**AI Educational System: [SYSTEM\_NAME]**

**Software Requirements Documentation**

(Version 1.0)

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# **Chapter 1: Introduction**

This document describes the requirements for **[SYSTEM\_NAME]**, an AI-powered educational web application designed to enhance independent student learning.

Premise: The system integrates textbook-based study with AI-generated video explanations, interactive exercises, and automated assessments to support students in mastering educational content.

Goal: Allow students to learn directly from digital textbooks, with each topic supported by short, easy-to-understand video explanations. As students progress, the system optionally locks content after completion and initiates a quiz, reinforcing learning and ensuring comprehension before advancing.

Key Functionalities:

**- User Account Management**: Sign up, login, and personalized progress tracking.

- **Digital Textbook Viewer**: Chapter-by-chapter navigation and topic access.

**- AI-Generated Video Explanations**: Embedded videos tailored to each topic.

- **Interactive Exercises and Quizzes**: Practice sessions with instant feedback and quizzes that unlock the next topic.

- **Save and Resume Feature**: Enables users to pause and continue their learning journey seamlessly.

Why Develop This System (Value Proposition)? It aims to make learning easier with AI-generated videos, reinforces learning through structures quizzes, and promotes efficient and engaging study habits, all aimed at improving students’ performances.

## **Chapter 2: Tech Overview**

This section outlines the primary technologies we intend to use and describes the role of each component in the system architecture.

**A) Frontend: React.js**

Role: Handles everything the user interacts with in the browser.

* Used for: Building the user interface (UI), rendering textbook pages, displaying videos, quizzes, progress indicators.

**B) Backend: Python (Django)**

Role: Controls the core logic of the application and manages data communication between the frontend and database.

* Used for: Authentication, handling API requests, serving textbooks and video data, generating responses to student queries.

**C) Database: PostgreSQL**

Role: Stores structured data for the application.

* Used for: Managing users, textbook metadata, exercise questions, quiz results, and progress tracking.

**D) AI Integration**

Role: Powers the generation of video summaries, explanations, and possibly Q&A features.

* Used for: Converting textbook topics into video scripts, summarizing chapters, and answering student questions.
* **Possible Tools/APIs**:
  + **OpenAI GPT** – for generating explanations and summaries.
  + **AWS Polly / Google Text-to-Speech** – for converting text to speech if needed.
  + **FFmpeg / AI Video Generator** – for creating or rendering educational videos.

**E) Development Tools**

* **VS Code** – code editor
* **Git + GitHub** – version control
* **Postman** – testing APIs
* **Browser DevTools** – debugging and testing layouts

**F) Authentication & Security**

* Use **JWT (JSON Web Tokens)** or **session-based auth.** for secure login.
* Implement password hashing and basic user data encryption.
* HTTPS enforced for secure communication.

**G) Deployment Stack**

* **Hosting**: T.B.D.
* **Domain**: T.B.D.

### **Chapter 3: Functional Requirements**

**1. User Account Management**

* **1.1. User Registration:**
  + Users must be able to register for an account using their email or through a third-party service (e.g., Google, Facebook).
  + Users must provide basic information: name, email, password, and age/grade level.
* **1.2. User Login/Logout:**
  + Registered users must be able to log in using their email and password.
  + Users can log out from the system at any time.
* **1.3. Password Recovery:**
  + Users must be able to reset their password through a “Forgot Password” process that sends a recovery email with instructions.

**2. Book Upload and Access**

* **2.1. Uploading Books:**
  + Users must be able to upload books in various formats (e.g., PDF, EPUB).
  + Users can add metadata, including title, author, description, and grade level.
* **2.2. Book Management:**
  + Users can view, delete, or update the metadata for their uploaded books.
  + The system should display a list of all uploaded books with search, filter, and sort capabilities based on metadata.
* **2.3. Accessing Books:**
  + Users can search for and browse available books based on keywords, categories, and grade levels.
  + Users can view the contents of books online, including text and images (no editing permissions for other users).

**3. AI Video Explanation Generation**

* **3.1. Text Extraction and Analysis:**
  + The system should extract text from the uploaded books (if the format allows it) to enable AI analysis.
* **3.2. Automatic Video Generation:**
  + For each section or chapter of the book, the AI should generate an explanation video summarizing the key points.
  + The videos should include animations, diagrams, and voiceover for clarity.
  + Users can select a specific part of the text (e.g., a paragraph) and request a video explanation for that segment.

**4. Question Asking and Answering**

* **4.1. Ask Questions About Specific Parts:**
  + Users can select a part of the text in a book or video and ask questions about it.
  + The system should generate answers based on the context of the selected text or video using AI-powered natural language processing.
* **4.2. Real-Time Answering:**
  + The system must provide real-time answers to user questions.
  + Answers should be clear, concise, and contextually accurate.
* **4.3. Question History:**
  + Users should have a history of their previously asked questions and the AI-generated answers.

**5. Interactive Exercises and Quizzes**

* **5.1. Exercise Generation:**
  + The system should generate exercises related to the content of the book.
  + Exercises should be customizable (e.g., multiple-choice, fill-in-the-blanks, short answer).
* **5.2. Quiz Creation and Administration:**
  + Users can take quizzes that assess their understanding of the material.
  + Quizzes should be auto-graded, and users should receive instant feedback.
* **5.3. Quiz Results and Feedback:**
  + After completing a quiz, users should receive a detailed breakdown of correct/incorrect answers.
  + The system should provide tips and resources based on incorrect answers to help students improve.

**6. Progress Tracking and Reporting**

* **6.1. Learning Progress Dashboard:**
  + Users should have access to a dashboard displaying their progress, including completed books, quizzes, and exercises.
* **6.2. Grade and Performance Reporting:**
  + The system should generate a report on user performance in quizzes and exercises over time, with visualizations (e.g., graphs, progress bars).

**7. Feedback Mechanism**

* **7.1. User Feedback for Videos:**
  + Users can rate and provide feedback on the quality of the AI-generated videos.
* **7.2. Report Content Issues:**
  + Users should be able to report errors or issues with content, videos, or exercises for review by administrators.

**8. Admin Panel**

* **8.1. User Management:**
  + Administrators should have the ability to view, add, update, and delete user accounts.
* **8.2. Content Moderation:**
  + Admins can review and moderate uploaded books, videos, and exercises to ensure quality and compliance with educational standards.
* **8.3. Analytics and Reporting:**
  + Admins should have access to system-wide usage analytics, including the number of active users, most popular books, and overall quiz performance.

**9. Security and Privacy**

* **9.1. Data Encryption:**
  + All user data (e.g., account details, uploaded books, questions) should be securely stored and encrypted.
* **9.2. Privacy Settings:**
  + Users should have control over their privacy settings, including who can view their uploaded content or question history.
* **9.3. Compliance:**
  + The system should comply with relevant data protection regulations (e.g., GDPR, CCPA) regarding user data and content.

#### **Chapter 4: Non-functional Requirements**

**1. Performance Requirements**

* **1.1. Response Time:**
  + The system should respond to user actions (e.g., clicking buttons, loading content) within **2 seconds** under normal load.
  + AI video explanations should be generated within **60 seconds** for an average-sized book section (e.g., 1–2 pages of text).
* **1.2. Scalability:**
  + The system must be horizontally scalable to support an increasing number of users, books, and video requests without degradation in performance.
  + It should handle at least **1,000 concurrent users** during peak hours.
* **1.3. Throughput:**
  + The system should support the generation of **100+ AI videos per hour** without delays.
  + It should process at least **1,000 quiz submissions per minute**.

**2. Reliability and Availability**

* **2.1. Uptime:**
  + The system should be available **99.9% of the time**, excluding scheduled maintenance.
* **2.2. Fault Tolerance:**
  + In the event of a server failure, the system should automatically redirect users to backup instances without data loss.
* **2.3. Data Backup:**
  + Daily backups of user data, uploaded books, and video content must be performed and stored securely.

**3. Security Requirements**

* **3.1. Authentication and Authorization:**
  + Role-based access control (RBAC) must be implemented to differentiate between students, teachers, and admins.
  + Two-factor authentication (2FA) should be available for user accounts.
* **3.2. Data Encryption:**
  + All sensitive data must be encrypted at rest and in transit using industry standards (e.g., AES-256, TLS 1.3).
* **3.3. Privacy Compliance:**
  + The system must comply with **GDPR** and **FERPA** guidelines to ensure user privacy, especially for minors.
  + Users must have control over their data, including the ability to request deletion.
* **3.4. Secure Uploads:**
  + Uploaded files must be scanned for malware and viruses before being processed.

**4. Usability Requirements**

* **4.1. Accessibility:**
  + The UI must comply with **WCAG 2.1 Level AA** standards to ensure accessibility for users with disabilities.
  + AI videos should have auto-generated subtitles and audio descriptions.
* **4.2. Multi-Device Compatibility:**
  + The system must be fully usable on desktops, tablets, and mobile devices with responsive design.
* **4.3. Ease of Use:**
  + Users should be able to complete major tasks (e.g., uploading a book, generating a video) within **3 clicks or less**.
  + A guided onboarding/tutorial must be available for new users.

