

Attendance Management System Using Face Recognition Model

By

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FINAL YEAR DESIGN PROJECT REPORT

This Report Presented in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science in Computer Science and
Engineering

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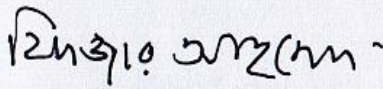


DAFFODIL INTERNATIONAL UNIVERSITY
Dhaka, Bangladesh
May 14, 2025

APPROVAL

This Project titled “Attendance Management System Using Face Recognition Model”, submitted by **Mehedi Hassan**, ID No: **201-15-3410** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **14 May, 2025**.

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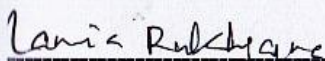
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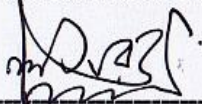
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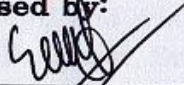
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DECLARATION

I hereby declare that this project has been done by me under the supervision of **Md. Sazzadur Ahamed, Assistant Professor**, Department of Computer Science and Engineering, Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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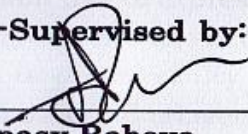
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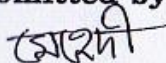
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Finally, I must acknowledge with due respect the constant support and patience of my parents.

ABSTRACT

In academical institutions, teachers are dependent on laborious, prone to mistakes, and easily misused methods, like fingerprint scanners or roll calls, to track attendance. This project offers a more suitable solution: a WEB-based facial recognition school management system. This technology takes students face data by a web cam or other camera connected to the system, checks them to match with the registered image, and automatically marks their attendance to provide a seamless and easy attendance system.

This platform is so user-friendly as React and Django is used in frontend and backend. The features for the teachers are to select their assigned courses, to take attendance and of course to log in safely using JWT authentication. Each attendance record is linked with individual courses, so, the chance of duplication and proxy attendance is reduced.

The system also provides the facility for downloadable attendance excel file and also have chances to make improvement like using as a mobile application and attendance-based research and monitoring.

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Chapter 1

Introduction

1.1 Introduction

The traditional attendance management system in our academic institutions is critical and time-consuming. Those methods, like the manual roll calls or paper-based method, all have the chance to make errors, insufficiencies and proxy attendance. To challenge these issues, I am introducing this project, “Attendance Management System”, based on a facial recognition system, a modern solution for attendance and management. Digital technologies like facial recognition systems are used in the system to reduce vulnerabilities and increase the accuracy of students’ data and their attendance[1][2]. This system gives the teachers an easy way to manage students, courses and their attendance records. In the frontend, I used React, and for the backend, Django to build this system[6][7]. By using a webcam to collect the real-time face data, the system ensures precision in collecting attendance records and separating them by the courses, and ensures that there is no duplication of records[3][4]. The system provides JWT authentication for safe login[11][16]. Also provides comprehensive attendance reports with a downloadable record[15][17].

In addition, this project ensures precision and reduces the dependability of attendance records, thus saving teachers time in the lecture hall. This system is one step advanced in the academic field of technology cause modern technological advancement ensures flexibility, efficiency and time saving through this system.

1.2 Motivation

This project was inspired by the challenges of old-school attendance systems. The manual approach takes too long and is prone to people signing in for others, which messes up the records[3]. As tech becomes more common in education, there's a bigger need for automated solutions that boost accuracy and save time. This project plans to use face recognition tech to create a smooth and trustworthy attendance system[1][2]. By using modern tools like Django, React, and OpenCV[7][14], the system not only makes attendance easier but also improves course and student management, helping both teachers and schools.

1.3 Objectives

This project is all about creating a facial recognition attendance system that makes tracking attendance easier and more accurate[4]. It helps teachers by offering a single platform to handle student, course, and attendance details. On top of that, it focuses on producing clear and easy-to-access attendance records for better tracking and analysis[17]. The system also protects sensitive data by ensuring that only authorized users can access it through secure JWT authentication. Basically, it's aimed at improving how schools manage attendance[16].

1.4 Methodology

I am working on the project, Attendance Management System. The aim is to automate the attendance management system using face recognition technology. The system is based on React, HTML, CSS, and Bootstrap for the frontend and Django REST Framework for the backend. This system is designed to avail an effective experience for teachers.

The key features are:

User Login and Registration: Teachers need to log in using their unique user ID and a strong password. After a login, they can access to their assigned courses and all.

Dashboard: Shows s view of assigned courses for teachers, also offer a quick access to course management, attendance marking, and attendance reports.

Course Management: Teachers get access to view and manage their assigned courses. Each course in the courses page shows the enrolled students and their details.

Face Recognition Attendance: Teachers can take attendance clicking start face recognition button after selecting a course in the attendance page. The system uses a camera to capture student real time images, match them with stored photos, and mark attendance accurately[2][9].

Attendance Reports: Teachers get access to the detailed attendance records for each course and to download them in Excel format for offline use[15].

Security: The system uses a secure authentication method, JWT. It ensures that only authorized users can access the system[11].

Scalability: The system handles multiple courses, teachers, and students, and ensures that, it can grow with the institution's needs[1][4].

Others: The platform can be implemented in external tools for sharing attendance reports and announcements. In future it may be included in mobile app integration and advanced analytics for attendance[18][22].

1.5 Project Outcome

The Attendance Management System using Face Recognition is all about making attendance and course management for schools. It automates the process, making it very easy for the teachers. The system aims to simplify the attendance system, reduce mistakes, and provide teachers more time to teach. Facial recognition is a blessing. It ensures the accuracy of the records and stops proxy attendance. Teachers get detailed attendance reports that are easy to download and use. Also, it boosts interaction between teachers and students by saving time and offering a one-stop platform for managing courses and student information. After all, this system is set to uplift the education world by advancing admin tasks and boosting efficiency. It will help schools run smoothly, protect data, and improve the experience for both teachers and students. With the flexible design, this system is ready to adapt to future needs, making it important for schools everywhere[17].

1.6 Organization of the Report

This report is organized into six chapters. Each of them focuses on different parts of the development, implementation, and assessment of the School Management System.

Chapter 1 presents the background, motivation, goals, and what we hope to achieve with the project. It also shows the methodology we followed during development and gives a quick overview of how the report is structured, so that readers can understand what to expect.

In Chapter 2 I've into the background research requirements for the project, which includes a literature review and a look at similar available systems. I have pointed out the shortcomings of current attendance management solutions and shown how my project integrates face recognition and fills those gaps.

Chapter 3 is about the methodology I used to design and build the system. This includes requirement analysis, system design specs, and the tools and technologies I have implemented. I also show the task allocation and project planning in this chapter.

Chapter 2

Background

2.1 Introduction

In this chapter, the necessary knowledge is organised to understand the ideas, technologies, and methodologies used to develop the Attendance Management System with Face Recognition. At first, the similar research, systems, and methodologies that influenced the design and development of this project are explained. This study utilises knowledge obtained from current attendance management systems and relevant literature to face the difficulties encountered in conventional and semi-automated attendance methods[2][3]. Again, this chapter highlights the unique features provided by the system I have made, such as face recognition-based attendance, detailed reporting, and secure authentication. These differentiate my project from existing ones. These features are for enhancing efficiency, accuracy, and user experience, ensuring the system's success in advancing attendance and course management in educational institutions[4][11].

2.2 Literature Review

The term literature review refers to a document that brings together the key sources on a subject and discusses those key sources in dialogue with one another. The review provides a good overview of the current state of knowledge, allowing us to identify the theories or methods commonly used and the gaps that exist in relation to the project topic.

A literature review is undertaken to understand the research that has been conducted in relation to the chosen project topic and to summarize this research within the project report. The main objective of the literature review is to identify the problems more accurately and to propose simple and effective solutions.

After analyzing the existing systems and methodologies, the Attendance Management System aims to improve these by integrating advanced technologies like face recognition, automating attendance processes, and enhancing the user experience for teachers and administrators.

2.2.1 Similar Applications

There are several applications similar to the School Management System with Face Recognition that aim to simplify attendance and student management processes. Below are some examples of such systems, along with their descriptions and links for further exploration:

Application 1: MyClassCampus

MyClassCampus is a cloud based educational management platform that offers facilities to track attendance, manages students, and facilitates communication. It is based on manual attendance recording, timetable organization, and fundamental reporting facilitated. Again it lacks the integration of facial recognition, which reduces its efficacy in modern educational environments. The provided illustration shows the MyClassCampus landing page, highlighting its key features, functionalities, and user interface. The School Management System project draws inspiration from MyClassCampus by including facial recognition technology for automated attendance and providing effective, downloadable reports.

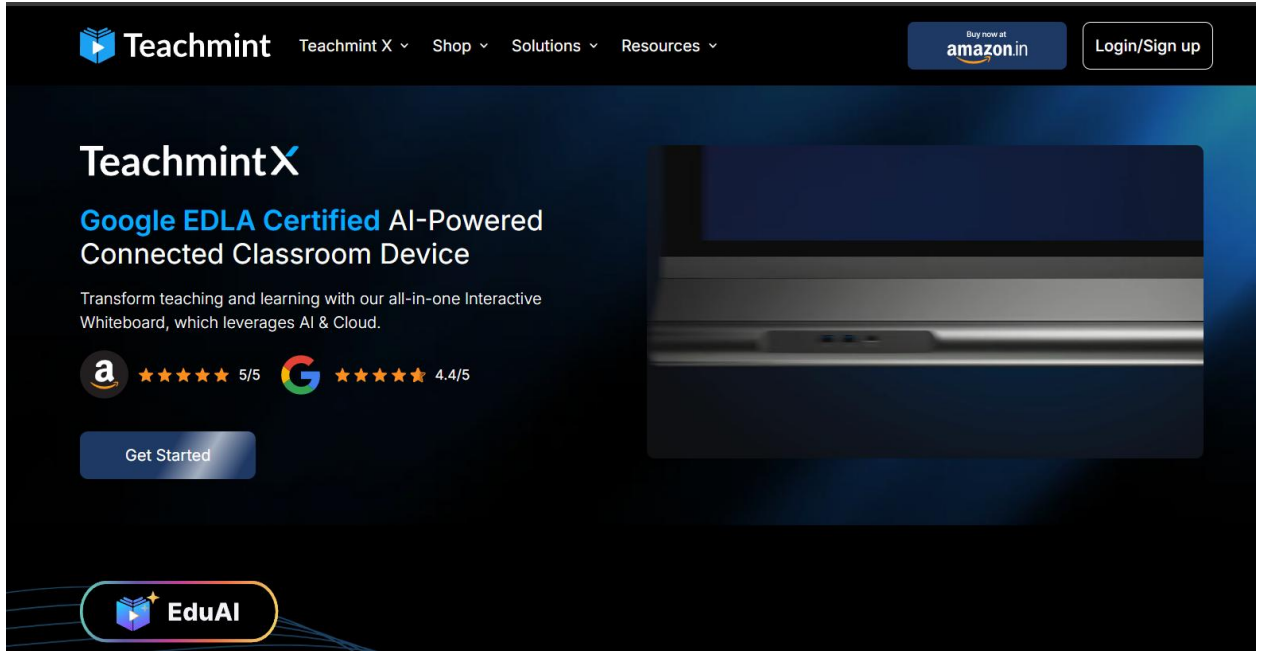


Figure 2.1: Landing Page of MyClassCampus.

Application 2: Fedena

Fedena is a popular school management software that provides facilities such as attendance tracking, management of student data and courses. It implements biometric authenticated attendance systems that includes fingerprint scanning, but lacks face recognition capabilities. This dependence on physical equipment may create challenges in specific situations. The illustration below displays the Fedena landing page interface highlighting its features and design. The School Management System gets inspiration from this one, without traditional biometric methods with a contactless face recognition system to improve convenience.

