Southern New Hampshire University

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CS 499

Milestone Four: Database Enhancement Narrative

Overview of the Artifact

The artifact I selected for enhancement in the databases category is the Library Management System, originally developed during IT 340: Database Management. This system was initially designed to store and manage books, users, and transactions using a MySQL relational database. The system allowed users to add, update, delete, and query book and user records but had several limitations, including scalability issues, lack of security measures, and no web-based interface for accessibility.

To improve the artifact, I implemented several enhancements, including:

* Migrating the database from MySQL to MongoDB for better scalability and flexibility.
* Developing a web-based front-end to allow users to interact with the system more easily.
* Implementing user authentication and role-based access control to improve security.
* Optimizing database queries for performance improvements.

These enhancements showcase modern database design principles, full-stack application development, and security best practices.

Justification for Including This Artifact in My ePortfolio

This artifact is included in my ePortfolio because it demonstrates my ability to design, manage, and optimize databases while also integrating them into a functional, user-friendly application. The project highlights key skills such as:

* Database Design and Optimization – The transition from MySQL to MongoDB required careful schema design and query optimization to maintain data integrity while improving flexibility.
* Full-Stack Development – I developed a web interface using HTML, CSS, and JavaScript, enabling users to interact with the database seamlessly.
* Security Implementation – I added user authentication and role-based access control, ensuring secure access to the system.

The enhancements significantly improved the system by making it more scalable, user-friendly, and secure, aligning with real-world industry expectations for database-driven applications.

Course Outcomes Addressed

Through this enhancement, I have successfully demonstrated progress toward several computer science program outcomes, including:

1. Software Engineering and Database Management – Migrating to MongoDB and improving database interactions strengthened my understanding of database structures, indexing, and performance optimization.
2. Computing Solutions and Design Trade-offs – Choosing between relational (MySQL) and non-relational (MongoDB) databases required evaluating trade-offs in data consistency, scalability, and complexity.
3. Security Mindset – Implementing user authentication, access control, and query sanitization addressed security vulnerabilities, reducing risks such as unauthorized access and SQL injection attacks.

Moving forward, my next focus is to further refine database queries, ensuring efficient retrieval and storage while enhancing security measures to meet enterprise standards.

Reflection on the Enhancement Process

Key Learnings

Throughout the enhancement process, I gained valuable experience in modern database management and security best practices. Some key takeaways include:

* MongoDB vs. MySQL – Understanding when to use document-based storage over relational databases and how to optimize NoSQL queries.
* Security Best Practices – Learning how to implement JWT-based authentication, encryption, and role-based permissions in database-driven applications.
* Optimizing Query Performance – Using indexing and aggregation pipelines to ensure database operations run efficiently, especially when handling large datasets.

Challenges Faced

One of the biggest challenges was migrating existing relational data to a NoSQL structure without compromising functionality. MySQL stores data in normalized tables, while MongoDB uses document-based storage. To resolve this, I:

* Converted relational data into JSON-like documents, restructuring how book records and user transactions were stored.
* Optimized read and write operations to prevent performance bottlenecks.
* Ensured data integrity by implementing schema validation within MongoDB.

Additionally, integrating the database with a web-based interface introduced new complexities, such as handling API calls efficiently and securing user authentication tokens.

Conclusion

This database enhancement significantly improved the Library Management System by making it more scalable, accessible, and secure. The transition from MySQL to MongoDB, implementation of a web-based front-end, and integration of security measures showcase my ability to develop real-world database solutions.

Moving forward, I will continue refining performance optimizations and enhancing security features to ensure that my final ePortfolio artifact represents a fully functional, enterprise-ready application.

This milestone demonstrates substantial progress in database management, full-stack development, and security best practices, aligning with modern industry standards and computer science program outcomes.