REPORT

AI-POWERED INTERACTIVE LEARNING ASSISTANT FOR CLASSROOMS

AI LearnHub

Your AI-Powered Learning Platform

An AI-Powered Interactive Learning Platform

Team: Tech Titans

Dinesh .Y

Alan Bevis .JP

Basheerah Batool .M

Department: B.Tech-CSE (Internet of Things)

Year of Study: IIIrd - year

University: B. S. Abdur Rahman Crescent Institute of Science and Technology

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1. Abstract:

AI LearnHub is a modern, AI-powered interactive learning platform designed to personalize and enhance the digital learning experience. It leverages cutting-edge frontend tools (React, TypeScript, Tailwind CSS, shadcn/ui) and AI integration (OpenRouter API) to provide real-time tutoring, dynamic quiz generation, study material creation, and personalized learning paths. With features like user analytics, progress dashboards, and downloadable content, it aims to empower students with intelligent, self-paced learning tools for classrooms and beyond.

2. Keywords:

AI Tutor, EdTech, Personalized Learning, React, Vite, Tailwind CSS, Quiz Generator, Study Material, Learning Dashboard, OpenRouter API

3. Introduction:

The landscape of education has rapidly shifted toward digital-first and hybrid learning environments. Yet, most traditional e-learning platforms provide static, one-size-fits-all content. Learners today demand more: instant support, adaptive materials, and progress visibility.

AI LearnHub addresses this gap by integrating artificial intelligence into a responsive frontend interface. By offering a conversational AI tutor, smart content generators, interactive quizzes, and progress tracking features, the platform transforms self-paced learning into an engaging, personalized journey.

The project's aim is not only to assist learners but also to empower educators and institutions with scalable, intelligent learning infrastructure—designed for today and adaptable for tomorrow.

4. Objectives:

- Develop an AI-powered web platform for interactive learning
- Enable real-time AI tutoring and query resolution
- Provide personalized quizzes and study materials
- Visualize learning progress via dashboards
- Support offline access and analytics
- Ensure responsive design and ease of use

5. Literature Review:

Recent advancements in AI-driven learning have shown promising results in boosting learner engagement and retention. Tools such as ChatGPT and OpenAI's Codex have enabled real-time assistance in coding and learning tasks. However, most educational platforms still rely on pre-recorded materials or static quizzes.

Platforms like Coursera and Khan Academy deliver excellent content but fall short on personal interaction. By integrating OpenRouter AI, AI LearnHub fills this gap by dynamically responding to users with contextual educational support. Studies also show that progress dashboards and gamification significantly enhance motivation and performance.

6. Methodology:

The platform is developed using the Agile software development methodology, ensuring continuous improvement and iterative testing.

Phases:

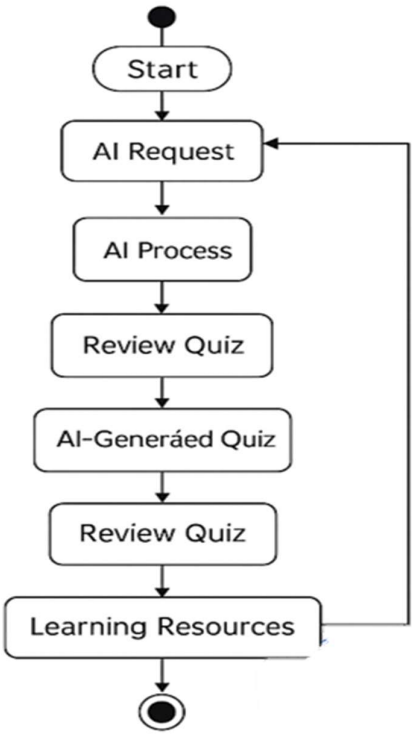
1. Requirement analysis and planning
2. UI/UX prototyping using Figma
3. Frontend development with React and Tailwind CSS

4. AI integration using OpenRouter API
5. Component testing and responsiveness checks
6. Deployment on Vercel with CI/CD pipeline

Tools used: Figma (design), Vite (build), React (framework), and Postman (API testing).

Process Flow Chart:

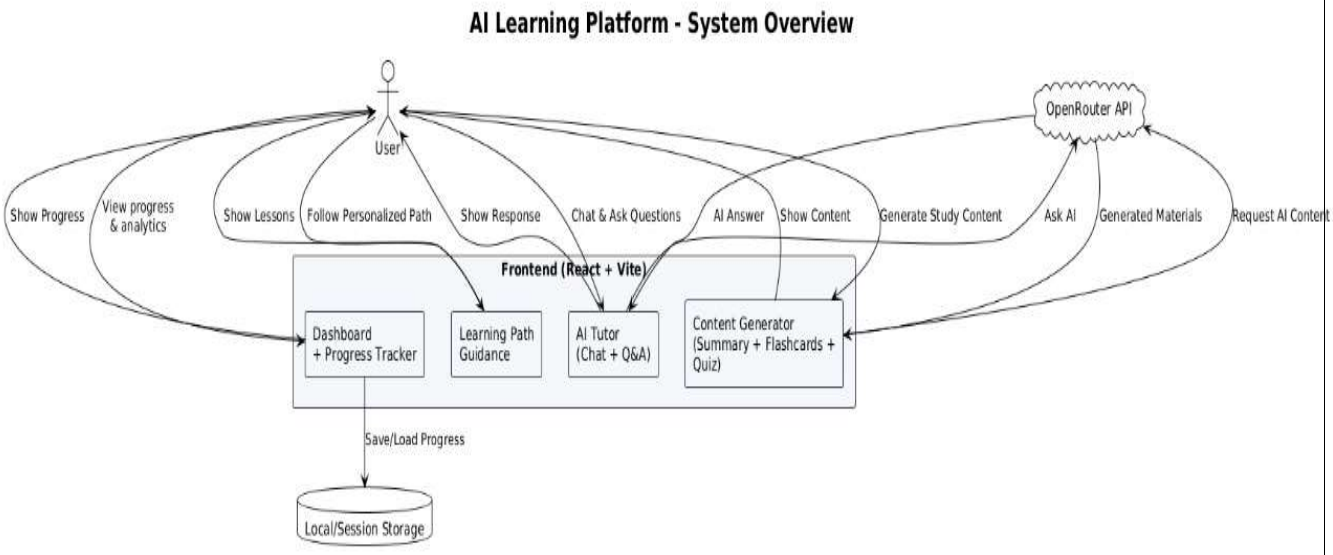
Data flow begins from user input to the frontend → AI request → AI response → display to user.



The system architecture is built to capture the user's query or selection (like generating study material or taking a quiz), send it to the AI service (OpenRouter API), and then display the result through a user-friendly interface. The dashboard then logs and visualizes progress.

7. System Overview:

AI LearnHub is an AI-powered e-learning solution that provides learners with personalized support via a modular architecture. The system offers real-time tutoring, custom content generation, and visual learning paths,



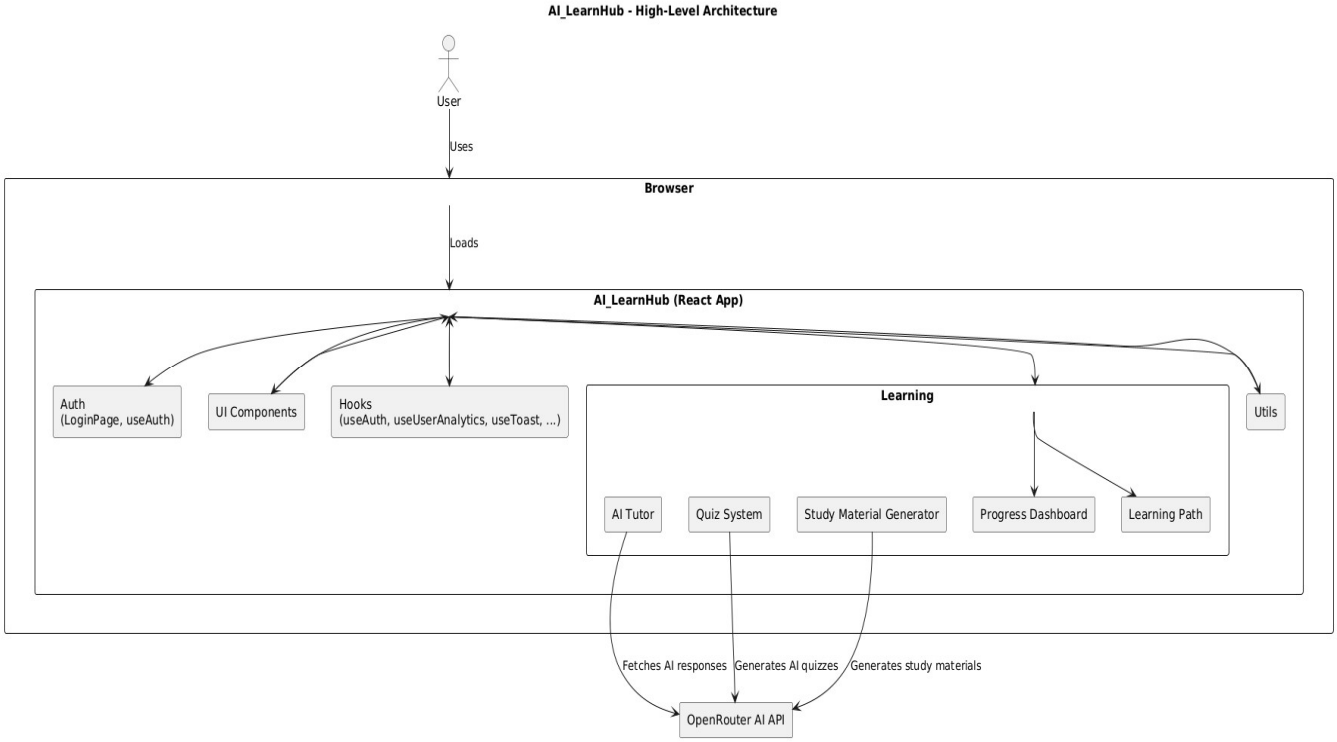
ensuring accessibility, flexibility, and adaptability for modern learners.