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Grade Book
ZENFACT School (CBSE)
Student: Karthik Sam Class: Grade-01 - A 2018-19 Admission No.: 51

SUBJECTS	MULTIPLE ASSESSMENT	PORTFOLIO 1	SUBJECT ENRICHMENT	HALF YEARLY	PT 1	TERM 1	GRADE
English	7	2.7	2.2	22(8)	2.84	31.94	F
Maths	3.5	3	3.4	11.5(8)	1.46	23.86	F
Science	3	3.1	2.9	23.5(8)	1.42	33.92	D
Social	2.4	2.5	4.5	34(2)	1.47	66.07	C2

PERFORMANCE ANALYSIS
■ Class Average ■ Percentage
Percentage of days present: 99.12 %
Days present/ Working days: 113.0/114.0

Attendance **Half Yearly**

Timetable
Science 10:00 am - 10:30 am
Mathematics 10:30 am - 10:55 am
Social 10:55 am - 11:30 am
English 11:30 am - 12:00 am
English 12:00 am - 12:30 am

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Figure 2.2: Landing Page of Fedena.

Application 3: eSkooly

eSkooly is also a school management platform. It uses RFID based attendance systems. Students scan ID cards to mark their attendance. It is effective but requires additional hardware and have chance to be misuse if ID cards are shared. The below figure shows the landing page interface of ESkooley.

Inspiration for the School Management System: My project have not the need for additional hardware by using face recognition, that ensures accuracy and reduces the risk of misuse.

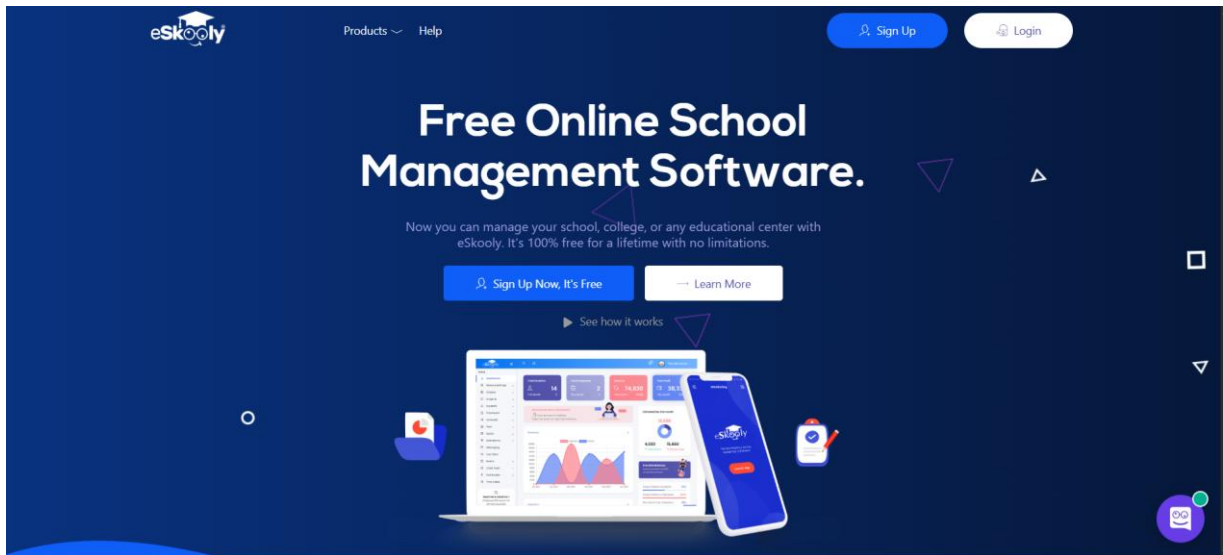


Figure 2.2: Landing Page of eSkooly.

These applications show important insights into the strengths and limitations of existing systems. The School Management System with Face is built with these ideas integrating advanced technologies. It improves efficiency, and addresses the gaps in traditional attendance systems.

2.2.2 Related Research

In contrast to other platforms, the School Management System with Face Recognition offers a great approach to automating attendance and observing courses within educational institutions. A key highlight of this system is its incorporation of face recognition technology, which removes the necessity for manual or physical attendance methods or any physical equipment[1][4][5]. This innovation improves accuracy, saves time, and significantly enhances the overall user experience. A comparative analysis table is provided below to analyze the strengths, weaknesses, user experience, and availability of existing applications in the market alongside the School Management System with Face Recognition.

Table 2.1: Comparative analysis with existing applications features.

Application Name	Strengths	Weaknesses	UI/UX	Availability
eSkooly	- Provides RFID-based attendance tracking.	- Requires additional hardware (RFID readers).	Modern and user-friendly.	Web, Android, iOS.
	- Includes basic course and student management features.	- Prone to misuse if ID cards are shared.		
Fedena	- Offers biometric attendance systems like fingerprint scanning.	- Requires physical interaction, which can be inconvenient.	Modern and user-friendly.	Web, Android, iOS.
	- Comprehensive student and course management tools.	- Does not include face recognition or advanced reporting features.		
MyClassCampus	- Cloud-based platform with tools for attendance, communication, and more.	- Attendance marking is manual, limiting efficiency.	Modern and user-friendly.	Web, Android, iOS.
	- Easy-to-use interface for teachers and administrators.	- Lacks automation through face recognition.		
School Management System with Face Recognition	- Automates attendance using face recognition, ensuring accuracy and saving time.	- Requires high-quality student photos for reliable recognition.	Modern and user-friendly.	Web (React-based).
	- Provides detailed, downloadable attendance reports.	- Initial setup may require additional effort for photo collection.		

The data presented in the table indicates that the School Management System with Face Recognition is better for it having of face recognition technology, which removes the necessity for physical contact or any hardware such as RFID card. In contrast to other systems, it delivers effective attendance reports and ensures precision, proving it a better and effective solution for educational establishments. This system aims to enhance the attendance management along with a user friendly experience for educators and administrators.

2.3 Gap Analysis

Applications like ESkoooly, Fedena and MyClassCampus are popular as school management system. But they have some limitations that the School Management System don't. Face Recognition solves it. This gap analysis shows the areas, where more improvements can be made.

ESkoooly uses RFID cards for attendance that is quit commom now a days. It needs extra hardware like card readers, and students can misuse it by sharing cards. The School Management System solves this issue by using face recognition model. It doesn't need any extra devices or card and ensures accurate attendance.

Fedena uses fingerprint scanning system for attendance which is also It requires physical contact, which is inconvenient especially in large schools or universities. The School Management System fixes this issue as well by using contactless face recognition. It is faster and easier to use.

MyClassCampus is a cloud-based platform that relies on manual attendance marking. It takes time and have chance to mistakes. The School Management System solves this gap too by automating attendance and providing detailed reports along with downloadable feature.

None of these existing platforms include advanced features like real-time attendance tracking and detailed analytics with real time data with a seamless way. School Management System includes these features that makes it a better and more effective solution for academic institutions. By solving the gaps, it ensures a smooth experience for teachers and students.

2.4 Summary

This chapter shows the gaps in existing systems. Examples are ESkooly, Fedena, and MyClassCampus. And also shown how the Attendance Management System with Face Recognition addresses these gaps. Currently available systems depend on methods like RFID cards, fingerprint scanning, or manual attendance. These systems have limitations such as the need for extra hardware, physical interaction and time consuming processes.

The Attendance Management System solves these issues by using face recognition technology. It is contactless, accurate and efficient. It requires no additional devices, reduces errors, generates detailed attendance reports and also downloadable one.

Addressing these gaps, the Attendance Management System offers an advanced, user friendly, and reliable solution for educational institutions, that ensures a better experience for teachers and students.

Chapter 3

Research Methodology

3.1 Requirement Analysis & Design Specification

3.1.1 Overview

This chapter discusses the methodology, requirement analysis, and design specifications of Attendance Management System, describing and highlighting the systematic approach to its development. According to Software Development Lifecycle, analyzing the project is the first phase of development. The previous chapters cover that part.

The next phase is designing the project, which includes UI/UX design and engineering approach with creating UML diagrams. The given diagrams bellow is beneficial, cause they provide clear roadmap for developing the project. They help the developer understand how the system should function, which components should be included, and how they should interact.

In my project this design phase ensures that the face recognition attendance, course management, and attendance reporting and all other features are well planned and structured. It also helps in identifying the phases and sequences of implementation and prioritize components. In short, this phase ensures that the developer knows how the system should be built and what features should be implemented for each stage. This structured approach will guide the development and analysis of Attendance Management System that ensures its success.

3.1.2 System Design

This design is to develop an advanced Attendance Management System. It uses face recognition technology for the automation of attendance and course management. The approach is based on React, HTML, CSS, and Bootstrap for the frontend development and Django REST Framework for the backend development. The system is designed to provide an user friendly and effective platform for teachers and administrators. The main key features for this project are:

User Login and Registration:

Teachers have to log in using their user id and password. After successful login, they can access to their assigned courses.

Dashboard:

Provides a view of assigned courses for teachers, offering quick access to course management, attendance marking, and attendance reports.

Course Management:

Teachers can view and manage their assigned courses. Each course shows a list of enrolled students and their details.

Face Recognition Attendance:

Teachers have to start the attendance record process by selecting a course. The system uses a webcam or other camera connected to the system to capture real time images. It matches the camera input with stored photos and mark attendance accurately.

Attendance Reports:

Attendance reports are generated automatically and stored. Teachers can view the attendance records for each course, and download them in Excel format for offline use.

Others:

This system can be implemented on external tools or platforms for sharing attendance. Future updates will include mobile app integration and advanced analytics of attendance.

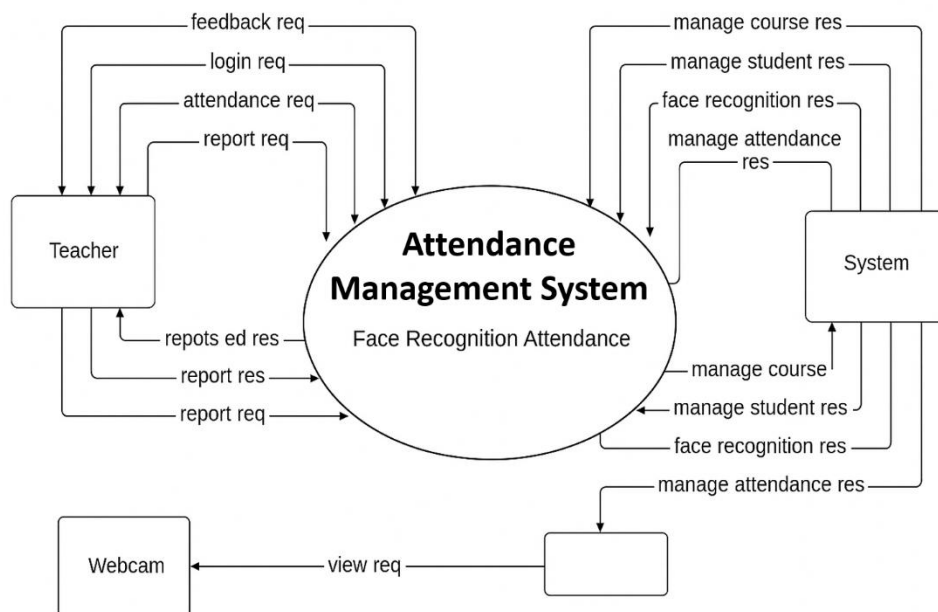


Figure 3.1: System Architecture Diagram of Attendance Management System.

Key Design Considerations

- **Scalability:** For being modular design , it allows easy addition of new features. Such as support for more user roles or advanced analytics.
- **Security:** JWT-based authentication ensures that only authorized users can access the system, protecting sensitive data.
- **Reliability:** The use of robust frameworks like Django and React enhances the system's performance and reliability.
- **User-Centric:** The UI/UX design focuses on intuitive navigation and accessibility, ensuring a smooth experience for teachers and administrators.

