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E-Library with Secure PDF Access

Project Overview & Objectives:

The E-Library with Secure PDF Access is a modern, web-based platform designed to provide users with a seamless and secure digital reading experience. The core problem it addresses is the challenge of distributing and accessing digital books (primarily PDFs) in a controlled manner, preventing unauthorized copying, redistribution, and ensuring that content is only available to verified users.

Key features will include:

User Authentication & Authorization:Secure user registration and login.

* Role-Based Access Control (RBAC):Differentiating between Admin users (who can upload and manage books) and Members (who can read books).

* Digital Library Catalog: A searchable and categorized collection of books with details like title, author, description, and cover

image.

* Secure PDF Viewer:Integrated PDF viewer that prevents easy downloading and printing. PDFs will be served dynamically rather than via direct, static links.

* Reading Progress Tracking:Allows users to bookmark their last read page and resume from there.

* Admin Dashboard: A dedicated interface for admins to upload new books, manage existing ones, and view user activity.

The expected outcome is a fully functional, secure, and user-friendly web application that can be deployed by educational institutions, small libraries, or organizations to manage and share their digital document collections confidently.

Phase 1: Planning & Foundation

1. Technology Stack & Environment Setup

* Backend:
  * Runtime:Node.js

    * Framework: Express.js for building robust and scalable RESTful APIs.

    * Authentication:JSON Web Tokens (JWT) for stateless and secure user sessions.

    * Password Hashing:bcryptjs to securely hash user passwords before storing them.

* Database:

    * System: MongoDB with Mongoose ODM. Its flexible schema is ideal for storing book metadata and user profiles. Collections will include `Users`, `Books`, and `ReadingSessions`.

* Frontend:

    * Framework:React.js (with Vite for fast setup) to create a dynamic and responsive single-page application (SPA).

    * State Management: React Context API or Redux Toolkit for managing global state like user authentication and the list of books.

    * UI Library:Tailwind CSS for rapid and modern UI development.

    * PDF Viewer: Mozilla's `PDF.js` integrated into a React component to display PDFs securely without exposing the original file URL.

* Tools & Services:

    * Version Control:Git with a repository on GitHub.

    * Package Manager:npm or yarn.

    *   File Upload:Multer` middleware for handling PDF and cover image uploads.

    *   Deployment: Backend on Render or Railway, Frontend on Netlify or Vercel, and MongoDB Atlas for the database.

2. API Design & Data Model

Data Models (Schema):

*   User: `{ _id, email, passwordHash, role ("admin" / "member"), createdAt }`

*   Book: `{ _id, title, author, description, genre, coverImageUrl, pdfUrl, uploadDate, uploadedBy (ref to User) }`

*   *ReadingSession: `{ _id, userId (ref to User), bookId (ref to Book), lastPage, updatedAt }`

Planned REST Endpoints:

*   Authentication Routes:

    *   `POST /api/auth/register` - Create a new member account.

    *   `POST /api/auth/login` - Authenticate user and return a JWT.

*   Book Routes (Protected):

* `GET /api/books` - Get a paginated list of all books (search/filterable).

* `GET /api/books/:id` - Get details of a single book.

* Admin Routes (Protected & Admin-only):

* `POST /api/admin/books` - Upload a new book (cover image + PDF).

* `PUT /api/admin/books/:id` - Update book metadata.

* `DELETE /api/admin/books/:id` - Remove a book from the library.

* Reading Routes (Protected):

* `GET /api/read/:bookId` - Securely serve the PDF file for the integrated viewer. This endpoint will verify the user's JWT before streaming the file.

* `POST /api/read/progress` - Save or update the user's current page in a book.

3. Front-End UI/UX Plan

*Wireframes & Navigation Flow:

1. Public Landing Page: Showcases the library, with calls-to-action for login and register.

2. *Login/Registration Pages:Simple forms for user access.