1. **User Interaction:**
    - The user begins by interacting with the platform through the **frontend** (built using React + Vite).
    - They can follow learning paths, ask questions, or request study material.
2. **Frontend Modules:**
    - **Dashboard + Progress Tracker**: Displays learning statistics, XP, and activity analytics. Saves user progress.
    - **Learning Path Guidance**: Helps users navigate structured lessons and modules.
    - **AI Tutor (Chat + Q&A)**: Allows users to interact with AI, ask academic questions, and receive real-time answers.

- **Content Generator**: Generates summaries, flashcards, and quizzes based on user input.

3. **AI Integration:**
    - The **OpenRouter API** is used to process AI-based requests.
    - The frontend sends input data (questions, topics) to the API.
    - The API returns the AI-generated response (answers, study content).
4. **Content Flow:**
    - The user sends input → routed to the appropriate module (Tutor or Generator).
    - The selected module sends a request to the OpenRouter API.
    - The API processes the request and sends generated materials or answers back.
    - The frontend displays this response to the user.
5. **Storage & Tracking:**
    - Progress is saved locally using **Local/Session Storage**.
    - Ensures user data is retained across sessions (e.g., dashboard stats, lesson tracking).
6. **End-to-End Functionality:**
    - The system creates a seamless loop from user input → AI processing → output display → progress tracking.

7. 1 System Architecture:



AI LearnHub is built as a modular React application that runs in the browser. It includes:

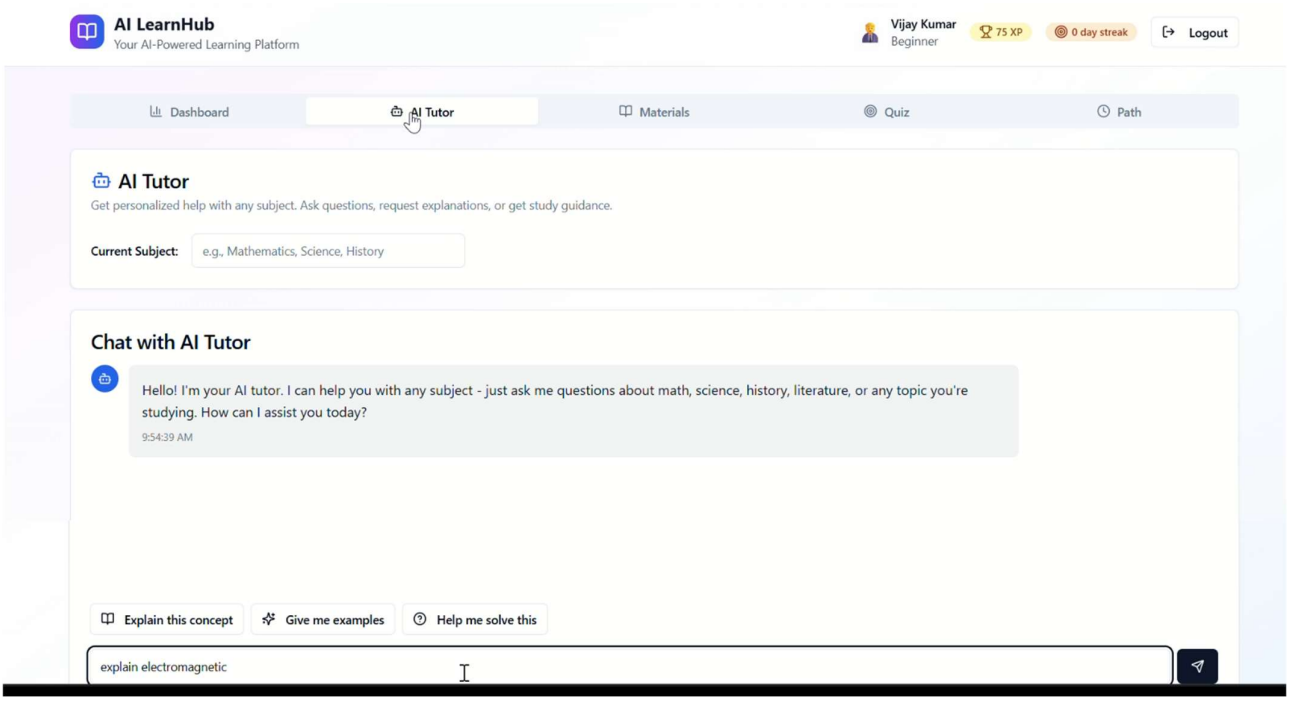
- **Authentication Module** for login and user session
- **UI Components** using Tailwind CSS and shadcn/ui
- **Custom Hooks** like useAuth, useUserAnalytics, and useToast
- **Learning Modules**:
    - AI Tutor (Q&A)
    - Quiz Generator
    - Study Material Creator
    - Progress Dashboard
    - Learning Path Navigation

These modules interact with the **OpenRouter AI API** to fetch responses, generate quizzes, and create study content. All data flows from the user → frontend → AI API → back to the UI with tracking via analytics and storage.

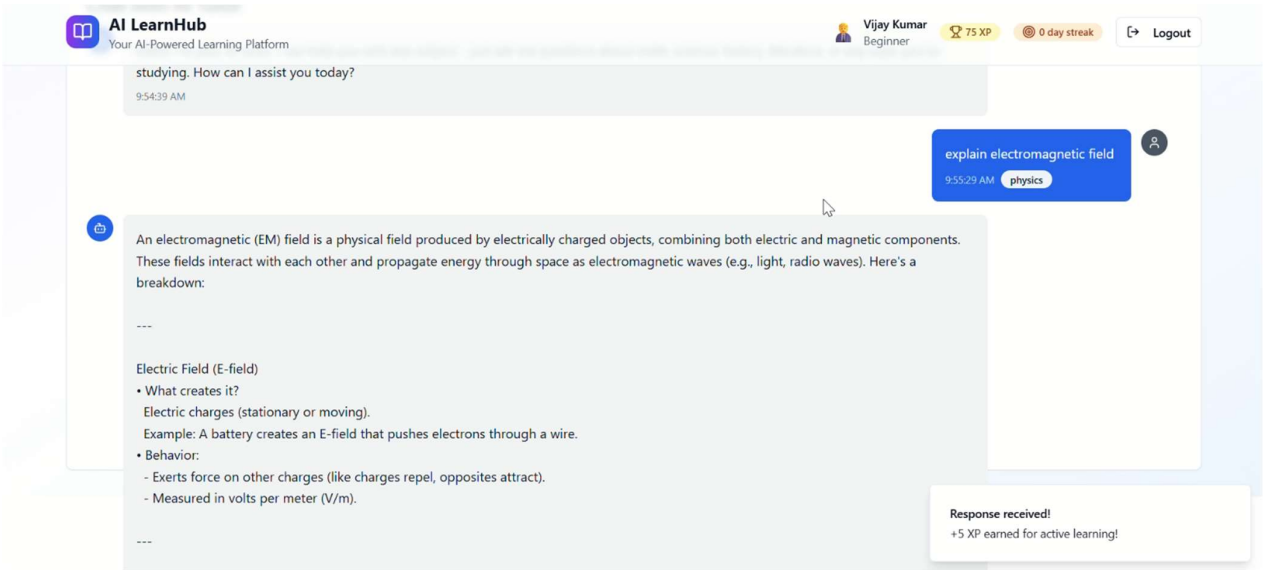
8. Features in Detail:

8.1 AI Tutor:

- Chatbot that assists learners by explaining concepts, answering questions.

