



# **CLASSROOM AUTOMATIC ATTENDANCE SYSTEM PROJECT REPORT**

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# PROJECT CONTENTS

## 1. Main Sections (EPICs)

- 1.1 EPIC 1 - System Requirements & Analysis
- 1.2 EPIC 2 - Database Analysis & Setup
- 1.3 EPIC 3 - Student Registration & Photo Process
- 1.4 EPIC 4 - Course & Classroom Management
- 1.5 EPIC 5 - Camera & Classroom Setup
- 1.6 EPIC 6 - Attendance Session & Recognition Flow
- 1.7 EPIC 7 - Teacher Approval & Manual Adjustment
- 1.8 EPIC 8 - Reporting & Semester Archive
- 1.9 EPIC 9 - Privacy, Access, and Data Retention Policies
- 1.10 EPIC 10 - Testing & Evaluation
- 1.11 EPIC 11 - Deployment & Maintenance

## 2. Database Design

- 2.1 ERD Description

## 3. Sequence Diagrams

- 3.1 Student Registration Sequence
- 3.2 Camera Setup Sequence
- 3.3 Attendance Session Sequence

## 4. Use Case Diagram

- 4.1 Use-Case Diagram Description

## 5. Page Designs

- 5.1 Login Page
- 5.2 Teacher Dashboard Page
- 5.3 Students Page
- 5.4 Courses & Classrooms Page
- 5.5 Camera & Classroom Setup Page
- 5.6 Attendance Sessions Page
- 5.7 Reports & Semester Archive Page

## 6. Database Development

- 6.1 Database Storage and Management Environment
- 6.2 Database Tables Description

# **Classroom Automatic Attendance System**

**Requirements Analysis Document - Main Sections (EPICs)**

**EPIC 1 - System Requirements & Analysis**

**EPIC 2 - Database Analysis & Setup**

**EPIC 3 - Student Registration & Photo Process**

**EPIC 4 - Course & Classroom Management**

**EPIC 5 - Camera & Classroom Setup**

**EPIC 6 - Attendance Session & Recognition Flow**

**EPIC 7 - Teacher Approval & Manual Adjustment**

**EPIC 8 - Reporting & Semester Archive**

**EPIC 9 - Privacy, Access, and Data Retention Policies**

**EPIC 10 - Testing & Evaluation**

**EPIC 11- Deployment & Maintenance**

## 1. System Requirements & Analysis

**Story:** Functional Requirements Definition

-**Subtask:** Prepare a *Functional Requirement Specification (FRS)* document describing user actions, system features, and data interactions.

**Story:** Non-Functional and System Constraints Analysis

-**Subtask:** Document *Non-Functional Requirements (NFR)* including performance, security, reliability, and scalability constraints.

## 2. Database Analysis & Setup

**Story:** Define Conceptual Database Design

-**Subtask:** Identify the main entities, attributes, and relationships required for the system before creating the ERD.

**Story:** Create Initial ERD Diagram

-**Subtask:** Create a structured list of entities, attributes, and relationship notes to be used as the ERD blueprint.

## 3. Initial System Foundations

**Story:** Database Development Setup

-**Subtask:** Create essential tables, relationships, and constraints according to the planned database model.

**Story:** Create Initial Application Screen Designs

-**Subtask:** Create basic wireframes and layouts for main screens such as login, dashboard, and attendance pages.

## 4. Course & Classroom Management

**Story:** Course Management Module

-**Subtask:** Develop CRUD (Create, Read, Update, Delete) operations for course data management..

**Story:** Classroom Assignment System

-**Subtask:** Build the classroom assignment feature; the system should automatically update timetables when changes occur.

## 5. Camera & Classroom Setup

**Story:** Camera Installation and Linking

-**Subtask:** Link each camera to its respective classroom and validate network accessibility.

**Story:** Camera Monitoring Dashboard

-**Subtask:** Build a real-time dashboard for monitoring camera status and live feed availability.

## 6. Attendance Session & Recognition Flow

**Story:** Automatic Attendance Session

-**Subtask:** Implement triggers to start and end attendance sessions based on class schedules.

**Story:** Face Recognition Attendance Flow

-**Subtask:** Integrate the face recognition module to automatically identify students and mark attendance.

## 7. Teacher Approval & Manual Adjustment

**Story:** Attendance Review Module

-**Subtask:** Create a user interface for teachers to review and confirm recognized attendance records.

**Story:** Manual Attendance Adjustment

-**Subtask:** Provide functionality for teachers to manually correct attendance errors or missing entries

## **8. Reporting & Semester Archive**

### **Story:** Attendance Reporting Module

-**Subtask:** Generate attendance reports by student, course, and semester.

### **Story:** Semester Archive System

-**Subtask:** Develop a system to archive and export attendance data at the end of each term.

## **9. Privacy, Access, and Data Retention Policies**

### **Story:** Data Privacy Control

-**Subtask:** Define and implement role-based access control for teachers, administrators, and system operators.

### **Story:** Data Retention & Deletion Policy

-**Subtask:** Add an automatic cleanup and secure data deletion mechanism after the retention period.

## **10. Testing & Evaluation**

### **Story:** System Integration Testing

-**Subtask:** Conduct integration tests between modules and document test results.

### **Story:** Performance & Accuracy Evaluation

-**Subtask:** Measure face recognition accuracy, system response time, and performance metrics; compile results into a report.

