



Tecnológico  
de Monterrey

**AIMAX**

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# 1 Introduction

## 1.1 Problem Definition

In today's academic and professional environment, staying updated with the latest knowledge is crucial for continuous development in any field. However, I have observed that many students and professionals face the challenge of finding educational resources that specifically match their needs and learning pace. There is a significant gap between the availability of information and its effective personalization to facilitate efficient and effective learning for each individual.

Additionally, the rapid pace of advancement in numerous disciplines demands a learning approach that is not only reactive but also proactive and adaptive. Individuals need a solution that not only educates them on what is already known but also prepares them to adapt to and master new theories, practices, and technologies that are constantly emerging. This implies an educational approach capable of evolving and dynamically responding to the changing trends in their specific sector.

Finally, the lack of a comprehensive system that continuously records and adjusts individual educational progress further complicates the ability of students and professionals to follow a coherent and cumulative learning path. Without adequate and personalized progress tracking, it is difficult to ensure that the education received is both pertinent and applicable in the long term, which is essential for growth and development in any area of knowledge.

# 2 User Analysis

## 2.1 User Observation Methodology

Through detailed observation of the interactions and behaviors of students and professionals across different fields of knowledge, I have identified key patterns that highlight their educational needs and challenges. I noticed that many individuals actively seek relevant education but often encounter resources that do not align with their specific knowledge level or particular interests. This disconnect between available material and learner needs underscores the importance of a more personalized approach.

Moreover, by observing how these users interact with existing educational platforms, it becomes evident that they desire a system that not only provides them with information but also allows them to influence the type of content they receive. Frustration arises when they are faced with rigid systems that do not adapt to their personal or professional evolution. This reflects the need for a platform that can adjust and evolve with the user over time.

Finally, I have noted that despite the vast amount of information available, many individuals still struggle to see a clear path toward achieving their educational and professional goals. The ability to visualize and track their progress and adapt their study plans as their personal goals and circumstances change is something they greatly value but rarely find in current systems. This observation has shown me the critical importance of personalization in education and progressive tracking to facilitate truly effective and relevant learning.

## 2.2 Empathy Map

- **Thinks and Feels:** They are motivated by the desire to advance professionally and are curious about new technologies and learning methods. Often feel the pressure to stay up-to-date with the changing demands of the technological market. They seek a learning experience that is both rewarding and efficient, desiring a clear return on their time investment.
- **Hears:** They listen to friends talk about the latest tools and learning platforms, as well as the most in-demand skills in the industry. They may also hear recommendations and critiques of different learning methods during conferences, webinars, or on professional networks.
- **Sees:** While exploring learning options, they see a variety of online educational offerings, from courses to tutorials and interactive roadmaps. They also observe the work of others in their field, which can inspire them to learn new skills or delve deeper into specific areas of interest.
- **Says and Does:** They discuss their learning plans and professional aspirations with friends and mentors, seeking advice and validation. They enroll and participate in courses they believe will maximize their learning potential. They act based on received recommendations and adjust their learning itineraries as they progress, marking achieved milestones and setting new goals as they advance.

## 2.3 Persona

### Carlos Rivera

*Junior Developer*

“Always moving forward; every line of code is one more step toward my goal.”

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- carlos.rivera@gmail.com
- Zapopan, JAL, Mexico

### Motivations

He is motivated by the idea of always being up-to-date with the latest trends in web development and being able to apply this knowledge to real projects that solve everyday problems. He is looking for a platform that guides him step by step and expands his competencies in a structured and efficient way.

### Biography

He is a technology enthusiast with a degree in Computer Science, recently graduated and eager to consolidate his practical skills. He loves exploring new technologies and tools that allow him to create innovative web applications.

### Personality

- Curious
- Determined

### Skills

- Teamwork
- Problem-solving

### Goals

His main objective is to become a full-stack developer. He wants to master everything from front-end fundamentals like HTML and CSS to complex back-end aspects and database management. He aspires to create complete applications on his own and contribute significantly in his workplace.

