

REPORT

AI-POWERED INTERACTIVE LEARNING ASSISTANT FOR CLASSROOMS



AI LearnHub

Your AI-Powered Learning Platform

An AI-Powered Interactive Learning Platform

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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:

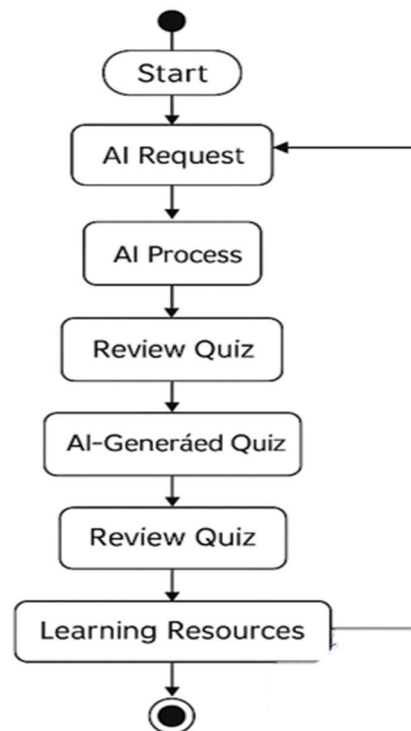
1. Requirement analysis and planning
2. UI/UX prototyping using Figma
3. Frontend development with React and Tailwind CSS

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.

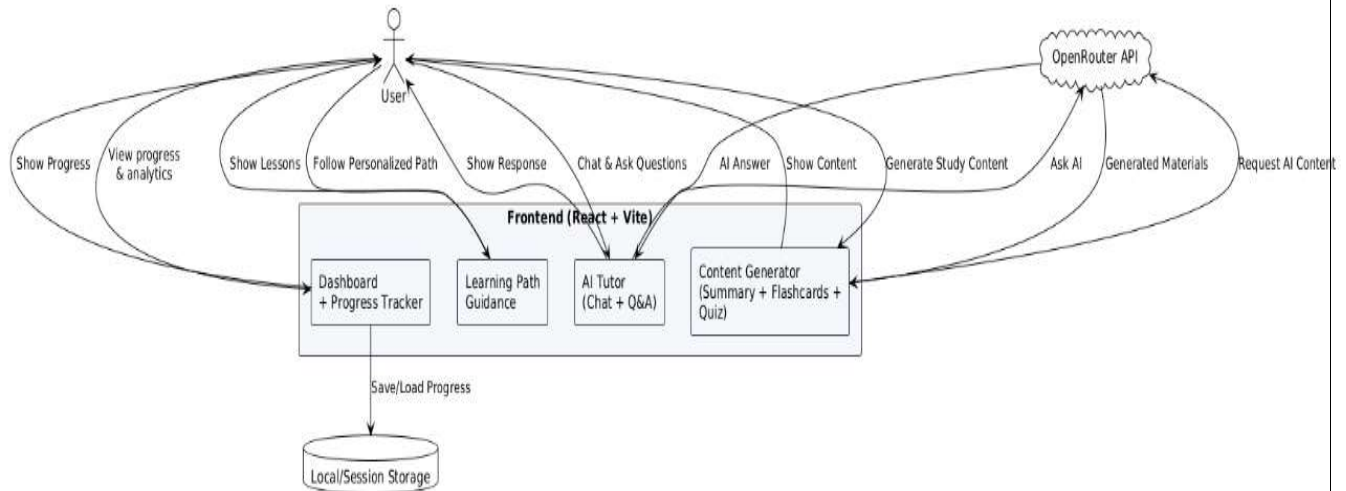


The system architecture is built to capture the user's query or selection (like generating study material or taking a quiz), send it to the AI service (OpenRouter API), and then display the result through a user-friendly interface. The dashboard then logs and visualizes progress.

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,

AI Learning Platform - System Overview



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.

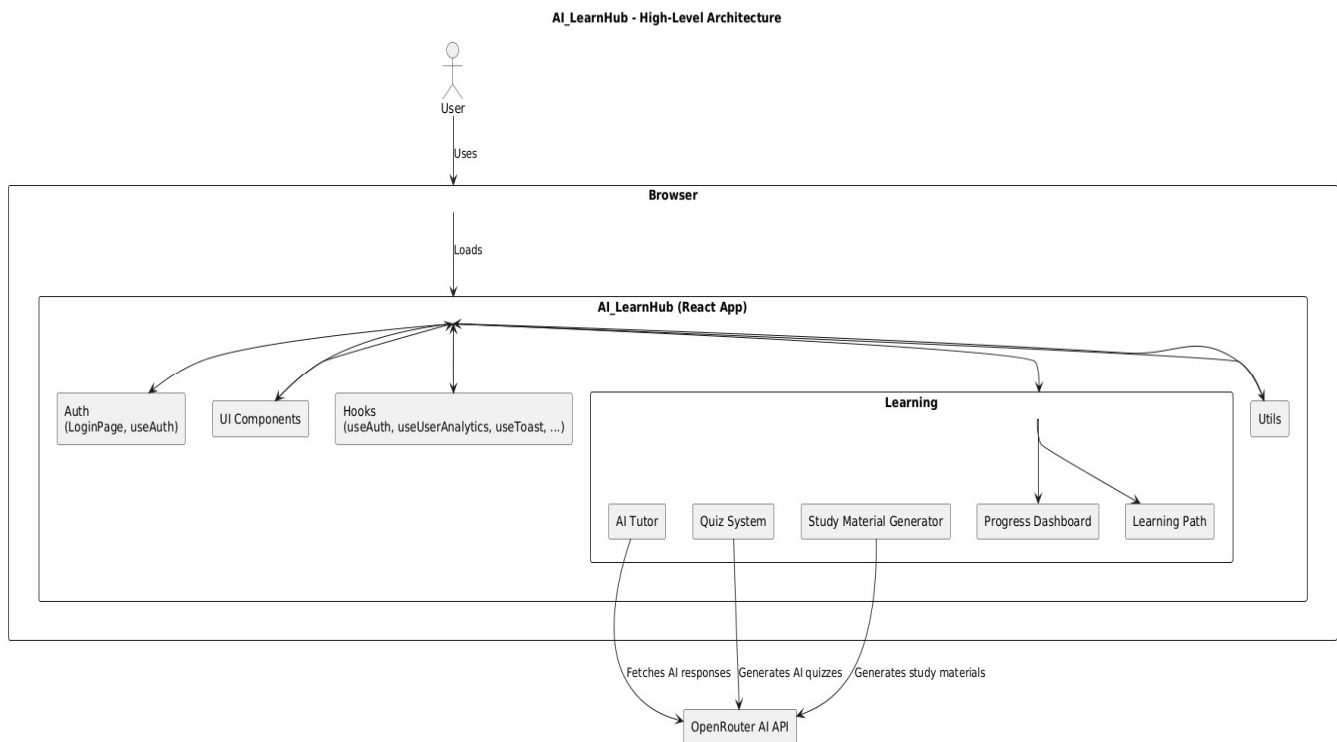
5. Storage & Tracking:

- 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:

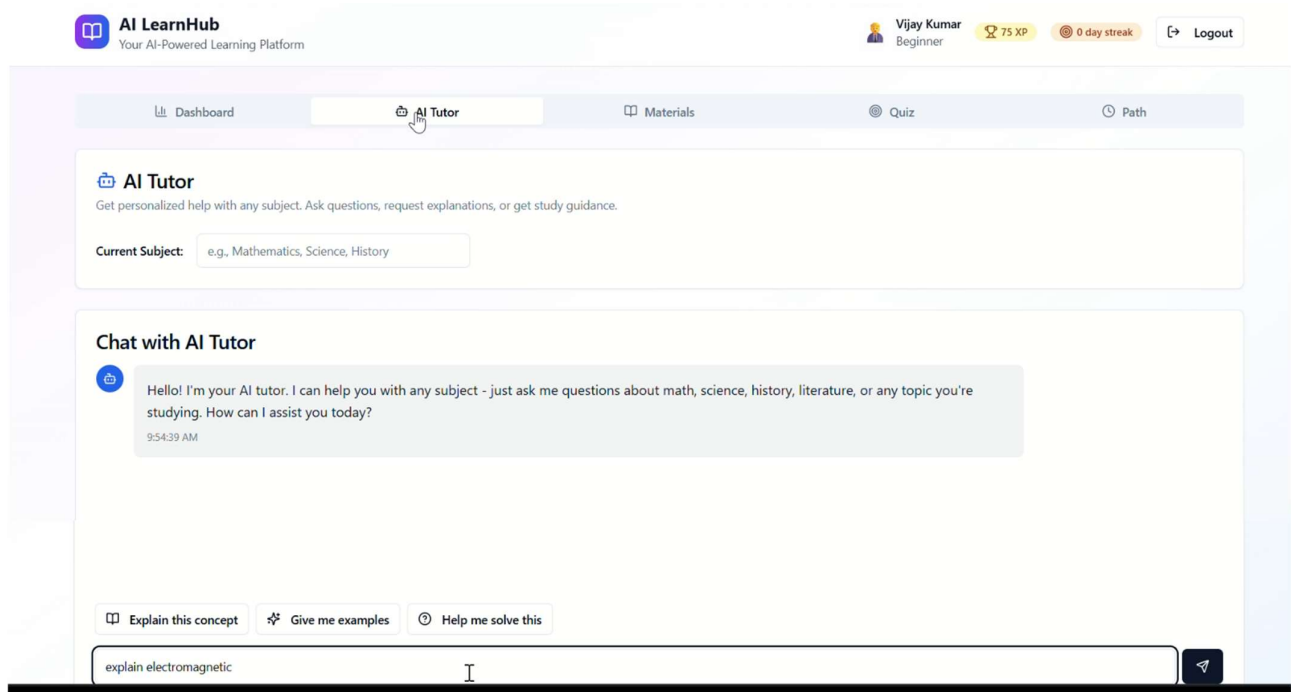
- **Authentication Module** for login and user session
- **UI Components** using Tailwind CSS and shadcn/ui
- **Custom Hooks** like useAuth, useUserAnalytics, and useToast
- **Learning Modules:**
 - AI Tutor (Q&A)
 - Quiz Generator
 - Study Material Creator
 - Progress Dashboard
 - Learning Path Navigation

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.

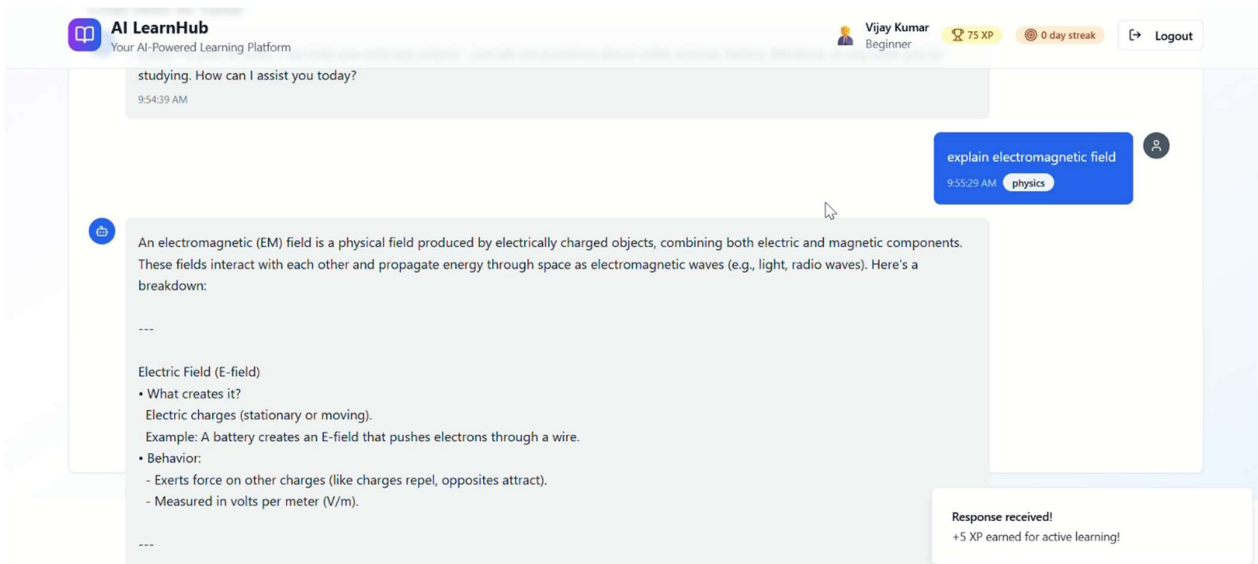
8. Features in Detail:

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

AI LearnHub

Your AI-Powered Learning Platform

Vijay Kumar

Beginner

75 XP

0 day streak

Logout

Dashboard

AI Tutor

Materials

Quiz

Path

AI Study Material Generator

Generate personalized study materials using AI. Create summaries, notes, flashcards, and outlines tailored to your needs.