## **11. Deployment & Maintenance**

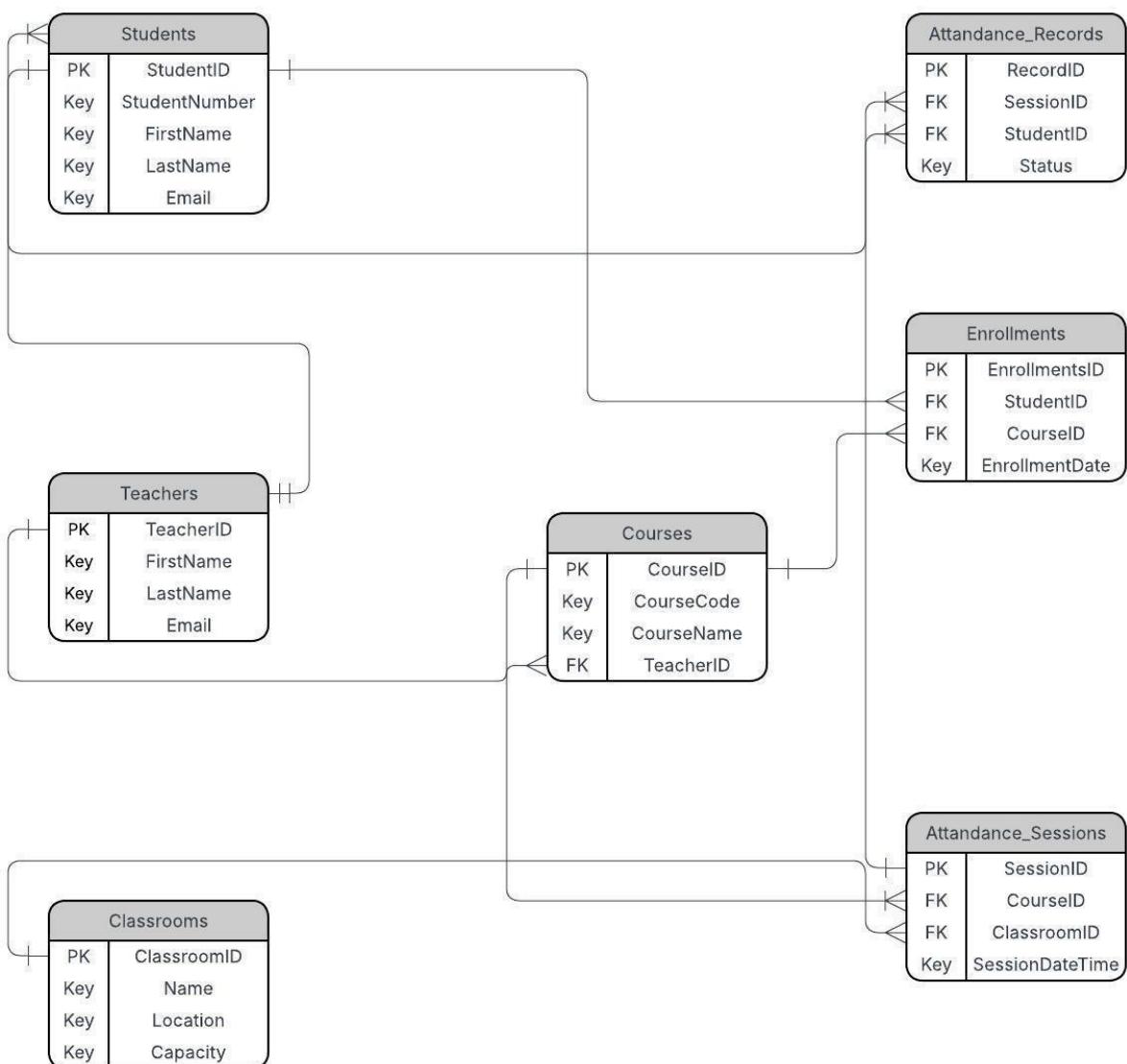
### **Story:** System Deployment & Environment Setup

-**Subtask:** Deploy the system, configure environment variables, and verify installation integrity.

### **Story:** System Maintenance & Update

**-Subtask:** Schedule regular maintenance, monitor system performance, and apply software updates.

## 2. Data Base Design



## 2.1 ERD Description

### 1. Students

- Stores student information such as ID, name, and email.
- Connected to **Enrollments** (courses they take).
- Linked to **Attendance\_Records** (their attendance per session).

### 2. Teachers

- Holds teacher identity and contact information.
- Each teacher is responsible for multiple **Courses**.

### 3. Courses

- Defines course details, including code and name.
- Each course is taught by one **Teacher**.
- Linked to:
  - **Enrollments** (students registered)
  - **Attendance\_Sessions** (scheduled attendance events)

### 4. Classrooms

- Contains physical classroom details such as name, location, and capacity.
- Each **Attendance\_Session** occurs in one classroom.

### 5. Enrollments

- Resolves the many-to-many relationship between **Students** and **Courses**.
- Indicates which student is registered in which course.

## **6. Attendance\_Sessions**

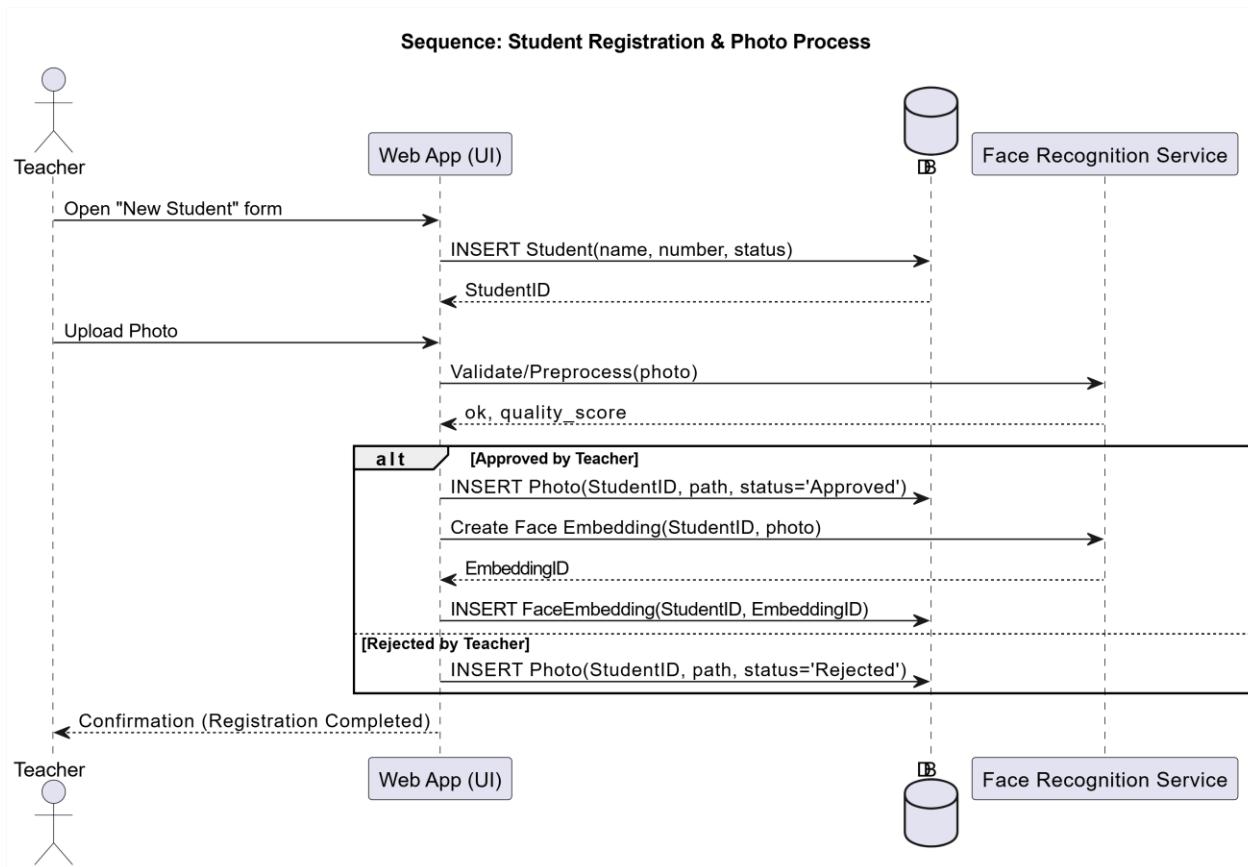
- Represents scheduled attendance sessions for a course.
- Linked to:
  - One Course
  - One Classroom
- Each session produces multiple **Attendance\_Records**.