### Favorite Brands

GitHub, Codecademy, Stack Overflow, Visual Studio Code

## 2.4 User Journey Map

Phase	User Actions	Touchpoints
<b>Awareness</b>	1. Hears about the platform from friends.	
	2. Discovers the platform through online search.	1. Conversations at social or professional gatherings.
<b>Research</b>	1. Explores the homepage to understand the offering.	
	2. Navigates through the "About Us" section for more details.	1. Clear and attractive user interface of the main page.
<b>Consideration</b>	1. Reviews key features and how learning is personalized.	
	2. Evaluates how the platform can fit his needs.	1. Detailed list of functionalities and benefits on the website.
<b>Purchase</b>	1. Decides to try the website.	
	2. Completes registration by entering personal data.	1. Simple and straightforward registration page.

<b>Support</b>	1. Actively explores initial roadmaps and recommendations.	
	2. Contacts support for specific usage questions.	1. Clear and intuitive roadmaps.

Table 1: User Journey Map for Carlos Rivera - Part 1

Phase	Pain Points	Solutions
<b>Awareness</b>	1. Difficulty understanding the unique value of the platform.	
	2. Lack of visibility and brand recognition online.	1. Create vivid content explaining benefits and unique features.
<b>Research</b>	1. Lack of specific information about the recommendation system.	
	2. Uncertainty about privacy and handling of personal data.	1. Include a detailed "About Us" section explaining the system.
<b>Consideration</b>	1. Uncertainty about the effectiveness of personalized content.	
	2. Unanswered questions about compatibility with specific educational needs.	1. Improve descriptions of existing functionalities for clarity.
<b>Purchase</b>	1. Fear of committing without a clear proof of concept.	
	2. Registration process may be perceived as too invasive.	1. Introduce a demo option.
<b>Support</b>	1. Lack of detailed guides for first steps.	
	2. Slow or inadequate responses from support.	1. Establish an accessible online knowledge base.

Table 2: User Journey Map for Carlos Rivera - Part 2

### 3 User Stories

#### 3.1 Registration and Profile Creation

**As** a new user, **I want** to easily register on the platform, **so that** I can create and personalize my profile by entering relevant information about my academic background and areas of interest.

#### 3.2 Secure Login

**As** a registered user, **I want** to log in with secure credentials, **so that** I can access my personal profile and learning recommendations safely.

#### 3.3 Personalized Recommendations

**As** a user interested in web development, **I want** to receive personalized topic recommendations based on my profile and previous preferences, **so that** I can choose specific areas like web development and obtain a personalized roadmap for my learning.

#### 3.4 Access to Learning Resources

**As** a user who has selected a specific learning topic, **I want** to click on a topic in the roadmap, such as HTML, **so that** I can view a detailed description and access links to relevant resources to learn the selected topic.

#### 3.5 Progress Tracking

**As** a user in the learning process, **I want** to mark the topics I have completed and see my progress in a visual bar, **so that** I can visualize how much I have advanced and which topics in the roadmap I have completed, facilitating my motivation and organization.

#### 3.6 Profile Modification

**As** a registered user, **I want** to have the option to modify my profile information, **so that** I can update my interests and skills as I progress in my learning and my goals change.

#### 3.7 Continuous Access to Roadmaps

**As** a user with multiple learning interests, **I want** to have the ability to access and view multiple roadmaps that I have started or saved, **so that** I can continue my learning in different areas without losing the progress

already made.

### 3.8 Dynamic Recommendations

**As** an active user who frequently changes interests, **I want** the platform to dynamically adjust learning recommendations based on changes in my profile and feedback, **so that** suggestions remain relevant and aligned with my current needs.

## 4 Requirements

### 4.1 Functional Requirements

- **User Registration:** Allow users to create a personal profile through a registration form that collects essential information such as name, university degree, and areas of interest.
- **User Authentication:** Implement a secure login system so users can access their profiles and personalized data.
- **Recommendation System:** Develop an artificial intelligence algorithm that generates learning topic recommendations based on the user's profile information and learning history.
- **Learning Content Management:** Allow users to access recommended educational resources and record the topics they have studied.
- **Profile Update:** Facilitate users to update their profile information, including interests and acquired skills.
- **Progress Tracking:** Provide functionality that allows users and the system to track learning progress through a dynamic roadmap that updates with each learned topic.
- **Multi-device Support:** Ensure the platform is accessible and functional on various devices, including desktops, tablets, and smartphones.

