

Project Design Phase

Solution Architecture

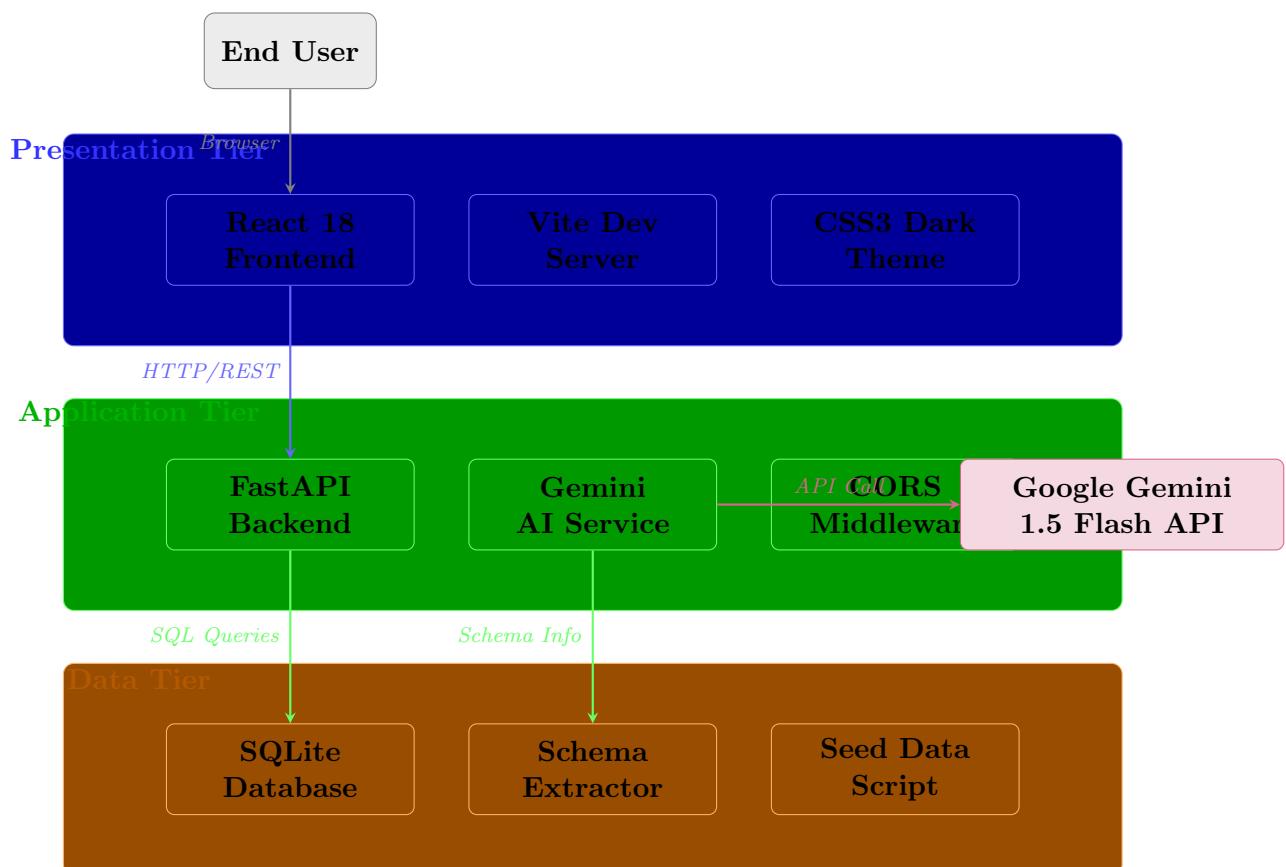
Date	February 18, 2026
Team ID	LTVIP2026TMIDS80425
Project Name	Smart Bridge – Intelligent SQL Querying
Maximum Marks	4 Marks

Solution Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram



Data Flow Description

1. **User Input:** The end user types a natural language question (e.g., “Show me the top 5 customers by total spending”) into the React frontend’s query panel.
2. **API Request:** The frontend sends an HTTP POST request to the FastAPI backend endpoint `/api/query` with the natural language query.
3. **Schema Extraction:** The backend’s schema extractor reads the SQLite database metadata to understand the available tables, columns, and data types.
4. **AI Prompt Construction:** The Gemini service constructs a prompt containing the user’s question and the database schema, then sends it to the Google Gemini 1.5 Flash API.
5. **SQL Generation:** Google Gemini AI generates a valid SQL query based on the natural language input and database schema context.
6. **Query Execution:** The generated SQL is executed against the SQLite database. Only SELECT queries are allowed for safety.
7. **Results Display:** The query results (columns + rows), the generated SQL query, and an AI-generated explanation are returned to the frontend and displayed in a formatted table.

Technology Mapping

Layer	Technology	Justification
Frontend	React 18 + Vite	Component-based architecture, fast HMR, modern build tooling
Backend	FastAPI (Python)	High-performance async framework, auto-generated API docs, native Python AI library support
AI Service	Google Gemini 1.5 Flash	Fast inference, strong SQL generation capability, schema context understanding
Database	SQLite 3	Lightweight, zero-configuration, perfect for development and demo; easily swappable
Communication	REST API (JSON)	Standard protocol, easy to debug, well-supported by both React and FastAPI

References

- <https://aws.amazon.com/blogs/industries/voice-applications-in-clinical-research-poc/>
- <https://fastapi.tiangolo.com/>
- <https://ai.google.dev/gemini-api/docs>