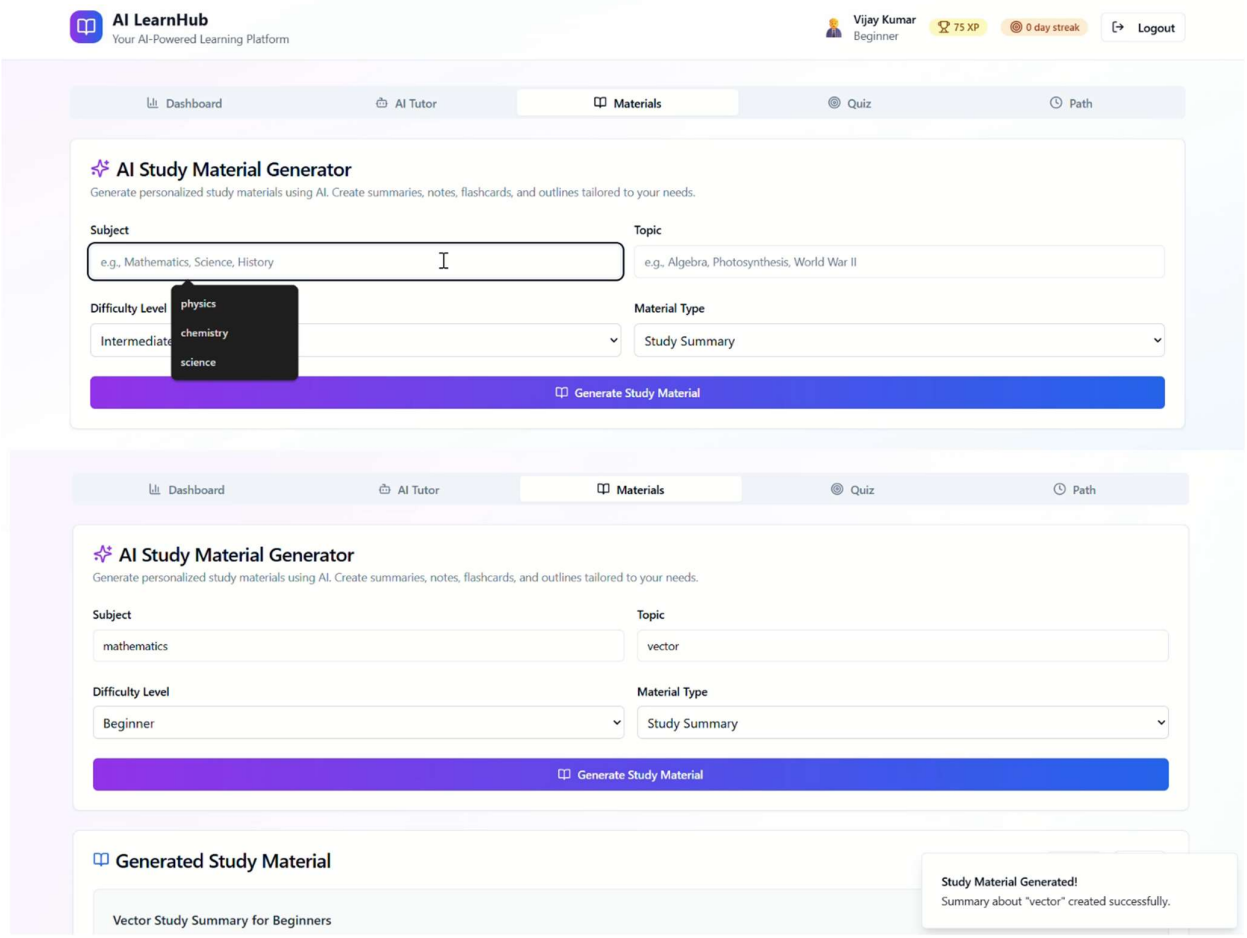


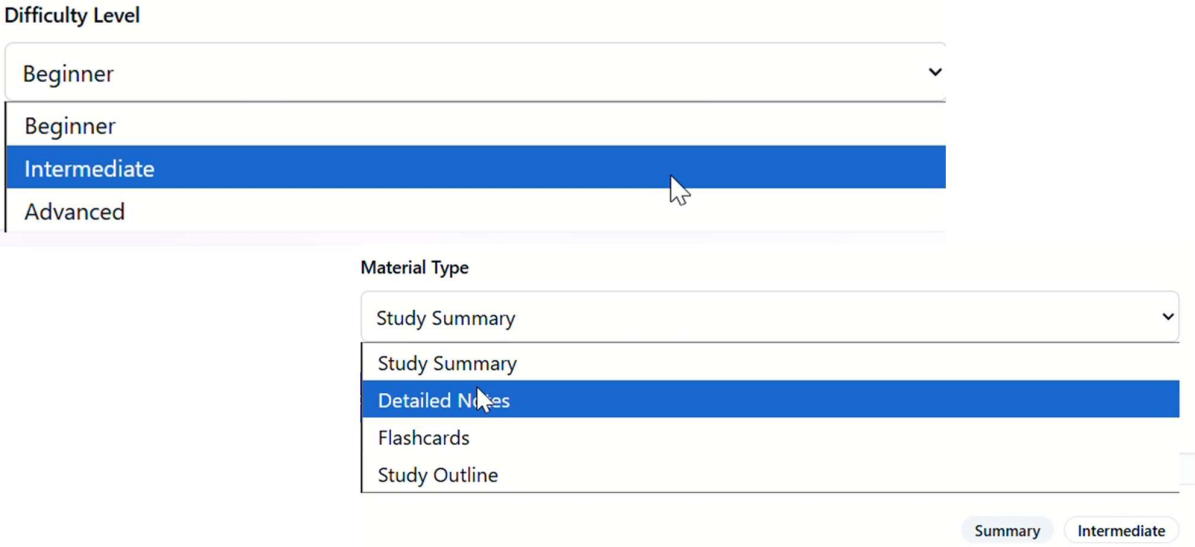
- Built with OpenRouter API and responsive UI
- Offers quick prompt buttons for frequently asked queries.



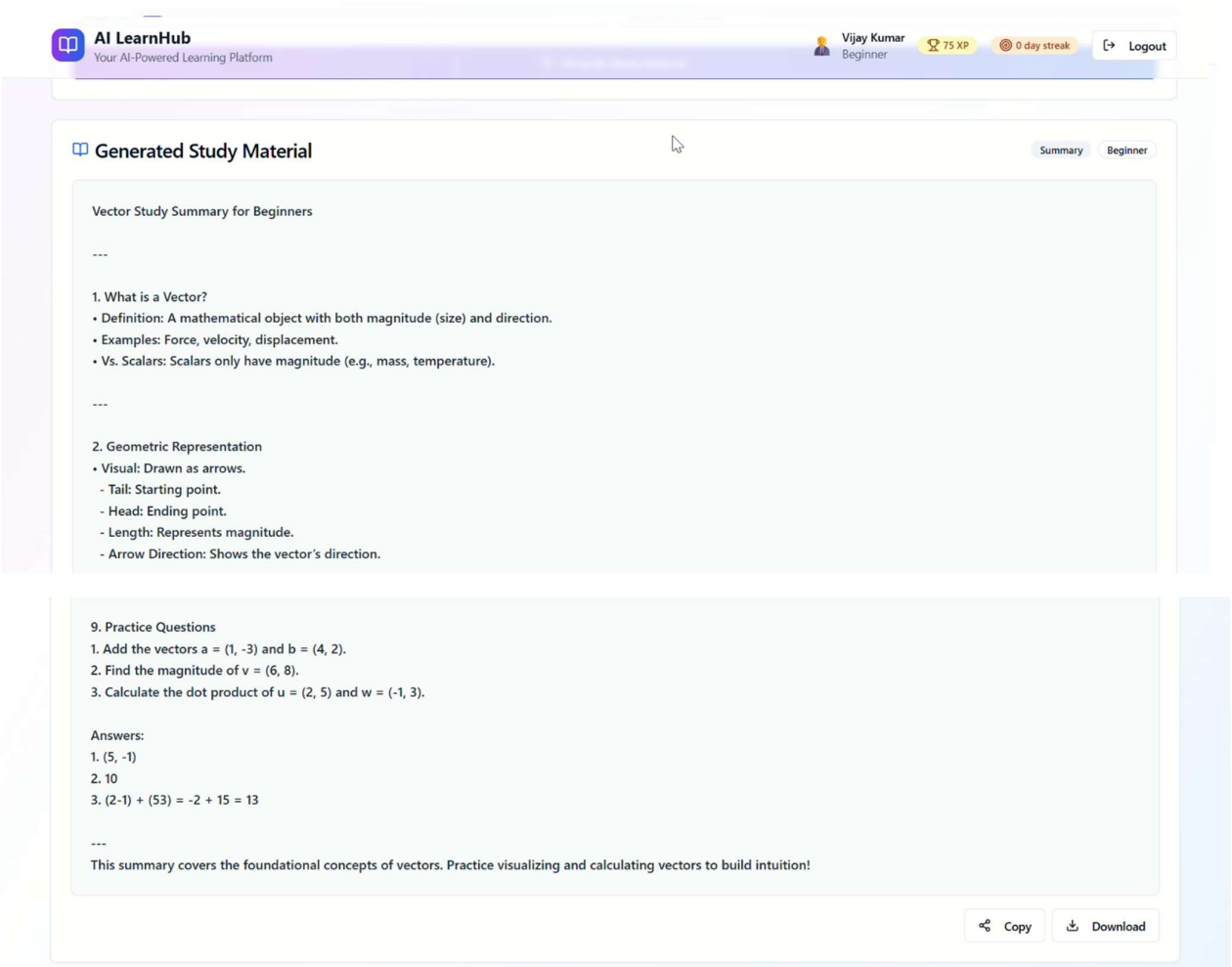
8.2 Study Material Generator:

- Generates topic-based summaries, flashcards, and MCQs.
- Improves learning accessibility for all user types

