

**IntelliSQL Intelligent  
SQL Querying with LLMs using Gemini Pro  
Solution Architecture**

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Team ID	LTVIP2026TMIDS66231
Project Name	IntelliSQL: Intelligent SQL Querying with LLMs using Gemini Pro
Maximum Marks	4 Marks

**Solution Architecture:**

The solution architecture of IntelliSQL is designed to enable intelligent, natural language-driven SQL query generation using Google's Gemini Pro large language model. The system begins with the user providing a plain English query along with a database schema. This input is processed through an NLP layer that identifies intent and context, which is then forwarded to the Gemini Pro LLM engine for accurate SQL generation. The generated query is validated for syntax, security, and semantic correctness before being executed against the target database, with results returned in a user-friendly format.

**Steps to be followed:-**

**1. User Input Layer**

- Accept natural language queries from users via web or API interface
- Allow users to upload or define their database schema for context

**2. NLP Processing Layer**

- Tokenize and parse the natural language query
- Identify query intent, entities, and relevant table references
- Provide contextual understanding for multi-turn conversations

**3. Schema Analyzer Layer**

- Parse and index the provided database schema and metadata
- Extract table relationships, foreign keys, and column types
- Validate and map user-referenced entities to schema columns

**4. Gemini Pro LLM Engine**

- Convert natural language query to SQL using Gemini Pro API
- Generate schema-aware, optimized SQL with multi-turn support

**5. SQL Validator Module**

- Perform syntax and semantic validation on generated SQL

- Scan for SQL injection and security vulnerabilities
- Analyze query complexity and suggest optimizations

## 6. Database Execution Layer

- Execute validated SQL against the target relational database
- Retrieve and format query results for downstream use
- Cache frequent queries to improve response performance
- Support multiple DB engines: MySQL, PostgreSQL, SQLite

## 7. Output and Visualization Layer

- Display results as interactive tables and charts
- Show the generated SQL query for transparency
- Explain the query in plain language for non-technical users

## Solution Architecture Diagram:

