

DataFlow: An SQL LLM Agent for Intelligent Database Interaction

An intelligent assistant enabling natural language queries on SQL databases.

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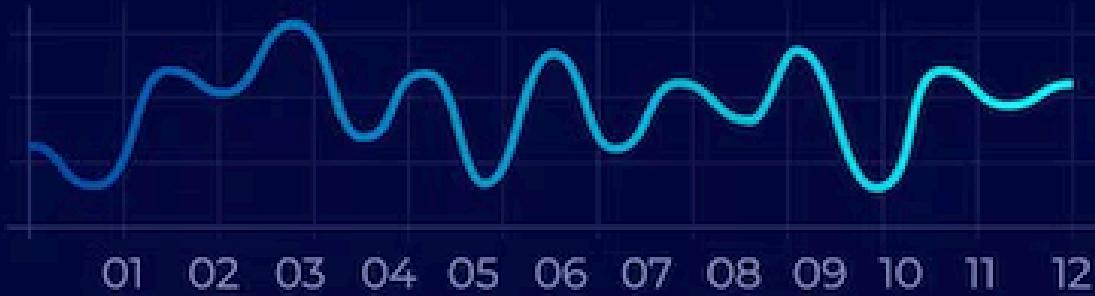
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DASHBOARD UI





The Challenge: Why Is Database Interaction Often Difficult?

Technical Barrier

SQL requires specialized knowledge, limiting access for many users.

Complexity

Manual query writing is error-prone and time-consuming.

Data Accessibility

Non-technical users struggle to retrieve meaningful insights from data.

