**Milestone Four: Database Enhancement**

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**Introduction**

For this milestone, I have chosen to enhance the database used in my food tracking application, originally developed in **CS 360 Mobile Architecture and Programming**. This application enables users to track their food intake, monitor nutritional information, and receive personalized dietary recommendations. The **database plays a crucial role** in storing and managing user data efficiently, ensuring that meal logs and nutritional data are accurately maintained.

**Artifact Description**

The **original database schema** was designed to store user profiles, meal logs, and nutritional data. However, it had **limitations in query efficiency, scalability, and real-time data synchronization**. The goal of this enhancement was to:

* **Optimize the schema** for better performance.
* **Improve query execution** using indexing.
* **Integrate cloud-based synchronization** for real-time updates.
* **Enhance analytics capabilities** to generate user dietary reports.

**Justification for Inclusion in ePortfolio**

This artifact was selected for my **ePortfolio** because it showcases my ability to **design and optimize databases** to support mobile applications. It highlights my skills in:

* **Database schema optimization**
* **Indexing for improved performance**
* **Cloud-based data synchronization**
* **Managing and analyzing large datasets**
* **Security enhancements in database storage**

The enhancements demonstrate my ability to manage **complex data operations** efficiently while ensuring **scalability and security**.

**Enhancements Implemented**

Several key enhancements were made to the database to **improve performance and usability**:

1. **Database Schema Optimization**
   * Normalized the database structure.
   * Added **indexing** to speed up query execution.
2. **Real-Time Synchronization**
   * Integrated **Firebase** to allow users to access their data across multiple devices.
   * Ensured **seamless updates** in real time.
3. **Advanced Analytics**
   * Implemented **SQL functions** to generate reports on **user dietary trends** (e.g., calorie intake trends, nutrient analysis).
4. **Security Enhancements**
   * Applied **encryption** to user passwords for better data protection.
   * Ensured **secure transmission** of user data.

**Course Outcomes Alignment**

This enhancement aligns with the following **Computer Science course outcomes**:

1. **Database Management**
   * Demonstrates an ability to use **well-founded and innovative** database techniques.
2. **Computing Solutions**
   * Designs and evaluates computing solutions that **solve data management challenges**.
3. **Security Mindset**
   * Ensures **secure storage and transmission** of sensitive user data.

**Reflection on the Process**

Throughout this **enhancement process**, I learned the importance of **optimizing database queries** for performance, as well as the **challenges of integrating cloud-based solutions** for real-time synchronization.

**Challenges Faced & Lessons Learned**

* The **biggest challenge** was ensuring **seamless data updates** while maintaining system efficiency.
* **Implementing Firebase synchronization** required **adapting the database structure** to support live data updates.
* **Balancing security and performance** was crucial in designing a **scalable and efficient database solution**.

These improvements have **strengthened my skills** in database **design, optimization, and security**, making this an essential addition to my **ePortfolio**.