



**KINGDOM OF CAMBODIA
NATION RELIGION KING**



**REPORT OF
SOFTWARE ENGINEERING**

GROUP: I4-GIC-A

PROJECT TITLE: *Course Enrollment System*

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I. Han Raby's Responsibility


1. Configuration File

a. Cloudary Configuration

 CloudinaryConfig.java

- Configures Cloudinary cloud storage for image uploads
- Reads API credentials from application.properties
- Provides a Cloudinary bean used by image upload services

b. Global Exception Handler

 GlobalExceptionHandler.java

- Handles application-wide exceptions
- Returns clean and consistent error responses
- Prevents application crashes when a resource is not found

c. Model Mapper Configuration

 ModelMapperConfig.java

- Provides a ModelMapper bean
- Simplifies conversion between Entity and DTO objects
- Reduces repetitive mapping code

2. Authentication & Security

a. Authentication Controller

 AuthController.java

- Handles user login and student registration
- Validates signup data and checks for duplicate users
- Encrypts passwords and assigns STUDENT role

b. Security Configuration

 SecurityConfig.java

- Configures Spring Security rules
- Defines login, logout, and role-based access control
- Restricts admin and student pages based on user roles

3. Controller

a. Global Controller

 GlobalController.java


- Makes the current logged-in user available to all views
- Retrieves user data from the security context
- Used for showing user information in templates

b. Student Controller

 StudentController.java

- Handles student home page
- Displays available courses
- Marks courses as enrolled or not enrolled for the student

c. Student Profile Controller

 StudentProfileController.java

- Manages student profile page
- Allows updating profile information
- Handles profile image upload and course withdrawal

4. Services

a. Image Upload Service

 ImageUploadService.java

- Uploads images to Cloudinary
- Returns secure image URLs
- Used for student profile image uploads

b. Student Profile Service

 StudentProfileService.java

- Contains business logic for student profiles
- Retrieves the currently logged-in user
- Handles profile updates, image upload, and enrollments

5. Data transfer Object

a. Student Profile DTO

 StudentProfileDto.java

- Transfers student profile data between view and controller
- Validates user input fields
- Prevents direct modification of User entity

II. Lo Bunleang's Responsibility

1. Controllers & Their Functions

a. Admin Classroom Controller (/admin/classrooms)

Purpose: Manage physical classrooms

Functions:

- CRUD operations for classrooms
- Track building, room number, capacity, equipment (projector/computer)
- Set status (AVAILABLE, MAINTENANCE, CLOSED)
- Uses modal forms for create/edit

b. Admin Schedule Controller (/admin/schedules)

Purpose: Manage course schedules with conflict prevention

Functions:

- Assign courses to classrooms at specific times
- Automatic conflict detection - prevent double scheduled
- Set status (SCHEDULED, CANCELLED)
- Validates time overlaps before saving
- Loads course and classroom data for dropdowns
- Uses modal forms with error handling

c. Student Classroom Controller (/student/classrooms)

Purpose: Display classrooms to students

Functions:

- View-only access to all classrooms
- See capacity, equipment, and availability status

d. Student Schedule Controller (/student/schedules)

Purpose: Show personalized weekly timetable

Functions:

- Get logged-in student from Spring Security
- Find courses student is enrolled in
- Display only active schedules (filters out CANCELLED)
- Build weekly timetable (time rows × day columns)
- Show course, classroom, and time for each class

2. Complete System Flow

a. Admin Creates Schedule

Admin clicks "Add Schedule"

- Form loads courses & classrooms
- Admin selects: Course, Classroom, Day, Time
- System validates for conflicts
- If conflict exists: Show error "Classroom already in use"
- If no conflict: Save schedule with status "SCHEDULED"
- Schedule now visible to enrolled students

b. Student Views Schedule

Student navigates to schedules

- System gets current user from login
- Finds courses student is enrolled in
- Gets schedules for those courses
- Filters out CANCELLED schedules
- Builds weekly timetable grid
- Displays personalized schedule