### 4.2 Non-functional Requirements

- **Availability:** The system must be operational and accessible at all times, minimizing service interruptions to provide a continuous user experience.
- **Scalability:** The system architecture must handle an increase in the number of users and requests without degrading performance, adapting to significant growth in registrations and transactions.
- **Performance:** System response times must be fast, ensuring a smooth experience for users.
- **Security:** Implement security measures to protect user data.
- **Maintainability:** The system's code and architecture must be clear and well-documented to facilitate updates and regular maintenance without excessive time or resource costs.
- **Compatibility:** The platform must be compatible with major web browsers and operating systems to ensure all users can access it smoothly regardless of their device or software.
- **Usability:** The user interface must be intuitive and easy to use for all levels of technical ability, with a clear and attractive design that promotes a positive user experience.



## 5 Proposed Solution

### 5.1 Idea Overview

I propose a platform that offers an innovative solution through a personalized learning system designed to adapt to each user's needs and preferences. Upon registering on the website, each user creates a profile by entering information about their university degree and specific interests. This information is crucial as it allows the artificial intelligence technology to generate highly personalized learning recommendations, ensuring that each user receives content relevant and tailored to their individual needs.

Once the profile is established, the platform presents the user with a list of recommended topics to explore. These recommendations are based on a detailed analysis of the user's needs and preferences, creating a flexible and evolving learning path designed to adjust dynamically to changes in the user's interests and goals.

The platform not only acts as an educational resource but also functions as a record of the topics the user has studied. This tracking allows continuous updating and refinement of the user's personal educational roadmap, supporting their ongoing development and ensuring they are always up-to-date with the latest trends and technologies in their field. This feature is vital for fostering a culture of continuous learning, crucial in a rapidly evolving technological environment.

The design of the platform is based on the client-server model, facilitating dynamic interaction between users and the central server where data is processed and stored. This approach is essential to efficiently handle the vast amount of information generated by user profiles, their educational preferences, and learning records. Additionally, the connection to a relational database plays a crucial role in the efficient organization and retrieval of data, allowing the system to scale as the number of users increases.

In summary, this platform represents a significant opportunity to integrate artificial intelligence into users' professional and personal development. By providing a learning system that evolves and adapts to the user's needs, it offers a valuable resource that accompanies users on their continuous growth and specialization journey, transforming how knowledge is acquired and updated in any field of study.

