Clint Monroe

CS 499 Computer Science Capstone

Southern New Hampshire University

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Enhancement Two: Algorithms and Data Structures

Narrative:

The artifact is the interactive animal shelter management dashboard, initially created as a Python-based application using the Dash framework during a previous course. For the capstone project, it is being transitioned to React for the frontend, FastAPI for the backend, and SQLite as the database. This week's enhancements focused on recreating the data visualization components from the original dashboard, specifically the data table, histogram, and map, using modern React libraries.

This artifact was selected for its ability to demonstrate a range of skills in computer science, particularly in algorithms, data structures, and user-focused design. This week's work highlights proficiency in implementing data visualization through libraries like TanStack Table, Recharts, and Leaflet. These tools required efficient data manipulation and structuring to present complex datasets in an intuitive and accessible way. Enhancements included optimizing how data is processed and displayed, ensuring responsiveness, and maintaining simplicity in user interaction. The bar chart and map rely on clear and efficient data structures to handle potentially large datasets while preserving performance. These improvements demonstrate the ability to transform raw data into actionable insights, a key competency for creating effective computing solutions.

This enhancement aligned with my Module One goals, particularly in designing and evaluating solutions using algorithmic principles. By researching and implementing React libraries, I demonstrated the use of well-founded and innovative tools to meet specific project requirements. The focus on delivering a user-friendly interface also supported the goal of creating professional-quality visual communications. There are no updates to my outcome-coverage plans at this time, as I remain on track to address all planned outcomes by the end of the capstone. Future iterations will focus on security and additional optimizations to ensure comprehensive outcome coverage.

This week's work deepened my understanding of leveraging external libraries in React and how they can simplify complex visualizations while maintaining flexibility. Researching TanStack Table, Recharts, and Leaflet provided valuable experience in navigating documentation and integrating third-party tools into a project. A primary challenge was selecting libraries that balanced functionality, performance, and ease of use. Configuring Leaflet for geolocation data proved particularly intricate, as ensuring accuracy in mapping while maintaining responsiveness required careful debugging and testing.

Additionally, I learned the importance of thoughtful data structuring to support dynamic, interactive features. For example, the histogram required data aggregation, while the map demanded precise geolocation handling. These experiences reinforced the need to approach enhancements with a clear focus on the end user, ensuring that each component not only functions correctly but also enhances the overall user experience. This process has underscored the value of iterative development, as well as the importance of user-centric design principles in driving decision-making. It has also prepared me to continue improving the artifact with a focus on performance and security in the next sprint.

Sprint Update

- **Sprint 1: Project Initialization & Environment Setup** – The initial sprint was successful, though I encountered challenges such as needing to restart the project after discovering that create-react-app was deprecated in favor of Vite. Despite these hurdles, all objectives were met, laying a solid foundation for future work.

- **Sprint 2: Core Feature Development** – This sprint exceeded expectations, as I successfully implemented all planned visualizations (table, chart, and map) while also enhancing the backend with PUT and DELETE operations and extending the frontend to support adding, editing, and deleting database records. These updates represent a significant improvement, making the app more functional and accessible.

- **Sprint 3: Data Optimization & Security** – My focus will be on optimizing data structures, adding data validation methods using Pydantic, and implementing rate limiting with SlowAPI. User registration and authentication through Firebase will also be integrated, aligning with the planned emphasis on security and optimization.

- **Sprint 4: Backlog & Polish** – I plan to refine the application by addressing any remaining backlog items, refactoring code, and exploring hosting solutions to deploy the application. With fewer expected backlog items, I can dedicate time to polishing the user interface and ensuring the application is production-ready.