Subject

e.g., Mathematics, Science, History

Topic

e.g., Algebra, Photosynthesis, World War II

Difficulty Level

Intermediate

physics

chemistry

science

Material Type

Study Summary

Generate Study Material

Dashboard

AI Tutor

Materials

Quiz

Path

AI Study Material Generator

Generate personalized study materials using AI. Create summaries, notes, flashcards, and outlines tailored to your needs.

Subject

mathematics

Topic

vector

Difficulty Level

Beginner

Material Type

Study Summary

Generate Study Material

Generated Study Material

Vector Study Summary for Beginners

Study Material Generated!
Summary about "vector" created successfully.

Difficulty Level

Beginner

Beginner

Intermediate

Advanced

Material Type

Study Summary

Study Summary

Detailed Notes

Flashcards

Study Outline

Summary

Intermediate

- Stored locally for future revision.

The screenshot shows the AI LearnHub interface. At the top, the header includes the AI LearnHub logo, the tagline 'Your AI-Powered Learning Platform', and user information for 'Vijay Kumar Beginner' with 75 XP and a 0-day streak. The main content area is titled 'Generated Study Material' and includes tabs for 'Summary' and 'Beginner'. The 'Summary' tab is active, displaying a 'Vector Study Summary for Beginners'. The summary is divided into sections: '1. What is a Vector?' with a definition and examples, '2. Geometric Representation' with visual details, and '9. Practice Questions' with three problems. Below the questions are the answers. At the bottom right of the summary, there are 'Copy' and 'Download' buttons.

AI LearnHub
Your AI-Powered Learning Platform

Vijay Kumar Beginner 75 XP 0 day streak Logout

Generated Study Material

Summary Beginner

Vector Study Summary for Beginners

1. What is a Vector?

- Definition: A mathematical object with both magnitude (size) and direction.
- Examples: Force, velocity, displacement.
- Vs. Scalars: Scalars only have magnitude (e.g., mass, temperature).

2. Geometric Representation

- Visual: Drawn as arrows.
- Tail: Starting point.
- Head: Ending point.
- Length: Represents magnitude.
- Arrow Direction: Shows the vector's direction.

9. Practice Questions

1. Add the vectors $a = (1, -3)$ and $b = (4, 2)$.
2. Find the magnitude of $v = (6, 8)$.
3. Calculate the dot product of $u = (2, 5)$ and $w = (-1, 3)$.

Answers:

1. $(5, -1)$
2. 10
3. $(2-1) + (53) = -2 + 15 = 13$

This summary covers the foundational concepts of vectors. Practice visualizing and calculating vectors to build intuition!

Copy Download

- Encourages revision without internet access

This screenshot shows the same AI LearnHub interface as before, but with a 'Save As' dialog box open in the foreground. The dialog box is set to save a file named 'vector_summary' as a 'TXT File' in the 'Documents' folder. The background content is partially obscured by the dialog box. At the bottom right, a 'Downloaded!' notification states 'Study material downloaded successfully.'

AI LearnHub
Your AI-Powered Learning Platform

Vijay Kumar Beginner 75 XP 0 day streak Logout

Generated Study Material

Summary Beginner

Vector Study Summary for Beginners

1. What is a Vector?

- Definition: A mathematical object with both magnitude (size) and direction.
- Examples: Force, velocity, displacement.
- Vs. Scalars: Scalars only have magnitude (e.g., mass, temperature).

2. Geometric Representation

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Answers:

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This summary covers the foundational concepts of vectors. Practice visualizing and calculating vectors to build intuition!

Copy Download

Save As

Documents

File name: vector_summary

Save as type: TXT File

Save Cancel

Downloaded!
Study material downloaded successfully.

8.3 Quiz System:

- AI-generated quizzes with explanation and scoring.

AI LearnHub
Your AI-Powered Learning Platform

Vijay Kumar
Beginner75 XP0 day streakLogout

DashboardAI TutorMaterialsQuizPath

AI Quiz Generator

Generate custom quizzes using AI. Enter your topic and subject to create personalized questions.

Subject

e.g., Mathematics, Science, History

Topic

e.g., Algebra, Photosynthesis, World War II

Generate AI Quiz

- Dynamic based on any subject/topic input.

AI LearnHub
Your AI-Powered Learning Platform

Vijay Kumar
Beginner75 XP0 day streakLogout

Interactive QuizQuestion 1 of 3

What is the capital of France?

A London

B Berlin

C Paris

D Madrid

Show Explanation

PreviousNext

AI LearnHub
Your AI-Powered Learning Platform

Vijay Kumar
Beginner75 XP0 day streakLogout

Interactive QuizQuestion 1 of 3

What is the capital of France?

A London

B Berlin

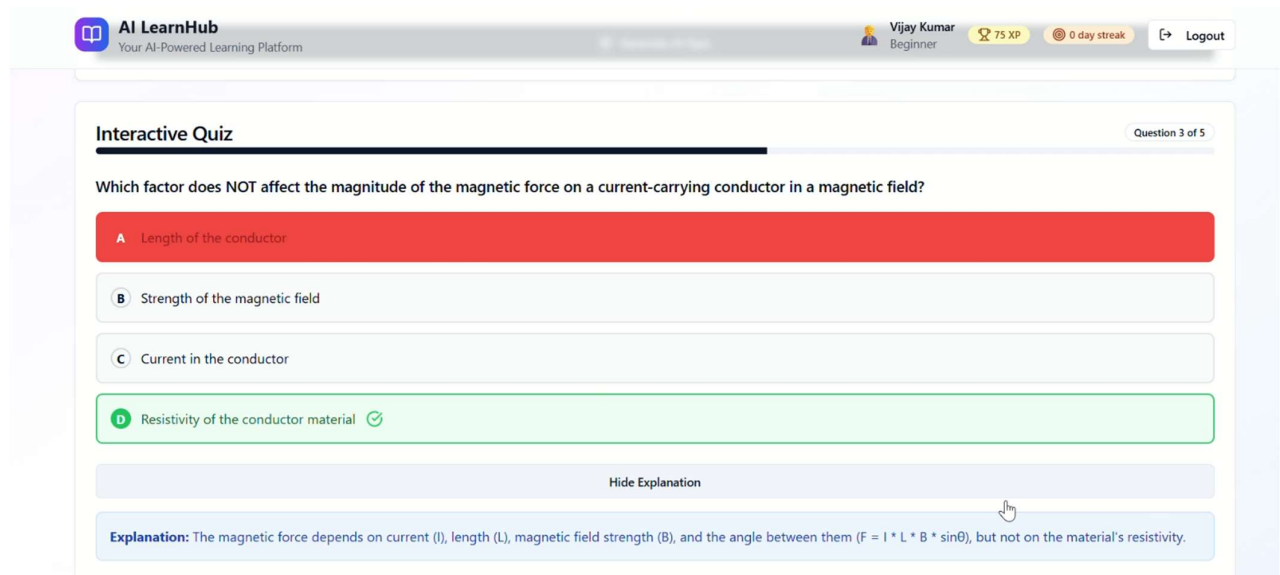
C Paris

D Madrid

Hide Explanation

Explanation: Paris is the capital and largest city of France.