Within this structured and layered system design, the Attendance Management System is guaranteed to be functional, efficient, reliable and scalable. This design ensures that the system meets the needs of any educational institutions providing a seamless user experience.

3.1.3 Functional and Nonfunctional Requirements

There are some functional and nonfunctional requirements of this project to meet the goals using Face Recognition. I have provided a smooth and effective experience for teachers and administrators by admitting to a well defined set of functional and nonfunctional requirements. These requirements emphasize the key behaviors and characteristics of the system. Also it fames the basis for its development and assessment.

Functional Requirements

User Registration and Authentication:

Teachers have to log in with the valid credentials, including their user id and a strong password. The system ensures secure login for accessing the system.

Face Recognition Attendance:

The system uses a webcam or other connected camera to capture student images, match them with stored photos, and mark attendance correctly.

Course Management:

Teachers have the ability to view and manage their assigned courses. Each course includes a number of enrolled students and their IDs.

Attendance Reports:

Teachers can view detailed attendance report for each course and download them in Excel format for offline use.

Integration with External Tools:

The system can be integrated with external platforms for sharing attendance and analysis.

Nonfunctional Requirements

Performance:

The system have to handle the high traffic efficiently along with fast response times and minimal loading delays even in the peak usage.

Scalability:

The modular design permits the easy addition of new features.

Security:

JWT-based authentication system is used here to ensure secure access.

Reliability:

The system have to provide consistent performance and ensure data integrity, even in high usage period.

Usability:

The user interface should have to be instructed with clear navigation and calls to action. Usability testing is conducted to identify and address issues.

Integration with Hardware:

The system should support integration with webcams or other camera for face recognition.

Language and Framework Knowledge:

The system is developed using React, Django, HTML, CSS, and JavaScript. Developers should have knowledge of these technologies to maintain the system.

Data Storage and Backup:

Attendance data and student data have to be securely stored in a database.

Accessibility:

The system should be accessible on multiple devices, including desktops and tablets.

Integration with Institutional Systems:

The system have to integrate with existing school management systems to ensure seamless data synchronization.

After adhering these functional and nonfunctional requirements, the Attendance Management System ensures a reliable, secure, and user friendly system platform for attendance and courses management in educational institutions.

3.1.4 Context Diagram

3.1.5 Data Flow Diagram Level 1

A DFD is a graphical representation of the transportation of data within a system. It shows how data passes between different entities, processes, stores. The DFD of Attendance Management System describes the system into major sub processes, focusing on how user inputs are processed and outputs are generated.

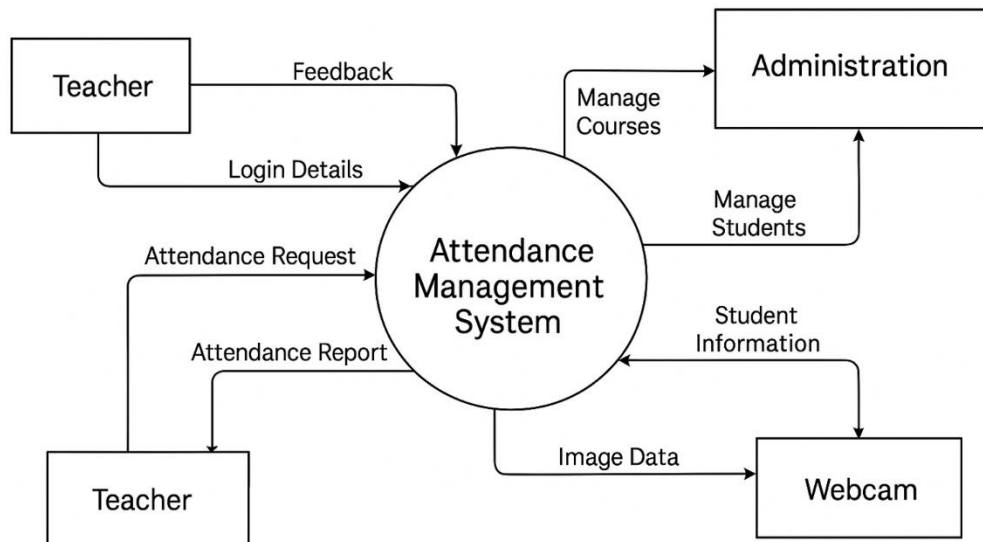


Figure 3.2: Data Flow Diagram of Attendance Management System.

This diagram presents a clear understanding of the systems data transportation and forms the foundation for its detailed design and implementation.

Key Data Flows

Teacher → Login → System: Login data sent to the system for authentication.

System → Student Database: The system replies with student data for visualization.

Webcam → Face Recognition: Captures student real time image.

System → Attendance Records: Updates attendance status (Present/Absent).

Teacher → Request Report → System: Shares report for specific courses.

3.1.6 Sequence Diagram

Sequence Diagram is a UML diagram that illustrates the interaction, and communication between the components.

The sequence diagram for the Attendance Management System shows how the system processes the operations, such as user login, attendance marking and report generation. It provides a clear representation of the interactions between the user, system and database.

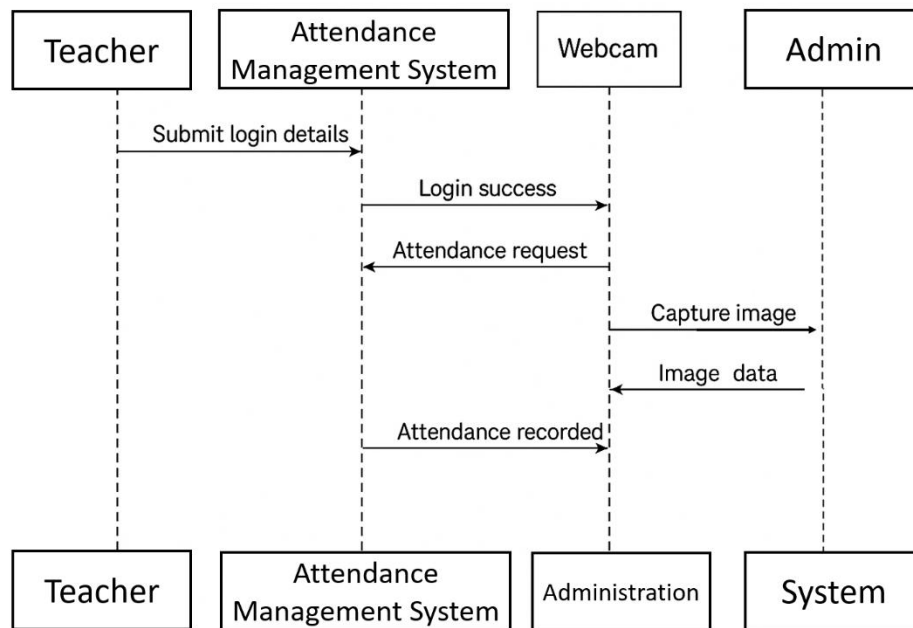


Figure 3.3: Sequence Diagram of Attendance Management System.

Sequence of Operations

Login Process :

Teacher → System: Sends login request.

System → Database: Verifies log in data.

Database → System: Returns status.

System → Teacher: provides or denies access.

Mark Attendance :

Teacher → System: Selects a course to starts face recognition.

System → Webcam: Captures Realtime images.

System → Database: Compares captured images with stored photos.

Database → System: Returns matching values.

System → Database: Updates attendance record.

System → Teacher: Confirms marking.

Accessing Report :

Teacher → System: Requests attendance report of a course.

System → Database: Retrieves attendance data.

Database → System: Returns attendance data.

System → Teacher: Provides a downloadable report.

3.1.7 Entity Relationship Diagram

An Entity Relationship Diagram shows visually of the data node. It highlights the entities, their attributes, and relationships between them. For the Attendance Management System, the ER Diagram shows the entities such as students, teachers, courses, and attendance records, with their attributes and also how they are related.

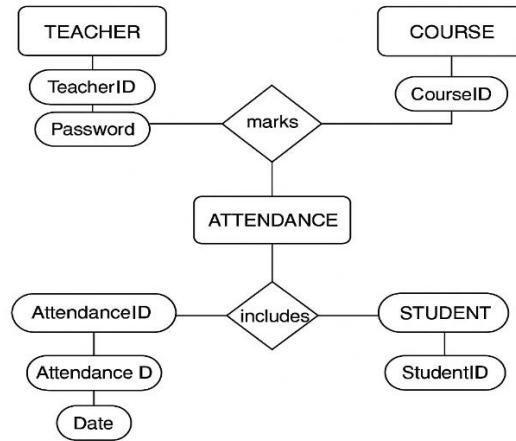


Figure 3.4: E.R. Diagram of Attendance Management System.

3.1.8 UI Design

The Attendance Management System UI design focuses on creating an user friendly interface for teachers and admin. The design ensures that the users can easily use the system. It ensures the easiness to perform tasks such as managing courses, marking attendance, and generating reports. It is simple and responsive, making it suitable for use in multiple devices like desktops, tablets, and mobile phones.

Dashboards are designed primarily for teachers. The teacher dashboard provides well oriented sections for managing courses. The layout ensures all the features are easily accessible, improving efficiency and comfort.

The design properties:

Login and Authentication: A secure login page for teachers to access the program.

Dashboard: A centralized view for teacher.

Face Recognition Attendance: A dedicated section for capturing real time data and marking attendance.

Course Management: A separate interface for managing courses.

Attendance Reports: A dedicated for generating and downloading attendance reports.

Student Registration: A different page to add new student.

The UI uses responsive layouts, and clear typography to enhance usability and visibility.