## 6 System Design

### 6.1 Use Case Diagram

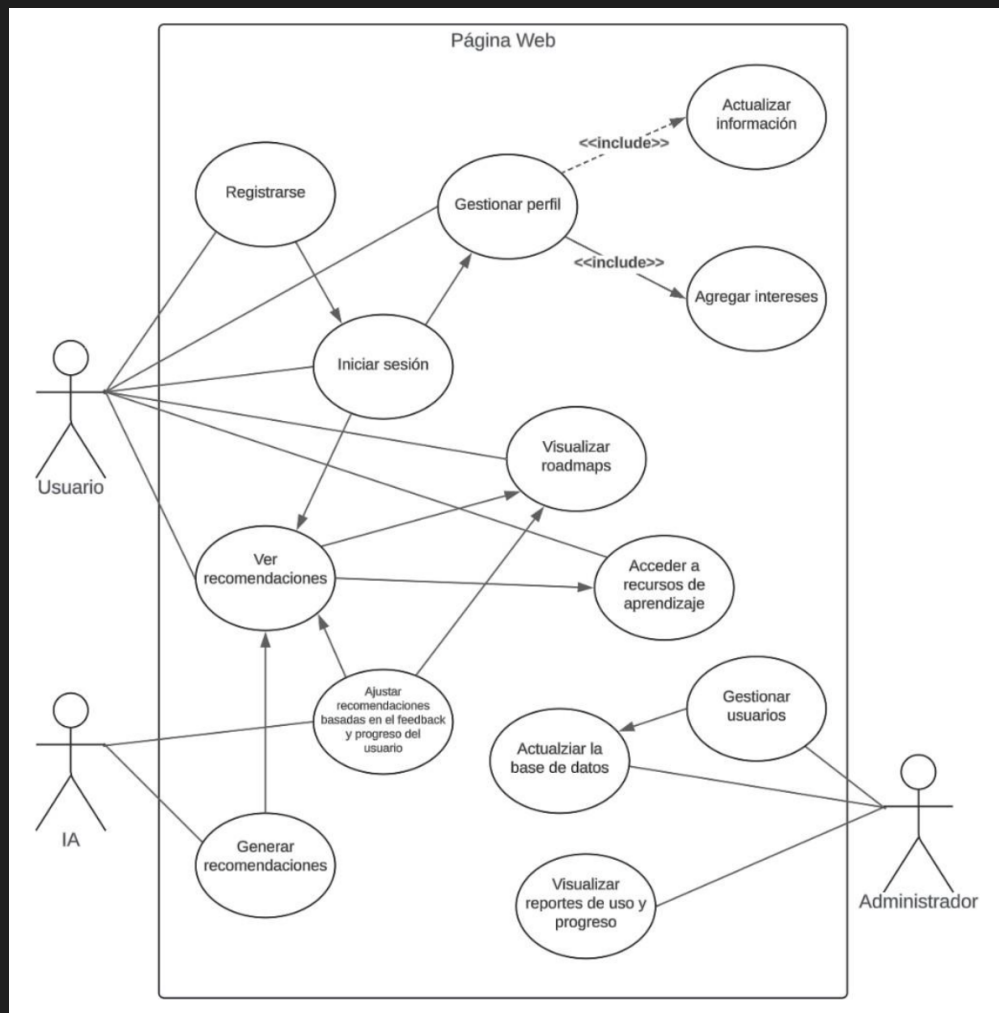


Figure 1: Use Case Diagram for AIMAX Platform

## 6.2 Activity Diagram

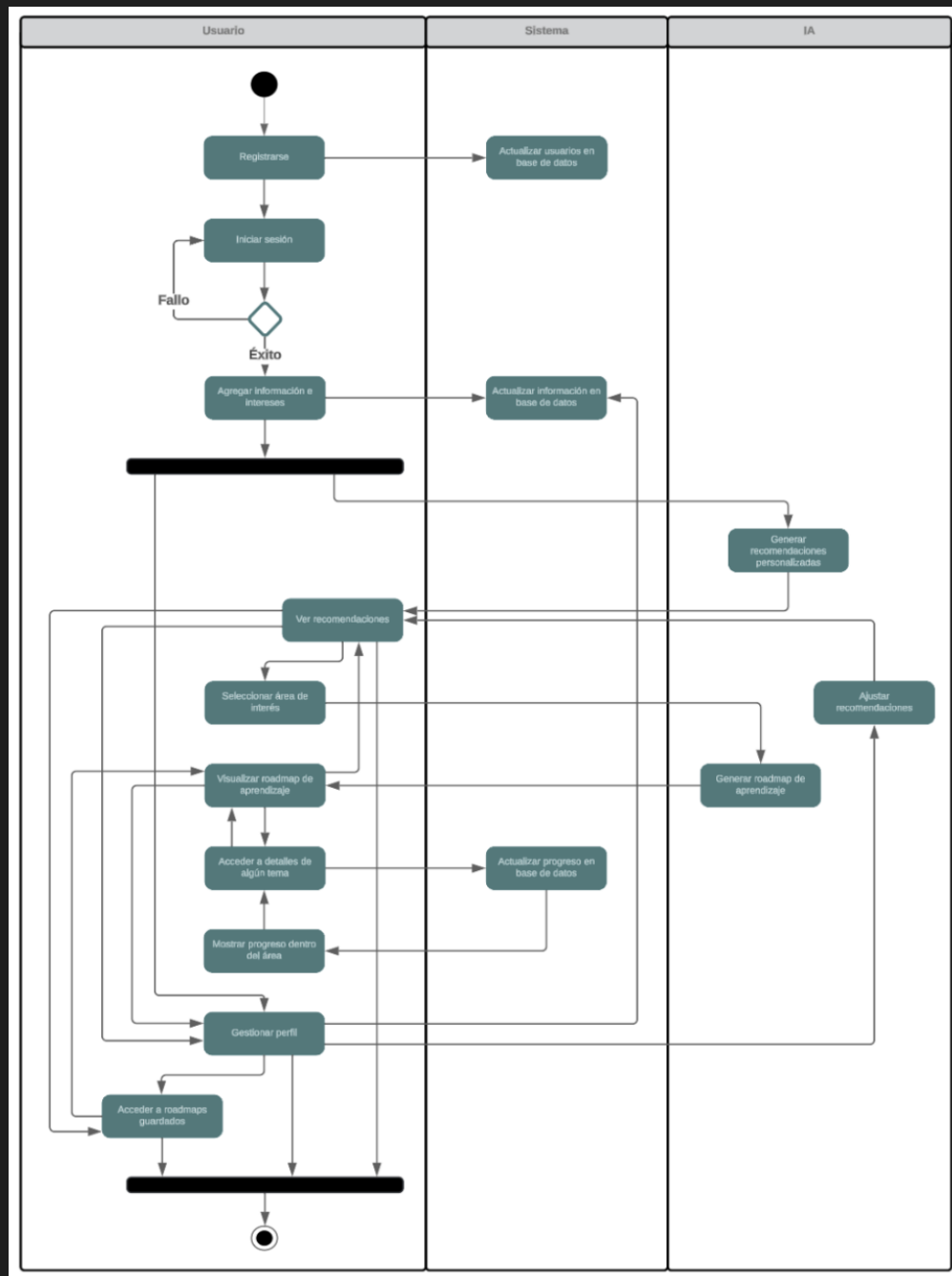


Figure 2: Activity Diagram for User Interaction

## **6.3 Database Model**

### **6.3.1 Entity-Relationship Diagram**

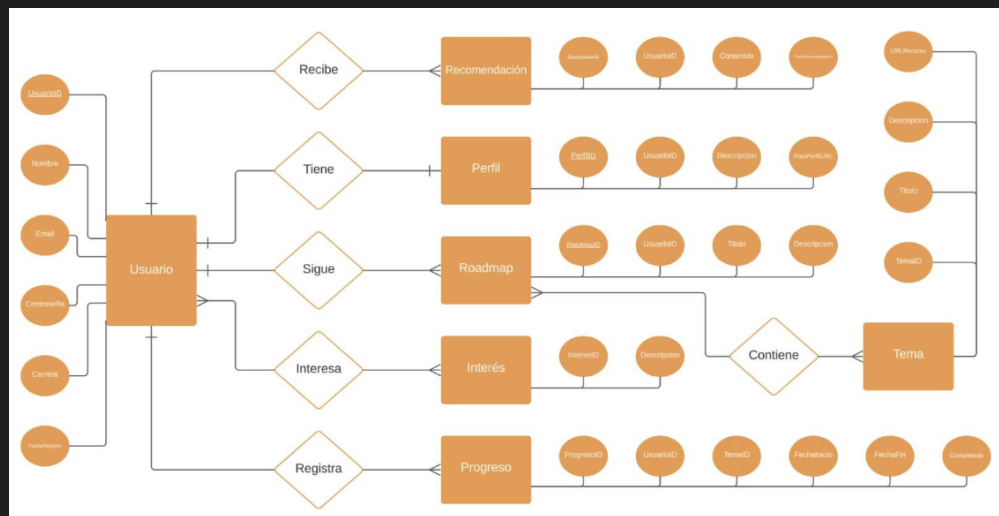


Figure 3: Entity-Relationship Diagram

### 6.3.2 Database Description

The database model is built around several key entities fundamental to the platform's functionality:

#### **Users**

This entity stores essential information about users, including identification and contact data. It facilitates authentication and secure access to the platform.

#### **Profiles**

Each user has a unique profile containing detailed information about their academic and professional interests, helping personalize the learning experience.

#### **Interests**

Represents the different fields of interest a user may have. This entity is used to generate personalized learning recommendations.

