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CS 499: Computer Science Capstone
5-2 Milestone Two: Enhancement Three: Databases
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For the third section of the ePortfolio, Databases, I have chosen to modify my animal

shelter application that was created during my CS 340 Client/Server Development course. The

original artifact was created in November of 2023. In the original version of the assignment, I

created a Python application that was designed to create a web interface using Dash web app

framework while also incorporating Dash Component modules. The Dash Component modules

were used for displaying animal data provided by the animal shelter and allowed users to filter

their searches for specific results.

To make this enhancement, I chose PyCharm as the development environment (IDE)

with Python as the programming language. I also utilized Jupyter Notebook to test and complete

the final enhancement. For this project, I updated several components to the database portion of

the portfolio. This web application works with an existing animal shelter database. The work is

based on Python, PyMongo driver, Dash framework, and MongoDB. The project helps identify

and categorize dogs that can then be trained for different types of rescue situations. These

include water based rescue, locating humans after a disaster, and mountain rescue. The built

application allows users to interaction with dog profiles to train from a MongoDB database. With

a user-friendly web application kept in mind, the dashboard reduces training time and errors.

When creating the application enhancement, a multi-tier design pattern called Model View

Controller (MVC) was done.

Furthermore, the RESTful protocol builds upon the HTTP protocol to provide an

application programming interface (API). The main user interface is a dashboard designed with

various components in Python and the Dash framework. Dashboard web applications are well-suited to the MVC design pattern, with the model stored in and accessed through MongoDB, and the views represented by Dash framework widgets. The controller utilizes a CRUD Python module for handling queries and facilitating interactions between components."

I selected this artifact for my ePortfolio because it demonstrates a comprehensive application of various software development skills, including data management, user authentication, web development using Dash, and enhanced testing to ensure the application meets the demands of the company. The inclusion of this project titled "Salvare Search for Rescue Web App" in my ePortfolio is a careful choice, reflecting the complete nature of the project and its overall alignment with the skills required for a successful career in software development. This artifact demonstrates my ability to develop a full-stack web application that utilized multiple technologies into a cohesive and functional system. The project's scope, and the challenges it presented makes it an ideal showcase for my technical understanding, problem-solving, and mindfulness of key software development principles.

One of the primary reasons I selected this artifact is its representation of my proficiency in client/server development. The project required a deep understanding of the Model-View-Controller (MVC) design pattern, which I implemented to separate the application's logic, user interface, and data management components. This separation ensures that the application is not only scalable but also easier to maintain and modify. The artifact also demonstrates my ability to work with databases, specifically MongoDB, and to use Python's PyMongo driver to perform essential CRUD (Create, Read, Update, Delete) operations. These skills are fundamental to any software developer working with full-stack. This project allowed me to apply them in a real-world context.

Specific sections of the artifact highlight different aspects of my software development skills. For example, the CRUD module is a key part of the application, showcasing my ability to design and implement database operations that are both efficient and secure. This module allows users to interact with the animal shelter database by creating new records, retrieving existing ones, updating information, and deleting outdated entries. Each of these operations was carefully designed to ensure data reliability and user authentication, reflecting my understanding of best practices in database management and security. Additionally, the user interface, built using the Dash framework, shows my capability to create intuitive and responsive web applications. The interactive dashboard enables users to filter data and visualize results in real-time, providing a seamless and engaging user experience.

The artifact was significantly improved through several key enhancements made during its revision. One major improvement was the optimization of database queries, which helped to reduce the application's response time and handle larger datasets more efficiently. This was crucial in ensuring that the application could scale and perform well under different scenarios. Another improvement was the refinement of the user interface, where I focused on making the dashboard more intuitive and user-friendly. This involved reworking the layout, enhancing the interactivity of the filtering options, and improving the overall aesthetics of the application. These enhancements not only made the application more robust and reliable but also demonstrated my commitment to continuous improvement and my ability to adapt and refine my work based on feedback and testing.

Overall, the "Salvare Search For Rescue Web App" is a well-rounded project that showcases a wide range of my software development skills, making it a valuable addition to my ePortfolio. It reflects my ability to tackle complex problems, integrate various technologies, and

deliver a product that is both functional and user-centered. This artifact is not just a demonstration of what I have learned but also a proof of my potential as a software developer capable of contributing effectively to any development team.

I successfully met the course outcomes I planned to achieve with the enhancement of the "Salvare Search For Rescue Web App" during Module One. My primary goal was to deepen my understanding of client/server development, specifically focusing on implementing the Model-View-Controller (MVC) design pattern, enhancing database management skills, and improving user interface design. Through the process of enhancing this artifact, I was able to solidify these areas, thereby aligning with the course objectives.