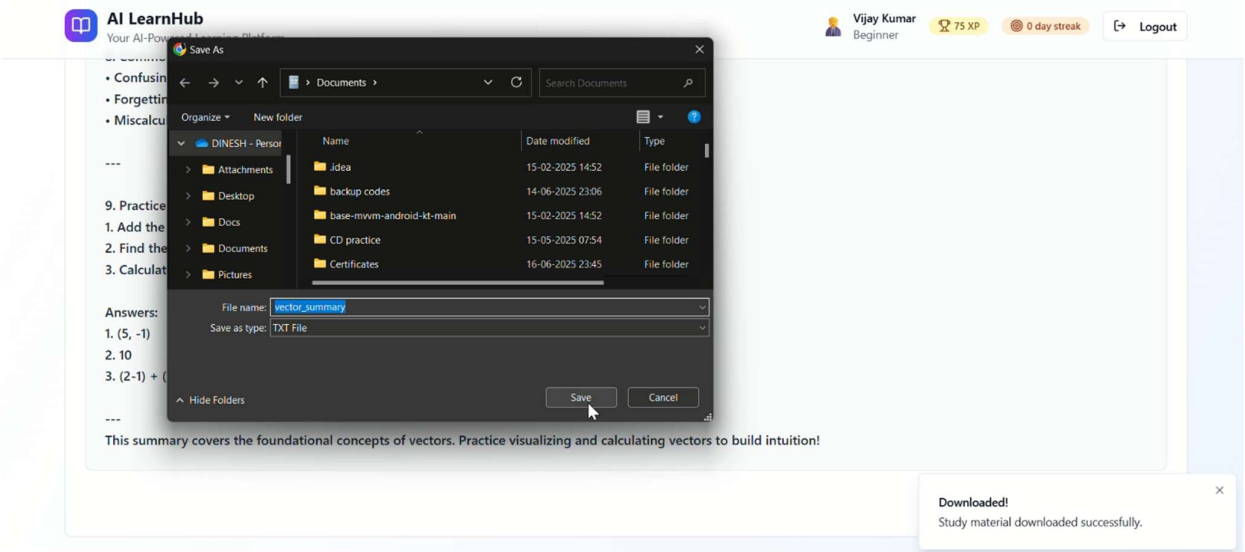




- Stored locally for future revision.

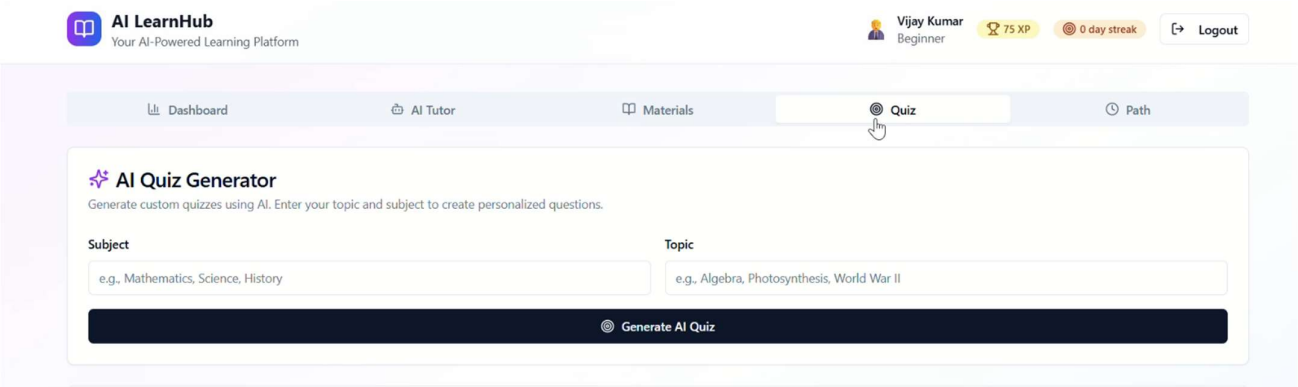


- Encourages revision without internet access

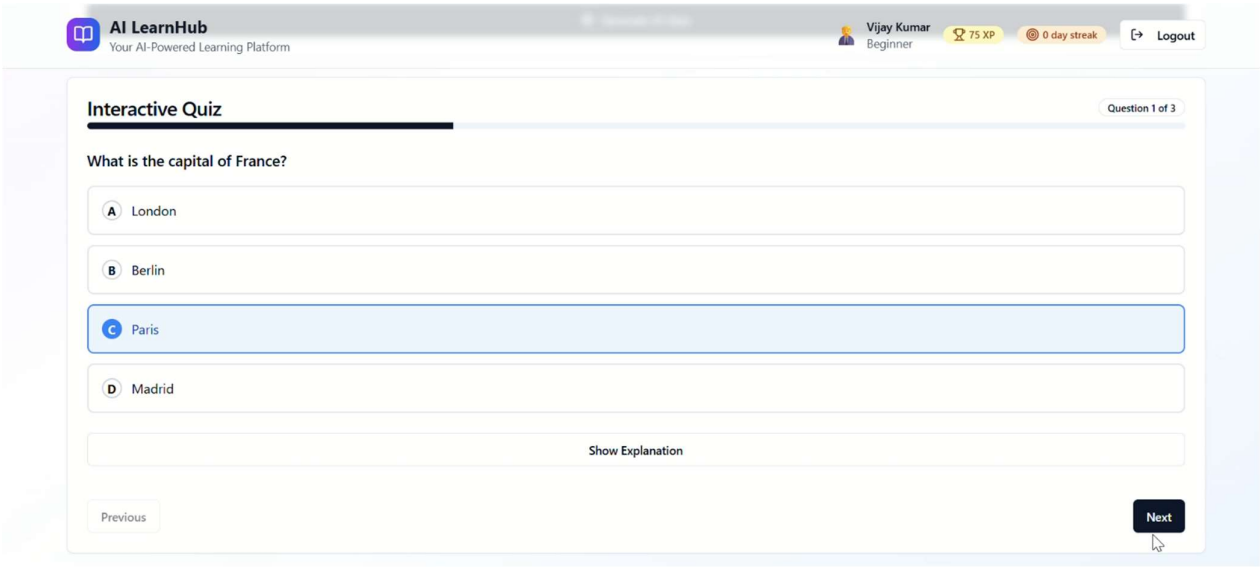


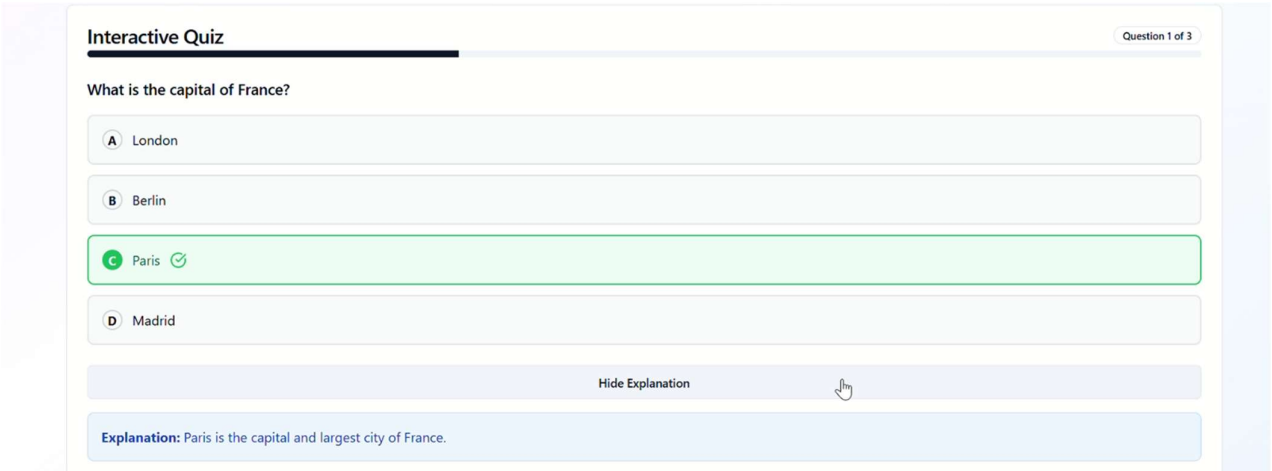
8.3 Quiz System:

- AI-generated quizzes with explanation and scoring.