Our Solution: DataFlow – Your Intelligent Database Assistant

Natural Language Queries

Translate plain English questions into optimized SQL queries.

Insight Generation

Provide meaningful summaries beyond raw data results.

Direct SQL Execution

Support advanced users with direct command input and confirmation.

Schema Awareness

Dynamically fetch and use database structure for accurate queries.



System Architecture & Workflow



User Input

Natural language or direct SQL commands via chat interface.

Backend Processing

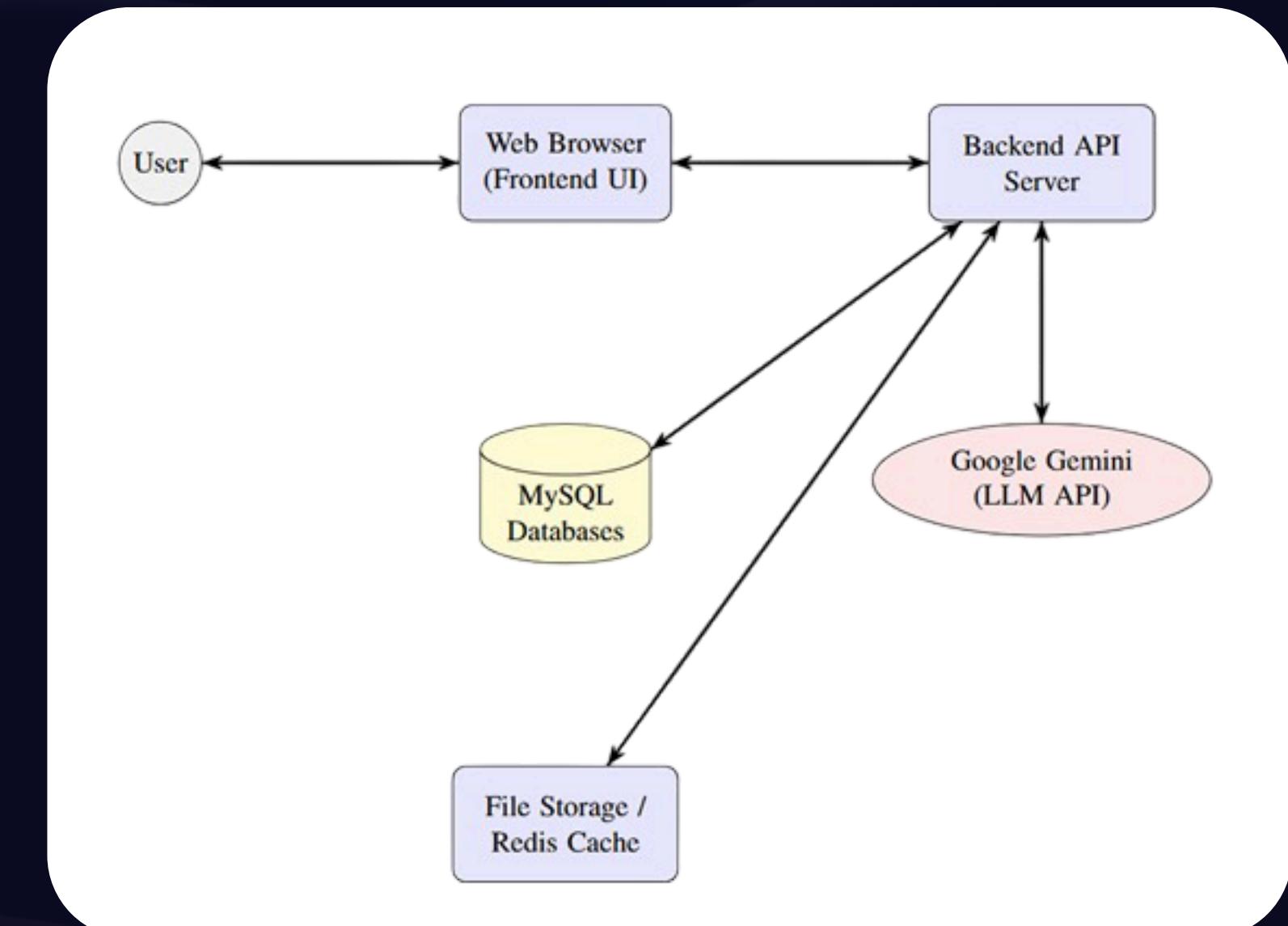
Schema fetching, SQL generation, and query execution.

