**🔹 Project Overview**

* This AI-powered adaptive learning chatbot will provide personalized education by leveraging LLMs (e.g., Gemini API), Streamlit for frontend, Fast API for backend, and Supa base for authentication and data storage. It includes recommendations, interactive learning, and AI-driven Q&A.

**🔹 Key Features & Components**

1. **Data Preparation & Vector Database Integration**

✅ Clean and preprocess course-related text data.

✅ Convert text into numerical vectors using embeddings (e.g., BERT, GPT).

✅ Store in a vector database (e.g., FAISS, Qdrant) for efficient retrieval.

1. **LLM & RAG (Retrieval-Augmented Generation) Pipeline**

✅ Use Lang Chain & Crew AI for conversation handling.  
✅ Integrate LLMs like Gemini API for dynamic content generation.  
✅ Implement context-aware memory (e.g., track last 20 interactions).  
✅ Enable file uploads (PDF, Excel, TXT) for knowledge retrieval.

1. **User Authentication & Data Management**

✅ Implement user sign-up, login, and profile management via Supabase or Firebase.  
✅ Store learning history, progress, and chatbot interactions securely.  
✅ Use OAuth & data encryption (bonus).

1. **Frontend Development (Streamlit)**

✅ Design intuitive UI with at least 5 interactive pages.  
✅ Allow users to add/view courses, navigate materials (videos, quizzes).  
✅AI-generated recommendations based on progress & interests.

1. **Backend Development (Fast API)**

✅ Create REST APIs for user & course management.  
✅ Implement chatbot communication endpoints.  
✅ Store & retrieve user progress, learning data.

1. **Deployment**

✅Host on Streamlit Community Cloud or other open-source deployment platforms.  
✅ Deploy Fast API backend (bonus: Docker, Kubernetes).

**🔹 Potential Enhancements & Additional Features**

✅ Gamification: Add leaderboards, achievements, and rewards to increase engagement.  
✅ Speech-to-Text Learning: Let users speak to the chatbot instead of typing.  
✅ Adaptive Difficulty Levels: Adjust question difficulty based on student performance.  
✅ Multimodal Learning: Support text, audio, and video explanations.  
✅ Real-Time Collaboration: Allow group discussions or peer interactions.

* **Database**

1️ Users Table (*users*)

Stores **user authentication details, roles, and preferences**.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique User ID |
| full name | Text | User’s full name |
| Email | Text (Unique) | Email for Authentication |
| password\_hash | Text | Hashed Password |
| Role | Text | “student”, “Admin” or “Instructor” |
| Bio | Text | Short user bio |
| Linkedin\_url | TEXT (URL) | LinkedIn Profile |
| Github\_url | TEXT (URL) | GitHub Profile |
| created\_at | TIMESTAMP | Account Creation Date |
| updated\_at | TIMESTAMP | Last Profile Date |
| profile\_picture | Text (URL) | Optional Profile Picture |
| preferences | JSON | Stores language, theme, notification settings |

2️ Courses Table (*courses*)

Stores all available courses, topics, and difficulty levels.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Course ID |
| Title | Text | Course Title |
| Description | Text | Detailed Course Info |
| Level | Text | “Beginner”, “Intermediate” or “Advanced” |
| Category | Text | eg. “AI”, “Data Science”, “Cybersecurity: … |
| Instructor\_id | (FK) | Linkes to user.id |
| Price | FLOAT | Course Price (if Paid) |
| Thumbnail\_url | TEXT | Course Image URL |
| Total\_Hours | FLOAT | Course Length in Hours |
| Created\_at | TIMESTAMP | Account Creation Date |
| updated\_at | TIMESTAMP | Last Profile Date |

3️ Videos Table (*Videos*)

Each Course has multiple Videos

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Video ID |
| Course\_id | FK | Links To course.id |
| Title | Text | Video Title |
| Video\_url | Text | URL to hosted video |
| Duration | Text | Video length in minutes |
| Order\_index | Int | Ordering of lesson |
| Created\_at | TIMESTAMP | Creation Date |
| updated\_at | TIMESTAMP | Last Update Date |

4️ Enrollments Table (*enrollments*)

Tracks which users are enrolled in which courses.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique enrollment ID |
| User\_id | FK | Links to user.id |
| Course\_id | FK | Links to course.id |
| Status | Text | “Unpaid”, “Active”, “Completed” |
| Progress | FLOAT | Percentage Progress (0~100%) |
| Started\_at | TIMESTAMP | Enrollment Start Date |

5️ Quizzes Table (*quizzes*)

Each course has multiple **quizzes**.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Interaction ID |
| Course\_id | FK | Links to course.id |
| Title | TEXT | Quiz Title |
| Created\_At | TIMESTAMP | Creation date |
| Updated\_at | TIMESTAMP | Updated date |

6️ Questions Table (*questions*)

Stores questions for quizzes

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Question ID |
| Quiz\_id | FK | Links to quizzes.id |
| Question\_text | TEXT | Question Content |
| Type | TEXT | “MCQ”, “Short Answer”, “True/False” |
| Correct\_Answer | TEXT | Correct Answer |
| Created\_At | TIMESTAMP | Creation date |
| Updated\_At | TIMESTAMP | Updated date |

