Jake Torres

CS 499

9/28/2025

Milestone 3 Narrative

Artifact Description

The artifact I selected is my mobile event tracker application from CS 360 (Mobile Architecture and Programming). It was originally created in Android Studio using Java and XML. The app lets a user sign up or log in, choose SMS notification permission, and then view an event page where events can be added, updated, or deleted. The application uses two SQLite databases: one for users and one for events.

Why I Selected This Artifact

I chose this artifact because it was a solid starting point but not fully complete, which made it a good candidate for enhancements. It already showed my ability to design and build working applications, but by improving it, I can also show that I can refactor and restructure code, apply best practices, and prepare an application for modern deployment.

Specific components :

Custom MongoDB Models: I created user and event models to represent data consistently across web and mobile platforms.

Efficient Algorithms: I replaced simplistic full-table scans with indexed queries that support filtering by date ranges, case-insensitive title searches, and sorting by fields such as startAt, title, and priority.

Compound Indexes: I added indexes on { userId, startAt } and { userId, titleLower }, ensuring that queries use logarithmic time lookups (O(log n)) rather than linear scans (O(n)), demonstrating my knowledge of algorithmic optimization.

Pagination: I introduced pagination to improve scalability. Instead of returning all results at once, queries return one page at a time, reducing complexity from O(n) responses to O(k) per request, where k is the page size.

Alignment With Course Outcomes

My original plan was to show mastery of:

* CO3: Design and evaluate computing solutions that solve a given problem using algorithmic principles and computer science practices.
* CO4: Demonstrate innovative techniques and tools in computing practices for implementing solutions that deliver value.

I believe I met both outcomes with this enhancement. I designed efficient search, filter, and sort algorithms supported by indexes, and I demonstrated innovative practices such as normalized fields for case-insensitive search, server-side projection for lighter payloads, and pagination to reduce resource usage.

Reflection on the Enhancement Process

Enhancing this artifact taught me valuable lessons about the relationship between algorithms and database structures. At first, the app relied on simple queries that worked but were inefficient at scale. By adding compound indexes, I learned how databases internally use IXSCAN (index scans) instead of costly COLLSCAN (collection scans). This reinforced the importance of analyzing time complexity in practical systems.

For this section, my work focused on the web application side. I designed and implemented features such as case-insensitive title searches, date filtering, sorting, and pagination. These enhancements demonstrated how algorithmic choices directly impact efficiency and scalability when managing larger datasets.

I have not yet connected the database to the mobile application. The original artifact was built with SQLite on Android, and I plan to replace that connection with MongoDB so both the mobile and web applications share the same backend. This step will be addressed in the next section, Databases. At that stage, I will focus on ensuring consistency across platforms so that events created on mobile are immediately available on the web, and vice versa.

Challenges in this phase included debugging query validation (such as invalid date ranges or ObjectIds) and integrating pagination without breaking the existing flow of results. These challenges deepened my understanding of MongoDB’s query planner and reinforced the need to combine clean design with algorithmic efficiency.