LLM Integration

Google Gemini API generates SQL and insights.

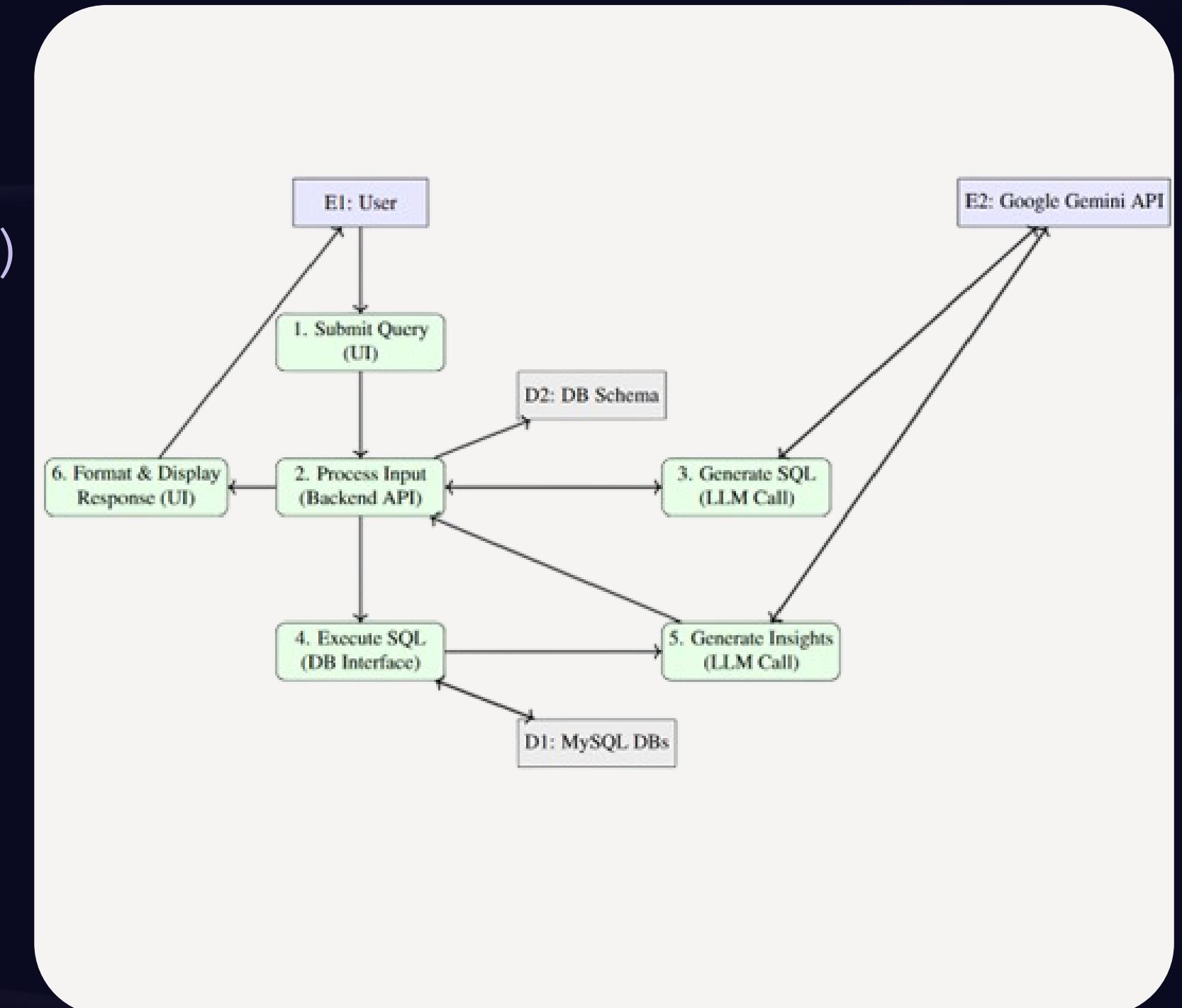
Results & Insights

Display query results and AI-generated summaries to users.



Operational Workflow: Question to Answer

- 1 User Submits Query (UI)
- 2 Backend Processes Input (Schema, LLM Prompt)
- 3 Gemini API Generates SQL
- 4 SQL Execution (DB Interface)
- 5 Gemini API Generates Insights
- 6 Results Formatted & Displayed (UI)



Technologies Powering DataFlow



Backend

- Python, FastAPI, MySQL Connector
- Google Gemini API for LLM capabilities

Frontend

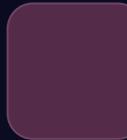
- HTML, Tailwind CSS, JavaScript
- Interactive chat interface



Data & Testing

- MySQL databases (SQLLLM, StoreDB)
- Faker library for sample data generation

User Experience: Chat Interface & Powerful Insights



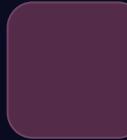
Conversational Chat

Users type questions or SQL commands in a familiar chat layout.



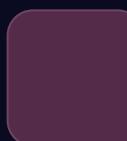
Schema Display

Toggleable panel shows databases, tables, and columns.



