

VIETNAM NATIONAL UNIVERSITY – HO CHI MINH CITY

THE INTERNATIONAL UNIVERSITY

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING



**WEB APPLICATION DEVELOPMENT**

**IT093IU**

**PROJECT FINAL REPORT**

**LMS - LEARNING MANAGEMENT SYSTEM**

**By Group 3PowerRangers - Members list**

- |                         |                           |
|-------------------------|---------------------------|
| 1. Phạm Gia Phúc        | ITCSIU22178 (Team Leader) |
| 2. Nguyễn Hồng Ngọc Hân | ITCSIU22229 (Team member) |
| 3. Lê Viễn Phát         | ITCSIU22213 (Team member) |



## TABLE OF CONTENTS

<b>TABLE OF CONTENTS.....</b>	<b>2</b>
<b>LIST OF FIGURES.....</b>	<b>4</b>
<b>LIST OF TABLES.....</b>	<b>6</b>
<b>ACKNOWLEDGEMENTS.....</b>	<b>7</b>
<b>ABSTRACT.....</b>	<b>8</b>
<b>CHAPTER 1: INTRODUCTION.....</b>	<b>9</b>
1. Background.....	9
2. Problem statement.....	9
3. Scopes and Objectives.....	10
3.1. Scopes.....	10
3.2. Objectives.....	10
4. Customer requirements.....	11
5. Structure of the Report.....	11
<b>CHAPTER 2: PROJECT TIMELINE AND RESPONSIBILITY.....</b>	<b>12</b>
1. Project Timeline and Milestones.....	12
2. Responsibility.....	13
<b>CHAPTER 3: METHODOLOGY.....</b>	<b>14</b>
1. User requirements analysis.....	14
2. Use case diagram.....	15
3. Activity diagrams.....	16
4. Sequence diagrams.....	25
5. System design.....	34
6. Database design.....	35
6.1. ERD design.....	35
6.2. Schema design.....	36
7. User interface design.....	36
<b>CHAPTER 4: IMPLEMENTATION AND RESULT.....</b>	<b>38</b>
1. Implementation.....	38



# International University

## School of Computer Science and Engineering

1.1. Overview.....	38
1.2. Frontend.....	39
1.3. Backend.....	39
2. Results.....	40
2.1. Authentication and authorization.....	40
2.2. Home page.....	41
2.3. Admin dashboard.....	43
2.4. Instructor section.....	46
2.5. Student section.....	48
3. Testing.....	50
3.1. User Authentication & Authorization.....	50
3.2. Course Management.....	53
<b>CHAPTER 5: CONCLUSION &amp; FUTURE WORK.....</b>	<b>59</b>
1. Conclusion.....	59
2. Contribution.....	59
3. Future works.....	59



## LIST OF FIGURES

Figure 2.1: Gantt Chart.....	12
Figure 3.1. Use case diagram.....	15
Figure 3.4 Edit profile.....	18
Figure 3.5 Search and view a course.....	19
Figure 3.6 Pay a course.....	20
Figure 3.7 Create a course.....	21
Figure 3.8 Edit a course.....	22
Figure 3.9 Manage students.....	23
Figure 3.10 View reviews.....	24
Figure 3.11 Sign inFigure 3.12 Sign up.....	26
Figure 3.13 Edit profile.....	28
Figure 3.14 Search and view a course.....	29
Figure 3.15 Pay a course.....	30
Figure 3.16 Create a course.....	31
Figure 3.17 Edit a course.....	32
Figure 3.18 Manage students.....	33
Figure 3.19 View reviews.....	34
Figure 3.20. Model-View-Controller Diagram.....	35
Figure 3.21. ERD design.....	35
Figure 3.22. Database design.....	36
Figure 3.23. Interface design.....	37
Figure 4.2. Sign up form.....	40
Figure 4.3. Email verification form.....	41
Figure 4.4. Hero section.....	41
Figure 4.5. Category and Course section.....	42
Figure 4.6. Footer section.....	42
Figure 4.7. Explore courses.....	43
Figure 4.8. Dashboard page.....	43



International University  
School of Computer Science and Engineering

Figure 4.9. Category section.....	44
Figure 4.10. Add new category.....	44
Figure 4.11. Delete multiple categories.....	45
Figure 4.12. Request section.....	46
Figure 4.13. Instructor dashboard.....	46
Figure 4.14. View instructor's courses.....	47
Figure 4.15. Create new course.....	47
Figure 4.16. View chapters of course.....	48
Figure 4.17. Add a lesson.....	48
Figure 4.18. User profile.....	49
Figure 4.19. Teaching and learning policy.....	49



## **LIST OF TABLES**

Table 2.1 Member's role and responsibility table.....	13
Table 3.1. Functional requirements and Non-functional requirements.....	14
Table 4.20. Test case 1 for User Authentication & Authorization.....	50
Table 4.21. Test case 2 for User Authentication & Authorization.....	51
Table 4.22. Test case 1 for Course Management.....	53
Table 4.23. Test case 3 for Course Management.....	54
Table 4.24. Test case 4 for Course Management.....	55
Table 5.1. Contribution table.....	59



## ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to everyone who supported us in completing this report on the development of a Learning Management System.

First and foremost, we extend our deepest thanks to our instructor, Nguyen Trung Nghia, for his invaluable guidance, expertise, and encouragement. His insightful feedback and direction have been instrumental in shaping both the quality and progress of our work.

We would also like to acknowledge our team leader and members — Phạm Gia Phúc, Nguyễn Hồng Ngọc Hân, and Lê Viễn Phát — for their commitment, effort, and teamwork. Each person's contributions, skills, and ideas played a vital role in the success of this project. The collaboration among us fostered creativity and helped us address challenges effectively.

Lastly, we are profoundly grateful to our families and friends for their patience, understanding, and continuous support throughout this journey. Their motivation and belief in us have been a constant source of strength and inspiration.

In conclusion, we wholeheartedly thank everyone who, in one way or another, contributed to making this project possible.



## ABSTRACT

This report presents the development journey of **Byway**, an online Learning Management System (LMS) created to elevate the educational experience for both instructors and students. The platform addresses common challenges found in traditional learning settings by offering greater accessibility, flexibility, and engaging learning interactions. Developed with modern technologies such as ReactJS and NodeJS, and powered by a PostgreSQL database, Byway enables the integration of diverse multimedia resources within lessons and supports seamless communication between learners and educators. The system provides free access to a variety of technology-focused learning modules, equipping users with comprehensive tools designed to enhance and personalize their learning experience.



## CHAPTER 1: INTRODUCTION

### 1. Background

In recent years, the rapid growth of digital technology has revolutionized the way education is delivered and consumed. Traditional classroom environments, while effective in fostering direct interaction, often face challenges such as limited accessibility, scheduling constraints, and a lack of flexibility for diverse learning needs. The increasing adoption of online platforms has created a shift toward digital learning ecosystems that allow students and educators to interact, collaborate, and track progress remotely.

Learning Management Systems (LMS) have emerged as essential tools for managing and organizing educational content, assessments, and communication. They provide centralized platforms where learners can access course materials, submit assignments, and receive feedback — while instructors can monitor student performance and manage classes efficiently. However, many existing LMS solutions are either too complex for small institutions or lack features that promote engagement, usability, and adaptability to different teaching contexts.

To address these gaps, this project introduces Byway, an intuitive and modern LMS web application designed to streamline teaching and learning processes. Byway aims to create an engaging, accessible, and user-friendly environment that supports both instructors and students through features like course management, progress tracking, and interactive content delivery.

### 2. Problem statement

Despite the availability of numerous LMS platforms, several persistent challenges remain:

- **Complexity and Poor User Experience:** Many LMS systems have cluttered interfaces or require extensive training, which discourages both educators and learners from using them effectively.
- **Limited Accessibility and Responsiveness:** Some systems fail to deliver a seamless experience across different devices, making it difficult for students to learn anytime and anywhere.



- **Lack of Interaction and Engagement:** Traditional LMS tools often focus on content delivery rather than fostering interactive and collaborative learning experiences.
- **Insufficient Performance Monitoring:** Instructors may find it difficult to track learners' progress in real time or identify areas where students struggle.

Therefore, there is a need for a lightweight yet powerful web-based LMS that emphasizes simplicity, interactivity, and accessibility while maintaining essential academic and administrative features.

### 3. Scopes and Objectives

#### 3.1. Scopes

The purpose of this project is to develop and evaluate an online learning management system which is more comprehensive and effective for both learners and instructors. It can address the aforementioned challenges while enhancing user engagement and managing data effectively, and also providing the necessary functions to meet learner's needs. This effort intends to serve various demands of stakeholders, such as students, instructors, university administrators and corporate clients or enterprises.

#### 3.2. Objectives

The primary objective of this project is to design and develop an online Learning Management System - Byway - that enhances the educational experience through intuitive design and robust functionality.

Specific objectives are displayed in this project:

- To provide a platform where instructors can create, manage, and publish courses with multimedia content.
- To allow students to enroll, view lessons, complete assignments, and monitor their own progress.
- To enable communication between instructors and students through discussion threads, announcements, or messaging tools.
- To implement user authentication and role management for secure access to course materials.
- To develop an admin dashboard for managing users, content, and system analytics.



- To ensure the system is responsive, accessible, and compatible across different devices and browsers.
- To integrate a database that securely stores user, course, and assessment information.

#### 4. Customer requirements

The development of this platform aligns with the requirements outlined by the users, who emphasize the need for available online learning resources and an efficient tool to create their own set of study lessons.

#### 5. Structure of the Report

- **Acknowledgements:** Expresses appreciation to individuals and organizations who provided support, guidance, or resources throughout the project.
- **Abstract:** Summarizes the project's purpose, development process, methodologies, key features, and final outcomes.
- **Chapter I – Introduction:** Presents the project background, team motivation, overall objectives, project scope, an overview of the system's implementation, and the structure of the report.
- **Chapter II – Project Timeline and Responsibilities:** Outlines the major project milestones, development timeline, assigned roles, and individual contributions of each team member.
- **Chapter III – Methodology:** Describes the approach taken to develop the system, including requirements gathering, database design, architectural design, and user interface development.
- **Chapter IV – Implementation and Results:** Details the implementation process for both the frontend and backend components, system integration, and testing outcomes.
- **Chapter V – Discussion and Evaluation:** Analyzes the project results, compares them with the initial goals, and discusses key observations, limitations, and insights gained during development.
- **Chapter VI – Conclusion:** Summarizes the overall achievements, highlights challenges faced, and proposes potential improvements or future extensions of the system.



## CHAPTER 2: PROJECT TIMELINE AND RESPONSIBILITY

### 1. Project Timeline and Milestones

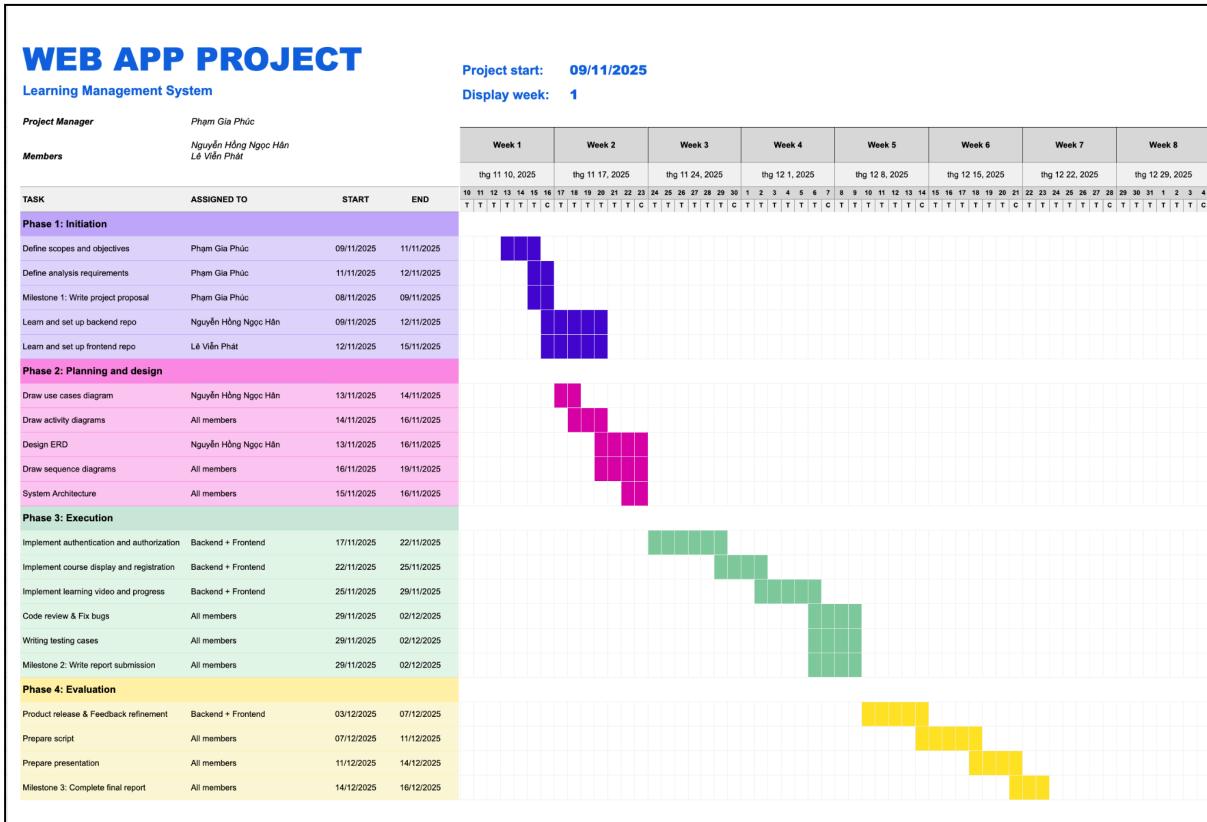


Figure 2.1: Gantt Chart

The project officially starts on 03/11/2025 and will end at the beginning of December, estimated time: 16/12/2025. Over the course of 7 weeks (midterm weeks excluded), our project will undergo four primary phases: project initiation, project planning and design, project execution and project evaluation

Three major milestones are integrated within these phases to meet the required deliverables: the Project Proposal, the Midterm Report, and the Final Report.

- **Milestone 1:** Project proposal submission: by this milestone, the project plan with a detailed timeline, feasibility study and requirements gathering need to be finished. The design phase is ongoing.
- **Milestone 2:** Midterm report submission: by this milestone, the requirements analysis (Use case, Activity, Sequence diagrams) needs to be finished. The



development of the product needs to be finished by 40% and documented in the midterm report.

- **Milestone 3:** Final report submission, the product needs to be ready for the soft launch, with functional testing and detailed technical documents.

## 2. Responsibility

*Table 2.1 Member's role and responsibility table*

Name	Student ID	Role	Contribution
Phạm Gia Phúc (Team leader)	ITCSIU22178	Full stack	32%
Nguyễn Hồng Ngọc Hân (Member)	ITCSIU22229	Backend	34%
Lê Viễn Phát (Member)	ITCSIU22213	Frontend	34%

It is important to note that a member's contribution is evaluated not only based on the tasks they are assigned but also on their efforts to generate ideas, contribute to the overall development of the product, meet deadlines consistently, and collaborate effectively with other team members.



