Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	27 February 2026
Team ID	LTVIP2026TMIDS66231
Project Name	IntelliSQL: Intelligent SQL Querying with LLMs using Gemini Pro
Maximum Marks	4 marks

Project Overview:
IntelliSQL is an AI-powered natural language to SQL query generation system that leverages Google Gemini Pro large language model (LLM) to enable users to interact with relational databases using plain English. The system eliminates the need for users to have SQL expertise by automatically converting natural language questions into accurate, optimized SQL queries, executing them against the target database, and presenting the results in a human-readable format.

Functional Requirements:
Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Natural Language Input	Accept natural language questions or queries from the user through a web-based interface and pass them to the Gemini Pro LLM for processing and SQL generation
FR-2	SQL Query Generation	Automatically convert user's natural language input into syntactically correct and semantically accurate SQL queries using the Gemini Pro language model
FR-3	Database Schema Integration	Allow users to upload or define their database schema so the LLM can generate context-aware SQL queries tailored to the actual table structures and column names
FR-4	Query Execution	Execute the generated SQL query against the connected relational database (MySQL / PostgreSQL / SQLite) and retrieve the results for display

FR-5	Result Display	Present query results in a structured, readable table format on the UI, along with the generated SQL query for user transparency and learning
FR-6	Query History Management	Maintain a session-based or persistent history of all user queries and their corresponding SQL translations for reference and audit purposes
FR-7	Error Handling & Correction	Detect invalid or failed SQL queries, display meaningful error messages, and optionally retry with a corrected query using LLM feedback loop
FR-8	User Authentication	Allow users to register, log in, and manage their accounts securely to access personalized query history and database connections

Non-functional Requirements:
Following are the non-functional requirements of the proposed solution.

NFR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The system shall provide a clean, intuitive, and user-friendly web interface that requires no SQL knowledge, enabling non-technical users to query databases using plain English effortlessly
NFR-2	**Performance**	The system shall generate and execute SQL queries within 5 seconds for standard queries, ensuring a responsive and efficient user experience even under concurrent usage
NFR-3	**Accuracy**	The Gemini Pro LLM integration shall achieve a minimum of 90% SQL query accuracy on standard natural language inputs, validated against the provided database schema
NFR-4	**Scalability**	The system architecture shall support horizontal scaling to accommodate a growing number of users, database connections, and query volumes without degradation in performance
NFR-5	**Security**	All user credentials, database connection strings, and query data shall be encrypted in transit (TLS/HTTPS) and at rest, with role-based access control enforced throughout the application

NFR-6	**Reliability**	The system shall maintain 99.5% uptime and implement robust error handling to gracefully manage LLM API failures, database connectivity issues, and malformed queries without crashing
NFR-7	**Maintainability**	The codebase shall follow modular design principles with clear separation of concerns (UI, LLM service, DB layer) to allow easy updates, testing, and future integration of new LLM models
NFR-8	**Availability**	The system shall be accessible 24/7 during academic and production usage with minimal planned downtime, supported by automated health checks and monitoring