## **7. Attendance\_Records**

- Stores the attendance status (present/absent) for each student in each session.
- Links:
  - One Student
  - One Attendance\_Session

# 3. Sequence Diagram

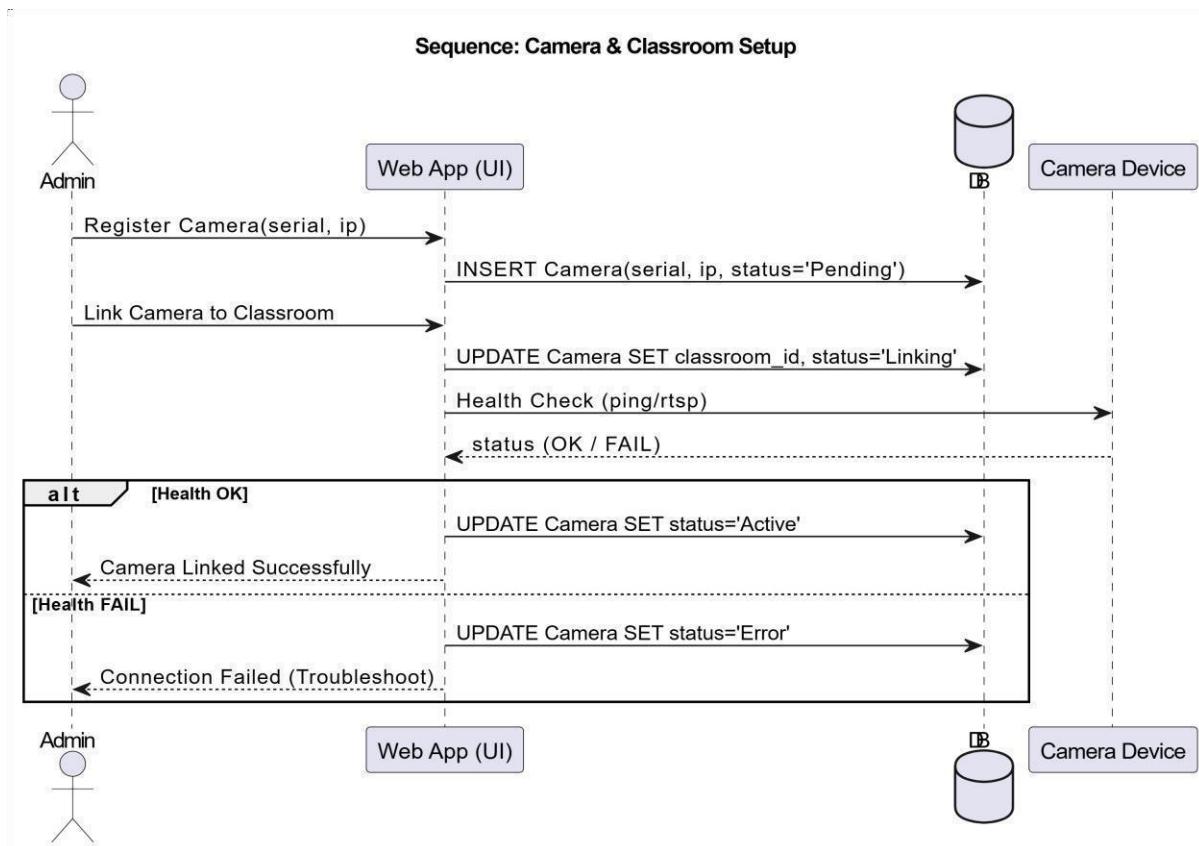
## 3.1 Sequence Diagram (Student Registration & Photo Process)



### Description:

- This workflow describes how a *teacher* adds a new student, uploads a photo, and interacts with the face recognition service.
- It focuses on the **registration** stage before attendance begins.
- **Goal:** Prepare accurate student data for later recognition.