## CHAPTER 3: METHODOLOGY

### 1. User requirements analysis

*Table 3.1. Functional requirements and Non-functional requirements*

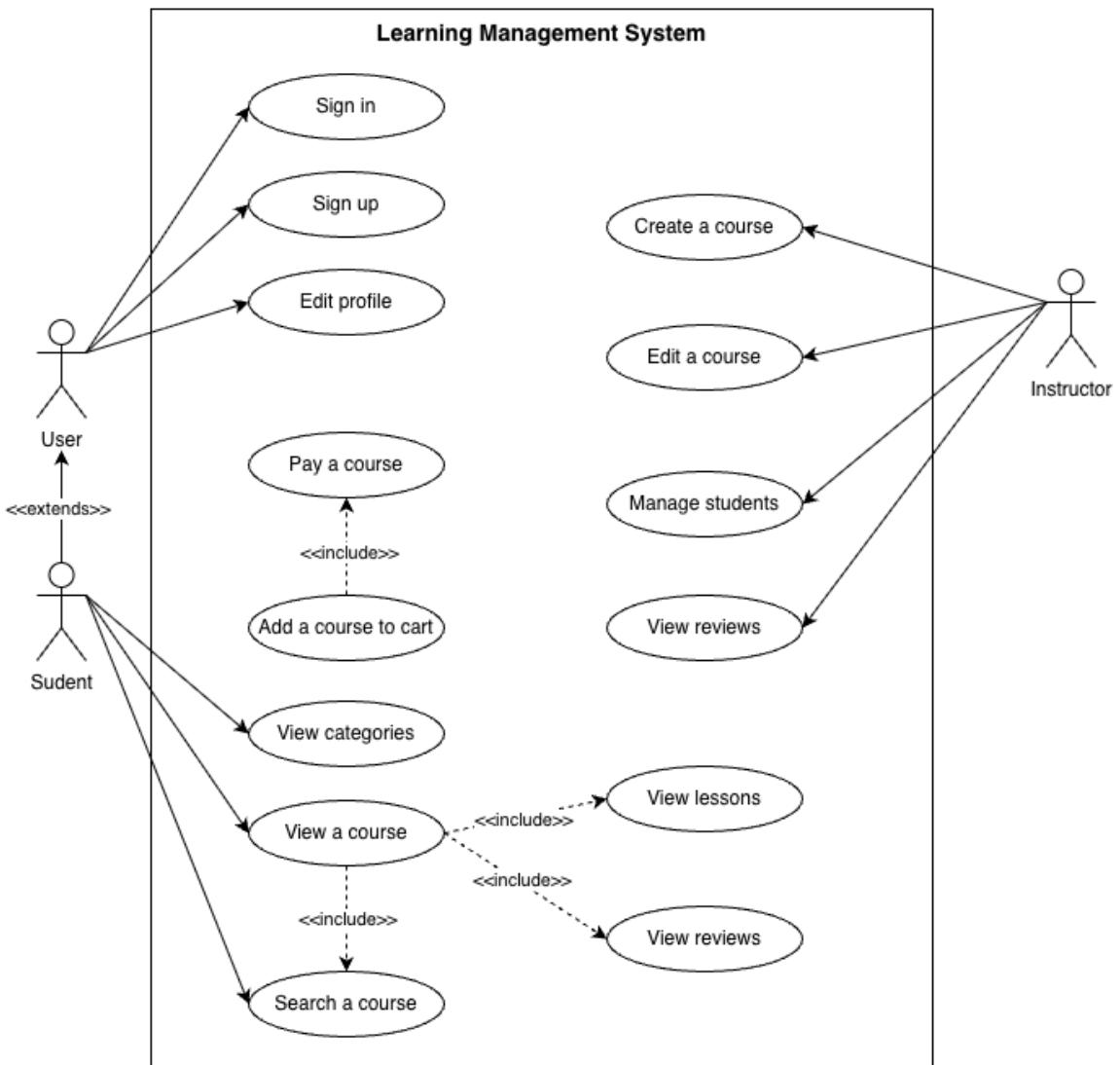
Requirement Type	ID	Name	Description
<b>Functional Requirements</b>	001	Authentication and authorization	The system should allow third-party login and have two-factor authentication via Gmail. Password recovery should be enabled.
	002	User interface	The user interface should be intuitive and user-friendly.
	003	Uploading course materials	Instructors should be able to upload lesson materials, including documents, videos, quizzes, and assignments.
	004	Course search and filter	Courses can be searched by names or categories.
	005	Progress Tracking	Students' progress should be transparent to the instructor and to the students themselves.
<b>Non-functional Requirements</b>	006	Performance	The system should handle up to 5,000 concurrent users efficiently with minimal latency.
	007	Response time	Response time should be under 1 seconds.
	008	Data security	The system will follow current privacy and data protection rules which consist of permission controls and using cookies in the right ways.



	009	Usability	Learners should be able to view desired courses within 3 clicks from the homepage.
	010	Maintainability	Backup and recovery mechanisms must be in place to ensure no data loss in the event of system failures.

## 2. Use case diagram

Figure 3.1. Use case diagram



This use case diagram describes the interactions of the Online Learning Management System. It includes three actors, namely User, two of its inheritors which are Student and



Instructor. Each actor participates in a corresponding use case, sometimes collaborating to perform a function with the help of the system.