3. Member Dashboard:Upon login, users see a searchable grid of book cards. A navigation bar provides links to the catalog and a logout button.

4. *Book Detail Page:Clicking a book card opens a page with the book's description, author, and a "Start Reading" button.

5. Reading Page:A clean, focused interface with the PDF.js viewer. The navigation is minimal, and the browser's right-click "Save As" functionality will be disabled for the PDF iframe.

6. *Admin Dashboard:A separate view for admins with a form to upload books and a table to manage existing ones.

* State Management Approach:The React Context API will be used to create an `AuthContext` to manage the global user state (user info, JWT token, login status). A `BookContext` may be used to cache the library catalog for faster navigation.

4. Development & Deployment Plan

* Team Roles:

* Backend Developer:Focuses on Node.js/Express API, database models, authentication, and secure file delivery.

* Frontend Developer: Implements the React UI, integrates with the API, and builds the secure PDF viewer component.

* UI/UX Designer (can be shared role):** Creates wireframes and ensures a consistent design system with Tailwind CSS.

*   Git Workflow:

    *   Use a feature-branch workflow. `main` branch will always hold the production-ready code.

    *   New features will be developed in branches named `feature/description` (e.g., `feature/user-authentication`).

    *   Pull Requests (PRs) are required to merge a feature branch into `main`, ensuring code review.

*   Testing Approach:

    *   Backend: Use Jest and Supertest for unit and integration testing of API endpoints.

    *   Frontend:Use React Testing Library for component testing.

    *   Manual Testing:Thoroughly test user flows like registration, login, book upload, and the secure reading experience.

*   Hosting & Deployment Strategy:

    1. Database: Set up a production cluster on MongoDB Atlas.

    2. Backend:Deploy the Node.js/Express API to Render or Railway, connecting it to the MongoDB Atlas database.

    3. Frontend: Build the React app into static files and deploy them on Netlify or Vercel. The frontend will be configured to communicate with the deployed backend API URL.

This comprehensive Phase 1 plan provides a solid blueprint for developing a robust and secure E-Library, ensuring the team is

aligned on the vision, technology, and execution path before a single line of code is written.

1. Technology Stack & Data Model Examples

A. Database Schema Examples (MongoDB with Mongoose)

```
// User Model (models/User.js)
const userSchema = new mongoose.Schema({
  email: { type: String, required: true, unique: true },
  passwordHash: { type: String, required: true },
  role: { type: String, enum: ['member', 'admin'], default: 'member' },
  createdAt: { type: Date, default: Date.now }
});

// Book Model (models/Book.js)
const bookSchema = new mongoose.Schema({
  title: { type: String, required: true },
  author: { type: String, required: true },
  description: String,
  genre: [String], // e.g., ["Fiction", "Science"]
  coverImageUrl: String, // e.g., "/uploads/covers/the-hobbit.jpg"
  pdfUrl: { type: String, required: true }, // e.g., "/uploads/pdfs/the-
```

```
hobbit.pdf"
  uploadedBy: { type: mongoose.Schema.Types.ObjectId, ref: 'User'
 },
  uploadDate: { type: Date, default: Date.now }
});


// ReadingSession Model (models/ReadingSession.js)
const readingSessionSchema = new mongoose.Schema({
  userId: { type: mongoose.Schema.Types.ObjectId, ref: 'User',
required: true },
  bookId: { type: mongoose.Schema.Types.ObjectId, ref: 'Book',
required: true },
  lastPage: { type: Number, default: 1 },
  updatedAt: { type: Date, default: Date.now }
});
```

B. Example JWT Token Payload

When a user logs in, the server creates a JWT token with a payload like this:

```
{
  "userId": "507f1f77bcf86cd799439011",
  "email": "user@example.com",
```

```
  "role": "member",
  "iat": 1719500000, // Issued at timestamp
  "exp": 1719503600  // Expires in 1 hour
}
```

