

**UNIVERSITY OF MYSORE**

(Re-accredited by NAAC with ‘A’ Grade)

(NIRF-2022: Ranked 33rd in University Category and 54th in Overall Category)

**MYSORE UNIVERSITY SCHOOL OF ENGINEERING**

Manasagangothri campus, Mysuru-570006

(Approved by AICTE, New Delhi)

**A Mini Project (21ADP67)**

**On**

***“*Revolutionising Database Interaction using Agentic AI.”**

Submitted in partial fulfilment for the award of the degree of

Bachelor of Engineering

In

Artificial Intelligence and Data Science

**Submitted By**

|  |  |
| --- | --- |
| **RANJAN U** | **22SEAD53** |
| **ROHITH DS** | **22SEAD56** |
| **SUDHANVA**  **H KASHYAP** | **22SEAD64** |
|  |  |

|  |  |
| --- | --- |
| Under Faculty Incharge  **Faculty name**  Asst. Professor,  Dept. of AI & DS,  MUSE, UOM, Mysuru - 570006 | Head of the Department  **Mrs Poornima K**  Asst. Professor and HOD  Dept. of AI & DS,  MUSE, UOM, Mysuru - 570006 |
|  |  |
| **Dr. M. S. Govinde Gowda**  Director  MUSE, UOM, Mysuru - 570006 | |

**D****EPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE,**

**MYSORE UNIVERSITY SCHOOL OF ENGINEERING,**

**UNIVERSITY OF MYSORE,**

**Manasagangothri campus, Mysuru-06.**

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**CERTIFICATE**

This is to certify that the Mini-Project (21ADP67) entitled “**Revolutionising Database Interaction using Agentic AI** ” is a bonafide work carried out by **Ranjan U, Rohith DS**, and **Sudhanva H Kashyap,** students of **VI Semester**, bearing Register No. **22SEAD53, 22SEAD56, and 22SEAD64** from the **Department of Artificial Intelligence and Data Science**, in partial fulfillment of the requirements for the award of the **Bachelor of Engineering** degree at the **Mysore University School of Engineering, University of Mysore, Mysuru.**

It is further certified that all corrections and suggestions indicated during the evaluation have been duly incorporated by the aforementioned candidate.

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|  |  |
| Signature of the Head of the Department  **Mrs Poornima K**  Asst. Professor and HOD  Dept. of AI & DS,  MUSE, UOM, Mysuru - 570006 | Signature of the Faculty Incharge  **Faculty name**  Asst. Professor,  Dept. of AI & DS,  MUSE, UOM, Mysuru - 570006 |
|  | |
| Signature of the Director  **Dr. M. S. Govinde Gowda**  Director  MUSE, UOM, Mysuru - 570006 | |
|  | |
| **Name of the Examiners:** | **Signature with date** |
|  |  |
|  |  |

**DECLARATION**

**We, Ranjan U, Rohith DS and Sudhanva H Kashyap,** bearing Register Nos. **22SEAD53, 22SEAD56 and 22SEAD64** of VI Semester, of **Department of Artificial Intelligence and Data Science, University of Mysore, Mysuru**, hereby declare that the **Mini-Project (21ADP67)** entitled **“Revolutionalising Database Interaction using Agentic AI”** has been duly carried out by us under the guidance of **Dr. Umera Almaz** , Asst.Professor, Department of Artificial Intelligence and Data Science, University of Mysore, Mysuru.

This Mini-Project report is submitted in partial fulfillment of the requirements for the award of the Bachelor of Engineering degree in the Department of Artificial Intelligence and Data Science by the University of Mysore, Mysuru, during the academic year **2024–2025**.

We further declare that the content of this report has not been submitted previously by anyone for the award of any degree.

|  |  |  |
| --- | --- | --- |
| Date: 11/08/2025 | **NAME** | **USN** |
| Place: Mysuru | **RANJAN U** | **22SEAD53** |
|  | **ROHITH DS** | **22SEAD56** |
|  | **SUDHANVA**  **H KASHYAP** | **22SEAD64** |
|  |  |  |

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We extend our sincere thanks to **Dr. M. S. Govinde Gowda, Director, Mysore University School of Engineering, University of Mysore**, for providing us with the necessary support, encouragement, and facilities to carry out and present our Mini-Project.

We express our heartfelt gratitude to **Mrs Poornima K, Head of the Department**, **Mysore University School of Engineering, University of Mysore**, for her constant encouragement and valuable suggestions throughout the Mini-Project.

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Finally, we would like to thank our family members and friends for their unwavering support and encouragement throughout this journey.

|  |  |
| --- | --- |
| **RANJAN U** | **22SEAD53** |
| **ROHTIH DS** | **22SEAD56** |
| **SUDHANVA**  **H KASHYAP** | **22SEAD64** |
|  |  |

**ABSTRACT**

The necessity of expertise in Structured Query Language (SQL) has long created a significant barrier, limiting direct database interaction to technically proficient users. This project addresses this challenge by developing an advanced agentic AI framework that revolutionizes database interaction, making it intuitive, conversational, and reliable. At its core, the system is a stateful multi-agent workflow orchestrated by LangGraph. It leverages a specialized multi-LLM strategy: Google's Gemini for initial intent analysis, Mistral's Codestral for precise SQL query generation, and DeepSeek R1 for a crucial verification and correction layer. This ensures that every query is not only syntactically valid but also semantically aligned with the user's intent. The agent employs a Retrieval-Augmented Generation (RAG) approach, dynamically fetching table schemas from a Chroma-DB vector store to provide context for the SQL generator. A key innovation is the interactive human-in-the-loop mechanism, managed through a lightweight Stream-lit interface. By successfully integrating these components, the project delivers a robust solution that democratizes data access. It transforms the complex task of database querying into a simple conversation, establishing a new paradigm for trustworthy and user-centric database interaction.