### 3. Activity diagrams

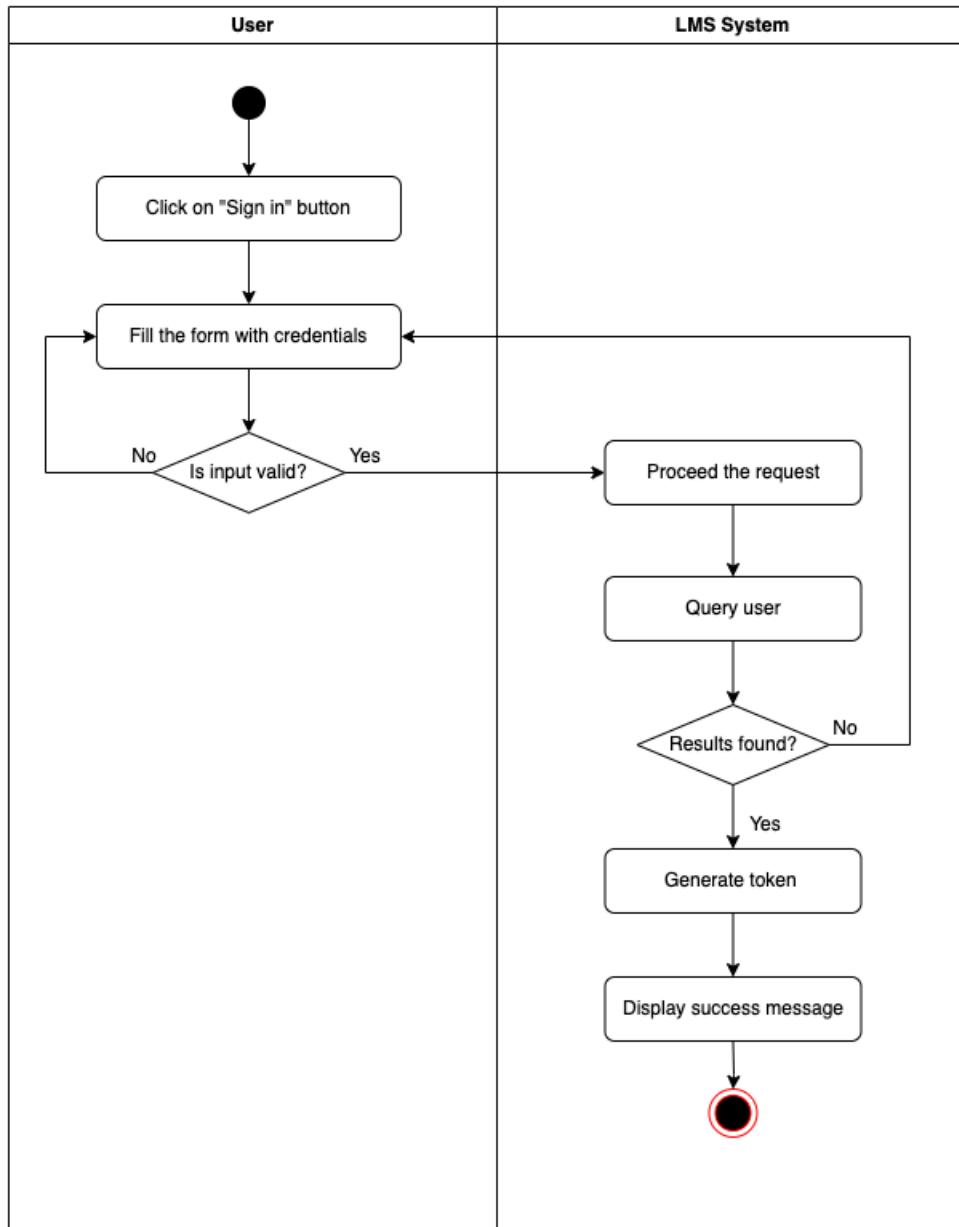


Figure 3.2 Sign in

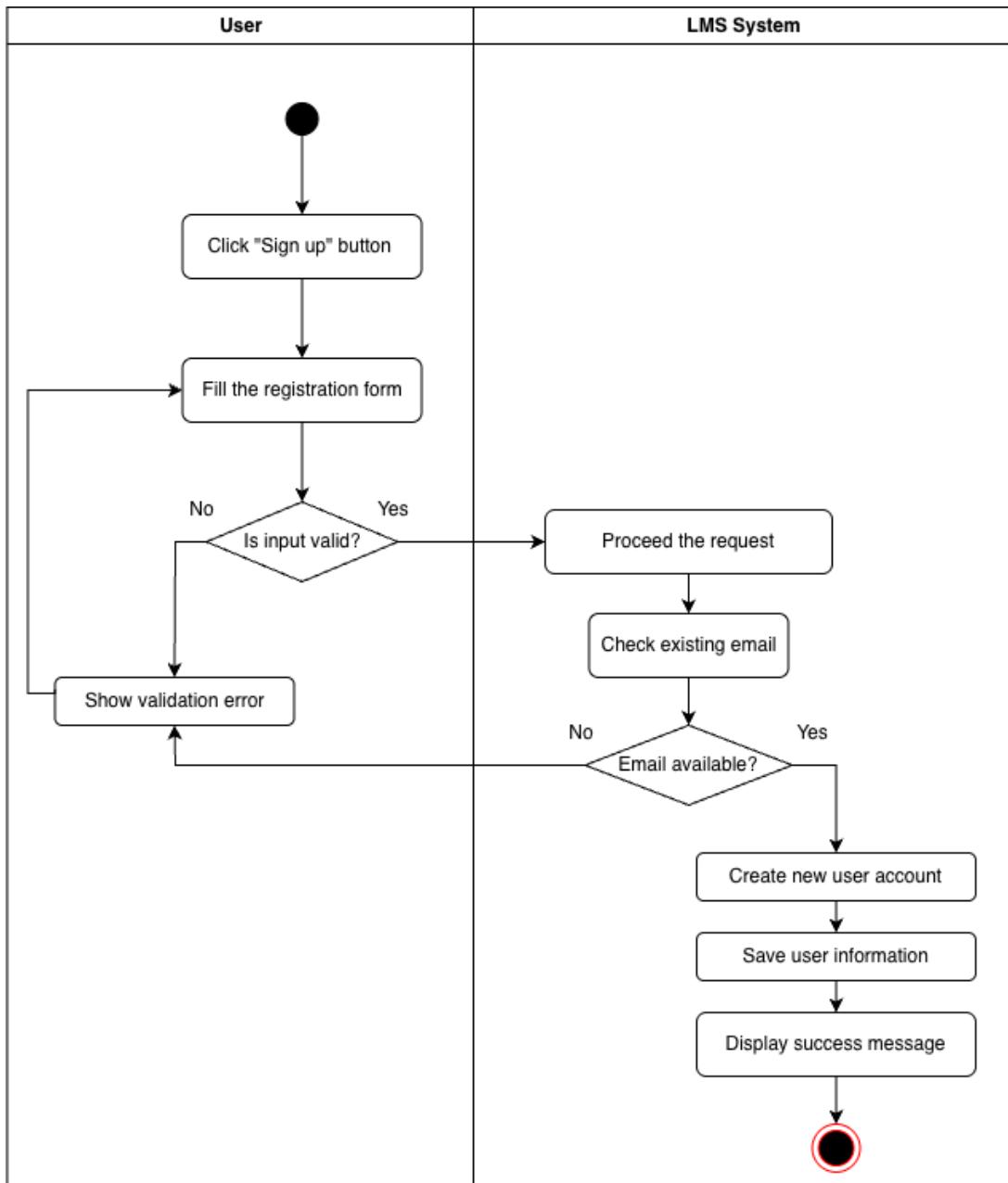


Figure 3.3 Sign up

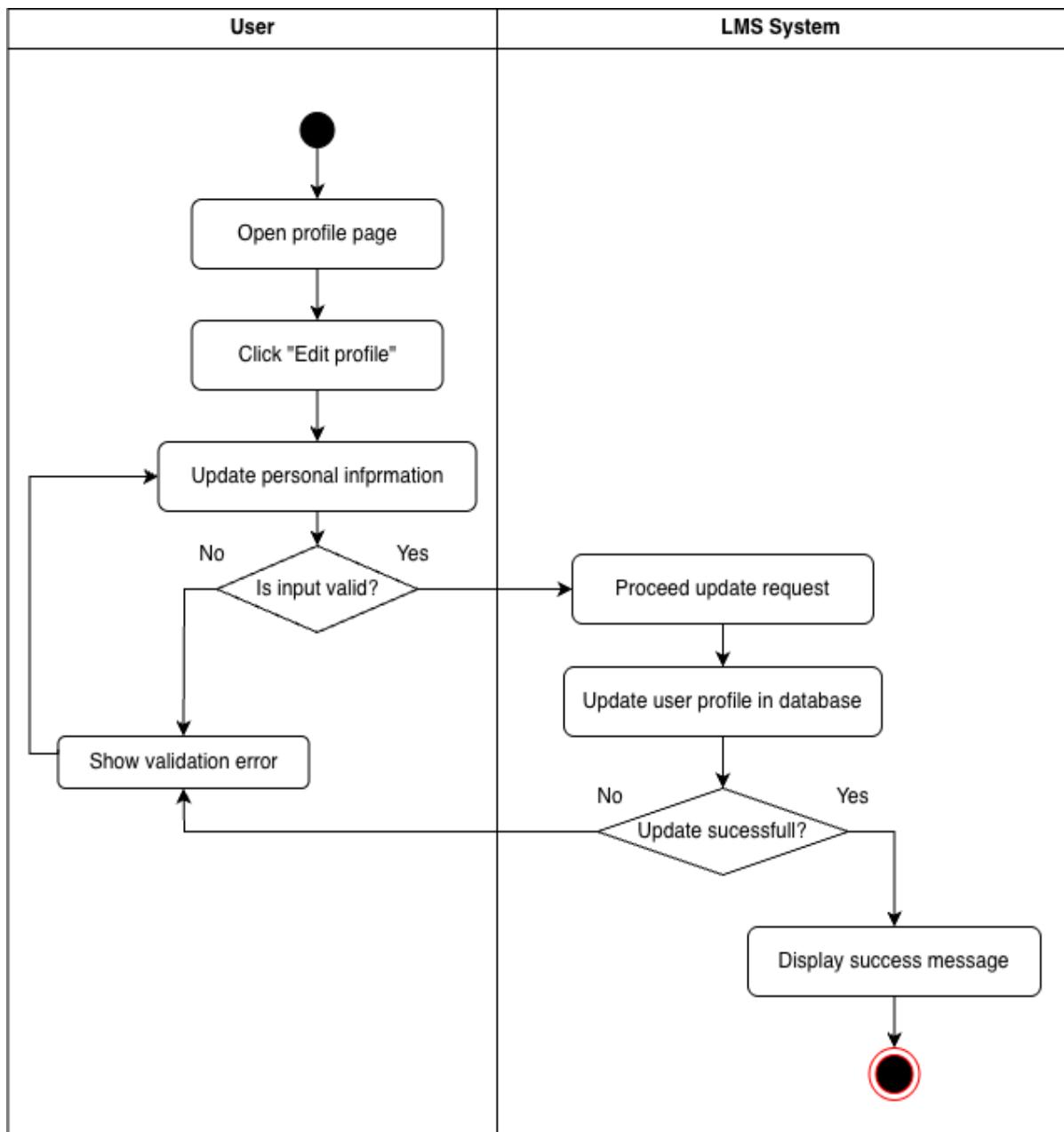


Figure 3.4 Edit profile

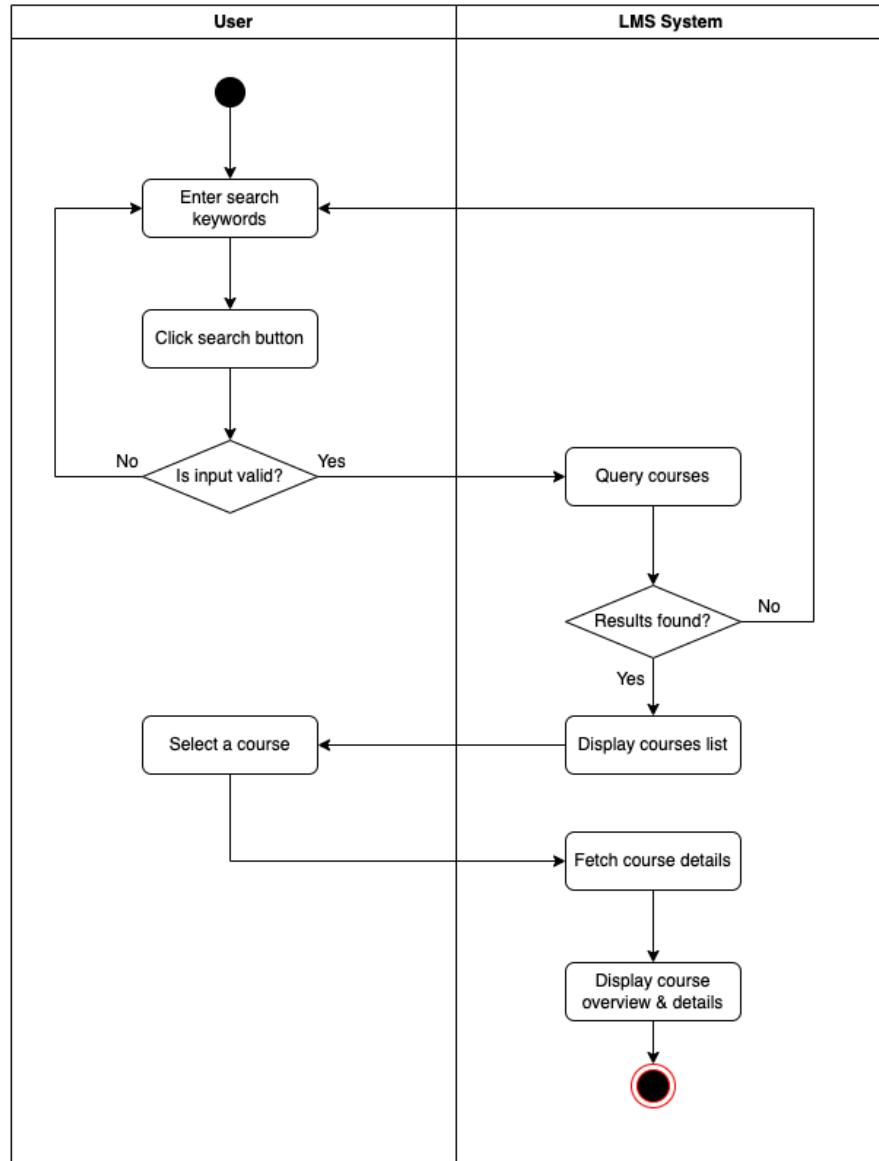


Figure 3.5 Search and view a course

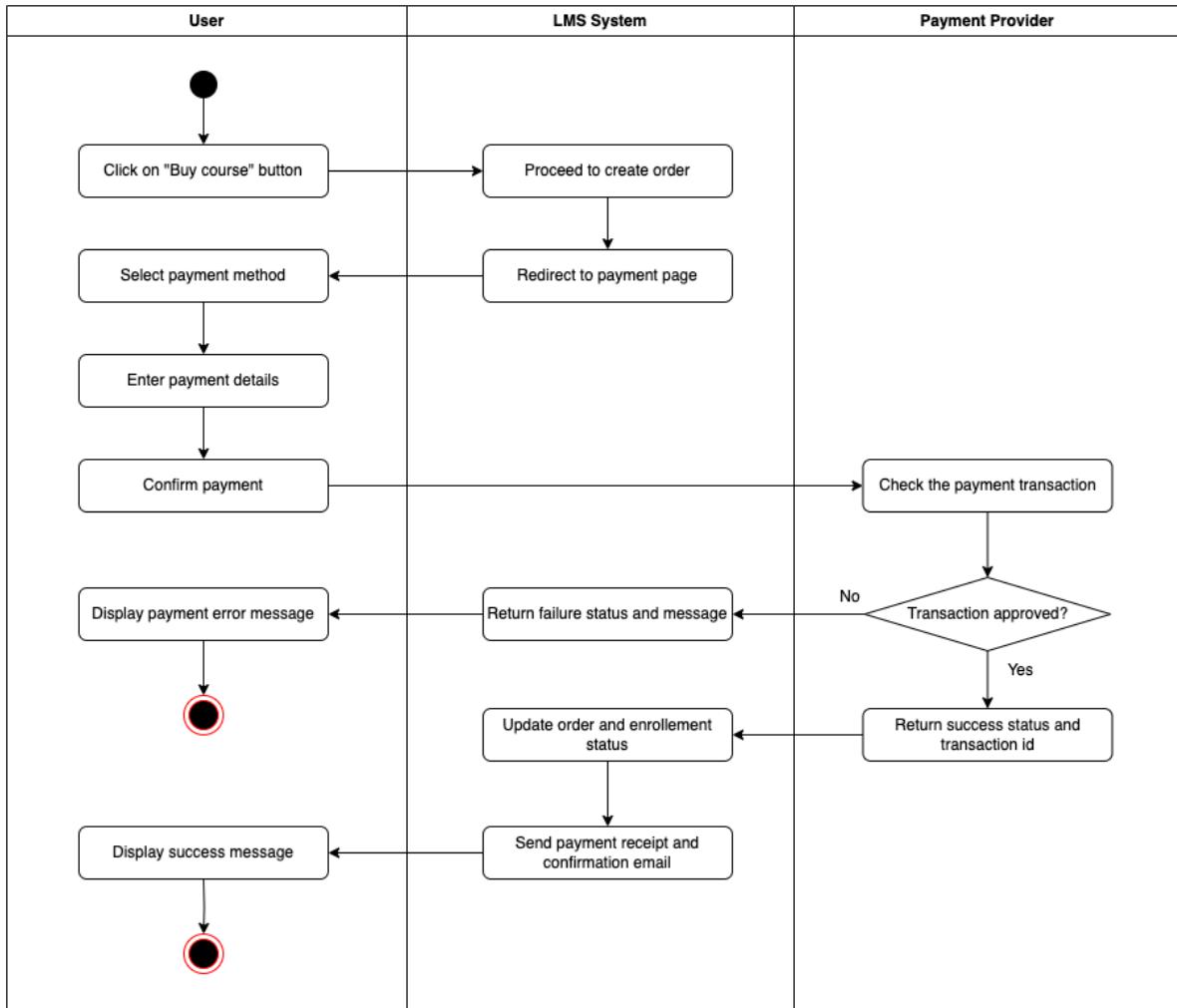


Figure 3.6 Pay a course

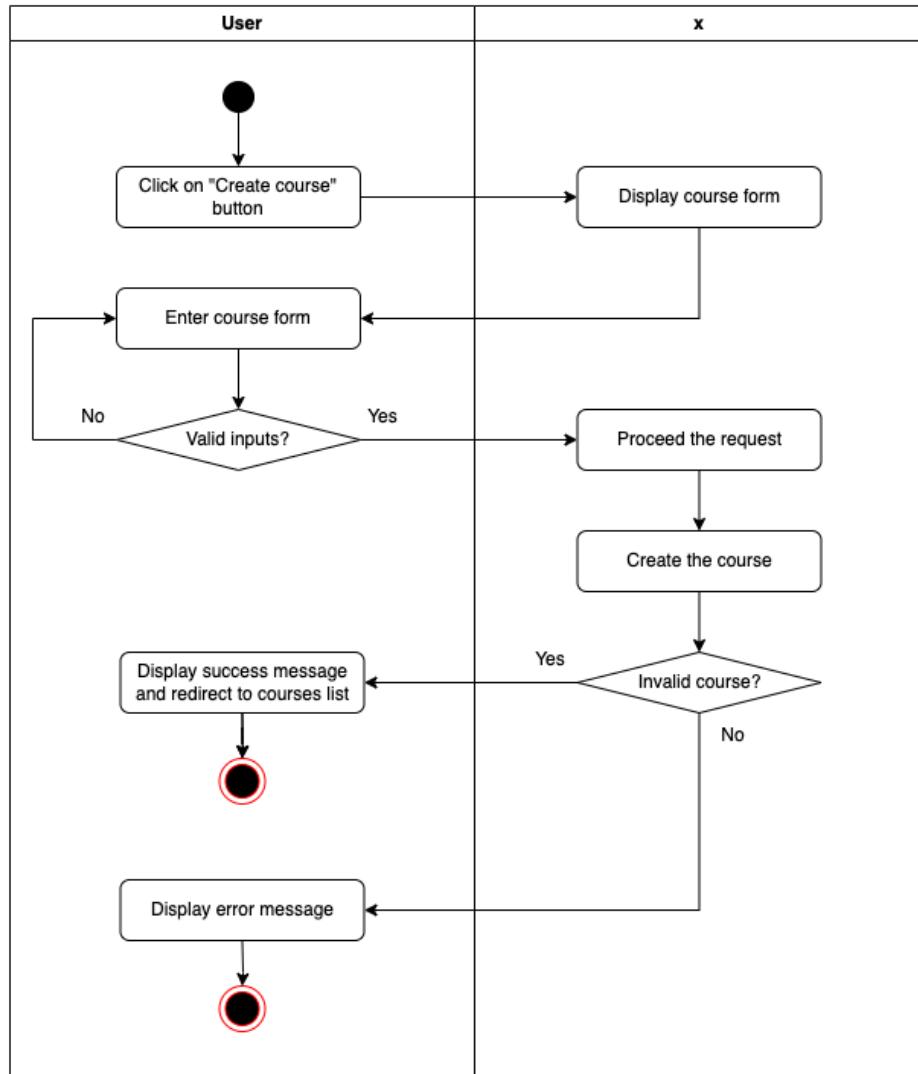


Figure 3.7 Create a course

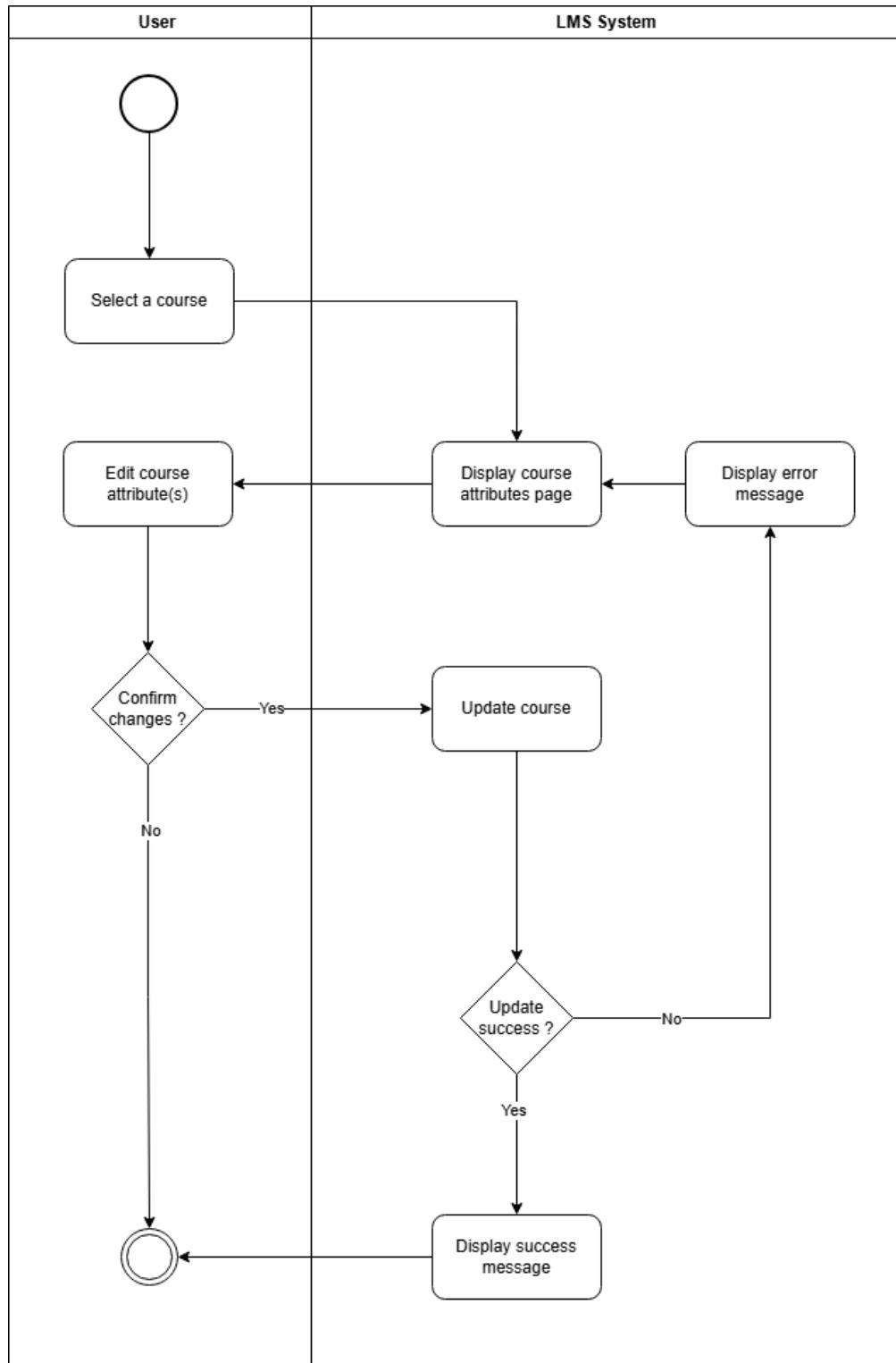


Figure 3.8 Edit a course

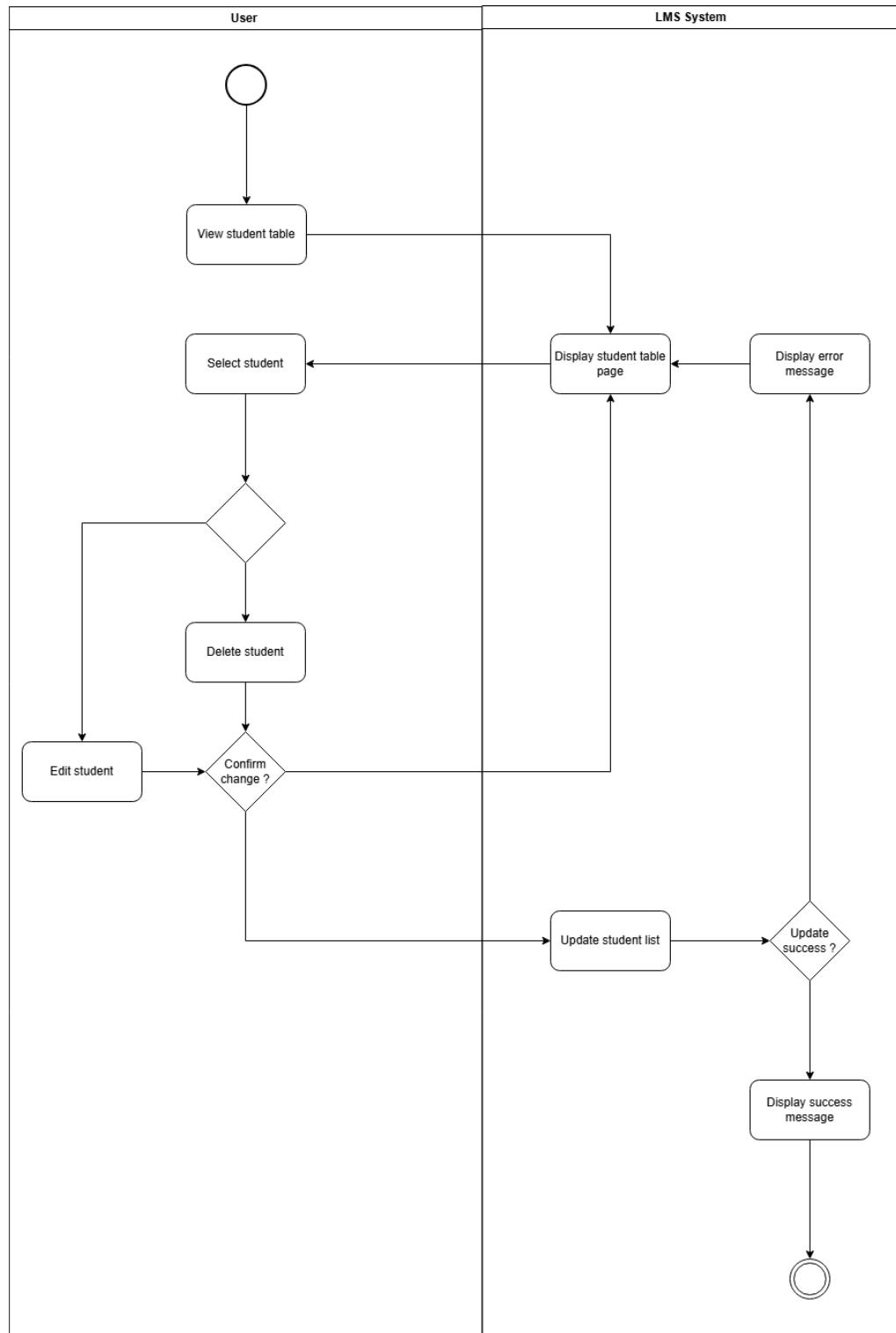


Figure 3.9 Manage students

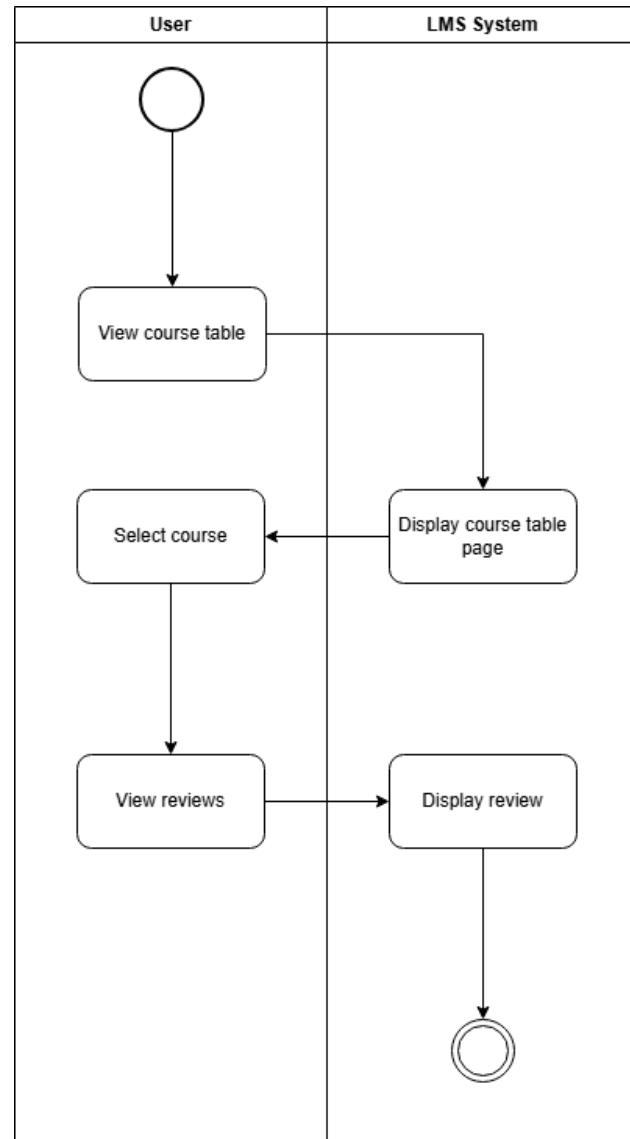


Figure 3.10 View reviews



International University  
School of Computer Science and Engineering

#### 4. Sequence diagrams

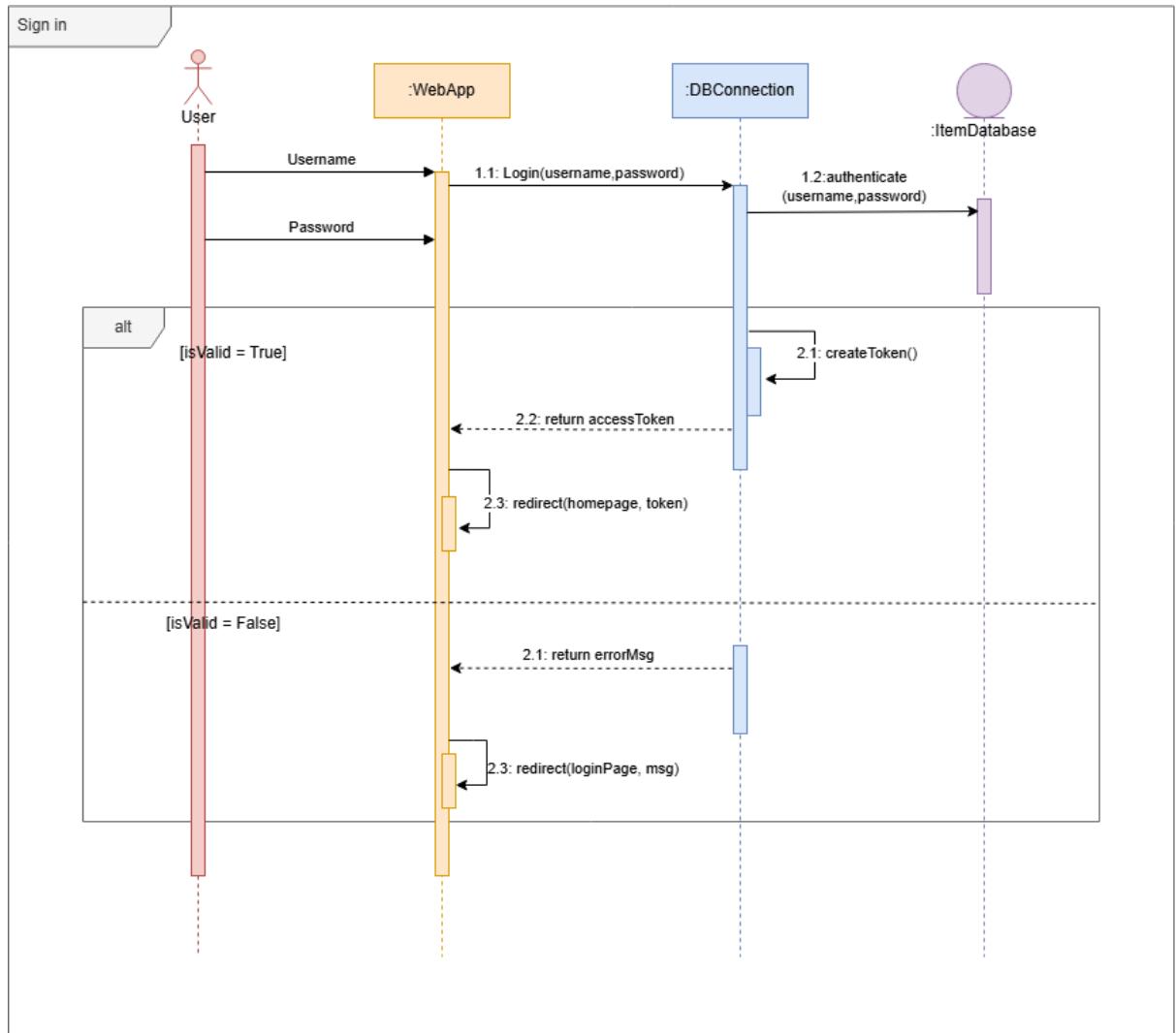


Figure 3.11 Sign in

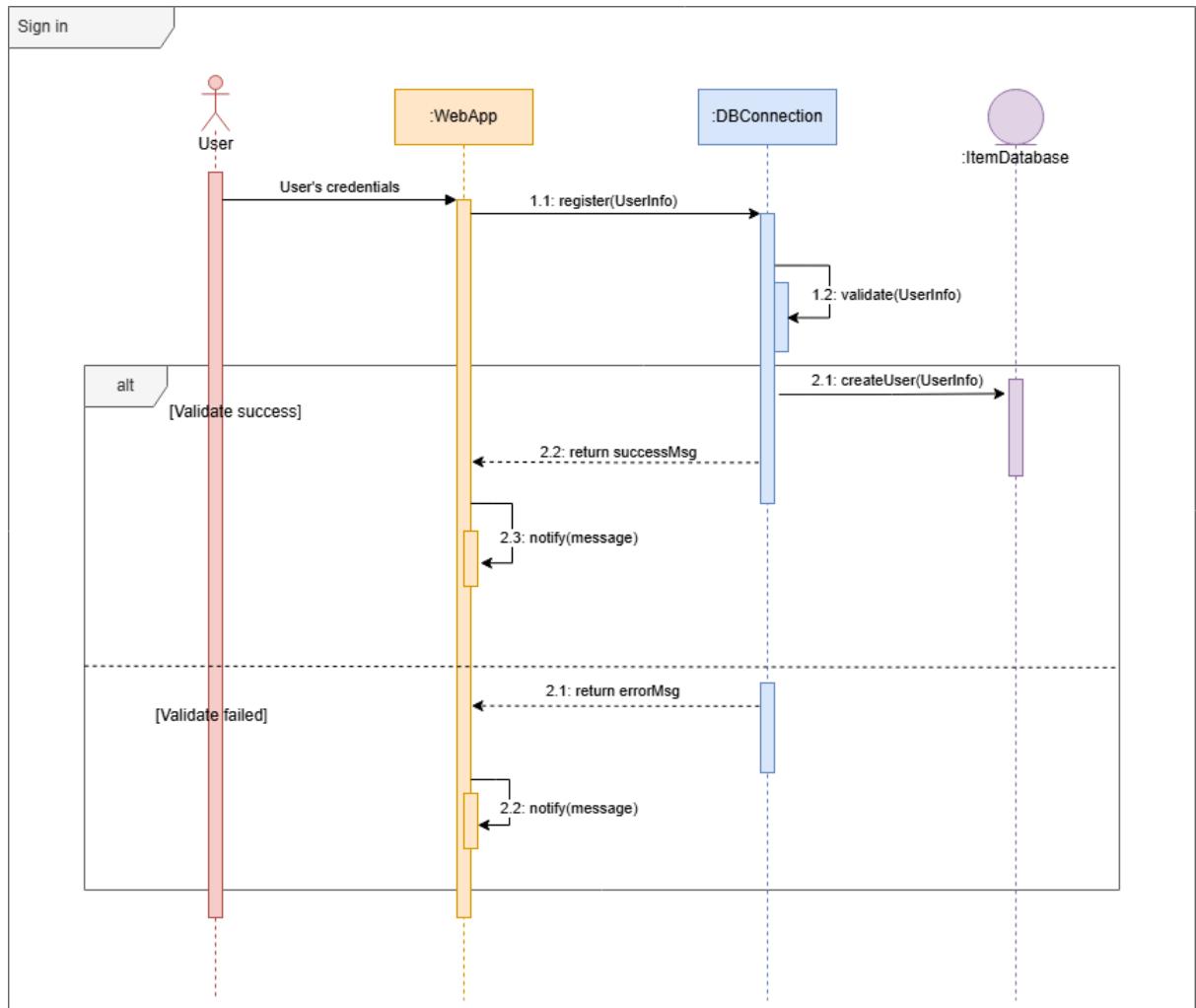


Figure 3.12 Sign up

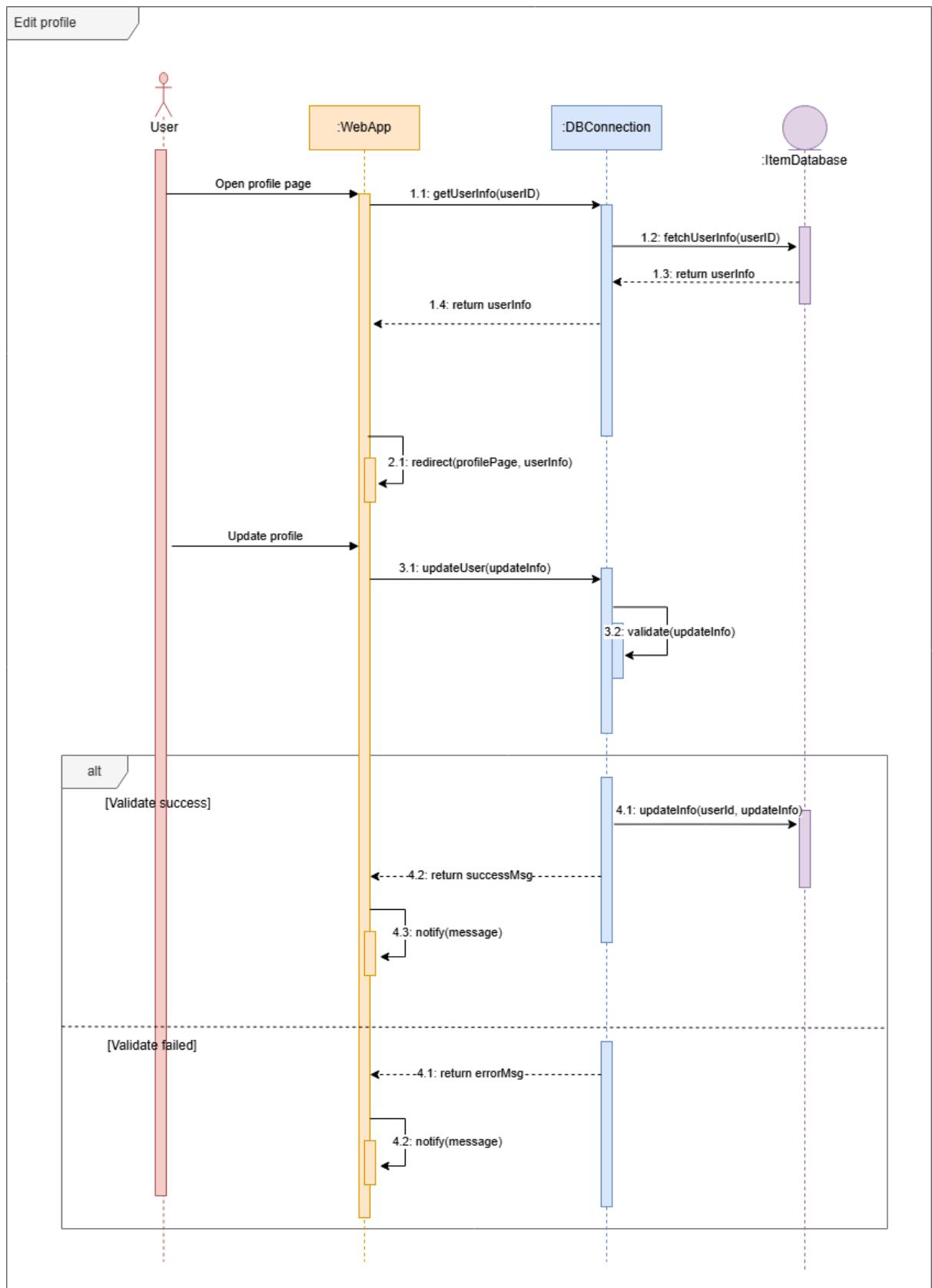


Figure 3.13 Edit profile

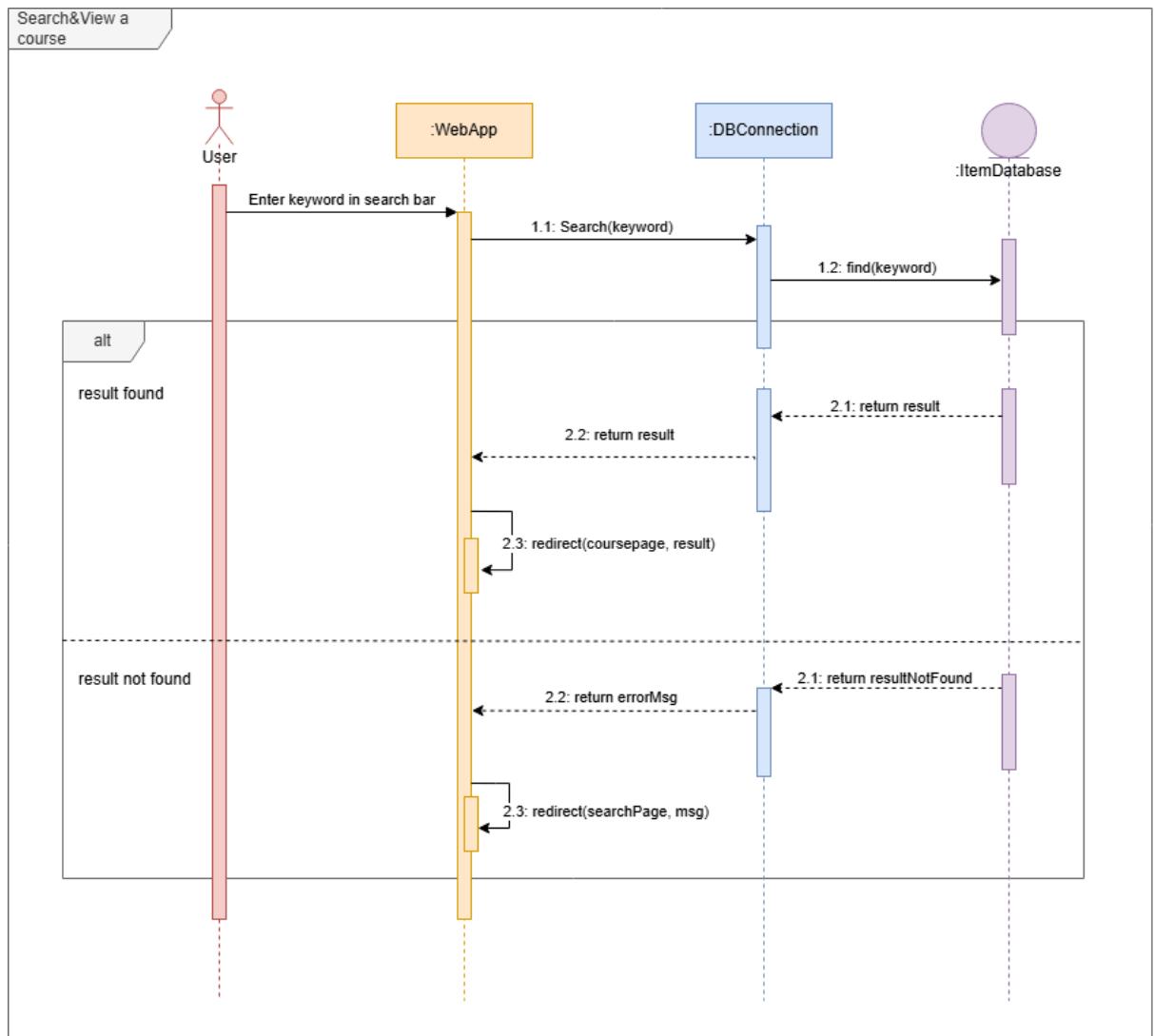


Figure 3.14 Search and view a course

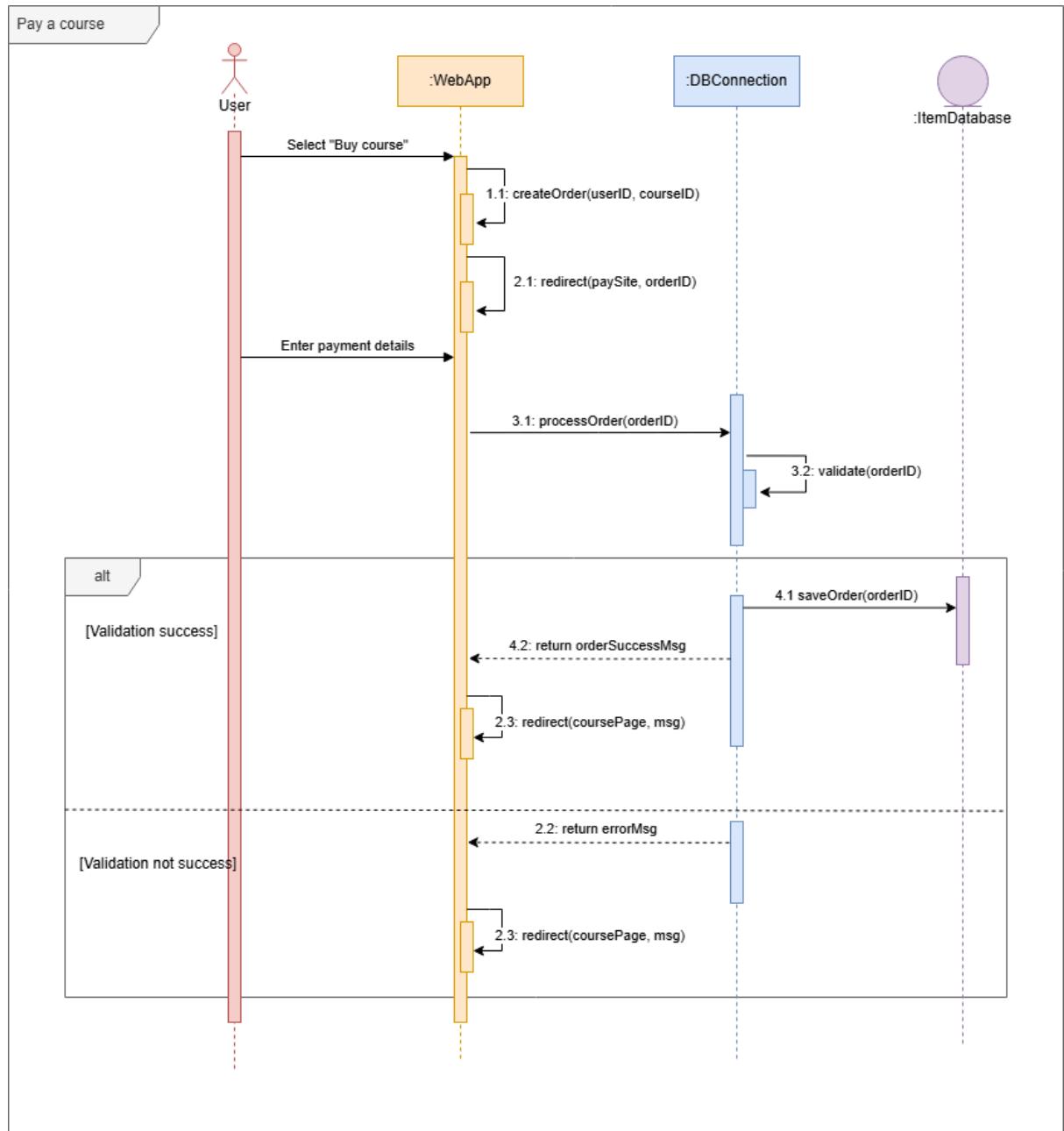


Figure 3.15 Pay a course

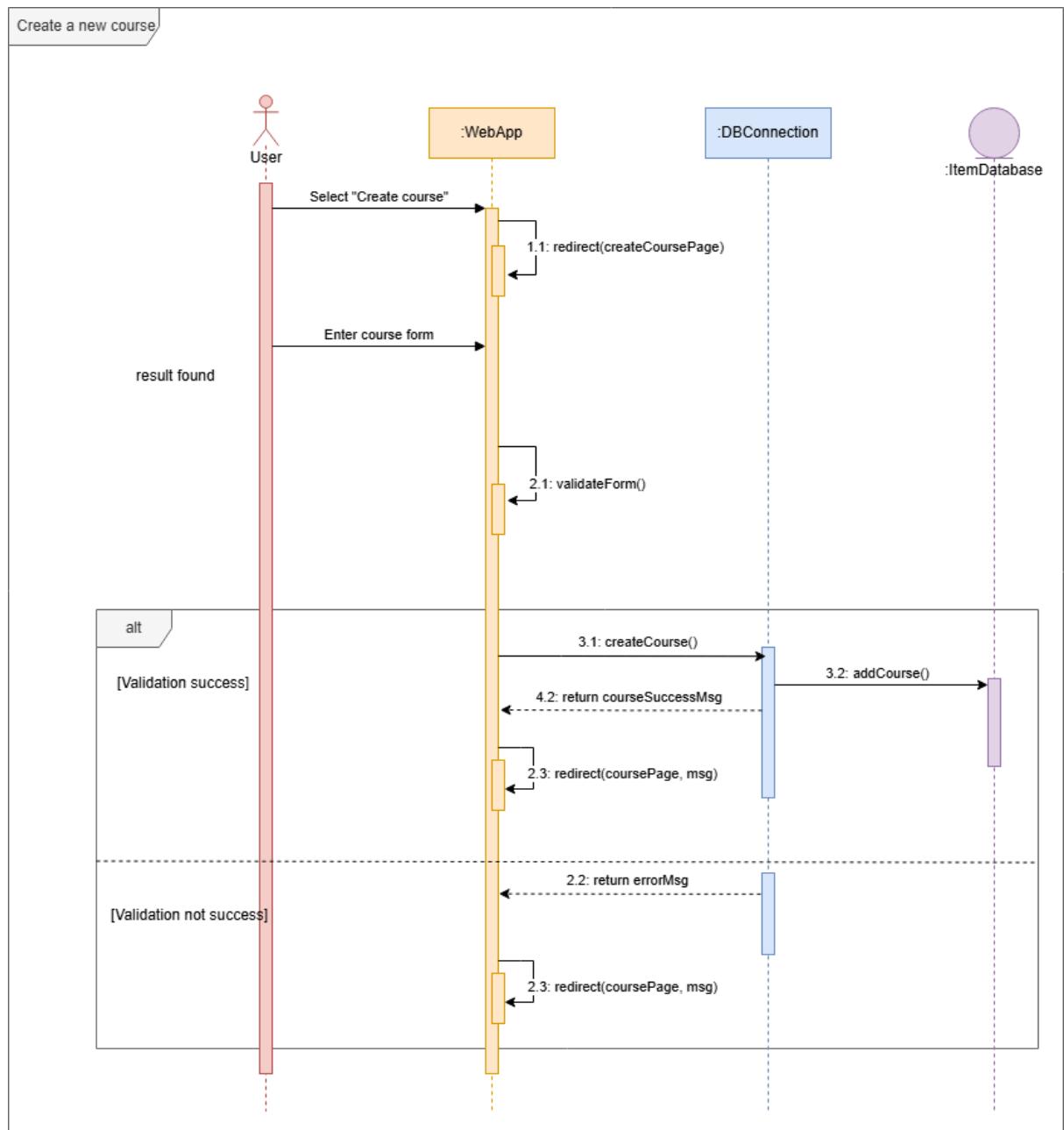


Figure 3.16 Create a course

