



Hamilton Library Database Final Report

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Executive Summary

This report presents the final deliverables for the Database Consulting Group's project for the Hawaiian and Pacific Collection at Hamilton Library, University of Hawai'i at Mānoa. The project aimed to modernize the collection's data management system by replacing the existing fragmented, Excel-based workflow with a scalable, cloud-based MySQL database integrated into a user-friendly website.

The primary objectives of the project were to streamline data entry, improve user access, and enhance archival material management for library staff and external users. The new system consolidates diverse records, including microfilm, maps, and audiovisual materials, into a single, accessible database. It includes advanced search features, report generation, real-time reservation management, an interactive map functionality, and an intuitive feedback mechanism, allowing users to suggest updates to collection data. This solution not only improves operational efficiency but also supports the long-term preservation and accessibility goals of the Hawaiian and Pacific Collection.

The project adopted the Rapid Application Development (RAD) methodology, which facilitated iterative development with frequent stakeholder feedback. This approach resulted in the successful delivery of a functional prototype that met the project's objectives and operational requirements. The database supports key functionalities such as data importation, real-time updates, loan management, and reporting capabilities. Additionally, security measures were implemented to ensure data protection through role-based access control (RBAC) by separating librarian access to the system from external users.

The final system achieved significant improvements over the previous AS-IS model by integrating a MySQL database with a dynamic website. This shift eliminated manual data entry, reduced redundancy, and streamlined library workflows. Library staff now benefit from automated processes that ensure real-time updates and efficient data management, freeing up time for more strategic tasks. The new system's centralized platform also simplifies data entry, reducing errors and improving overall operational efficiency.

For external users, the system enhances the user experience by offering advanced search functionalities, real-time material reservations, and a feedback mechanism for continuous updates. This user-friendly interface makes it easy for researchers, students, and the public to access and interact with the collection. This modernization positions Hamilton Library to better serve its community while ensuring scalability for future growth.

Looking forward, the system is designed to scale with the library's growing needs, incorporating future technologies and expanding capabilities. As the collection continues to evolve, the system will adapt to support new types of materials and enhance user engagement. Ultimately, this system strengthens the library's role as a key resource for both academic research and the general public, ensuring that its archives remain a vital asset for generations to come.

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I. Introduction

A. Company Background and Project Goals

Hamilton Library, part of the University of Hawai‘i at Mānoa, serves as a vital resource for students, researchers, and the broader community. Among its collections, the Hawai‘i and Pacific Collection stands out as a cornerstone of regional scholarship. This collection preserves invaluable historical documents, maps, photographs, and government records that offer unique insights into the history and culture of Hawai‘i and the Pacific region.

The library’s vision is to bridge the gap between the past and the present by ensuring that these resources are preserved, accessible, and usable for future generations. Its mission emphasizes providing innovative solutions for managing knowledge and fostering an inclusive research environment. Key strategies include digitization, improved data accessibility, and user-centric service design. Hamilton Library’s overarching business goal is to enhance its reputation as a world-class archival institution by adapting its systems and processes to meet the demands of modern researchers and the general public.

This project aims to modernize the Hawai‘i and Pacific Collection’s data management by implementing a cloud-based database using MySQL and integrating it with a user-friendly website. The central objective is to provide a seamless, efficient, and modernized system that allows users to interact directly with archival records. Through this platform, users will be able to search for specific books or archival materials, view their availability and quantity, and determine if they are eligible for reservation.

Additionally, the website will feature a feedback mechanism where users can submit suggestions to correct or update inaccurate information. By creating an intuitive interface, the project ensures that users—regardless of technical expertise—can navigate the system effectively. This solution addresses current inefficiencies by digitizing and centralizing data, streamlining library operations, and making the collection more accessible to researchers, families, and the public. Furthermore, the cloud-based design ensures scalability, long-term preservation, and support for future advancements, aligning with Hamilton Library’s mission to enhance user experience and resource accessibility.

B. Problem Statement

The current catalog in the Hawai‘i and Pacific archives collection faces significant inefficiencies due to its reliance on a non-digitized, labor-intensive system, particularly for managing microfilm records. These manual processes create significant barriers to accessibility and introduce bottlenecks in retrieving and analyzing archival data. For example, staff must extract information from physical records and manually input details into disparate Excel spreadsheets, making it time-consuming to locate materials or update records. This fragmented approach not only increases the likelihood of errors during data entry but also delays responses to user requests, undermining operational efficiency.

Furthermore, the lack of integration between indices for maps, audiovisual materials, and other records exacerbates these challenges. Researchers and general users must navigate through separate systems or spreadsheets, which complicates searches and prevents comprehensive data analysis. For instance, the absence of a unified database limits the ability to generate detailed reports on document distribution or identify key contributors, such as government agencies, within the collection. These gaps hinder the library's ability to provide user-friendly search experiences and meet its goal of streamlined accessibility and accurate data retrieval.

The following Physical Data Flow Diagram (DFD) illustrates these inefficiencies. For example, library staff manually extract data from received materials, such as books or microfilm, verify its accuracy against checklists, and input the details into separate spreadsheets. These records are then linked with external repositories like eVols through unique URLs, requiring additional manual steps. This process highlights the disjointed and time-intensive nature of the current system, which significantly hampers the library's ability to achieve its mission.

By addressing these critical issues—manual processes, fragmented data management, and limited analytical capabilities—the proposed system will centralize data, automate workflows, and integrate indices to enable seamless data retrieval and reporting, supporting the library's vision for a more accessible and efficient archive.

Level 0.0 AS-IS DFD Context Diagram Process

A publisher, author or department gives the Hawaiian and Pacific Collection Department of the Hamilton Library a physical copy of a requested collection material (Records). The Library Staff will receive this file and manually extract information on the collection (File_Info) and input this into the Excel spreadsheet. The information on collection material will be uploaded into the eVols repository of the Hawaiian and Pacific Collection Department and a unique link (eVols_Link) for the respective collection material will be created and inputted back into the Excel spreadsheet.

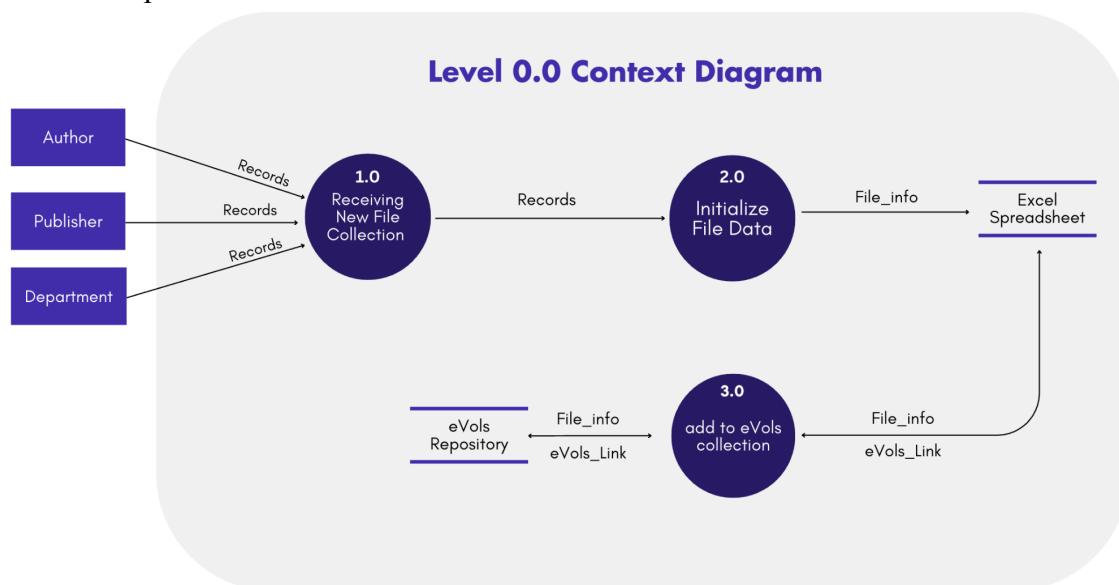


Figure A1. Physical Data Flow Diagram: Context Diagram

C. Database Approach/RAD Methodology

Addressing the inefficiencies and challenges in managing the Hawaiian and Pacific Collection required transforming a fragmented, Excel-based data management system into a centralized and accessible platform. The old system relied on miscellaneous data spread across multiple unlinked Excel spreadsheets, which made data retrieval slow, cumbersome, and error-prone. Staff had to manually search through various files, often requiring significant time and effort to locate relevant information.

The proposed system leverages a cloud-based database hosted on MySQL, integrated with a dynamic PHP-powered website. This unified database centralizes archival records, enabling users to perform comprehensive searches across formats such as microfilm, digital, and print via a streamlined, user-friendly interface. Logical and physical DFDs illustrate how this new approach integrates indexing, record retrieval, and report generation into a single, cohesive workflow. Current and legacy records will be uploaded into the MySQL database using SQL, ensuring seamless integration of existing data. Staff can update archival records from any location, with real-time updates reflected on the website. The new system automates previously manual processes, significantly reducing the time required for data retrieval and updates.

By replacing the Excel-based workflow with an integrated, efficient search system, the solution enhances accessibility and usability for all stakeholders, including researchers, students, and public users. Users can now locate materials effortlessly, regardless of format or geographic origin, fostering critical research and enabling quick, accurate responses to inquiries. Additionally, the geographic accessibility of unified data supports research into Indigenous versus colonial contexts and land disputes, making the system invaluable to both academic and public users.

Level 0.0 Logical DFD Context Diagram Process

A publisher, author or department delivers a physical copy of a requested collection material (Records) to the Hawaiian and Pacific Collection Department of the Hamilton Library. The Library Staff will receive this file and begin the catalog integration process (Process 1.0: Receive New File Collection).

The staff will extract and standardize the information about the collection (File_Info) and input it into the HPC Catalog (Process 2.0: catalog Integration). The collection material information in the database will be automatically cleaned and standardized to ensure data consistency (Cleaned File Info: CF_Info).

This cleaned data, along with the collection material, will be made accessible on the Hawaiian and Pacific Collection website for external users to search, reserve, or interact with. External users can log into the website, browse the catalog, and send a loan request (Loan_req) for a specific collection material (Process 3.0: Loan Management and Feedback).

The system will cross-check the loan request information against the availability data in the HPC Catalog. Once the external users send in a request to loan a collection material, the Library Staff will generate a reservation notice (Loan_decision) detailing the date and time of loan approval, as well as the return schedule. The approved collection material will then be provided to the user, and the system will update the material's availability and loan status (Avail_Status) in real-time.

External users can also submit feedback forms to suggest updates to collection data or provide feedback on their experience. These forms will be reviewed by the Library Staff to determine their validity. If the suggestion is accurate (Suggestion_valid), the HPC Catalog will be updated accordingly (Process 3.0: Loan Management and Feedback).

The new system can also generate reports to analyze document distribution and user contributions. These reports will be compiled from the cleaned file information and stored in the database (HPC catalog). These reports would be accessible to all external users (Process 4.0: Generate Reports).

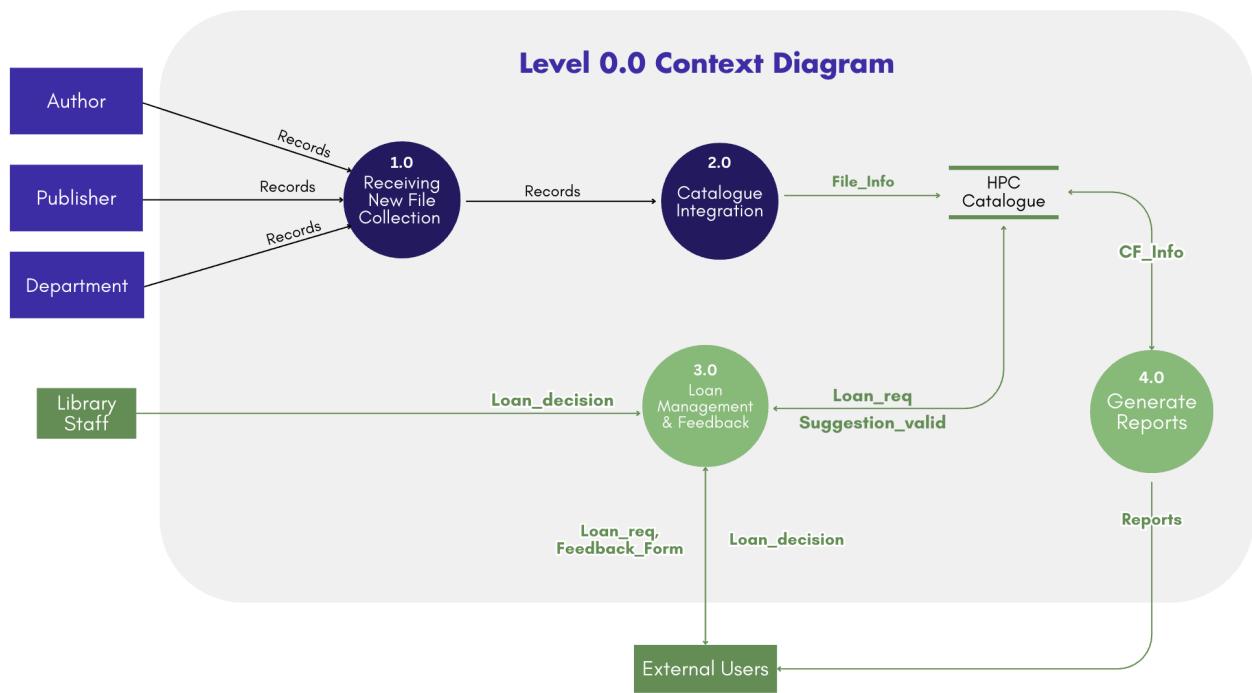


Figure A2. Logical Data Flow Diagram

By referencing the Logical Data Flow Diagram (DFD), we can visualize the integrated data management approach, which demonstrates how the new system enhances old processes and introduces new, streamlined workflows. This implementation will ultimately improve operational efficiency, support the long-term preservation of the archives, and make the Hawaiian and Pacific collection more accessible to both researchers and the general public.

D. Physical vs Logical DFD Evaluation & Achievements

Physical DFD

The current system for managing the Hawaiian and Pacific Collection is heavily reliant on manual, disjointed processes. Library staff input collection information into Excel spreadsheets, verifying details manually and often duplicating efforts across various platforms. For example, cataloging records requires separate manual entries into the local repository and the eVols digital archive, increasing the likelihood of errors and delays. Data remains static, with no mechanisms for real-time updates or cross-referencing, and user interaction is minimal. External users are unable to access the catalog directly or provide feedback, leading to missed opportunities for engagement and improvement. Furthermore, reporting capabilities are limited to labor-intensive manual data compilation, which is both time-consuming and prone to inaccuracies. These inefficiencies hinder the library's ability to meet modern user expectations and operational goals.

Logical DFD

The proposed system transforms these outdated workflows into a centralized, automated database solution powered by MySQL and integrated with a user-friendly website. Data entry is now centralized, with automated validation processes to ensure accuracy and consistency. For example, standardized fields such as author, publisher, and metadata are automatically cleaned and indexed during entry. Staff updates are immediately reflected in the database and accessible via the website, eliminating redundant steps and reducing delays. External users can log in, search the catalog, and submit loan requests directly through the website. Suggestions for updates or corrections can also be submitted, with staff able to review and implement changes seamlessly. The system generates detailed reports—such as document distribution by geographic region or usage statistics—through built-in tools, saving significant time compared to manual compilation. A dedicated staff interface enables librarians to add records, manage reservations, and perform ad hoc queries efficiently, empowering them to handle operational tasks more effectively.

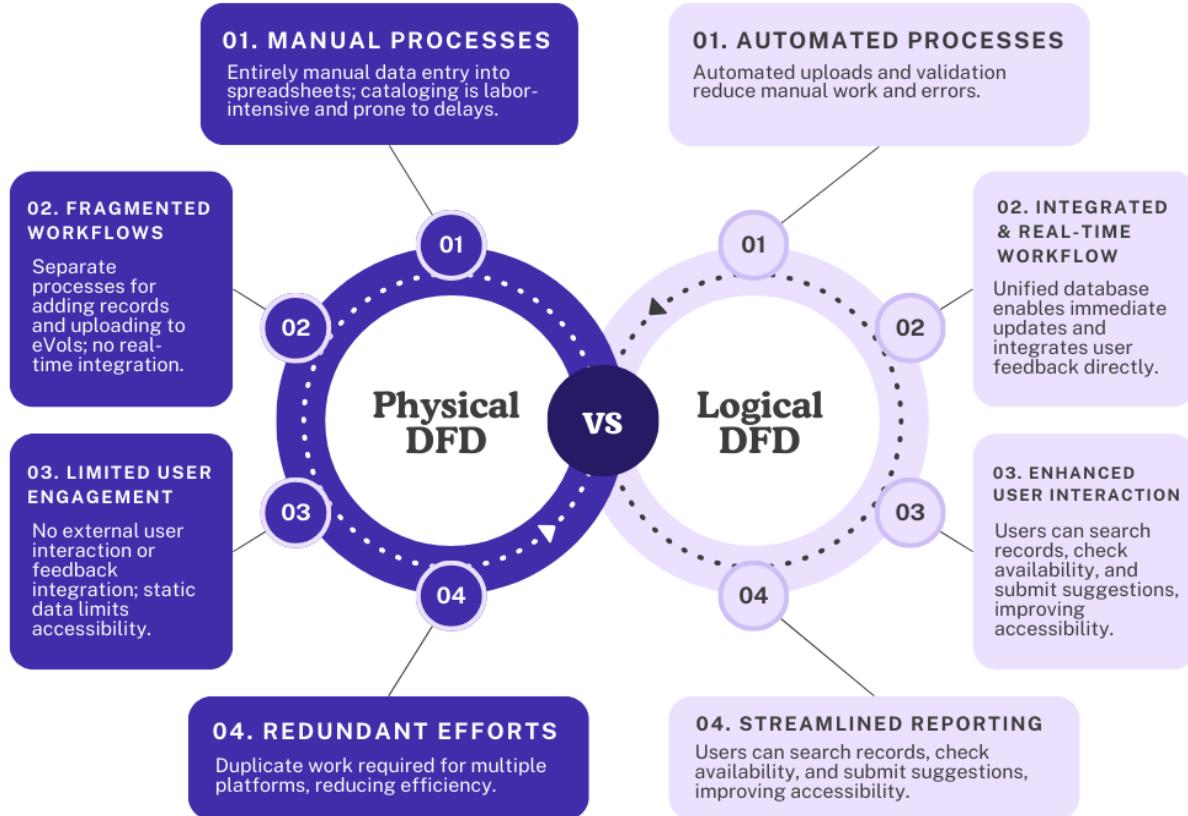


Figure A3. Physical and Logical DFD Comparison Model

The proposed system modernizes the management of the Hawai‘i and Pacific Archives collection by automating workflows, enhancing data accessibility, and addressing inefficiencies present in the AS-IS system. While some processes, such as Process 1.0, remain unchanged, others undergo significant improvement.

Key Changes Between AS-IS and Proposed System

1. Process 1.0: Receiving New File Collection
 - a. AS-IS and Proposed: Both systems retain the same approach to receiving collection materials. The Hawaiian and Pacific Collection Department continues to receive physical copies of requested materials (Collection_material) from publishing houses. These materials are placed into their designated collection drawers without immediate digitization.
 - i. This process is consistent across both systems as it aligns with the current operational flow and does not require additional automation.
2. Process 2.0: catalog Integration

- a. AS-IS: Staff manually extract data (File_Info) from the collection and input it into Excel spreadsheets. This process lacks automation, requiring time-consuming manual verification to ensure accuracy.
 - b. Proposed: Staff input data into the centralized HPC Catalog database, which automatically cleans and standardizes the data (CF_Info). This eliminates manual error-checking, ensures uniform formatting, and significantly reduces redundancy.
3. Process 0.3: Loan Management & Feedback
- a. AS-IS: No formal mechanism exists for external users to request loans or interact with the collection catalog.
 - b. Proposed: External users gain access to the catalog through a user-friendly website, where they can easily submit loan requests (Loan_req) and receive real-time availability updates. Upon approval, Library staff issue a reservation notice (Loan_decision) detailing the approved loan's date, time, and return deadline. This streamlined process enhances loan management efficiency while significantly improving user engagement. Users also have the ability to submit any suggestions regarding the usability of the website as well as suggestions for any data changes on the collection materials. These suggestions will be cross-checked by the library staff, and if approved (Suggestion_valid) these changes will be reflected in the catalog.
4. Process 4.0: Generate Reports
- a. AS-IS: Reporting is nonexistent or relies on manual data compilation from disparate sources—making it labor-intensive and error-prone.
 - b. Proposed: The new system includes automated reporting tools. Library staff can generate detailed reports on document distribution and user contributions, which are stored in the centralized database (HPC catalog). These insights inform better decision-making and operational planning.

While Process 1.0 (Receiving New File Collection) remains the same in both systems, the proposed solution transforms subsequent processes, addressing inefficiencies in data initialization, user accessibility, and reporting. By integrating automation, real-time updates, and user-centric features, the proposed system modernizes operations, enhances engagement, and positions the Hawai‘i and Pacific Archives collection for sustained growth and utility.

E. Usability Study

A usability study was conducted to assess the user experience for library staff and external users, focusing on navigation ease, accessibility, and overall satisfaction. The goal was to ensure users could efficiently access, enter, and retrieve information without the need for extensive training. The survey revealed strengths such as an intuitive landing page and an aesthetically pleasing design, while also identifying areas for improvement, such as refining layout consistency and enhancing the map interface. The insights gained from this study will

help refine the system's interface and functionality—ensuring it remains user-friendly, accessible, and adaptable to the changing needs of users.

F. Transition/Roadmap

The RAD methodology roadmap for this project follows seven iterative stages designed to refine the system's functionality and usability while aligning with the project's goals. It begins with Requirements Analysis, where stakeholder needs are gathered through interviews and surveys to identify inefficiencies and establish a foundation for improvement. In the Conceptual Design phase, an ER diagram is developed to create a scalable database structure. Next, DBMS Selection finalizes MySQL as the database platform, chosen for its scalability, compatibility, and cost-effectiveness. During Logical Design, relational schemas and normalized data models are created to streamline workflows and optimize storage. The Physical Design phase configures MySQL on servers and incorporates indexing, partitioning, and storage strategies to enhance performance. A functional Prototype is then developed, allowing stakeholders to interact with the system and provide feedback for improvements. Finally, the system undergoes Performance Evaluation, including testing for functionality, usability, and scalability to ensure it meets operational and user requirements. This roadmap's iterative nature, emphasis on stakeholder involvement, and focus on efficient workflows seamlessly align with the current project goals of creating a user-friendly, scalable, and efficient database system.