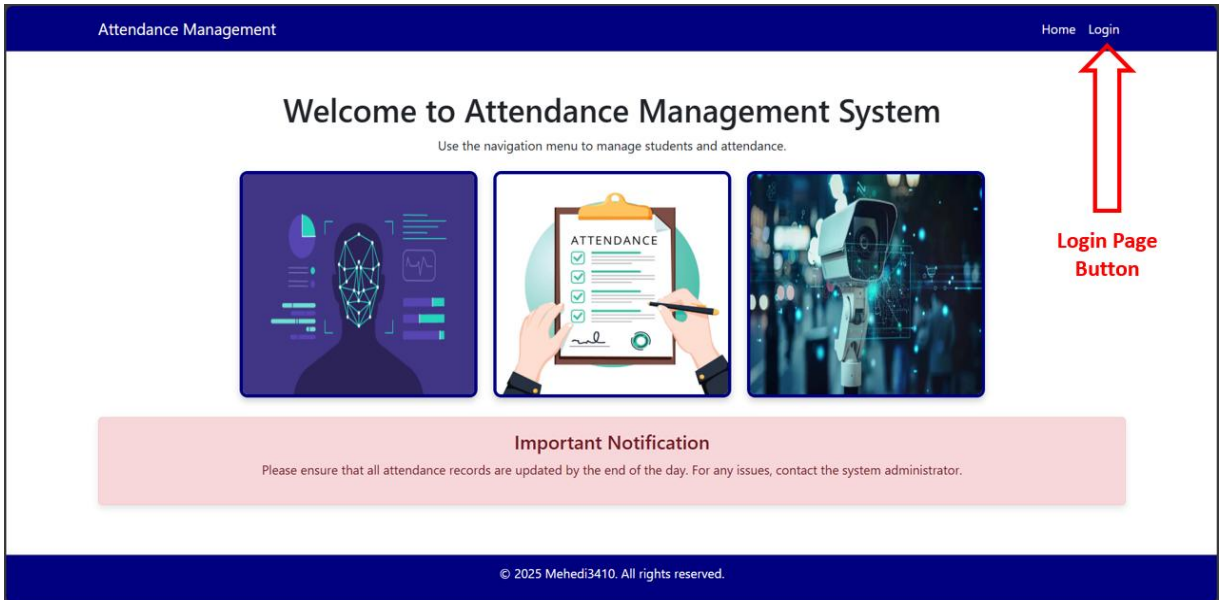


Figure 3.5: Home page of Attendance Management System

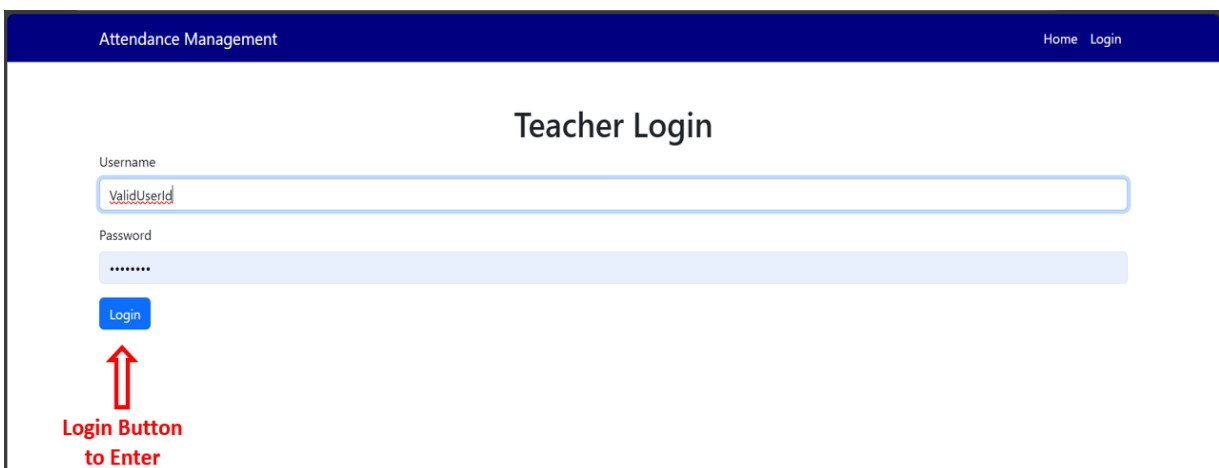


Figure 3.6: Login page of Attendance Management System

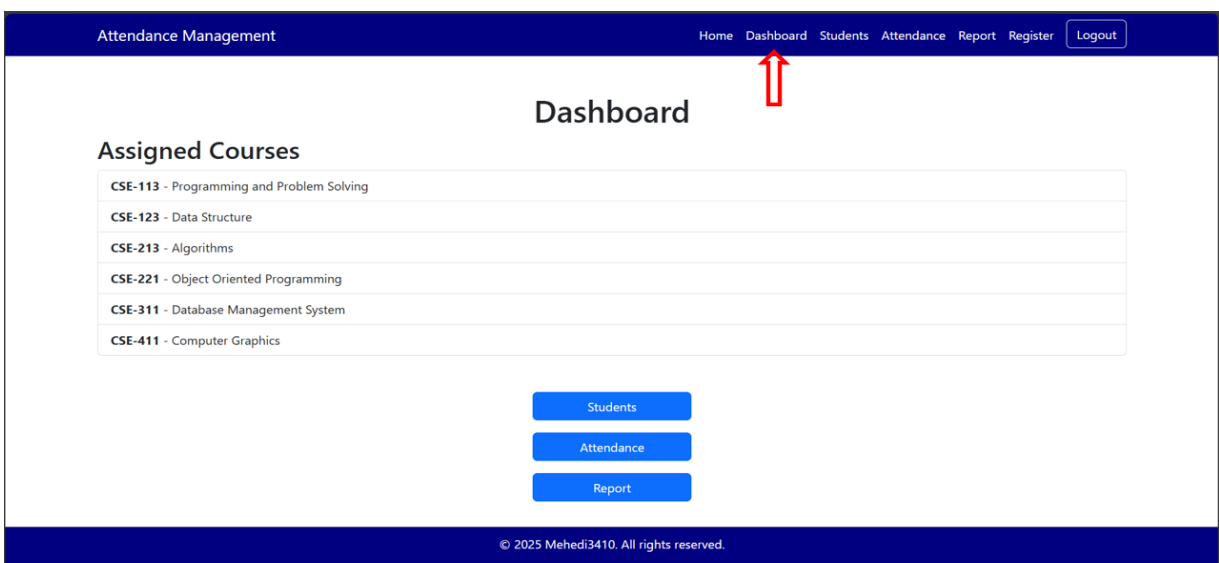


Figure 3.7: Dashboard page of Attendance Management System

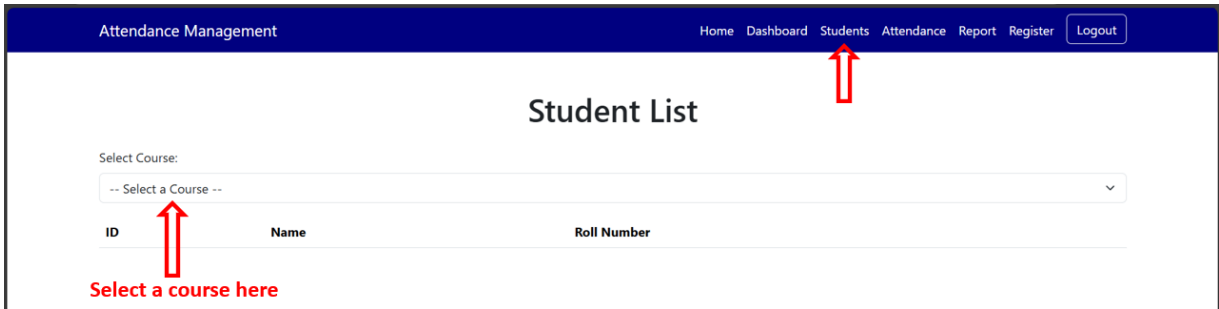


Figure 3.8: Student list page of Attendance Management System

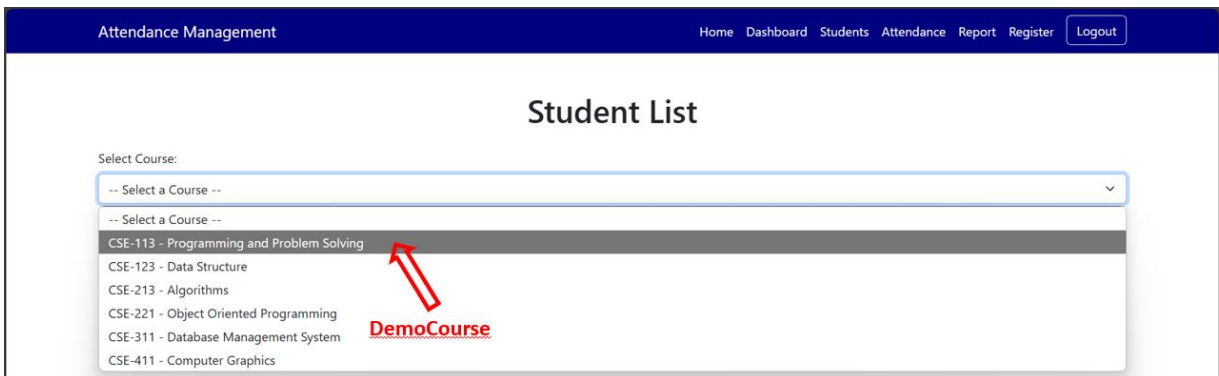


Figure 3.9: Selecting course to view student list .

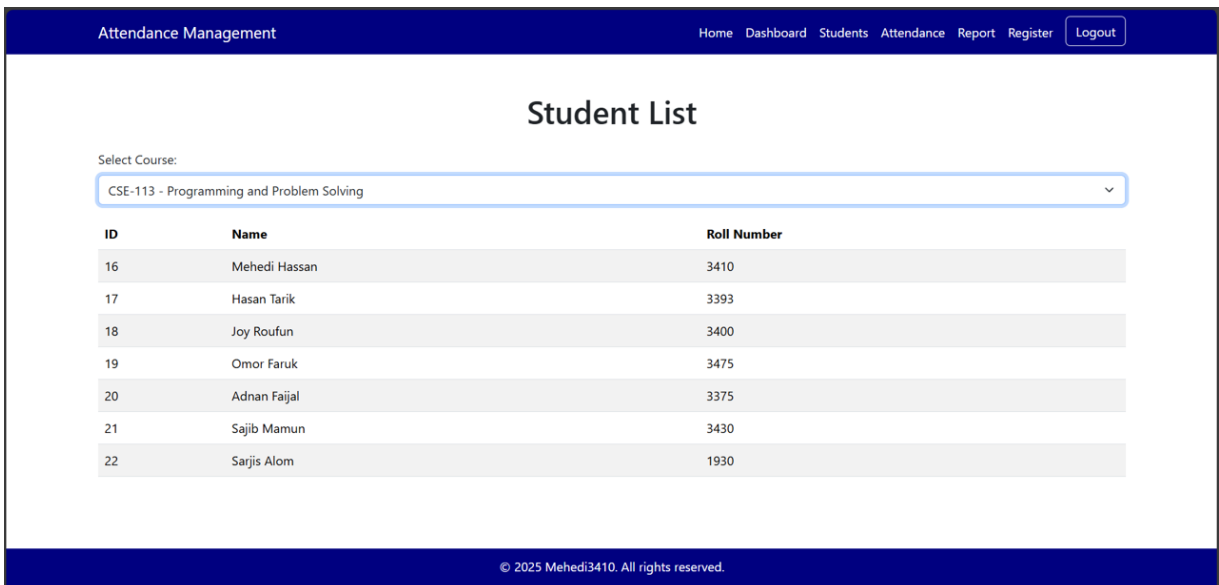


Figure 3.10: Student list view .

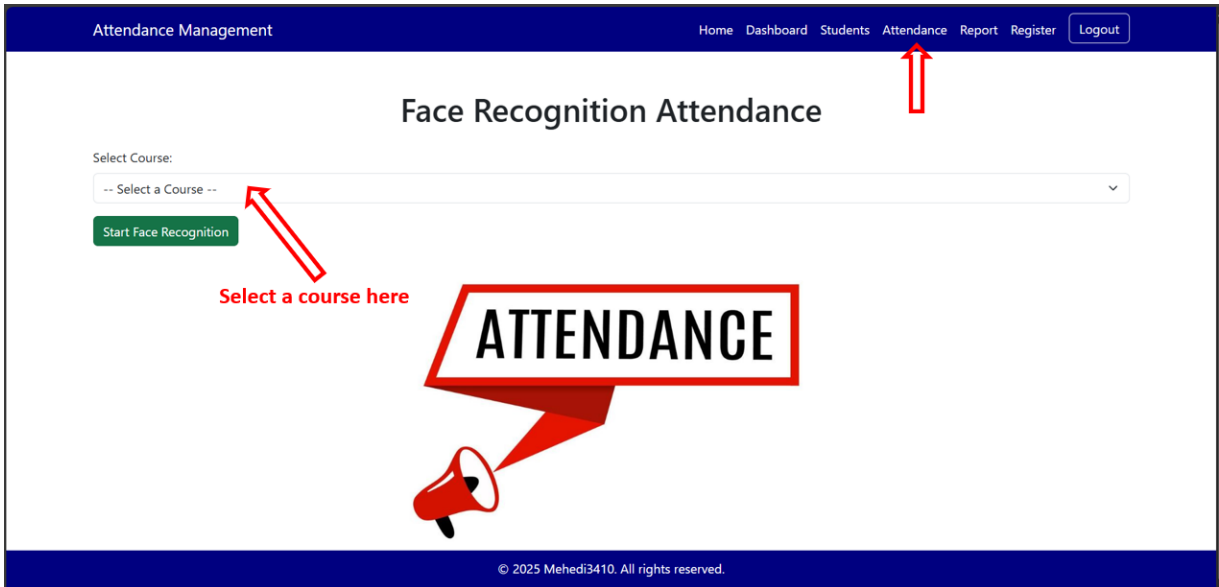


Figure 3.11: Selecting course to take attendance .

