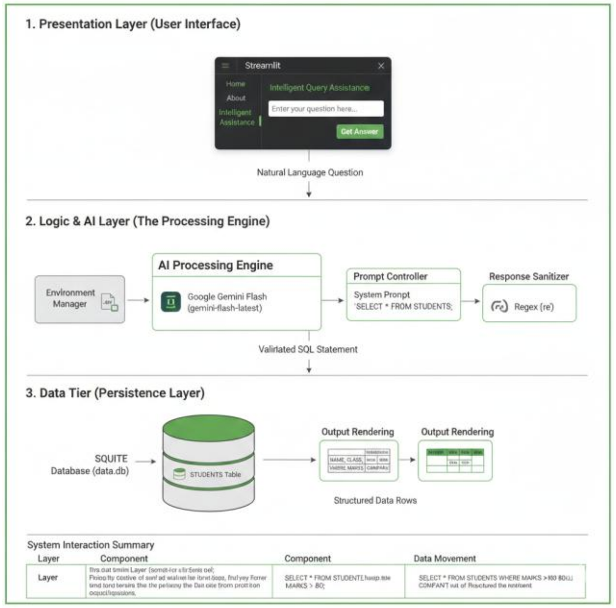
Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	11 February 2026
Team ID	LTVIP2026TMIDS66080
Project Name	IntelliSQL: Intelligent SQL Querying with LLMs Using Gemini Pro
Maximum Marks	4 Marks

Technical Architecture:

- Presentation: Managed by Streamlit with custom CSS accents (#4CAF50) for a modern appearance.
- Logic Execution: Orchestrated by Python, ensuring that the database connection is safely opened and closed during each query.
- Intelligence: Powered by the Gemini Flash model to ensure the "Intelligent Query Assistance" remains fast and reliable.


1. Presentation Layer (User Interface)
Streamlit
Home
About
Intelligent Assistance
Intelligent Query Assistance
Enter your question here...
Get Answer
Natural Language Question
2. Logic & AI Layer (The Processing Engine)
Environment Manager
AI Processing Engine
Google Gemini Flash (gemini-flash-latest)
Prompt Controller
System Prompt 'SELECT * FROM STUDENTS;
Response Sanitizer
Regex (re)
Valirlated SQL Statement
3. Data Tier (Persistence Layer)
SQUITE Database (data.db)
STUDENTS Table
Output Rendering
NAME, CLASS,
WHERE MARKS
Output Rendering
Structured Data Rows
System Interaction Summary

Layer	Component	Component	Data Movement
Layer	[illegible] Layer [illegible] [illegible] [illegible]	SELECT * FROM STUDENT[illegible] MARKS > 80;	SELECT * FROM STUDENTS WHERE MARKS >[illegible] CONFANT [illegible] of [illegible] the [illegible]

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	A web-based dashboard with a professional dark theme that allows users to navigate between Home, About, and the Query Tool.	Streamlit, Custom CSS
2.	Application Logic-1	Core backend processing for environment setup, model configuration, and coordinating data flow between the UI and LLM.	Python
3.	Application Logic-2	Natural language processing logic to translate English questions into structured SQL queries.	**Google Gemini Flash API** (gemini-flash-latest)
4.	Application Logic-3	Data cleaning and sanitization logic to extract valid SQL from conversational AI responses.	Python Regex (re)
5.	Database	Relational database containing the STUDENTS table with columns for Name, Class, Marks, and Company.	**SQLite** (data.db)
6.	Cloud Database	N/A - The current project utilizes a local database setup for rapid development.	Local SQLite
7.	File Storage	Local storage for database files and environment configuration.	Local Filesystem
8.	External API-1	Primary generative AI interface used to perform the conversion of text to SQL.	Google Generative AI SDK
9.	External API-2	Secure management of environment variables to protect the system's API keys.	python-dotenv
10.	Machine Learning Model	High-speed Large Language Model (LLM) optimized for fast inference and accurate code generation.	Gemini 1.5 Flash
11.	Infrastructure (Server / Cloud)	Deployment configuration for local testing and interactive web hosting.	Local System / Streamlit Cloud

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	The project utilizes a high-performance open-source framework for building the web interface. It also relies on environmental management libraries to handle configuration safely.	Streamlit, Python-dotenv
2.	Security Implementations	Access control is managed by storing the sensitive GOOGLE_API_KEY in a local environment file rather than the source code. A .gitignore file prevents these credentials from being exposed in public repositories	Environment Variable Masking (.env)
3.	Scalable Architecture	The application follows a modular 3-tier architecture—separating the **UI Layer**, **AI Logic Layer**, and **Database Layer**. This allows for the AI model to be upgraded or the database to be migrated with minimal impact on other components.	3-Tier Architecture (Python/Gemini/SQLite)
4.	Availability	As a local executable or cloud-hosted Streamlit app, the tool is available as long as the host server is active and the Google AI services are reachable.	3-Tier Architecture (Python/Gemini/SQLite)
5.	Performance	Performance is optimized by using the **Gemini 1.5 Flash** model, specifically chosen for its low-latency response times and efficient token processing for code generation. Data retrieval is kept fast by using a lightweight SQLite local store.	Gemini 1.5 Flash, SQLite Indexed Storage