Project Abstract

Database Management Systems (DBMS) are fundamental to modern software applications, providing structured data storage, retrieval, and management. Understanding their internal workings is crucial for software developers and database engineers. This project, "KeystoneDB," aims to design and implement a lightweight custom DBMS that supports essential SQL features and provides persistent storage using an LSM-tree-based key-value store (RocksDB).

The core objectives of this project include:

- **SQL Parsing & Execution**: Implementing a lexical and syntax analyser using Flex and Bison to parse SQL queries.
- **Intermediate Representation (IR)**: Developing an IR for parsed SQL statements to facilitate execution.
- **Query Execution Engine**: Processing IR commands efficiently, including nested expression evaluation.
- **Persistent Storage**: Using RocksDB as a backend for durable data management.
- **Interactive Shell**: Enabling multi-line query support, command history, and intuitive user interaction.
- **Constraint Enforcement**: Supporting essential constraints such as NOT NULL.
- **Multi-table Queries**: Implementing support for selection operations across multiple tables.

The implementation will be done in **C++**, utilizing **Flex** and **Bison** for SQL parsing, **RocksDB** for storage, and **googletest** for unit testing. The project will follow a structured development approach, covering system architecture design, component-wise implementation, integration, testing, and documentation.

By completing this project, we aim to gain practical insights into database internals, compiler design, persistent storage solutions, and modern C++ software development practices. This hands-on experience will provide a deeper understanding of how database systems function and lay the foundation for further exploration in database and systems programming.

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