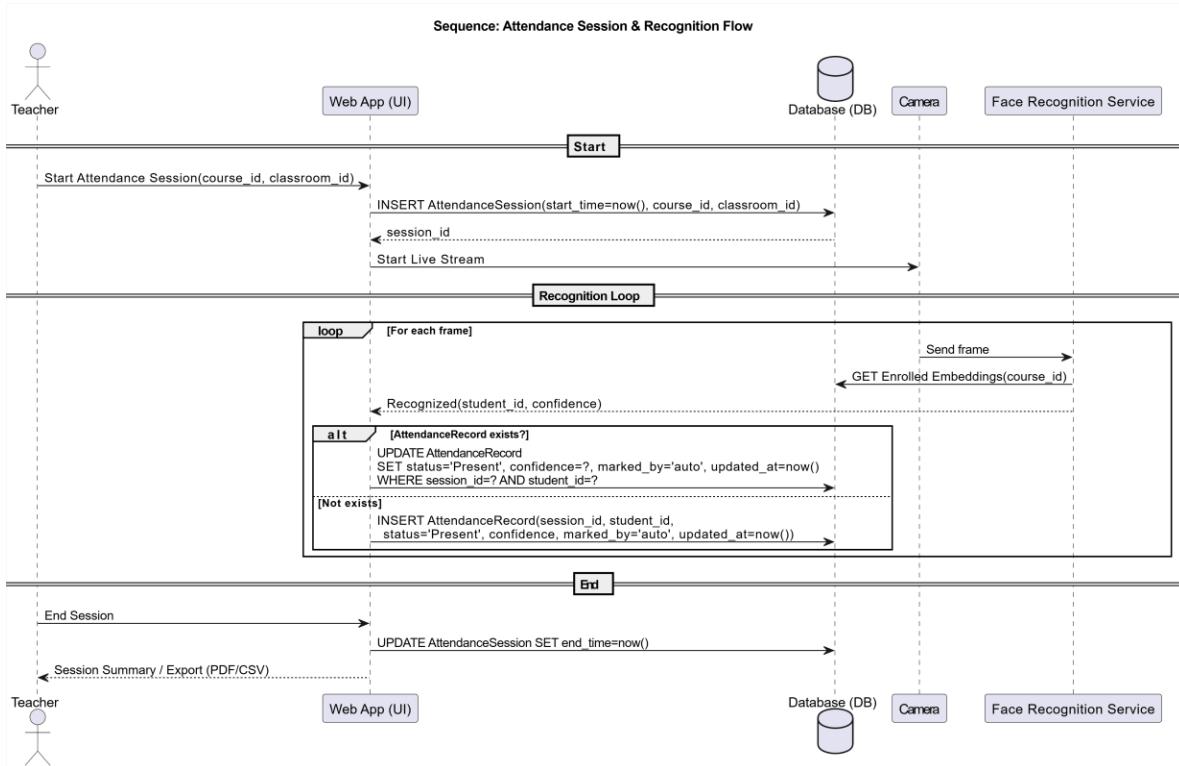
### 3.2 Sequence Diagram (Camera & Classroom Setup)



#### Description:

- This workflow shows how the *admin* installs and links cameras to classrooms.
- It's a completely different process – involves hardware checks and configuration, not student data.
  - **Goal:** Make sure the physical camera system is connected and ready to record sessions.

### 3.3 Sequence Diagram (Attendance Session & Recognition Flow)

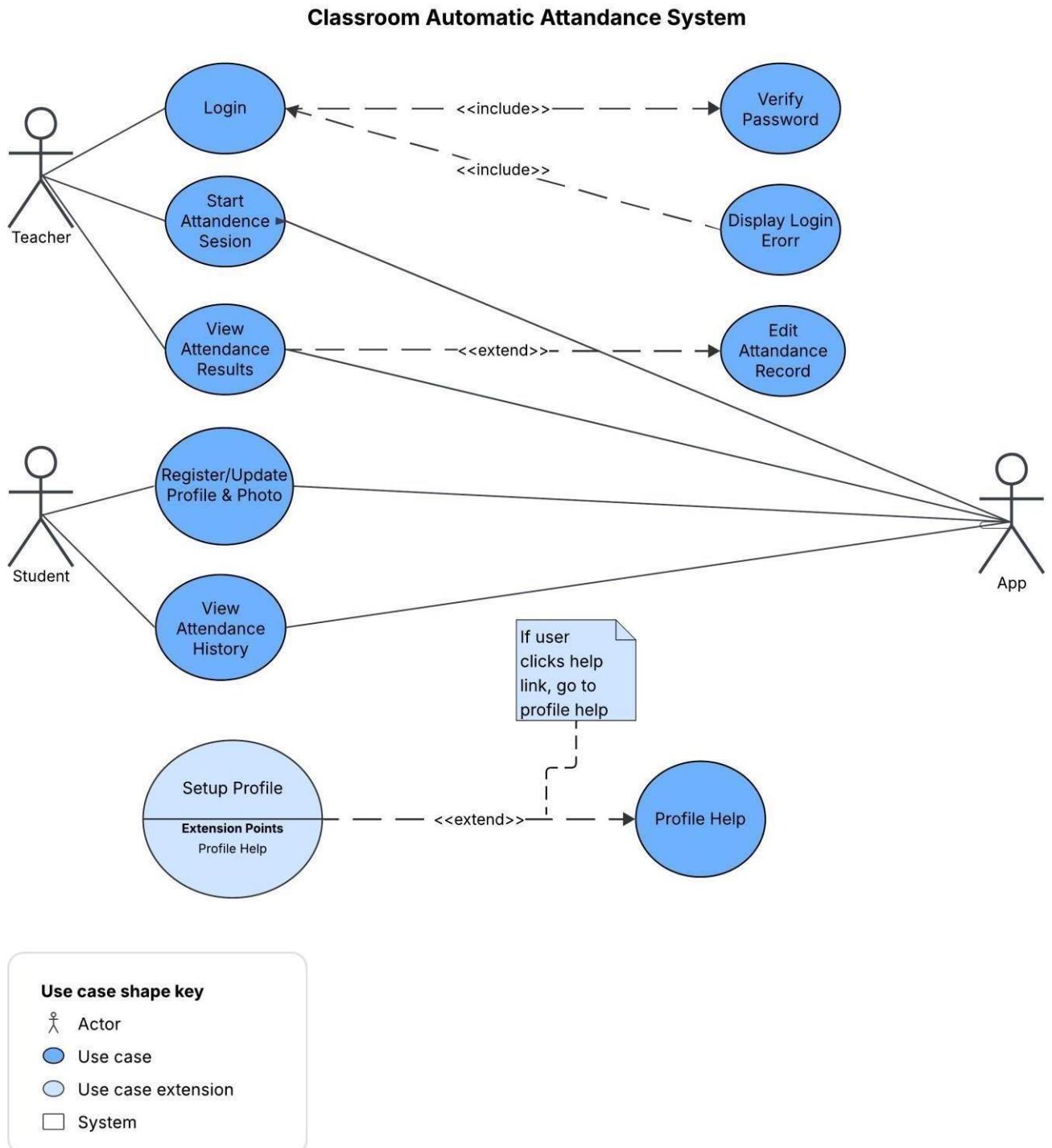


#### Description:

- This is the main **operational phase** – where the teacher starts a session, the camera streams video, and the recognition service marks attendance.
- It depends on the previous two processes but runs as a separate daily routine.