One of the key outcomes I aimed to meet was the ability to design and implement software solutions that are both efficient and maintainable. By adhering to the MVC design pattern, I ensured that the application's architecture was well-structured, making it easier to manage and scale. This approach also allowed for clear separation of concerns, where the data layer, user interface, and control logic were distinct yet interacted seamlessly. This not only met the course outcome related to understanding and applying software architecture principles but also demonstrated my ability to create scalable and maintainable codebases, which is a crucial skill in software development.

Another outcome I planned to meet was the enhancement of my database management capabilities, particularly with non-relational databases like MongoDB. Through this project, I was able to gain a deeper understanding into the workings of MongoDB, including performing CRUD operations efficiently and ensuring data integrity. The enhancements I made, such as optimizing query performance and implementing user authentication, were directly aligned with the course objectives related to database management. These improvements not only

strengthened my technical skills but also reinforced my understanding of how to manage and manipulate large datasets in a real-world application.

In terms of user interface design, one of the outcomes I sought was to create an instinctual and responsive dashboard that enhances the user experience. The use of the Dash framework to build the interactive dashboard allowed me to achieve this goal. By focusing on making the interface more user-friendly and ensuring that the interactive elements, such as filtering options and data visualization tools, were both functional and aesthetically pleasing, I was able to meet the course objectives related to front-end development and user experience design.

As for updates to my outcome-coverage plans, I believe that the enhancements made to this artifact have allowed me to cover all the intended course outcomes comprehensively. The process of refining the project not only met my initial objectives but also uncovered new areas for further research, such as advanced data visualization techniques and more complex user authentication mechanisms. Moving forward, I plan to explore these areas in future projects, further expanding my skill set and ensuring that I continue to align with both the course outcomes and my personal development goals. This artifact serves as a strong foundation, and the insights gained from this enhancement will inform my approach to future challenges and learning opportunities in software development.

Reflecting on the process of enhancing and modifying the "Salvare Search For Rescue Web App," I realize that it was a valuable learning experience that deepened my understanding of several key aspects of software development. As I worked on improving the artifact, I gained practical insights into the workings of the MVC architecture, the importance of efficient database management, and the challenges of creating a user-friendly interface. Each step of the

enhancement process provided an opportunity to refine my technical skills and address real-world software development challenges.

One of the most significant lessons I learned was the importance of adhering to the MVC design pattern. Initially, the separation between the Model, View, and Controller components was somewhat unclear, which led to challenges in maintaining and scaling the application. Through the enhancement process, I restructured the codebase to ensure a clear division between these components. This restructuring not only made the code more organized and maintainable but also reinforced the principle of separation of concerns, which is essential for building scalable software. I learned that adhering to established design patterns like MVC has practical benefits that make software development more efficient and manageable in the long run.

Database management was another area where I gained valuable insights. Working with MongoDB, I learned the importance of optimizing queries and managing data efficiently, especially when dealing with large datasets. During the enhancement process, I faced challenges related to the performance of certain database operations, particularly when retrieving and filtering data. To address these issues, I delved deeper into MongoDB's indexing and query optimization techniques. This experience taught me that understanding the underlying mechanics of a database is crucial for ensuring that an application performs well, especially as it scales. It also highlighted the importance of continuous learning and staying updated with best practices in database management.

The process of improving the user interface of the application also presented its own set of challenges. Initially, the dashboard was functional but lacked the intuitive design and responsiveness needed for a seamless user experience. Enhancing the dashboard required me to experiment with different components of the Dash framework, including interactive filtering

options and data visualization tools. One of the challenges I faced was ensuring that these components were both aesthetically pleasing and functionally robust. Through this process, I learned the importance of balancing functionality with user experience. It's not enough for an application to work well; it must also be intuitive and easy to use. This experience reinforced the idea that user interface design is a critical aspect of software development that requires careful attention to detail and an understanding of the user's needs.

Another challenge I encountered was managing the complexity of the enhancements while ensuring that the application remained stable and bug-free. As I added new features and optimized existing ones, I had to be mindful of the potential impact on the overall system. This required rigorous testing and debugging to ensure that the enhancements did not introduce new issues. I learned that enhancing a software artifact is not just about adding new features; it's also about maintaining the integrity of the application as a whole. This experience showed the importance of thorough testing and quality assurance in the software development process.

Overall, the process of enhancing and modifying the "Salvare Search For Rescue Web App" was both challenging and rewarding. It provided me with practical experience in applying software development principles, managing databases, and designing user interfaces. The challenges I faced along the way helped me grow as a developer, and the lessons I learned will undoubtedly inform my approach to future projects. This experience has reinforced the importance of continuous learning, attention to detail, and a commitment to quality in software development.