2. API Endpoint Examples

A. User Registration Request & Response

Request:

```
POST /api/auth/register
Content-Type: application/json

{
  "email": "newuser@example.com",
  "password": "mySecurePassword123"
}
```

Success Response (201 Created):

```
json
{
  "message": "User registered successfully",
```

```
  "user": {
    "id": "507f1f77bcf86cd799439011",
    "email": "newuser@example.com",
    "role": "member"
  }
}
```

C. Secure PDF Serving Endpoint

Backend Logic (pseudo-code for the route handler):// routes/read.js

```
app.get('/api/read/:bookId', authenticateUser, async (req, res) => {
  try {
    const book = await Book.findById(req.params.bookId);
    if (!book) return res.status(404).json({ message: 'Book not found' });

    // Check if user has permission (is logged in)
    // The `authenticateUser` middleware already verified the JWT
```

```
    // Set headers to prevent caching and discourage saving
    res.setHeader('Content-Type', 'application/pdf');
    res.setHeader('Cache-Control', 'no-cache, no-store, must-revalidate');
    res.setHeader('Pragma', 'no-cache');

    // Stream the PDF file to the client
    const filePath = path.join(__dirname, '..', book.pdfUrl);
    const fileStream = fs.createReadStream(filePath);
    fileStream.pipe(res);

  } catch (error) {
    res.status(500).json({ message: 'Error serving book' });
  }
});
```

3. Front-End UI/UX Examples

A. Book Card Component (React)

```
// components/BookCard.jsx
import { Link } from 'react-router-dom';

const BookCard = ({ book }) => {
```

```
  return (
    <div className="bg-white rounded-lg shadow-md overflow-hidden hover:shadow-lg transition-shadow">
      <img
        src={book.coverImageUrl}
        alt={`Cover of ${book.title}`}
        className="w-full h-48 object-cover"
      />
      <div className="p-4">
        <h3 className="text-xl font-semibold mb-2">{book.title}</h3>
        <p className="text-gray-600 mb-2">by {book.author}</p>
        <div className="flex flex-wrap gap-1 mb-3">
          {book.genre.map((tag, index) => (
            <span key={index} className="bg-blue-100 text-blue-800 text-xs px-2 py-1 rounded">
              {tag}
            </span>
          ))}
        </div>
        <Link
```

```
          to={`/book/${book._id}`}
          className="bg-blue-500 hover:bg-blue-600 text-white px-4
py-2 rounded block text-center"
        >
          View Details
        </Link>
      </div>
    </div>
  );
};
```