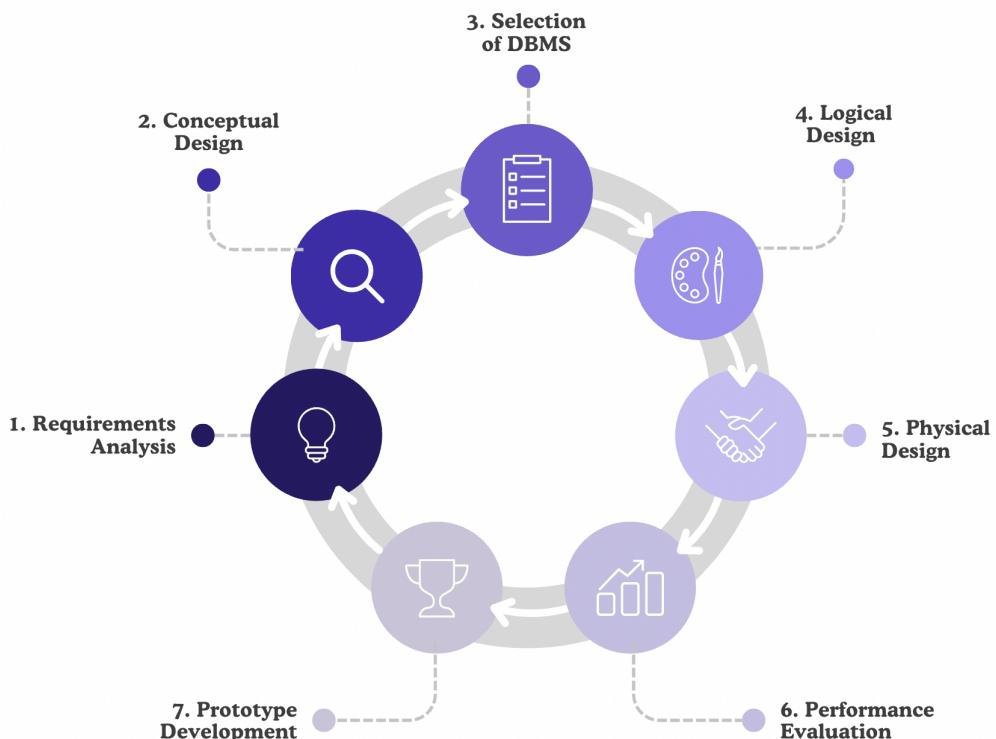


Figure A4. 7-Stage Roadmap Model

II. Approaches and Accomplishments

A. RAD Database Design Methodology

The proposed database system for the Hawaiian and Pacific Collection will be developed using the Rapid Application Development (RAD) methodology. RAD's iterative and user-centric approach is well-suited for projects requiring regular stakeholder involvement and adaptability. This methodology allows us to rapidly prototype and refine the database system, reducing the overall development time while maintaining flexibility to align with stakeholder needs. Each phase of RAD focuses on addressing specific project requirements through iterative cycles.

A. Advantages of RAD

The RAD methodology offers several key benefits that are crucial for the successful implementation of this project. By leveraging these advantages, RAD will enable us to replace the current Excel-based system with an integrated database solution tailored to the collection's needs.

- Rapid Prototyping
 - Early prototypes of the database system will allow stakeholders to interact with a functional model, providing immediate feedback for refinements.
- Iterative Development
 - Each iteration will focus on solving identified challenges, incorporating real-time feedback to continuously improve system functionality.
- User Involvement
 - Frequent collaboration with library staff and external stakeholders ensures the system meets both operational and user expectations.
- Reduced Development Time
 - RAD's streamlined processes allow for faster delivery compared to traditional waterfall approaches, enabling quicker deployment of a scalable and user-friendly database.

B. RAD Stages and Their Application

The RAD methodology will be implemented in iterative cycles, comprising seven key stages. The following stages form the backbone of the project, ensuring thorough planning, development, and testing. Each stage will conclude with stakeholder reviews and refinements, ensuring the system evolves to meet operational and user expectations.

1. Requirements Analysis

This foundational phase establishes the critical functionalities and performance criteria needed for the database system:

- Functional requirements, such as data importation, search filters, reporting capabilities, and loan management, will be gathered through staff interviews and surveys.
- Non-functional requirements, including scalability, performance benchmarks, and security protocols, will be defined to address current inefficiencies like fragmented data storage and manual workflows.

2. Conceptual Design

Building on the insights from the analysis phase:

- An Entity-Relationship (ER) diagram will be developed to define the relationships among entities like records, users, and reservations. This supports requirements for data organization and consistency.
- The conceptual design will ensure the database accommodates various media types, including microfilm, maps, and audiovisual materials, aligning with the need for diverse cataloging and search capabilities.

3. Selection of DBMS

MySQL will be implemented as the database management system due to its compatibility with the library's budget and technical infrastructure:

- Its relational model will support functional requirements like advanced querying and data integrity.
- Security features such as role-based access control will address non-functional requirements, safeguarding sensitive information.

4. Logical Design

The logical design phase focuses on creating a normalized data model that supports efficient and reliable database operations:

- The Third Normal Form (3NF) schema will be employed to eliminate redundancy, enhancing system performance as specified in the requirements.
- Relational schemas and constraints will ensure consistency, supporting key functionalities such as reporting and real-time data validation.

5. Physical Design

This phase ensures the database structure is optimized for performance and scalability:

- Indexing and partitioning strategies will be implemented to fulfill performance requirements for rapid data retrieval.
- Storage planning will accommodate future data growth, ensuring scalability.

6. Prototype Development

A functional prototype will be created to showcase and validate the system's core features:

- Data entry forms, advanced search functionality, and reporting tools will directly address functional requirements.
- Guided workflows and intuitive interfaces will meet the usability and accessibility goals outlined in the non-functional requirements.
- Stakeholder feedback during this phase will refine the system to better support operational needs.

7. Performance Evaluation

Comprehensive testing will validate the system's alignment with the defined requirements:

- White-box testing will assess internal processes like data validation and indexing, ensuring performance and reliability targets are met.
- Black-box testing will simulate real-world usage scenarios, evaluating usability and user interaction with core functionalities such as searching and reporting.
- Usability testing will confirm that the system is intuitive for both library staff and external users, as specified in the requirements.

B. Solving Managerial Issues

During the execution of this project, our team encountered several managerial challenges, including resource coordination, communication, task delegation, and time management. By employing structured project management techniques and leveraging our collective skills, we successfully addressed these challenges and ensured the project met its objectives. Addressing these managerial challenges through structured processes and open communication allowed us to deliver a comprehensive, user-focused database solution. These experiences also enhanced our project management skills, equipping us with valuable insights for future endeavors.

Coordination of Team Resources

With team members balancing other coursework and responsibilities, resource allocation posed a challenge. We implemented regular team meetings and utilized project management tools like Gantt charts to assign tasks and track progress. This ensured transparency in workload distribution and allowed the team to adapt to changing availability effectively.

Communication Barriers

Clear and consistent communication was critical to our success, especially with different team members working on different tasks. We established a dedicated group Discord channel for consistent, real-time updates and used shared documents on Google Drive for collaborative work. Weekly meetings provided a platform for clarifying objectives, resolving blockers, and ensuring alignment across the team.

Task Delegation and Ownership

Early in the project, overlapping roles and unclear task ownership led to inefficiencies. To address this, we defined specific responsibilities for each member based on individual strengths and interests. For example, one member focused on database design while another specialized in interface development. This clear delineation of roles minimized duplication of effort and empowered team members to take ownership of their tasks.

Time Management

Meeting tight deadlines required meticulous planning and prioritization. We broke down the project into smaller milestones aligned with the RAD methodology, ensuring iterative progress and continuous feedback. Tools like Gantt charts were used to visualize deadlines and track deliverables, keeping us on schedule.

Quality Assurance

Ensuring the final deliverable met high standards of quality required testing and review processes. Peer reviews and group check-ins were conducted at each milestone, and testing responsibilities were rotated among team members to gain diverse perspectives. This iterative approach minimized errors and enhanced the system's functionality.

C. Comparison of Requirements vs. the Delivered System

This section provides a comprehensive comparison of the system requirements, which were identified during the planning phase, and the features implemented in the delivered system. This project aimed to modernize and improve the Collection's data management processes by transitioning from the overburdened spreadsheet workflow, to implementing a MySQL database that can better address the needs of this organization.

The comparison includes annotated web pages, emphasizing the alignment of key functionalities such as data importation, advanced search, loan management, and feedback mechanisms with the specified requirements. Each annotation identifies the requirement fulfilled. Explaining how the fulfilled requirements are implemented in the delivered system. This section highlights the key achievements of the delivered system. *For a detailed overview of how each webpage aligns with the project requirements, please refer to Appendix E14–E22.*

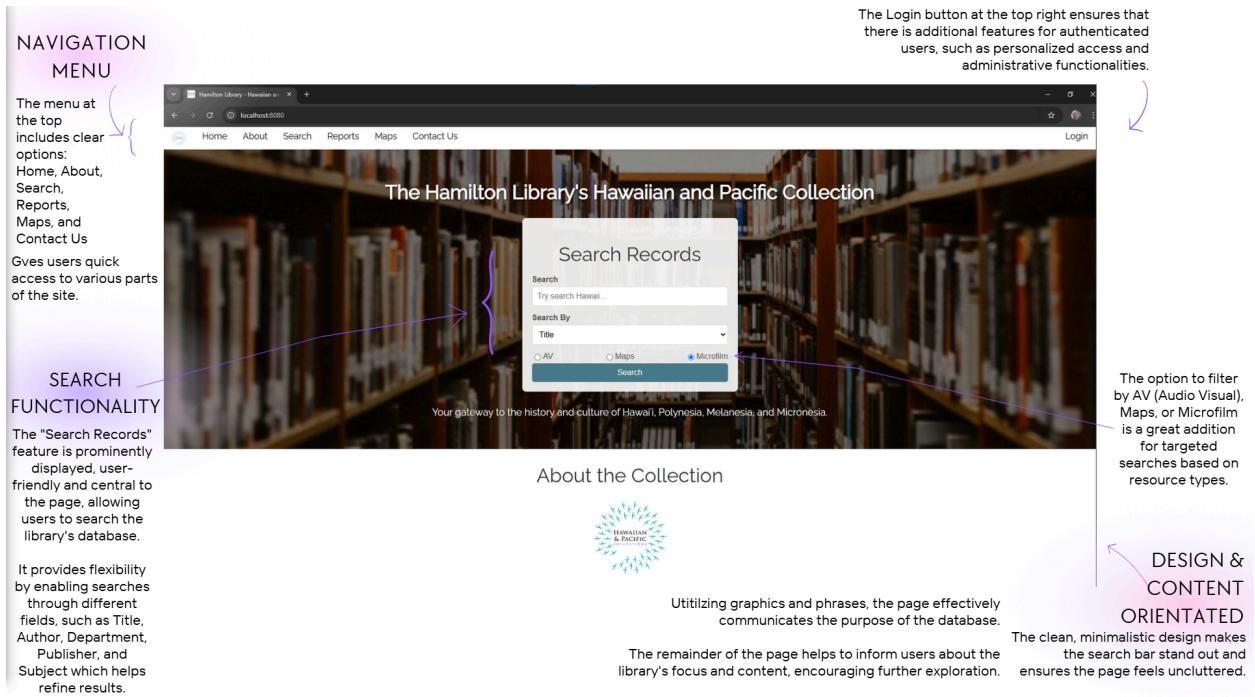


Figure E14. Annotated Navigation of Home page - Addressed requirements 3 (Advanced Search Functionality) and 8 (Requirement Met: Usability and Accessibility)

The figure displayed above serves as the central interface for users, providing access to core system functionalities, including a powerful search bar and intuitive navigation menus. The search bar supports filtering by criteria such as title, author, date, and document type, making it easy for users to locate desired resources. This directly fulfills Requirement 3 (Advanced Search Functionality) by offering an efficient and accessible way to interact with the database. The homepage's clean design and responsive layout ensure that users of all backgrounds can navigate the system effortlessly, addressing Requirement 8 (Usability and Accessibility).

Once selected, the "Request Checked" button allows users to finalize their reservation. The button visually responds (e.g., changes in size and color) when hovered over, improving interactivity.

The results are well-structured, displaying key details such as Title, Department, Year Range, Subject, Medium, and Language.

SEARCH RESULTS PAGE

Results for 'hawaii'

Showing 2 results:

- Land Management Report: Hawaii**
 - Department: Department of Land Management
 - Year Range: 2023-05-15
 - Subject: Land Usage
 - Language: English
 - Medium: Microfilm
 - Request
- Military Base Infrastructure in Hawaii**
 - Department: Department of Defense
 - Year Range: 2023-05-22
 - Subject: Defense Infrastructure
 - Language: English
 - Medium: Microfilm
 - Request

USER LOGGED-IN FEATURES

Once "Request Checked" is clicked, the selected item is added to the reservation system and logged under the user's account, where it can be viewed within their account

After logging in, the navigation bar replaces the "Login" option with "Account", providing seamless access to user details.

The Account Details Page displays Reservations, including information like Record ID, Title, Date, Department, Subject, and the current Status (e.g., "Returned").

Users can select items for reservation using the checkbox under the "Request" column.

Users can manage requests efficiently, with an option to Submit Request for additional actions

The flow from searching, reserving items, and viewing reservations is intuitive and user-friendly.

Figure E16. Annotated navigation search results and reservations - 6 (Loan and Reservation Management) and 7 (Performance)

This figure illustrates the navigation process through search results and reservation features. Users can view material availability in real-time and submit reservation requests directly from the results page. This functionality meets Requirement 6 (Loan and Reservation Management) by streamlining the borrowing process and ensuring real-time updates on material availability. Additionally, the system's optimized database structure ensures rapid query responses, fulfilling Requirement 7 (Performance).

The Report Type dropdown allows users to select from four report options:

- Location Frequency Report
- Government Agency Report
- Distribution Report
- Monthly Document Report

This provides flexibility for generating specific reports based on user needs.

Once a report type is selected, clicking the "Generate Report" button produces the corresponding report seamlessly.

The button is prominently displayed and enhances usability.

REPORT GENERATION

Enables users to generate tailored reports quickly and efficiently based on selected criteria, providing organized data for analysis and decision-making.

Department Name	Report Title	Status
Department of Agriculture	Agricultural Policies in Guam	Agriculture
Department of Agriculture	Agricultural Survey in Palau	Agriculture
Department of Agriculture	Agricultural Trends in Micronesia	Agriculture
Department of Defense	Defense Infrastructure in Palau	Defense Infrastructure
Department of Defense	Defense Infrastructure Report Guam	Defense Infrastructure
Department of Defense	Defense Infrastructure Report Palau	Defense Infrastructure
Department of Education	Educational Progress in Palau	Education Progress
Department of Education	Educational Programs in Marshall Islands	Education Progress
Department of Education	Educational Policies in Palau	Education Policies
Department of Education	Educational Systems in Chuuk	Education Systems
Department of Energy	Public Safety Facilities in Palau	Public Safety
Department of Energy	Renewable Energy in Micronesia Islands	Energy Projects
Department of Energy	Renewable Energy in Marshall Islands	Energy
Department of Health	Healthcare Development in Palau	Healthcare Infrastructure
Department of Health	Healthcare Facilities in Palau	Healthcare
Department of Health	Healthcare Facilities in Micronesia Islands	Healthcare

The clean layout and inclusion of diverse subjects highlight the report's comprehensive nature, allowing users to quickly locate and analyze records categorized by department and subject matter.

Displays data in a well-organized table format, listing the applicable columns ensuring clarity and easy readability for users.

Consistent column alignment and alternating row colors improve visual separation of records.

GENERATED REPORT CONTENT

Figure E19. Annotated navigation for report generation - Addressed Requirements: 5 (Reporting Capabilities) and 8 (Usability)

This webpage highlights the system's reporting tools, which enable library staff to generate customized reports efficiently. Users can create reports such as Document Distribution Reports, Government Contribution Reports, and Monthly Record Activity Reports, fulfilling Requirement 5 (Reporting Capabilities). The user-friendly interface ensures that staff with varying technical expertise can navigate the tools effortlessly, addressing Requirement 8 (Usability)

The table below provides a detailed summary of how the delivered system fulfills each of the identified project requirements. Each requirement is aligned with specific system functionalities, showcasing the implemented features and their role in addressing organizational needs. This comprehensive overview highlights the successful alignment between project objectives and the final system design:

Requirement	How the Delivered System Meets the Requirement
1. Data Importation	Existing records from Excel spreadsheets were imported into a centralized MySQL database. Data cleaning and validation routines were implemented to ensure consistency and eliminate duplicate or erroneous entries.
2. Data Entry and Updates	Library staff can add, edit, and update records through an intuitive web interface. Forms include input validation for fields such as title, author, publication date, geographic location, and format type.
3. Search Functionality	Advanced search capabilities are provided through the homepage's search bar. Users can filter results by criteria such as title, author, date, geographic location, and document type, fulfilling precise search needs.
4. Feedback Mechanism	An inquiry form on the "About" page and the "Contact Us" page allows users to provide feedback and suggest corrections. Submitted data is logged for review by library staff.
5. Reporting Capabilities	The system enables users to generate customizable reports, including document distribution, government contribution, and monthly activity reports. A user-friendly interface allows staff to define criteria for report generation.
6. Loan and Reservation Management	The search results page includes a reservation feature that allows users to check real-time availability and submit loan requests. Approved or rejected requests are communicated to users automatically.
7. Performance	The database uses a third normal form (3NF) schema, reducing redundancy and optimizing storage. Indexed queries ensure fast search and retrieval, even as the database scales.
8. Usability	The user interface is designed to be intuitive and accessible, with clear navigation menus, guided workflows for staff, and responsive design for users of all technical levels. Accessibility guidelines were followed to ensure inclusivity.
9. Scalability	The system is built on a scalable infrastructure, allowing for the addition of new records, document types, and user demands. The architecture supports future enhancements without performance degradation.
10. Reliability	Backup routines and error-handling mechanisms ensure data integrity. A redundant storage system prevents data loss in case of hardware or system failures.
11. Security	Role-based access control (RBAC) restricts access based on user roles. Staff can perform administrative tasks, while external users have limited access.

Figure E23: Summary of System Requirements and Their Implementation in the Delivered System

III. Results

A. Methodology and Project Management

While the project followed the principles of the Rapid Application Development (RAD) methodology, project management tools and strategies ensured accountability, communication, and timely delivery. The project adhered to a structured series of phases designed to transform the library's current Excel-based system into a dynamic database-driven solution. Each phase was integral to building upon the previous, with tasks refined iteratively based on stakeholder feedback.

1. Requirements Analysis

- What We Did: Multiple interviews, meetings, and surveys with library staff identified inefficiencies and prioritized system requirements.
- Key Tasks: Defined functional requirements (search filters, user authentication) and non-functional requirements (scalability, performance benchmarks).
- Design Choices: Incorporated stakeholder input to prioritize features like advanced search filters, user authentication, and role-based access, ensuring the system meets operational demands and provides a seamless user experience.

2. Conceptual Design

- What We Did: Developed an ER diagram to define entity relationships, such as links between users, records, and reservations.
- Key Tasks: Created a hierarchical data structure to map library materials effectively.
- Design Choices: Incorporated attributes for geographic origin and colonial versus indigenous language records to reflect unique dataset complexities.

3. DBMS Selection

- What We Did: Evaluated MySQL, PostgreSQL, and MongoDB for scalability, performance, and alignment with relational database needs.
- Key Tasks: Choose MySQL for its strong relational support.
- Design Choices: Prioritized a DBMS with a straightforward PHP integration.

4. Logical Design

- What We Did: Normalized the schema to Third Normal Form (3NF) and enforced referential integrity.
- Key Tasks: Designed schemas for records, reservations, and users with clear primary and foreign key relationships.
- Design Choices: Focused on efficiency, reducing data duplication while ensuring flexibility for diverse data queries.

5. Physical Design

- What We Did: Implemented the database structure with indexing, partitioning, and storage strategies.
- Key Tasks: Indexed fields frequently used in searches (e.g., title, author) and clustered data for faster retrieval.
- Design Choices: Incorporated regular backup routines and disaster recovery protocols to safeguard data.

6. Implementation

- What We Did: Developed a user interface using HTML, CSS, PHP, and integrated it with MySQL.
- Key Tasks: Built web pages for browsing, searching, and reserving materials.
- Design Choices: Ensured accessibility through intuitive navigation and a responsive design for varied user demographics.

7. Performance Evaluation

- What We Did: Conducted load testing to evaluate response times and system behavior under peak conditions.
- Key Tasks: Adjusted indexing strategies to optimize query performance.
- Design Choices: Addressed usability concerns identified during stakeholder testing, enhancing interface intuitiveness.

Effective project management was critical to maintaining alignment with deliverables and timelines. The team implemented agile-inspired strategies to manage tasks and track progress. By combining a structured methodological framework with adaptive project management practices, the team successfully delivered a scalable, user-friendly system that met the library's operational and user-centric goals.

- Gantt Chart Management: A Gantt chart visualizes tasks across phases, ensuring timely completion and clear accountability.
- Regular Meetings: Weekly check-ins facilitated progress reviews, addressed blockers, and reallocated resources as needed.
- Task Delegation: Responsibilities were assigned based on individual expertise. For instance, database schema design was led by members proficient in normalization, while UI development was handled by those experienced in web technologies.
- Collaboration Tools: Shared documents and a dedicated Discord channel streamlined communication and collaboration.
- Milestone Reviews: Iterative reviews ensured that each phase met its objectives, with feedback loops reinforcing continuous improvement.

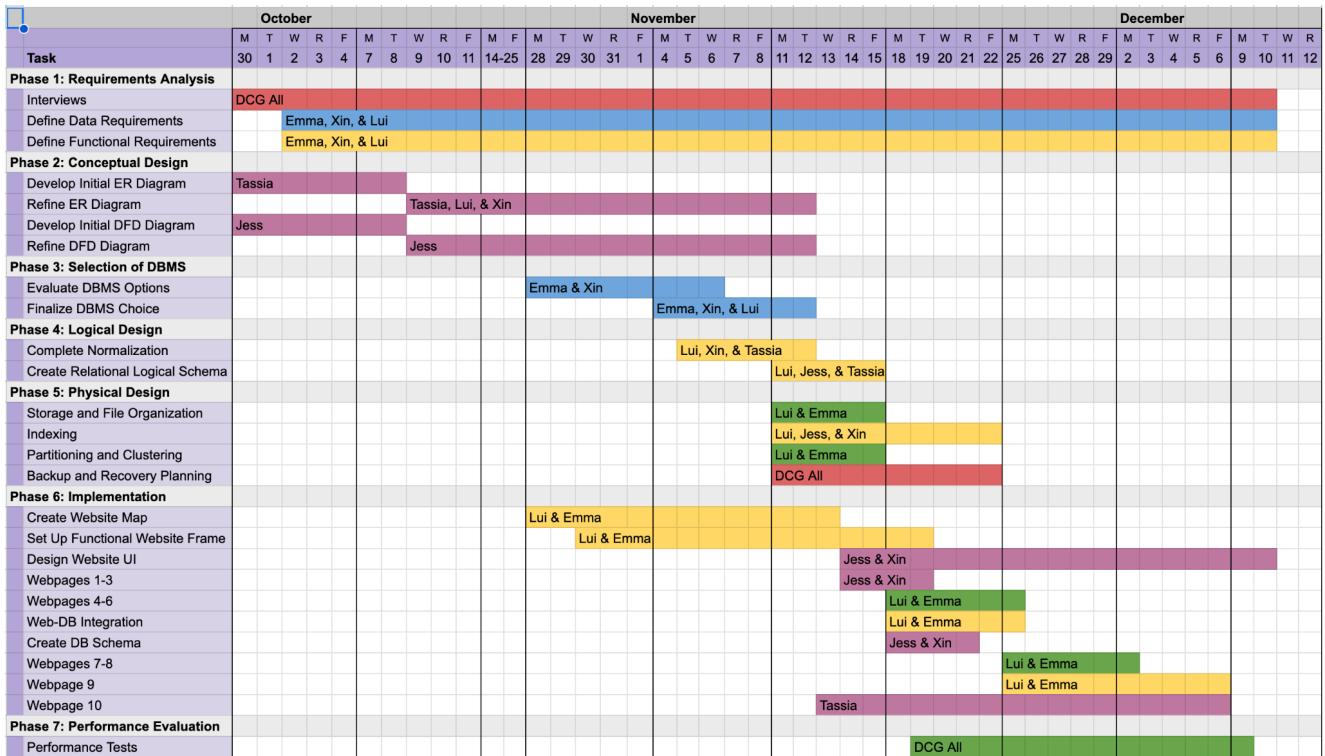


Figure A5. Project Gantt Chart

B. Requirement Analysis Results

1.0 Receiving New File Collection

A publisher, author or department gives the Hawaiian and Pacific Collection Department of the Hamilton Library a physical copy of a requested collection material (Records). The Library Staff will verify the received material's details against a checklist for completeness and accuracy. Based on the File_Info, the collection material will be assigned a unique catalog number (Record_ID) as well as a classification (Subject).