Insightful Responses

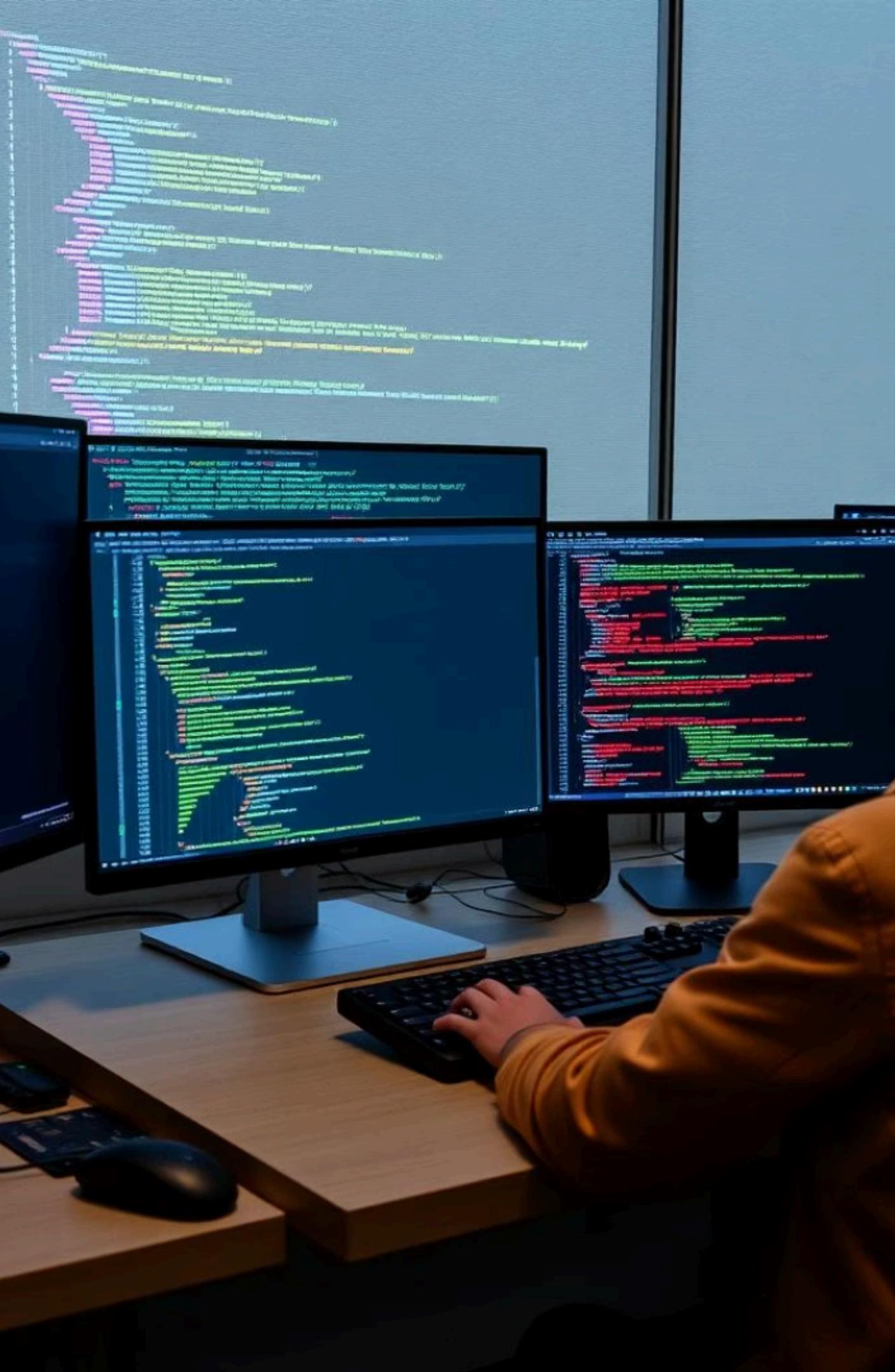
Results include generated SQL, data tables, and AI insights.



Error Handling

Clear messages guide users on invalid inputs or failures.

The screenshot displays the DataFlow application interface. At the top, there's a blue header bar with the title "DataFlow". On the right side of the header are "Config" and "Hide Schema" buttons. Below the header, on the left, is a large input field containing the message "show me the databases". To the right of this input field is a "Generated SQL:" section showing the query "SHOW DATABASES;". Further down, there's a "Database" section listing several databases: information_schema, mysql, performance_schema, sakila, sql1m, storedb, and sys. On the far right, a "Database Schema" sidebar is visible, showing a tree structure of database schemas. The sidebar includes sections for "sakila", "sql1m" (which has a "employees" table listed with columns employee_id, first_name, last_name, date_of_birth, and department), "salaries", "storedb", and "world". At the bottom of the interface is a text input field with the placeholder "Type your message or /run command..." and a small upward arrow icon.



Demonstration & Testing Setup

Manual & Black Box Testing

Extensive input-output validation from user perspective.

Integration Testing

Ensured smooth interaction between frontend, backend, LLM, and DB.

Sample Data Generation

Used Faker to create realistic test databases for demonstrations.