- Visual feedback and review section.



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Vijay Kumar
Beginner 75 XP 0 day streak Logout

Interactive Quiz Question 3 of 5

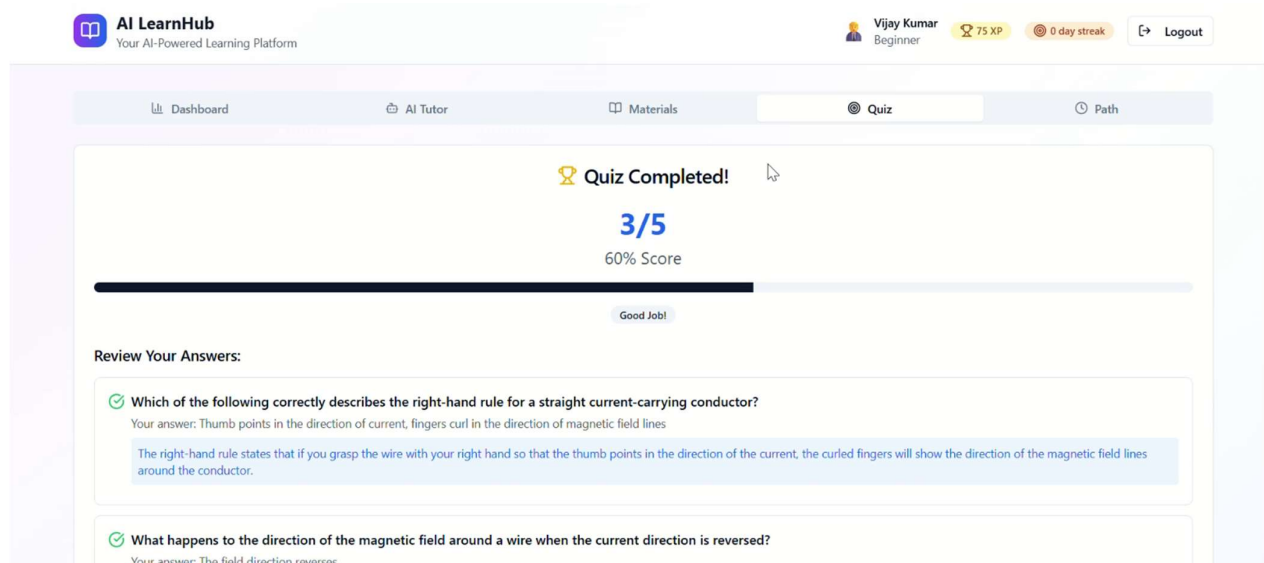
Which factor does NOT affect the magnitude of the magnetic force on a current-carrying conductor in a magnetic field?

- A Length of the conductor
- B Strength of the magnetic field
- C Current in the conductor
- D Resistivity of the conductor material ✓

Hide Explanation

Explanation: The magnetic force depends on current (I), length (L), magnetic field strength (B), and the angle between them ($F = I * L * B * \sin\theta$), but not on the material's resistivity.

- Evaluates user answers, provides correct options with explanations



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Your AI-Powered Learning Platform

Vijay Kumar
Beginner 75 XP 0 day streak Logout

Dashboard AI Tutor Materials Quiz Path

Quiz Completed!

3/5
60% Score

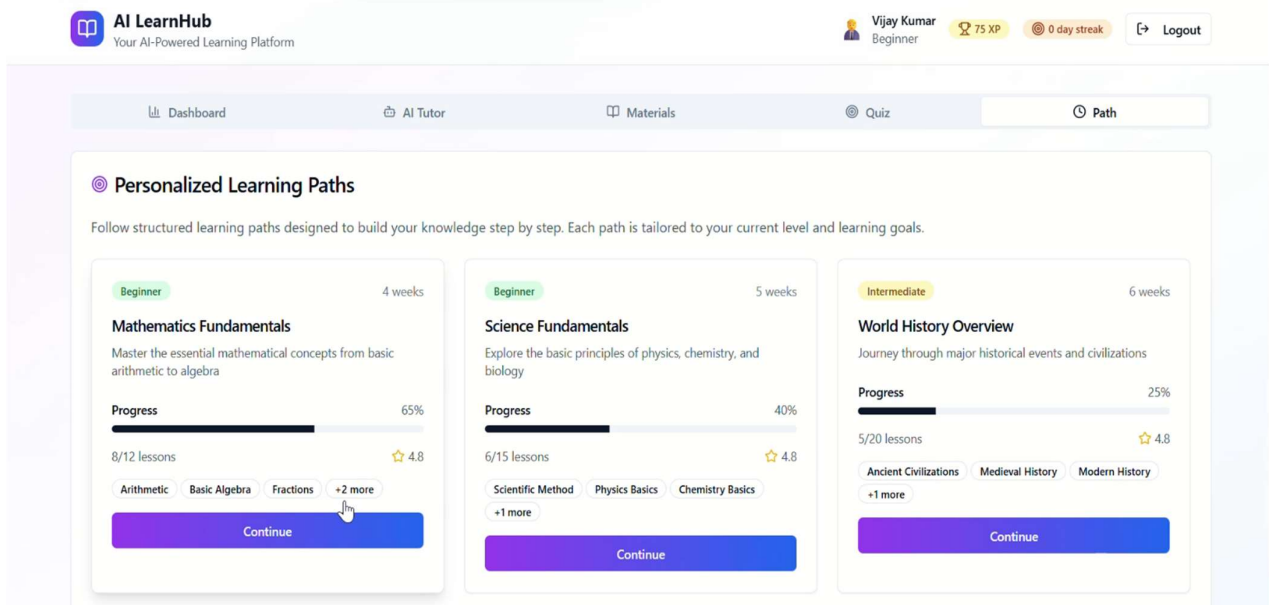
Good Job!

Review Your Answers:

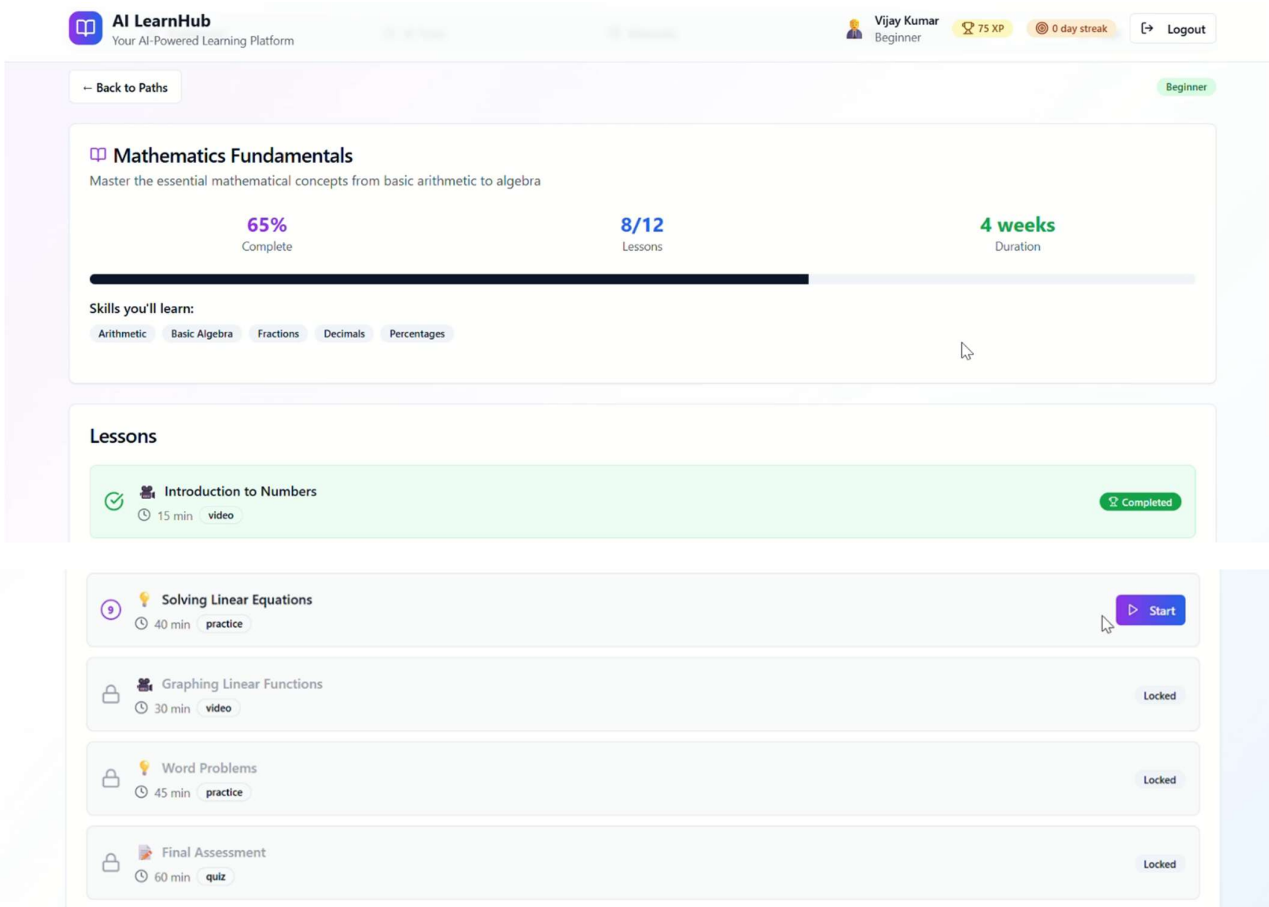
- ✓ Which of the following correctly describes the right-hand rule for a straight current-carrying conductor?
Your answer: Thumb points in the direction of current, fingers curl in the direction of magnetic field lines
The right-hand rule states that if you grasp the wire with your right hand so that the thumb points in the direction of the current, the curled fingers will show the direction of the magnetic field lines around the conductor.
- ✓ What happens to the direction of the magnetic field around a wire when the current direction is reversed?
Your answer: The field direction reverses

8.4 Learning Path:

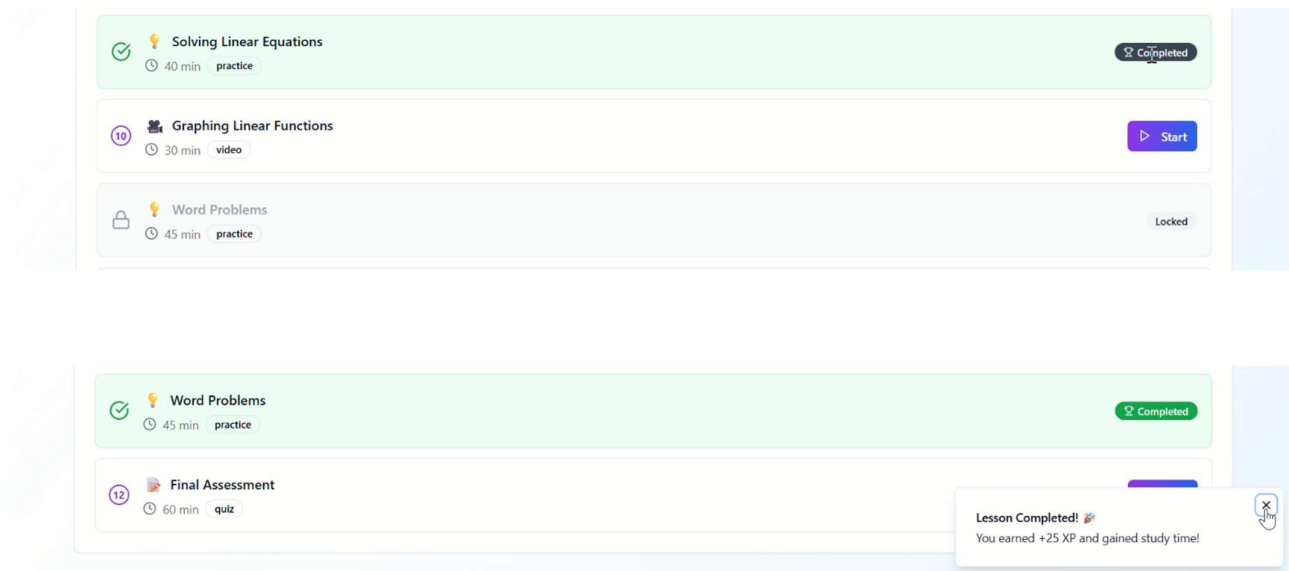
- Predefined and personalized learning journeys.
- Lesson-wise progression tracking.



