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CS-499-12303 Computer Science Capstone

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**Milestone Four Narrative**

1. *Briefly describe the artifact. What is it? When was it created?*

As mentioned last week, the artifact I’ve continued to enhance is the interactive MongoDB dashboard originally developed during my CS-340 Client-Server Development course. Built with Dash (by Plotly), Python, and MongoDB, the application allows users to filter and analyze shelter dog data from the Austin Animal Center. While the original project was finalized back in February, this week’s work focused specifically on improving the application's database interaction and security practices as part of my capstone project.

1. *Justify the inclusion of the artifact in your ePortfolio. Why did you select this item? What specific components of the artifact showcase your skills and abilities in software development? How was the artifact improved?*

I chose this artifact again because of its flexibility and relevance to real-world database applications. It provided a great foundation to showcase improvements in secure database access, modular query logic, and performance optimizations. For this enhancement, I focused entirely on how the dashboard interacts with the database layer, ensuring it is both efficient and secure.

1. Input Validation and Sanitization: All user-provided inputs (such as filters) are now validated before interacting with the database to prevent injection attacks and malformed queries.
2. CSV/JSON Export Feature: I added secure export functionality to allow users to download filtered datasets in CSV or JSON format for offline analysis.
3. Authentication: A basic login system was added to restrict access to the dashboard, protecting sensitive database operations from unauthorized users.
4. Indexing: MongoDB indexes were created on frequently queried fields (e.g., breed, outcome type) to significantly improve query efficiency.
5. *Did you meet the course outcomes you planned to meet with this enhancement in Module One? Do you have any updates to your outcome-coverage plans?*

Yes, the enhancements I made this week align strongly with outcome five, which emphasizes secure and efficient data management. By implementing input validation, user authentication, and MongoDB indexing, I demonstrated my understanding of best practices in secure database design and data processing. I also continued to support outcome four by using modern tools and frameworks in a scalable and professional way. No changes to my outcome coverage plan are needed at this time.

1. *Reflect on the process of enhancing and modifying the artifact. What did you learn as you were creating it and improving it? What challenges did you face?*

This week’s focus showed me how critical it is to consider not just the frontend experience, but also how data flows behind the scenes. One challenge I faced was managing callback errors when dynamic components weren’t yet available during login, which required setting suppress\_callback\_exceptions=True and carefully organizing layout initialization. Another challenge was integrating login functionality into an already complex callback system. While it took some trial and error to manage the layout switching logic, this process helped me better understand Dash’s callback lifecycle and state management.

In the end, this enhancement taught me how to build secure, modular database access in a full-stack context. It also reinforced the value of user authentication and efficient query design in real-world applications.