Advanced Database Features

Overview

This document explains the advanced database features implemented in StudyBuddy Phase 3, specifically for Quizzes and Flashcards.

1. ACID Transactions

What is an ACID Transaction?

Why This Matters

When creating a quiz with multiple questions and answers, if something goes wrong halfway through (like a network error), you don't want a partially created quiz. ACID transactions ensure everything succeeds together or everything fails together.

Implementation in StudyBuddy

```
1. User submits form with: quiz title, description, questions, and answers
```

Code Example:

```
conn.start_transaction()
```

Real-World Example

2. Parametrized SQL Queries

What is SQL Injection?

SQL Injection is a security vulnerability where bad actors insert malicious SQL code into input fields.

Dangerous Example (DON'T DO THIS):

```
email = request.get_json()["email"]
```

Safe Example (WHAT WE DO):

```
email = request.get_json()["email"]
```

The database treats the input as DATA, not SQL code. Even if user enters ' OR '1'='1, it's treated as a literal string to search for.

Where We Use This

• Login: cursor.execute("SELECT ... WHERE email = %s", (email,))

• Quizzes: cursor.execute("INSERT INTO Quiz ... VALUES (%s, %s, %s, %s)", (title, desc, course_id, creator_id))

• Flashcards: cursor.execute("INSERT INTO flashcardset ... VALUES (%s, %s, %s, %s)", (title, desc, course_id, creator_id))

• All user data updates

3. Proper Error Handling

Transaction Error Handling Pattern

```
try:
```

What This Does

• try: Attempts database operation

• except: If error occurs, rolls back all changes

• finally: Always closes connections (prevents resource leaks)

Example Flow

• Quiz creation starts

• Insert quiz: Success ✓

• Insert question 1: Success ✓

• Insert question 2: FAILS ✗

• Exception caught

• Rollback executed → removes quiz and question 1

• Connection closed

• Error returned to user

4. Database Constraints

Foreign Key Constraints

NOT NULL Constraints

Data Type Validation

• Points are numbers, not text

• IDs are integers

• Descriptions have max length

5. Summary of Benefits

Conclusion

This makes StudyBuddy reliable and safe for students to use.

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