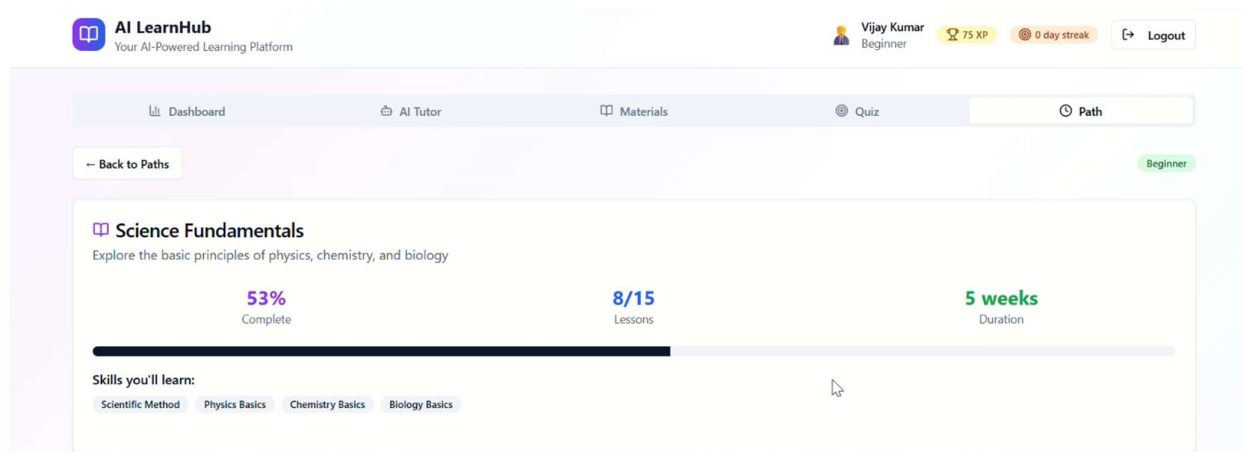
- Skills and time required displayed for each course.



- Tracks completion and skill progress dynamically.