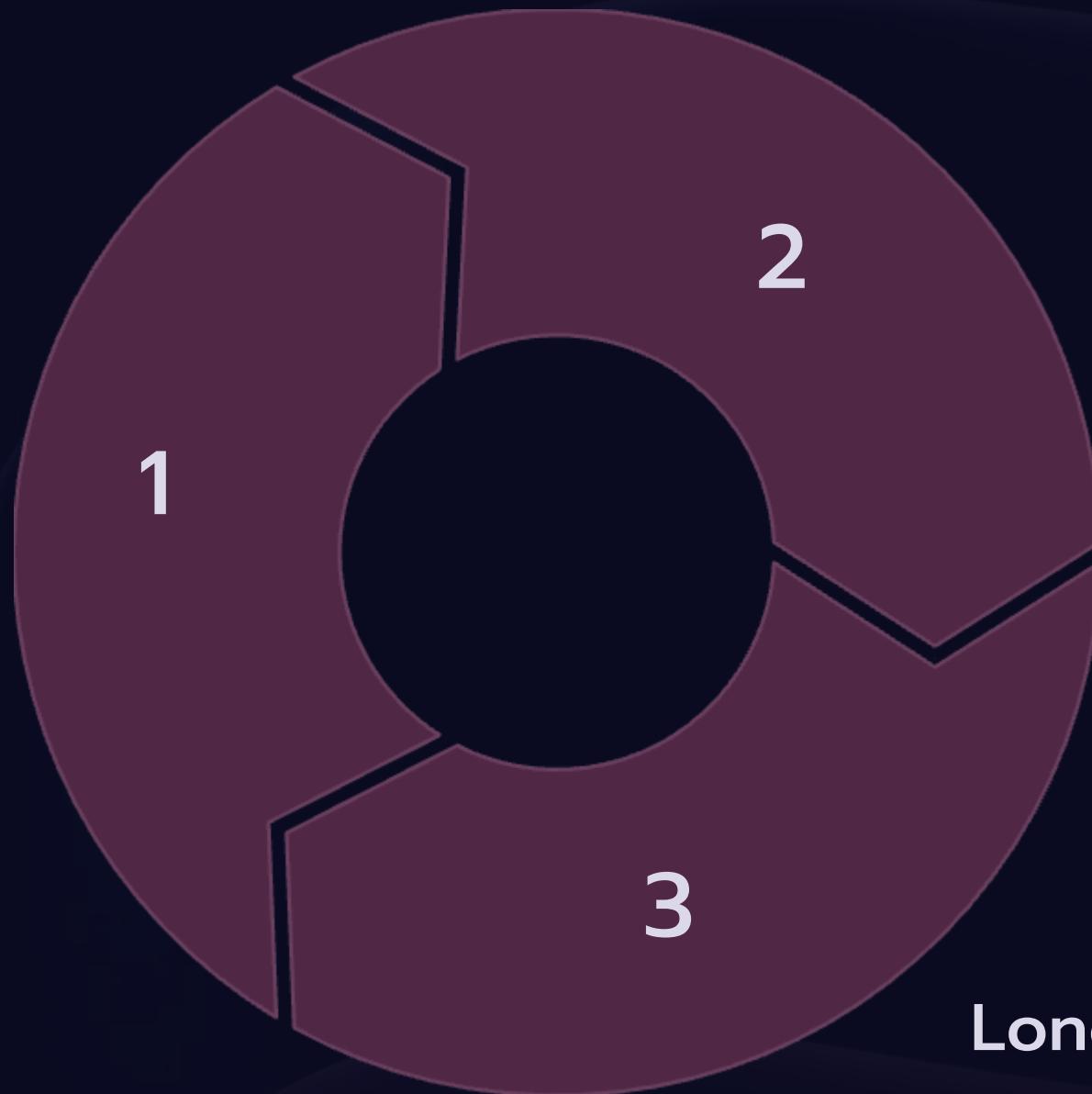
Error & Usability Checks

Tested error messages and interface clarity.

Achievements & Future Roadmap

Current Achievements

Natural language to SQL translation,
schema awareness, chat UI.

