## **Data Chat – Smart Data Query & Visualization Assistant**

### **Overview**

**Data Chat** is a frontend-powered interactive data query tool that empowers users to explore datasets, generate SQL queries, derive insights, and visualize results — all using natural language, without writing any code.

Users can upload CSV or SQLite files and instantly interact with the data through smart question suggestions and real-time table previews. The system intelligently generates SQL queries, insights, and chart visualizations using LLM models like GPT-4.1-nano, GPT-4.1-mini, o4-mini, and Gemini 2.5 Flash.

### **System Architecture**

Data Chat is a purely frontend-driven system. It does not require any backend or server integration.

### **Tech Stack**

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| **Layer** | **Technology** |
| **Frontend** | Vanilla JavaScript, jQuery, Chart.js |
| **Database** | SQLite (no backend required) |
| **File Support** | CSV, Excel, .sqlite3, .db |
| **LLM Models** | GPT-4.1-nano, GPT-4.1-mini, o4-mini, Gemini 2.5 Flash |

#### **Architecture Highlights:**

* **Frontend Only**: Built with Vanilla JavaScript and jQuery (optional).
* **In-browser SQLite Parsing**: SQLite database files are parsed directly in the browser using WebAssembly-based libraries.**LLM Integration**: Natural language questions are processed via embedded lightweight LLM models (offline or API-based).
* **Chart Generation**: Uses Chart.js to visualize results with downloadable chart code.

### **How It Works**

### **Describe manner**

This tool lets you upload data files like CSV, Excel, or SQLite. After uploading, it shows your table structure with columns and data types. It can suggest smart questions based on your data, or you can ask your own in plain English. The system understands your question and gives you the answer, the steps, an SQL query, a chart, and the JavaScript code used. You can view the results, see the chart, and download everything if needed

**Upload your file** – Only supports .csv, .xls, .xlsx, .sqlite3, or .db formats.

**View data structure** – Automatically detect and show table structure, columns, and data types.

Get Smart Questions The system suggests questions based on your data.

**Enter Your Query**  
 Use two text fields to input:

* **Context:** Briefly describe your dataset
* **Query:** Ask your question in plain English (e.g., “What is the total revenue for 2023?”)

**System Processes and Answers**  
 The system provides:

* A clear understanding of your question
* Steps to solve it
* Table relationships
* SQL query
* Chart
* JavaScript (Chart.js) code

**View and Download Results**

* See answers in a dynamic table
* Download as .csv
* View the SQL query used

**See Visual Insights**

* Charts are automatically created using Chart.js
* Various chart types supported (bar, pie, line, etc.)
* See the JavaScript code used for each chart

### **Functional Requirements**

#### **User Interaction**

* Users can upload csv, xlsx, sqlite3, or db files.
* The system automatically detects and displays data structure.
* Users can input natural language queries.

#### **Query Processing**

* The system parses natural language into SQL queries.
* It supports joins, filters, aggregation, ordering, and grouping.

#### **Output Presentation**

* SQLite queries are displayed along with execution results.
* Users can download results in CSV format.
* Automatically suggested questions appear based on the uploaded schema.

#### **Visualization**

* Results are visualized using relevant chart types.
* Auto-generation of Chart.js code for each chart.
* Users can choose the type of chart (bar, pie, line, etc.).
* Responsive, interactive charts appear alongside table views.

### **Capabilities**

#### **Natural Language Understanding**

* Translates user queries into accurate SQL statements using lightweight LLMs.
* Understands synonyms, relationships, and contextual keywords.
* Supports multi-turn conversations for refining queries.

#### **Smart Query Suggestions**

* Auto-suggests questions based on table schema and sample data.
* Detects data types and offers analytics-specific prompts.
* Highlights potential analysis paths (e.g., trends, groupings, comparisons).

#### **Data Visualization**

* Auto-generates the most relevant chart (bar, line, pie, scatter, etc.).
* Generates complete Chart.js JavaScript code.
* Allows custom chart (optional) selection by user input.
* Renders responsive, interactive charts in-browser.

#### **Table Structure Exploration**

* Displays schema overview with column names, types, and sample rows.
* Identifies foreign key relationships.
* Allows filtering and sorting directly in the preview.

#### **Downloadable Outputs**

* Enables CSV export of any table or result.
* Allows downloading generated SQLite code and chart code.
* Optionally saves entire session with logs.

#### **Real-Time Updates**

* Automatically updates charts and tables upon data upload or question input.
* Instantaneous feedback loop for better UX.

#### **Multi-format Support**

* Accepts csv, xls, xlsx, sqlite3, db files.
* Parses Excel workbooks with multiple sheets.
* Displays error messages for unsupported or corrupted files.

#### **Zero Backend Dependency**

* Fully functional in browser with no server requirement.
* SQLite queries executed using WebAssembly in the frontend.
* Can run offline after loading in browser once (progressive web app ready).

#### **Dark Mode & Accessibility**

* Supports dark/light theme toggle.
* Keyboard navigation and Accessible Rich Internet Applications (ARIA) labels for screen readers.

#### **Embeddable Widget Mode (Planned)**

* Can be embedded inside other applications as a plugin/widget.
* Accepts configuration props for file input, theme, and default queries.

#### **Pre-Trained Context Awareness (Planned)**

* LLMs learn from previous queries to improve suggestions.
* Tracks question context to answer follow-ups better.