3. Conflict Detection

How It Works:

- Checks if classroom is already booked at overlapping times
- For CREATE: Check all existing schedules
- For UPDATE: Check all schedules except current one

- Logic: existingStart < newEnd AND existingEnd > newStart

Example:

- Existing: Monday 9:00-11:00 in Room 101
- New: Monday 10:00-12:00 in Room 101
- Result: CONFLICT DETECTED

4. Key Data Object

ClassroomDTO: Building, Room, Capacity, Equipment, Status

ScheduleDTO: Course, Classroom, Day, Time (start/end), Semester, Year, Status

TimeTableRowDTO: Time slot + Map of schedules by day (for grid display)

5. Service Layer Purpose

The service layer contains business logic and acts as a bridge between Controllers (user requests) and Repositories (database).

a. Classroom Service

Used for: Managing classroom CRUD operations

- Create, read, update, delete classrooms
- Convert ClassroomDTO ↔ Classroom entity
- Set default status to "AVAILABLE"

b. Schedule Service

Used for: Managing schedules with conflict prevention

- Create, read, update, delete schedules
- Validate conflicts - prevent double creation of classrooms
- Build weekly timetable grid structure
- Provide dashboard statistics (count schedules by status)
- Filter active schedules (exclude CANCELLED)

Key Feature: Automatically detects if a classroom is already created at the same time

c. Student Schedule Service

Used for: Providing personalized schedules for students

- Get logged-in student's identity from Spring Security

- Find courses student is enrolled in
- Filter schedules to show only student's enrolled courses
- Remove CANCELLED schedules from view
- Build personalized weekly timetable

Key Feature: Shows students only their relevant active schedules

III. Heng Oulong's Responsibility

1. Functional Tasks

- Course CRUD (Create, Read, Update, Delete)
- Student enrollment & enrollment removal
- Capacity control and duplicate enrollment prevention
- Course visibility based on status (ACTIVE / DRAFT)
- Image upload and management using Cloudinary
- Pagination for course
- Searching for courses in Admin

2. UI Tasks

- Admin course list with pagination
- Admin create/edit course forms (professional UI)
- Enrollment management UI for admin such as assigning, views, drop.

3. Controller

a. Admin Course Controller

Purpose: Allows ADMIN to fully manage courses:


- View all courses
 - Form contains: Course name, Course code, Description, Credits, Max capacity, Lecturer (dropdown), Status (ACTIVE / DRAFT) , Image upload (Cloudinary)
- Create courses
 - Business logic: Lecturer must exist, Status defaults to DRAFT if not selected, Image uploaded & URL saved, Course stored safely, Capacity ≤ 500 , Credit ≤ 10

- Edit courses
 - Old image kept if no new upload
 - New image replaces old if uploaded
- Delete courses
 - Delete course from database
- Manage capacity, status, lecturer, and image

b. Admin Enrollment Controller

Purpose: Allows ADMIN to:

- View all enrollments
 - Enrollment ID
 - Student name
 - Course name
 - Status
 - Delete option
- Assign enrollments manually
 - Select student
 - Select course
 - Assign enrollment
- Delete enrollments

 Why Admin enrollment exists

- Manual assignment
- Administrative override
- Real school scenario

c. Student Course Controller

Purpose: Allows STUDENT to:

- View available courses: Only ACTIVE courses shown
- View course details
 - Image
 - Description
 - Lecturer

- Capacity
- Enroll button

d. Student Enrollment Controller

Purpose: Allows STUDENT to:

- Enroll themselves
 - Course name
 - Enrollment date
 - Status
 - Drop button
- View their enrollments
- Drop enrollment
 - Student can only drop their own enrollment

4. DTO Data Flow Summary

CourseCreateUpdateDto → Entity

Used for:

- Create course
- Update course

Contains:

- Basic fields
- Status
- Image file

Course → CourseDto

Used for:

