

Software Requirement

Specifications

PROJECT – AI Based LMS Portal

FULL STACK WEB DEVELOPMENT

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1. Introduction
   1. Purpose

An AI-Based Learning Management System (LMS) portal enables users to register and manage courses efficiently. The system allows users to create new courses, automatically generate course content based on AI, and view course details on the dashboard.

* 1. **Future Scope**

The AI-Based LMS Portal has significant potential for growth and innovation in the future. Some of the key areas of enhancement include:

1. **Personalized Learning Paths**
   * Use AI to analyze users' learning patterns, preferences, and progress to suggest tailored course recommendations and adaptive learning paths.
   * Dynamic difficulty adjustment for quizzes and assignments based on user performance.
2. **Natural Language Query Support**
   * Integrate AI chatbots to answer user queries, provide guidance on course selection, and offer instant feedback on assignments.
3. **Voice and Video Learning Modules**
   * Include AI-generated voice-over content and video lectures tailored to the course material.
   * Provide auto-captioning and language translation for better accessibility.
4. **Gamification Features**
   * Implement AI-powered gamified elements like badges, leaderboards, and progress streaks to boost learner engagement.
5. **Predictive Analytics**
   * Use AI to predict user drop-off rates and suggest intervention strategies for at-risk learners.
   * Generate insights into course performance and learner success rates.
6. **Multilingual Support**
   * Expand the system with AI-driven translation tools, enabling courses to be delivered in multiple languages, making it accessible to a global audience.
7. **Integration with AR/VR**
   * Introduce AI-enhanced augmented and virtual reality modules for an immersive learning experience in fields like medicine, engineering, and more.
8. **Content Creation Automation**
   * Use AI to generate not just tests but also reading materials, videos, and case studies based on the course theme.
   * AI can curate external resources, such as articles or videos, to enhance course content.
9. **Skill Assessment and Certification**
   * AI-based assessments to evaluate a user's practical knowledge and skill level.
   * Automatically generate dynamic, verified certificates upon course completion.
10. **Collaboration and Community Features**
    * Build AI-powered forums and discussion boards to connect learners with similar interests.
    * Suggest peer study groups based on course enrollment and progress.
11. **Enterprise Solutions**
    * Develop a B2B offering where organizations can use the LMS for employee training, with AI generating company-specific training modules.
    1. **Software Interface**

The software interface for the AI-Based LMS Portal is designed to be user-friendly, visually appealing, and highly functional. It incorporates AI-driven features to enhance the user experience. The following are the key components:

**A. Landing Page**

1. **Registration**
   * A clean and intuitive registration form with fields for:
     + Name, email, phone number, and password.
     + OTP-based mobile number verification for secure account creation.
   * Terms and Conditions checkbox with a link to the privacy policy.
2. **Login**
   * Login options include:
     + Email and password authentication.
     + Social login options (Google and Facebook).
   * "Forgot Password" feature integrated with email or OTP verification.

**B. Dashboard (Post-Login)**

The dashboard serves as the main control panel, showcasing user courses and options to create new ones:

1. **Course Overview**
   * Display all available courses in a **box view** format, each containing:
     + Course Name.
     + Difficulty Level (Easy, Medium, Advanced).
     + Progress Indicator (e.g., completion percentage).
     + Quick Actions (e.g., "Resume Course," "View Details").
2. **Create Course Button**
   * A prominent button labeled **"Create New Course"**.

**C. Course Creation Workflow**

1. **Pop-Up Form**
   * On clicking "Create New Course," a pop-up form appears requiring inputs:
     + **Course Name.**
     + **Difficulty Level:** Select from Easy, Medium, or Advanced.
2. **AI-Powered Course Generation**
   * Once submitted, the AI dynamically generates:
     + A course outline.
     + Chapter-wise lessons.
     + Quizzes and assignments tailored to the chosen difficulty level.
3. **Editable Course Content**
   * Users can review and edit AI-generated course content for customization.

**D. Course Details Page**

1. **Lesson Structure**
   * Displays a list of chapters/modules with corresponding content:
     + Videos, text lessons, and interactive activities.
2. **Quizzes and Assignments**
   * Auto-generated quizzes for knowledge checks after each module.
   * AI evaluates quiz results and provides detailed feedback.
3. **Progress Tracker**
   * Visual representation of user progress, such as a progress bar or checklist.

**F. Profile Management**

1. **User Profile**
   * Option to update personal details like name, email, and password.
   * View certification achievements and earned badges.
2. **Notification Settings**
   * Manage preferences for email/SMS notifications regarding course updates, deadlines, and suggestions.
   1. **Project Functionalities**

The AI-Based LMS Portal provides various functionalities to ensure a seamless and engaging learning experience. These functionalities include user management, course creation, AI-driven features, and advanced analytics.