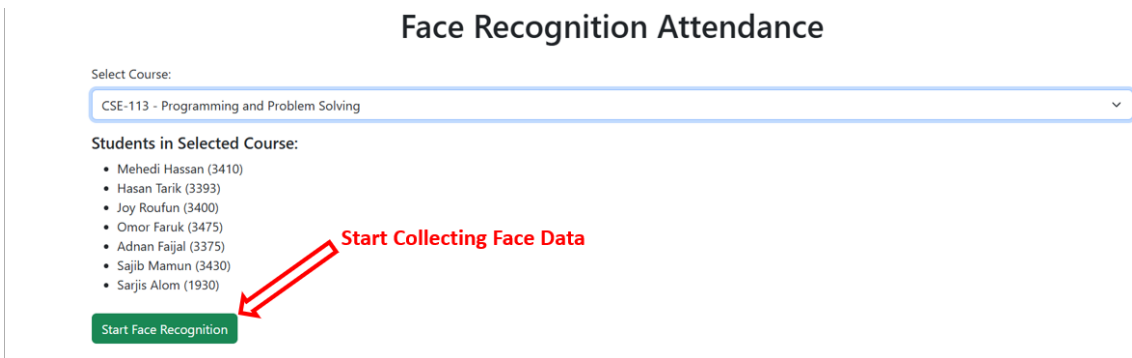


Figure 3.12: Ready to take attendance interface.

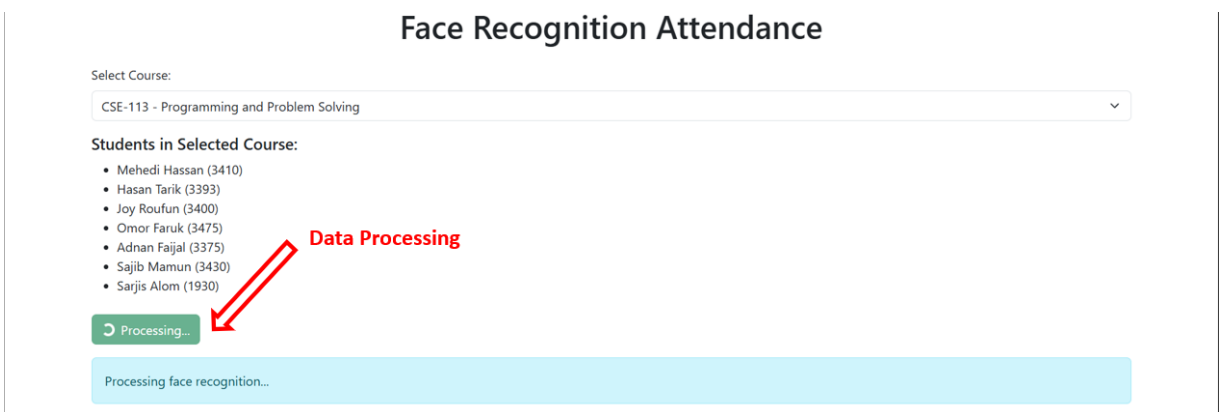


Figure 3.13: Processing phase for facial recognition .

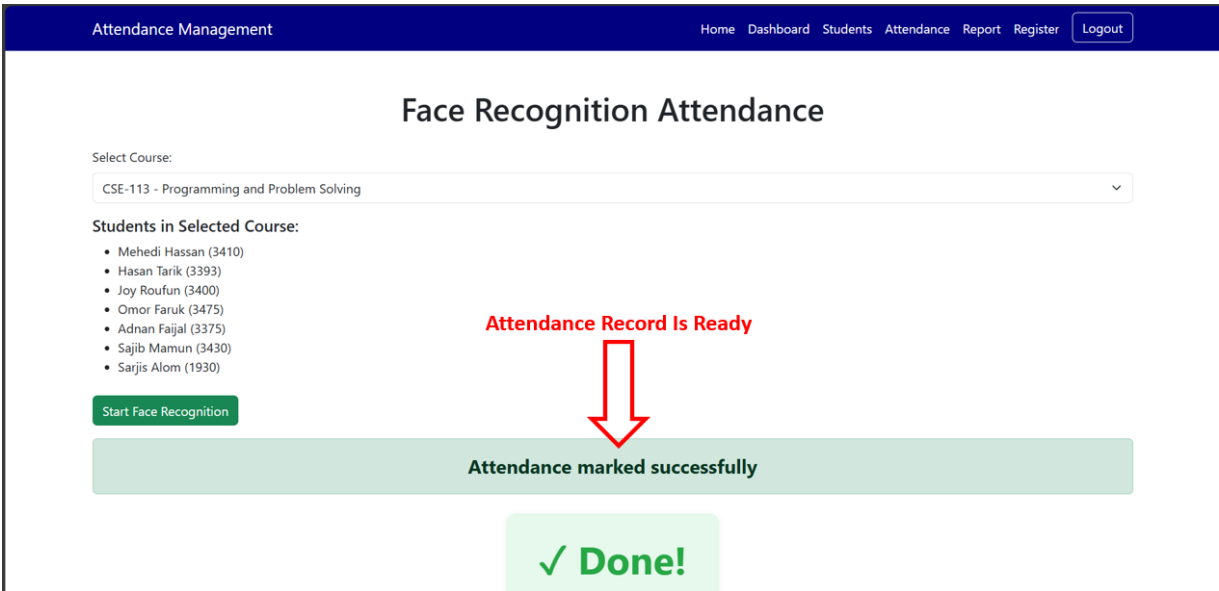


Figure 3.14: Attendance marked succeed interface .

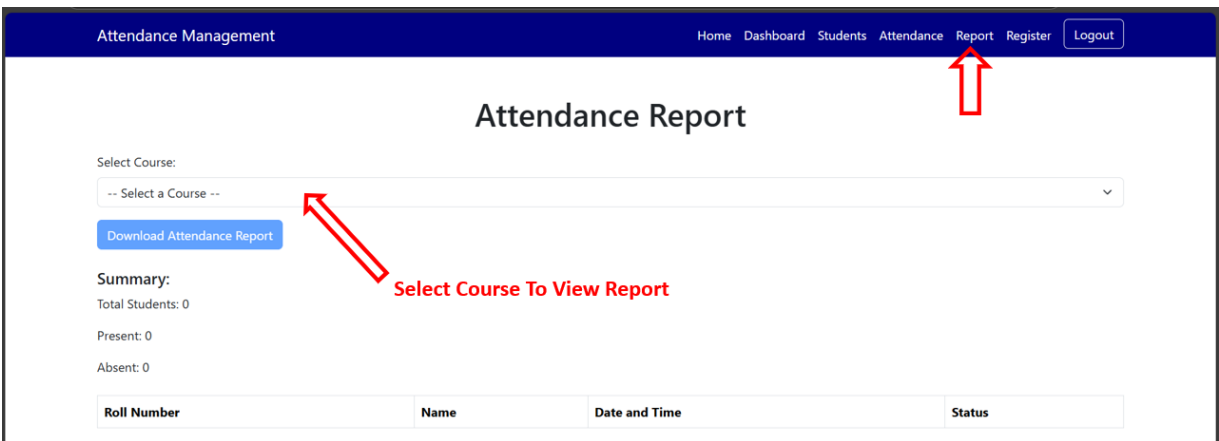


Figure 3.15: Selecting course to view report.

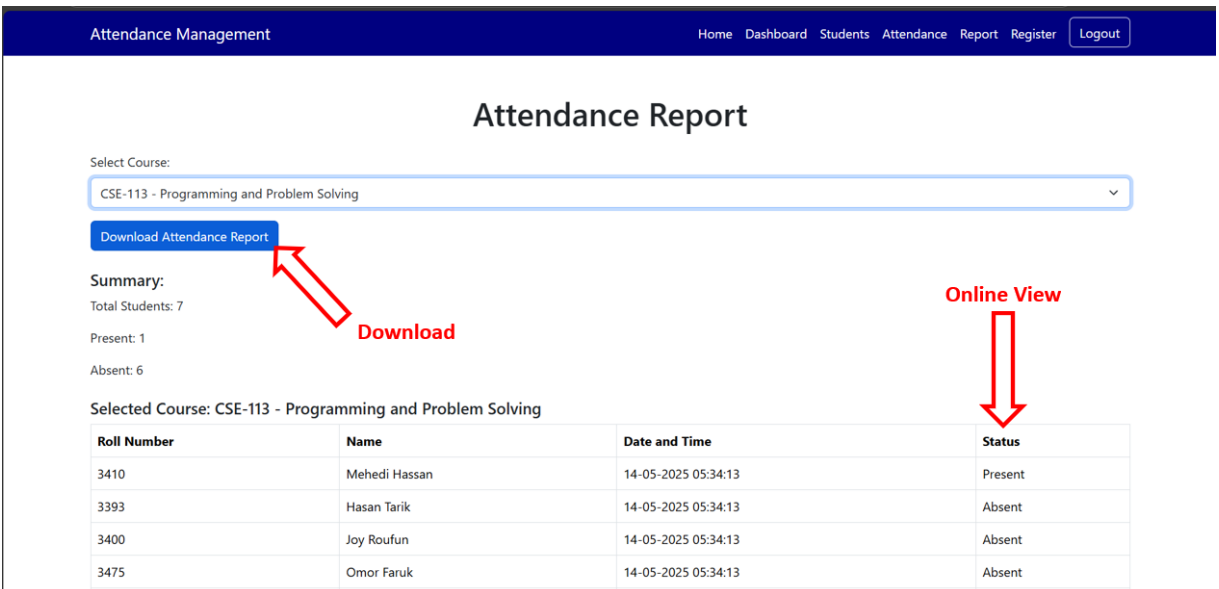


Figure 3.16: Attendance report view interface.

Attendance Management Home Dashboard Students Attendance Report Register Logout

Student Registration

Name
 ← 1

Roll Number
 ← 2

Photo
 student_photo.png ← 3

Search Courses

Select Courses
 ← 4. Select one or more

Hold Ctrl to select multiple courses.

← 5. Click here to add

Figure 3.17: Student registration process.

Student Registration

Student added successfully!

Name

Roll Number

Conformation

Figure 3.18: Registration Successful message.

Attendance Management Home Dashboard Students Attendance Report Register Logout

Student List

Select Course:

ID	Name	Roll Number
16	Mehedi Hassan	3410
17	Hasan Tarik	3393
18	Joy Roufun	3400
19	Omor Faruk	3475
20	Adnan Fajjal	3375
21	Sajib Mamun	3430
22	Sarjis Alom	1930
23	Student Name	0000

New Student

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Figure 3.19: New student visible interface.