1.0 Receiving New File Collection

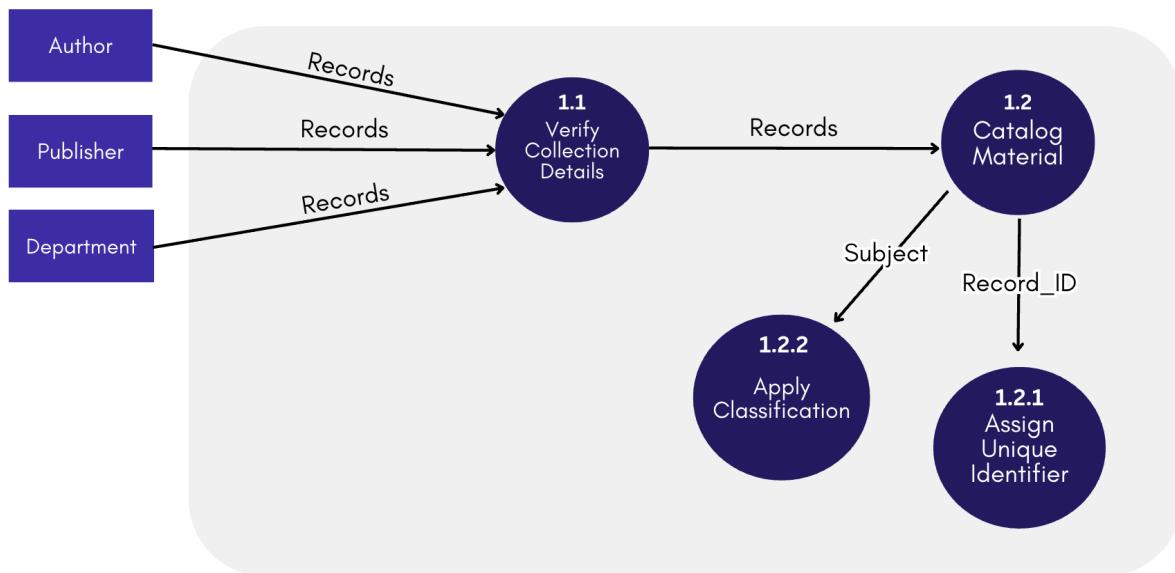


Figure A6. Logical Lower Level DFD: 1.0 Receiving New File Collection

2.0 catalog Integration

A publisher, author or department gives the Hawaiian and Pacific Collection Department of the Hamilton Library a physical copy of a requested collection material (Records). The Library Staff will extract information coming from the collection material, such as Author_ID, Publisher_ID, Department_ID, ISBN, Rights, Title, Geo_Location, Date, Medium, and Subject (File_info). The staff will also determine any Ad Hoc information, such as Location, Description, Metadata, and Language (Adhoc_Info). Once gathering all this information, the staff will determine if the data is complete and meets the database standards. If it is not complete, they will resolve any missing data (Missing_data) to complete the requirements for data entry onto the catalog. This cleaned and complete file information (CF_Info) will then be integrated onto the HPC catalog. If the data is complete, the complete file information will also be integrated onto the HPC catalog.

2.0 Catalogue Integration

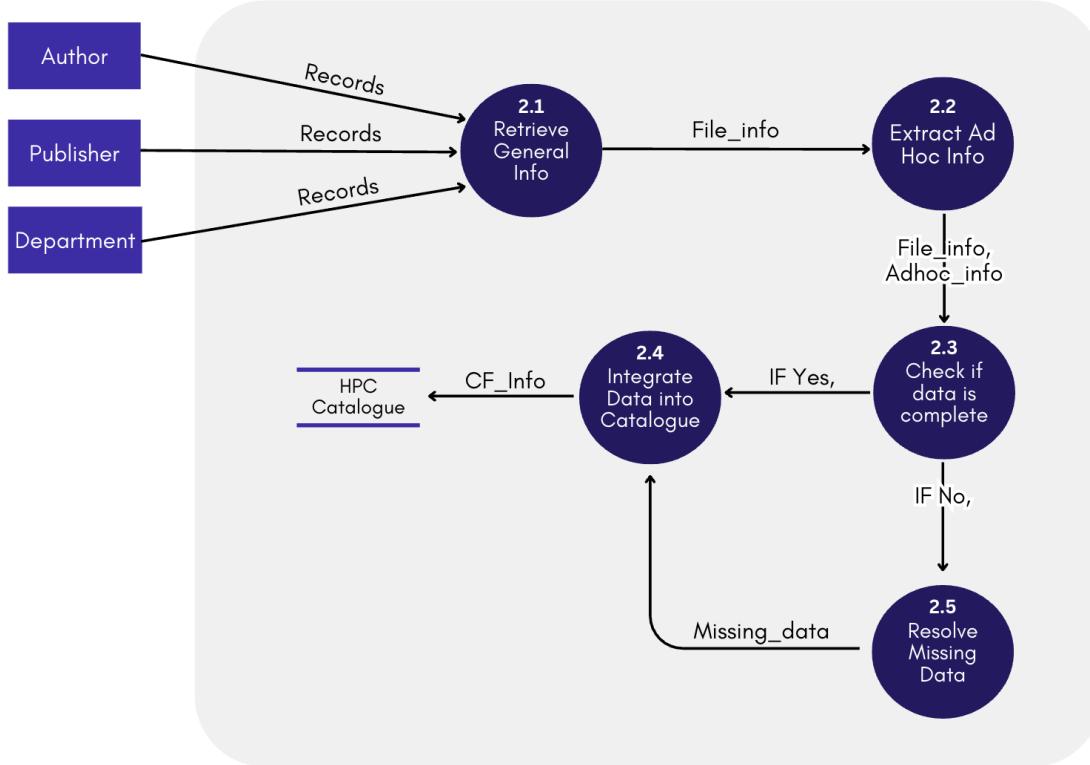


Figure A7. Logical Lower Level DFD: 2.0 catalog Integration

3.0 Loan Management & Feedback

External users now have the ability to submit requests to loan a collection material, as well as submit feedback and suggestions. Users begin by entering their User_ID to check if they have an existing account. If an account exists, the user logs in with their account credentials (Acc_info) to access the system. If no account exists, a new account is created with the necessary details (User_ID, User_Name, Account_Email, and Account_Password). Once logged in, users can send a Loan Request (Loan_req) for specific collection material. Library staff process the request by generating a loan decision email that details the approval, including the loan date, loan time, and return deadline. Additionally, the availability status (Avail_Status) of the material is updated in real-time within the HPC Catalog to reflect the loaned status.

Users also have the option to submit a Feedback Form to suggest updates to the collection data or share insights on the loan process. Submitted forms for data suggestions and are reviewed by the library staff to check for accuracy. If a suggestion is deemed valid (Suggestion_valid), the collection data is updated in the HPC Catalog to ensure accuracy and consistency. If the suggestion is invalid, the feedback form will be deleted from the database. This process ensures efficient loan management while maintaining the accuracy and reliability of the HPC collection data.

3.0 Loan Management and Feedback

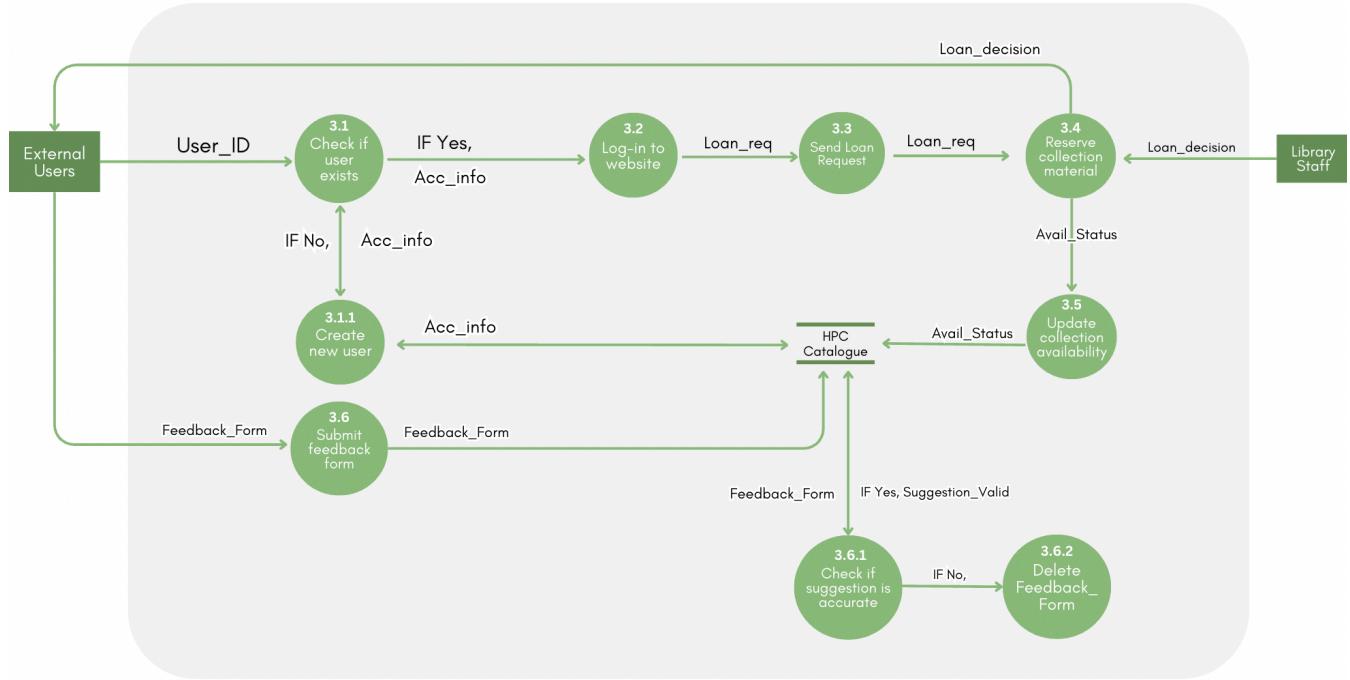


Figure A8. Logical Lower Level DFD: 3.0 Loan Management and Feedback

4.0 Generate Report

Library staff use the Hawaiian and Pacific Collection catalog to generate tailored reports for external users, including students, researchers, and government agencies. The process begins with retrieving specific data fields from the catalog (CF_Info).

The extracted data is then used to produce three distinct reports:

- Distribution Report (4.2): Generated using Geological-Origin and Language_Code, providing insights into the geographic and linguistic diversity of the collection.
- Government Agency Report (4.3): Created using Creator and Subject, focusing on materials related to or produced by government entities.
- Monthly Document Report (4.4): Compiled using TTPIAId, summarizing newly archived documents for the specified timeframe.

Once the reports are generated (D_Report, GA_Report, MD_Report), they are transmitted to the requester on the website for distribution. External users can then access these reports via the HPC website, ensuring streamlined information sharing and supporting diverse research and operational needs.

4.0 Generate Report

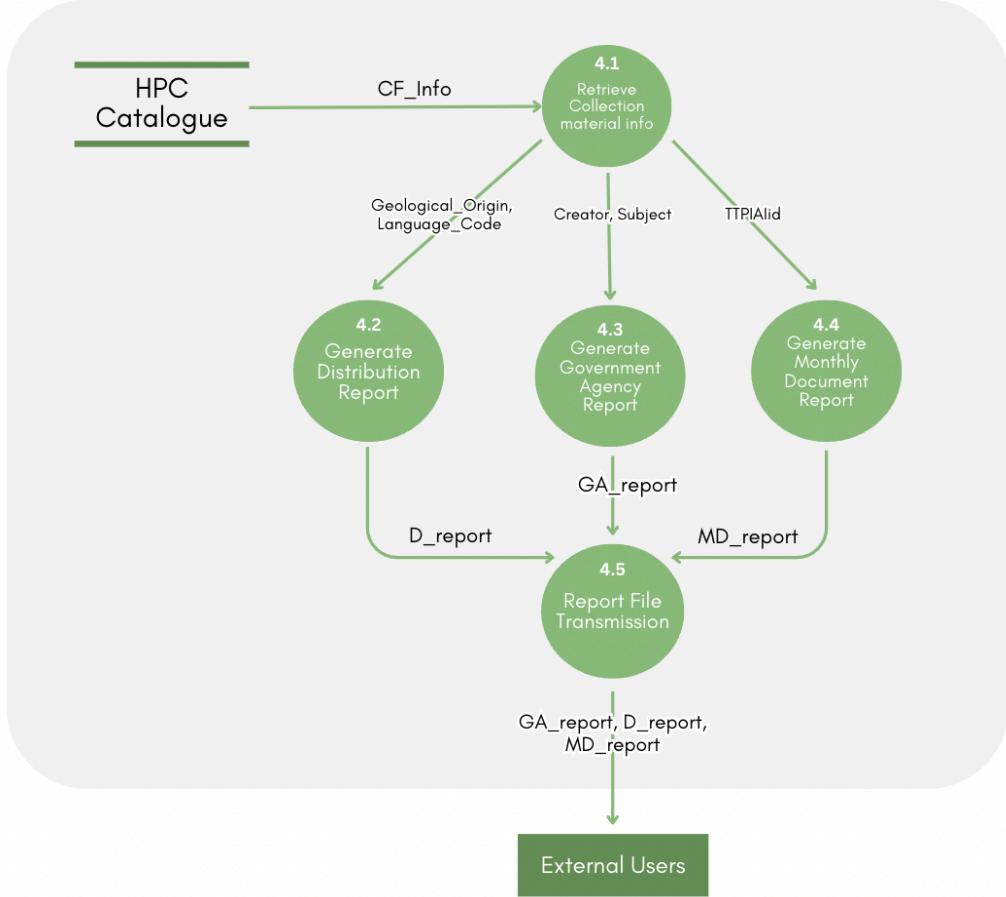


Figure A9. Logical Lower Level DFD: 4.0 Generate Report

Functional Requirements

1. Data Importation
 - a. The system will import existing records from the current Excel spreadsheets into a centralized database. This process will include data cleaning and validation to ensure consistency.
2. Data Entry and Updates
 - a. Library staff will be able to enter, update, and maintain records directly through the system's interface. This includes fields such as document title, author, publication date, geographic location, government agency affiliation, and format type (e.g., microfilm, maps, audiovisual materials).
3. Search Functionality
 - a. Users will have the ability to perform advanced searches using criteria such as title, author, date, geographic location, document type, and keywords. Filters will

allow users to refine search results by document type (e.g., microfilm, maps, or audiovisual materials) and thematic relevance.

4. Feedback Mechanism

- a. External users will be able to submit suggestions for corrections or updates to records and provide feedback on the system's usability. This functionality supports ongoing improvements and enhances data accuracy.

5. Reporting Capabilities

- a. The system will enable library staff to generate reports, including:
 - i. Document Distribution Reports: Analyze the geographic distribution of records, highlighting regions with extensive archival materials.
 - ii. Government Contribution Reports: Identify government agencies contributing to or referenced in the collection.
 - iii. Monthly Record Activity Reports: Summarize new additions to the archive for internal review or public sharing.

6. Loan and Reservation Management

- a. Users will be able to reserve materials online, with the system cross-checking availability in real-time and notifying users of approval or rejection.

Non-Functional Requirements

To ensure the success and sustainability of the database system, the following non-functional requirements are prioritized:

7. Performance

- a. The database will be designed using a third normal form (3NF) schema to eliminate redundancy and optimize storage efficiency. Queries will be indexed to ensure rapid search results, even as the database grows in size.

8. Usability

- a. The user interface will be intuitive and accessible, catering to both library staff and external users with varying levels of technical expertise. Features will include:
 - i. Clear labeling of fields and forms.
 - ii. Straightforward navigation menus.
 - iii. Guided workflows for staff performing data entry or generating reports.

9. Scalability

- a. The system will accommodate future growth, including the addition of new records, document types, and search capabilities. It will be hosted on a platform capable of handling increasing user demand and data volumes.

10. Reliability

- a. The system will incorporate backup routines and error-handling mechanisms to ensure data integrity. Redundant data storage solutions will prevent data loss in case of system failures.

11. Security

- a. Role-based access control (RBAC) will restrict database operations based on user roles.
 - i. Library staff will have administrative privileges for tasks such as data entry, editing records, and generating reports.
 - ii. External users will have limited access, allowing them to view and search records but preventing unauthorized modifications.
 - iii. Sensitive information, such as metadata related to restricted archives or private donor details, will be safeguarded through encrypted storage and controlled access.

C. Conceptual Design Results

The conceptual design of the created library management system establishes a structured framework to meet all system requirements, this ensures efficient organization, interaction, and functionality. The provided Entity-Relationship diagram captures the relationships and interactions within the system, specifically documenting the foundation of the library systems operation.

For detailed definitions and descriptions of all entities, attributes, and their respective data types, *please refer to the Data Dictionaries in Appendix B3-B9*. These appendices provide a comprehensive overview of the logical structure and attributes of the database, offering additional context for the design.

Entity Relationship Schema

The provided Entity-Relationship (ER) diagram models the new library management system in this system each librarian manages one or more reservations in the system. In this system, each user interacts with the system through an account. Each user has a unique User ID and a username. Users are responsible for creating accounts, submitting feedback, and reserving records. A user creates one account, which includes details such as Account Email and Account Password. Users generate reports based on their interactions within the system.

Each reservation links users to the records they wish to access. A reservation includes details such as Return Time, Reservation Start Date, and Reservation Status. Reservations are made by users and connected to records in the system. Each reservation is also associated with a librarian, represented by the Librarian ID.

Every record in the system has a unique Record ID, a title, a description, and metadata, including attributes like Language, Location, Geo Location, Rights, Medium, Date, Subject,

ISBN, and Metadata. Records are created by authors and published by publishers. In addition, records are initialized and overseen by a specific department.

Each author is responsible for creating one or more records. An author has a unique Author ID, a name, an email, an affiliation, and a description. Authors play a role in producing content for the system. Since authors create one or more records, the Author Table is necessary to establish and maintain this relationship. This ensures that the system can track which authors are responsible for specific records. Similarly, each publisher is responsible for publishing one or more records. A publisher has a unique Publisher ID and a Publisher Name.

Departments play a role in organizing and managing records. Each department initializes one or more records and has a unique Department ID, a department name, a department address, a country, and a description. The country attribute in the Department Table is critical for identifying which government each department belongs to, ensuring proper categorization and compliance with jurisdictional requirements. Departments ensure proper oversight and organization of records.

The system also supports feedback from users. Feedback includes a unique Feedback ID, Feedback Data, and a Feedback Date. Users submit feedback on records they interact with, making sure our company can continue to improve the system.

Finally, Reports are generated by users. Each report has a unique Report ID, a Generation Date, and Report Data. Reports capture user interactions, reservations, and feedback, providing essential insights into the system's usage.

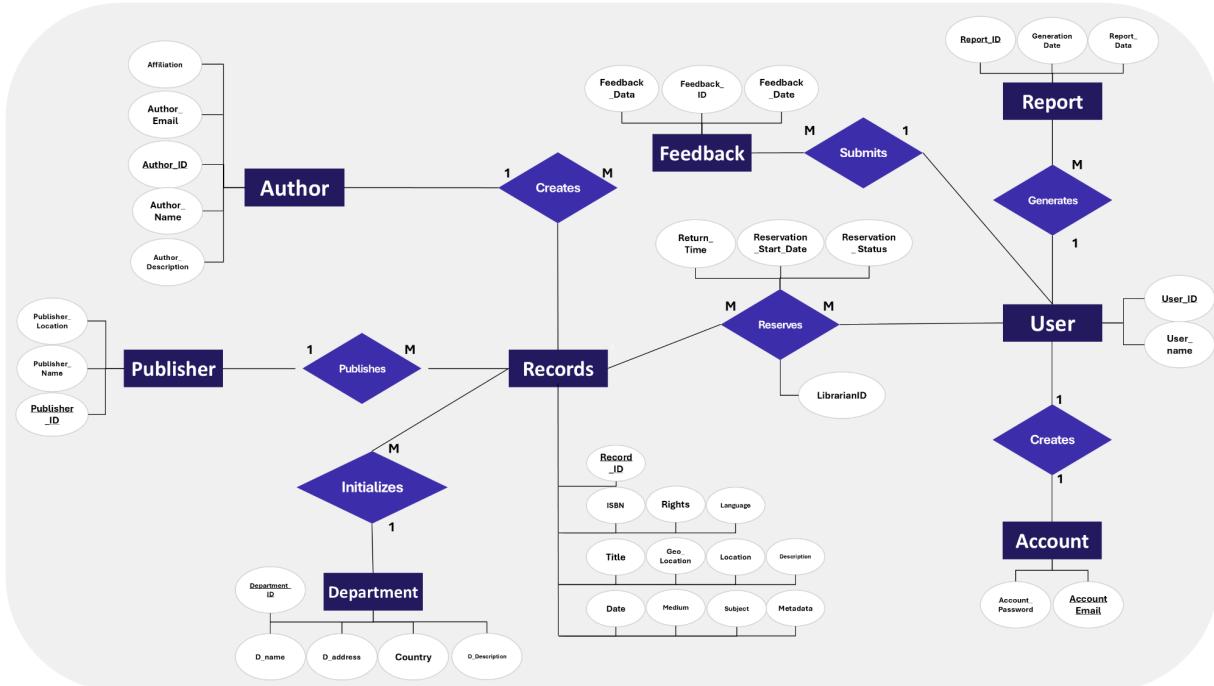


Figure B1. Entity Relationship Diagram

Design Considerations

The design of the library management system was meticulously crafted with scalability, efficiency, and user-friendly functionalities as key considerations. The goal of conceptual design was to maintain data integrity and minimize redundancies. Relationships were crafted to model real-world interactions. Including users creating accounts, making reservations, and submitting feedback. These relationships, defined with clear cardinalities, ensure the system effectively supports business processes. The schema was normalized to the Third Normal Form (3NF) to minimize redundancy, improve data integrity, and optimize storage. For instance, metadata attributes like language and ISBN are stored only within records, and user information resides in a dedicated table linked to reservations and feedback via foreign keys. These choices were made to ensure data consistency and efficient maintenance while improving any potential future scalability.

