**Artifact 4 Narrative**

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**CS 499 Computer Science Capstone**

**Professor Brooke**

My capstone project involves refining a full stack web application called "Travlr Getaways," which was originally created in my CS 465 Full Stack Development I course. The project entails developing a static customer-facing website using the MEAN stack. To demonstrate my skills in the category of algorithms and data structures, I added search, filter, and sort functions for the hotels database to my hotel booking app.

I selected this artifact for my ePortfolio because it showcases my skills in algorithms and data structures through various components. For instance, I implemented search and sort functions within the Hotel Booking App, which required designing efficient algorithms to retrieve and display hotel information based on user input. The inclusion of route handlers, middleware for user authentication, and backend APIs for hotel searches demonstrate my ability to design and implement complex algorithms to handle different functionalities within the application. Furthermore, the enhancements made, such as adding components for filtering hotels based on facilities, hotel types, price, and star ratings, required careful consideration of data structures to efficiently manage and manipulate the data.

The enhancements made in Module 1 align with the course objectives by demonstrating proficiency in designing and implementing algorithms and data structures within a full stack web application. The addition of search and sort functionalities, along with the various filters and pagination, effectively meets the objectives set for this phase of the project. There are no updates to the outcome-coverage plans as the enhancements successfully addressed the targeted project objectives that were outlined in my enhancement plan.

Reflecting on the process of enhancing the artifact, I learned the importance of designing efficient algorithms and data structures to optimize the performance of the web application. Challenges were encountered during the implementation of complex filtering functionalities, where I had to carefully consider the trade-offs involved in design choices to ensure both functionality and performance. One of the primary trade-offs I had to make is between time complexity and space complexity. More complex algorithms might offer better performance in terms of execution time but may require additional memory space. Conversely, simpler algorithms might use less memory but take longer to execute. Balancing these trade-offs involves choosing algorithms and data structures that strike an optimal balance between time and space efficiency.

Course outcomes that were met through the development of the "Travlr .com" web application:

1. **Design and evaluate computing solutions using algorithmic principles and computer science practices.**

In this project, I designed and implemented various algorithms and data structures to enable functionalities such as hotel searching, sorting, and filtering. For instance, I employed algorithms for sorting search results based on user preferences and utilized data structures like arrays and objects to manage and manipulate hotel data efficiently.

Additionally, I evaluated different algorithmic approaches and data structures to ensure optimal performance and scalability. For example, I compared the time and space complexity of different sorting algorithms and chose the most suitable one based on the size of the dataset and user requirements.

1. **Demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices:**

Throughout the development of the web application, I utilized a range of tools and technologies commonly employed in full-stack web development, including HTML, CSS, JavaScript, React.js, Node.js, and Express.js. These tools and frameworks allowed me to implement innovative features and functionalities within the application.

Additionally, I applied software engineering principles and best practices to ensure the reliability, maintainability, and scalability of the application. For example, I modularized the codebase, implemented error handling mechanisms, and adhered to coding standards to facilitate collaboration and long-term maintainability.

1. **Develop a security mindset that anticipates adversarial exploits in software architecture and designs to expose potential vulnerabilities:**

Security considerations were integrated into the design and implementation of the web application to mitigate potential vulnerabilities and ensure the privacy and security of user data. For example, I implemented user authentication middleware to verify user credentials and restrict access to sensitive endpoints.

Additionally, I followed secure coding practices to prevent common security threats such as cross-site scripting (XSS) and SQL injection. For instance, I sanitized user inputs and utilized parameterized queries when interacting with the database to prevent SQL injection attacks.

Furthermore, I incorporated encryption techniques to protect sensitive data, such as user authentication tokens and passwords, during transmission over the network. This helped enhance the overall security posture of the application and mitigate potential adversarial exploits.

By effectively addressing these course outcomes, the "Travlr.com" project demonstrates my mastery of key concepts and skills in computer science and software engineering, as well as my ability to develop professional-quality web applications.

URL for Artifact 2:

https://travlr-booking-app.onrender.com/