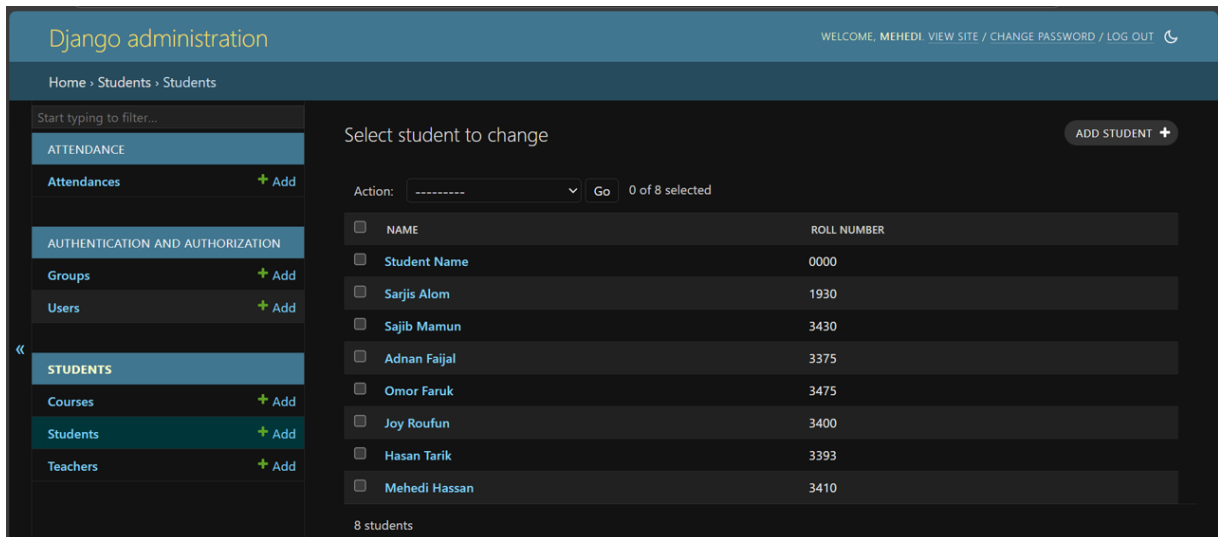


Figure 3.20: Backend database of Attendance Management System.

3.2 Detailed Methodology and Design

Variou solutions, and technologies are considered to address the challenges of building an efficient and automated System with Face Recognition. Tools and design choices are selected on the basis of their ability to meet system's functional and non-functional requirements, scalability, design and performance.

1. Frontend Development:

- Alternatives: Angular, Vue.js.
- Selected Technology: React.js.

Reason: React.js offers a component based design that enables modular code. It has large developer community and extensive library support that make it ideal for frontend applications. Reacts virtual DOM ensures high performance that is important for responsive user interface.

2. Styling Framework:

- Alternatives: Material-UI, Tailwind CSS.
- Selected Technology: Bootstrap.

Reason: Bootstrap has a interactive grid system and pre designed components, that make it easy to make a clean and UI.

3. Backend Development:

- Alternatives: Flask, Ruby on Rails.
- Selected Technology: Django REST Framework (DRF).

4. Database:

- Alternatives: PostgreSQL, MongoDB.
- Selected Technology: MySQL.

5. Authentication:

- Alternatives: OAuth2, Firebase Authentication.
- Selected Technology: JWT (JSON Web Token).

6. Face Recognition :

- Alternatives: OpenCV , TensorFlow.
- Selected Technology : Face Recognition Library.

Why selecting the Specific Design Pattern:

The flowchart of this System is designed to give a complete description of the applications workflow. It maps the roles, actions, decision for teachers and students ensuring a clear understanding of the systems functionality. This design pattern is chosen for it effectively describes complex transaction between multiple entities, makes it easy for all to understand the system's capabilities.

Benefits of This Specific Design Pattern:

- Modularity:

Each user has distinct workflows, that makes the system easier to understand and maintain.

- Scalability:

The design ensures the chance of future enhancements, like adding more user roles or advanced analytics.

- User-Centric:

The flow focuses to simplify user interactions and ensures a seamless experience for the users.

- Error Reduction:

By visualizing workflows, errors can be identified and addressed.

Selected Technologies:

The combination of React.js, Bootstrap, Django REST Framework, MySQL, JWT, and Face Recognition Library ensures that the System is robust, scalable, secure and user-friendly. These technologies work to deliver an efficient attendance management platform. That meets all functional requirements when providing excellent performance and flexibility.

By following the structured methodology, the development process is streamlined, that ensures the alignment between the design and implementation phases. These approach not only addressing the challenges of creating an automated attendance system but also establishing a strong foundation for future enhancements.

3.3 Project Plan

The project plan for the Attendance Management System outlined the structured approaches taken to design, to develop, to test, and to implement the system. It is a major blueprint for the project. The plan covers all the scope of the project, the resource allocation, milestones, timelines, major risk management strategies, along with testing protocols to ensure successful delivery.

Scope of the Project

The scope of the System is to provide an automation and efficient platform for attendance management using face recognition. The system supports a multi user roles such as teachers and administrators, each with a role specific dashboards and functionalities. It includes special features like secure login, easy course management, seamless attendance marking, auto attendance reports, and all.

Milestones and Timelines

The development process is parted into the following major segments, each with some specific tasks and deliverables:

1. Requirement Gathering and Analysis (Week 1-2):
 - Identify system requirements through brainstorming and research.
 - Creating Software Requirements document.
 - Deliverables: Requirement documentation, preliminary system design.
2. System Design and Prototyping (Week 3-4):
 - Design system architecture, including Data Flow Diagrams, ER diagrams, and flowcharts.
 - Create wireframes for user interfaces.
 - Deliverables: System architecture diagrams, UI mockups.
3. Frontend Development (Week 5-6):
 - Build the client-side application using React.js and Bootstrap.
 - Create responsive and user-friendly interfaces for login, dashboard, attendance marking, and reports.
 - Deliverables: Fully functional frontend application.
4. Backend Development (Week 5-6):
 - Develop the server-side application using Django REST Framework.
 - Implement APIs. (user authentication, attendance management, and report generation)
 - Deliverables: Fully functional backend application.
5. Integration and Testing (Week 7):
 - Integrate the frontend with the backend and external systems
 - Perform testing.
 - Deliverables: Tested and integrated application.
6. Deployment and Documentation (Week 8):
 - Deploy the system on a cloud platform.
 - Prepare final project documentation, including user manuals and testing reports.
 - Deliverables : Live system with a complete documentation.

Resource Allocation

The resources of the project are allocated bellow:

- Team Members:
 - Project Manager : Overall management of the project
 - Frontend Developers : Develops the user interface part.
 - Backend Developers : Builds the server side with database.
 - QA Engineer : Performs testing.

- UI/UX Designer : Creates mockups.
- Technologies and Tools:
 - Technologies: React.js, Bootstrap, Django REST Framework, MySQL, JWT, Face-Recognition Library.
 - Tools: Visual Studio Code, Postman, GitHub, Figma.

Risk Management

Potential risks were identified and mitigated through proactive strategies:

- Technical Risks:
 - Risk: Integration between frontend and backend.
 - Mitigation: Testing and use of standard APIs.
- Resource Risks:
 - Risk : Unavailability of developer during critical phases.
 - Mitigation: Flexible assignment and overlapping skill among team members.
- Timeline Risks:
 - Risk: Delays in the meeting deadline.
 - Mitigation: Regularly review progress and regular plans for critical tasks.

Testing Protocols

- Unit Testing: Verify the functionality of individual components and modules.
- Integration Testing: Test the interaction between the frontend, backend, and external systems.
- System Testing: Evaluate the overall performance and functionality of the application.
- User Acceptance Testing (UAT): Gather feedback from teachers and administrators to identify and address usability issues.

3.4 Task Allocation

As a sole developer of the project, Attendance Management System, I took responsibility on all of the project, from requirement analysis to deployment. Each phase of this project is carefully planned and executed to ensure that the successful delivery of the system within the exact timeline.

The detailed task allocation is shown bellow:

1. Requirement Analysis and Documentation
 - Gathered system requirements through brainstorming and research.
 - Created the Software Requirements Specification (SRS) document.
 - Defined functional and non-functional requirements for the system.
2. System Design
 - Designed the architecture including DFD, ERD and flowcharts.
 - Carefully planned the workflows for user interface, attendance marking, and report generation.

3. Frontend Development
 - Developed the client-side application using React.js.
 - Implemented React Router.
 - Designed interface with Bootstrap.
4. Backend Development
 - Built the server-side application using Django REST Framework.
 - Developed RESTful APIs for user authentication, attendance management, and report generation.
5. Database Management
 - Set up and managed the MySQL database.
 - Defined schemas for students, teachers, courses, and attendance records.
 - Optimized database queries for performance and reliability.
6. Integration
 - Connected frontend and backend together to ensure seamless communication.
 - Configured JWT-based authentication for secure user login and access control.
 - Integration of the face recognition modul.
7. Testing and Debugging
 - Unit testing for each segment and modules.
 - Performed integration testing to ensure smooth interaction.
8. Deployment
 - Deployed the system on a cloud platform for live access.
 - Monitored system performance and addressed any deployment-related issues.
9. Documentation
 - Created the final project documentation with including technical details, user manuals and testing reports.

3.5 Summary

This chapter details about the methodologies, design specifications and implementation plan for the Attendance Management System. I have described the requirements analysis, system architecture, and the implementation of technologies like React.js, Django REST Frameworks, MySQL, JWT and the Face Recognition Library. These technologies are chosen for their ability to make a robust, scalable, and efficient application.

The project plan detailed milestones, timelines, and resource allocation that ensures the systematic progress of the project's goals. As a sole developer, I have managed all the tasks independently, requirement gathering to deployment and ensured a smooth workflow. Some risk management strategies and testing protocols are also addressed to ensure that the systems reliability and performance.

This chapter provides a complete understanding how the System is conceptualized, designed and implemented. It is a blueprint for whoever looking to enhance the system's features.

Chapter 4

Implementation and Results

4.1 Environment Setup

The environment setup for the development of this project and deployment of the Attendance Management System was carefully designed to ensure a seamless integration of the technologies and the efficient execution of the system. The environment is divided into local a development, testing, and deployment stages, each are configured with the necessary tools along with frameworks, and services.

Development Environment

1. Frontend Setup:
 - React.js : Used to build a client-side application (frontend) with a component based architecture.
 - Bootstrap: Integrated for styling to achieve a responsive and user friendly UI.
 - Node.js and npm: Installed to manage dependencies and run development scripts.
 - Development Server :React built in development server is used for real-time update.
2. Backend Setup:
 - Django REST Framework : Used to create the server side application, REST APIs.
 - MySQL: A locall host MySQL instance is used for database management.
3. External Services:
 - Face-Recognition Library : Integrated to make attendance using face recognition.
 - JWT (JSON Web Token): Configured for a secure user authentication.
4. Development Tools:
 - Visual Studio Code: Used as the primary code editor with extensions for linting and debugging.
 - Postman: Utilized for testing API endpoints.
 - Figma: Used for creating UI mockups and wireframes.

Testing Environment

1. Testing Frameworks:
 - Jest: Used for unit testing frontend components.
 - React Testing Library: Applied for testing React components.
 - Pytest: Utilized for testing backend APIs and database interactions.
2. Browsers and Devices:
 - Cross browser testing is conducted over Chrome, Firefox and Edge.

Deployment Environment

1. Cloud Hosting:
 - Frontend Deployment: Deployed on Netlify for fast, scalable, and secure hosting.
 - Backend Deployment: Deployed on Heroku for reliable and scalable hosting.
2. Database Hosting:
 - MySQL Cloud Instance : Used as a cloud hosted database ensuring high availability and scalability.
3. Environment Variables:
 - Sensitive data like API and database connection strings are securely managed using .env files in development and environment variables in deployment.

4.2 Testing and Evaluation

Testing Methodologies

1. Unit Testing:
 - Individual components, modules, and API are tested to verify their functionality in isolation.
 - Frontend components are tested with React Testing Library, when backend APIs are validated using Pytest.
2. Integration Testing:
 - Focuses on the interaction in the client side application, backend services and external API like the Face Recognition Library.
 - Ensures smooth data transaction between different parts the system.
3. System Testing:
 - The complete system is tested to evaluate its behavior under real world conditions.
4. Cross Browser and Responsiveness Testing:
 - The application is opened in different browsers like Chrome, Firefox and Edge.
 - Ensured the UI is responding and working seamlessly on various devices.

Testing Tools

1. Postman:
 - Used to test API endpoints, ensure proper response handling, data retrieval.
2. React Testing Library:
 - Validated behavior of individual React components.
3. Pytest:
 - Testes the server side APIs.