The addition of normalization also enhances the system's performance and usability by streamlining data organization and retrieval. Queries such as fetching reservations by users or feedback for specific records are now optimized through the schema structure. Indexing strategies and the use of unique identifiers further improve query efficiency. Additionally, the design aligns with both functional and non-functional requirements, supporting key operations like secure user login, record management, and reporting. Challenges, such as managing complex relationships between authors, publishers, and records, were addressed with well-defined constraints and cardinalities. These design considerations provided a scalable yet maintainable foundation, ensuring the system is prepared for the logical and physical design phases while supporting library operations and long-term enhancements.

D. DBMS Evaluation and Results

For the Hamilton Library database project, MySQL was selected as the optimal Relational Database Management System (RDBMS) to address key requirements related to data organization, scalability, integrity, accessibility, and security. This decision was made after analyzing the library's needs and evaluating available database options.

MySQL's open-source nature makes it cost-effective, aligning well with the library's budget constraints. Unlike proprietary systems, it allows funds to be directed toward collection expansion and enhanced user services. Additionally, MySQL's relational schema is well-suited for organizing the library's diverse collections, replacing the current spreadsheet-based system. By structuring data into tables with primary and foreign keys, MySQL ensures efficient organization and data integrity, resolving issues related to redundancy and inconsistent record connections.

For long-term scalability, MySQL offers flexible table structures and indexing, allowing the database to grow in size and complexity without significant disruptions. This adaptability supports the library's expansion plans. Moreover, MySQL's support for SQL querying enables library staff to perform complex searches and generate ad hoc reports, improving data retrieval efficiency and simplifying access for users with varying technical skills.

To protect sensitive archival materials, MySQL provides strong security features, including role-based access control and encryption. These features ensure that only authorized personnel can view or modify restricted data, maintaining privacy and data integrity.

When compared to other options such as PostgreSQL, Oracle, and MongoDB, MySQL stands out as the most practical solution for Hamilton Library. It offers the best balance of affordability, ease of use, scalability, data organization, and security, making it the ideal choice to support the library's operational needs and future growth.

DBMS	Type	License	Best For	Key Features	Limitations
MySQL	Relational	Open-source	Small to medium businesses	User-friendly, scalable, strong community support, fast querying, and low cost	Limited to SQL, some advanced features paid-only
Oracle	Relational	Proprietary	Large enterprises	Autonomic management, multi-model support, high security, enterprise-level features	High cost, complex setup for smaller institutions
PostgreSQL	Object-Relational	Open-source	All sizes	Inheritance (object-oriented), supports complex queries, highly customizable	Performance can be slower on very large datasets
Microsoft SQL Server	Relational	Proprietary	Medium to large businesses	Seamless integration with Microsoft products, strong reporting services	Expensive licensing, limited flexibility for non-MS platforms
MongoDB	Document-Oriented (NoSQL)	Open-source	All sizes	Handles unstructured data, highly flexible and scalable, schema-less	Not ideal for structured data or SQL queries

Table C1. Database Management System Comparative Chart

By comparing these factors, MySQL emerges as the conclusively best-suited DBMS for the Hawaiian and Pacific Collection—providing a comprehensive solution for their database needs. It balances cost-efficiency, ease of use, scalability, data integrity, and security, making it the ideal choice for managing and expanding the library's vast and varied collections. Satisfying

the required functionality, performance, and scalability required while remaining within budget constraints.

Requirement	MySQL	PostgreSQL	MongoDB	Oracle	Microsoft SQL Server
Data Organization and Structure	5	4	3	4	4
Data Integrity and Consistency	5	5	4	4	5
Scalability and Flexibility	4	5	5	3	4
Query Capability and User Accessibility	5	4	3	4	5
Security and Access Control	5	4	3	4	5
Total	24	22	18	19	23

Table C2. Database Management System Evaluation Matrix

Each score, 5 being the highest and 1 being the lowest, reflects the suitability of the DBMS for Hamilton Library's needs. MySQL excels in structuring relational data, making it ideal for managing the library's diverse collections, such as maps, audiovisual materials, and microfilm, while ensuring seamless connections between entities like departments, users, and reservations. Its relational schema and referential integrity minimize errors and maintain data consistency, effectively addressing the library's current fragmented spreadsheets. Though PostgreSQL and MongoDB offer strong scalability, MySQL's balance of flexibility and user-friendliness positions it as the most practical option for the library's expanding data needs.

Additionally, MySQL's straightforward query language enables complex searches and ad hoc reporting, improving accessibility for both staff and external users. Security features, including encryption and role-based access controls, ensure that sensitive data remains protected. Overall, MySQL's superior performance across these criteria makes it the best-suited DBMS for Hamilton Library, offering a cost-effective, scalable, and secure solution tailored to both current inefficiencies and future growth.

E. Logical Design Results

The database for the Hawaiian and Pacific Collection was designed using a mixed approach, combining normalization principles with selective denormalization where necessary. This approach ensures the database is both logically sound and efficient in terms of retrieval and operational performance. The emphasis on normalization during the logical design phase was critical to achieving data consistency, reducing redundancy, and preserving data integrity, while denormalized elements were applied strategically to address potential performance challenges.

Normalization Justifications

The database schema was normalized to the Third Normal Form (3NF) to ensure data integrity, eliminate redundancy, and improve efficiency in data retrieval and maintenance. This approach involves breaking down large tables into smaller, related tables, each with a clear relationship to others, as demonstrated in the updated schema.

1. Redundancy Elimination
 - a. The Record table serves as the central repository for collection metadata, holding attributes like Title, Language, and Subject. Related entities such as Author, Publisher, and Department were separated into individual tables. For instance, author information (like Author_Name and Affiliation) was stored in the Author table and referenced in the Record table via a foreign key—eliminating the need to duplicate author details across multiple records. This also simplifies updates, such as when an author's affiliation changes.
2. Foreign Key Relationships
 - a. Foreign keys were used to establish relationships between tables and maintain referential integrity:
 - i. Author_ID in the Record table references the Author table.
 - ii. Publisher_ID links the Record to the Publisher table.
 - iii. User_ID in the Feedback and Report tables links to specific users.
3. Many-to-Many Relationships
 - a. The Reserves table handled the many-to-many relationship between users and records. It used a composite primary key made up of User_ID and Record_ID—ensuring each reservation entry was unique while linking users and records.
4. Functional Dependency Compliance
 - a. Each table was designed to have attributes fully dependent on its primary key:
 - i. In the Record table, attributes like Title and ISBN depend solely on Record_ID.
 - ii. In the Publisher table, Publisher_Name and Publisher_Location depend only on Publisher_ID.
5. Logical Organization and Modularity
 - a. The modular structure allows for easy updates and scalability. For instance, adding a new department only requires updates in the Department table. The Feedback table handles user feedback separately from the Record and Account tables—preserving their integrity.
6. Performance Optimization
 - a. Denormalization was deferred to the physical design phase to prioritize a logical schema at this stage. To improve query efficiency, views were created during the physical design phase:

- i. A view combining Record, Reserves, and Account tables was created to simplify reporting on loan activities.
 - ii. Another view consolidated Author, Publisher, and Record data for easier metadata analysis.
7. Enhanced Security and Access Control
- a. Sensitive data, such as Account_Password, was stored in the Account table separately from other tables, ensuring better security. The Account_Email was used to link user credentials to their respective accounts.
8. Future Scalability
- a. The design is scalable, allowing for the easy addition of new attributes (e.g., Author_Nationality) or features (e.g., automated feedback reports) without affecting other parts of the system.

In conclusion, the design of the database achieves a balance between normalization for data integrity and performance considerations for practical use. By leveraging a mixed approach, the database is powerful enough to handle complex relationships while remaining user-friendly for retrieval and reporting purposes. The incorporation of views in the physical design phase ensures that the system can meet operational needs without compromising the logical structure established during the design process. This approach provides a strong foundation for the database to support the library's collection management and user access requirements.

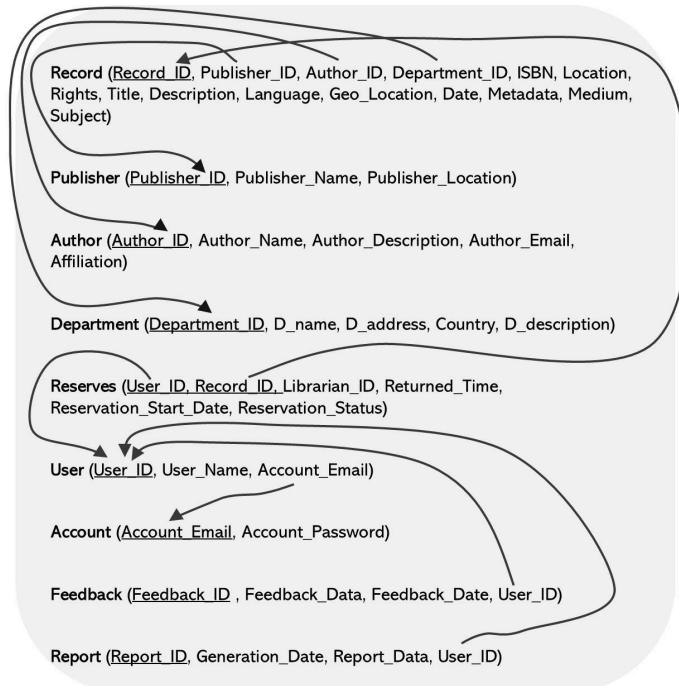


Figure D1. Relational Logical Schema

F. Physical Design Results and Implementation

The database system prototype implemented includes critical design considerations such as storage-level decisions, index design, and the implementation of special indexes to optimize performance. Additionally, various components such as forms, canned queries, reports, and security measures have been developed to meet the outlined requirements.

Storage-Level Decisions and Index Design

The storage-level decisions and index design were primarily determined using MySQL. MySQL employs a B-tree structure for indexing, which efficiently supports data retrieval and enhances query performance. Key attributes across the database tables index on primary keys to ensure fast lookups and maintain data uniqueness, as well as on foreign key constraints to support referential integrity and optimize query performance.

Performance Optimization through Subqueries and Views

Subqueries and views were strategically implemented to streamline complex query execution and improve performance.

Views: A read-only view was created to simplify our most frequently searched query (a search for records):

```
CREATE VIEW Record_Summary AS
SELECT r.Record_ID, r.Title, r.Medium, r.Date, p.Publisher_Name, d.D_name AS
Department_Name
FROM Record r
JOIN Publisher p ON r.Publisher_ID = p.Publisher_ID
JOIN Department d ON r.Department_ID = d.Department_ID;
```

Subqueries: Optimized subqueries were used to minimize unnecessary data scans, particularly in performance-critical areas. This was especially important when searching for records reserved by users who provided feedback in 2024 or generated reports in 2024.

Feedback in 2024 (Subquery)

```
SELECT r.Record_ID, r.Title, r.Medium, r.Date
FROM Record r
WHERE r.Record_ID IN (SELECT DISTINCT f.Record_ID
                      FROM Feedback f
                      JOIN Reserves res ON f.User_ID = res.User_ID
                      WHERE f.Feedback_Date LIKE '2024%');
```

Reports in 2024 (Subquery)

```
SELECT r.Record_ID, r.Title, r.Medium, r.Date
```

```

FROM Record r
WHERE r.Record_ID IN (SELECT DISTINCT res.Record_ID
                      FROM Report rep
                      JOIN Reserves res ON rep.User_ID = res.User_ID
                      WHERE rep.Generation_Date LIKE '2024%');

```

See Appendix E1.2 for JOIN versions of the above queries.

Analyzing both of the above queries, the internal memory requirement is 39 for both. Using JOIN instead of subqueries, brings the internal memory requirement to 360 for each. This huge reduction in memory is one of the ways DCG has improved the performance of the system. The number of operations using subqueries is 63 for both and 1080 for both when using JOINS. The graph below illustrates this.

Calculation	Type	Reports & Feedback queries
Internal Memory	Subquery	39
	JOIN	360
Number of Operations	Subquery	63
	JOIN	1,080

Table

E1.1.

Internal Memory and Number of Operations Results

See Appendix E1.3. for a detailed breakdown of the calculations supporting these figures.

System Components

The implemented system directly addresses the library's functional and non-functional requirements through the following components:

- **Database:** Designed with structured tables, relationships, primary/foreign keys, and indexed attributes to meet data importation, performance, and scalability requirements.
- **Forms:** User-friendly forms enable data entry and updates by library staff and facilitate the feedback mechanism for external users.
- **Canned Queries:** Predefined SQL queries support search functionality by efficiently retrieving data based on the location clicked on from a map. *See Appendix E.*
- **Parameter Queries:** Queries support search functionality by efficiently retrieving data based on user input. Specifically, users are able to search for records based on fields such as Title, Author, and Subject. *See Appendix E.*
- **Ad Hoc Queries:** Admin users are able to access an Ad Hoc query portal where they may search with any query.

- **Reports:** Reporting capabilities address the requirement for document distribution reports, government agency reports, and monthly record activity reports, providing insights for staff and stakeholders. *See Appendix E.*
- **Security Measures:** Role-based access control (RBAC), password encryption, and secure authentication fulfill the security requirement by ensuring authorized access and protecting sensitive information.

System Operations

A user manual has been included to guide end-users through the database functionalities, covering:

- Data entry, query execution, and report generation.
- Troubleshooting and system maintenance guidelines.

UI Specifications and Web-Enabled Features

To meet the library's requirement for an intuitive and accessible system, special features, including UI enhancements and web-enabled functionalities using JavaScript, were implemented to enhance interactivity and user experience. These features include:

- Dropdown menus and dynamic forms.
- Report generation functionalities linked to an HTML frontend, with form submission actions directing to server-side query execution.
- Web-enabled features that allow users to access reports and system data via a browser interface.

Data Conversion

To meet the library's requirement of preserving and integrating existing records, DCG implemented efficient data conversion mechanisms to ensure a seamless migration. Existing data was cleaned, formatted, and imported into the new database, eliminating the need for reentry.

System Codes and Deliverables

The full system codes, including database scripts, UI components, and web-enabled features include:

- JavaScript and HTML code for web interfaces.
- Backend query optimizations.

This comprehensive implementation ensures the system is performant, secure, and user-friendly while meeting all functional and non-functional requirements.

G. Performance Evaluation Results

To ensure the database system performs as intended, the team conducted white-box testing by executing specific queries to validate the system's functionality and reliability. This

process involved verifying whether the code meets its requirements and assessing the database's ability to handle diverse queries.

Test Case 1: Retrieving Records Donated by the Department of Education

- Objective: Verify that the database correctly retrieves all records donated by the Department of Education.
- Query:

```
SELECT *
FROM `Record` AS R, `Department` AS D
WHERE D.Department_ID = R.Department_ID
      AND D.D_name = 'Department of Education';
```
- Result: The query successfully returned all matching records, confirming the database's ability to filter by donor name.

Record_ID	Author_ID	Publisher_ID	Department_ID	ISBN	Location	Rights	Title	Description	Language	Geo_Location	Date	Metadata	Medium	Subject	Department_ID	D_name	D_address	Country	D_description
R00000005	A00000005	P00000005	D00000005	ISBN-3344556677	Public Library, Pohnpei	Public Domain	Educational Facilities in Pohnpei	Study of schools and educational facilities in Pohnpei...	English	Pohnpei	2023-03-20	Metadata Completed	Microfilm	Education Facilities	D00000005	Department of Education	321 Liliuokalani Ave, Honolulu, HI	USA	Oversees education policies and public schools.
R00000015	A00000001	P00000005	D00000005	ISBN-3344556688	Education Office, Chuuk	Open Access	Educational Systems in Chuuk	Analysis of education systems and school facilities...	English	Chuuk	2023-08-30	Updated Metadata	AV	Education Systems	D00000005	Department of Education	321 Liliuokalani Ave, Honolulu, HI	USA	Oversees education policies and public schools.
R00000025	A00000005	P00000005	D00000005	ISBN-5005000005	Education Office, Marshall Islands	Open Access	Educational Programs in Marshall Islands	Report on educational outreach and programs.	English	Marshall Islands	2023-05-01	Updated Metadata	AV	Education Programs	D00000005	Department of Education	321 Liliuokalani Ave, Honolulu, HI	USA	Oversees education policies and public schools.

Figure E2. SQL Query Test 1: Retrieving Records Donated by the Department of Education

Test Case 2: Retrieving all loans on June 22, 2023

- Objective: Verify that the database correctly retrieves all loans with a start date of June 22, 2023
- Query:

```
SELECT *
FROM `Reserves`
WHERE Reservation_Start_Date = '2023-06-22';
```
- Result: The query successfully retrieved all records reserved for the specified date, demonstrating accurate date filtering.

User_ID	Record_ID	Librarian_ID	Returned_Time	Reservation_Start_Date	Reservation_Status
U00000003	R00000003	U00000004	NULL	2023-06-22	Pending

Figure E3. SQL Query Test 2: Retrieving all loans on June 22, 2023

Test Case 3: Querying Records for an Island Not in the Database

- Objective: Test the database's response when searching for a non-existent geographical location.
- Query:

```
SELECT *
FROM `Record`
WHERE Geo_Location = 'Vanuatu';
```
- Result: The query returned 0 results, indicating the database correctly handles non-existent entries without errors.

MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)

```
SELECT * FROM `Record` WHERE Geo_Location = 'Vanuatu';
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Record_ID Author_ID Publisher_ID Department_ID ISBN Location Rights Title Description Language Geo_Location Date Metadata Medium Subject

Figure E4. SQL Query Test 3: Querying records for an island not in the database

Black-box testing focused on simulating real-world user interactions to verify that the system delivers accurate results, handles data efficiently, and remains responsive under various conditions.

Test Case 1: Log-in Functionality

- Objective: Verify users can securely log into the system without errors.
- Result: The log-in process functions seamlessly, granting users secure access to their accounts.

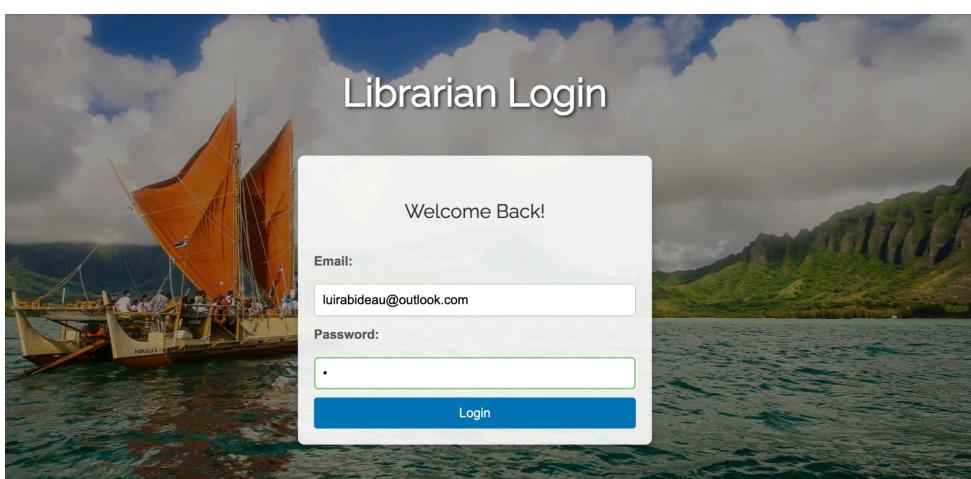


Figure F1. External User Log-in Portal

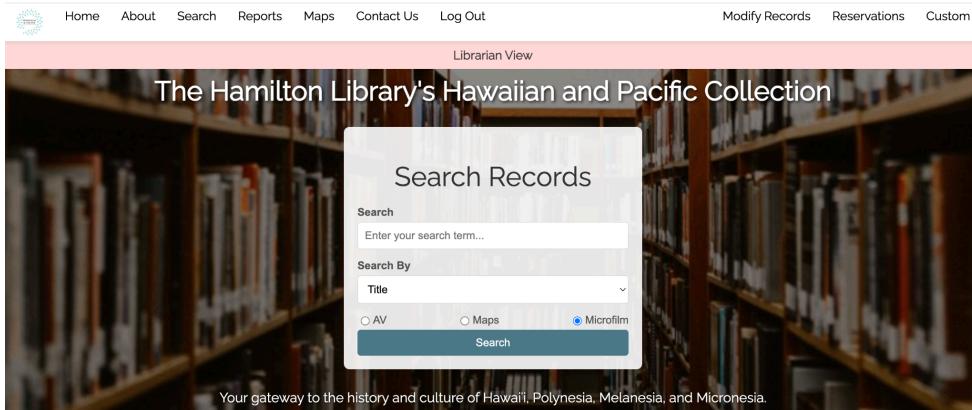


Figure F2. Librarian Log-in Portal

Test Case 2: Searching the Catalog

- Objective: Test the system's ability to display accurate search results based on specific queries.
- Result: Search results are accurate but currently limited to showing a maximum of 10 records at a time, indicating an area for scalability improvements.



Figure F3. Home page search navigation

The screenshot displays the search results for the query 'HAWAIIAN'. At the top, it says 'Showing 10 result(s.)'. Below that is a teal header bar with the text 'Request Checked'. The main content area has a blue header box containing the title 'Hawaiian dredging and construction Corp. (application for permit to do business in Palau)'. To the right of the title are filters: 'Year Range: 1973-1975', 'Medium: Record', and a 'Request' checkbox. Below the title are detailed item descriptions: 'Department: Department of Resources and Development, Foreign Investment', 'Subject: economic development commerce and industry cooperatives\$\$immigration and emigration entry reentry requests and permits\$\$public works construction maintenance and repairs', 'Language: eng', and 'Includes correspondence.'.

Figure F4. catalog search results

Test Case 3: Submitting Loan Requests

- Objective: Confirm users can request to loan collection materials and receive confirmation.
- Result: Loan requests are processed successfully, with confirmation emails sent automatically.

Test Case 4: Library Staff Tools

- Objective: Ensure library staff can update material information and generate reports without issues.
- Result: Staff functions work as intended, supporting material edits and efficient report generation.

The screenshot shows a web-based application interface for library staff. At the top, there is a navigation bar with links: Home, About, Search, Reports, Maps, Contact Us, Log Out, Modify Records, Reservations, and Custom. Below the navigation bar, a pink header bar says "Librarian View". The main content area has a title "Modify Records". Underneath, there is a form titled "Select Action:" with a dropdown menu showing "Select an action". The form contains several input fields for modifying record details, such as Record ID, Title, Alt Title, Digital File Name, Department Name, Creator, Description, Medium (with a dropdown "Select Medium"), Language, Rights, Year Range, Subject, Geographic Location, Map Number, Location, Containers Info, Cabinet, File Folder, Reel Format, and NULL fields. A "Submit" button is located at the bottom of the form.

Figure F5. Librarian dashboard for modifying records

The screenshot shows a web-based application interface for library staff. At the top, there is a navigation bar with links: Home, About, Search, Reports, Maps, Contact Us, Log Out, Modify Records, Reservations, and Custom. Below the navigation bar, a pink header bar says "Librarian View". The main content area has a title "Reservations". There is a table with columns: Reservation ID, Account ID, Start Date, Status, Fulfilled Date, and Change Status. A "Save Changes" button is located at the bottom of the table.

Figure F6. Librarian dashboard for managing reservations

The screenshot shows a top navigation bar with links: Home, About, Search, Reports, Maps, Contact Us, Log Out, Modify Records, Reservations, and Custom. Below this is a pink header bar labeled 'Librarian View'. The main content area has a title 'Run a Custom SQL Query' and a sub-instruction 'Enter your SQL code below to query the database:'. A text input box contains the following SQL code:

```
SELECT *  
FROM records  
WHERE Department_name = 'Department of Education';
```

Below the input box is a 'Run Query' button.

Figure F7. Librarian dashboard for pulling customized SQL requests

The results of both White-Box and Black-Box testing demonstrate the effectiveness and reliability of the database system in fulfilling its intended functions. White-Box Testing revealed that the system performs queries accurately and efficiently, ensuring that all modules process data as expected. For instance, queries targeting specific attributes, such as records from the Northern Mariana Islands or specific loan dates, worked successfully, and invalid queries were correctly rejected. This indicates that the database is able to meet data integrity standards.

Black-Box Testing validated the system's usability and functionality from the perspective of end users. The log-in feature operates seamlessly, catalog searches produce accurate results—although showing a display limit of 10 records—and the loan request process is functional, including the automated email notification. Additionally, library staff successfully accessed advanced functionalities like editing material information on the website directly and generating reports. These results showcase how the database system not only meets current requirements but also delivers a user-friendly experience for both library staff and external users. Areas for improvement, such as addressing the record display limit in search results, provide a roadmap for further refinement to enhance system performance and usability.

Usability Study Results

To evaluate the success and performance of the implemented DBS, a usability survey was conducted to assess key aspects such as system features, user satisfaction, and areas for improvement. The survey included a combination of ratings and open-ended questions to capture detailed feedback and identify future requirements.

Hawaii and Pacific Collection Usability Survey

Hi, Jessica. When you submit this form, the owner will see your name and email address.

* Required

- What is your role at the library (e.g., staff, administrator, researcher, user)?

Enter your answer

- How often do you use the current system to manage or retrieve information? *
 Daily
 Weekly
 Monthly
 Rarely
 Never

*Figure F8. Usability Survey
See Appendix F8 for further details.*

Survey Questions

- What is your role at the library (e.g., staff, administrator, researcher, user)?
 - Purpose: To identify the respondent's relationship with the library system and their specific needs or expectations based on their role. This helps in tailoring the system to accommodate diverse user groups.
- How often do you use the current system to manage or retrieve information?
 - Purpose: To gauge user engagement and familiarity with the existing system, providing insights into the level of reliance on digital tools for daily operations.
- How easy is it to navigate the proposed system?
 - Purpose: To assess the intuitiveness of the new system's design and its ability to meet user expectations for seamless navigation.
- Which features or sections of the system are the most intuitive to use?
 - Purpose: To identify strengths in the system's design, highlighting areas that align well with user needs and expectations.
- Were there any features or sections that you found confusing or hard to navigate?
 - Purpose: To pinpoint usability challenges and areas requiring refinement for improved user experience.
- Did you encounter any technical issues while using the system (e.g., loading time, broken links)?
 - Purpose: To uncover potential technical flaws or inefficiencies that could hinder system performance or user satisfaction.

7. How accessible do you find the system in terms of design and functionality (e.g., font size, layout, responsiveness)?
 - Purpose: To evaluate the system's compliance with accessibility standards, ensuring inclusivity for users with varying needs.
8. How satisfied are you with the overall usability of the system?
 - Purpose: To measure general user satisfaction, providing an overarching view of the system's success in meeting user expectations.
9. How likely are you to recommend this system for library operations?
 - Purpose: To determine the perceived value and practicality of the system in a professional setting, indicating its potential for adoption.
10. Do you feel the system requires additional training or resources to use effectively?
 - Purpose: To identify gaps in user education or support that could affect the system's implementation and usability.
11. What additional features or improvements would you suggest for the system?
 - Purpose: To gather constructive feedback and ideas for enhancing the system's functionality and addressing unmet user needs.

Key Findings

The usability study provided valuable insights into the strengths and areas for improvement of the library's website. Overall, users appreciated its intuitive design, efficient search functionality, and accessible interface, which catered to diverse roles and usage needs. However, feedback highlighted specific areas for enhancement, such as refining visual elements, providing clearer instructions for advanced features, and improving navigation on certain pages. These findings informed recommendations aimed at creating a more seamless and user-friendly experience while addressing the varied requirements of staff, researchers, and general users.

Strengths

1. Landing Page and Search Functionality
 - The landing page's main search bar was praised for its intuitive design—receiving an overall rating of 4 out of 5. Users commended its seamless navigation and straightforward focus, which allowed them to quickly locate desired resources.
2. Accessibility and User Interface
 - The website's accessibility features, including font size, layout, and interface responsiveness, were highly rated by both staff and researchers. Many users emphasized the inclusivity and user-friendly nature of the design—catering to a broad range of accessibility needs.
3. Categorization and Dashboard Features
 - The categorized menu for resource types, along with librarian-specific dashboards, were frequently highlighted as valuable tools. These features

introduced access to essential functions such as borrowing history, record management, and renewal processes—streamlining workflows for users.

4. Design and Navigation

- The homepage design stood out for its simplicity and ease of navigation. Users appreciated the logical layout, which made locating contact information and suggestion forms straightforward and efficient.

Weaknesses

1. Map Page Enhancements

- Feedback indicated that the map page could benefit from increased clarity. Users recommended greying out non-selectable regions to reduce visual clutter and make the interface more intuitive. Additionally, they suggested including instructions to help users navigate and understand the map's purpose.

2. Spacing and Layout

- Inconsistencies in the spacing between the "Map," "AV," and "Microfilm" sections were noted for improvement. Adjustments to the layout were proposed to improve the visual flow and usability.

3. Advanced Features Training

- Some users found the custom query features challenging due to the requirement of SQL knowledge. Suggestions included the development of instructional guides or simplified query-building tools to make these features more accessible to all users.

2. How often do you use the current system to manage or retrieve information?

● Daily	4
● Weekly	0
● Monthly	2
● Rarely	2
● Never	0

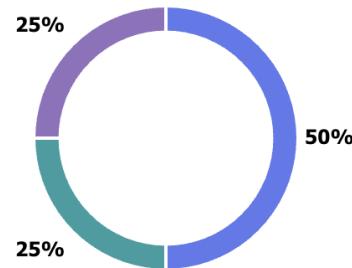


Figure F9. Usability Survey: Question 2 Results

3. How easy is it to navigate the proposed system?

[More details](#)

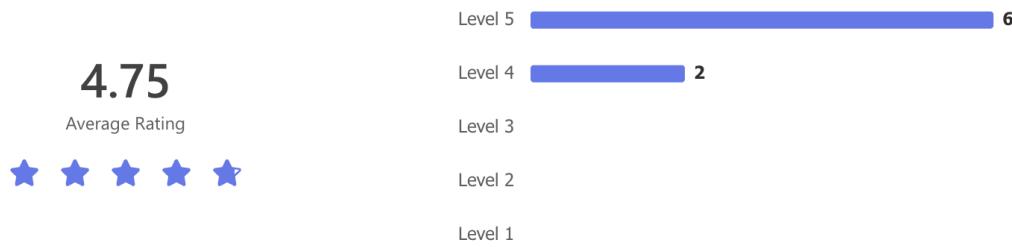


Figure 10. Usability Survey: Question 3 Results

7. How accessible do you find the system in terms of design and functionality (e.g., font size, layout, responsiveness)?

[More details](#)



Figure 11. Usability Survey: Question 7 Results

8. How satisfied are you with the overall usability of the system?

[More details](#)



Figure F12. Usability Survey: Question 8 Results

9. How likely are you to recommend this system for library operations?

[More details](#)

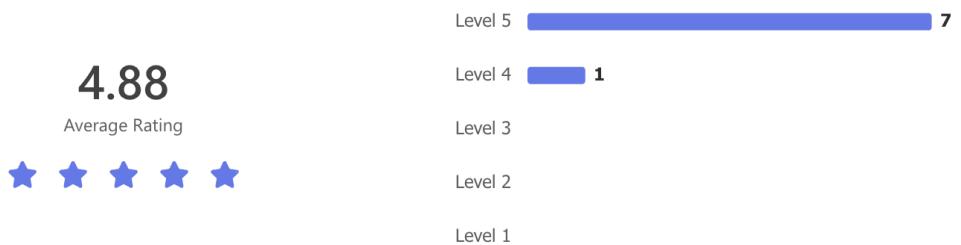


Figure F13. Usability Survey: Question 9 Results

10. Do you feel the system requires additional training or resources to use effectively?



Figure F14. Usability Survey: Question 10 Results

Future Requirements

Based on survey feedback, future enhancements should focus on developing a more responsive and intuitive map interface, refining layout designs to improve accessibility and navigation, and expanding report generation features to address emerging user needs. These changes will ensure the system continues to meet the evolving requirements of its users.

Overall Ratings and Takeaways

The system scored 4/5 for usability and functionality, and an impressive 5/5 for aesthetic appeal—reflecting its overall success in design and user satisfaction. The ratings highlight that while the system has made significant strides in enhancing usability and functionality, there remains room for improvement in fine-tuning specific features to provide an even better user experience.

IV. Conclusion and Future Path

The successful completion of this project marks a significant improvement in the management and accessibility of the Hawaiian and Pacific Collection at Hamilton Library. Through the integration of a MySQL database and a dynamic, user-friendly website, we have eliminated the inefficiencies of the previous Excel-based system. Library staff can now manage records from a centralized platform with automated workflows that reduce manual processing, improve data accuracy, and increase operational efficiency. External users benefit from intuitive search features, real-time reservations, and the ability to provide feedback on collection data. The system's performance and usability have been validated through testing, confirming its effectiveness in meeting both operational and user needs. This successful implementation ensures that the library's archives are more accessible to researchers, students, and the general public, strengthening the library's role as a key resource in preserving and sharing the cultural and historical heritage of Hawai'i and the Pacific region.

Looking ahead, the system is designed to be scalable, capable of evolving with the library's growing needs and expanding collection. As new materials are added, the database can accommodate these changes with minimal disruption. The system is built with flexibility in mind, allowing for the incorporation of future technologies such as machine learning for advanced search functionalities, natural language processing for improved user queries, and cloud-based solutions to support increasing data volumes. Additionally, the platform could integrate with other digital repositories or external databases, further enriching the library's collection and enhancing its value to users. By staying adaptable to emerging technologies, the system ensures that the Hawaiian and Pacific Collection remains accessible for years to come.

As the system continues to evolve, advanced database design considerations will play a key role in its future development. One area of exploration is the adoption of NoSQL databases, which would offer more flexibility in handling large, unstructured data sets, such as multimedia files or user-generated data. This approach would allow for better scalability and performance, especially as the collection grows in size and complexity. Furthermore, the continued optimization of database indexing and query performance will ensure that users can always retrieve data quickly and accurately, even as the system grows. These advanced design considerations will help future-proof the database, ensuring it can meet the library's evolving needs and the demands of future users while maintaining the highest standards of data integrity and security.

V. Appendix

Appendix A: Requirement Analysis Results

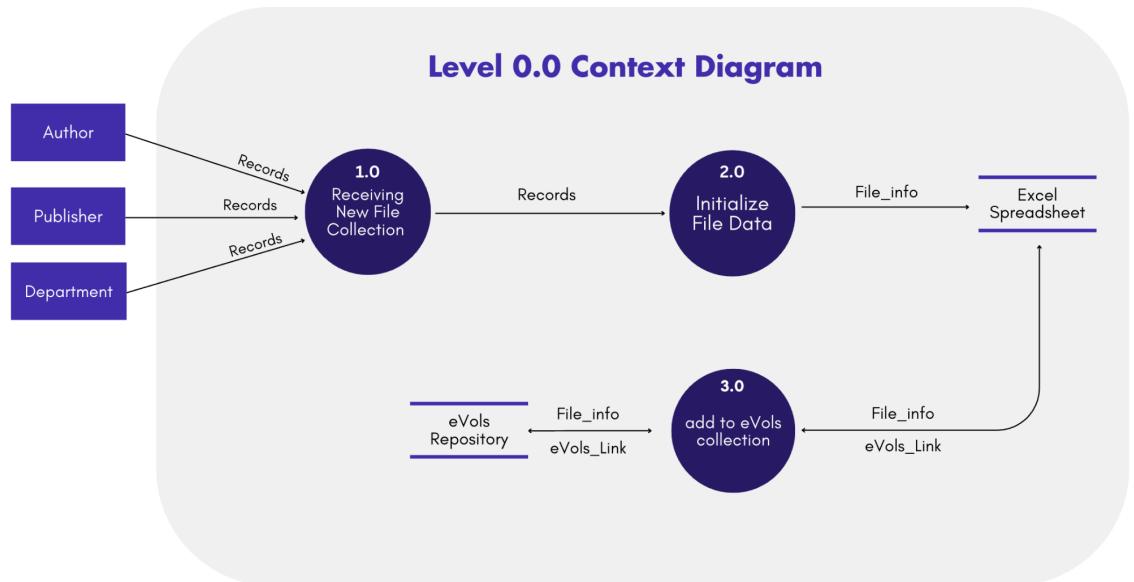


Figure A1. Physical Data Flow Diagram: Context Diagram

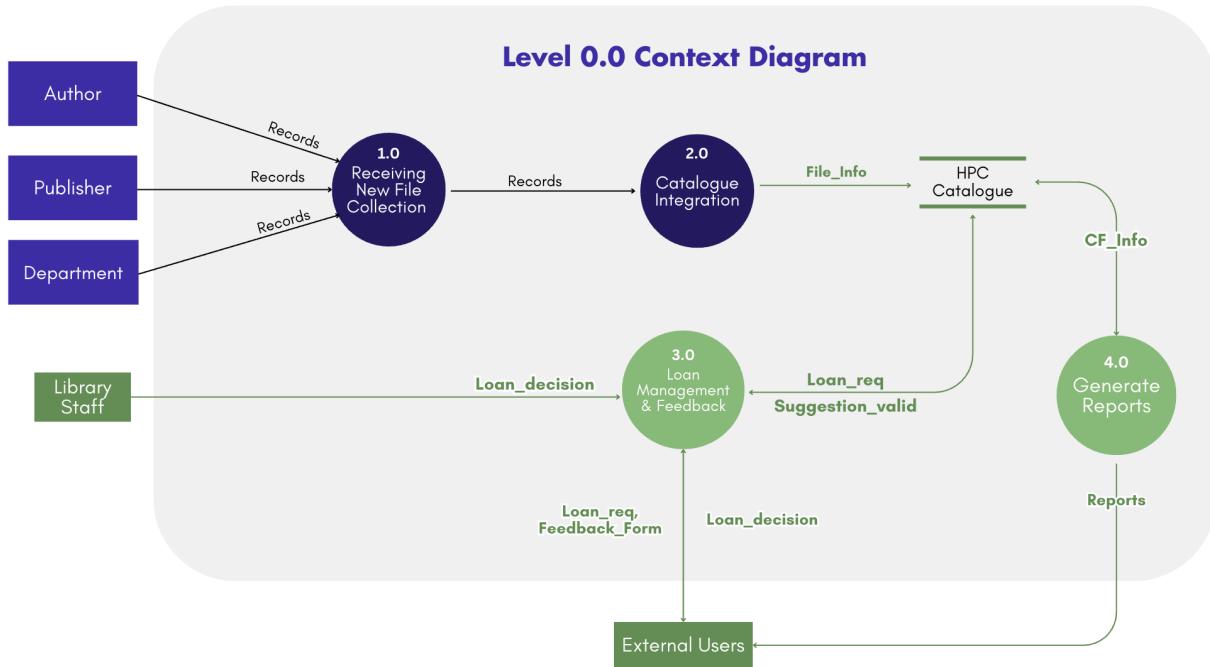


Figure A2. Logical Data Flow Diagram

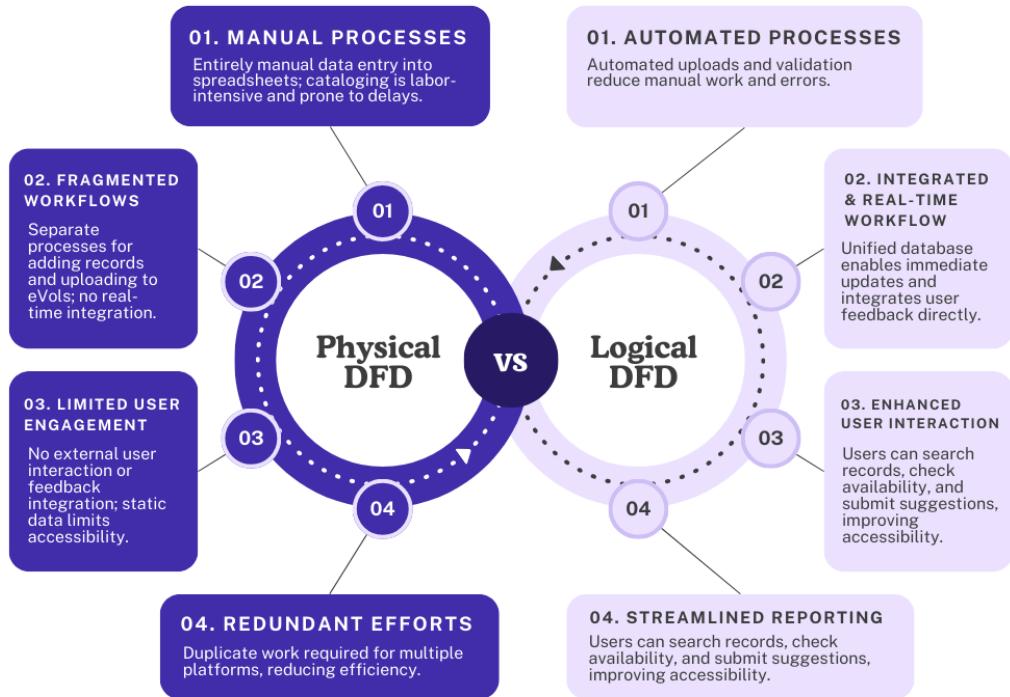


Figure A3. Physical and Logical DFD Comparison Model

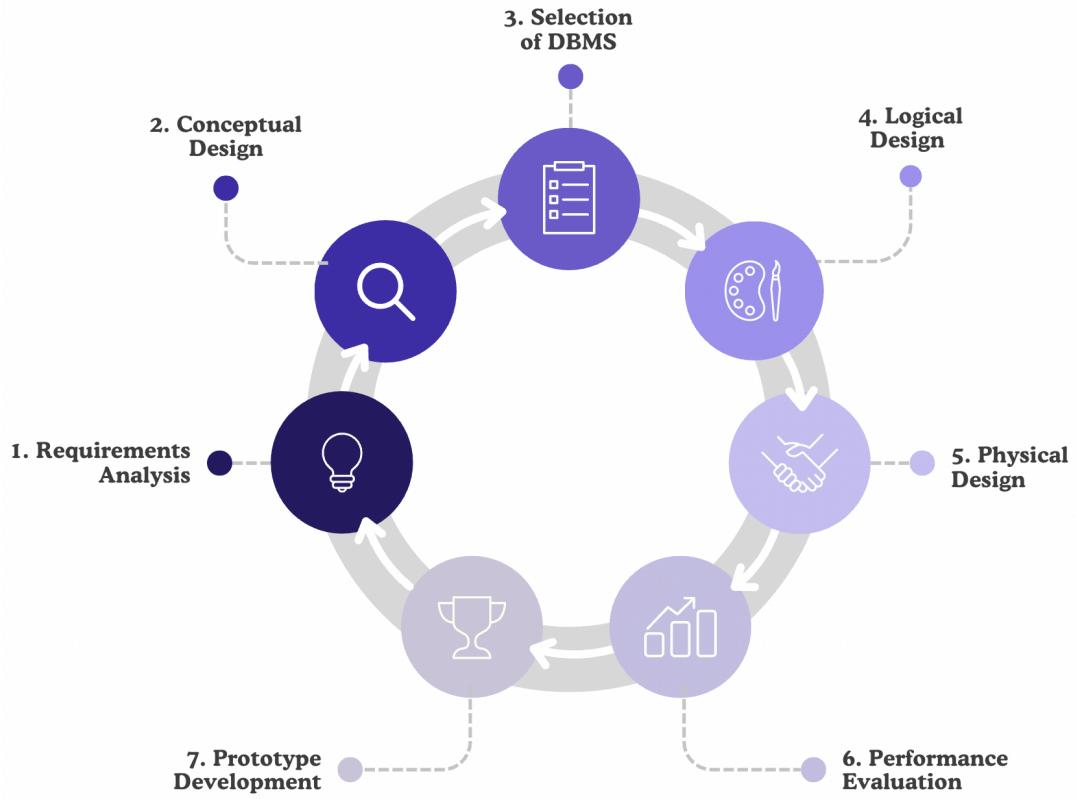


Figure A4. 7-Stage Roadmap Model

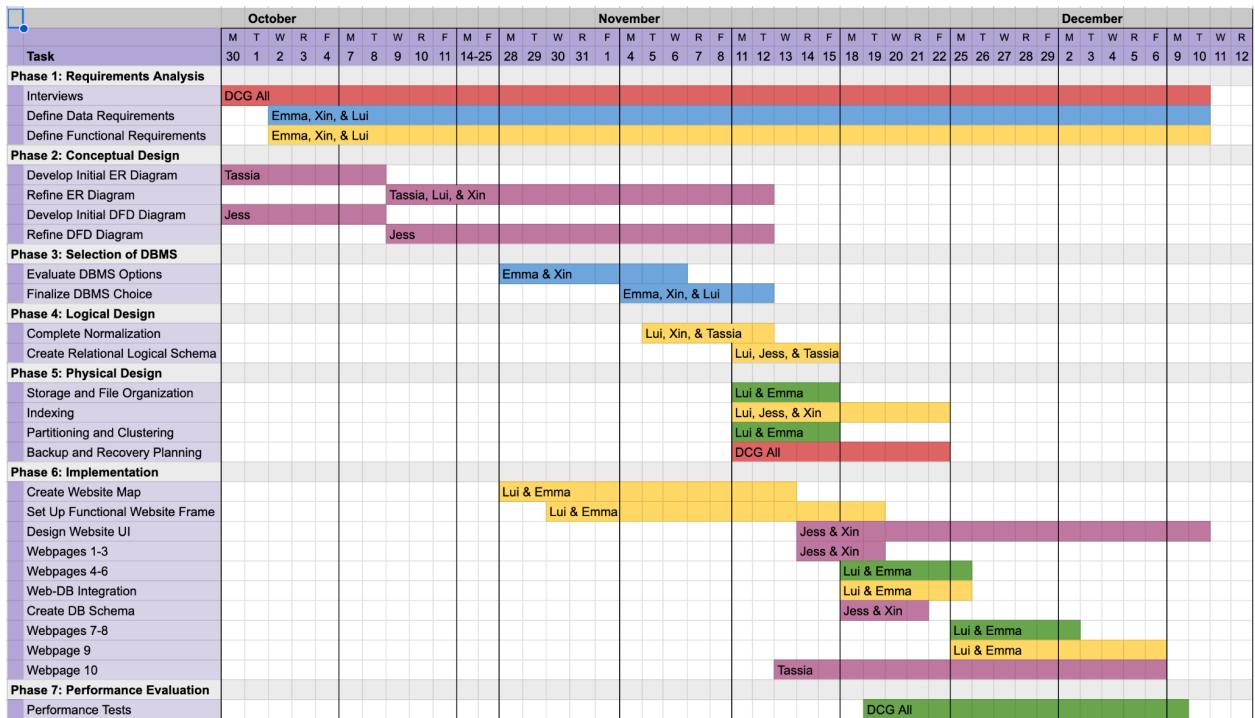


Figure A5. Project Gantt Chart

1.0 Receiving New File Collection

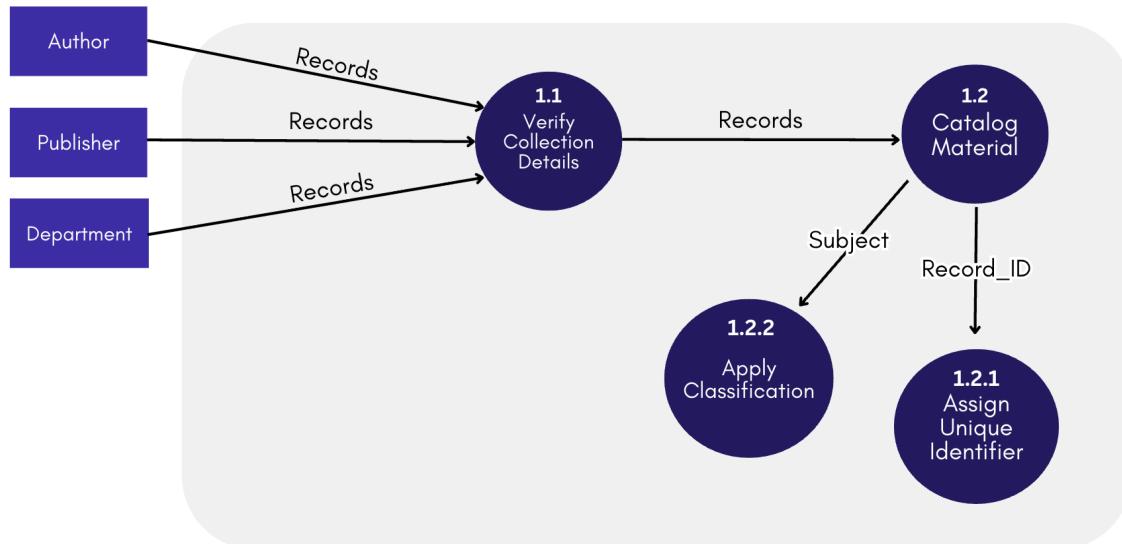


Figure A6. Logical Lower Level DFD: 1.0 Receiving New File Collection

2.0 Catalogue Integration

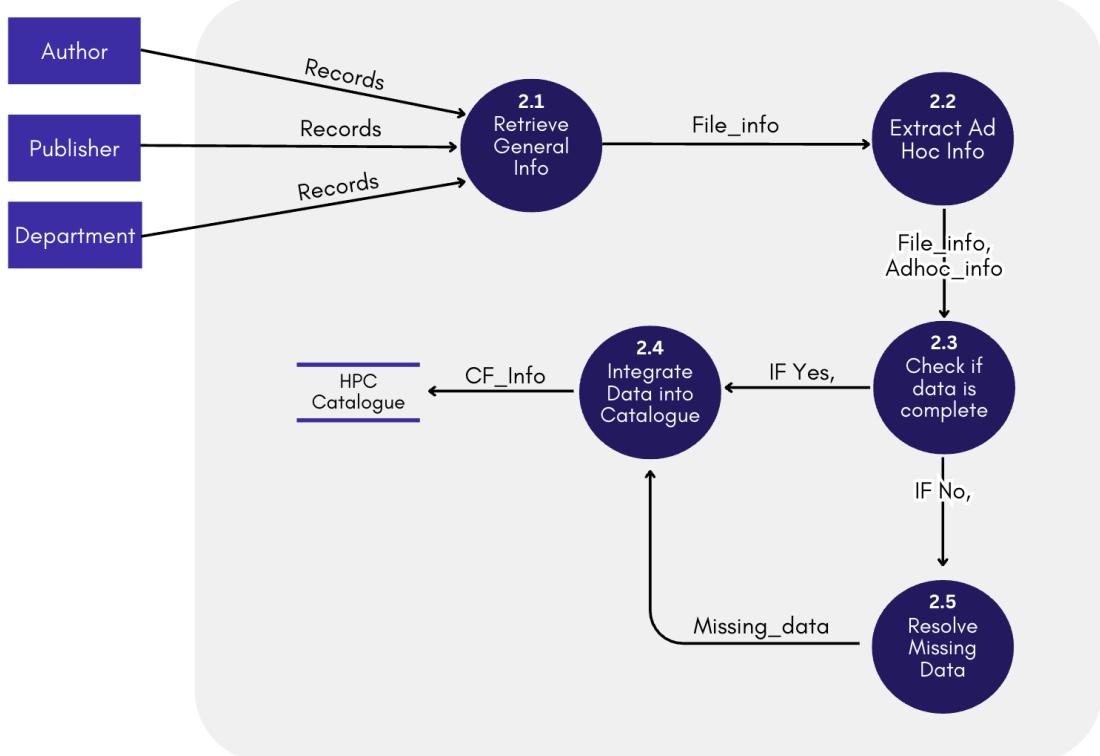


Figure A7. Logical Lower Level DFD: 2.0 catalog Integration

3.0 Loan Management and Feedback

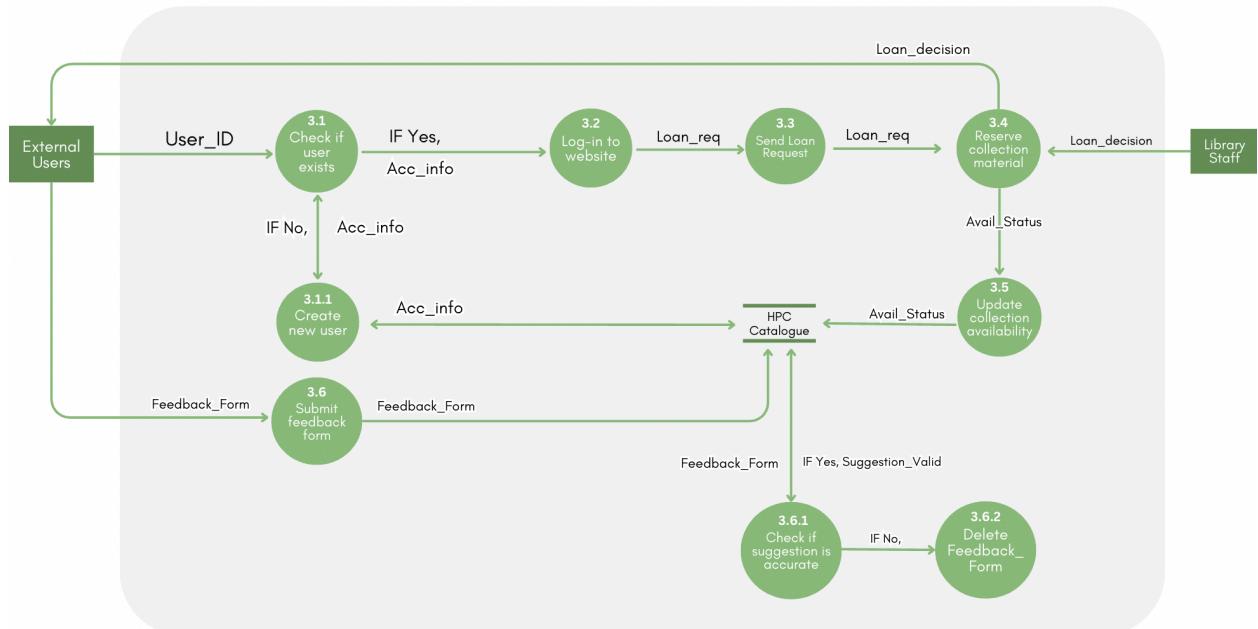


Figure A8. Logical Lower Level DFD: 3.0 Loan Management and Feedback

4.0 Generate Report

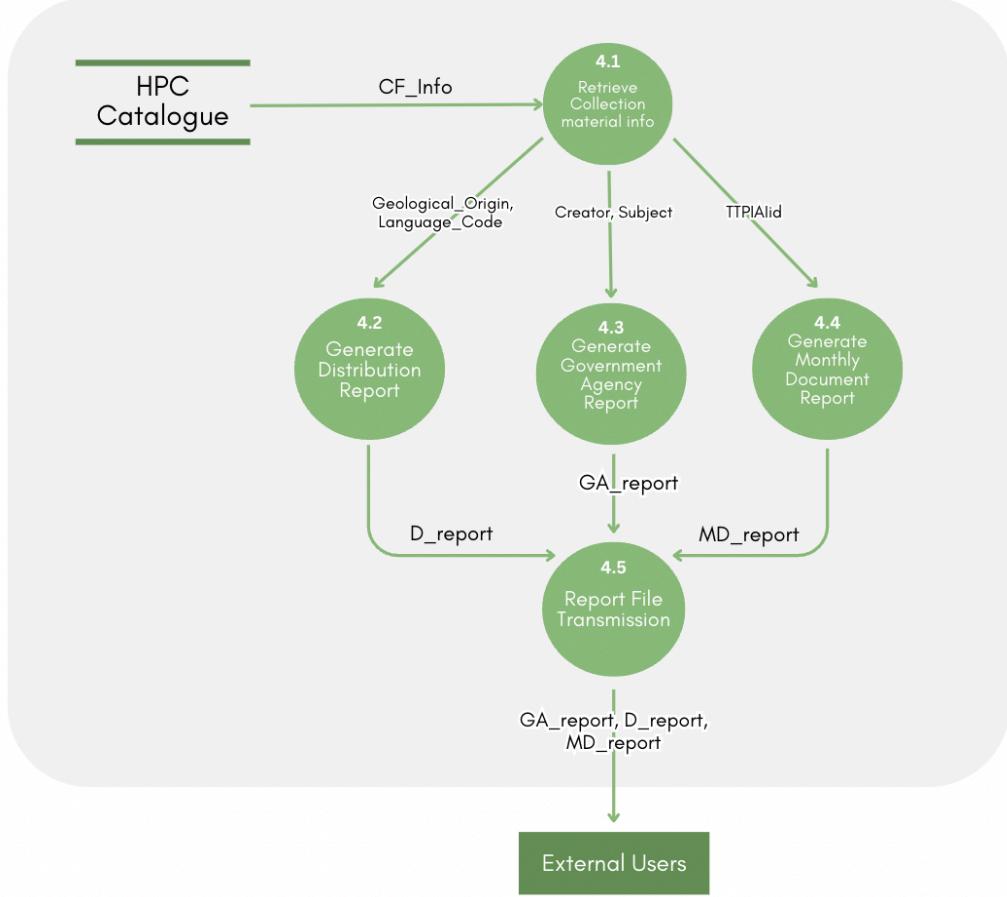


Figure A9. Logical Lower Level DFD: 4.0 Generate Report

Appendix B: Conceptual Design Results

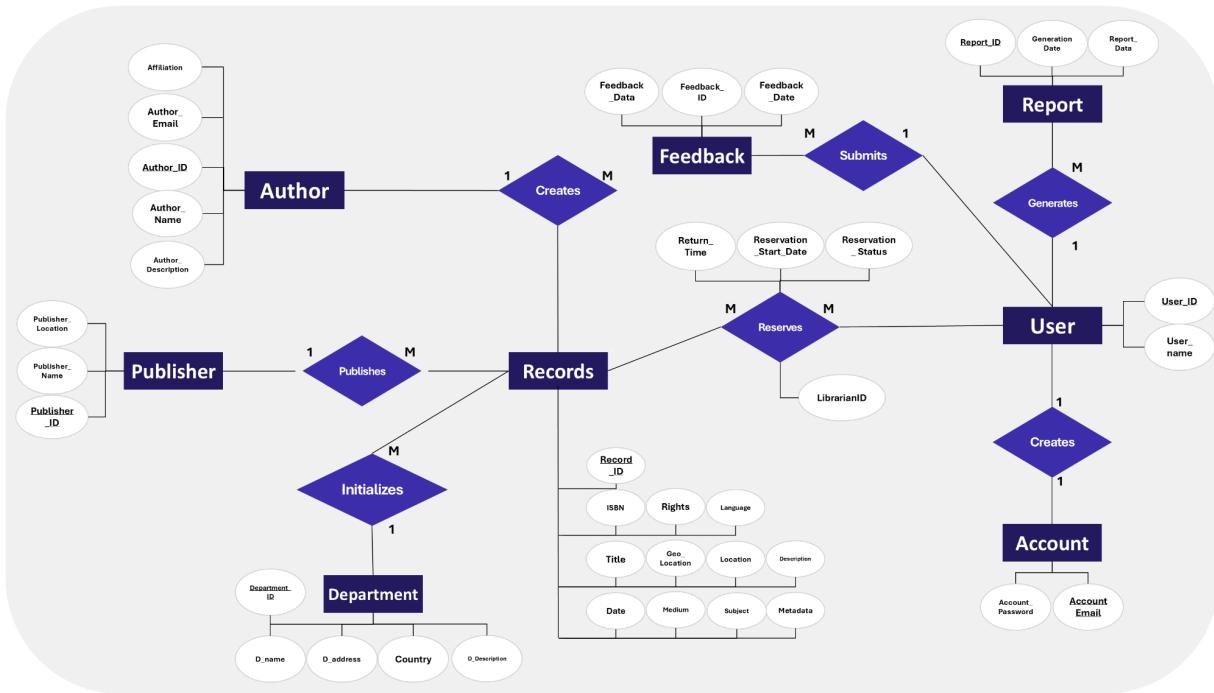


Figure B1. Entity Relationship Diagram

Entity Name	Entity Description	Data Type	Length	Primary Key	Nullable	Unique
User	A user represents an individual who interacts with the library management system. Each user is required to create an account to interact with the system. Users can submit feedback, make reservations, and generate reports.					
User_ID	A unique identifier for the user.	VARCHAR	50	TRUE	FALSE	TRUE
User_name	The chosen name of the user.	VARCHAR	50	FALSE	FALSE	TRUE
Account	An account contains user-specific information used to authenticate and access the system. Each user has one account, which includes login credentials like email and password.					
Account_Email	The email address for login and contact.	VARCHAR	100	TRUE	FALSE	TRUE
Account_Password	The password for accessing the user account.	VARCHAR	100	FALSE	FALSE	FALSE
Librarian	A librarian is an individual responsible for managing reservations within the system. Each librarian can manage multiple reservations and is identified by a unique Librarian ID.					
Librarian_ID	A unique identifier for the librarian	VARCHAR	50	TRUE	FALSE	TRUE

Reservation	A reservation represents a user's request to access a record within the system. It links users to the records they wish to reserve, and is managed by a librarian. Reservations contain details such as the reservation status, start date, and expected return time.					
Reservation_ID	Unique identifier for the reservation.	VARCHAR	50	TRUE	FALSE	TRUE
Reservation_Start_Date	The date when the reservation was made.	DATE	-	FALSE	FALSE	FALSE
Return_Time	The expected time for the reservation's return.	DATETIME	-	FALSE	TRUE	FALSE
Reservation_Status	The current status of the reservation (e.g., Active, Completed).	VARCHAR	50	FALSE	FALSE	FALSE
Record	A record represents a library item, such as a book or digital content, available for reservation and interaction by users. Each record is associated with metadata such as its title, language, rights, and other descriptive information.					
Record_ID	Unique identifier for the record.	VARCHAR	50	TRUE	FALSE	TRUE
Title	The title of the record.	VARCHAR	255	FALSE	FALSE	FALSE
Description	A brief description of the record.	TEXT	150	FALSE	FALSE	FALSE
Language	The language in which the record is available.	VARCHAR	50	FALSE	FALSE	FALSE
Location	The physical location of the record.	VARCHAR	255	FALSE	FALSE	FALSE
Geo_Location	The geographical location related to the record.	VARCHAR	255	FALSE	FALSE	FALSE
Rights	The access rights to the record.	VARCHAR	100	FALSE	FALSE	FALSE
Medium	The format or medium of the record (e.g., digital, book).	VARCHAR	50	FALSE	FALSE	FALSE
Date	The publication or creation date of the record.	DATE	-	FALSE	FALSE	FALSE
Subject	The subject category the record falls under.	VARCHAR	100	FALSE	FALSE	FALSE
ISBN	International Standard Book Number (for books).	VARCHAR	20	FALSE	FALSE	TRUE
Metadata	Additional data about the record.	TEXT	150	FALSE	FALSE	FALSE