**Goal:** Automatically detect students and record attendance.

# 4. Use Case Diagram



## 4.1 Use-Case Diagram Description

This use-case diagram shows the main interactions in the *Classroom Automatic Attandance System*. **Teacher** and **Student** perform core actions such as logging in, managing profiles, starting attendance sessions, and viewing results or history. The **App** supports the system by handling automated tasks and optional extensions like login

validation, error display, editing attendance records, and profile help. The diagram highlights mandatory steps using **include** and optional behaviors using **extend** relationships.

## <<include>> — Role in the Diagram

In the diagram, <<include>> is used to show **required sub-actions** that must occur as part of the main use case.

For example, the **Login** use case always includes **Verify Password**, and may include **Display Login Error** when needed.

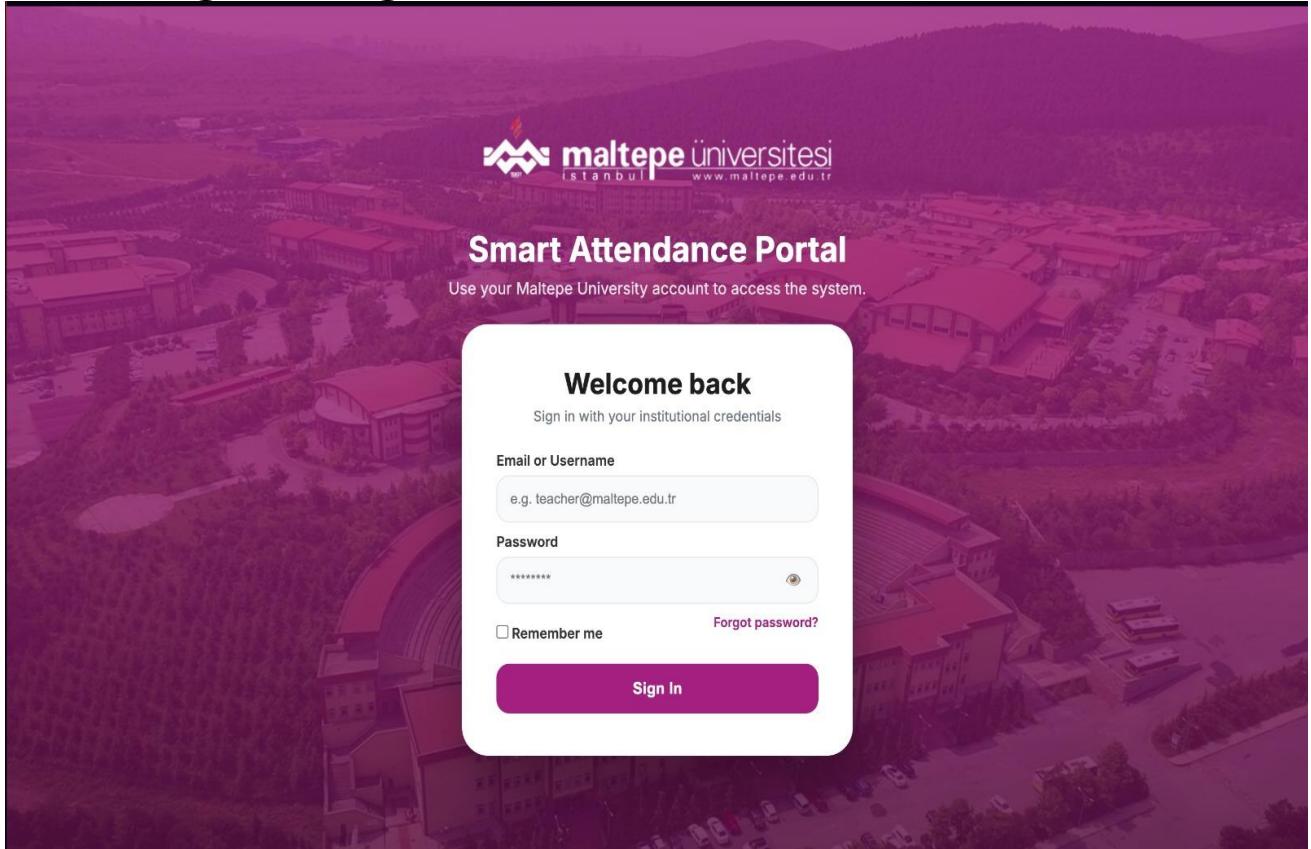
## <<extend>> — Role in the Diagram

In the diagram, <<extend>> is used to show **optional or additional actions** that can be triggered depending on specific conditions within the main use case.

For example, **View Attendance Results** can be extended with **Edit Attendance Record**, and **Setup Profile** can be extended with **Profile Help** if needed.

# 5. Page Designs

## 5.1 Login Page



### Description:

The Login Page allows teachers to securely sign in with their Maltepe University

credentials. It provides a clean interface with username and password fields, a “Remember me” option, and a modern layout styled with the university’s colors.

