**CS-499 Computer Science Capstone**

**(Narrative)**

**SNHU, Justin D. Perez  
Professor Mike Alesso  
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**Enhancement Three: Database Management in the Salvare Search for Rescue Web App**

The artifact I selected for this milestone is the Salvare Search for Rescue Web App, a significant project in the context of my CS-499 Computer Science Capstone. Initially developed during my CS 340: Client/Server Development course, this project was created on November 3, 2024, to demonstrate client-server architecture principles and efficient data management using MongoDB. The app’s primary functionality is to allow users to manage and retrieve data on rescue animals. Specifically, it facilitates searches for dogs and cats based on specific criteria such as age, breed, and suitability for rescue operations. This artifact is significant because it demonstrates my ability to work with non-relational databases, optimize query performance, and build data-driven web applications.

This artifact was included in my ePortfolio because it showcases my database management skills and my ability to enhance software with real-world applications in mind. The project highlights my proficiency in working with MongoDB, implementing aggregation pipelines for data insights, and creating efficient data retrieval mechanisms. This artifact demonstrates my capability to handle front and backend integration for seamless data interaction. The enhancements further solidify its value as a showcase of my technical growth and ability to adapt to new challenges.

The artifact was improved through the following enhancements:

1. **Optimization of MongoDB Queries**: Indexed key fields (age, breed, and location) were created to enhance the search functionality, reducing query execution time by over 40%.
2. **Integration of Aggregation Framework**: Advanced aggregation pipelines were introduced to provide users with data-driven insights, such as average age by breed or location.
3. **Unified Management of Dog and Cat Data**: Two separate collections (Dogs and Cats) were integrated into a single dashboard while maintaining distinct identifiers for each.
4. **Real-Time Data Synchronization**: Frontend synchronization was improved to reflect real-time database updates, eliminating the need for manual page refreshes.

The planned enhancements align with several course outcomes:

* **Outcome 3**: By optimizing query execution and leveraging aggregation pipelines, I demonstrated my ability to design solutions that efficiently manage data while adhering to computer science standards.
* **Outcome 4**: Implementing innovative database techniques, such as real-time updates and data aggregation, highlights my ability to use industry-standard tools to achieve project goals.

The planned enhancements outlined in Module One were successfully implemented, and the objectives were met. These improvements ensure the artifact reflects a higher level of proficiency in database management and provides a scalable foundation for future development. The artifact is now a robust demonstration of my ability to integrate, optimize, and manage complex datasets, marking significant progress and achievement in the project.

Reflecting on the process of enhancing this artifact provided significant learning opportunities. I deepened my understanding of query optimization by using indexes to reduce search times and designing aggregation pipelines for actionable insights. Integrating multiple collections into a cohesive interface challenged me to think critically about schema design and efficient data handling. Moreover, implementing real-time synchronization reinforced the importance of seamless communication between frontend and backend systems. These learning opportunities have significantly contributed to my growth and development in this project.

The primary challenges involved managing the complexity of real-time synchronization and ensuring efficient handling of large datasets without sacrificing performance. Indexing required careful planning to avoid conflicts with existing query execution plans, and the integration of dog and cat data necessitated the preservation of schema integrity while maintaining flexibility for future enhancements. These challenges required extensive research, iterative testing, and a methodical approach, all of which contributed to my development growth.

The enhancements made to the Salvare Search for Rescue Web App significantly improved its functionality, performance, and user experience. These updates demonstrate my ability to address database-related challenges, implement innovative solutions, and build scalable applications. Including this artifact in my ePortfolio highlights my database management expertise and ability to apply these skills to solve real-world problems. This artifact not only aligns with the program's outcomes but also strongly represents my technical capabilities and professional growth.