Evaluation Criteria

1. Functionality:
 - All defined features like user login function, attendance marking, and report generation are tested to ensure that they operated as expected.
2. Performance:
 - Tested system performance in various situations.
3. Security:
 - Safety of data like user credentials and attendance record sand all are ensured.
 - Verified the implementation of token-based authentication using JWT.
4. Usability:
 - Assessed the intuitiveness of the UI and ease of navigation for teachers and administrators.

Testing Results

1. Success Rates:
 - Unit tests for individual components and APIs achieved a success rate of 95%.
 - Integration tests confirmed that 98% of workflows were executed without errors.
2. Identified Issues:
 - Minor UI inconsistencies were identified during User Acceptance Testing (UAT) and resolved promptly.
 - A performance bottleneck in the backend was optimized by refactoring database queries.

The rigorous testing and evaluation processes ensured that the Attendance Management System was reliable, secure, and user-friendly. By identifying and resolving issues during development, the system was delivered as a robust attendance management platform that met the expectations of its stakeholders. This thorough approach minimized risks and ensured a smooth deployment and operation of the system.

Table 4.1: Detailed system testing table for major features.

Test ID	Test Scenario	Test Case Description	Test Steps	Expected Result	Actual Result	Pass /Fail
01	User Registration	Verify that a new user can register successfully.	1. Navigate to the registration page. 2. Enter valid user details. 3. Click "Register".	Registration confirmation message displayed.	As Expected	Pass
02	User Login	Verify that a registered user can log in.	1. Navigate to the login page. 2. Enter valid credentials. 3. Click "Login".	User is directed to the dashboard with a success message.	As Expected	Pass
03	User Login with Invalid Data	Verify that a user cannot log in with invalid credentials.	1. Navigate to the login page. 2. Enter invalid credentials. 3. Click "Login".	Error message "Invalid username/password" displayed.	As Expected	Pass
04	Attendance Marking	Verify that attendance is marked using face recognition.	1. Log in as a teacher. 2. Select a course. 3. Start face recognition.	Attendance is marked and confirmation message displayed.	As Expected	Pass
05	Attendance Report Generation	Verify that a teacher can generate attendance reports.	1. Log in as a teacher. 2. Navigate to the reports section. 3. Generate a report.	Attendance report is generated and available for download.	As Expected	Pass
06	Cross-Browser Responsiveness	Verify that the application works across browsers.	1. Access the app on Chrome, Firefox, and Edge. 2. Test all features.	Application works seamlessly across all tested browsers.	As Expected	Pass

4.3 Results and Discussion

The implementation and testing of the System shows significant results that proves the system's ability to meet its objectives addressing all the challenges of traditional attendance management methods.

Results

1. Successful Implementation:
 - The system successfully integrates face recognition technology to automate attendance marking, eliminating the need for manual processes. The role based dashboards are implemented for teachers.
2. System Performance:
 - The application is maintained fast response times over all functionalities and even under rapid user loads.
 - Attendance marking and report generation are executed without delays.
3. User Experience:
 - High levels user satisfaction is observed during usability testing, with participants. That indicates the system is intuitive and easy to use.

- Cross browser device testing ensured a consistent service over various platforms.
4. Security and Reliability:
- Secure authentication ensures the protection of user data and sensitive data.

Discussion

The results shows that the Attendance Management System is effectively addressing the challenges faced by teachers and administrators in attendance management. Its combined approach eases attendance marking and reporting along with making the process more efficient and accurate.

1. Addressing Identified Problems:
 - The system automates the attendance marking system using face recognition model ..
 - Role based dashboards empowers teachers managing their courses and attendance records efficiently.
2. Impact on Stakeholders:
 - Teachers are benefited from a streamlined process that saves time and effort also enhancing their overall experiences.
3. Challenges and Solutions:
 - Challenge : Ensuring seamless transaction between the frontend and the backend along with face recognition module.
 - Solution : Integration testing with the use of reliable tools like Postman and Pytest solves this challenge.
 - Challenge : Maintaining performance while rapid load.
 - Solution : Database queries are optimized cause scalable technologies like Django REST Framework and MySQL were used.
4. Opportunities for Improvement:
 - When the system meets all the functional and non functional requirements additional could further enhance the user experience.
 - Integration with third party services like SMS notifications or mobile app support can broaden the systems scope.

The result confirms that the Attendance Management System meets the needs of modern educational institution by aproviding unified, efficient, and reliable platforms for attendance management system.

4.4 Summary

This chapter has focused on the implementation processes of the Attendance Management System, the strategies of testing, the method of evaluation, and the result achieving during the development phase of the application. It details the integration of the frontend with the backend and external service like the Facerecognition library and JWT-based authentication.

The final section of this chapter confirms the stability, security and efficiency of this system. A number of tests including unit testing, integration testing, system testing, and user acceptance testing are conducted to ensure that all functions work as those are expected. Challenges resolved during testing were resolved resulting with a reliable and user friendly system which meets the needs of a modern educational institution.

Chapter 5

Engineering Standards and Design Challenges

5.1 Compliance with the Standards

Compliance with engineering standards ensures the development of the Attendance Management System to industry best practices by promoting reliability, security and compatibility. The project follows well established software, hardware and communication standard to deliver a user friendly system.

These standards ensure consistency across various components and enable seamless integration with third party services like the Face Recognition Library and JWT authentication. By adhering these guidelines, the system gains high performance, scalability, user satisfaction. More details on the specific standards are discussed in the following subsections.

5.1.1 Software Standards

The development of Attendance Management System adheres to the widely recognized software standards ensuring quality, reliability, maintainability. Key standards that are followed include :

1. Coding Standards:
 - The project followed PEP 8 guidelines for consistent Python code styling and error detection during backend development.
 - Modular and reusable code practices were adopted in both the React.js frontend and the Django REST Framework backend to ensure maintainability and scalability.
 - Meaningful variable and function naming conventions were implemented to improve code readability and understanding.
2. Security Standards:
 - Secure communication was established using JWT-based authentication to protect sensitive user data during client-server interactions.
 - Passwords and sensitive data were encrypted and stored securely in the database following best practices.
3. API Standards:
 - RESTful API principles were implemented using Django REST Framework for consistency in resource naming and proper use of HTTP methods (GET, POST, PUT, DELETE).

- APIs returned well-structured JSON responses with appropriate HTTP status codes for error handling and success notifications.
4. Database Standards:
 - MySQL was designed with a clear and normalized schema structure to avoid redundancy and optimize data retrieval.
 - Proper use of indexing and unique constraints was implemented to enhance performance and maintain data integrity.
 5. UI/UX Standards:
 - The frontend design followed modern UI/UX principles to ensure accessibility and responsiveness across devices using Bootstrap.
 - Consistent design patterns, navigation flows, and feedback mechanisms (e.g., form validations, notifications) enhanced the user experience.
 - W3C guidelines were considered for cross-browser compatibility and responsive design.

By adhering to these standards, the implementation of the Attendance Management System resulted in a secure, efficient, and user-friendly application. It ensures compliance with industry best practices while meeting the project's requirements.

5.1.2 Hardware Standards

The development and deployment of the Attendance Management System adhered to industry-recognized hardware standards to ensure compatibility, performance, and scalability. The following hardware considerations were applied:

1. Development Environment:
 - Development workstations met modern hardware requirements, including a minimum of 8 GB RAM, Intel Core i5 processor, and SSD storage, to support tools like React.js, Django REST Framework, and MySQL during the development process.
2. Server Requirements:
 - The backend server hosting the Django REST Framework application required cloud infrastructure compatible with Linux-based operating systems, with at least 2 vCPUs, 4 GB RAM, and scalable storage options to handle database operations and API requests efficiently.
3. Database Hosting:
 - A cloud-hosted MySQL instance was used for database hosting, providing high availability, auto-scaling, and compliance with data center standards such as ISO 27001 and SOC 2 for secure storage and retrieval of attendance and user data.
4. Network Infrastructure:
 - Hosting servers were connected to high-speed, reliable networks with low-latency connections to support real-time communication between the client and server.
5. End-User Devices:
 - The application was optimized to run on devices adhering to common consumer hardware standards, such as smartphones, tablets, and desktops, with modern browsers and an active internet connection.

By following these hardware standards, the Attendance Management System ensured that the system could run efficiently in both development and production environments while providing a seamless experience for end users. These considerations also contributed to the system's scalability and compatibility across various platforms.

5.1.3 Communication Standards

The development and operation of the Attendance Management System adhered to widely recognized communication standards to ensure secure, efficient, and reliable data exchange between components and external systems. The following standards were implemented:

1. HTTP/HTTPS Protocols:
 - Communication between the client and server, as well as external APIs (e.g., Face-Recognition Library), was conducted over HTTPS, ensuring encrypted and secure data transmission.
 - Standard HTTP methods (GET, POST, PUT, DELETE) were used consistently in RESTful API design, adhering to protocol conventions.
2. JSON Format:
 - All client-server interactions were standardized using JSON (JavaScript Object Notation) as the data interchange format, enabling lightweight, human-readable, and easily passable communication.
3. Authentication and Authorization:
 - Secure token-based communication was achieved using JWT (JSON Web Tokens), ensuring that only authenticated users could access protected resources.
 - Tokens were passed through the HTTP headers as per standard practices.
4. Email Communication (Future Scope):
 - While not implemented in the current version, the system is designed to integrate SMTP (Simple Mail Transfer Protocol) for delivering email notifications in future iterations.
 - Standard email headers and MIME formats will be employed to ensure compatibility with all major email clients.
5. Error Handling and Status Codes:
 - HTTP status codes were consistently used to indicate the outcome of API requests (e.g., 200 for success, 401 for unauthorized access, 500 for server errors).
 - Detailed error messages were included in API responses to assist in debugging and enhance the developer experience.

By adhering to these communication standards, the Attendance Management System ensured secure, consistent, and seamless interactions between its components, external services, and end users.

5.2 Impact on Society, Environment and Sustainability

This section shows the greater implications of the Attendance Management System on society, environment and sustainability. It highlights that how the platform influences educational institutions, boosts efficiency and accessibilities addressing challenges in traditional attendance management system. Additionally this section examines ethical consideration and sets a sustainability plan ensuring that the systems impact remains positive and good in the long term. Through this discussion this section demonstrates how the Attendance Management System suits with social needs along with global sustainability goals.

5.2.1 Impact on Life

The development and deployment of Attendance Management System has a great impact on the lives of teachers, students and administrators by addressing several challenges with traditional attendance management system. By proposing an automated platform for attendance marking, course management, reporting the system significantly improves the convenience, accessibility and accuracy of attendance processes.

Empowering Teachers

The system gifts teachers a seamless way to manage attendance and courses. By automating attendance through face recognition, the platform saves time reducing errors. Teachers get benefit from features like detailed attendance reports, notifications and secure access.

- **Time Savings:** Marking attendance is more effective and time saving rather than the traditional way.
- **Enhanced Confidence:** Accurate attendance records build trust and confidence in the system.
- **Improved Accessibility:** The user-friendly design ensures that teachers of all technical abilities can benefit from the platform.

Supporting Administrators

- **Increasing Visibility:** Administrators can access real-time attendance data for better oversight.
- **Enabling Growth:** The system provides insights into attendance trends, helping institutions improve student engagement.

Fostering Educational Opportunities

The Attendance Management System boosts educational growth by fulfilling the gap between technology and traditional classroom practices. By ensuring institutions to adopt modern attendance solutions the platform promotes efficiency and innovation in the education system. This has a ripple effect improving the overall learning environment along with fostering a culture of accountability.

5.2.2 Impact on Society & Environment

The revolution of the Attendance Management System brings significant positive impacts on society and the environment by promoting efficiency, improving accessibility and enabling sustainable solution. Automating attendance processes and reducing reliance on paper based systems the platform influences social dynamics and environmental awareness.