B. Secure PDF Viewer Component

```
// components/PDFReader.jsx
import { useState, useEffect } from 'react';
import { Document, Page, pdfjs } from 'react-pdf';
import 'react-pdf/dist/Page/AnnotationLayer.css';

// Configure PDF.js worker
pdfjs.GlobalWorkerOptions.workerSrc =
`//cdnjs.cloudflare.com/ajax/libs/pdf.js/${pdfjs.version}/pdf.work
er.min.js`;
```

```
const PDFReader = ({ bookId }) => {
  const [numPages, setNumPages] = useState(null);
  const [pageNumber, setPageNumber] = useState(1);
  const [lastSavedPage, setLastSavedPage] = useState(1);

  // Secure PDF URL - points to our backend endpoint, not the direct file
  const pdfUrl = `/api/read/${bookId}`;

  function onDocumentLoadSuccess({ numPages }) {
    setNumPages(numPages);
    // Here you would fetch the user's last saved page from the API
    // and setPageNumber to that value
  }

  // Auto-save progress when page changes
  useEffect(() => {
    const saveProgress = setTimeout(() => {
      if (pageNumber !== lastSavedPage) {
```

```
      fetch('/api/read/progress', {
        method: 'POST',
        headers: {
          'Content-Type': 'application/json',
          'Authorization': `Bearer ${localStorage.getItem('token')}`
        },
        body: JSON.stringify({
          bookId: bookId,
          lastPage: pageNumber
        })
      });
      setLastSavedPage(pageNumber);
    }
  }, 1000);

  return () => clearTimeout(saveProgress);
}, [pageNumber, bookId, lastSavedPage]);

return (
  <div className="pdf-viewer">
```

```
    <div className="pdf-controls bg-gray-100 p-2 flex justify-between items-center">
      <button
        onClick={() => setPageNumber(prev => Math.max(prev - 1, 1))}
        disabled={pageNumber <= 1}
        className="bg-blue-500 text-white px-4 py-2 rounded disabled:bg-gray-300"
      >
        Previous
      </button>

      <span className="text-gray-700">
        Page {pageNumber} of {numPages}
      </span>

      <button
        onClick={() => setPageNumber(prev => Math.min(prev + 1, numPages))}
        disabled={pageNumber >= numPages}
        className="bg-blue-500 text-white px-4 py-2 rounded
```

```
disabled:bg-gray-300"
        >
          Next
        </button>
      </div>

      <div className="pdf-container border">
        <Document
          file={pdfUrl}
          onLoadSuccess={onDocumentLoadSuccess}
          options={{
            httpHeaders: {
              'Authorization': `Bearer ${localStorage.getItem('token')}`
            }
          }}
        >
          <Page
            pageNumber={pageNumber}
            renderTextLayer={false} // Makes text selection harder
          />
```

```
        </Document>
      </div>
    </div>
  );
};
```

C. Admin Book Upload Form

```
// components/AdminUploadForm.jsx
const AdminUploadForm = () => {
  const [formData, setFormData] = useState({
    title: '',
    author: '',
    description: '',
    genre: '',
    coverImage: null,
    pdfFile: null
  });

  const handleSubmit = async (e) => {
    e.preventDefault();
    const submitData = new FormData();
```

```
submitData.append('title', formData.title);
submitData.append('author', formData.author);
submitData.append('description', formData.description);
submitData.append('genre', formData.genre);
submitData.append('coverImage', formData.coverImage);
submitData.append('pdfFile', formData.pdfFile);

try {
  const response = await fetch('/api/admin/books', {
    method: 'POST',
    headers: {
      'Authorization': `Bearer ${localStorage.getItem('token')}`
    },
    body: submitData
  });

  if (response.ok) {
    alert('Book uploaded successfully!');
    // Reset form
    setFormData({ title: '', author: '', description: '', genre: '',
```

```
coverImage: null, pdfFile: null });
      }
    } catch (error) {
      alert('Error uploading book');
    }
  };

  return (
    <form onSubmit={handleSubmit} className="space-y-4 max-w
-2xl mx-auto">
      <input
        type="text"
        placeholder="Book Title"
        value={formData.title}
        onChange={(e) => setFormData({...formData, title:
e.target.value})}
        className="w-full p-2 border rounded"
        required
      />
      <input
```

```
        type="text"
        placeholder="Author"
        value={formData.author}
        onChange={(e) => setFormData({...formData, author: e.target.value})}
        className="w-full p-2 border rounded"
        required
      />
      <textarea
        placeholder="Description"
        value={formData.description}
        onChange={(e) => setFormData({...formData, description: e.target.value})}
        className="w-full p-2 border rounded"
        rows="3"
      />
      <input
        type="file"
        accept="image/*"
        onChange={(e) => setFormData({...formData, coverImage: e.target.files[0]})}
```

```
        className="w-full p-2 border rounded"
        required
      />
      <input
        type="file"
        accept=".pdf"
        onChange={(e) => setFormData({...formData, pdfFile:
e.target.files[0]})}
        className="w-full p-2 border rounded"
        required
      />
      <button
        type="submit"
        className="bg-green-500 text-white px-6 py-2 rounded
hover:bg-green-600"
      >
        Upload Book
      </button>
    </form>
  );
```

```
};
```