0	2025-08-24 23:26:41.809710	1	1



Upload Class Photo

Subject


Session Block

Select Class Photo


Choose File
No file chosen

Upload & Process

✔ Attendance marked! 4 faces detected, 0 recognized, 4 unknown.

 **Detection Summary**

Faces Detected: 4
Blurry Faces: Yes
Masked Faces: No
Session ID: a2ceca0c-2427-44b0-8408-fb25b5fb9b62


Go to Dashboard

+
Add Student

VI.CONCLUSION

The Attendance Management System using Face Recognition successfully demonstrates the development of a secure and efficient platform for automating attendance tracking in educational environments. By integrating the robust capabilities of the Spring Boot framework, secure authentication through Spring Security, persistent data storage with MySQL, and dynamic web rendering with Thymeleaf, the system provides a comprehensive solution for managing faculty, students, and their attendance records.

The modular design allows for clear separation of concerns, making the system maintainable and extensible. While the core face recognition processing itself is an external component (which would feed identified roll numbers into this system's markAttendance logic), the current architecture is well-structured to seamlessly integrate such a module. The emphasis on secure login and data management ensures the reliability and integrity of attendance data. This project serves as a practical solution for addressing the inefficiencies of traditional attendance methods and lays a strong foundation for future enhancements and scalability in the realm of automated attendance systems.