#### **Recommendations**

Stores learning suggestions generated by an artificial intelligence algorithm based on the user's profile and learning history.

#### **Roadmaps**

These are learning guides containing a series of topics and educational resources organized sequentially or logically to achieve specific learning objectives.

#### **Topics**

Includes detailed information about specific study areas or skills, along with links to relevant resources for learning.

#### **Progress**

Records the user's evolution in the different topics studied, allowing both the user and the platform to track learning.

#### **Functionality**

The system allows for user registration and authentication, where users provide basic data and access with verified credentials. Profiles, containing academic and professional information, are updatable and used to personalize recommendations and learning roadmaps. These roadmaps guide the user from basic to advanced concepts and are enriched with educational resources linked to each topic. The user's progress is visualized and dynamically updated in the system, based on their interaction and feedback, maintaining the

relevance of recommendations.

Moreover, progress tracking not only reflects advances but also motivates the continuation of learning by marking achievements and outlining the path toward future goals.

### **Integration and Scalability**

The design is intended to be highly scalable, allowing the incorporation of new users and growth in the amount of educational content without degrading performance. This database design not only facilitates crucial operations for managing individualized learning but is also prepared to adapt to changing user needs and technological evolutions in the field of online education.

## **6.4 Class Diagram**



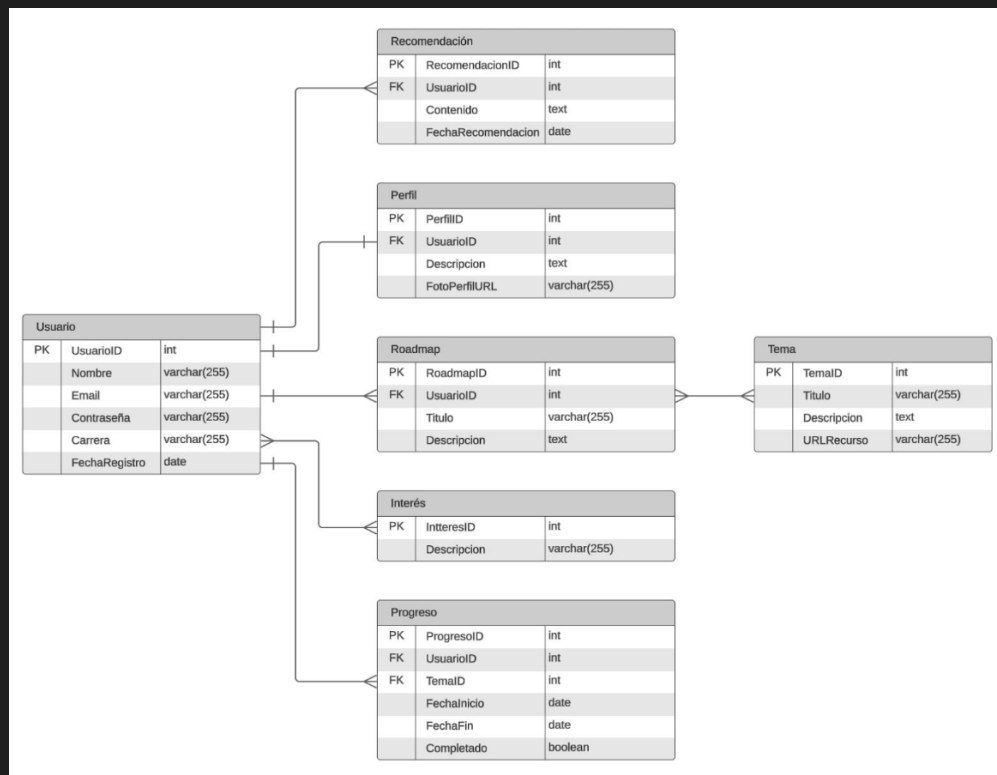


Figure 4: Class Diagram for AIMAX Platform

## 7 Technological Implementation

### 7.1 Front-End Explanation and Technologies Used

The front-end is utilized to display information obtained from the generative AI and to collect user information about their interests, which will be considered for generating recommendations. The application is characterized by having three distinct stages: the initial questionnaire, the recommendation of topics with resources to explore, and the adjustment of preferences to improve the personalization of recommendations.