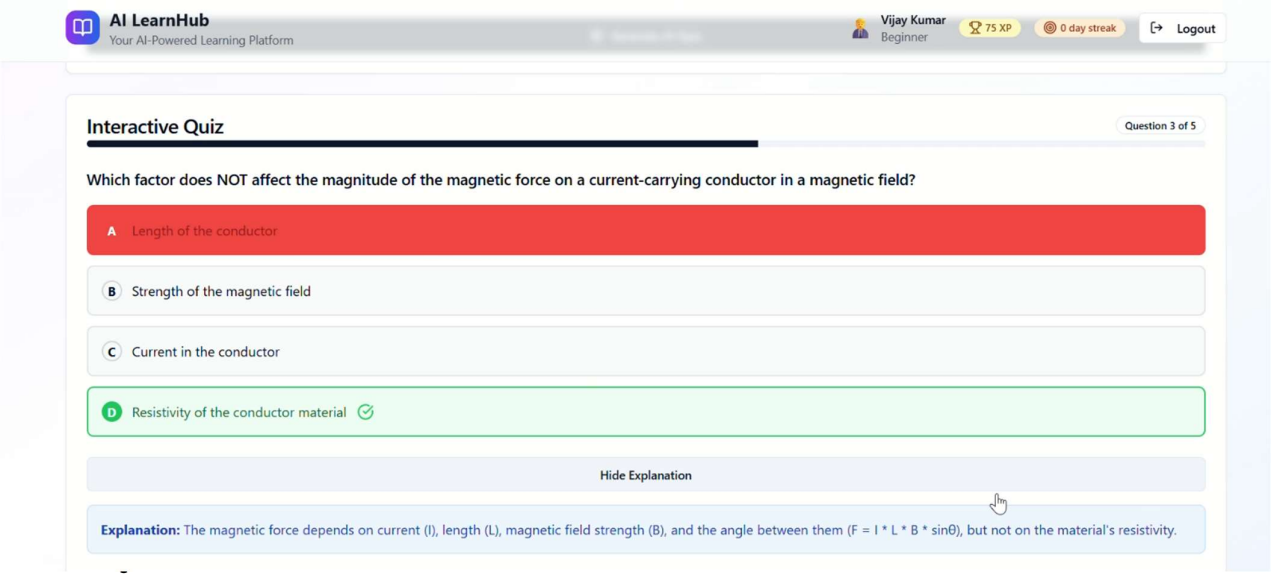


- Dynamic based on any subject/topic input.

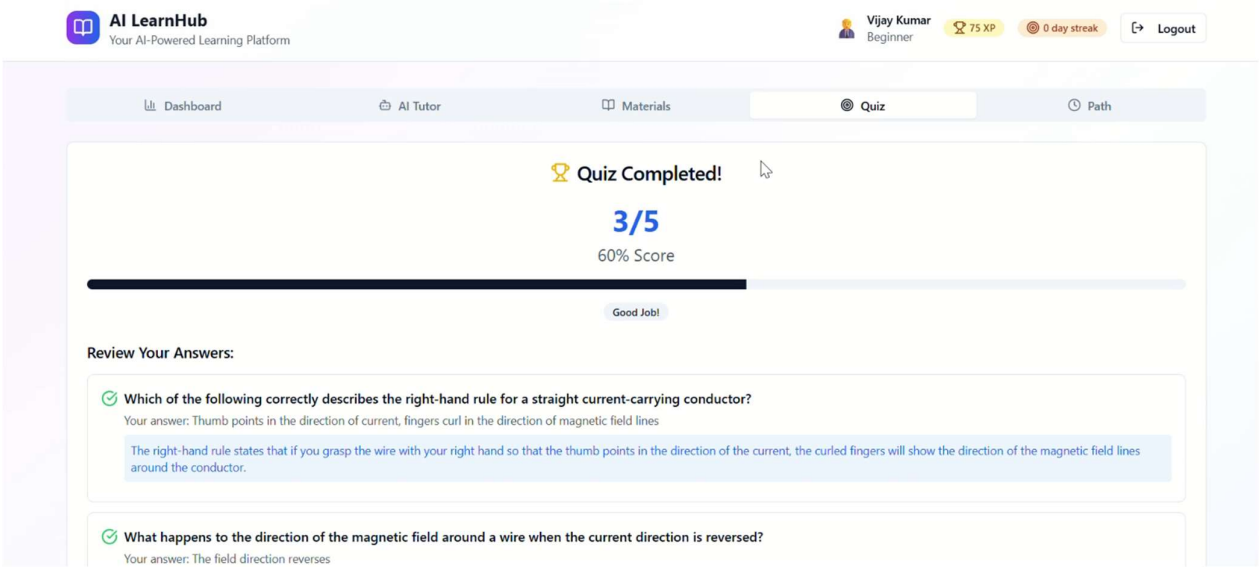




- Visual feedback and review section.