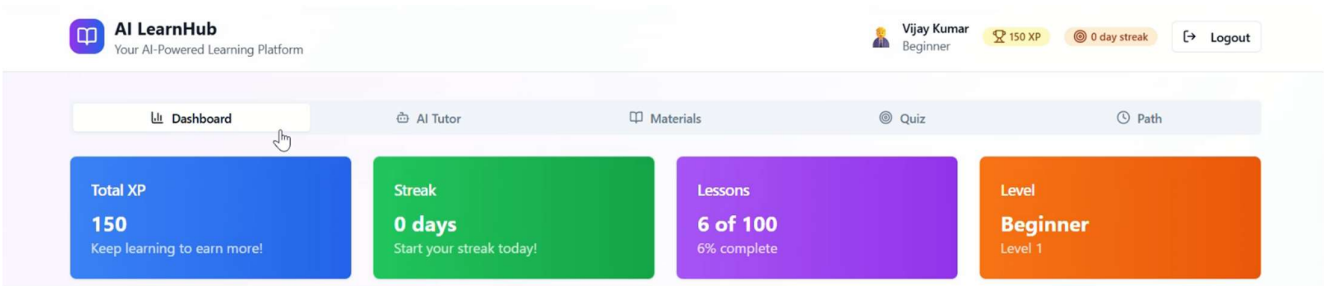


- Motivates learners through structured learning goals

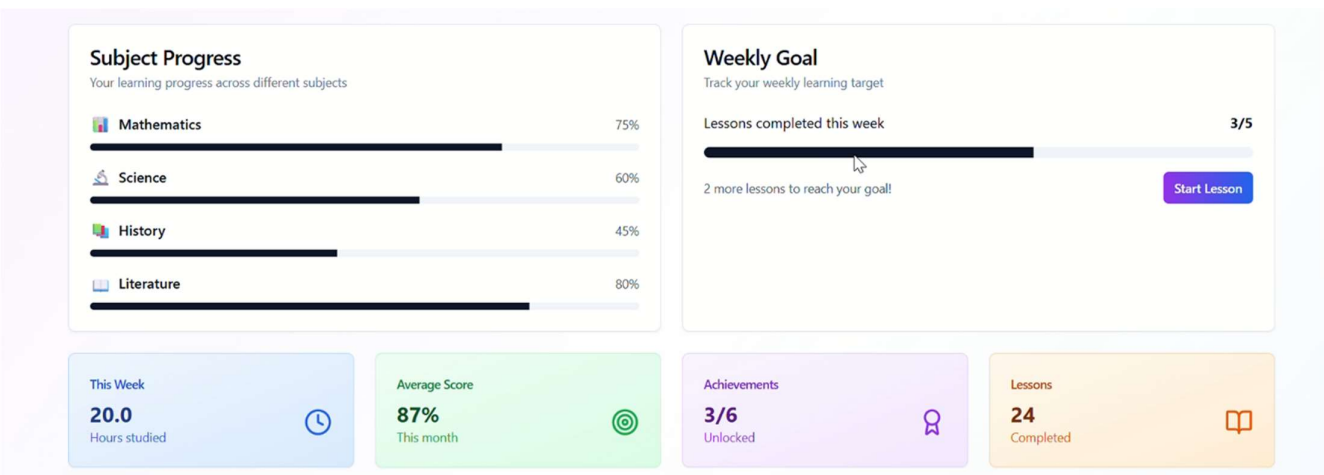


8.5 Progress Dashboard:

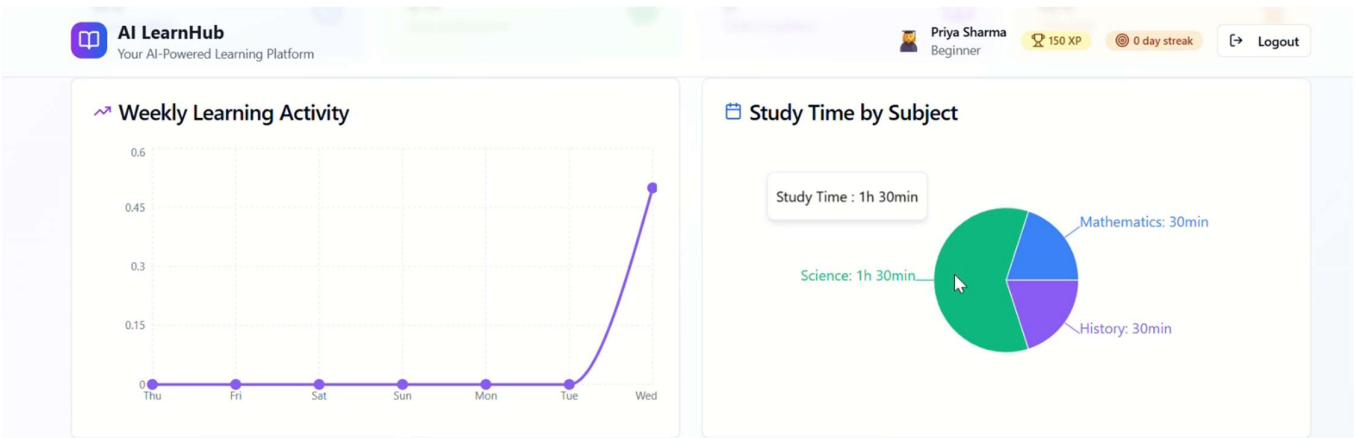
- Tracks weekly study hours, subject-wise performance.



- Displays XP points, achievements, lesson stats.



- Graphs and charts powered by Recharts.

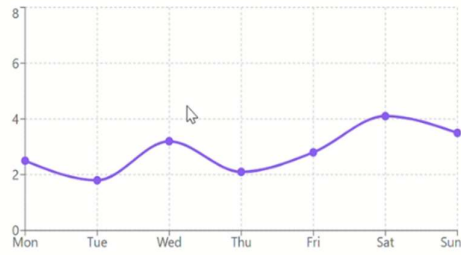




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Your AI-Powered Learning Platform

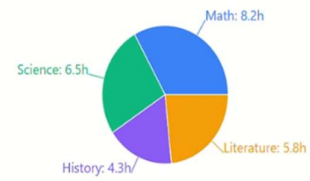
Weekly Learning Activity



1250 XP

7 day streak

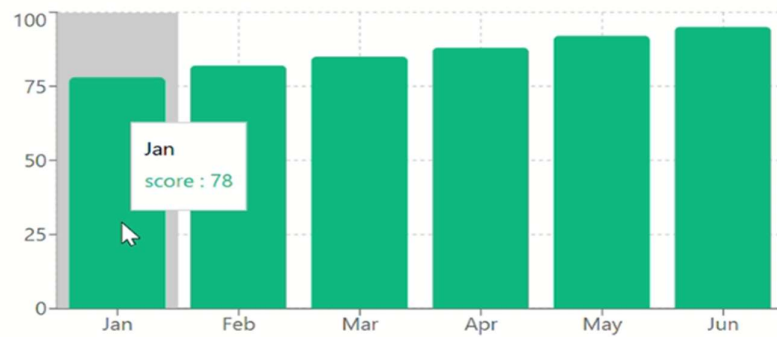
Subject Distribution



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Performance Trend



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

 **AI LearnHub**

Your AI-Powered Learning Platform

Sign In

Welcome back! Please sign in to your account.

Email

vijay@example.com

Password

..... I

Sign In

Don't have an account? Sign up

Demo Accounts

Try the platform with these pre-configured accounts

Vijay Kumar

vijay@example.com

Use Account

Priya Sharma

priya@example.com

Use Account

Arjun Patel

arjun@example.com

Use Account

Password for all demo accounts: demo123

9. Technologies Used:

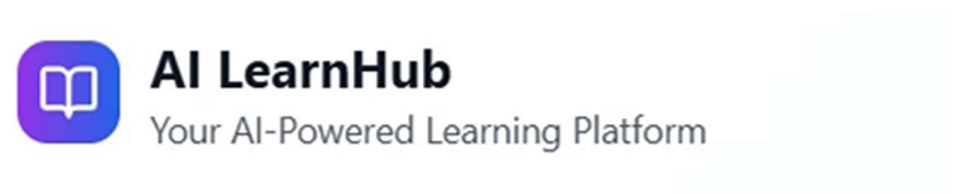
TECHNOLOGY	PURPOSE
REACT.JS	Frontend Framework
TYPESCRIPT	Type safety in JavaScript
VITE	Fast development server
TAILWIND CSS	Utility-first styling framework
SHADCN/UI	Ready-to-use accessible components
OPENROUTER API	AI responses for education
VERCEL	Hosting and deployment
RADIX UI	Accessibility primitives