Impact on Society

1. Promoting Efficiency in Education:
 - The system provides a platform for teachers and administrators to manage attendance efficiently.
2. Improving Accessibility:
 - The platforms user friendly interface ensures teachers and administrators from diverse technical backgrounds can access and utilize its services effectively.
 - Features like detailed reports notifications make attendance management more inclusive and accessible for users specific needs.

Impact on the Environment

1. Reducing Paper Waste:
 - Digitalizing the entire attendance management process the system eliminates the need for paper based attendance registers and reports, reducing the environmental footprint of educational institutions.
2. Promoting Awareness:
 - Through its communication channels the system can educate users about the benefits of adopting digital solution like minimizing waste and conserving resources.
3. Encouraging Sustainable Practice:
 - The system enables institutions to adopt eco friendly practices by reducing their reliance on traditional resource intensive methods of attendance management.

5.2.3 Ethical Aspects

5.2.4 Sustainability Plan

5.3 Project Management and Financial Analysis

This section explores a structured management of Attendance Management System project emphasizing the importance of planning, resource allocation, risk assessment and financial analysis. Following a systematic approach the project aims to improve efficiency in attendance management enhancing user satisfaction for teachers and administrators along with optimize resources for educational institutions.

5.3.1 Project Management

Table 5.1 : Project Management table .

Feature	Input	Output
User Registration and Verification	User details (Name, email, password).	Registered user profile with secure login credentials.
Dashboard	User login with username and password.	Personalized dashboard displaying assigned courses and key information.
Attendance Marking	Captured student images via webcam.	Attendance records marked as "Present" or "Absent" for each student.
Attendance Reports	Teacher requests attendance reports for a course.	Downloadable attendance reports in Excel format.
Course Management	Teacher inputs course details and student enrollments.	Organized course data with assigned students and teachers.
Notifications	System-generated updates and reminders.	Notifications sent to teachers and administrators.
Face Recognition	Student photos and real-time webcam input.	Automated attendance marking based on face recognition.
Others	Feedback and suggestions from users.	Improved system features and user experience.

5.3.2 Financial Analysis

The financial analysis for the Attendance Management System outlines the time and effort required for each task. Since this project does not involve monetary costs, the "Cost Estimate" column is left blank. The table below provides an overview of the tasks, their duration, priority, and estimated hours of work.

Table 5.2: Financial Analysis.

Task Name	Duration	Priority	Hours Time	of	Cost Estimate (Taka)
Project Scope Definition	2 weeks	High	40 hours		2000
Risk Identification and Mitigation	1 week	Medium	20 hours		2000
Feasibility Study	3 weeks	High	70 hours		2000
Resource Plan	2 weeks	High	30 hours		2000
Cost Estimation	3 weeks	High	75 hours		2000
Cost-Benefit Analysis	5 weeks	High	55 hours		2000
Design	4 weeks	High	75 hours		5000
Development	7 weeks	High	95 hours		7000
Testing	6 weeks	High	60 hours		3000
Deployment and Launch	2 weeks	High	34 hours		2000
Continuous Improvement	Ongoing	Low	Ongoing		1000

Notes

- The project was developed independently, so no external costs were incurred.
- Tasks such as "Continuous Improvement" and "Marketing and Promotion" are not applicable in this project as it is a standalone academic system.
- The focus was on time management and efficient resource allocation to ensure the successful completion of the project.

5.4 Complex Engineering Problem

5.4.1 Complex Problem Solving

The development of the Attendance Management System involved addressing real-life complex engineering problems by adhering to various categories of problem-solving. Each mapping is detailed below with a rationale for how it applies to the project and is referenced within the report.

Table 5.3: Mapping with Complex Problem Solving

EP1 Depth of Knowledge	EP2 Range of Conflicting Requirements	EP3 Depth of Analysis	EP4 Familiarity of Issues	EP5 Extent of Applicable Codes	EP6 Extent of Stakeholder Involvement	EP7 Interdependence
✓	✓	✓	✓		✓	✓

EP1: Depth of Knowledge

Rationale: The project required an in-depth understanding of multiple domains, including frontend development using React.js, backend technologies like Django REST Framework, and database management with MySQL. Additionally, integrating the Face-Recognition Library demanded advanced knowledge of image processing and API communication. These aspects are extensively discussed in Sections 3.1 (Requirement Analysis and Design Specification) and 3.2 (Detailed Methodology and Design).

EP2: Range of Conflicting Requirements

Rationale: Balancing the needs of diverse user roles (e.g., teachers and administrators) required resolving conflicting requirements. For example:

Teachers required simplicity in attendance marking, while administrators needed detailed reports and data management tools.

These conflicts were resolved through role-based dashboards and a modular design approach, as detailed in Sections 3.1.3 (Functional Requirements) and 3.1.9 (UI Design).

EP3: Depth of Analysis

Rationale : Developing Attendance Management System required selecting a suitable implementation model as there is no obvious solution existed for integrating face recognition, attendance marking and reporting into one platform. After observing multiple approaches a modular architecture was chosen as discussed in Section 3.2.

Technologies like Django REST Framework and React.js were selected for ability to handle dynamic , interconnected functionalities. The methodology detailed in Section 3.2 ,highlights that how these tools were combined to address complex system requirements efficiently.

EP4: Familiarity of Issues

Rationale : Developing Attendance Management System required selecting a suitable implementation model as there is no obvious solution existed for integrating face recognition, attendance marking and reporting into one platform. After observing multiple

approaches a modular architecture was chosen as discussed in Section 3.2.

Technologies like Django REST Framework and React.js were selected for ability to handle dynamic , interconnected functionalities. The methodology detailed in Section 3.2 ,highlights that how these tools were combined to address complex system requirements efficiently.

EP6: Extent of Stakeholder Involvement

Rationale : The development involves extensive collaboration with users, including teachers and administrators to gather requirements for the system. Feedback during User Acceptance Testing was instrumental in improving the application as outlined in Section 4.2 . Stakeholders actively participated in requirement analysis UAT phases to be sure that the system aligned with the user expectations.

EP7: Interdependence

Rationale : This project features high interdependence within components such as the frontend, backend and external systems like the face recognition module. Each module has to function seamlessly with others, requiring robust integration and testing as demonstrated in Sections 3.2 and 4.2.

Interdependence is managed using modular architecture testing to ensure consistent data flow and functionality.

Mapping with Knowledge Profile for EP1

Table 5.4: Mapping with Knowledge Profile.

K3 Engineering Fundamentals	K4 Specialist Knowledge	K5 Engineering Design	K6 Engineering Practice	K8 Research Literature
✓	✓	✓	✓	✓

K3: Engineering Fundamentals

Rationale: Fundamental programming skills and system design principles were applied in creating efficient algorithms for attendance marking and reporting functionalities. This is discussed in Section 3.1.2 (System Design).

K4: Specialist Knowledge

Rationale: Specialized knowledge of web development frameworks (React.js) and third-party integrations (Face-Recognition Library) was essential. This is detailed in Section 3.1.3 (Functional Requirements).

K5: Engineering Design

Rationale: The project employed structured engineering design methodologies such as system architecture, data flow diagrams, context diagrams, sequence diagrams, and ER diagrams to create scalable and maintainable solutions. These are covered in Section 3.1 (Requirement Analysis and Design Specification).

K6: Engineering Practice

Rationale: Best practices in software development, including modular coding, secure authentication, and scalable deployment, were implemented. These are discussed in Section 4.1 (Environment Setup).

K8: Research Literature

Rationale: The design and implementation were informed by research into existing attendance systems, identifying gaps and opportunities for improvement. This is covered in Section 2.2 (Literature Review).

5.4.2 Engineering Activities

In The implementation of the Attendance Management System involved multiple complex engineering activities, each mapped to critical aspects of engineering practices. These mappings highlight how the project addressed challenges and contributed to solving real-world problems.

Table 5.5: Mapping with Complex Engineering Activities

EA1 Range of Resources	EA2 Level of Interaction	EA3 Innovation	EA4 Consequences for Society and Environment	EA5 Familiarity
✓	✓		✓	✓

5.5 Summary

This chapter has provided a comprehensive overview for the engineering standards and design challenges that addressed during the development of the Attendance Management System. It details the projects adherence to software, hardware and communication standards ensuring quality, security and reliability. These standards formed the foundation for a robust system meeting both the technical and the user requirements.

The chapter also explored the broader of societal, environmental and ethical impacts of the project. The System contributes positively to the society by improving efficiency in attendance management reducing manual errors and enhancing user experiences for teachers and administrators. Environmental-sustainability was improved through this attendance processes reducing paper waste and optimizing resource utilization. Ethical considerations such as data privacy and inclusivity were integral to the systems design.

The project management and financial analysis section outlined a structured approach to resource allocation, task management and risk mitigation ensuring the projects success within the defined timeline. Additionally the chapter addressed complex engineering problems showcasing the depth of analysis, innovative solutions and the application of engineering principles to bridge knowledge gaps between computer science and the education domain.

Finally the engineering activities here mapped the projects key processes highlighting the effective use of resources, interaction between components and the systems social and environmental consequences. Overall Chapter 5 demonstrates how the Attendance Management System aligns with professional engineering practices while delivering impactful, sustainable and innovative solutions to real world challenges.

Chapter 6

Conclusion and Future Work

6.1 Summary

This report presents the comprehensive development journey of Attendance Management System a platform designed to automate attendance management processes in educational institutions. The report began by identifying the realworld challenges faced by teachers and administrators emphasizing the need for an efficient and automated solution. It outlined the projects objectives, motivations and anticipated outcomes to provide a clear understanding of the systems purpose and goals.

The report details the methodologies, engineering standards and design challenges addressed during the development process. It also highlighted the systems impact on society and the environment showcasing how it improves efficiency, reduces manual errors and promotes sustainability by digitizing attendance records. Finally the projects management and financial aspects were discussed, providing insights into resource allocation, risk mitigation and overall execution. By aligning with industry standards and addressing real world challenges the Attendance Management System demonstrates its potential as a transformative tools for modern educational institutions delivering meaningful value to teachers, administrators and students alike.

6.2 Limitation

While the Attendance Management System successfully integrates face recognition technology and automates attendance processes a few limitations were identified during development and implementation:

Limited Scalability for Large Institutions:

The system is designed to handle moderate user loads but its performance under extremely high concurrent usage has not been thoroughly tested and may require further optimization.

Dependency on High-Quality Photos:

The accuracy depends on the photo quality. Poor quality or outdated photos may reduce the systems effectiveness.

Limited Analytics Features:

While basic attendance reports are provided, advanced analytics such as attendance trends or predictive insights are not yet implemented.

No Mobile App Integration:

The system currently lacks a dedicated mobile application which could improve accessibility for teachers and administrators.

Initial Adoption Challenges:

Being a new system it may face challenges in adaptation due to lack of familiarity with automated attendance solutions. These limitations provide opportunities for improvement and future enhancements to ensure the system continues to evolve to meet the needs of educational institutions.

6.3 Future Work

For further enhancement, Attendance Management System address its current limitations several future directions have been identified. These improvements aim to expand the systems functionality, scalability and user experience to ensure its continued growth and relevance in the education sector.

Advanced Analytics and Insights:

Incorporate features like attendance trends, predictive analytics detailed visualizations to help administrators make data driven decisions.

Mobile App Development:

Develop a mobile application to allow teacher to manage attendance more easily.

Enhanced Scalability:

Implement load balancing techniques optimizing database queries to support high user traffic and ensure consistent performance under peak loads.

Integration with Learning Management Systems :

Integrate the system with popular LMS platform to provide unified solution for attendance and course management.

Offline Access and Data Sync:

Adding offline functionality to allow teachers to mark attendance without an internet connection with automatic syncing once reconnected.

Improved Face Recognition Accuracy:

Enhance the face recognition module by incorporating advanced algorithms to improve accuracy even with low quality photos.

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