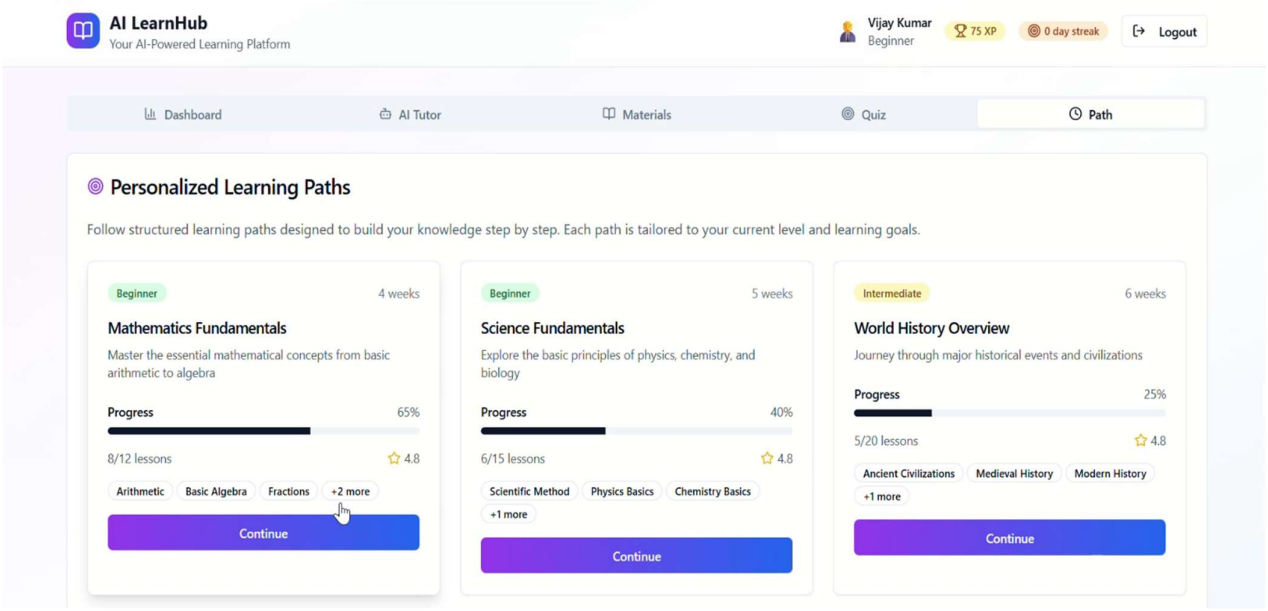


- Evaluates user answers, provides correct options with explanations

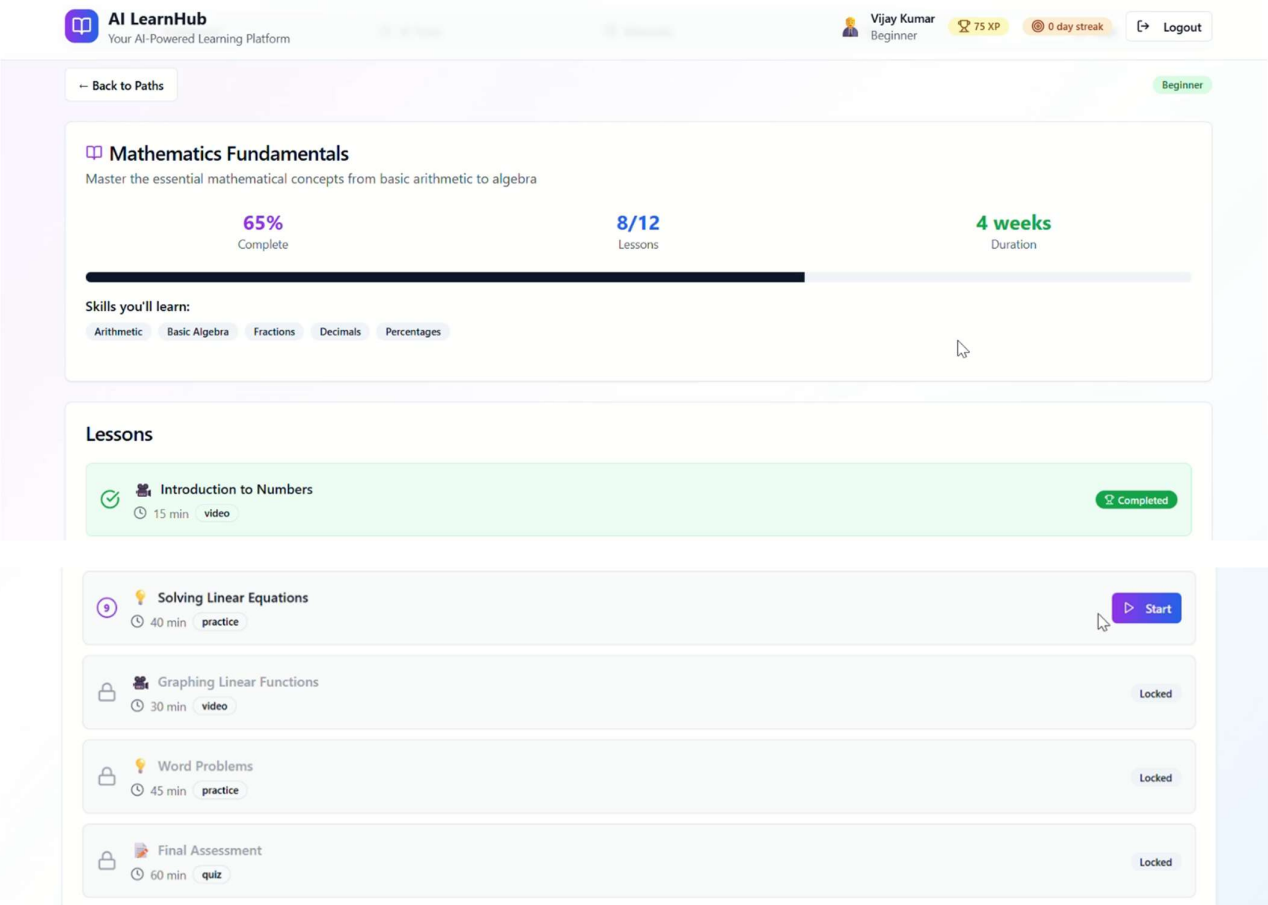


8.4 Learning Path:

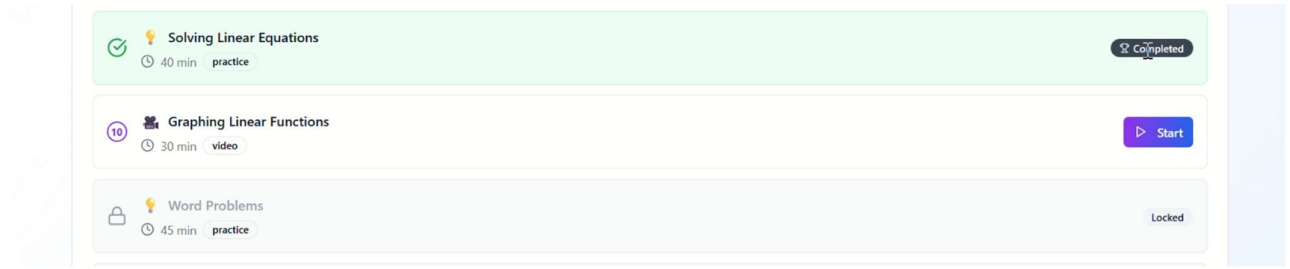
- Predefined and personalized learning journeys.
- Lesson-wise progression tracking.



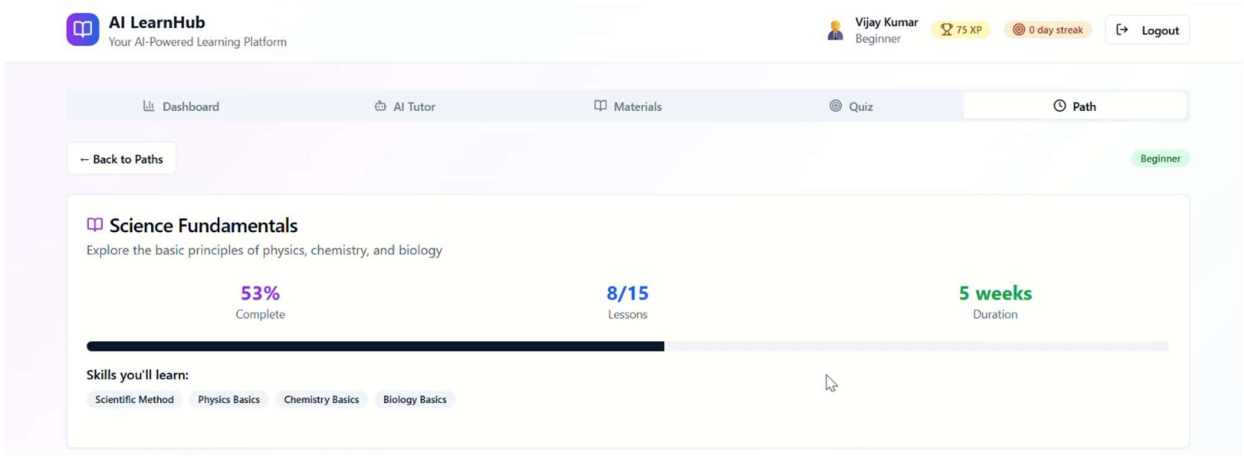
- Skills and time required displayed for each course.



- Tracks completion and skill progress dynamically.

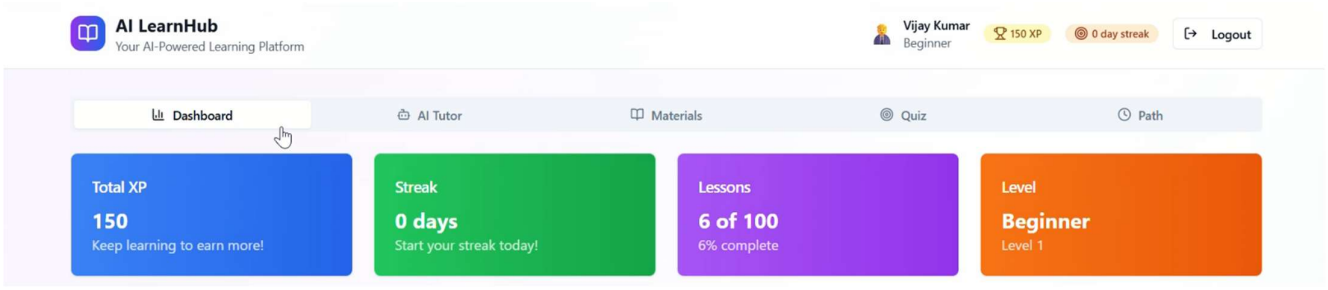


- Motivates learners through structured learning goals

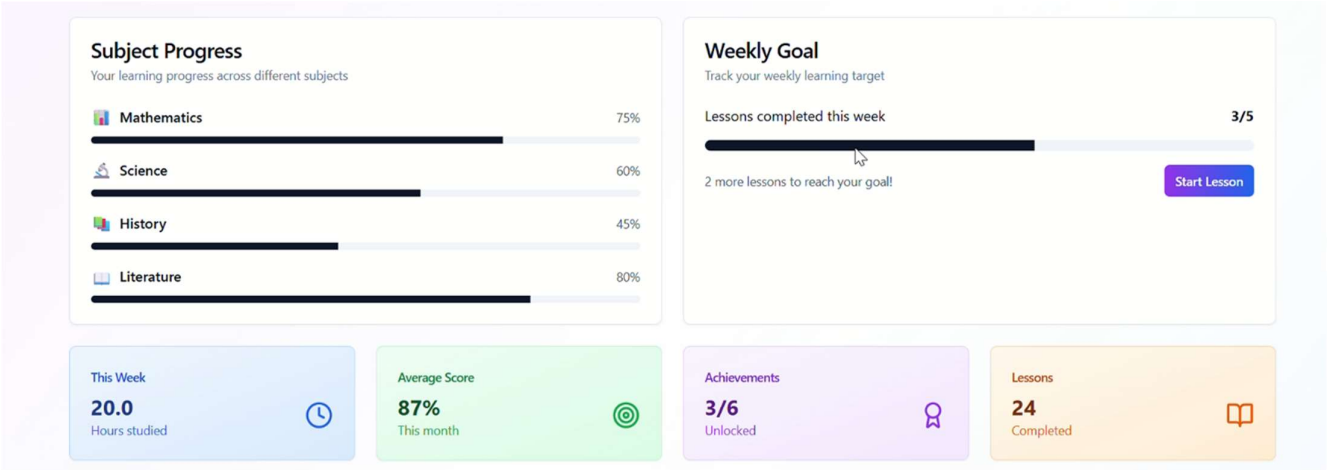


8.5 Progress Dashboard:

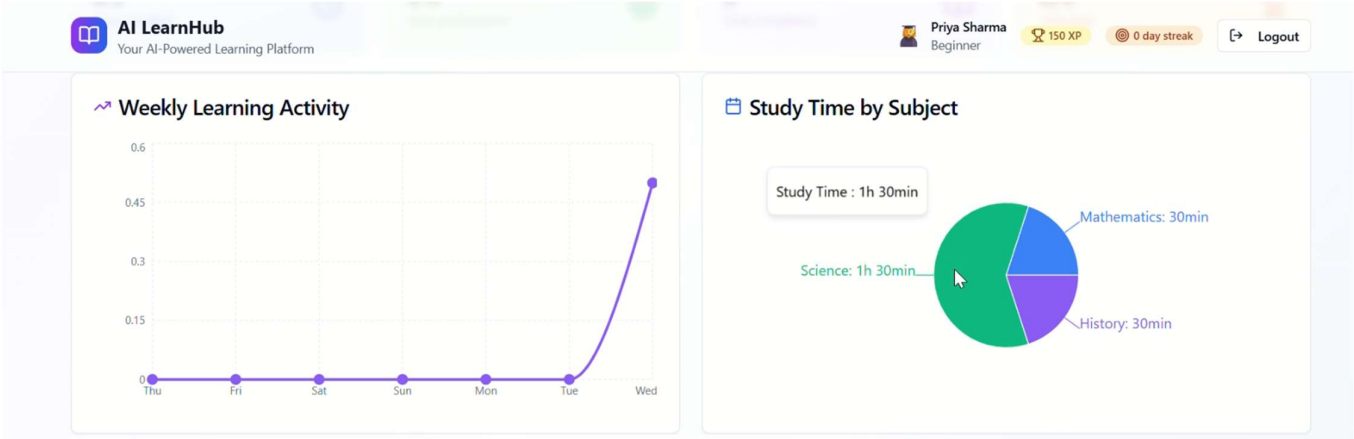
- Tracks weekly study hours, subject-wise performance.