Author	An author is an individual who creates content for the records in the system. Each author can contribute to one or more records and is identified by a unique Author ID.					
Author_ID	Unique identifier for the author.	VARCHAR	50	TRUE	FALSE	TRUE
Author_Name	The name of the author.	VARCHAR	100	FALSE	FALSE	FALSE
Author_Email	The email address of the author.	VARCHAR	100	FALSE	TRUE	TRUE

Affiliation	The organization or institution the author is affiliated with.	VARCHAR	100	FALSE	TRUE	FALSE
Author_Description	A short bio or description of the author.	TEXT	150	FALSE	TRUE	FALSE
Publisher	A publisher is an entity responsible for publishing records within the system. Each publisher can publish multiple records and is identified by a unique Publisher ID.					
Publisher_ID	Unique identifier for the publisher.	VARCHAR	50	TRUE	FALSE	TRUE
Publisher_Name	The name of the publisher.	VARCHAR	100	FALSE	FALSE	TRUE
Publisher_Location	Origin location of the publisher.	VARCHAR	100	FALSE	FALSE	FALSE
Department	A department oversees the records within the system, ensuring proper organization and management. Each department is responsible for initializing and managing multiple records.					
Department_ID	Unique identifier for the department.	VARCHAR	50	TRUE	FALSE	TRUE
D_Name	The name of the department.	VARCHAR	100	FALSE	FALSE	FALSE
D_Address	The physical address of the department.	VARCHAR	150	FALSE	FALSE	FALSE
Country	The country where the department is located.	VARCHAR	50	FALSE	FALSE	FALSE
D_Description	A brief description of the department's role or scope.	TEXT	150	FALSE	FALSE	FALSE
Feedback	Feedback represents user-submitted responses about records within the system. Users can submit feedback on records they have interacted with, and the feedback is stored for system improvement purposes.					
Feedback_ID	Unique identifier for each feedback entry.	VARCHAR	50	TRUE	FALSE	TRUE
Feedback_Data	The content of the feedback submitted by the user.	TEXT	255	FALSE	FALSE	FALSE
Feedback_Date	The date the feedback was submitted.	DATE	-	FALSE	FALSE	FALSE
Report	Reports represent the system-generated insights based on user interactions, reservations, and feedback. Reports are generated by users and help analyze system usage and improve performance.					
Report_ID	Unique identifier for the report.	VARCHAR	50	TRUE	FALSE	TRUE
Generation_Date	The date the report was generated.	DATE	-	FALSE	FALSE	FALSE
Report_Data	The content or results of the report.	TEXT	255	FALSE	FALSE	FALSE

Table B2. Entity Relationship Diagram Data Dictionary

Process Name	Relationship (Entities)	Cardinality	Action Between Entities
Creates	User-Account	1:1	Each user has one account for authentication, providing secure access to the system. Each account is tied to one user, storing login credentials for secure and personalized system access.
Reserves	User-Reservation	1:N	Users create multiple reservations to access library records, linking them to items they wish to borrow. Many reservations can belong to one user.
Submits	User-Feedback	1:N	Users provide feedback on records they interacted with, helping to improve system offerings and content quality. Feedback is provided by a single user, identifying who submitted the review or commentary.
Generates	User-Report	1:N	Users generate reports to analyze their system interactions, reservations, or feedback data.
Manages	Librarian-Reservation	1:N	Librarians manage multiple reservations submitted by users, ensuring smooth handling and fulfillment. A reservation is overseen by a single librarian, who ensures proper management and resolution.
Links	Reservation-Record	N:1	Each reservation is linked to a single record, tracking which library item the user intends to access. Records may have multiple reservations, reflecting user demand for the item.
Creates	Record-Author	N:1	Each record is authored by a single author, establishing its source or origin. An author may create multiple records, showcasing their contributions to the system's content.
Publishes	Record-Publisher	N:1	Records are linked to one publisher, indicating the entity responsible for its distribution. A publisher can be responsible for multiple records, reflecting their role in disseminating various items.
Initializes	Record-Department	N:1	Records are categorized under a single department, reflecting their organizational grouping in the library. A department initializes many records to be submitted to the Library.

Table B3 Entity Relationship Diagram Data Dictionary for Relationships and Cardinality

Process ID	Processes Name	Description
Physical Key Processes		
1	Receiving New File	This process involves the intake of physical copies of collection materials from

	Collection	publishers, authors, or departments. The received materials are prepared for further cataloging and processing within the system.
2	Initialize File Data	Library staff manually extracts relevant data from the collection materials and inputs the details into an Excel spreadsheet, which serves as their current database system. This step ensures that all information is captured for future reference and use.
3	Add to eVols collection	In this process, the Library Staff uploads the extracted collection data to the eVols repository. A unique link (eVols_Link) is generated for each collection item, ensuring easy access and reference. This link is then recorded back in the Excel spreadsheet.

Table B4 Physical Data Flow Diagram Data Dictionary

Process ID	Processes Name	Description
Logical Key Processes		
1	Receiving New File Collection	The primary mechanism for the intake of new documents. It ensures that incoming files are systematically received, cataloged, and prepared for integration into the broader system, establishing an organized foundation for subsequent handling and processing.
2	catalog Integration	This process focuses on validating the integrity of incoming file data. This step ensures that initial data validation is performed, producing results that confirm whether the files meet the required standards for accuracy and completeness.
3	Loan Management and Feedback	Facilitates the initiation of loan requests. During this stage, users submit a loan request, and a unique loan identifier is generated to track and manage the transaction throughout its lifecycle
4	Generate Report	Responsible for creating reports based on system data. Each generated report is assigned a unique report identifier, ensuring accurate tracking and easy retrieval for future reference or analysis

Table B5 Logical Data Flow Diagram Data Dictionary

Process ID	Process Name	SubProcess	Field Name	Data Type	Length	Nullable	Description
Process Level #1: Receiving New File Collection							
1.1	Verify Collection Details	Material verification	Records	VARCHAR	255	FALSE	Materials collected from the publisher, author, or department are verified for completeness and accuracy.

1.2	catalog Material	catalog integration preparation	File_Info = Record_ID + Author_ID + Publisher_ID + Department_ID + ISBN + Rights + Title + Geo_Location + Date + Medium + Subject	VARCHAR	255	FALSE	Key details about the collection material used for catalog integration.
			Record_ID	INT	-	FALSE	Unique identifier for the record.
			Author_ID	INT	-	FALSE	The ID of the author who created the record.
			Publisher_ID	INT	-	FALSE	The ID of the publisher responsible for the record.
			Department_ID	INT	-	FALSE	The department responsible for overseeing the record.
			ISBN	VARCHAR	20	FALSE	International Standard Book Number (for books).
			Rights	VARCHAR	100	FALSE	The access rights to the record.
			Title	VARCHAR	255	FALSE	The title of the record.
			Geo_location	VARCHAR	255	FALSE	The geographical location related to the record.
			Date	DATE	-	FALSE	The publication or creation date of the record.
			Medium	VARCHAR	50	FALSE	The format or medium of the record (e.g., digital, book).
			Subject	VARCHAR	100	FALSE	The subject category the record falls under.
1.2.1	Assign Unique Identifier	ID generation	Record_ID	VARCHAR	30	FALSE	Unique identifier for document tracking is a distinct identifier specific to the Trust Territory Pacific Islands Archives for document

							tracking and management purposes.
1.2.2	Apply Classification	Subject assignment	Subject	VARCHAR	20	FALSE	Internal classification code is a system-generated or manually assigned code for internal categorization and retrieval of the document.

Table B6 Logical Data Flow Diagram: Process 1 Data Dictionary

Process ID	Process Name	SubProcess	Field Name	Data Type	Length	Nullable	Description
Process Level #2: catalog Integration							
2.1	Retrieve General Info	General data extraction	File_Info = Record_ID + Author_ID + Publisher_ID + Department_ID + ISBN + Rights + Title + Geo_Location + Date + Medium + Subject	VARCHAR	255	FALSE	Extraction of general data from the collection material to create a standardized and structured record.
			Record_ID	VARCHAR	50	FALSE	Unique identifier for the record.
			Author_ID	VARCHAR	50	FALSE	The ID of the author who created the record.
			Publisher_ID	VARCHAR	50	FALSE	The ID of the publisher responsible for the record.
			Department_ID	VARCHAR	50	FALSE	The department responsible for overseeing the record.
			ISBN	VARCHAR	20	FALSE	International Standard Book Number (for books).

			Rights	VARCHAR	100	FALSE	The access rights to the record.
			Title	VARCHAR	255	FALSE	The title of the record.
			Geo_location	VARCHAR	255	FALSE	The geographical location related to the record.
			Date	DATE	-	FALSE	The publication or creation date of the record.
			Medium	VARCHAR	50	FALSE	The format or medium of the record (e.g., digital, book).
			Subject	VARCHAR	100	FALSE	The subject category the record falls under.
2.2	Extract Ad Hoc Info	Additional data	Adhoc_info = Location + Description + Metadata + Language	VARCHAR	255	FALSE	Extraction of supplementary information, including location of the material, description, metadata details, and language attributes.
			Location	VARCHAR	255	FALSE	The physical location of the record.
			Description	TEXT	150	FALSE	A brief description of the record.
			Metadata	TEXT	150	FALSE	Additional data about the record.

			Language	VARCHAR	50	FALSE	The language in which the record is available.
2.3	Check if data is complete	Completeness check	Data_Complete	BOOLEAN	-	FALSE	Verification step to check if all required metadata fields (File_Info and Adhoc_Info) are complete and meet the database standards.
2.31	Resolve Missing Data	Data completion	Missing_data	TEXT	150	TRUE	Identification and resolution of missing or incomplete data fields to ensure readiness for catalog integration.
2.4	Integrate Data into Catalog	Data integration	CF_Info = Record_ID + Author_ID + Publisher_ID + Department_ID + ISBN + Rights + Title + Geo_Location + Date + Medium + Subject + Location + Description + Metadata + Language + Missing_data	VARCHAR	255	FALSE	Final integration step where the cleaned and complete file information (CF_Info) is uploaded into the HPC catalog.

Table B7 Logical Data Flow Diagram: Process 2 Data Dictionary

Process ID	Process Name	SubProcess	Field Name	Data Type	Length	Nullable	Description
Process Level #3: Loan Management & Feedback							
3.1	Check if user exists	Verification	User_ID	VARCHAR	50	FALSE	A unique identifier assigned to each user.
3.1.1	Create an account	Account Creation	Acc_Info = User_ID + Account_Password + User_Name + Account_Email	VARCHAR	250	FALSE	Creation of an account if no account exists yet. Encapsulates account information such as User_ID, User_password, Account_ID, and Account_Name

			Account_Password	VARCHAR	100	FALSE	The password for accessing the user account.
			User_Name	VARCHAR	50	FALSE	The chosen name of the user.
			Account_email	VARCHAR	100	FALSE	The email address associated with the user's account.
3.2	Log-in to Website	Authentication	Acc_Info = User_ID + User_password	VARCHAR	100	FALSE	User account credentials for accessing the system.
3.3	Send request to loan	Loan request	Loan_req	VARCHAR	255	FALSE	Loan request details, including the requested material's specifics, request date, user ID, and material information.
3.4	Reserve collection material	Reservation	Loan_decision	VARCHAR	30	FALSE	Decision on loaning a material, including approval status, and request and return date.
3.5	Update collection availability	Status update	Avail_Status	BOOLEAN	-	FALSE	Current availability status shows whether a material is currently available, on loan, or reserved for another user.
3.6	Submit feedback form	Feedback submission	Feedback_Form	TEXT	-	TRUE	User feedback information contains user-provided input or comments about their experience with the system or its materials.
3.6.1	Check if suggestion is accurate	Feedback validation	Suggestion_Valid	BOOLEAN	-	FALSE	Feedback validation status confirms whether the feedback submitted by the user has been reviewed and deemed valid.
3.6.2	Delete feedback form	Form deletion	Delete_form	BOOLEAN	-	FALSE	Delete any feedback form that is not approved or deemed accurate by the Library staff.

Table B8 Logical Data Flow Diagram: Process 3 Data Dictionary

Process ID	Process Name	SubProcess	Field Name	Data Type	Length	Nullable	Description
Process Level #4: Generate Report							
4.1	Retrieve collection material info	Data gathering	CF_Info = Record_ID + Author_ID + Publisher_ID + Department_ID + ISBN + Rights + Title + Geo_Location + Date + Medium + Subject + Location + Description + Metadata + Language + Missing_data	TEXT	-	FALSE	Collected material information includes details about the materials gathered, such as their type, origin, and purpose for collection.
4.2	Generate distribution report	Distribution	D_report	TEXT	-	FALSE	Distribution report content summarizes the details of how materials have been distributed, including recipients and quantities.
4.3	Generate government agency report	Agency reporting	Ga_report	TEXT	-	FALSE	Government agency report content contains information and data originating from or created by a government agency.
4.4	Generate monthly document report	Monthly statistics	Md_report	TEXT	-	FALSE	Monthly document report content provides a summary of documents processed, accessed, or updated within a specific month.
4.5	Report File Transmission	Send report files	Report_Deliv	VARCHAR	255	FALSE	Specifies the method or platform used to send report files for transmission or delivery purposes.

Table B9 Logical Data Flow Diagram: Process 7 Data Dictionary

Appendix C: DBMS Evaluation and Results

DBMS	Type	License	Best For	Key Features	Limitations
MySQL	Relational	Open-source	Small to medium businesses	User-friendly, scalable, strong community support, fast querying, and low cost	Limited to SQL, some advanced features paid-only
Oracle	Relational	Proprietary	Large enterprises	Autonomic management, multi-model support, high security, enterprise-level features	High cost, complex setup for smaller institutions
PostgreSQL	Object-Relational	Open-source	All sizes	Inheritance (object-oriented), supports complex queries, highly customizable	Performance can be slower on very large datasets
Microsoft SQL Server	Relational	Proprietary	Medium to large businesses	Seamless integration with Microsoft products, strong reporting services	Expensive licensing, limited flexibility for non-MS platforms
MongoDB	Document-Oriented (NoSQL)	Open-source	All sizes	Handles unstructured data, highly flexible and scalable, schema-less	Not ideal for structured data or SQL queries

Table C1 Database Management System Comparative Chart

Requirement	MySQL	PostgreSQL	MongoDB	Oracle	Microsoft SQL Server
Data Organization and Structure	5	4	3	4	4
Data Integrity and Consistency	5	5	4	4	5
Scalability and Flexibility	4	5	5	3	4
Query Capability and User Accessibility	5	4	3	4	5
Security and Access Control	5	4	3	4	5
Total	24	22	18	19	23

Table C2 Database Management System Evaluation Matrix

Appendix D: Logical Design Results

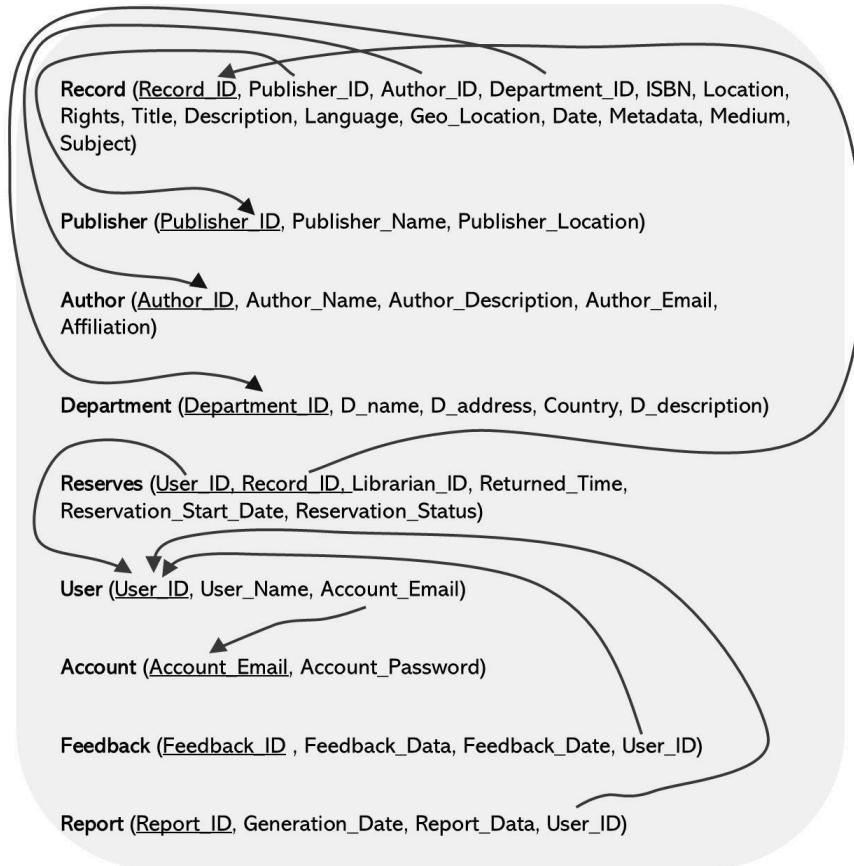


Figure D1 Relational Logical Schema

Appendix E: Database System Prototype Implemented

Calculation	Type	Reports & Feedback queries
Internal Memory	Subquery	39
	JOIN	360
Number of Operations	Subquery	63
	JOIN	1,080

Table E1.1 Internal Memory and Number of Operations Results

Feedback in 2024 (JOIN)