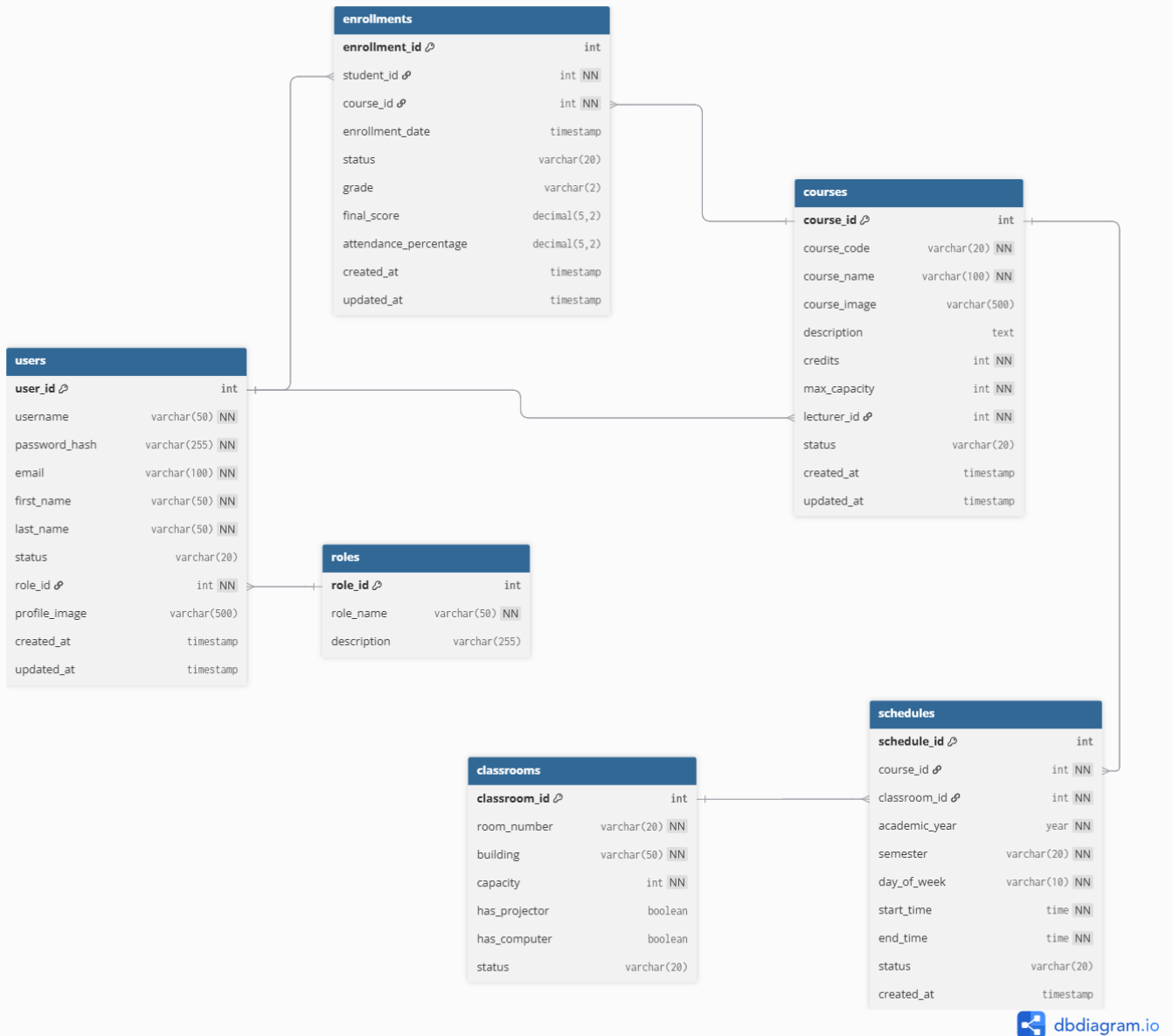
- Admin UI
- Student UI

Contains:

- Display-safe fields
- Computed fields (capacity)

IV. Chea Chanminea's Responsibility

1. Database Schema



2. Database Code Implementation

a. Overall Design Approach

- Used **JPA/Hibernate** with modern Jakarta Persistence annotations
- Followed **clean entity structure** with separation of concerns:
 - Core attributes
 - Relationships (bidirectional where appropriate)
 - Business/helper methods
 - Lifecycle callbacks

- Proper indexing & unique constraints
- Implemented **soft status management** instead of hard deletes (most entities have status field)
- Used **enums** for type-safe status/role values (RoleName, UserStatus, EnrollmentStatus, CourseStatus)

b. Entity Summary

➤ User

- Full personal info + DOB validation
- Profile image support
- Bidirectional with Role, Courses (lecturer), Enrollments (student)
- Lifecycle timestamps
- Full name helper

✚ Important Decision

- @Past on DOB
- Unique on email & password_hash
- Indexes on role & status

➤ Role

- Enum-based role names
- Bidirectional with Users
- Simple description field

✚ Important Decision

- Unique constraint on role_name
- Cascade ALL (careful usage)

➤ Course

- Lecturer assignment (ManyToOne)
- Schedules & Enrollments (OneToMany)
- Capacity management
- Current enrollment count calculation

- isFull() business method

Important Decision

- Unique course_code
- Business logic in entity (getCurrentEnrollmentCount, isFull)
- Cascade ALL on collections

➤ **Classroom**

- Composite unique constraint (building + room_number)
- Equipment flags
- Status management
- Bidirectional with Schedules
- Helper methods: getFullLocation(), isAvailable(), hasEquipment()

Important Decision

- Multiple indexes for search performance
- Composite unique very important for real-world usage

➤ **Schedule**

- Very strong double-booking prevention with two unique constraints
- Time overlap checking method
- Classroom capacity & equipment validation methods (placeholder)
- Many useful business methods (overlapsWith, isValidTimeRange, getDurationInHours...)

Important Optimization

- Most important entity for business rules
- Two critical unique constraints
- DayOfWeek enum usage

➤ **Junction Table Enrollment**

- Composite unique (student + course)
- Rich grade & performance tracking

- Multiple statuses (PENDING → ENROLLED → COMPLETED)
- Automatic enrollment date
- Bidirectional with User & Course

Good Optimization

- Very good status lifecycle management
- Precision/scale on decimal fields
- Indexes on both sides of relationship

c. Important Technical Decisions & Best Practices Applied

- Proper use of FetchType.LAZY everywhere → performance oriented
- Correct cascade types (mostly CascadeType.ALL – be careful in production)
- Good usage of @PrePersist / @PreUpdate for audit fields
- Meaningful business methods inside entities (recommended for domain-driven design)
- Strong constraint strategy:
 - Unique constraints at database level (not just application)
 - Composite unique constraints where it matters most (classroom booking, student-course)
- Strategic indexing on frequently filtered/searched columns
- Consistent naming convention between Java fields and database columns
- Used String-based enums (@Enumerated(EnumType.STRING)) → more readable in DB
- Helper methods for common operations (getFullName, getFullLocation, isFull, overlapsWith...)

3. Admin Controller

- Mapped routes for dashboard (/admin/adminDashboard), classrooms (/classrooms, /classrooms/create), schedules (/schedules, /schedules/create).

- Autowired services (UserService, CourseService, EnrollmentService, ScheduleService) to fetch stats.
- Added model attributes for stats (e.g., totalUsers, pendingRequests, totalCourses) and activePage for navigation.
- Fetched latest enrollment for display.