10. Code Structure:

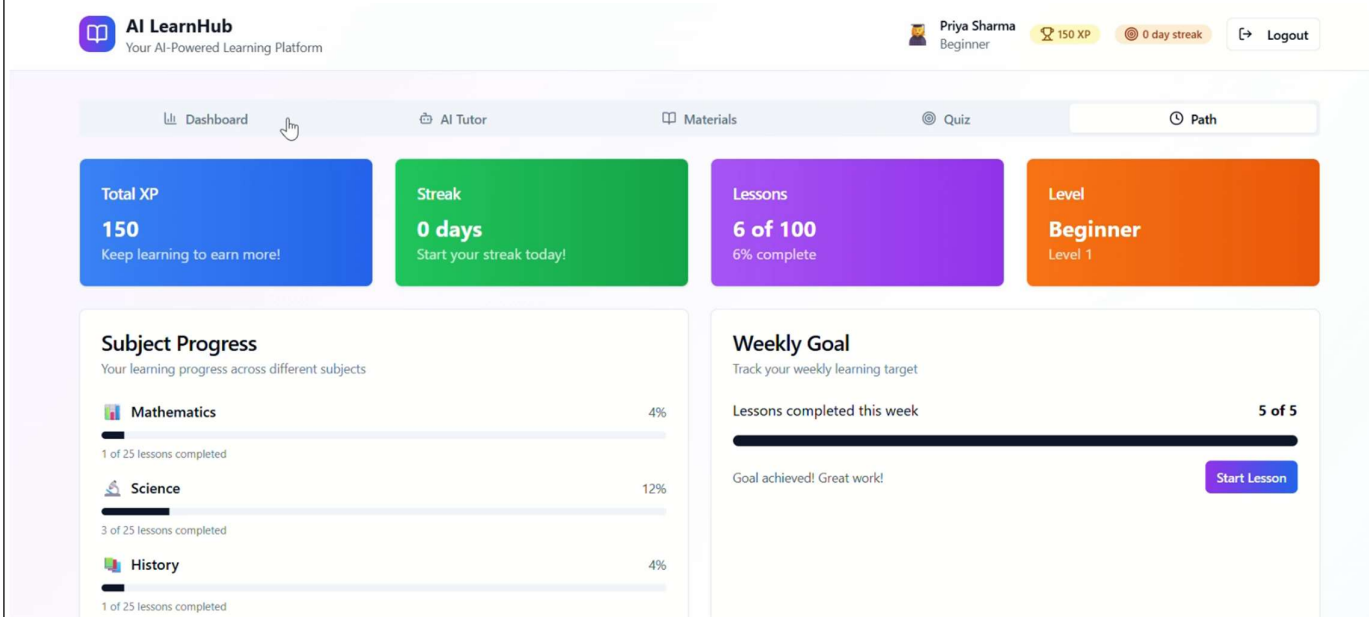
```
AI_LearnHub/  
├── public/           # Static assets  
├── src/  
│   ├── App.tsx      # Main app component  
│   ├── main.tsx     # Entry point  
│   ├── index.css    # Global styles (Tailwind)  
│   ├── components/  
│   │   ├── auth/    # Login page  
│   │   ├── learning/ # AI Tutor, Quiz, Study 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:

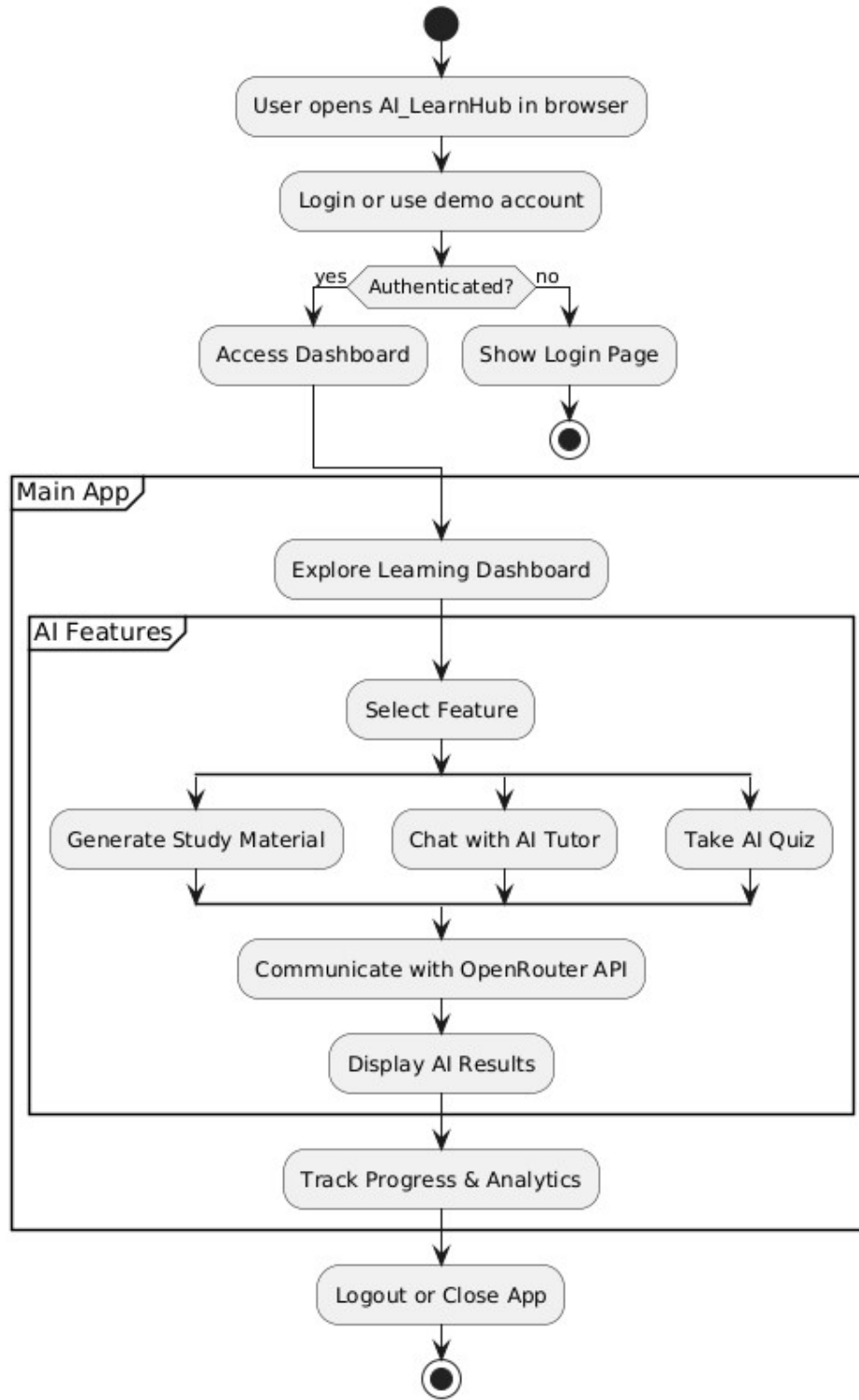


- Responsive design supports mobile, tablet, and desktop
- Light and dark modes enabled
- Icons, badges, cards, and toast notifications enhance interactivity
- Uses modular UI components (shadcn/ui + Radix UI)
- Visual elements represent learning progress and gamification

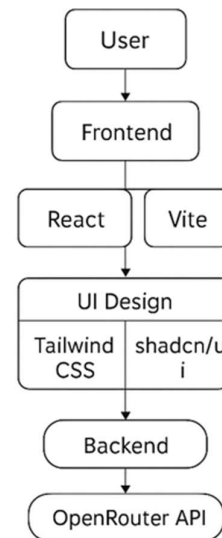


12. Working Procedure:

AI_LearnHub - User Workflow (Simplified)



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/>
- <https://tailwindcss.com/>
- <https://vitejs.dev/>
- <https://ui.shadcn.com/>
- <https://openrouter.ai/>
- <https://vercel.com/>