```
SELECT DISTINCT r.Record_ID, r.Title, r.Medium, r.Date
FROM Record r
JOIN Reserves res ON r.Record_ID = res.Record_ID
JOIN Feedback f ON res.User_ID = f.User_ID
WHERE f.Feedback_Date LIKE '2024%';
```

Reports in 2024 (JOIN)

```
SELECT DISTINCT r.Record_ID, r.Title, r.Medium, r.Date
FROM Record r
JOIN Reserves res ON r.Record_ID = res.Record_ID
JOIN Report rep ON res.User_ID = rep.User_ID
WHERE rep.Generation_Date LIKE '2024%';
```

Figure E1.2 Join operations - Note: Feedback in 2024 (subquery) and Reports in 2024 (subquery) are non-correlated queries.

The number of attributes (columns) for each table the database:

Record: 15 attributes

Publisher: 3 attributes

Author: 5 attributes

Department: 5 attributes

Reserves: 6 attributes

User: 3 attributes

Account: 2 attributes

Feedback: 4 attributes

Report: 4 attributes

Calculations use the following formulas:

JOIN	Subquery (non-correlated)	Subquery (correlated)
A * B	A + B	A + B
(a + b) * A * B	aB + bB	(a + b) * A * B

Table E1.3 Internal Memory Requirement and Number of Operations Formula

Showing rows 0 - 2 (3 total, Query took 0.0005 seconds.)

```
SELECT * FROM `Record` AS R,`Department` AS D WHERE D.Department_ID = R.Department_ID AND d_name = 'Department of Education';
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Record_ID	Author_ID	Publisher_ID	Department_ID	ISBN	Location	Rights	Title	Description	Language	Geo_Location	Date	Metadata	Medium	Subject	Department_ID	D_name	D_address	Country	D_description
R00000005	A00000005	P00000005	D00000005	ISBN-3344556677	Public Library, Pohnpei	Public Domain	Educational Facilities in Pohnpei	Study of schools and educational facilities in Pohnpei	English	Pohnpei	2023-03-20	Metadata Completed	Microfilm	Education Facilities	D00000005	Department of Education	321 Liliokalani Ave, Honolulu, HI	USA	Oversees education policies and public schools.
R00000015	A00000001	P00000005	D00000005	ISBN-3344556688	Education Office, Chuuk	Open Access	Educational Systems in Chuuk	Analysis of education systems and school facilities	English	Chuuk	2023-06-30	Updated Metadata	AV	Education Systems	D00000005	Department of Education	321 Liliokalani Ave, Honolulu, HI	USA	Oversees education policies and public schools.
R00000025	A00000005	P00000005	D00000005	ISBN-5005000005	Education Office, Marshall Islands	Open Access	Education Programs in Marshall Islands	Report on educational outreach and programs.	English	Marshall Islands	2023-05-01	Updated Metadata	AV	Education Programs	D00000005	Department of Education	321 Liliokalani Ave, Honolulu, HI	USA	Oversees education policies and public schools.

Figure E2 SQL Query Test 1: Retrieving Records Donated by the Department of Education

Showing rows 0 - 0 (1 total, Query took 0.0001 seconds.)

```
SELECT * FROM reserves WHERE Reservation_Start_Date = '2023-06-22';
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

User_ID	Record_ID	Librarian_ID	Returned_Time	Reservation_Start_Date	Reservation_Status
U00000003	R00000003	U00000004	NULL	2023-06-22	Pending

Figure E3. SQL Query Test 2: Retrieving all loans on June 22, 2023

MySQL returned an empty result set (i.e. zero rows). (Query took 0.0001 seconds.)

```
SELECT * FROM `Record` WHERE Geo_Location = 'Vanuatu';
```

Profiling [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Record_ID	Author_ID	Publisher_ID	Department_ID	ISBN	Location	Rights	Title	Description	Language	Geo_Location	Date	Metadata	Medium	Subject
-----------	-----------	--------------	---------------	------	----------	--------	-------	-------------	----------	--------------	------	----------	--------	---------

Figure E4. SQL Query Test 3: Querying records for an island not in the database

Canned Query Geographical Location

```
SELECT Record_ID, Title, D_name, Date, Subject, Description, Medium, Language
FROM record r
INNER JOIN Department d ON r.Department_ID = d.Department_ID
WHERE Geo_Location LIKE '<Map Location>';
```

Figure E5. Geographical Location Query

Canned Query Fetching Reservations

```
SELECT User_ID, Record_ID, Librarian_ID, Reservation_Start_Date,  
Reservation_Status, Returned_Time  
FROM reserves;
```

Figure E6. Retrieving Reservations Query

Parameter Query General Search

```
SELECT Record_ID, Title, D_name, Date, Subject, Description, Medium, Language  
FROM record r  
INNER JOIN Department d ON r.Department_ID = d.Department_ID  
WHERE <Search Field> LIKE '%<Search Term>%' AND Medium = '<Format of Record>';
```

Figure E7. General Search Query

Transaction Creating Reservation

```
INSERT INTO Reserves (User_ID, Record_ID, Librarian_ID, Returned_Time,  
Reservation_Start_Date, Reservation_Status)  
VALUES (<Input>);
```

Figure E8. Creating Reservation

Transaction Adding Record

```
INSERT INTO record (Record_ID, Author_ID, Publisher_ID, Department_ID, ISBN,  
Location, Rights, Title, Description, Language, Geo_Location, Date, Metadata,  
Medium, Subject) VALUES (<Input>);
```

Figure E9. Adding Records Query

Location Frequency Report

```
SELECT Location, COUNT(*) AS Record_Count  
FROM record  
GROUP BY Location  
ORDER BY Record_Count DESC;
```

Figure E10. Location Frequency Report

Government Agency Report

```
SELECT d.D_name AS Department_Name, r.Title AS Record_Title, r.Subject  
FROM record r  
JOIN department d ON r.Department_ID = d.Department_ID  
WHERE d.D_name LIKE '%Department%'  
ORDER BY d.D_name, r.Title;
```

Figure E11. Government Agency Report

Distribution Report

```
SELECT Medium, COUNT(*) AS Record_Count
FROM record
GROUP BY Medium
ORDER BY Record_Count DESC;
```

Figure E12. Distribution Report

Monthly Document Report