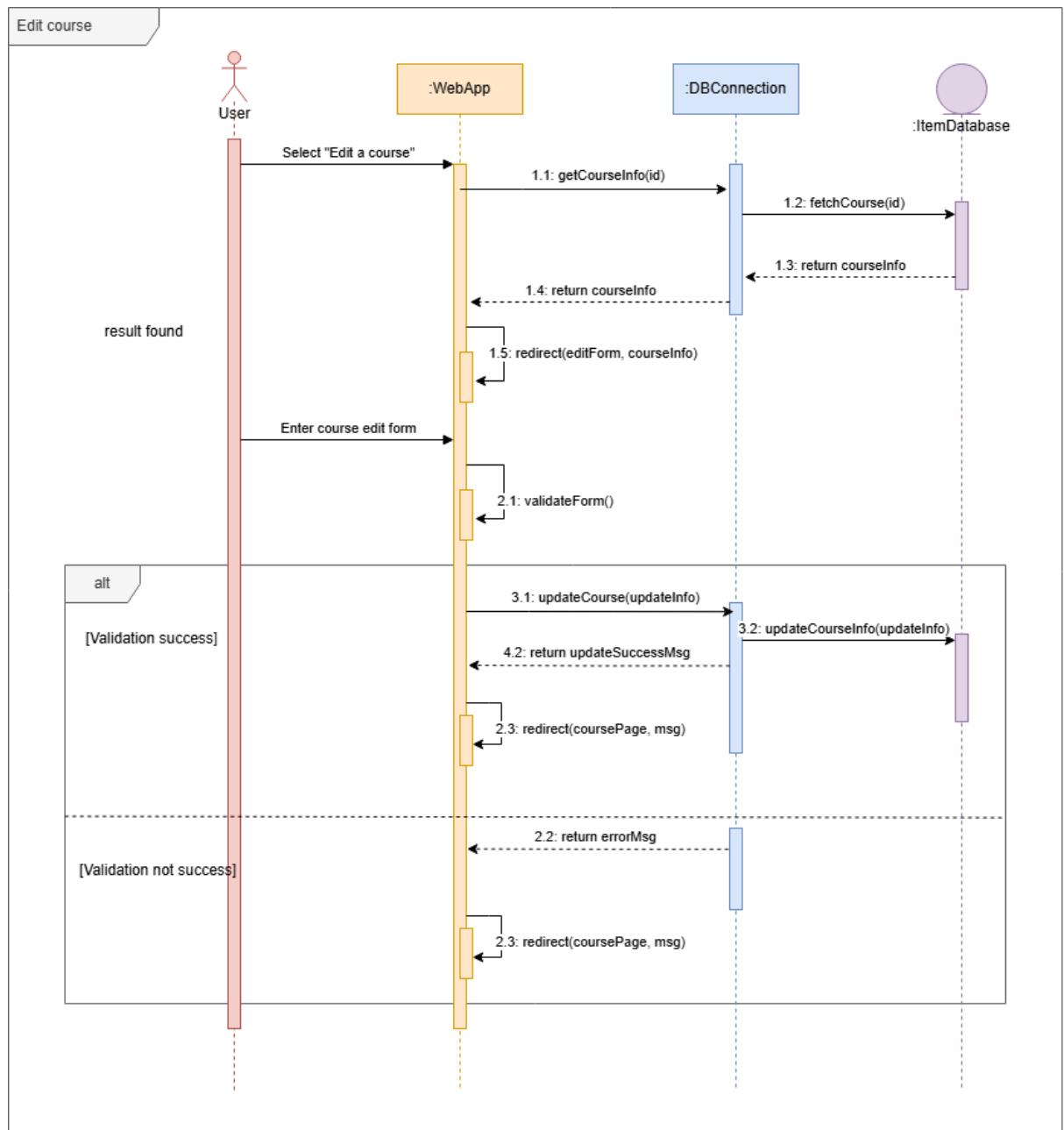


Figure 3.17 Edit a course



# International University

## School of Computer Science and Engineering

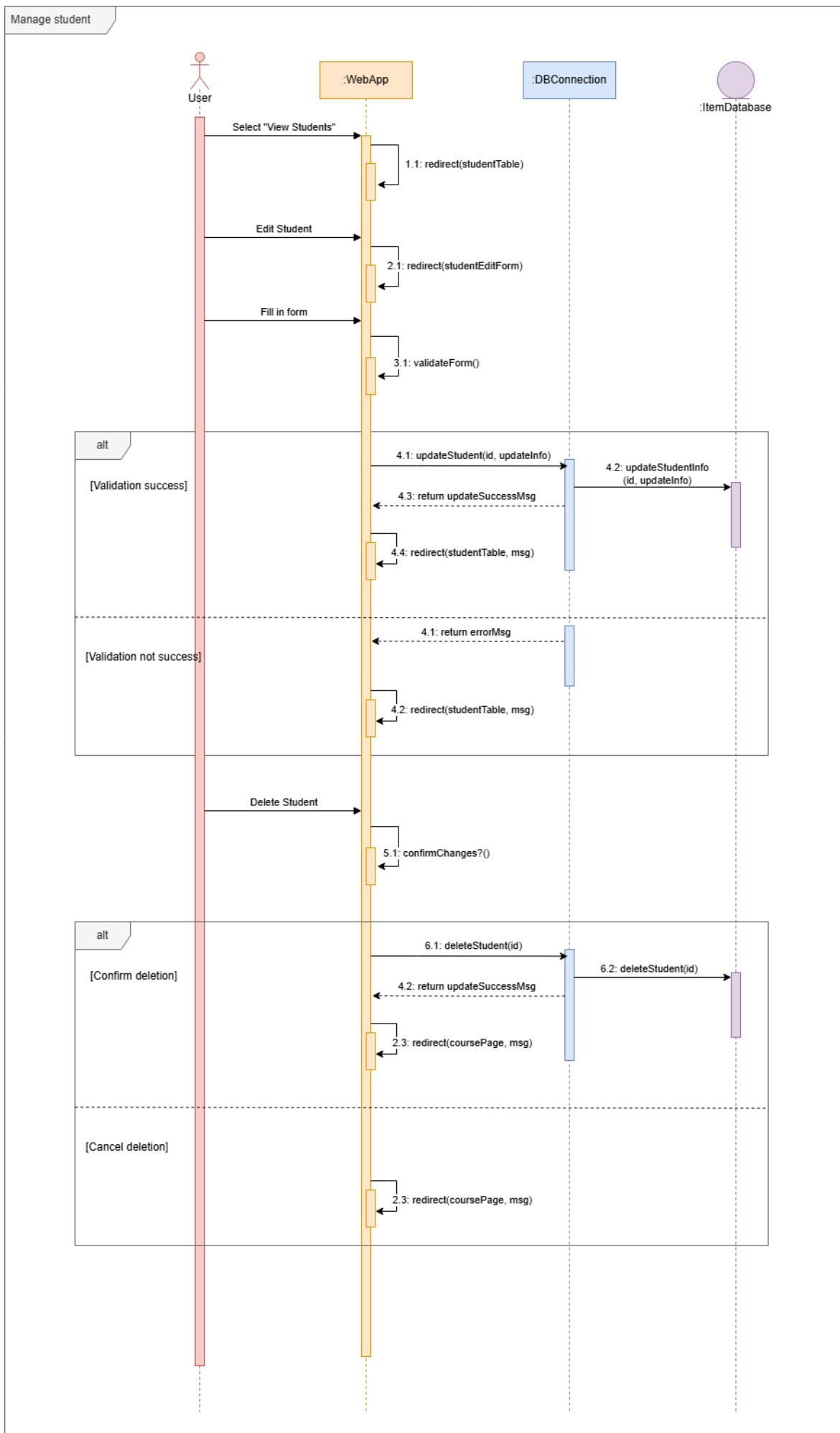




Figure 3.18 Manage students

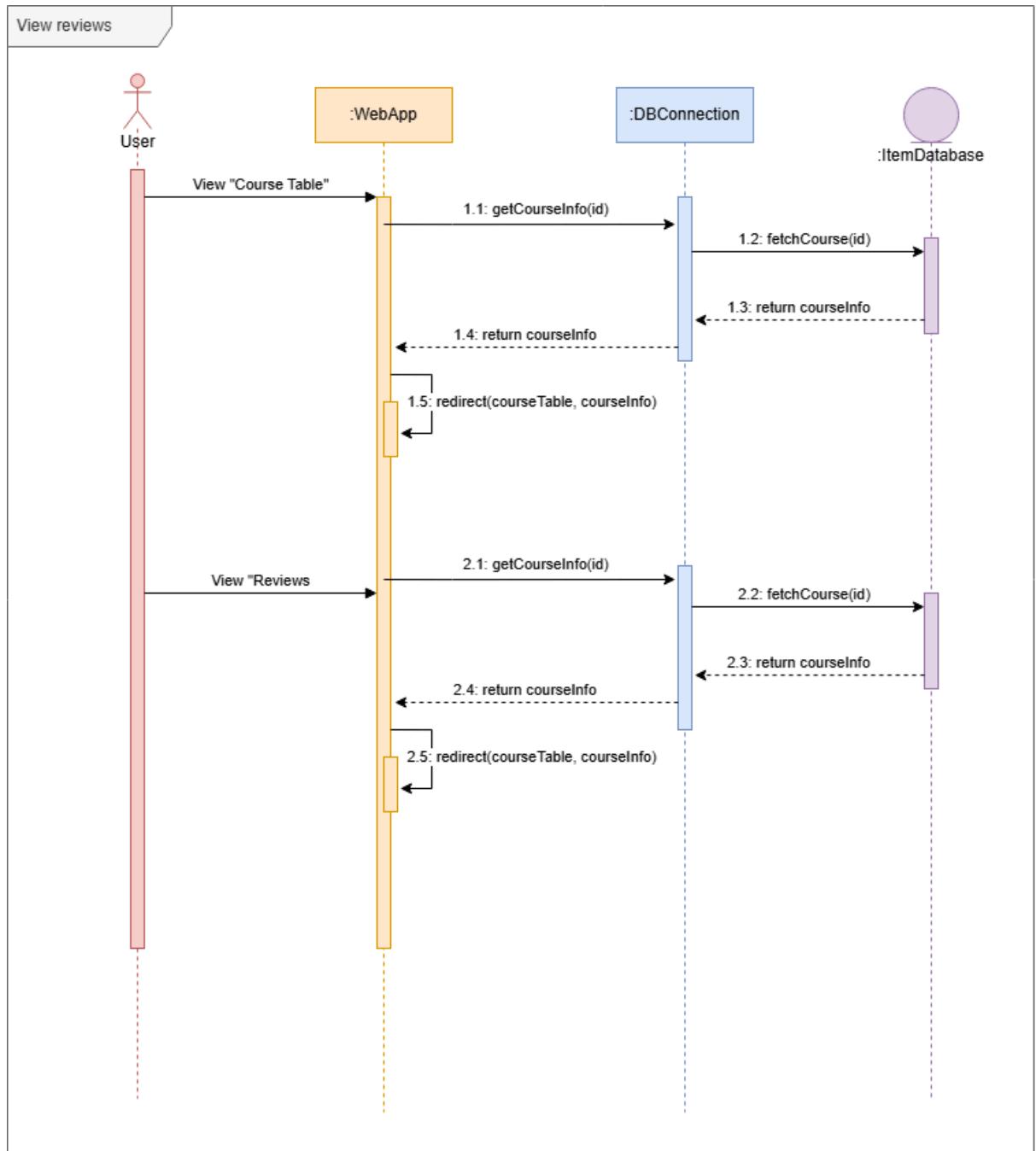


Figure 3.19 View reviews

## 5. System design

**Model-View-Controller (MVC):** The LMS adopts an MVC architectural pattern to effectively separate the presentation, business logic, and data layers. This structure enhances code organization, supports testing, and enables modular development for efficient system maintenance and growth.

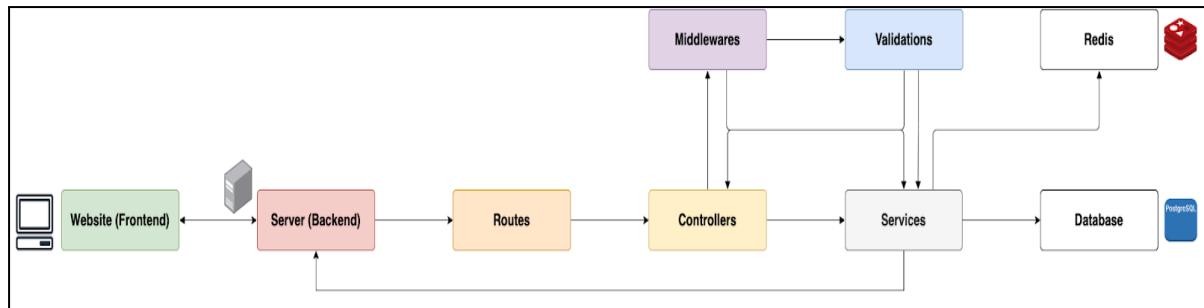


Figure 3.20. Model-View-Controller Diagram

## 6. Database design

### 6.1. ERD design

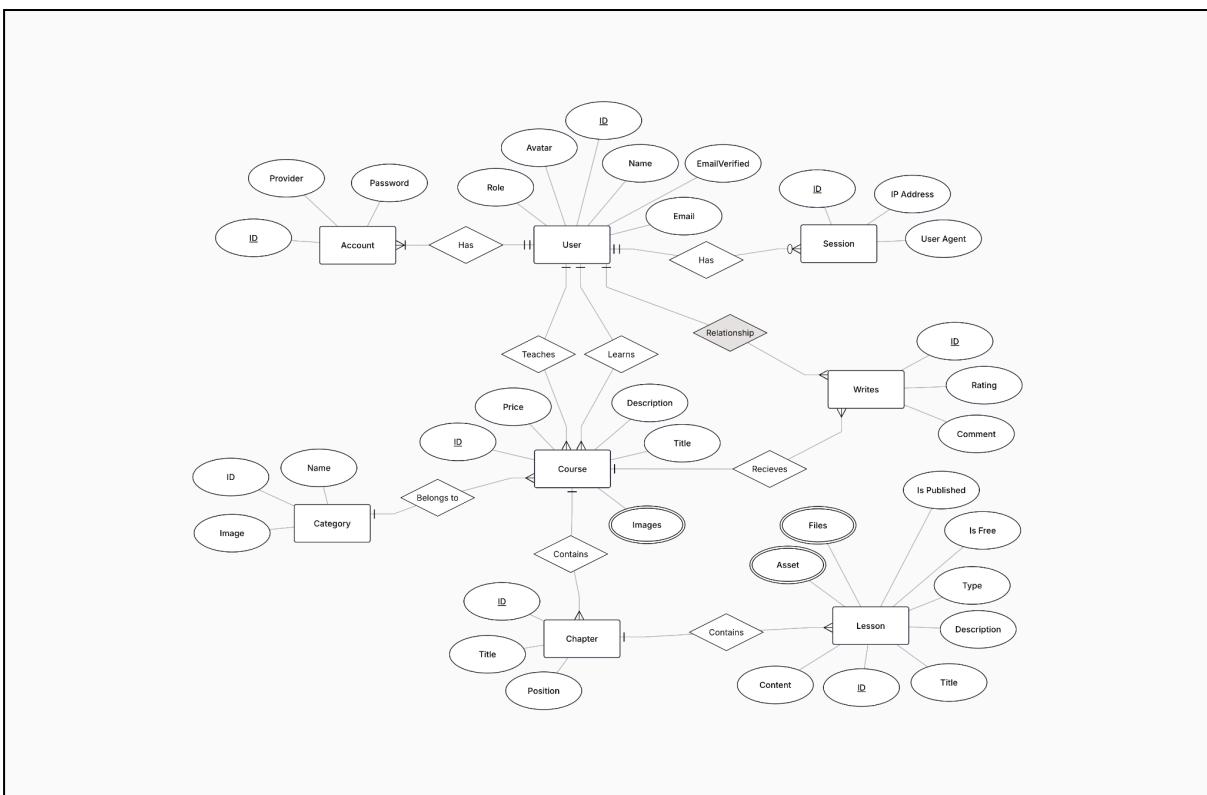


Figure 3.21. ERD design



## 6.2. Schema design

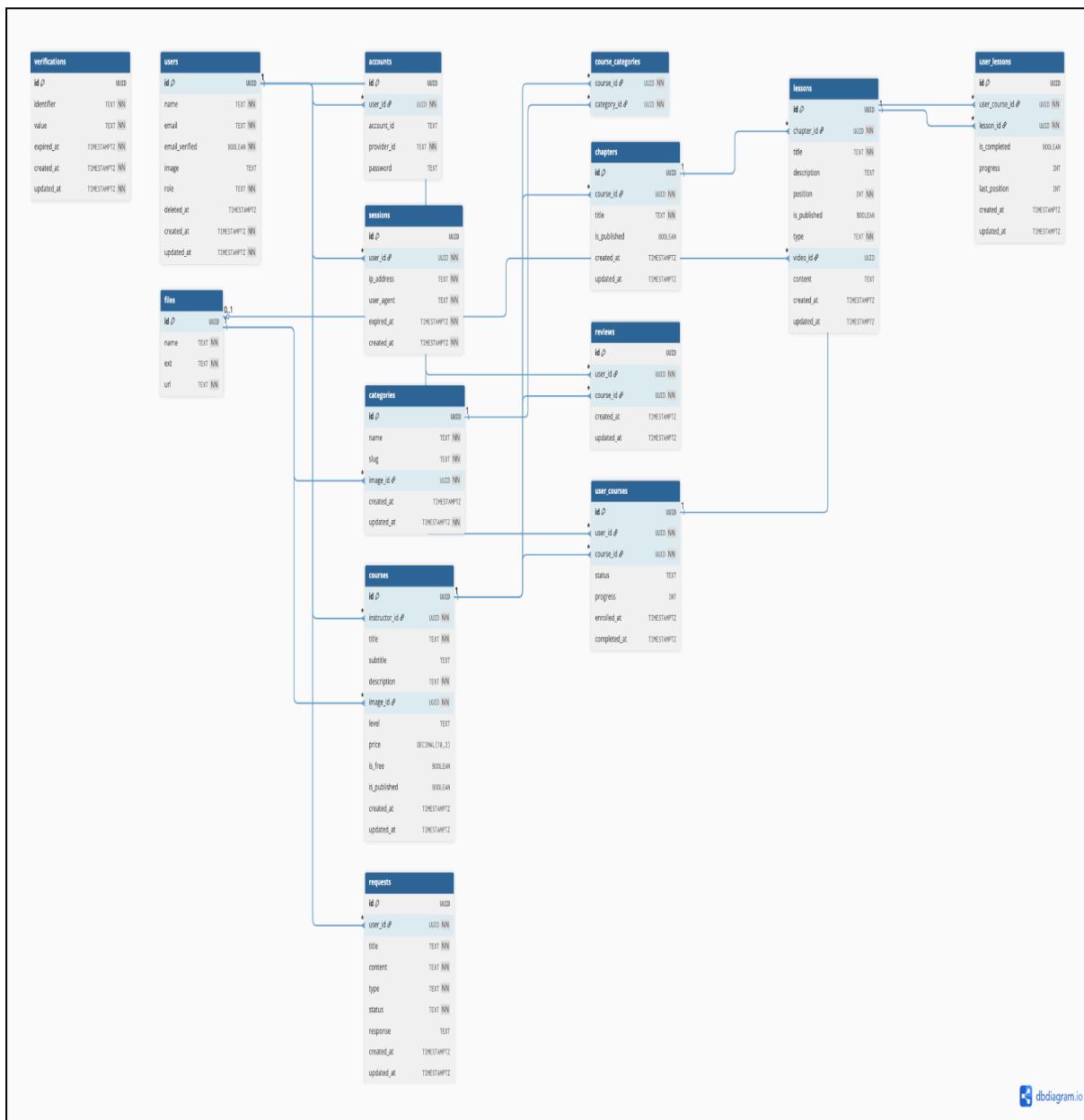


Figure 3.22. Database design

## 7. User interface design

The user interface (UI) design of Byway LMS is focused on intuitiveness, convenience, and user-friendly experience. The design process was carried out using figma, where wireframes, prototypes, and interactive flows were carefully crafted to ensure usability. Components were selected from the ShadCN Figma design library to maintain design consistency across devices.



