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Software Project I, Winter 2024
E-Learning Platform with Adaptive Modules and Performance Tracking
Project Description

Project Overview

Students are tasked with developing a feature-rich E-Learning Platform using modern web technologies (NestJS, MongoDB, and Next.js). The platform aims to deliver adaptive learning experiences, and provide personalized insights into user performance. It will cater to three user rolesâstudents, instructors, and administratorsâfocusing on interactive learning and robust security.

Features

1. User Management

- **User Authentication and Role-Based Access Control:**
  - Students, instructors, and admins with distinct access levels.
  - Secure login and registration using JSON Web Tokens (JWT).
- **User Profile Management:**
  - Students and instructors can update their personal information, view enrolled courses, track completed courses, and monitor average scores.

2. Course Management

- **Course Creation and Organization:**
  - Instructors can create course modules, upload multimedia resources (videos, PDFs), and organize content hierarchically.
- **Version Control:**
  - Enable instructors to update course content while maintaining access to previous versions.
- **Search Functionality**:
  - Users can search for a certain course.
  - Instructors can search for a certain student.
  - Students can search for a certain instructor.

3. Interactive Modules

- **Quizzes and Assessments:**
  - Adaptive quizzes dynamically adjust question difficulty based on user performance.
- **Real-Time Feedback:**
  - Instant feedback on quizzes, highlighting correct answers and areas for improvement.

4. Performance Tracking

- **Student Dashboard:**
  - Visualizes progress with metrics like course completion rates, average scores, and engagement trends.
- **Instructor Analytics:**
  - Reports on student engagement, content effectiveness, and assessment results.
  - Downloadable analytics for external use.

5. Security and Data Protection

- **Secure Authentication:**
  - Use JSON Web Tokens (JWT) for secure login and session management.
  - Passwords stored with hashing using bcrypt to ensure data integrity.
- **Role-Based Access Control (RBAC):**
  - Implement middleware in the backend to control access to APIs based on user roles (student, instructor, admin).
- **Data Backup:**
  - Simple scheduled backups of critical data (e.g., user accounts, course progress) to prevent loss.

6. Communication Features

- **Real-Time Chat:**
  - Enable Instructors to communicate with students for queries and discussions.
  - Students can also form study groups and chat with peers.
- **Discussion Forums:**
  - Forums for course-specific discussions moderated by instructors.
  - Features include thread creation, replies, and search functionality.
- **Notification System:**
  - Students and instructors receive notifications for new messages, replies, or announcements.
- **Saved Conversations:**
  - Chat history and forum discussions are saved for future reference.

Additional Features

Teams consist of 5-8 members will choose 1 out of 3 additional features.
Teams consist of 9 members will choose 2 out of 3 additional features.
Teams consist of 10 members will implement the 3 additional features.

a) **Data Science: Adaptive Recommendation Engine:** An AI-powered recommendation system tailors content to user preferences, performance metrics, and engagement patterns.

b) **Information Security: Biometric Authentication:** Provides robust identity verification for exams and other critical operations.

c) **Software Engineering: Quick Notes:** Allow users to create and save quick notes for their courses or modules. This feature provides students with a personal space to jot down key points, reminders, or study tips as they navigate the course.

User Stories

1. User Management

- As a student, I want to securely log in and access my course progress.
- As an instructor, I want to create and manage student accounts and assign them to courses.

2. Course Management

- As an instructor, I want to create, update, and organize course modules with resources and quizzes.
- As a student, I want personalized learning paths to guide my progress effectively.

3. Interactive Modules

- As a student, I want immediate feedback on quizzes to understand my mistakes.
- As an instructor, I want to create adaptive quizzes that challenge students based on their skills.

4. Performance Tracking

- As a student, I want a dashboard to visualize my progress and engagement metrics.
- As an instructor, I want analytics on student performance to identify areas needing improvement.

5. Security and Data Protection

- **Students:**
  - As a student, I want my account to be securely protected against unauthorized access.
- **Instructors:**
  - As an instructor, I want role-based access to manage only the courses and users I am responsible for.
- **Admins:**
  - As an admin, I want a simple logging system to track failed login attempts or unauthorized API access.

6. Communication Features

- As a student , I want to chat with peers to clarify doubts or discuss topics.
- As an instructor, I want to communicate with students via chat or discussion forums to answer questions and guide discussions.

Additional Features User Stories

Data Science: Adaptive Learning Recommendation Engine

- **Students:**
  - As a student, I want to receive recommendations for additional courses or materials that match my learning progress and interests.
  - As a student, I want personalized suggestions to help me identify areas I need to improve.

Information Security: Biometric Authentication

- **Students:**
  - As a student, I want to use biometric authentication during exams to secure my identity.
  - As a student, I want to know my biometric data is encrypted and safe.
- **Admins:**
  - As an admin, I want to enforce biometric authentication for high-stakes actions to maintain exam integrity.

Software Engineering: Quick Notes

- **Students:**
  - As a student, I want to create notes tied to specific modules to organize my learning effectively.
  - As a student, I want my notes to autosave to prevent data loss.
  - As a student, I want to edit and delete my notes to keep them updated and relevant.
- **Instructors:**
  - As an instructor, I want students to have a personal space to take notes to enhance their learning process.

Technology Stack

- **Backend:** NestJS (Node.js, TypeScript).
- **Frontend:** Next.js.
- **Database:** MongoDB for flexible and scalable storage.
- **Data Science:** Python-based recommendation engine served via Flask or FastAPI.
- **Authentication:** JSON Web Tokens (JWT) and bcrypt for secure login.
- **Security:** Multi-Factor Authentication (MFA).

Deliverables

- Fully functional E-Learning platform with backend and frontend services deployed to the cloud.
- Complete source code hosted on GitHub with documentation for all contributions.

Timeline

Team Members: Each team consists of 5-8 members (Mandatory). Extra members up to 2 members means extra additional features
Team Registration submission form: `https://forms.gle/tqNEBaa8Yr41KD3p7`

- **Milestone 1 (Week 1):** Setup project structure and implement all schemes. **MS1 Submission Form:** `https://forms.gle/SiYAff4gLcV4vHWN8`
- **Milestone 2 (Week 2-3):**Back-end **MS2 Submission Form:** `https://forms.gle/QHxTg6PCPBkZpU969`
- **Milestone 3 (Week 4-5):** Front-end and deployment .
  MS3 Submission Form: `https://forms.gle/6qUDzThuxg4YV4rx6`
- **Bonus** Good ui/ux .
- **Bonus** Deployment .

Project Presentation

At the end of the project, each team will present their E-Learning platform, showcasing its features, implementation processes, and potential future enhancements.