## 5.2 Teacher Dashboard Page

The screenshot displays the Teacher Dashboard interface. At the top left is the Maltepe Universities logo. To the right are user profile icons for 'Emre Olca' and a 'Logout' button. On the far left, a sidebar titled 'Attendance System' lists navigation options: Dashboard, Students, Courses & Classrooms, Cameras, Attendance Sessions, and Reports. The main content area is divided into several sections: 'Student Registration' (Add new students and upload photos, with a '+ New Student' button), 'Courses & Classrooms' (Manage courses and classroom assignment, with an 'Open Course List' button), 'Camera & Classroom Setup' (Link cameras to classrooms, with an 'Open Camera Panel' button), 'Attendance Session & Recognition' (Select course and classroom, then start automatic attendance. Fields show 'Course: CS101', 'Classroom: A-201', and a 'Start Attendance Session' button. Below are 'Camera preview / live feed' and 'Live Attendance' sections listing student presence: 'Hakki Dökmecl — Present' and 'Berkay Aksoy — Present'), and 'Reports & Semester Archive' (View attendance reports by course and student, with a progress bar and text: 'CS101 — 92% average attendance' and 'MAT102 — 85% average attendance', and an 'Open Reports' button).

### Description:

The Teacher Dashboard serves as the central control panel for instructors, providing quick access to all core features of the Smart Attendance System. From this interface, teachers can navigate to student management, course and classroom settings, camera setup, attendance sessions, and reporting tools. The dashboard offers an organized overview that helps instructors efficiently manage daily academic tasks and monitor classroom activities.

## 5.3 Students Page

The screenshot shows the 'Students' page of the Maltepe Üniversitesi Attendance System. The left sidebar includes links for Attendance System, Dashboard, Students (which is highlighted in pink), Courses & Classrooms, Cameras, Attendance Sessions, and Reports. The main content area has a header 'Student Management' with the sub-instruction 'Manage registered students and their information.' Below this is a search bar 'Search student by name or ID...' and a purple 'Add Student' button. A large central box contains two sections: 'Students' on the left and 'Selected Student' on the right. The 'Students' section lists several students with their names and IDs: Hakkı Dökmevi (ID: 220706026), Berkay Aksoy (ID: 220706027), Student A (ID: 220706010), and Student B (ID: 220706011). The 'Selected Student' section shows detailed information for Hakkı Dökmevi: Name (Hakkı Dökmevi), Student ID (220706026), Program (Computer Engineering), and Average Attendance (96%). It also features 'View Attendance' and 'Remove Student' buttons.

### Description:

The Students Page allows instructors to view and manage all registered students in the system. It provides a searchable list of students and displays detailed information—such as program, student ID, and attendance performance—for the selected student. This interface helps teachers quickly access student data and monitor academic participation.

## 5.4 Courses & Classrooms Page

The screenshot shows the 'Courses & Classrooms' management interface. On the left sidebar, under 'Attendance System', there are links for Dashboard, Students, Courses & Classrooms (which is highlighted in blue), Cameras, Attendance Sessions, and Reports. The main content area has a header 'Course & Classroom Management' with a sub-instruction 'Define courses, assign classrooms and manage weekly schedules.' Below this, there are two main sections: 'Courses' and 'Selected Course'. The 'Courses' section lists active courses for the semester, including CS101, SE342, MAT102, and AI220. The 'Selected Course' section shows 'CS101 – Introduction to Programming' (Department of Computer Engineering, 3 credits, 2 sessions/week). It includes tabs for 'Classroom Assignment' (Primary Classroom A-201, Capacity: 40, linked camera: CAM-01), 'Weekly Schedule' (Monday: 09:00-10:50 - A-201, Tuesday: No session, Wednesday: 13:00-13:50 - A-201, Thursday: No session, Friday: No session), and 'Enrollment Summary' (Enrolled Students: 32, Max Capacity: 40, Average Attendance: 92%). A tip at the bottom states: 'Tip: Make sure each course has a valid classroom and schedule before creating attendance sessions.'

### Description:

This page allows teachers to manage their courses, assign classrooms, and view weekly schedules. It provides a clear overview of course details, classroom assignments, and student enrollment, helping instructors organize their teaching activities efficiently.

## 5.5 Camera & Classroom Setup Page

The screenshot shows the 'Camera & Classroom Setup' page of the Maltepe Üniversitesi Attendance System. The top navigation bar includes the university logo, teacher name, and logout options. On the left, a sidebar lists 'Attendance System' sections: Dashboard, Students, Courses & Classrooms, Cameras (highlighted in pink), Attendance Sessions, and Reports. The main content area is titled 'Camera & Classroom Mapping' and displays 'Active cameras linked to classrooms'. A table lists three cameras: CAM-01 (A-201, Online, 30 sec ago), CAM-02 (B-105, Offline, 12 min ago), and CAM-03 (Lab-1, Online, 5 min ago). To the right, the 'Selected Camera: CAM-01' is shown with its status (Classroom A-201, IP 10.0.0.21, Status Online) and a placeholder for a live camera preview. Buttons for 'Edit', 'Remove', 'Test Connection', 'Reassign Classroom', and 'Open Fullscreen' are available. A 'Connection Log' section shows recent activity logs.

Camera ID	Classroom	Status	Last Ping
CAM-01	A-201	Online	30 sec ago
CAM-02	B-105	Offline	12 min ago
CAM-03	Lab-1	Online	5 min ago

Selected Camera: CAM-01  
Classroom A-201 • IP 10.0.0.21 • Status Online  
Edit Remove

LIVE  
Live camera preview (placeholder)