## International University School of Computer Science and Engineering

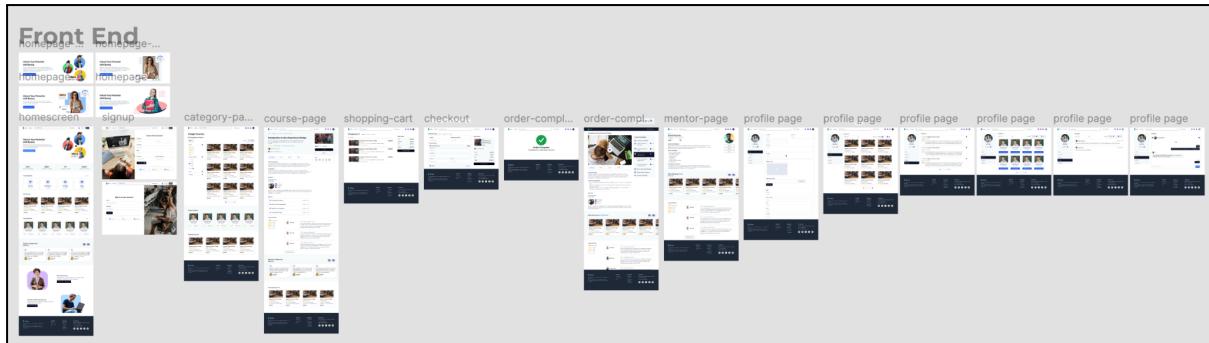


Figure 3.23. Interface design



## CHAPTER 4: IMPLEMENTATION AND RESULT

### 1. Implementation

#### 1.1. Overview

To implement the online learning management system, our group utilizes the following tools and programming languages:

- + **UI/UX design:** Figma is utilized to design the user interface (UI).
- + **Front-end development:** The front end of the project is developed using the React framework and TypeScript, complemented by the Tailwind component library ShadCN.
- + **Back-end development:** The backend is built with TypeScript and Node.js.
- + **Database management:** PostgreSQL is the chosen database for storing and managing project data. ERDPlus and Lucidchart are used to create the Entity-Relationship Diagram (ERD).
- + **Version Control:** GitHub serves as the primary platform for version control and collaboration among team members.
