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AI POWERED STUDENT PERFORMANCE CHATBOT

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ABSTRACT—

In modern educational environments, managing and interpreting academic performance data requires intelligent and scalable solutions. This project introduces an Agentic RAG-powered Student Performance Dashboard that enables faculty and administrative users to interact with academic records through natural language queries. Built using Retrieval-Augmented Generation (RAG) and Large Language Models (LLMs), the system autonomously handles query interpretation, SQL generation, error correction, and result summarization. Users can ask complex academic-related questions in plain language, and the system translates these into structured database queries, retrieves the relevant data, and presents results in both textual and visual formats when appropriate. Its agentic design allows the system to reason across multiple steps—such as validating SQL, deciding whether to summarize or visualize, and generating responses—mimicking a human-like assistant .This dashboard significantly reduces the manual workload of analysing student data and enhances the efficiency and clarity of academic performance tracking through seamless AI integration and automatic visualization support.

Keywords:- Agentic RAG, Generative AI, Academic Performance, SQL Query Generation, Natural Language Processing, Data Visualization, LLM Automation.

Introduction

In today's data-centric educational environment, deriving actionable insights from academic records is critical for enhancing institutional performance and supporting student success. This project presents an AI-powered Student Performance Dashboard built to empower faculty, administrators, and academic decision-makers with intelligent access to real-time student performance data. The dashboard leverages Agentic Retrieval-Augmented Generation (RAG) and Large Language Models (LLMs) to enable natural language querying, automatic SQL generation, and seamless visualizations—eliminating the need for manual data extraction or technical expertise.

Designed as a centralized and intuitive platform, the dashboard provides faculty and administrators with dynamic views of academic metrics such as grades, attendance, assignment completion, and examination performance. Through AI-enhanced analysis and visualization capabilities, stakeholders can easily identify performance trends, detect learning gaps, and make informed, data-driven interventions.

Faculty members can query student-specific or aggregated performance using plain English, receiving responses in both text and graph formats depending on the context. This capability allows instructors to tailor their teaching strategies and address student needs more precisely. Administrators and department heads gain a strategic overview of institutional performance, with the ability to monitor key performance indicators (KPIs), evaluate program effectiveness, and ensure alignment with academic objectives—all through intelligent interaction with the dashboard.

This project not only simplifies complex academic data interpretation but also integrates human-like AI reasoning and response generation, making it a powerful and transformative tool for modern educational management.

LITERATURE REVIEW

Existing Systems

The proposed AI-Powered Student Performance Dashboard offers a unified, intelligent, and highly interactive solution to overcome the shortcomings of legacy academic management systems. It introduces an Agentic RAG-based architecture that allows users—such as faculty, administrators, and heads of departments—to interact with academic databases using natural language queries. Unlike traditional systems, this dashboard automatically interprets user queries, generates safe SQL statements, retrieves relevant data, and presents results both textually and visually.By integrating Retrieval-Augmented Generation (RAG) and Large Language Models (LLMs), the system mimics a human-like assistant capable of reasoning through multi-step academic queries, error handling, and even generating appropriate visualizations like performance graphs or attendance heatmaps. Moreover, the dashboard enforces strict role-based access control, ensuring data privacy while allowing dynamic feature availability based on the user's role (e.g., only administrators can configure completion criteria).

Technological Advancements and Proposed System

Recent advancements in AI, particularly Large Language Models (LLMs) and Retrieval-Augmented Generation (RAG), enable more intuitive and intelligent user interactions with complex databases. Leveraging these technologies, the proposed system offers a natural language interface for querying student performance data, replacing fragmented tools with a unified, responsive dashboard. It supports real-time analytics, role-based access, visual insights, and mobile compatibility—creating a modern, efficient alternative to traditional academic systems.

METHODOLOGY

A. Requirement Analysis

The first phase involved gathering detailed functional and non-functional requirements through consultations with college officials, including administrators, faculty, and students. Key features identified include role-based login, user management, the better identification for better student for better placement can be found easily. Emphasis was placed on usability, security, and scalability to ensure the system's effectiveness in a real-world academic environment.

B. System Design

The system is built using a modular architecture comprising a Fast API backend, MySQL/PostgreSQL databases, and an LLM-powered Agentic RAG engine. Natural language queries are processed by the LLM to generate SQL, which retrieves data securely. Results are visualized using Matplotlib/Seaborn and displayed via a responsive frontend built with HTML, Tailwind CSS, and JavaScript. Role-based access ensures secure, personalized data interaction for staff and administrators.

C. Database Setup

The system uses *MySQL* to store structured academic data such as grades, attendance, and assignment records, while *PostgreSQL* handles chat history and LLM interactions. Both databases are read-only for the LLM, ensuring data integrity. Tables are normalized for performance, and access is controlled based on user roles to maintain privacy and security.

D. Backend Development Using Fast API

The backend API was developed using the Flask framework The backend is developed using FastAPI, enabling high-performance, asynchronous handling of API requests. It connects the frontend with the LLM, databases, and visualization modules. FastAPI handles natural language query routing, invokes the Agentic RAG model for SQL generation, and returns structured or visual results efficiently. It also enforces role-based authentication and ensures secure data access.

E. Frontend Development

The frontend is built using **HTML, Tailwind CSS, and TypeScript**, providing a responsive and user-friendly interface. It allows users to input natural language queries, view data in text and visual formats, and receive real-time feedback. The design ensures accessibility across devices and supports interactive features for seamless academic data exploration.

F.LLM and Prompt Engineering

The system uses a **Large Language Model (LLM)** integrated with **Agentic RAG** to interpret natural language queries and generate

accurate SQL commands. Prompt engineering techniques are applied to guide the model's behavior, ensuring relevant, context-aware responses tailored to academic data. This approach improves the model's reliability in understanding domain-specific queries.

CONCLUSION

The AI-powered student performance dashboard demonstrates the practical integration of Large Language Models (LLMs) and educational data systems to simplify academic data access through natural language. By automating SQL generation and visualization, the system enables faculty and administrators to gain insights without requiring technical expertise. The agentic design ensures multi-step reasoning, secure data handling, and user-specific responses. While the system excels in structured queries, challenges remain in handling ambiguous inputs. Overall, it offers a transformative solution for academic monitoring and lays the groundwork for future enhancements like voice interaction and real-time analytics.

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