7 Assignment Table (*Assignments*)

Stores questions for quizzes

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Assignment ID |
| Course\_id | FK | Links to course.id |
| Title | TEXT | Assignment Title |
| Description | TEXT | Instructions |
| Deadline | TIMESTAMP | Submission Deadline |
| Created\_At | TIMESTAMP | Creation Date |
| Scope Pass Grade | INT | The grade to pass the Assignment |

8. Submissions Table (*submissions*)

Tracks student assignment submissions.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Submission ID |
| User\_id | FK | Links to users.id |
| Assignment\_id | FK | Links to Assignment.id |
| File\_url | TEXT | Link to submission |
| Grade | Float | Score given by the instructor |
| Submitted\_at | TIMEASTAMP | Submission Time |
| Attempts | INT | Attempts (0,1,2) |
| Status | TEXT | “Not Submitted”, “Pending”, “Failed”, “Passed” |

9. QA Section Table (qa)

Stores student-instructor discussions for each course.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique QA ID |
| Course\_id | FK | Links to courses.id |
| student\_id | FK | Links to users.id (Student) |
| Instructor\_id | FK | Links to users.id (Instuctor) |
| Question | TEXT | Question Asked |
| Answer | TEXT | Instructor’s Answer |
| Created\_at | TIMESTAMP | TIMESTAMP |

10. Chatbot Interactions Table (interactions)

Stores **chatbot questions and responses**.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Interaction ID |
| User\_id | FK | Links to users.id |
| Query | TEXT | User Question |
| Response | TEXT | AI-Generated Response |
| timestamp | TIMESTAMP | When the message was sent |

11. Course Reviews & Ratings

* Allow students to rate courses (1-5 stars) and leave reviews.
* Helps new learners decide which courses are high-quality.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Review ID |
| Course\_id | FK | Links to courses.id |
| User\_id | FK | Inks to users.id |
| Rating | FLOAT | 1–5-star rating |
| review | TEXT | User Feedback |
| Created\_At | TIMESTAMP | Timestamp |

12. Certificates & Badges

* Generate completion certificates for students.
* Add achievement badges for milestones (e.g., "100% Course Completion", "Top Quiz Scores").

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Certificate ID |
| User\_id | FK | Links to users.id |
| Course\_id | FK | Links to courses.id |
| Certification\_URL | TEXT | Download Link |
| Issued\_at | TIMESTAMP | When Issued |

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Badge ID |
| User\_id | FK | Links to users.id |
| Badge\_type | TEXT | “QUIZ MASTER”, “TOP Performer” |
| Earned\_At | TIMESTAMP | TIMESTAMP |

13. Live Classes & Webinars

* Allow instructors to schedule live sessions.
* Integrate Zoom, Google Meet, or WebRTC.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Unique Session ID |
| Course\_id | FK | Links to courses.id |
| Instructor\_id | FK | Links to users.id |
| Title | TEXT | Session Title |
| Meeting\_link | TEXT | Zoom/ Google Meeting Link |
| Start\_time | TIMESTAMP | Schedule Time |
| duration | INT | Duration in minutes |

14. Discussion Forums & Peer Learning

* Course forums where students discuss topics and ask questions.
* Helps peer-to-peer learning.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Post ID |
| User\_id | FK | Links to users.id |
| Course\_id | FK | Links to courses.id |
| Post\_title | TEXT | Discussion Topic |
| Post\_content | TEXT | Content of Post |
| Created\_At | TIMESTAMP | Timestamp |

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Comment ID |
| Post\_id | FK | Links to form\_post.id |
| User\_id | FK | Links to users.id |
| Comment\_text | TEXT | Content of the comment |
| Created\_at | TIMESTAMP | Timestamp |

15. Payment System & Subscriptions (OPTIONAL)

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Payment ID |
| User\_id | FK | Links to users.id |
| Course\_id | FK | Links to courses.id |
| Subscription\_plan | TEXT | “Monthly”, “Annual” |
| Amount | FLOAT | Payment Amount |
| Payment\_status | TEXT | “Success”, “Pending”, “Failed” |
| Created\_at | TIMESTAMP | Timestamp |

16. AI-Based Personalized Course Recommendations (Optional)

* AI recommends new courses based on user interests & past enrollments.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Recommendation ID |
| User\_id | FK | Links to users.id |
| Recommended\_course\_id | FK | Suggested courses.id |
| Confidence\_Score | FLOAT | AI Confidence Score (0~1) |
| Created\_at | TIMESTAMP | TimeStamp |

17. Leaderboards & Gamification

* Show top learners based on quiz scores, progress, and engagement.

|  |  |  |
| --- | --- | --- |
| Column Name | Type | Description |
| Id | PK | Leaderboard ID |
| User\_id | FK | Links to users.id |
| Course\_id | FK | Links to courses.id |
| Score | FLOAT | Total Points |
| rank | INT | Position on Leaderboard |
| Updated\_at | TIMESTAMP | Timestamp |