- + **Project Management:** GoogleSheet provides the primary workspace for the team.

Here are the links to our implementation's resources:

*Table 4.1 Resources links*

Section	Link
UI/UX (Figma)	<a href="https://www.figma.com/design/S1VF1OetiHacEH1daPCNwu/Learning-Management-System--Community---Copy--?node-id=410-10726&amp;p=f&amp;t=8vcAkCYJ5pg9mzn5-0">https://www.figma.com/design/S1VF1OetiHacEH1daPCNwu/Learning-Management-System--Community---Copy--?node-id=410-10726&amp;p=f&amp;t=8vcAkCYJ5pg9mzn5-0</a>
Backend	<a href="https://github.com/phamgiaphuc/byway-lms-be">https://github.com/phamgiaphuc/byway-lms-be</a>
Frontend	<a href="https://github.com/phamgiaphuc/byway-lms-fe">https://github.com/phamgiaphuc/byway-lms-fe</a>



## 1.2. Frontend

To build our frontend, here is the list of tools, programming languages, and dependencies that we used:

- + **Programming language:** TypeScript and ReactJS
- + **Framework:** Vite and Tanstack Router
- + **UI Library:** ShadCN
- + **Icon Library:** Lucide Icons
- + **State Controller:** Zustand
- + **HTTP Client Library:** Tanstack Query and Ky
- + **Others:** Prettier, ESLint, Husky and React Hook Form.

