**5-2 Milestone Four Narrative**

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CS499: Computer Science Capstone

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The original artifact was a MySQL-based airline booking system developed for CS340: Client/Server Development. The application utilized a relational database to manage flights, customers, and bookings, supported by basic CRUD (Create, Read, Update, Delete) operations via a Python Flask interface. The system functioned well for fundamental operations but lacked advanced capabilities such as RESTful API design, NoSQL integration, middleware security, and robust authentication.

I selected this artifact for enhancement because it represents a comprehensive example of real-world database interaction and web service design. It allowed me to demonstrate my growth in backend development, specifically by transitioning from a traditional SQL database to a modern NoSQL solution using MongoDB and Mongoose. The artifact also highlights my ability to integrate middleware (i.e., JWT authentication and logging), define Mongoose schemas with validation, and build RESTful APIs using Express.js. These enhancements reflect both foundational database principles and current industry standards in backend engineering.

The key improvements and skills I have demonstrated include the following:

* **NoSQL Migration**: The project was fully transitioned from MySQL to MongoDB using Mongoose schemas to manage **Flights** and **Bookings**.
* **RESTful API Design**: All database interactions were exposed via RESTful endpoints in Express, demonstrating modular route/controller patterns.
* **Authentication**: JWT-based authentication was implemented to secure booking routes, ensuring only logged-in users can create bookings.

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* **Middleware and Security**: Authentication middleware and request logging were added, demonstrating a security-aware backend structure.
* **Advanced CRUD Features**: Admin-only CRUD routes were developed for managing flight records and booking records, illustrating both role-based access control and data integrity practices.
* **Full Frontend Integration**: Unlike the original artifact, I have also created a fully functioning frontend that is reachable on localhost:500, including a customer-facing application and an admin-facing application.
* **Going from Python to JavaScript**: The original artifact, done in Python, was also fully rewritten to be used in JavaScript, including all of the previously mentioned enhancements.

These enhancements collectively illustrate my proficiency in backend design, database schema modeling, API development, authentication, and request validation.

This enhancement fulfills my planned outcome of demonstrating proficiency in database management and secure software engineering. It showcases my ability to design and evaluate computing solutions with real-world trade-offs between SQL and NoSQL design paradigms, use well-founded and modern tools (MongoDB, Node.js, Express, JWT) to implement robust and modular software, and develop with a security mindset through authentication, protected routes, and input validation.

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Enhancing this project was both challenging and rewarding. Migrating from a relational schema to a document-based schema required me to rethink data relationships, especially between bookings and flights. Implementing role-based functionality and token verification deepened my understanding of Express middleware patterns. Working with Postman for route testing taught me how to simulate client interactions efficiently and debug API behavior. One major challenge I faced was ensuring data consistency when handling required objects, such as seat availability, which involved atomic updates to flight documents and the creation of bookings. I also had to adjust how I managed user identity without a pre-built registration/login system to ensure admin privileges and user privileges were separate until I had a fully functioning login/registration system and a “first” admin user to use for more admin registration.

Overall, this project enhancement represents a significant leap in not only my backend development but also my full-stack development skills. On the backend, I gained valuable skills in NoSQL architecture and API security, which is a valuable representation of my readiness for professional software development roles.