**TABLE OF CONTENT**

CERTIFICATE…….....................…………………………………………………………I - II DECLARATION…………………......................…………………………………………...III ACKNOWLEDGEMENT…………......................………………………………………….IV ABSTRACT………………………………………….......................………………………...V TABLE OF CONTENTS……………………………………….................…………..VI - VIII LIST OF FIGURES…………………………………………….....................………………IX LIST OF TABLES……………………………………………………….......................…….X

**CHAPTER 1.** INTRODUCTION.............................................................................................1

* 1. History........................................................................................................................1

1.1.1 Background and Evolution................................................................................2

1.2 Origin of the Idea.......................................................................................................3

**CHAPTER 2.** PROBLEM STATEMENT.................................................................................

**CHAPTER 3.** LITERATURE SURVEY..................................................................................

**CHAPTER 4.** OBJECTIVES...................................................................................................

**CHAPTER 5.** METHODOLOGY / SYSTEM DESIGN...........................................................

5.1 HARDWARE REQUIREMENTS.............................................................................

5.2 SOFTWAREREQUIREMENTS**................................................................................**

**CHAPTER 6.** IMPLEMENTATION.........................................................................................

**CHAPTER 7.** RESULT ANALYSIS AND PERFROMANCE EVALUATION......................

CONCLUSION AND FUTURE WORK..................................................................................

REFERENCES..........................................................................................................................

**LIST OF FIGURES**

Page No

* 1. System Architecture 24
  2. Use case Diagram 36

**LIST OF TABLES**

Page No

* 1. Hardware Requirements 12
  2. Accuracy Comparison 48

**ACRONYMS**

|  |  |
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| UI | User Interface |
| API | Application Programming Interface |

**CHAPTER 1**

**INTRODUCTION**

In an increasingly data-driven world, relational databases stand as the backbone of modern information systems, storing vast quantities of valuable information. However, accessing this data has traditionally been gated by the need for proficiency in SQL, creating a significant barrier for non-technical users and hindering the democratization of data access . The field of Natural Language Processing (NLP) has long sought to bridge this gap through Agentic systems, which aim to translate natural language questions into executable SQL queries. This endeavor promises to empower users from all domains to interact with complex databases as easily as having a conversation .

The evolution of Text-to-SQL has been marked by several distinct paradigms. Early efforts relied on rule-based systems and handcrafted templates, which were effective in constrained environments but lacked scalability and robustness when faced with complex database schemas or linguistic variations . The advent of deep learning brought about a significant shift, with models based on Long Short-Term Memory (LSTM) and Transformer architectures demonstrating the ability to learn the mapping between natural language and SQL syntax automatically . Then sequence-to-sequence models (Transformer era) represented a major leap forward, yet they still struggled with the nuances of complex, nested queries and cross-domain generalization. The recent emergence of Large Language Models (LLMs) has revolutionized the field, introducing a new state-of-the-art (SOTA) through powerful in-context learning and fine-tuning capabilities. Despite their prowess, even advanced LLMs are not a panacea; they are susceptible to challenges such as generating syntactically incorrect queries, hallucinating table or column names, and misinterpreting ambiguous user intent. To address these shortcomings, contemporary research has pivoted towards more sophisticated architectures, including Retrieval-Augmented Generation (RAG) to provide LLMs with accurate, real-time schema context , and multi-agentic frameworks that decompose the complex Text-to-SQL task into a series of manageable sub-problems .

This project builds upon modern frontiers to deliver solution for database interaction. Our work makes several key contributions to the field including:

1. **A Specialized Multi-Agent Framework:** Development of stateful multi-agent system using LangGraph. This architecture moves beyond a monolithic approach, assigning distinct roles (analysis, generation, verification) to specialized agents, leading to a more modular and effective workflow.
2. **A Strategic Multi-LLM Approach:** Our system synergizes the capabilities of multiple best-in-class LLMs. It leverages Google's Gemini for nuanced intent understanding, Mistral's Codestral for highly precise SQL query generation, and DeepSeek R1 as a dedicated verification cum database operator agent to correct, validate and execute the generated query.
3. **A Fully Interactive Human-in-the-Loop Interface:** This framework integrates the SOTA feature called human-in-the-loop from LangGraph which provides an interface for the intermediate process of the ongoing agentic workflow with human interaction for desired outcome.
4. **Emphasis on Verified and Trustworthy Generation:** The inclusion of a dedicated verification and correction layer (the DeepSeek agent) is a core contribution. This step ensures that the final query executed on the database is not only syntactically correct but also semantically aligned with the user's request, significantly enhancing the reliability of the system.

By integrating these advancements, this project demonstrates a significant step forward in creating a practical, powerful, and accessible natural language interface for databases. The remainder of this report will detail the system's architecture, the implementation of each agentic component, the design of the user interface, and an evaluation of its performance.