**Software Design and Engineering Enhancement Narrative**

The artifact I selected for enhancement is a CRUD-based web dashboard built using Dash, Plotly, and MongoDB. This dashboard provides a user interface for viewing, filtering, and managing rescue animal data, making it easier for users to analyze and visualize important insights. Originally created as part of my coursework in CS-340 (Client/Server Development), the artifact demonstrates fundamental software engineering principles, including database interactions, data visualization, and user interface design.

This artifact is a strong representation of my software design and engineering skills because it incorporates multiple key components of full-stack development, including database operations with MongoDB, data visualization with interactive graphs and maps using Plotly and Dash Leaflet, user interaction and accessibility with DataTables offering filtering, sorting, and pagination, and security considerations like using environment variables to manage database credentials. The enhancements made to this project improve its usability, performance, and maintainability, further demonstrating my ability to design and refine software solutions.

To elevate the artifact’s quality and align it with industry best practices, I implemented several key improvements. These include adding pagination to the data table, improving the user experience by enabling native pagination and reducing performance overhead for large datasets; refactoring CRUD operations to streamline database queries for efficiency and modularity; enhancing data visualization by improving graph responsiveness and map interactivity to provide clearer insights; and optimizing the code structure by refactoring callback functions for better maintainability and readability. These enhancements directly support industry standards in software engineering, UI/UX principles, and data-driven application development.

This enhancement aligns with multiple Computer Science program outcomes, particularly designing and evaluating computing solutions, as demonstrated through improved CRUD operations and UI updates; using well-founded techniques, skills, and tools, as shown by implementing Dash, Plotly, and MongoDB to create a dynamic web dashboard; and developing secure and efficient software solutions by securing database credentials and optimizing query execution. I have successfully met my planned course outcomes, and the enhancements have further strengthened my competency in these areas.

Throughout this process, I encountered several challenges, including managing database queries efficiently to ensure MongoDB queries were optimized for performance, especially when handling large datasets; structuring Dash callbacks effectively to prevent unnecessary re-rendering; and learning how to implement pagination in Dash’s DataTable system and integrating it smoothly with CRUD operations. These challenges helped me refine my problem-solving skills, debugging techniques, and ability to work with real-world data-driven applications.

Enhancing this artifact has strengthened my expertise in software development, database management, and user interface design. It has also reinforced my ability to iterate on existing codebases, implement industry best practices, and develop scalable, maintainable software solutions.

This project serves as a testament to my growing proficiency in software engineering and data science applications, making it an ideal addition to my professional ePortfolio.