**A. User Management**

1. **Registration**
   * New users can register by filling in details like name, email, phone number, and password.
   * OTP-based mobile number verification for secure account creation.
2. **Login**
   * Multiple login options:
     + Email and password.
     + Social login via Google and Facebook.
   * "Forgot Password" feature with password recovery through email or OTP.
3. **Profile Management**
   * Users can update personal details, upload profile pictures, and manage account settings.
   * Notifications and preferences for email/SMS alerts.

**B. Dashboard**

1. **Course Display**
   * Shows all enrolled and created courses in a **box view** format with:
     + Course Name.
     + Difficulty Level (Easy, Medium, Advanced).
     + Progress Bar and Quick Actions (e.g., "Resume," "Edit," or "View Details").
2. **Create Course**
   * A prominent button labeled "Create New Course" that triggers a pop-up for course creation.

**C. Course Creation**

1. **Pop-Up Form**
   * Users input course details like:
     + Course Name.
     + Difficulty Level (Easy, Medium, Advanced).
2. **AI-Driven Content Generation**
   * The AI generates:
     + A detailed course outline.
     + Lessons and chapters.
     + Quizzes, assignments, and tests tailored to the course's difficulty.
3. **Content Customization**
   * Users can review and modify AI-generated content to better suit their needs.
4. Requirements
   1. Software Requirements

To build the AI-Based LMS Portal, you need a set of software tools and technologies for the frontend, backend, and database. These requirements ensure flexibility, scalability, and ease of development. Below are the software requirements

**A. Frontend**

1. **Next.js (Preferred)**
   * A React-based framework for building server-rendered or statically generated web applications.
   * Offers better performance, SEO optimization, and routing features.

**Alternative:** React.js

* + A JavaScript library for building user interfaces with a component-based architecture and virtual DOM for efficient rendering.

1. **Styling and UI Frameworks**
   * Tailwind CSS or Bootstrap for responsive and modern UI design.
   * Custom CSS for fine-tuned styling.

**B. Backend**

1. **Node.js**
   * A JavaScript runtime environment for building scalable and efficient server-side applications.
   * Handles APIs, authentication, and business logic for the LMS.
2. **Express.js**
   * A lightweight and flexible framework for building RESTful APIs and managing server-side logic efficiently.

**C. Database**

1. **MongoDB (Preferred)**
   * A NoSQL database that stores data in JSON-like documents, suitable for handling complex and dynamic data structures.

**Alternative Databases:**

* + **PostgreSQL:** A powerful relational database for structured data.
  + **MySQL:** A widely used relational database for structured and semi-structured data

**D. Additional Tools**

**1. AI and Machine Learning Libraries**

* **Gemini API or OpenAI API**: Leverage these APIs for advanced AI capabilities like automated course generation, dynamic quiz creation, and natural language-based interactions. These APIs can generate content such as course outlines, tests, and personalized suggestions based on user inputs.

**Authentication and Authorization**

* **JWT (JSON Web Tokens):** For secure user authentication, session management, and role-based access control.
* **OAuth 2.0:** For enabling third-party login options, such as signing in with Google, Facebook, or LinkedIn, providing users with a seamless login experience.

**2..2 Hardware Requirements (AI-Based LMS Portal)**

The hardware requirements for the AI-Based LMS Portal depend on whether the system is being accessed by users (client-side) or hosted by administrators (server-side). Below are the details:

**A. Client-Side Requirements**

These are the minimum requirements for end-users (learners and instructors) to access the LMS portal.

1. **Personal Computer or Laptop**
   * **Processor:** Dual-core processor (e.g., Intel i3 or AMD Ryzen 3) or higher.
   * **RAM:** 4 GB minimum (8 GB recommended for smooth browsing).
   * **Storage:** 500 MB of free disk space for cached files and data.
   * **Display:** 1024x768 resolution or higher for optimal UI experience.
   * **Internet:** Broadband connection with at least 2 Mbps speed.
2. **Mobile Devices (Optional)**
   * **Processor:** Quad-core (e.g., Snapdragon 600 series or higher).
   * **RAM:** 2 GB minimum (4 GB recommended).
   * **Storage:** 100 MB of free space for the mobile app, if available.
   * **Operating System:** Android 8.0 or iOS 12.0 and above.
3. **Browser**
   * Latest version of Chrome, Firefox, Safari, or Edge (JavaScript and cookies enabled).