```
SELECT Record_ID, Title, Date, Subject, Medium
FROM record
WHERE Date LIKE '2024-01%'
ORDER BY Date ASC;
```

Figure E13. Distribution Report

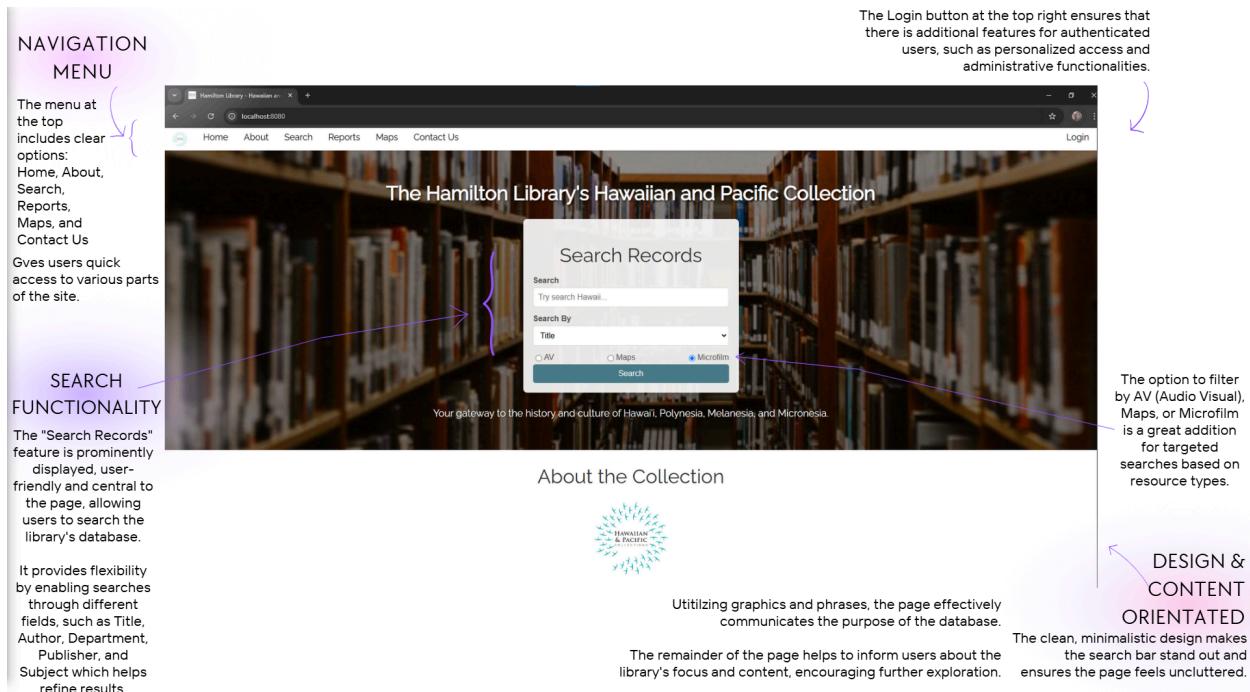


Figure E14. Annotated Navigation of Home page - Addressed requirements 3 (Advanced Search Functionality) and 8 (Requirement Met: Usability and Accessibility)

REGISTRATION PAGE

Users can create a new account by providing their First Name, Last Name, Email, and Password.

The minimalistic design focuses on simplicity, streamlining the registration process.



A link below the form allows users to return to the standard login page, maintaining easy navigation.

This page provides a dedicated login form for librarians, ensuring role-based access.

LIBRARIAN LOGIN PAGE

LOGIN PAGE

The Login button on the homepage and general navigation bar directs users to this page, where they can securely log in using their email and password.

The clean layout with a visually appealing background makes the login process simple and intuitive.

Users can seamlessly switch between the Librarian Login and Standard User Login using the prompt at the bottom of the page, which provides a clear link to access the appropriate login portal.

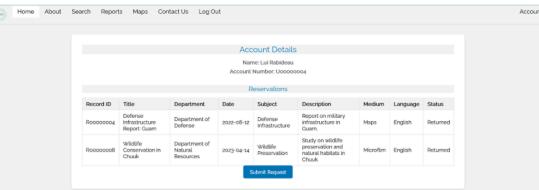
The prompt dynamically adjusts, stating either "Librarian Login Portal" or "Not a Librarian? Click here to access User Login" for easy navigation.

Figure E15. Annotated Navigation of Log-In Portal and Account Registration - Addressed Requirements: 11 (Security) and 8 (Usability)

Once selected, the "Request Checked" button allows users to finalize their reservation. The button visually responds (e.g., changes in size and color) when hovered over, improving interactivity.



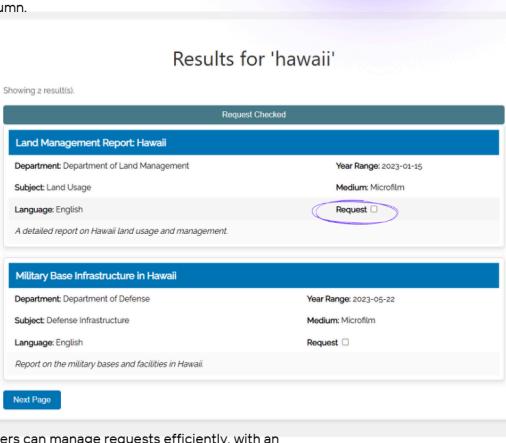
Once "Request Checked" is clicked, the selected item is added to the reservation system and logged under the user's account, where it can be viewed within their account.



After logging in, the navigation bar replaces the "Login" option with "Account", providing seamless access to user details.

The Account Details Page displays Reservations, including information like Record ID, Title, Department, Date, Subject, Description, Medium, Language, and Status.

Users can select items for reservation using the checkbox under the "Request" column.



The results are well-structured, displaying key details such as Title, Department, Year Range, Subject, Medium, and Language.

Users can manage requests efficiently, with an option to Submit Request for additional actions.

The flow from searching, reserving items, and viewing reservations is intuitive and user-friendly.

SEARCH RESULTS PAGE

Figure E16. Annotated Navigation for Search Results and Reservations - Addressed Requirements: 6 (Loan and Reservation Management) and 7 (Performance)

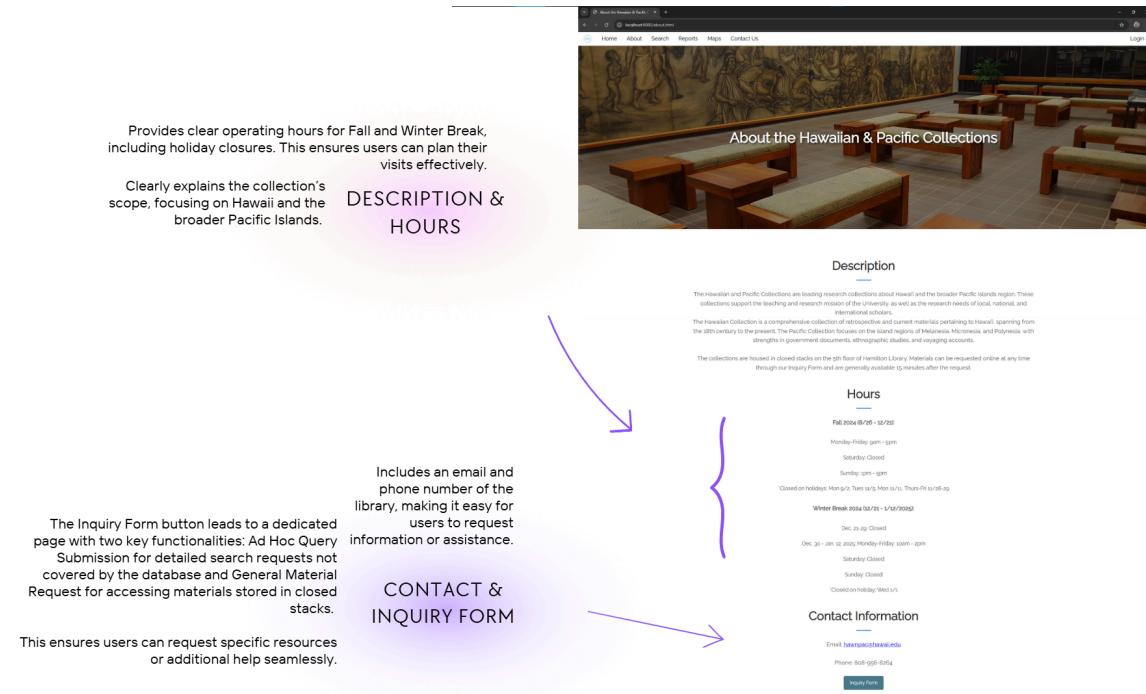


Figure E17. Annotated Navigation for About Page and Inquiry Form - Addressed Requirements: 4 (Feedback Mechanism) and 8 (Usability)

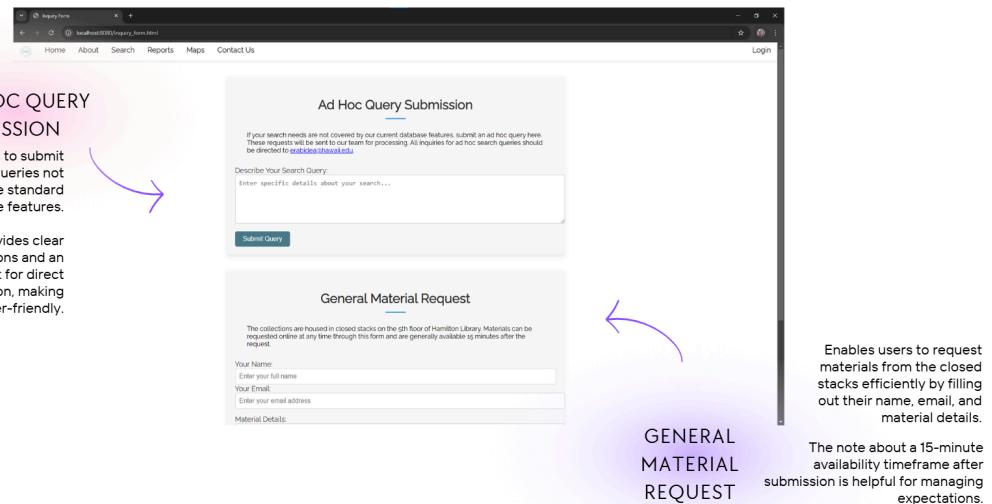


Figure E18. Annotated Navigation for Ad Hoc Query Submissions and General Requests - Addressed Requirements: 2 (Data Entry and Updates) and 5 (Reporting Capabilities)

The Report Type dropdown allows users to select from four report options:

- Location Frequency Report
- Government Agency Report
- Distribution Report
- Monthly Document Report

This provides flexibility for generating specific reports based on user needs.

Once a report type is selected, clicking the "Generate Report" button produces the corresponding report seamlessly.

The button is prominently displayed and enhances usability.

REPORT GENERATION

Enables users to generate tailored reports quickly and efficiently based on selected criteria, providing organized data for analysis and decision-making.

GENERATED REPORT CONTENT

Department Name	Report Title	Status
Department of Agriculture	Agricultural Policies in Guam	Agriculture
Department of Agriculture	Agricultural Survey in Palau	Agriculture
Department of Agriculture	Agricultural Trends in Micronesia	Agriculture
Department of Defense	Defense Infrastructure in Palau	Defense Infrastructure
Department of Defense	Defense Infrastructure Report Guam	Defense Infrastructure
Department of Defense	Defense Infrastructure in Micronesia	Defense Infrastructure
Department of Education	Educational Progress in Palau	Education Progress
Department of Education	Educational Programs in Marshall Islands	Education Progress
Department of Education	Educational Policies in Palau	Education Policies
Department of Education	Educational Systems in Chuuk	Education Systems
Department of Energy	Public Safety Facilities in Palau	Public Safety
Department of Energy	Renewable Energy in Micronesia Islands	Energy Projects
Department of Energy	Renewable Energy in Marshall Islands	Energy
Department of Health	Healthcare Development in Micronesia	Healthcare Infrastructure
Department of Health	Healthcare Facilities in Hawaii	Healthcare
Department of Health	Healthcare Facilities in Mariana Islands	Healthcare

The clean layout and inclusion of diverse subjects highlight the report's comprehensive nature, allowing users to quickly locate and analyze records categorized by department and subject matter.

Displays data in a well-organized table format, listing the applicable columns ensuring clarity and easy readability for users.

Consistent column alignment and alternating row colors improve visual separation of records.

Figure E19. Annotated Navigation for Report Generation - Addressed Requirements: 5 (Reporting Capabilities) and 8 (Usability)

QUICK ACCESS LINKS MENU

The list of regions, such as Mariana Islands, Hawaii, Guam, and others, provides a secondary, straightforward way to access specific areas, ensuring usability for all users.

DYNAMIC MAP

Regions on the map are clickable, enabling users to access additional information or relevant resources seamlessly.

The interactive map allows users to hover over regions to display the flag and name of the area, providing a visually engaging and intuitive way to explore locations.

This feature is particularly beneficial for individuals who may not speak English, offering a visual and interactive alternative for navigation and discovery.

Figure E20. Annotated Navigation for Maps Page and Usability - Addressed Requirements: 9 (Scalability) and 8 (Usability)

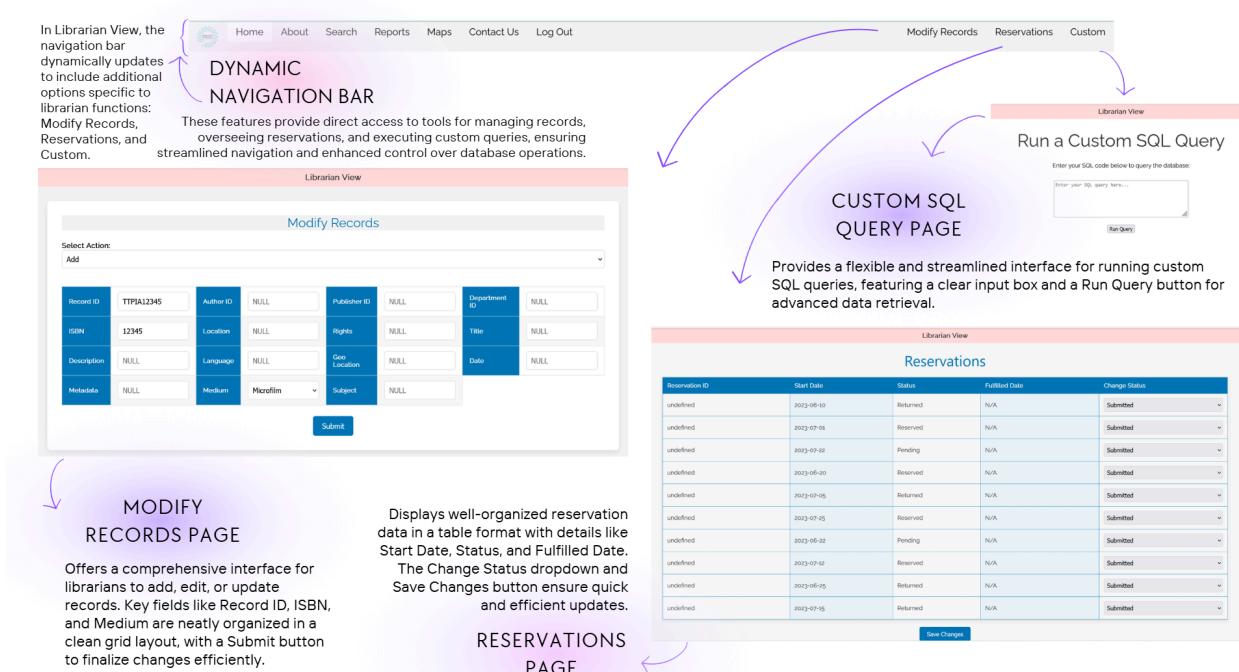


Figure E21. Annotated Navigation for Custom SQL Requests and Staff Management - Addressed Requirements: 2 (Data Entry and Updates) and 11 (Security)

The screenshot shows a contact page for the Hawaiian & Pacific Collections Department. At the top, there is a navigation bar with links for Home, About, Search, Reports, Maps, Contact Us, and Login. Below the navigation is a large photograph of a modern building with glass windows and green landscaping, with the text "Contact Us" overlaid. Underneath the photo, the text "Hawaiian & Pacific Collections Department" is followed by the address "Fifth Floor, Hamilton Library, 2550 McCarthy Mall, Honolulu, HI 96822". Below the address are the phone number "(808) 956-8264" and email address "humpac@hawaii.edu". A link "Visit the Inquiry Form" is also present. A section titled "Meet the Team" follows, featuring two profiles: Jodie Mattox and Stu Dawrs.

Jodie Mattox
Librarian V
Hawaiian Collection Librarian and Department Chair
Pacific Collection Librarian
Hawaiian and Pacific Collections
Public Services Division
[\(808\) 956-2851](mailto:jode@hawaii.edu)

Stu Dawrs
Librarian V
Pacific Collection Librarian
Hawaiian and Pacific Collections
Di Libr - Hawaiian Collection

Figure E22. Navigation for Contact Us Page - Addressed Requirements: 4 (Feedback Mechanism) and 8 (Usability)

Requirement	How the Delivered System Meets the Requirement
1. Data Importation	Existing records from Excel spreadsheets were imported into a centralized MySQL database. Data cleaning and validation routines were implemented to ensure consistency and eliminate duplicate or erroneous entries.
2. Data Entry and Updates	Library staff can add, edit, and update records through an intuitive web interface. Forms include input validation for fields such as title, author, publication date, geographic location, and format type.
3. Search Functionality	Advanced search capabilities are provided through the homepage's search bar. Users can filter results by criteria such as title, author, date, geographic location, and document type, fulfilling precise search needs.
4. Feedback Mechanism	An inquiry form on the "About" page and the "Contact Us" page allows users to provide feedback and suggest corrections. Submitted data is logged for review by library staff.
5. Reporting Capabilities	The system enables users to generate customizable reports, including document distribution, government contribution, and monthly activity reports. A user-friendly interface allows staff to define criteria for report generation.
6. Loan and Reservation Management	The search results page includes a reservation feature that allows users to check real-time availability and submit loan requests. Approved or rejected requests are communicated to users automatically.
7. Performance	The database uses a third normal form (3NF) schema, reducing redundancy and optimizing storage. Indexed queries ensure fast search and retrieval, even as the database scales.
8. Usability	The user interface is designed to be intuitive and accessible, with clear navigation menus, guided workflows for staff, and responsive design for users of all technical levels. Accessibility guidelines were followed to ensure inclusivity.
9. Scalability	The system is built on a scalable infrastructure, allowing for the addition of new records, document types, and user demands. The architecture supports future enhancements without performance degradation.
10. Reliability	Backup routines and error-handling mechanisms ensure data integrity. A redundant storage system prevents data loss in case of hardware or system failures.
11. Security	Role-based access control (RBAC) restricts access based on user roles. Staff can perform administrative tasks, while external users have limited access.

Figure E23: Summary of System Requirements and Their Implementation in the Delivered System

Appendix F: Performance Evaluation Results

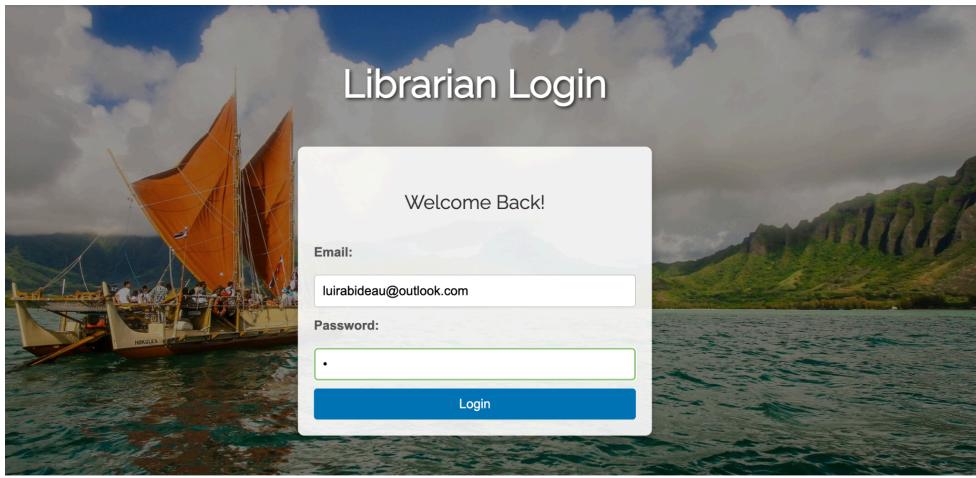


Figure F1. External User Log-in Portal

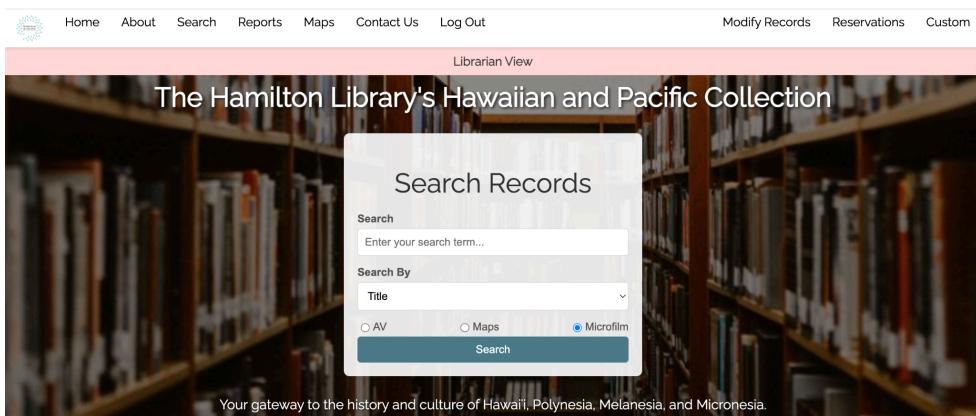


Figure F2. Librarian Log-in Portal



Figure F3. Home page search navigation

Results for 'HAWAIIAN'

Showing 10 result(s).

Request Checked	
Hawaiian dredging and construction Corp. (application for permit to do business in Palau).	
Department: Department of Resources and Development, Foreign Investment	Year Range: 1973-1975
Subject: economic development commerce and industry cooperatives\$\$immigration and emigration entry reentry requests and permits\$\$public works construction maintenance and repairs	Medium: Record
Language: eng	Request <input type="checkbox"/>
<i>Includes correspondence.</i>	

Figure F4. catalog search results

Home About Search Reports Maps Contact Us Log Out Modify Records Reservations Custom

Librarian View

Modify Records

Select Action:

Record ID	NULL	Title	NULL	Alt Title	NULL	Digital File Name	NULL
Department Name	NULL	Creator	NULL	Description	NULL		
Medium	Select Medium	Language	NULL	Rights	NULL	Year Range	NULL
Subject	NULL	Geographic Location	NULL	Map Number	NULL	Location	NULL
Containers Info	NULL	Cabinet	NULL	File Folder	NULL	Reel Format	NULL

Figure F5. Librarian dashboard for modifying records

Home About Search Reports Maps Contact Us Log Out Modify Records Reservations Custom

Librarian View

Reservations

Reservation ID	Account ID	Start Date	Status	Fulfilled Date	Change Status
----------------	------------	------------	--------	----------------	---------------

Figure F6. Librarian dashboard for managing reservations

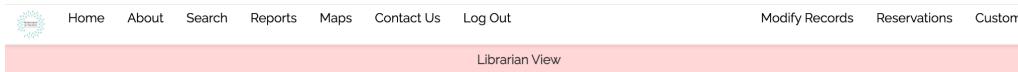


Figure F7. Librarian dashboard for pulling customized SQL requests

The image consists of two side-by-side screenshots. On the left, a mobile phone screen displays an invitation to a survey titled "Hawaii and Pacific Collection Usability Survey". The background shows the exterior of a library building with people walking by. The text on the screen says "You are invited!" and features a "Start now" button. On the right, a computer screen shows a survey titled "Hawaii and Pacific Collection Usability Survey". The survey asks "What is your role at the library (e.g., staff, administrator, researcher, user)?". There is a required field indicator (*). The survey also includes questions about frequency of use and other demographic or usage-related questions.

3. How easy is it to navigate the proposed system? *

Stars: 1 - Very Difficult, 5 - Very Easy

4. Which features or sections of the system are the most intuitive to use?

*

Enter your answer

5. Were there any features or sections that you found confusing or hard to navigate?

*

Enter your answer

6. Did you encounter any technical issues while using the system (e.g., loading time, broken links)?

If yes, please describe.

Enter your answer

7. How accessible do you find the system in terms of design and functionality (e.g., font size, layout, responsiveness)?

*

Stars: 1 - Very Poor, 5 - Excellent

8. How satisfied are you with the overall usability of the system?

*

Stars: 1 - Very Unsatisfied, 5 - Very Satisfied

9. How likely are you to recommend this system for library operations? *

Stars: 1 - Very Unlikely, 5 - Very Likely

10. Do you feel the system requires additional training or resources to use effectively?

*

Yes

No

11. What additional features or improvements would you suggest for the system?

*

Enter your answer

Figure F8. Usability Survey

2. How often do you use the current system to manage or retrieve information?

● Daily	4
● Weekly	0
● Monthly	2
● Rarely	2
● Never	0

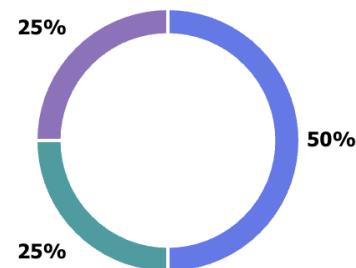


Figure F9. Usability Survey: Question 2 Results

3. How easy is it to navigate the proposed system?

[More details](#)



Figure F10. Usability Survey: Question 3 Results

7. How accessible do you find the system in terms of design and functionality (e.g., font size, layout, responsiveness)?

[More details](#)

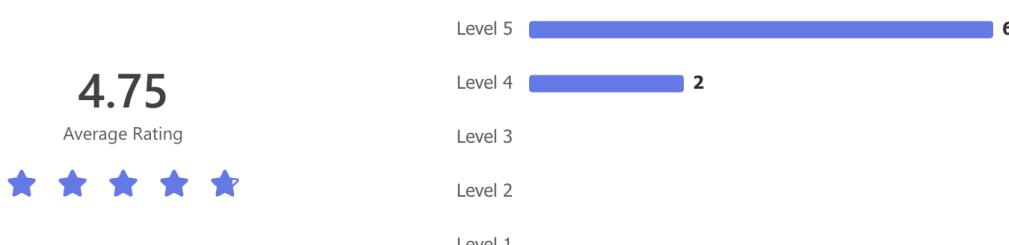


Figure F11. Usability Survey: Question 7 Results

8. How satisfied are you with the overall usability of the system?

[More details](#)

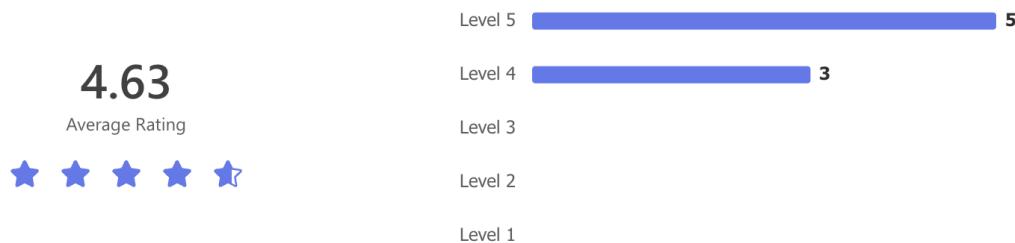


Figure F12. Usability Survey: Question 8 Results

9. How likely are you to recommend this system for library operations?

[More details](#)



Figure F13. Usability Survey: Question 9 Results

10. Do you feel the system requires additional training or resources to use effectively?

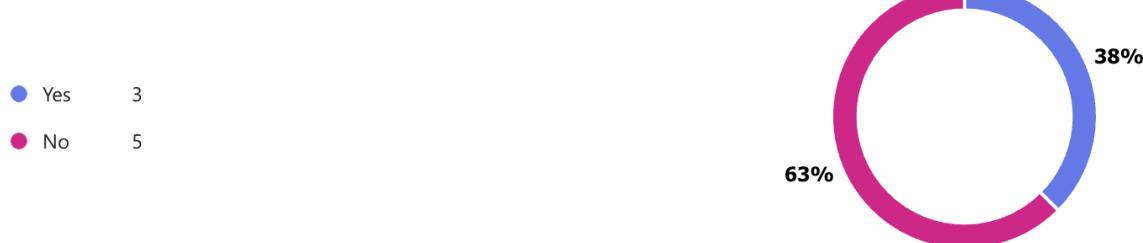


Figure F14 Usability Survey: Question 10 Results