**5-2 Milestone Four: Enhancement Three: Databases**

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**Artifact Description:**

The artifact I selected is a full-stack web application designed to support Grazioso Salvare, a company that trains dogs for various types of rescue operations. Originally developed in CS 340, this project began as a data visualization dashboard built using JupyterDash and a Python-based MongoDB integration. It enabled users to filter and visualize shelter animal data according to their suitability for rescue missions. In CS 499, I enhanced this artifact by converting it into a production-ready, full-stack application using Node.js, Express, MongoDB, and React.

**Justification for Inclusion:**

I included this artifact in my ePortfolio because it represents my most comprehensive work with database systems, data security, and full-stack integration. It demonstrates not only my technical capabilities in backend development and RESTful API design but also my ability to make software scalable, maintainable, and secure.

Specifically, this artifact showcases:

* Proficiency in MongoDB through advanced query operations like aggregation pipelines and geospatial searches.
* Use of Express and Node.js to create modular and secure backend services.
* Implementation of JWT-based authentication and role-based access control (RBAC), reflecting best practices in application security.
* Integration of the backend with a React front-end, reinforcing my skills in full-stack system architecture.

These improvements transformed the project from a single-page dashboard into a dynamic, secure application ready for real-world deployment.

**Course Outcomes Met:**

I successfully met the course outcomes I originally planned for this enhancement:

* **Outcome 3**: Integration of database and front-end components via a Node/Express API.
* **Outcome 4**: Design and execution of complex MongoDB queries to meet data retrieval and analytics needs.
* **Outcome 6**: Implementation of data security mechanisms, including authentication and role-based authorization.

There are no changes to my outcome-coverage plans. All original objectives were achieved, and the artifact now reflects a well-rounded demonstration of my database and security-related competencies.

**Reflection on the Enhancement Process:**

The enhancement process challenged me to step outside of a single-language solution and embrace a multi-layered architecture. While I was already comfortable with Python and MongoDB, building a full Express backend and securing it with JWTs deepened my understanding of how to structure and protect APIs. Learning to manage user roles, handle asynchronous logic across components, and maintain consistent data exchange between frontend and backend was a pivotal experience.

Some key challenges I faced included:

* Ensuring consistency in request/response structures between React and Express.
* Debugging CORS issues during development.
* Creating and enforcing security layers without impacting performance or usability.

These challenges forced me to dive deeper into API design patterns, error handling, and secure coding principles. In the end, I gained not just technical knowledge but also a better understanding of how to build scalable, secure, and user-focused web applications.