Test Connection Reassign Classroom Open Fullscreen

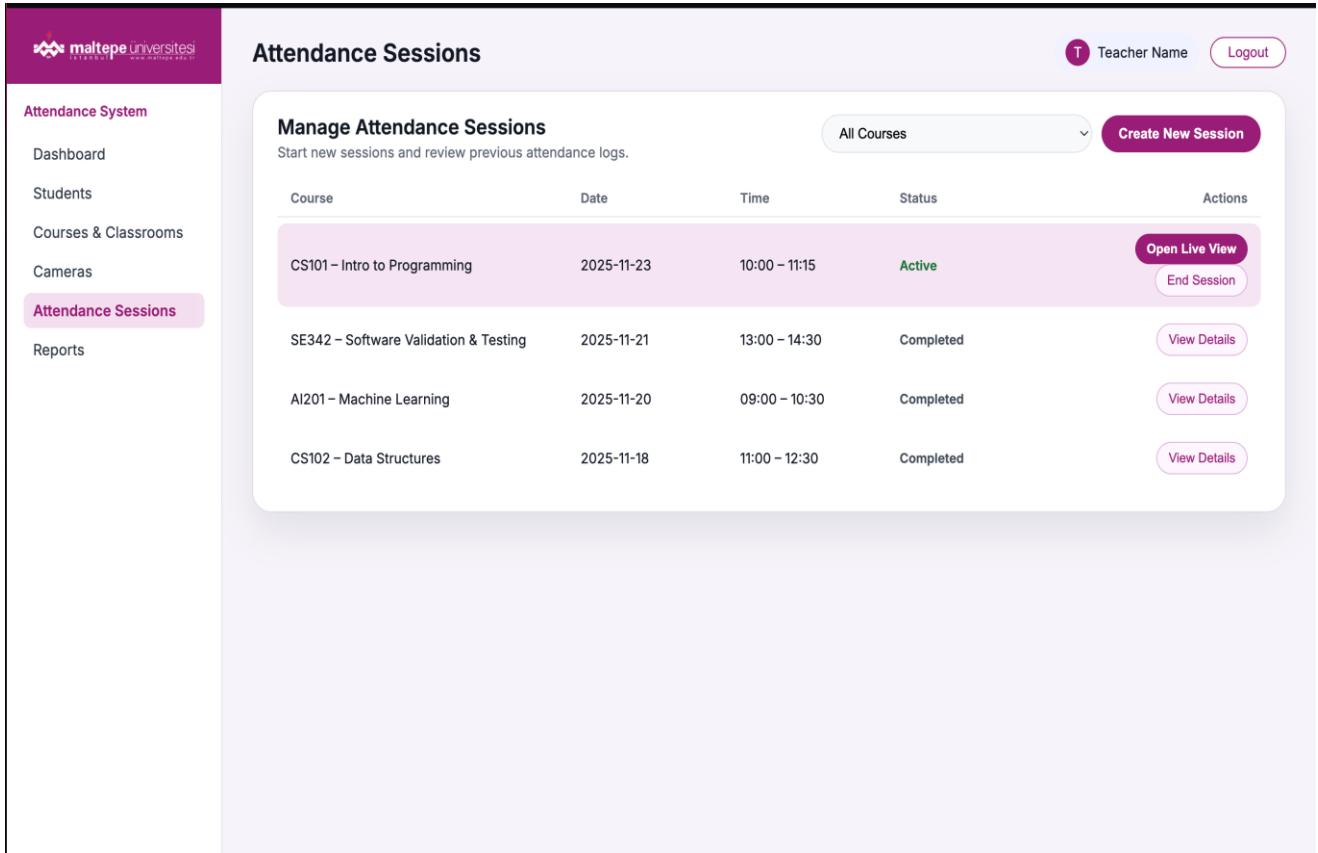
Connection Log

[12:32:10] Ping OK — 45 ms  
[12:31:48] Stream initialized for CAM-01 (A-201)  
[12:30:02] Camera CAM-01 selected by Teacher Name

### Description:

This page allows teachers to manage classroom cameras by monitoring their status, reviewing live previews, and assigning cameras to specific classrooms. It provides tools for testing connections, updating camera links, and viewing real-time activity logs to ensure reliable attendance recording.

## 5.6 Attendance Sessions Page



The screenshot shows the 'Attendance Sessions' page of a web application. The left sidebar has a purple header 'maltepe üniversitesi istanbul www.maltepe.edu.tr' and a menu with 'Attendance System' (Dashboard, Students, Courses & Classrooms, Cameras, **Attendance Sessions**, Reports). The main content area has a title 'Attendance Sessions' with 'Teacher Name' and 'Logout' buttons. A sub-header 'Manage Attendance Sessions' with a dropdown 'All Courses' and a 'Create New Session' button. Below is a table with columns Course, Date, Time, Status, and Actions. Data rows include:

Course	Date	Time	Status	Actions
CS101 – Intro to Programming	2025-11-23	10:00 – 11:15	Active	<a href="#">Open Live View</a> <a href="#">End Session</a>
SE342 – Software Validation & Testing	2025-11-21	13:00 – 14:30	Completed	<a href="#">View Details</a>
AI201 – Machine Learning	2025-11-20	09:00 – 10:30	Completed	<a href="#">View Details</a>
CS102 – Data Structures	2025-11-18	11:00 – 12:30	Completed	<a href="#">View Details</a>

### Description:

The Attendance Sessions Page allows instructors to start new attendance sessions, monitor active sessions, and review completed ones. It provides a structured list of all sessions with details such as course name, date, time, and session status. Teachers can quickly open live camera views, end active sessions, or review past attendance records through this interface.

## 5.7 Reports & Semester Archive Page

Reports & Semester Archive

Teacher Name Logout

Attendance System

- Dashboard
- Students
- Courses & Classrooms
- Cameras
- Attendance Sessions
- Reports

**Attendance Reports**  
View and export course-level and student-level attendance summaries.

Course: CS101 Semester: 2024-2025 Spring View: By Student Export CSV Download PDF

**Overall Attendance**  
**89%**  
Average attendance rate for selected course & semester.

Present	89%
Late	6%
Absent	5%

**At-risk Students**  
Students below the minimum required attendance threshold.

Student A	64%
Student B	68%
Student C	70%

Threshold: 70% minimum attendance.

**Weekly Attendance Trend**  
Attendance percentage per week for the selected course.

Week 1 Week 4 Week 8 Week 12

**Student Attendance Detail**  
Each row shows cumulative attendance for this course.

Student	Student ID	Attendance	Status
Hakki Dökmeçi	220706026	98%	On Track
Berkay Aksoy	220706027	92%	On Track
Student A	220706010	68%	At Risk
Student B	220706011	64%	Critical

Tip: Use the export options above to share attendance summaries with department coordinators.

### Description:

This page provides detailed attendance analytics for each course and semester. Teachers can view overall attendance rates, weekly attendance trends, at-risk students, and individual student records. It also offers export options such as CSV and PDF for sharing attendance summaries with academic departments.