**5. Maintainability and Supportability**

* **5.1. Modular Design:**
  + The system architecture must be modular to support future updates and enhancements without major rewrites.
* **5.2. Logging and Monitoring:**
  + All user interactions, system events, and errors must be logged for debugging and analytics.
  + Real-time monitoring tools must alert administrators of system downtime or anomalies.
* **5.3. Error Handling:**
  + The system should gracefully handle errors and display user-friendly messages with appropriate suggestions.
* **5.4. Documentation:**
  + Up-to-date system documentation (technical and user-facing) must be maintained and accessible.

**6. Portability**

* **6.1. Browser Compatibility:**
  + The platform must work across major browsers (Chrome, Firefox, Edge, Safari) with consistent performance and appearance.
* **6.2. Cloud Deployment:**
  + The system must be deployable on multiple cloud platforms (e.g., AWS, Azure, GCP) with minimal changes.

**7. Localization and Internationalization**

* **7.1. Language Support:**
  + The system must support **multi-language interfaces**, starting with English and optionally expandable to other languages like Spanish, French, and Arabic.
* **7.2. Date/Time/Currency Formats:**
  + Localized formatting for dates and times must be supported based on the user’s locale.

**8. Legal and Ethical Considerations**

* **8.1. Copyright Handling:**
  + The system must enforce checks to ensure that only copyright-cleared or user-owned books are uploaded.
  + It must provide clear terms of service and content usage guidelines.
* **8.2. Ethical AI Use:**
  + AI-generated videos and answers must avoid biased, harmful, or inappropriate content using established filters and human oversight.

**9. Interoperability**

* **9.1. API Support:**
  + The system should expose RESTful APIs for integration with external learning management systems (LMS) or education tools.
* **9.2. File Format Compatibility:**
  + The platform must support standard file formats for upload (PDF, EPUB, DOCX) and export (MP4 for videos, CSV/JSON for reports).

##### **Chapter 5: System Evolution**

As educational needs, technologies, and user expectations evolve, the AI Video Education System is designed to be adaptable and extendable. The following are potential areas of future enhancement and improvement:

**1. Enhanced AI Capabilities**

* **Context-Aware Explanations:** Improve AI to better understand broader textbook context, user history, and learning patterns for more personalized video explanations.
* **Emotion Detection:** Incorporate emotion recognition (via webcam or feedback) to adjust the pace, tone, or complexity of the content.
* **Multi-modal Interaction:** Support voice and visual-based queries (e.g., users asking questions verbally or submitting images from books).

**2. Teacher and Parent Portals**

* **Teacher Dashboard:** Allow teachers to create and assign custom learning paths, monitor student progress, and upload their own educational content.
* **Parent Access:** Provide parents with read-only access to their child’s performance metrics, progress, and recommended actions.

**3. Collaborative Learning Features**

* **Discussion Forums:** Introduce community-based Q&A forums or threaded discussions per book/topic to encourage collaborative learning.
* **Study Groups:** Enable students to form or join virtual study groups and share notes, resources, or quiz questions.

**4. Gamification**

* **Achievements and Rewards:** Add badges, points, and levels to reward quiz completion, consistent study habits, or mastering difficult concepts.
* **Leaderboard Integration:** Display user rankings to encourage healthy competition in a classroom or globally.

**5. Multilingual Expansion**

* Expand the AI's ability to generate explanations, quizzes, and interactions in multiple languages, with localization for cultural and educational standards.

**6. Offline Mode**

* Develop downloadable content packs (books, videos, exercises) for offline learning, with progress syncing once reconnected.

**7. Third-Party Integrations**

* **LMS Integration:** Support integration with platforms like Moodle, Google Classroom, or Microsoft Teams.
* **Content Partnerships:** Collaborate with publishers to offer licensed textbooks and high-quality educational materials.

**8. Advanced Analytics**

* **Learning Pattern Recognition:** Use machine learning to analyze long-term behavior and suggest optimal learning paths.
* **Predictive Performance Analytics:** Forecast student performance and recommend early interventions.

**9. Content Curation & Marketplace**

* Launch a marketplace where educators can upload, sell, or share high-quality, AI-optimized textbooks, exercises, or video packs.

###### **Chapter 6: Appendix**

**A. Supported File Types for Upload**

* PDF (.pdf)
* EPUB (.epub)
* DOCX (.docx)

**B. AI Video Output Format**

* Video: MP4 (with 720p or 1080p resolution)
* Subtitles: SRT or VTT
* Optional voiceover languages (future): English, Spanish, French

**C. Target Users**

* Primary: Students in Grades 4–12
* Secondary: Teachers, Parents, Educational Institutions

**D. Compliance Standards**

* **GDPR:** General Data Protection Regulation (EU)
* **FERPA:** Family Educational Rights and Privacy Act (US)