Dean H - Online Learning Platform Design Document

Note - This project is not completed yet and I will still be working on this documentation as I produce the product. So there will be pseudocode to help structure the project and might change when I finish. But hopefully this will give you an idea of where I intend the project to go.

Introduction

The Online Learning Platform is a robust web application built with ASP.NET Core and Vue.js, designed to deliver an efficient and scalable online education experience. This platform enables users to register, browse a diverse range of courses, enroll in them, and track their learning progress seamlessly. Utilizing PostgreSQL for database management and deployed on Azure for optimal performance and reliability, the platform integrates modern development practices including test-driven development (TDD) to ensure high code quality. This application aims to revolutionize online learning by offering an intuitive interface for course management, user engagement, and insightful analytics.

Key Features

- The User Authentication and Authorization feature utilizes ASP.NET Identity to manage user registration, login, and role-based access control. This ensures secure access to platform features by implementing role-based access (Admin, User).

- The Course Management feature uses PostgreSQL to handle the creation, update, and deletion of courses by admin users. Each course can be structured with multiple modules and lessons, providing a user-friendly interface for admins to manage course content dynamically.

- The Enrollment System feature allows users to browse available courses and enroll in them. Enrolled courses are automatically added to the user’s dashboard for easy access, offering a seamless course browsing and enrollment experience.

- The Progress Tracking feature monitors user progress through modules and lessons. It displays progress bars and completion statuses for each course, providing a clear and intuitive interface for tracking learning progress.

- The Interactive UI feature builds a responsive and user-friendly interface using Vue.js. It includes components for detailed course views, enrollment processes, and user dashboards, ensuring an engaging and intuitive user experience.

- Admins can view dashboards with metrics on user enrollments, course completions, and other key data, facilitating data-driven decision-making through detailed analytics.

- The Deployment and Scalability feature deploys the application to Azure using Azure App Service and Azure SQL Database. This ensures the application is scalable to handle varying user loads and includes CI/CD pipelines configured with Azure DevOps for automated and reliable deployment.

- The Test-Driven Development (TDD) feature includes writing unit tests for backend logic using xUnit frameworks and implementing frontend tests using Jest. This ensures high code quality and coverage through continuous testing and refinement.

Tools and Technologies

ASP.NET Core - For building the backend web API and implementing business logic.
Entity Framework Core - For handling database operations and data access.
Vue.js - For developing a responsive and interactive frontend interface.
PostgreSQL - For robust and reliable database management.
ASP.NET Identity - For managing user authentication and authorization.
xUnit - For writing unit tests for backend logic.
Jest - For implementing frontend tests to ensure functionality and performance.
Azure App Service - For deploying and hosting the web application.
Azure SQL Database - For scalable and secure data storage.
Azure DevOps - For configuring CI/CD pipelines and automating deployment processes.
SQL Server Reporting Services (SSRS) - For generating and displaying comprehensive reports.

System Architecture

Online Learning Platform follows a three-tier architecture, comprising the presentation layer, the application layer, and Data Layer. Each layer plays a distinct role in ensuring the functionality and performance of the system.

Presentation Layer

The presentation layer encompasses the user interface components responsible for displaying courses, enrollment options, and progress tracking. This layer includes web pages, views, and client-side scripts developed with Vue.js, facilitating user interaction with the application. Designed to be intuitive and user-friendly, the interface allows users to easily navigate through available courses, enrollments, and progress metrics.

Application Layer

Serving as the intermediary between the presentation layer and the data layer, the application layer handles business logic and data processing tasks. It comprises controllers, business logic components, and service layers built with ASP.NET Core, responsible for processing user requests, fetching data from the data layer, and orchestrating the flow of information within the application. This layer ensures seamless integration of course data, user enrollments, and progress tracking metrics retrieved from the data layer.

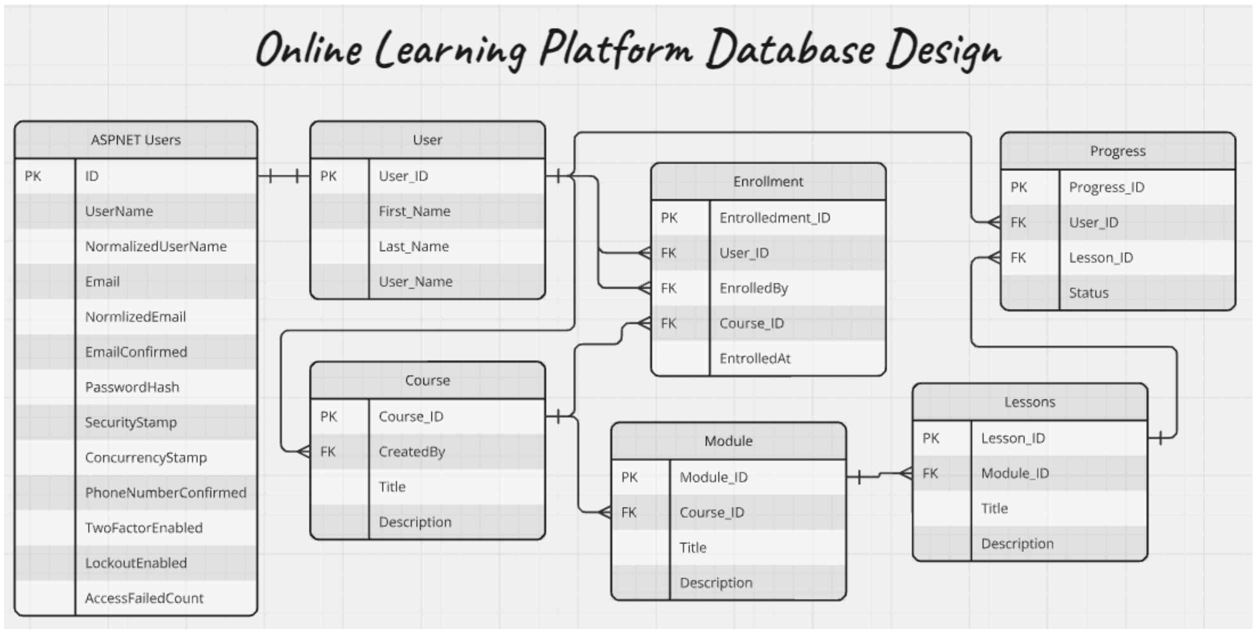
Data Layer

The data layer is responsible for storing and managing persistent data used by the application. It consists of PostgreSQL, which stores course information, user enrollments, progress tracking data, and other relevant information. The data layer ensures data integrity, consistency, and security through proper database design, including the definition of tables, relationships, and constraints. It also provides mechanisms for data retrieval, modification, and deletion, enabling efficient access to and manipulation of data by the application layer.

Scalability and Performance Considerations

The system architecture of the application is designed to be scalable and performant, capable of handling increasing loads and user interactions. Horizontal scalability is achieved through load balancing and auto-scaling mechanisms on Azure, allowing the application to dynamically allocate resources based on demand. Performance optimizations, such as efficient database queries and caching strategies, are implemented to minimize latency and improve responsiveness. Additionally, asynchronous processing and parallelization techniques are employed to enhance throughput and resource utilization, ensuring optimal performance under varying workloads.

Database Design


Online Learning Platform Database Design
ASPNET Users
PK ID
UserName
NormalizedUserName
Email
NormlizedEmail
EmailConfirmed
PasswordHash
SecurityStamp
ConcurrencyStamp
PhoneNumberConfirmed
TwoFactorEnabled
LockoutEnabled
AccessFailedCount
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