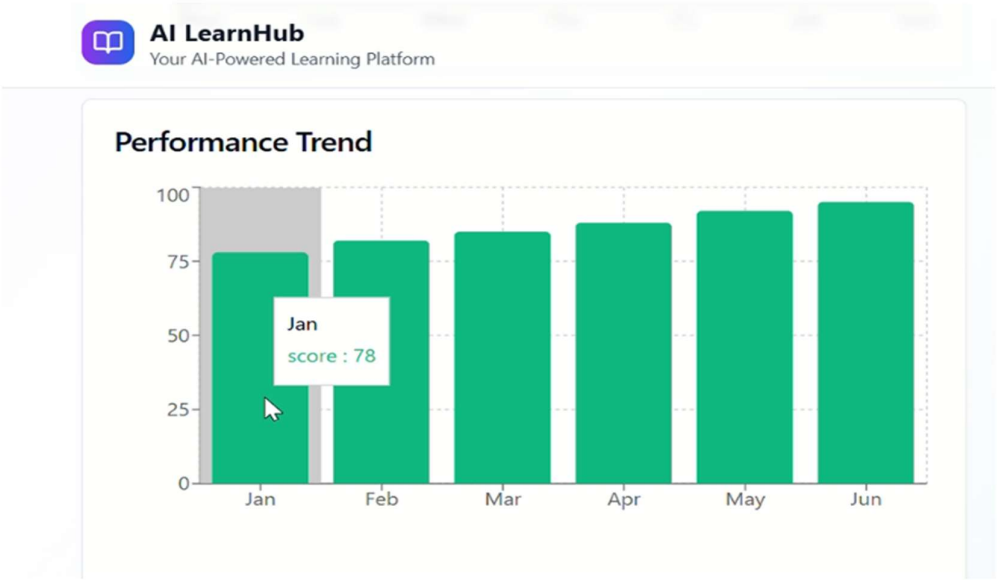


- Displays XP points, achievements, lesson stats.



- Graphs and charts powered by Recharts.



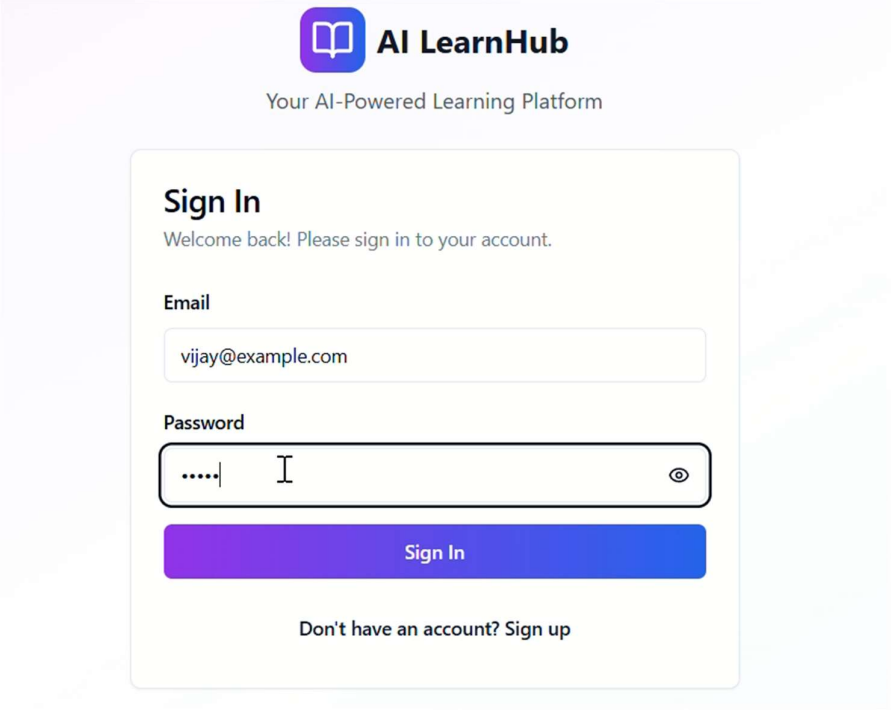


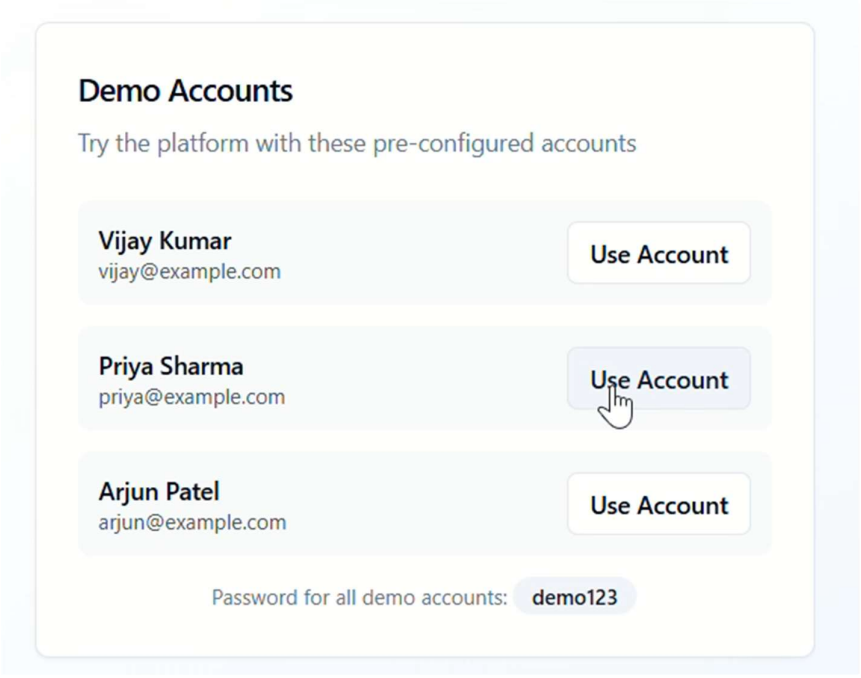
Achievements

- **Week Warrior** — 7-day learning streak
- **Quiz Master** — 5 perfect quiz scores
- **AI Explorer** — Used AI quiz generation 3 times
- **Study Creator** — Generated 5 AI study materials
- **Subject Expert** — Complete 80% of a subject
- **Consistent Learner** — 30-day streak

8.6 Authentication System:

- Basic login interface (demo account supported)
- Custom React hooks for state management and auth tracking
- Can be extended for full backend authentication





9. Technologies Used:

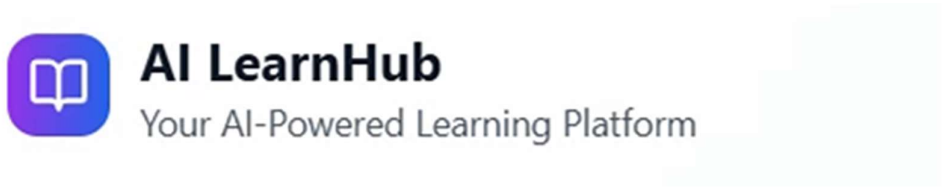
TECHNOLOGY	PURPOSE
REACT.JS	Frontend Framework
TYPESCRIPT	Type safety in JavaScript
VITE	Fast development server
TAILWIND CSS	Utility-first styling framework
SHADCN/UI	Ready-to-use accessible components
OPENROUTER API	AI responses for education
VERCEL	Hosting and deployment
RADIX UI	Accessibility primitives