## 1.3. Backend

The backend of the Byway LMS was developed with a focus on scalability, maintainability, and security. This section outlines the key aspects of the backend implementation, including the technologies utilized, architectural patterns adopted, and deployment strategies:

- + **Programming language:** TypeScript
- + **Framework:** Express
- + **Database:** PostgreSQL
- + **ORM:** Prisma
- + **Storage:** R2 Storage (Cloudflare)

The screenshot shows the Swagger UI interface for the Byway LMS API. At the top, it displays "Byway LMS API 1.0.0 OAS 3.0". Below this, there are links for "API documentation" and "Apache License, Version 2.0". A dropdown menu labeled "Servers" is set to "/api". On the right side, there is a "Authorize" button with a lock icon. The main content area is divided into sections: "Auth", "Files", and "Users". The "Auth" section contains endpoints for authentication: GET /auth/status, POST /auth/sign-in, POST /auth/sign-up, POST /auth/send-verification, POST /auth/verify, GET /auth/google, and GET /auth/google/callback. The "Files" section contains endpoints for file uploads: POST /files/upload-single and POST /files/upload-multiple. The "Users" section is currently collapsed.



## 2. Results

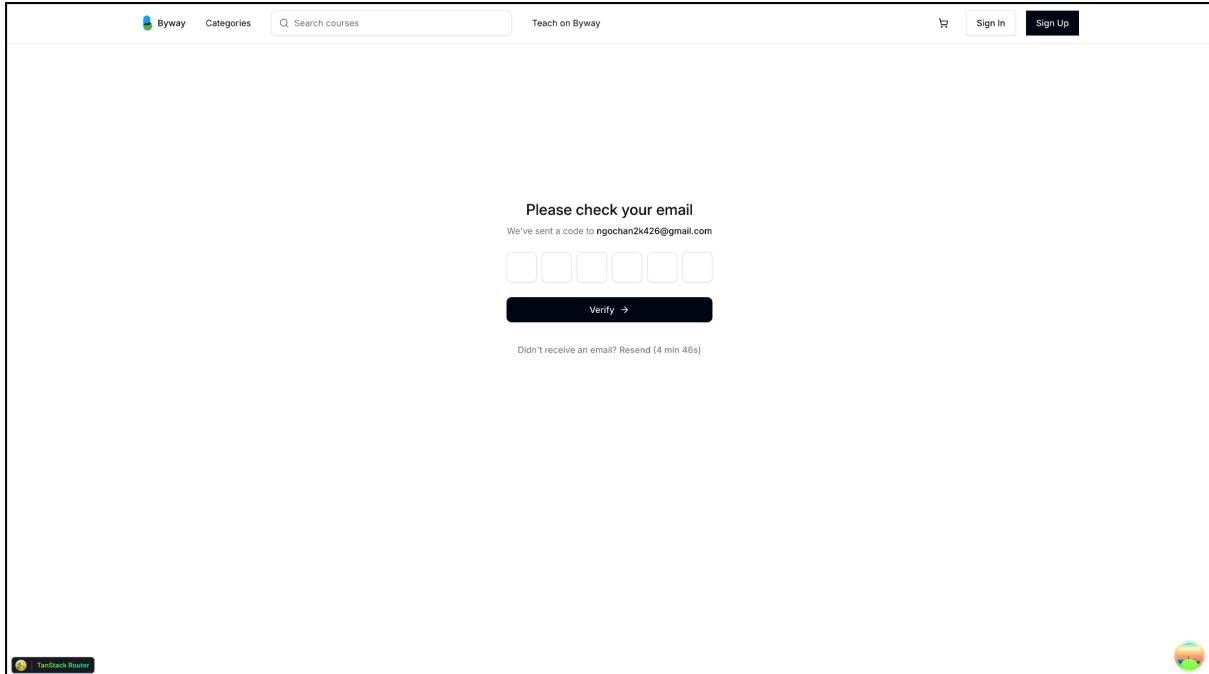
### 2.1. Authentication and authorization

When registering for a new account, the user will be asked to fill in the sign up form, which consists of first, last name, email, username, password and password confirmation.

The screenshot shows a web-based sign-up form for 'Create your account'. The form is divided into two columns: 'First name' and 'Last name' (both with placeholder text 'Enter your first name'), 'Email' (placeholder 'Enter your email'), and 'Password' and 'Confirm password' (both with placeholder 'Enter your password'). Below the form is a 'Create account →' button. At the bottom left, there's a link 'Already have an account? Sign in'. The background of the page features a photograph of a person from behind, looking at a computer screen where a video lesson is playing. The computer setup includes a keyboard and a mouse on a wooden desk.

Figure 4.2. Sign up form

After filling in the sign-up form, the system will send a verification email to the registered address to ensure the authenticity and ownership of the email. The user needs to enter the OTP correctly to activate their account.

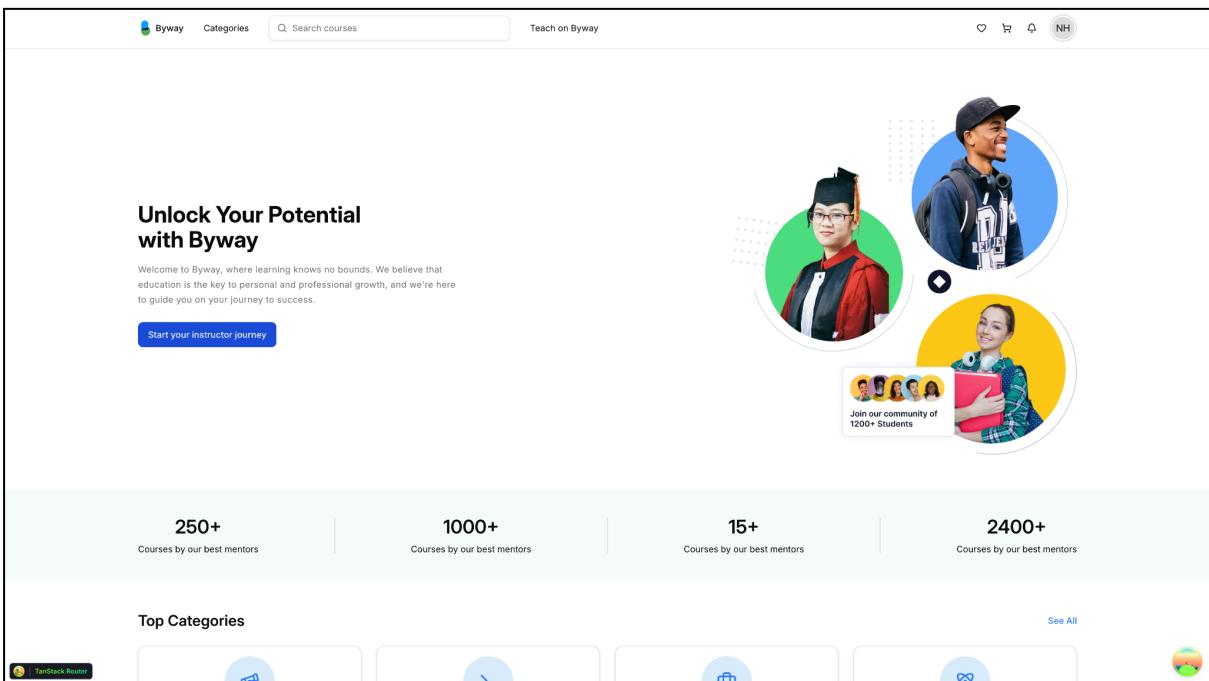


The screenshot shows a 'Please check your email' page. At the top, it says 'Byway Categories Q. Search courses Teach on Byway' and 'Sign In Sign Up'. Below that, it says 'We've sent a code to ngochan2k42@gmail.com' and shows five empty input fields for entering the verification code. A 'Verify →' button is below them. A link 'Didn't receive an email? Resend (4 min 46s)' is at the bottom. The footer includes a 'TanStack Router' icon and a globe icon.

Figure 4.3. Email verification form

## 2.2. Home page

When users first access Scholaro, they are greeted with the hero section, which displays some of the popular categories and courses of the site. In order to enroll in courses, students will have to sign in to their accounts.



The hero section features a central text 'Unlock Your Potential with Byway' with a subtext about education's role in personal and professional growth. It includes a 'Start your instructor journey' button and three circular profile pictures of diverse individuals. Below this, four statistics are displayed: '250+' courses by best mentors, '1000+' courses by best mentors, '15+' courses by best mentors, and '2400+' courses by best mentors. A 'Top Categories' section shows several categories with icons. The footer includes a 'See All' link and a 'TanStack Router' icon.

Figure 4.4. Hero section



## International University School of Computer Science and Engineering

The screenshot shows the main dashboard of the Byway platform. At the top, there's a navigation bar with 'Byway' logo, 'Categories', 'Search courses', 'Teach on Byway', and user icons. Below the navigation is a section titled 'Top Categories' featuring four boxes: 'Astrology' (11 Courses), 'Development' (11 Courses), 'Marketing' (11 Courses), and 'Physics' (11 Courses). Each category has a blue circular icon with a white symbol. To the right of the categories is a 'See All' link. Below this is a section titled 'Top Courses' which displays four identical course cards for 'Beginner's Guide to Design' by Ronald Richards. Each card includes a thumbnail image of a laptop on a desk, the course title, author, rating (4.5 stars from 1200 ratings), duration (22 Total Hours, 155 Lectures), level (Beginner), and price (\$149.9). To the right of the courses is another 'See All' link. In the center of the page is a large, semi-transparent purple circular overlay containing a portrait of a smiling woman with short brown hair and glasses.

Figure 4.5. Category and Course section

The screenshot shows the footer section of the Byway platform. It features a large circular profile picture of a woman with glasses and a brown blazer. To the right of the profile picture is a 'Become an Instructor' section with the text: 'Instructors from around the world teach millions of students on Byway. We provide the tools and skills to teach what you love.' and a 'Start Your Instructor Journey →' button. Below the profile picture is a section titled 'Transform your life through education' with the text: 'Learners around the world are launching new careers, advancing in their fields, and enriching their lives.' and a 'Checkout Courses →' button. To the right of this is a smaller image of a man sitting on the floor, working on a laptop. The footer is divided into several sections: 'Byway' (with tagline 'Empowering learners through accessible and engaging online education.'), 'Get Help' (Contact Us, Latest Articles, FAQ), 'Programs' (Art & Design, Business, IT Software, Languages, Programming), and 'Contact Us' (Address: 123 Main Street, Anytown, CA 12345, Tel: +1(23) 456-7890, Mail: bywayedu@webkul.in). Social media links for Google and Facebook are also present. A small 'TinStack Router' icon is visible at the bottom left.

Figure 4.6. Footer section



## International University School of Computer Science and Engineering

The screenshot shows the Byway platform's course exploration interface. At the top, there are navigation links for 'Byway', 'Courses', and a search bar. A 'Teach on Byway' button is also present. On the left, there are two filter sections: 'Category (11)' and 'Price'. The 'Category' section includes filters for Actors, Laws, Music, Finance, Health & Fitness, Designer, Mathematics, Physics, Economics, Web Development, and Data Analytics. The 'Price' section includes filters for Free, Under \$20, \$20 - \$50, \$50 - \$100, and Over \$100. To the right, there are two course cards: 'Photography Masterclass: Your Complete Guide to Photography' (Physics, Data Analytics, Web Development, 3500 chapters) and 'Go: The Complete Developer's Guide (Golang)' (Data Analytics, Web Development, 1 chapter). The footer contains the Byway logo, a brief description, and links for 'Get Help', 'Programs', and 'Contact Us'.

Figure 4.7. Explore courses

### 2.3. Admin dashboard

Admin is allowed to manage the users, categories and process the requests from users (students) and instructors.

The screenshot shows the Admin dashboard. The left sidebar lists 'Platform' sections: 'Dashboard' (selected), 'Course', 'Category', 'User Management', and 'Request'. The main area displays a 'Good afternoon' message and a calendar entry for 'Sunday, December 14, 2025'. Below this, there is a 'Community' feed with posts from users like Vell Dincer, Theresa Webb, and Nor Pena. There are four main management cards: 'Course' (Click here to view and manage courses), 'Category' (Click here to manage categories for courses), 'User Management' (Click here to manage users, teachers and admins), and 'Requests' (Click here to view and manage requests). The bottom left shows a user profile for 'Hi, Gia Phuc Pham Admin'. The bottom right shows a URL: 'localhost:5173/admin/course'.

Figure 4.8. Dashboard page



## International University School of Computer Science and Engineering

In the category section, an admin can view a list of categories. They can click to create, edit or delete a category and select multiple categories to delete many.

The screenshot shows the 'Category Management' page with a list of categories. The columns are: #, Category, Created at, Updated at, and Actions. The categories listed are:

#	Category	Created at	Updated at	Actions
1	Actors	10 Dec 2025	10 Dec 2025	
2	Laws	10 Dec 2025	10 Dec 2025	
3	Music	10 Dec 2025	10 Dec 2025	
4	Finance	10 Dec 2025	10 Dec 2025	
5	Health & Fitness	10 Dec 2025	10 Dec 2025	
6	Designer	10 Dec 2025	10 Dec 2025	
7	Mathematics	10 Dec 2025	10 Dec 2025	
8	Physics	09 Dec 2025	09 Dec 2025	

At the bottom right, there are buttons for 'Rows per page' (set to 10), 'Page 1 of 2', and a small preview icon.

Figure 4.9. Category section

The screenshot shows the 'Category Management' page with a modal window titled 'Create new category'. The modal contains fields for 'Name' (with placeholder 'Enter category name') and 'Image' (with a file upload area). There are 'Cancel' and 'Create' buttons at the bottom. The main table of categories is visible in the background.

Figure 4.10. Add new category



# International University

## School of Computer Science and Engineering

The screenshot shows the 'Category Management' section of the Byway platform. A modal window titled 'Delete categories' is open, asking 'Do you really want to delete these categories?' with 'Cancel' and 'Delete' buttons. In the background, a table lists eight categories: Actors, Laws, Music, Finance, Health & Fitness, Designer, Mathematics, and Physics. Rows 1 and 2 are selected. The interface includes a sidebar with navigation links like Dashboard, Course, Category, User Management, Request, and a user profile for 'Hi, Gia Phuc Pham Admin'. At the bottom, there are pagination controls for 'Rows per page' (10) and 'Page 1 of 2'.

#	Category	Created at	Updated at	Actions
1	Actors	10 Dec 2025	10 Dec 2025	
2	Laws	10 Dec 2025	10 Dec 2025	
3	Music	10 Dec 2025	10 Dec 2025	
4	Finance	10 Dec 2025	10 Dec 2025	
5	Health & Fitness	10 Dec 2025	10 Dec 2025	
6	Designer	10 Dec 2025	10 Dec 2025	
7	Mathematics	10 Dec 2025	10 Dec 2025	
8	Physics	09 Dec 2025	09 Dec 2025	

Figure 4.11. Delete multiple categories

In the request section, an admin can process the requests (category or teaching requests) from the users. The list of requests is shown in a table format.

The screenshot shows the 'Request Management' section of the Byway platform. It displays a table of two requests, both titled 'Teach Request' and containing the content 'This is a teach request'. The requests are from 'Ngọc Hân Nguyễn Hồng' and 'Gia Phúc Pham', both with 'Pending' status and 'Teaching' type. The table has columns for #, Request Title, Request Content, From, Request Type, Request Status, Response, Created at, and Updated at. The interface includes a sidebar with navigation links like Dashboard, Course, Category, User Management, Request, and a user profile for 'Hi, Gia Phuc Pham Admin'. At the bottom, there are pagination controls for 'Rows per page' (10) and 'Page 1 of 1'.

#	Request Title	Request Content	From	Request Type	Request Status	Response	Created at	Updated at
1	Teach Request	This is a teach request	Ngọc Hân Nguyễn Hồng ID: 9b905798-31c1-4daa-ad84-5ae6f6d5fed8	Teaching	Pending	---	14 Dec 2025	14 Dec 2025
2	Teach Request	This is a teach request	Gia Phúc Pham ID: 98ab459e-1d4a-4cd2-a444-a7f359a2ff32	Teaching	Pending	---	10 Dec 2025	10 Dec 2025



## International University School of Computer Science and Engineering

Figure 4.12. Request section

### 2.4. Instructor section

Instructors can manage and create courses with chapters and lessons. Beside that, they can view their students and reviews.