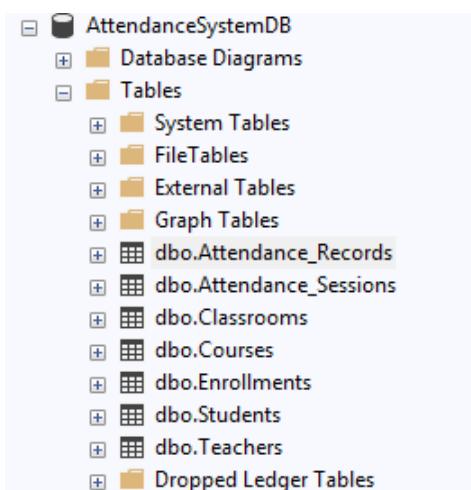


# 6. Database development

The database layer of the system was implemented based on the previously designed ERD (Entity Relationship Diagram). All entities, attributes, relationships, and constraints defined in the ERD were successfully translated into a fully normalized relational database structure using Microsoft SQL Server. The final schema includes seven core tables—Students, Teachers, Courses, Classrooms, Enrollments, Attendance\_Sessions, and Attendance\_Records—ensuring data integrity, scalability, and support for the system's functional requirements.

## 6.1 Database Storage and Management Environment

The database structure designed based on the ERD was successfully created and stored in the Microsoft SQL Server (MSSQL) environment. As shown in the figure, all related tables are organized under the **AttendanceSystemDB** database, including Students, Teachers, Courses, Classrooms, Enrollments, Attendance\_Sessions, and Attendance\_Records. These tables are managed within SQL Server to ensure data consistency, relational integrity, secure storage, and efficient query execution throughout the system.



## 6.2 Database Tables Description

This section provides a detailed explanation of all database tables created as part of the attendance management system. Each table has been implemented based on the finalized Entity Relationship Diagram (ERD), ensuring proper normalization, data integrity, and relational consistency. The tables collectively support user management, course assignment, enrollment tracking, session scheduling, and attendance recording processes within the system.

## Teachers Table

Stores mandatory personal and contact information for instructors responsible for teaching courses.

Column Name	Data Type	Allow Nulls
TeacherID	int	<input type="checkbox"/>
FirstName	nvarchar(50)	<input type="checkbox"/>
LastName	nvarchar(50)	<input type="checkbox"/>
Email	nvarchar(100)	<input type="checkbox"/>
	nchar(10)	<input type="checkbox"/>

Column	Data Type	Purpose
TeacherID	INT	Primary Key, unique identifier
FirstName	NVARCHAR(50)	Instructor's first name
LastName	NVARCHAR(50)	Instructor's last name
Email	NVARCHAR(100)	Instructor's unique email address

## Students Table

Stores academic identity and personal contact information for enrolled students.

Column Name	Data Type	Allow Nulls
StudentID	int	<input type="checkbox"/>
StudentNumber	nvarchar(20)	<input type="checkbox"/>
FirstName	nvarchar(50)	<input type="checkbox"/>
LastName	nvarchar(50)	<input type="checkbox"/>
Email	nvarchar(100)	<input type="checkbox"/>

Column	Data Type	Purpose
StudentID	INT	Primary Key
StudentNumber	NVARCHAR(20)	Unique institutional student number
FirstName	NVARCHAR(50)	Student's first name
LastName	NVARCHAR(50)	Student's last name
Email	NVARCHAR(100)	Student's email, must be unique

## Enrollments Table

Represents the **bridge table** managing the Many-to-Many relationship between Students and Courses.

Column Name	Data Type	Allow Nulls
EnrollmentsID	int	<input type="checkbox"/>
StudentID	int	<input type="checkbox"/>
CourseID	int	<input type="checkbox"/>
EnrollmentDate	date	<input type="checkbox"/>

Column	Data Type	Purpose
EnrollmentsID	INT	Primary Key
StudentID	INT	Foreign Key referencing Students
CourseID	INT	Foreign Key referencing Courses
EnrollmentDate	DATE	Course enrollment date

## Courses Table

Defines institution courses and links each one to the assigned teacher.

Column Name	Data Type	Allow Nulls
CourseID	int	<input type="checkbox"/>
CourseCode	nvarchar(20)	<input type="checkbox"/>
CourseName	nvarchar(100)	<input type="checkbox"/>
TeacherID	int	<input type="checkbox"/>

Column	Data Type	Purpose
CourseID	INT	Primary Key
CourseCode	NVARCHAR(20)	Unique course identifier
CourseName	NVARCHAR(100)	Full course title
TeacherID	INT	Foreign Key referencing Teachers

## Classrooms Table

Stores physical classroom information used for scheduling teaching sessions.

Column Name	Data Type	Allow Nulls
ClassroomID	int	<input type="checkbox"/>
Name	nvarchar(100)	<input type="checkbox"/>
Location	nvarchar(100)	<input type="checkbox"/>
Capacity	int	<input type="checkbox"/>

Column	Data Type	Purpose
ClassroomID	INT	Primary Key
Name	NVARCHAR(100)	Classroom title/label
Location	NVARCHAR(100)	Physical building/room identification
Capacity	INT	Maximum number of students allowed

## 6-Attendance\_Sessions Table

Records scheduled course sessions, connecting a lesson, location, and scheduled time.

Column Name	Data Type	Allow Nulls
SessionID	int	<input type="checkbox"/>
CourseID	int	<input type="checkbox"/>
ClassroomID	int	<input type="checkbox"/>
SessionDateTime	datetime2(0)	<input type="checkbox"/>

Column	Data Type	Purpose
SessionID	INT	Primary Key
CourseID	INT	Foreign Key referencing Courses
ClassroomID	INT	Foreign Key referencing Classrooms
SessionDateTime	DATETIME2(0)	Exact start time of the session

## **7-Attendance\_Records Table**

Stores attendance results for each student and each session.

Column Name	Data Type	Allow Nulls
RecordID	int	<input type="checkbox"/>
SessionID	int	<input type="checkbox"/>
StudentID	int	<input type="checkbox"/>
Status	nvarchar(20)	<input type="checkbox"/>

Column	Data Type	Purpose
RecordID	INT	Primary Key
SessionID	INT	Foreign Key referencing Attendance_Sessions
StudentID	INT	Foreign Key referencing Students
Status	NVARCHAR(20)	Attendance status (Present, Absent, Late)