#### Technologies

- **Shadcn/ui:** Component library for React.js, a superset of Radix UI.
- **React.js:** Used as the front-end framework within Next.js.
- **Tailwind CSS:** Utilized as a CSS framework for styling.

### 7.2 Back-End Explanation and Technologies Used

The back-end is used to register and modify user preferences as well as to return recommendations based on whether they exist within the database or need to be requested from the generative AI. The selection of topics to recommend is generated by querying the AI about the next ideal topics for the user.

#### Technologies

- **Next.js:** Full-stack framework with server-side rendering for TypeScript.
- **OpenAI API:** Utilizing ChatGPT-3.5-turbo for the generative AI component.
- **Auth.js:** Authentication framework, handles OAuth and token-based sessions.
- **Zod:** Used as a data validation library for JavaScript.

### 7.3 API Description

#### **api/auth/**

Managed by the Auth.js framework for authentication processes.

#### **api/interests/**

##### **POST**

Receives a JSON with a list (string) of interests, checks if they exist, creates them if not, and returns a JSON with the IDs of the requested interests.

#### **api/knowledge/**

**POST**

Receives a JSON with a list (string) of knowledge areas, checks if they exist, creates them if not, and returns a JSON with the IDs of the requested knowledge areas.

**api/preferences/**

**POST**

Receives a dictionary of lists of strings, searches for the IDs of each parameter of the preferences, and checks if an ID already exists for that choice. If not, it creates them and creates a User Preference linked with other tables, containing simple information like booleans or strings of other preferences that cannot be multiple. Returns the User Preference.

**PUT**

Receives a dictionary of lists of strings, where it changes the fields listed in the input and returns the new User Preference.

**api/preferences/importance/**

**POST**

Receives a JSON with a list (string) of parameters important to the user, checks if they exist, creates them if not, and returns a JSON with the IDs of the requested parameters.

**api/preferences/language/**

**POST**

Receives a JSON with a list (string) of languages spoken by the user, checks if they exist, creates them if not, and returns a JSON with the IDs of the requested languages.

**api/preferences/method/**

**POST**

Receives a JSON with a list (string) of the user's preferred study methods, checks if they exist, creates them if not, and returns a JSON with the IDs of the study methods.

**api/preferences/reason/**

**POST**

Receives a JSON with a list (string) of the user's reasons for studying, checks if they exist, creates them if not, and returns a JSON with the IDs of the study reasons.

**api/preferences/user/:id**

**GET**

Receives the user ID in the URL, returns the user's preference information.

**api/recommendations/**

**GET**

Returns information about the latest recommendation made to a user, including the subjects and their associated resources.

**POST**

Receives a JSON with interests, knowledge, reasons, priorities, and language of the user, generates study recommendations using OpenAI, saves them in the database, and returns a JSON with the created recommendations.

**api/studyresources/**

**GET**

Returns a JSON with all study resources stored in the database.

**POST**

Receives a JSON with id, name, description, url, type, and subjectId, creates a new study resource in the database, and returns a JSON with the created resource.

**api/subject/**

**GET**

Returns a JSON with all subjects stored in the database, including their associated resources.

**POST**

Receives a JSON with name and description, creates a new subject in the database, and returns a JSON with the created subject.

## 7.4 Database Interaction and Technologies Used

I create a record of all the options that have been selected within the surveys and recommendations to display them later. The queries are generated by Prisma, which uses a format like the following to:

### Generate New Entries

```
1  const data = await prisma.importance.create({ data: { name: imp } });
```

Listing 1: JavaScript Code Using Prisma to Create an Entry

### Create Relations

```
1  await prisma.preferencesReason.create({  
2    data: {  
3      preferences: { connect: { id: preferences.id } },  
4      reason: { connect: { id: reasonId } },  
5    },  
6  });
```

Listing 2: JavaScript Code Using Prisma to Create a Preferences Reason Entry

### Technologies

- **Prisma:** ORM for PostgreSQL, generates tables within the local PostgreSQL instance.
- **PostgreSQL:** Local database used for data storage.