

Full Stack Development with MERN

Project Documentation format

1. Introduction

- **Project Title:** IntelliSQL: Intelligent SQL Querying with LLMs Using Gemini Pro

- **Team Members:**

Name	Role
K Jyothirmayee	FrontEnd
P Jyothika Reddy	BackEnd
K Kumuda	AI Integration
S Lakshmi Narayana Chethan	DataBase
Mohammad Nadeem Ahmed	Testing

2. Project Overview

- **Purpose:**

IntelliSQL enables users to convert natural language queries into SQL statements using Gemini Pro LLM. It reduces the complexity of SQL writing and improves data accessibility for non-technical users.

Features:

- Natural Language to SQL conversion using Gemini Pro
- Secure relational database connectivity
- Query validation and execution
- Data visualization (tables and charts)
- Query history management
- JWT-based authentication

3. Architecture

- **Frontend(React):**

Built using React.js for creating an interactive dashboard that allows users to input queries, view generated SQL, and analyze results visually.

- **Backend(Node.js & Express.js):**

Handles API requests, integrates with Gemini Pro API for NL-to-SQL conversion, validates SQL queries, and manages secure communication with databases.

Database:

MongoDB stores user credentials and query history. MySQL/PostgreSQL databases are dynamically connected for executing generated SQL queries.

4. Setup Instructions

- **Prerequisites:**

- Node.js
- MongoDB
- MySQL or PostgreSQL
- Gemini Pro API Key
- npm package manager

Installation:

1. Clone the repository.
2. Run npm install in client and server directories.
3. Configure environment variables (DB credentials, API key).
4. Start backend and frontend servers.

5. Folder Structure

- **Client:** Contains React components, pages, services, and UI assets
- **Server:** Contains routes, controllers, models, middleware, and Gemini integration logic.

6. Running the Application

- Frontend: npm start (inside client folder).
- Backend: npm start (inside server folder).

7. API Documentation

- POST /api/generate-sql – Convert natural language to SQL.
- POST /api/execute-query – Execute SQL and return results.

GET /api/history – Retrieve past queries

8. Authentication

- JWT-based authentication ensures secure access. Role-based authorization controls database query permissions.

9. User Interface

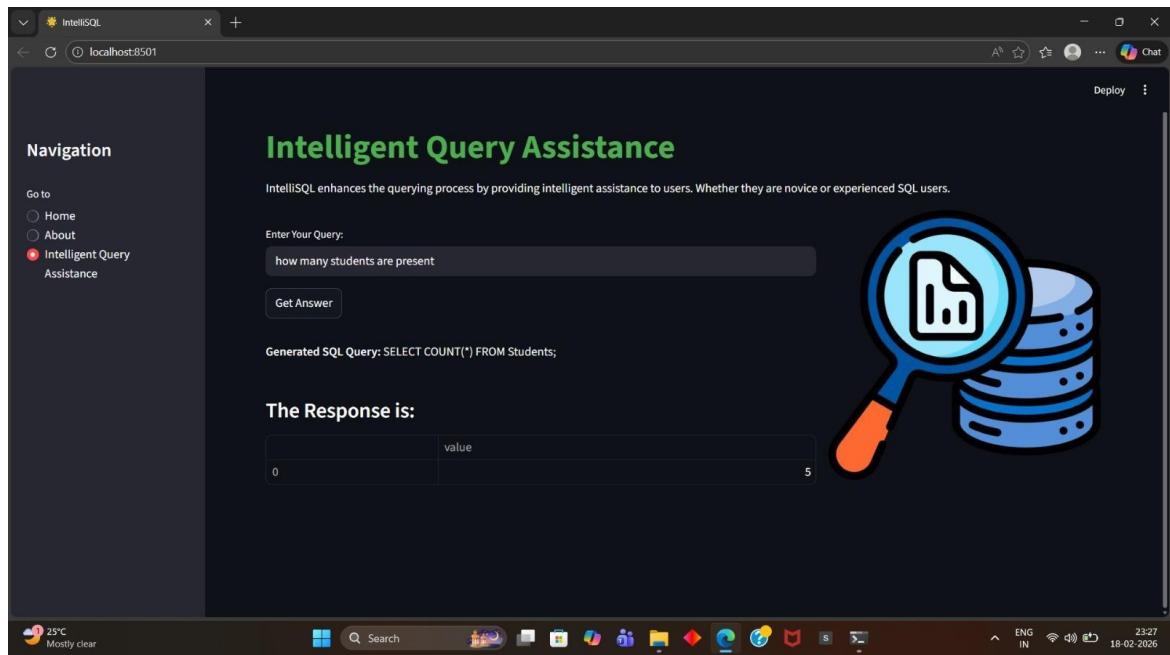
- Includes login page, dashboard for query input, SQL output display, results table, and graphical visualization section.

10. Testing • Unit testing for APIs and integration testing for NL-to-SQL workflow.

Performance testing for large datasets.

11. Screenshots or Demo

```
C:\ > SmartInternz > app.py > ...
1 import streamlit as st
2 import os
3 import sqlite3
4 from dotenv import load_dotenv
5 load_dotenv()
6 from google import genai
7
8 client = genai.Client(api_key=os.getenv("GOOGLE_API_KEY"))
9 print("API KEY LOADED:", os.getenv("GOOGLE_API_KEY"))
10
11 prompt = """
12 You are an expert in converting English questions to SQL queries.
13
14 The SQL database has one table named Students with the following columns:
15 name, class, marks, company.
16
17 Examples:
18 How many entries are present?
19 SQL: SELECT COUNT(*) FROM Students;
20
21 Tell me all the students studying in MCom class?
22 SQL: SELECT * FROM Students WHERE class='MCom';
23
24 only return the SQL query. Do not explain anything.
25 """
26
27 def get_response(que, prompt):
28     response = client.models.generate_content(
29         model="models/gemini-2.5-flash",
30         contents=prompt + "\n" + que,
31     )
32
33     sql = response.text.strip()
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35     # Remove markdown formatting if present
36     sql = sql.replace("``sql", "")
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12. Known Issues

- SQL accuracy depends on database schema clarity.
- Complex nested queries may need refinement.
- Performance varies with dataset size

13. Future Enhancements

- Multi-LLM support.
- Advanced optimization engine.
- Voice-based querying.
- BI tool integration.