**B. Server-Side Requirements**

These are the minimum requirements for hosting and running the AI-Based LMS Portal on a web server.

1. **Server Configuration**
   * **Processor:** Quad-core processor (e.g., Intel Xeon E3 or AMD EPYC) or higher.
   * **RAM:** 16 GB minimum (32 GB recommended for AI functionalities).
   * **Storage:**
     + 1 TB SSD for faster data retrieval and storage of course content.
     + Additional storage for backups.
   * **Network:** Dedicated connection with at least 10 Mbps upload/download speed.
2. **AI-Specific Hardware**
   * **GPU (for AI computations):**
     + NVIDIA Tesla T4 or A100 for handling AI model training and predictions.
3. **Operating System**
   * Ubuntu 20.04 LTS or CentOS 8 for server stability.
4. **Database Requirements**
   * **Database Server:** MySQL, PostgreSQL, or MongoDB.
   * **Storage Allocation:** Minimum 500 GB for database storage, scalable as per the number of users and courses.

**Conclusion**

* The AI-Based LMS Portal represents a powerful and innovative solution for modern education and training needs. By integrating advanced technologies such as **Next.js/React.js** for an intuitive frontend, **Node.js** for a robust backend, and **MongoDB or other databases** for efficient data storage, the system ensures scalability and performance.
* With the incorporation of **AI tools** like TensorFlow.js, PyTorch, Gemini API, or OpenAI API, the portal can dynamically generate courses, personalized recommendations, and assessments, offering a tailored learning experience for every user. Secure authentication mechanisms like **JWT** and **OAuth 2.0** further enhance user trust and accessibility.
* The platform’s modular architecture and use of industry-standard tools such as **Git**, **Postman**, and cloud hosting solutions ensure seamless development, deployment, and scalability. It’s designed not only to meet current educational demands but also to adapt to future advancements, making it a sustainable and innovative choice for online learning.
* In conclusion, the AI-Based LMS Portal is a comprehensive, future-ready solution that combines cutting-edge technology with user-centric design, empowering both learners and educators in an ever-evolving digital landscape.

**References:**

1. **Next.js** - Next.js Documentation
   * <https://nextjs.org/docs>
   * Next.js is a powerful React framework for building server-rendered applications, and it's well-suited for creating fast, SEO-friendly, and dynamic web applications.
2. **React.js** - React Documentation
   * <https://reactjs.org/docs/getting-started.html>
   * React is a JavaScript library used to build user interfaces with a component-based architecture, making it ideal for creating dynamic and interactive UIs.
3. **Node.js** - Node.js Documentation
   * <https://nodejs.org/en/docs/>
   * Node.js is a JavaScript runtime for building scalable and efficient server-side applications, commonly used for web servers and APIs.
4. **MongoDB** - MongoDB Documentation
   * <https://www.mongodb.com/docs/>
   * MongoDB is a NoSQL database designed for storing JSON-like documents and is a popular choice for applications requiring high scalability and performance.
5. **Gemini API**
   * <https://www.gemini.com/>
   * The Gemini API can be used for advanced AI tasks, including content generation and data analysis.
6. **OpenAI API**
   * <https://beta.openai.com/docs/>
   * The OpenAI API provides access to powerful models for natural language processing, content generation, and AI-driven recommendations, making it ideal for creating dynamic and personalized learning experiences.
7. **OAuth 2.0**
   * https://oauth.net/2/
   * OAuth 2.0 is an authorization framework enabling third-party login features, allowing secure access to user accounts via services like Google and Facebook.
8. **JWT (JSON Web Tokens)**
   * <https://jwt.io/>
   * JWT is a compact, URL-safe means of representing claims between two parties, commonly used for secure authentication and authorization.
9. **Postman**
   * <https://www.postman.com/>
   * Postman is an API testing tool that simplifies the process of developing, testing, and documenting APIs, ensuring smooth integration with backend services.
10. **Git**
    * <https://git-scm.com/doc>
    * Git is a version control system that helps manage source code, track changes, and collaborate on software development projects.

### ****Demo Project****

For a practical demonstration of how to build an AI-based LMS Portal, you can refer to this demo project: [AI-Based LMS Demo Project](https://www.youtube.com/watch?v=YwcyE1XlUZU&t=410s) (<https://www.youtube.com/watch?v=YwcyE1XlUZU&t=410s>)

However, please **do not copy the project**; instead, use it as a reference or inspiration to develop your own unique version. The goal is to understand the concepts and technologies used, then apply them creatively to suit your own requirements and vision for the project.