4. Admin Dashboard

a. AdminDashboard.html

- Layout with sidebar inclusion, top bar (header with logout), stats grid, and action cards.
- Dynamic stats display using Thymeleaf (e.g., `${totalCourses}`, fallback to 0).
- Three stat cards (Courses, Users, Schedules) with icons, colors, and sub-metrics.
- Action cards for quick navigation (Add Classes, Add Course, Add Schedule) with gradients and buttons.
- JavaScript for interactive hover effects on stat cards.

b. AdminSidebar.html

- Reusable fragment with logo, dynamic navigation links (Overview, Users, Courses, Enrollments, Classes, Schedules).
- Active page highlighting using Thymeleaf conditionals.
- Admin profile section with dynamic user data (avatar, name, email) from `${currentUser}`.
- Gradient background and responsive flex layout.

c. Important Technical Decisions & Best Practices Applied

- Thymeleaf Integration: Used for dynamic content (e.g., `th:text`, `th:href`, `th:classappend`) to bind backend data securely, preventing XSS via escaping.
- Spring MVC Patterns: Controller handles GET mappings only (for read operations); autowired services promote separation of concerns (controller focuses on routing, services on business logic).

- UI/UX Focus: Tailwind for rapid styling; custom CSS for transitions and hovers; icons enhance usability; gradients create a modern, branded look.
- Data Handling: Null checks and fallbacks (e.g., `{totalCourses != null ? totalCourses : 0}`) ensure robust rendering; stats fetched via services for real-time accuracy.
- Security/Usability: Logout link in header; dynamic user info from session (`{currentUser}`); active page tracking for intuitive navigation.
- Performance: Lazy loading implied via services; no heavy computations in controller; CSS/JS minimized for fast load.
- Error Prevention: Conditional rendering avoids NPEs; enums ensure consistent status queries.

V. Hun Lyhorng's Responsibility

1. Controller

a. Home Controller

After a user logs in successfully, the system:

- Detects the user's role
- Redirects them to the correct homepage
 - Admin → Admin Dashboard
 - Student → Student Home page

b. Admin User Controller

- Implemented an AdminUserController to handle all HTTP requests related to user management.

Defined routes for:

- Displaying the list of all users
- Showing the create user form
- Creating a new user
- Activating or deactivating a user
- Deleting a user

- Applied role-based access control, ensuring that only users with the ADMIN role can access these endpoints.
- Used model attributes to pass user data, role lists, and status lists from the backend to the UI.
- Managed page state (such as active sidebar menu) to improve navigation and user experience

2. Service Layer

- Implemented a UserService to handle all business logic related to users.
- The service performs:
 - Validation to ensure username and email uniqueness
 - Password encryption using BCrypt before saving users to the database
 - Assignment of roles and user status during user creation
 - Safe toggling of user status between ACTIVE and INACTIVE
 - Deletion of users from the database
- Centralized business logic in the service layer to maintain clean separation of concerns and improve maintainability.

3. DTO

- Used DTOs to prevent direct exposure of the User entity to the UI.
- Implemented:
 - UserCreateDto to capture form input data such as username, email, password, role, and status when creating a user.
 - UserListDto to display user information in the admin dashboard without exposing sensitive data such as password hashes.

4. UI Tasks

a. Student HomePage & Admin Dashboard Integration

- Integrated the User Management module into an existing Admin Dashboard layout.
- Reused a common sidebar, header, and footer across admin pages to ensure UI consistency.
- Highlighted the active menu item dynamically based on the current page.

b. User Management Page (User List)

- Designed a responsive user list table using Tailwind CSS.
- Displayed key user information:
 - Profile image
 - Username
 - Full name
 - Email
 - Role
 - Status
- Used visual indicators (colored badges) to clearly represent user roles and statuses.
- Added action buttons to:
 - Activate or deactivate users
 - Delete users with confirmation prompts
- Ensured sensitive information such as passwords is never displayed.

c. Create User Interface

- Implemented a Create User form accessible only to administrators.
- The form allows input of:
 - Username
 - Email
 - Password
 - Role

- Status
- Applied Tailwind CSS to create a clean, modern, and user-friendly design.
- Ensured proper form submission and redirection back to the user list after successful creation.
- Designed the UI to align visually with the admin dashboard theme.