Figure 4.13. Instructor dashboard



# International University

## School of Computer Science and Engineering

The screenshot shows the Byway platform's course management interface. On the left, a sidebar menu includes 'Platform', 'Dashboard', 'Course' (selected), 'Message', 'Revenue', and 'Notification'. Below the menu is the user profile of 'Ngoc Hân Nguyễn Hồng' (Instructor). The main area is titled 'Course Management' with the sub-instruction 'Create and manage courses here.' It features two course cards:

- Photography Masterclass: Your Complete Guide to Photography**  
Physics, Data Analytics, Web Development +1  
\$500, Published
- Go: The Complete Developer's Guide (Golang)**  
Data Analytics, Web Development  
Free, Published

A large red button at the bottom left says 'Go Back'.

Figure 4.14. View instructor's courses

The screenshot shows the 'Add new course' form. The left sidebar and user profile are identical to Figure 4.14. The main form fields include:

- Course Title:** A text input field with placeholder 'Enter title'.
- Course Subtitle:** A text input field with placeholder 'Enter subtitle' and character count '0/200 characters'.
- Course Description:** A rich text editor with toolbar icons (Normal, Bold, Italic, Underline, etc.) and a text input field with placeholder 'Enter your description'.
- Course Price:** Radio buttons for 'Course is free' (selected) and 'Students have to paid'.
- Course Category:** A dropdown menu labeled 'Select category'.
- Course Level:** A dropdown menu labeled 'Beginner'.
- Publish course:** A toggle switch labeled 'Make this course visible to students'.

A large red button at the bottom left says 'Go Back'.

Figure 4.15. Create new course



The screenshot shows the Byway platform interface. On the left is a dark sidebar with navigation links: Byway, Platform, Dashboard, Course (which is selected), Message, Revenue, and Notification. Below the sidebar is a user profile for 'Ngoc Han Nguyen Hong' (Instructor). The main content area has a breadcrumb navigation: Dashboard > Course > Go: The Complete Developer's Guide (Golang). It displays 'Course chapters' with a sub-section for 'Building RESTful HTTP JSON API [Gin + JWT + PASETO]'. This chapter contains two lessons: 'Go Getting Started' and 'Go Syntax', both marked as 'Published'. A button '+ Add a lesson' is visible at the bottom of the chapter list. At the bottom right of the main content area is a small globe icon.

Figure 4.16. View chapters of course

The screenshot shows the 'Add a lesson' form for the 'Building RESTful HTTP JSON API [Gin + JWT + PASETO]' chapter. The left sidebar remains the same. The main form has a header with back and forward arrows, a 'Lesson Details' section (with a note 'Fill in the lesson information.'), and a 'Lesson Title' input field ('Enter title'). Below it is a 'Lesson Description' input field ('Enter description') with a character limit of '0/120 characters'. The next section is 'Lesson Content' with a rich text editor toolbar ('Normal', 'B', 'I', 'U', 'G', 'H1', 'H2', 'H3', 'H4', 'H5', 'H6', 'List', 'Table', 'Image', 'Text'). An 'Enter your content' placeholder is present. The final section is 'Lesson Video' with a file upload input ('Choose a file or drag & drop it here. MP4 and MOV formats'). At the top right of the form are 'Cancel X' and 'Submit →' buttons. To the right of the form is a 'Publish course' toggle switch, which is turned off. The bottom right of the main content area features a small globe icon.

Figure 4.17. Add a lesson

## 2.5. Student section

Students can search and enroll in the courses they want to learn. Byway provides a friendly user interface like the text editor and modules tree list to help the student easier to learn the lectures. The student can also track the progress of their



## International University School of Computer Science and Engineering

courses while they are learning. Moreover, if the student want to become an instructor they can request a teaching permission from the Byway's admin

Byway Courses Search courses Teach on Byway AD

Email acuscodinghcm@gmail.com

Name Acus Dev

Avatar Choose a file or drag & drop it here JPEG, PNG, and SVG formats, up to 10MB

Profile My Courses My Requests Settings Update profile

Byway Empowering learners through accessible and engaging online education. Byway is a leading online learning platform dedicated to providing high-quality, flexible, and affordable educational experiences.

Get Help Contact Us Latest Articles FAQ Programs Art & Design Business IT Software Languages Programming

Contact Us Address: 123 Main Street, Anytown, CA 12345 Tel: +(123) 456-7890 Mail: bywayedu@webkul.in

Google Facebook

Figure 4.18. User profile

Byway Categories Search courses Teach on Byway NH

## TEACHING AND LEARNING POLICY

Reviewed on: Nov 2025 Next Review: Nov 2026

### 1. Introduction

We value our reputation for providing the highest quality of education within an international context. We believe that every child matters. All gifts and talents are recognised and nurtured so that pupils are prepared to become responsible, caring, active members of a global community in the twenty-first century.

SCHOOL AIMS

- To create a learning environment that challenges and supports pupils to achieve high standards in the pursuit of excellence.
- To create a supportive, interactive educational environment that will promote the development of independent, life-long learners.
- To recognize the importance of the technological world in which we live, and therefore to embrace new technology and to make it an integral part of teaching and learning across the curriculum.
- To promote opportunities for communication, collaboration, creativity and critical thinking in all aspects of teaching and learning.
- In partnership with the community, to develop an awareness of local and involvement in global issues.
- As an international school, to build bridges between cultures; and by developing respect, understanding and interest in the beliefs and cultures of others, to ensure that our pupils are comfortable with a multi-cultural society that embraces and celebrates the differences between us.
- To provide an environment that encourages pupils to become caring, thoughtful and responsible citizens.

### 2. Teaching

To provide high-quality, excellent teaching, all teachers at our schools do the following:

I have read the policy and agree to become the Byway LMS's instructor.

Send request →

Byway Empowering learners through accessible and engaging online education. Byway is a leading online learning platform dedicated to providing high-quality, flexible, and affordable educational experiences.

Get Help Contact Us Latest Articles FAQ Programs Art & Design Business IT Software Languages Programming

Contact Us Address: 123 Main Street, Anytown, CA 12345 Tel: +(123) 456-7890 Mail: bywayedu@webkul.in

Google Facebook

Figure 4.19. Teaching and learning policy



### 3. Testing

#### 3.1. User Authentication & Authorization

Table 4.20. Test case 1 for User Authentication & Authorization

<b>Test Case #:</b> UAA_01	<b>Test Case Name:</b> User sign up with email verification <b>Subsystem:</b> User Authentication & Authorization
<b>System:</b> Byway LMS	<b>Design Date:</b> 25/11/2025
	<b>Execution Date:</b> 01/12/2025
<b>Designed by:</b> Gia Phúc	
<b>Executed by:</b> Ngọc Hân	
<b>Short Description:</b> Test the user's account registration with valid information.	

#### Preconditions:

The email used for registration does not exist in the system database.

Step	Action	Expected System Response	Pass/Fail	Comments
1	Navigate to the "Sign Up" page.	The system displays the sign-up form with input fields and role selection for role Student/Teacher.	Pass	
2	Enter valid details in required fields	The system checks the email format, email existence and password convention (at least 6 characters, including numbers).	Pass	
3	Click the “Sign up” button.	The system sends a verification OTP to the registered email and redirects the user to the verification page.	Pass	



4	Open the registered email and check for the OTP code.	The verification OTP code is sent successfully.	<b>Pass</b>	
5	Back to the Sign up page and enter the verification OTP in the required field.	The system activates the user account and displays a confirmation message. The user is redirected to the Homepage.	<b>Pass</b>	
6	Repeat from step 2 but with an already registered email address.	The system displays an error message showing that this email is already registered, and prompts the user to log in or use a different email address.	<b>Pass</b>	

#### Postconditions

- Happy path: A new user account is created with the provided email address and password in the system database. The user successfully logs in and is navigated to the Homepage.
- Edge case: System displays unsuccessful message, user stays in Sign up page for another attempt.

Table 4.21. Test case 2 for User Authentication & Authorization

<b>Test Case #:</b> UAA_02	<b>Test Case Name:</b> User login with account	
<b>System:</b> Byway LMS	<b>Subsystem:</b> User Authentication & Authorization	
	<b>Design Date:</b> 25/11/2025	
<b>Designed by:</b> Gia Phúc	<b>Execution Date:</b> 01/12/2025	
<b>Executed by:</b> Ngọc Hân	<b>Short Description:</b> Test user login with valid credentials.	

#### Preconditions



The user has a valid account with the registered email and password.

Step	Action	Expected System Response	Pass/Fail	Comments
1	Navigate to the "Log in" page.	The login form is displayed with fields for username/email and password.	Pass	
2	Fill the email/username and password into appropriate fields.	The system validates the entered credentials and activates the “Sign in” button.	Pass	
3	Click the “Sign in” button.	The system verifies the account and redirects the user to the Homepage.	Pass	
4	Repeat step 2 with an invalid email or password format.	These fields are highlighted with red color to notify that email or password is not in correct format.	Pass	
5	Repeat steps 2,3 with a non-registered email or the wrong password.	The system replies with the wrong account and then prompts the user to check the information again.	Pass	

#### Postconditions

- Happy path: The user is logged in and has access to their account. A user session is created in the system.
- Edge case: The user remains on the login page with an error message.



### 3.2. Course Management

Table 4.22. Test case 1 for Course Management

<b>Test Case #:</b> CM_01	<b>Test Case Name:</b> Display Course
<b>System:</b> Byway LMS	<b>Subsystem:</b> Course Management
<b>Designed by:</b> Gia Phúc	<b>Design Date:</b> 26/11/2025
<b>Executed by:</b> Viễn Phát	<b>Execution Date:</b> 01/12/2025
<b>Short Description:</b> Test that the user can view courses and access restricted content like course modules, and course lessons after logging in.	

#### Preconditions:

The user is logged in with a valid account.

The system stores available courses with contents.

Step	Action	Expected System Response	Pass/Fail	Comments
1	Navigate to the Homepage.	The homepage is displayed with many recommended courses.	Pass	
2	Click on a specific course.	The system displays the course page with general information and course content.	Pass	
3	Attempt to enroll for the course by clicking the “Join the class” button.	The system activates the enrollment process.	Pass	
4	Enroll in the course.	The user is successfully enrolled in the course, and the system shows a confirmation message.	Pass	



5	Check the course progress after enrolling in a course.	The system displays the correct course progress and marks lessons as completed when the user has completed them.	<b>Pass</b>	
---	--	--	-------------	--

#### **Postconditions**

The logged-in user can view all course details and can enrol in new courses.

The logged-in user can keep track of the course learning progress.

*Table 4.23. Test case 3 for Course Management*

<b>Test Case #:</b> CM_04	<b>Test Case Name:</b> Enroll Course
<b>System:</b> Byway LMS	<b>Subsystem:</b> Course Management
<b>Designed by:</b> Gia Phúc	<b>Design Date:</b> 26/11/2025
<b>Executed by:</b> Viễn Phát	<b>Execution Date:</b> 01/12/2025
<b>Short Description:</b> Test the enrollment process for a course with a Student role.	

#### **Preconditions:**

The user is logged in with valid credentials.

The course must be available for enrollment and not already be enrolled by the user.

Step	Action	Expected System Response	Pass/Fail	Comments
1	Navigate to the course detail page.	The system displays the course details page, including the "Join the course" button.	<b>Pass</b>	
3	Click the "Join the course" button.	The system processes the enrollment.	<b>Pass</b>	
	Check the user's course page "My	The newly enrolled course appears in the "My Courses"	<b>Pass</b>	



	Course”.	section.		
4	Attempt to access course content (video lesson, text lesson).	The system allows the user to access the course content.	<b>Pass</b>	

#### Postconditions

The user is successfully enrolled in the course and can access course content.

The course appears in the “My Course” section in the “In Progress” tag.

Table 4.24. Test case 4 for Course Management

<b>Test Case #:</b> CM_05	<b>Test Case Name:</b> Instructor Creates Course
<b>System:</b> Byway LMS	<b>Subsystem:</b> Course Management
<b>Designed by:</b> Gia Phúc	<b>Design Date:</b> 26/11/2025
<b>Executed by:</b> Ngọc Hân	<b>Execution Date:</b> 01/12/2025
<b>Short Description:</b> Test the process of creating a new course by an instructor, modules, and lessons by an instructor.	

#### Preconditions:

The user is logged in as an Instructor.

Required resources like course templates and storage should be available.

Step	Action	Expected System Response	Pass/Fail	Comments
1	Log in to the platform with an instructor account.	The user is authenticated and redirected to the Homepage.	<b>Pass</b>	
2	Navigate to the “My Course” section.	The course management page is displayed.	<b>Pass</b>	



3	Click on the “Add new course” button.	The system displays an “Add new course” form with fields for the course’s name and description.	<b>Pass</b>	
4	Fill in the course name and description.	The system validates the inputs for any required fields and formats.	<b>Pass</b>	
5	Click the “Add course” button to continue.	The system assigns the course with a unique identifier and proceeds with the creation process.	<b>Pass</b>	
6	Select the level (Beginner, Intermediate, Advanced)	The system shows the multiple choice form for the user to select the corresponding level.	<b>Pass</b>	
7	Upload course thumbnails.	The system allows the instructor to upload the image and validates the file type/size.	<b>Pass</b>	
8	In the “Course content” section, click the “Add new section” and enter the module title (e.g., "Chapter 1: Introduction").	The system saves the module in the course but does not require detailed content at this point.	<b>Pass</b>	
9	Repeat step 8 to add multiple modules to the course (e.g., "Chapter 2: Variables and Methods").	The system adds each module with its respective titles and descriptions under the course page.	<b>Pass</b>	



10	Click the “Edit” button in a specific module to edit it.	Navigate to the Course Module management page within the newly created course.	<b>Pass</b>	
11	Modify the module details (change the title or update the module description).	The system saves the updated module details and reflects them on the course page.	<b>Pass</b>	
12	In the “Lesson” section, click “Add new lesson” and enter the lesson title.	The system validates the lesson details and saves the new lesson within the module.	<b>Pass</b>	
13	Repeat step 12 to add multiple lessons to the course module.	The system adds each lesson with its respective titles and descriptions under the course module page.	<b>Pass</b>	
14	Click the “Edit lesson” button in a specific lesson tag to edit it.	Navigate to the Lesson Creation management page.	<b>Pass</b>	
15	Edit the description and upload the video lesson.	The system allows the instructor to upload materials and validates the file type/size.	<b>Pass</b>	
16	Click "Save" to complete the process.	The system confirms that the course has been created successfully; saves new courses to the instructor’s course management page; gives availability to the course.	<b>Pass</b>	

**Postconditions**



The courses, modules, and lessons are successfully created and saved in the system.

The course can be found on Homepage and is available for students to view and enrol in.



## CHAPTER 5: CONCLUSION & FUTURE WORK

### 1. Conclusion

Overall, the Byway Learning Management System (LMS) project was carried out over a period of 2 months by a development team consisting of three members. This section presents a comprehensive discussion of the project outcomes and implementation approach.

The Byway LMS was designed and developed following the Waterfall development model. This approach was selected because the project scope was relatively small and the system requirements were clearly defined with minimal expected changes. In addition, limited direct interaction with stakeholders made Agile methodologies less appropriate. At the early stages of development, internal training sessions were organized to help team members who were unfamiliar with the chosen technologies, while other project phases progressed in parallel to maintain the overall timeline.

Regarding project management and collaboration, all meetings and discussions were conducted through Discord, ensuring effective real-time communication. Google Drive was used for sharing documentation and development resources, while Google Sheets supported task tracking and progress monitoring. These tools were chosen for their comprehensive features, ease of use, and cost-effectiveness, aligning well with the project's budget constraints.

### 2. Contribution

*Table 5.1. Contribution table*

Name	Role	Contribution
Phạm Gia Phúc	Leader + Fullstack developer	33%
Nguyễn Hồng Ngọc Hân	Reporter + Backend developer	33%
Lê Viễn Phát	Frontend developer	33%

### 3. Future works



## International University School of Computer Science and Engineering

Although the Byway Learning Management System successfully fulfills its core objectives, several enhancements can be considered for future development to further improve functionality, scalability, and user experience.

Future work may include the integration of real-time communication features, such as live video classes or virtual classrooms, to support synchronous learning. Additionally, incorporating advanced analytics and reporting tools would enable instructors and administrators to gain deeper insights into learner performance, engagement levels, and course effectiveness.

The system can also be extended by adding mobile application support to provide a more seamless learning experience across smartphones and tablets. Implementing AI-driven features, such as personalized course recommendations and automated assessment feedback, could further enhance learning outcomes.

From a system perspective, future improvements may involve strengthening security mechanisms, optimizing database performance, and supporting scalability to accommodate a larger number of users. Integration with third-party tools such as payment gateways, certification services, or external learning resources could also broaden the platform's usability.

By addressing these potential enhancements, Byway LMS can evolve into a more comprehensive and adaptive learning platform that meets the growing demands of modern online education.