

ElearnSphere – Project Documentation

1. Project Overview

ElearnSphere is a full-featured e-learning platform where:

- **Students** can enroll in courses, track progress, and take quizzes.
- **Instructors** can add teaching materials, create quizzes, and guide the learning process.
- **Admins** manage the entire platform, ensuring smooth operations, security, and compliance.

The platform integrates **frontend, backend, database, security, algorithms, and task management** to deliver a scalable and robust learning ecosystem.

2. Tech Stack

Component	Technology
Frontend	React.js
Backend	Node.js, Express.js
Database	MongoDB Atlas (NoSQL)
Authentication	JWT, 2FA (Email OTP, Google Authenticator), Backup Codes
Styling	Tailwind CSS
Routing	React Router
Algorithms	DFS Recommendation Algorithm, QuizPath Adaptive Quiz Algorithm

3. Key Algorithms

3.1 DFS Recommendation Algorithm

- Used in **student dashboard** to recommend courses based on user history and interests.
- Traverses course relationships like a graph to find the most relevant learning paths.

3.2 QuizPath Adaptive Pathway Quiz Algorithm

- Dynamically adjusts quiz questions based on learner performance.
- Uses a decision-tree-like structure to unlock the right level of difficulty.
- Provides a smooth, personalized learning experience without overwhelming the student.

4. Frontend Features

4.1 Homepage

- **Navbar:**
 - Project name: **ElearnSphere**
 - Search bar (center): Supports related search suggestions.
 - Icons (right): Notifications (🔔), Cart, User Profile (avatar, dropdown with profile info & logout).
- **Knowledgebase:**
 - AI-powered chatbot for real-time support.
 - Knowledgebase grid with categorized content.
- **Courses:**
 - **All Courses Page:**
 - Displays courses with image, title, description, category, price, and number of lessons.
 - **Single Course Page:**
 - Detailed course description.
 - Videos accessible only after enrollment.
- **Products Section:**
 - Learning-support tools and resources.
- **Blog Section:**
 - Articles from instructors/admins.
- **About Us:**
 - Platform overview and mission.

5. Authentication & Security

- **Roles:** Student, Instructor, Admin
- **Verification Process:**
 - Admin approval for new instructors and admins.
- **Two-Factor Authentication (2FA):**
 - Email OTP and Google Authenticator.
 - Forced TOTP setup for instructors and admins on first login.
 - Backup codes (with regeneration option in admin dashboard).
- **Role-based login redirection:**
 - Each role is redirected to its dashboard after login.

6. Dashboards

6.1 Student Dashboard (Learner's Sanctuary)

- **My Courses:** Enrolled courses with progress tracking.
- **Continue Learning:** Quick access to last viewed lesson or quiz.
- **Deadlines & Assignments:** Calendar view for tasks.
- **Quiz Scores & Feedback:** Past results and recommendations.
- **Course Recommendations:** DFS-powered suggestions.
- **Announcements & Messages:** Updates from instructors/admins.
- **Profile & Settings:** Personal details, password reset, 2FA settings.
- **Cart & Payments:**
 - Add to cart, apply coupons, and checkout.
 - View payment history and invoices.
- **Notifications:** Assignment alerts, quiz results, promotions.

6.2 Instructor Dashboard (Mentor's Command Center)

- **My Courses:** Add, edit, and manage courses.
- **Student Progress Overview:** Engagement analytics and performance tracking.
- **Manage Quizzes & Assignments:** Create quizzes, set deadlines, grade submissions.
- **Communication Panel:** Send announcements/messages to students.
- **Course Approval Status:** Track admin approvals for new courses.
- **Resource Upload:** Upload videos, documents, or links.
- **Earnings Dashboard:** Track revenue and payouts.
- **Notifications:** Submissions, feedback, platform updates.

6.3 Admin Dashboard (Overlord's Control Room)

- **User Management:** Approve, block, or delete users.
- **Roles & Permissions:** Assign or modify user roles.
- **Platform Analytics:** User stats, course stats, revenue, engagement.
- **Course Management:** Approve or remove courses.
- **Reports & Logs:** Activity logs, error reports, compliance.
- **Support & Feedback:** Manage user support tickets.
- **Security Tools:** Regenerate backup codes for admins/instructors.
- **Payments:**
 - Manage instructor payouts.
 - Refund approvals.
 - Coupon and discount management.
- **Notifications:** Flagged content, approval requests, system alerts.

7. Cart, Notifications & Payments

Cart (Student)

- View added courses.
- Save for later or remove items.
- Checkout with payment methods.
- Payment history.

Notifications

- **Students:** Assignments, quiz scores, promotions.
- **Instructors:** Submissions, reviews, platform updates.
- **Admins:** Reports, approvals, flagged content.

Payments

- **Students:** Payments, refunds, subscriptions.
- **Instructors:** Earnings, payouts, financial reports.
- **Admins:** Global transactions, revenue, and discounts.

8. Backend API Endpoints

Authentication

- POST /auth/register
- POST /auth/login
- POST /auth/verify-totp
- POST /auth/verify-backup-code
- POST /auth/regenerate-backup-codes

Courses

- GET /courses/student
- GET /courses/instructor
- POST /courses/create (Instructor)
- POST /courses/approve (Admin)

Quizzes

- POST /quizzes/start (runs QuizPath)
- POST /quizzes/submit
- GET /quizzes/results/:userId

Assignments

- POST /assignments/create (Instructor)
- GET /assignments/student
- POST /assignments/grade (Instructor)

Cart & Payments

- POST /cart/add
- GET /cart/view
- POST /cart/checkout
- GET /payments/history
- POST /payments/payouts (Instructor)
- POST /payments/refund (Admin)

Notifications

- GET /notifications
- POST /notifications/send (Instructor/Admin)

Analytics

- GET /analytics/student
- GET /analytics/instructor
- GET /analytics/admin

9. Database Schema (MongoDB)

Collection	Purpose	Key Fields
users	Stores user data	_id, name, email, password, role, avatar, enrolledCourses[], twoFactor, backupCodes[]
courses	Course details	_id, title, description, category, price, instructor, content[], videos[], students[], status
quizzes	Quiz questions	_id, courseId, questions[]
assignments	Assignments & grading	_id, courseId, title, description, deadline, submissions[]
cart	Shopping cart items	_id, studentId, items[]
payments	Transactions & payouts	_id, userId, type, amount, status, transactionId, courseId
notifications	Alerts & announcements	_id, userId, role, message, type, read
backupCodes	2FA backup codes	_id, userId, codes[]

☒ Extra Features

- Related search in the navbar with auto-suggestions.
- Videos restricted until enrollment.

- Real-time notifications using WebSockets.
- Responsive design for all dashboards.