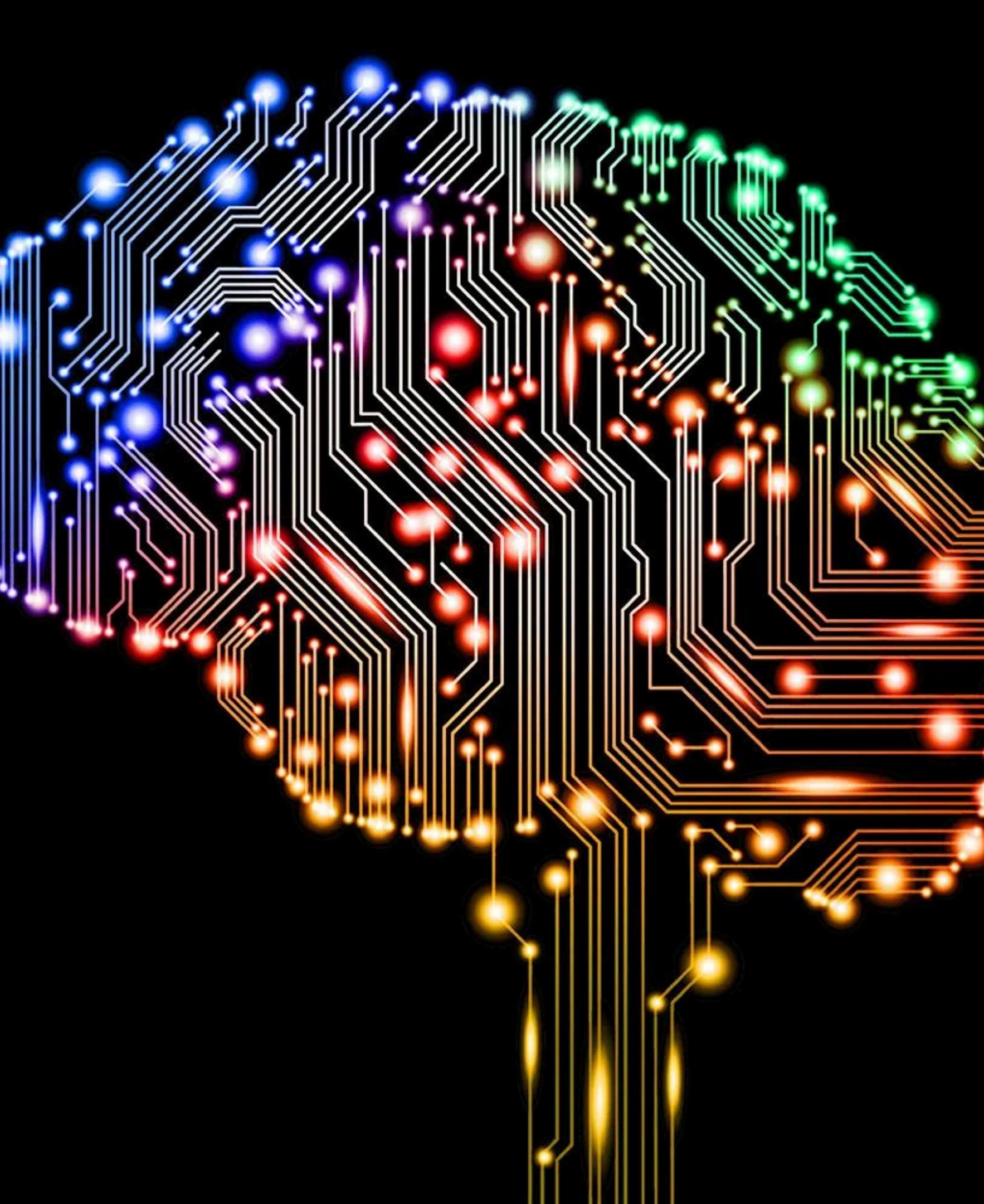


Future Enhancements

- Support more SQL databases (PostgreSQL, SQL Server)
- Advanced security and user authentication
- Conversational context and multi-turn queries
- Data visualization and saved queries

Long-Term Vision

Conversational, context-aware, and secure data interaction platform.



Thank You

We appreciate your time and interest in DataFlow.

Questions and feedback are welcome.