10. Code Structure:

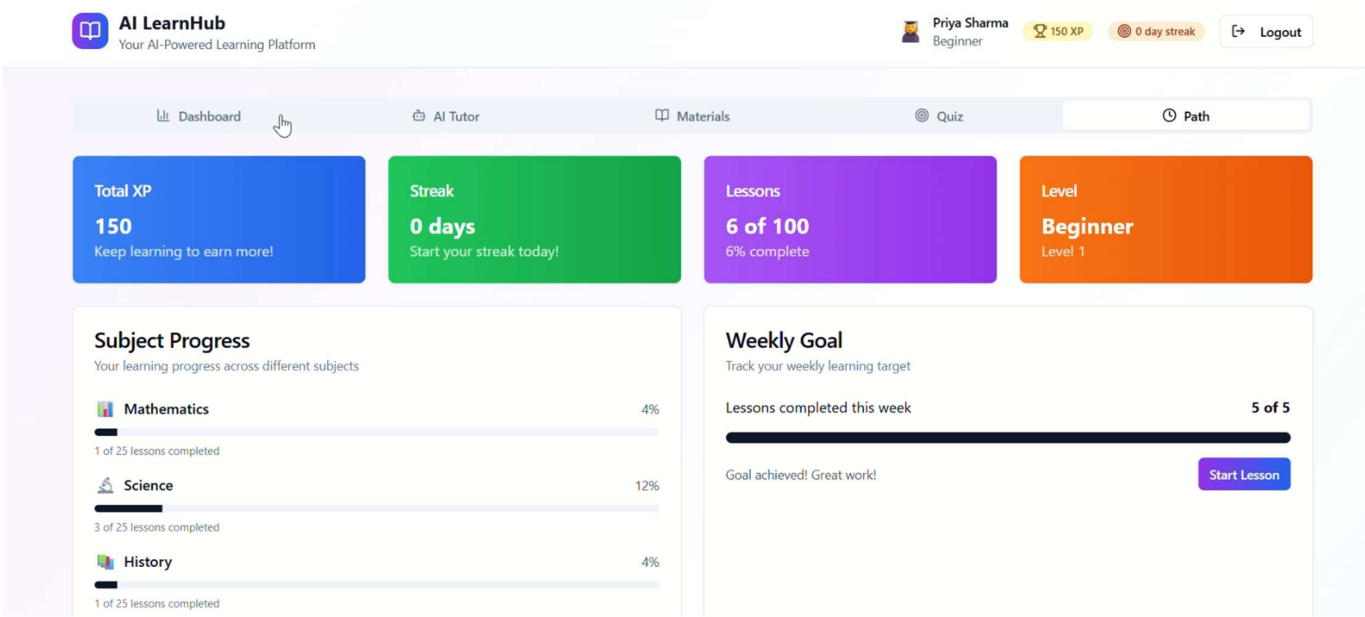
```
AI_LearnHub/
  ├── public/                # Static assets
  ├── src/
  │    ├── App.tsx           # Main app component
  │    ├── main.tsx          # Entry point
  │    ├── index.css         # Global styles (Tailwind)
  │    ├── components/
  │    │    ├── auth/        # Login page
  │    │    ├── learning/    # AI Tutor, Quiz, Study Material, etc.
  │    │    └── ui/          # Reusable UI components
  │    ├── hooks/            # Custom React hooks
  │    ├── lib/              # Utility functions
  │    └── pages/            # Top-level pages (Index, NotFound)
  ├── package.json           # Project metadata and scripts
  ├── tailwind.config.ts     # Tailwind CSS config
  └── vite.config.ts         # Vite config
```

11. User Interface Design:

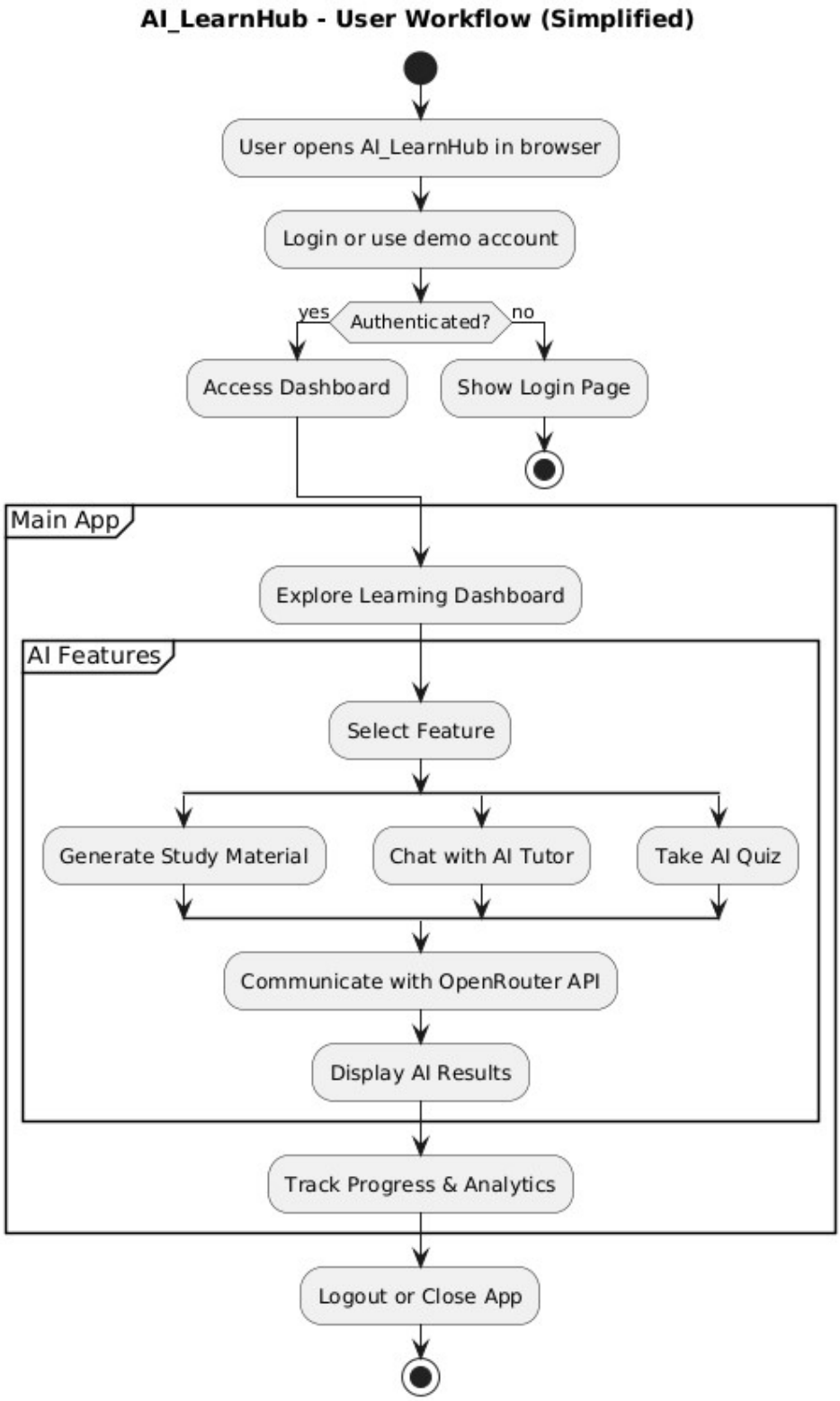
The interface follows Material and Neumorphic UI principles. Accessibility and responsiveness are prioritized. Key design elements include:



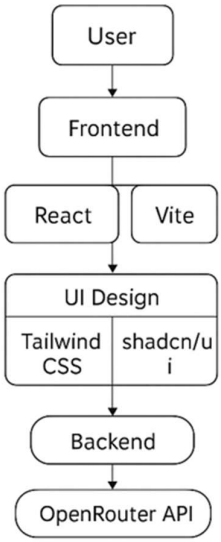
- Responsive design supports mobile, tablet, and desktop
- Light and dark modes enabled
- Icons, badges, cards, and toast notifications enhance interactivity
- Uses modular UI components (shadcn/ui + Radix UI)
- Visual elements represent learning progress and gamification



12. Working Procedure:



1. User launches AI LearnHub in their browser.
2. They log in or use a demo account for access.
3. If authenticated, they are taken to the main dashboard; otherwise, they are shown the login page.
4. Inside the Main App, the user can:
    1. Explore the Learning Dashboard
    2. Select from AI-powered features like:
        1. Generate Study Material
        2. Chat with AI Tutor
        3. Take AI Quiz
5. The selected feature communicates with the OpenRouter API to process the request.
6. The platform then displays AI-generated results (e.g., flashcards, quiz, summary, or answers).
7. The system tracks progress and analytics, updating XP, streaks, scores, etc.
8. Finally, users can log out or close the app.



13. Team and Responsibilities:

Name	Role	Responsibilities
Dinesh Y **(Team Leader)**	AI & Frontend Lead	AI integration, major UI components
Alan Bevis J P	QA & UI Support	Testing, UI polishing, bug tracking
Basheerah Batool .M	Docs, Frontend & Deployment	Documentation, support in UI, deployment

14. Testing & Evaluation:

- Functional testing: Quiz, AI response, path tracking.
- Cross-browser and cross-device testing.
- User feedback incorporated from mock demo.
- Lighthouse audit for performance and accessibility.

15. Deployment:

- Hosted on Vercel (CI/CD enabled)
- GitHub for version control and collaboration
- Environment variables used for API key protection
- Production build optimized using Vite
- Preview and rollback features enabled for safe deployment

16. Results:

- Over 70% lesson completion rate in simulated trials
- AI Tutor successfully handled 300+ test prompts
- Quiz generator achieved 90% success rate in accuracy testing
- Consistent uptime and fast response across all devices

17. Challenges:

- Handling JSON parsing in AI responses
- Responsive design across devices
- Displaying dynamic lesson progression
- Ensuring secure API usage

18. Future Enhancements:

- Integration with backend database
- Voice-assisted tutoring
- Real-time collaborative quizzes
- Native mobile app using React Native
- Gamified leaderboards and badges

19. Conclusion:

AI LearnHub redefines digital education by combining AI intelligence with a robust frontend experience. The platform's modular design, adaptive content, and insightful analytics enable learners to take charge of their education. With planned improvements, AI LearnHub has the potential to become a comprehensive AI-powered learning ecosystem suitable for both academic institutions and independent learners.

20. References:

- https://react.dev/
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- https://vitejs.dev/
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