Library Management Program Tool

Project Analysis

Version 14

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Revision History

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| --- | --- | --- | --- |
| Revision Number | Date | Description | Author |
| 1 | 25 Jan 2022 | Creation of this document. Wrote the input/output/data-processing table. Wrote the “Possible Enhancements” and “Possible Risk and Risk Mitigation” sections. | John Kucera |
| 2 | 27 Jan 2022 | Created Context Diagram. Wrote Context Diagram Description. Reviewed input/output/data-processing table and added suggestion. | Ursula Richardson |
| 3 | 28 Jan 2022 | Created Subsystem Diagram | Jason Martin |
| 4 | 28 Jan 2022 | Edited Context Diagram | John Kucera |
| 5 | 29 Jan 2022 | Updated Context Diagram description. Edited Subsystem Diagram | Ursula Richardson |
| 6 | 30 Jan 2022 | Added Subsystem Diagram descriptions | Jason Martin |
| 7 | 30 Jan 2022 | Edited Subsystem Diagram and Subsystem Diagram descriptions | John Kucera |
| 8 | 30 Jan 2022 | Added Mapping Subsystem to requirements table | Ursula Richardson |
| 9 | 30 Jan 2022 | Reviewed and edited previous Subsystem to requirements table entries. Added to the Possible Enhancements and Risk and Risk Mitigations Section. | Jason Martin |
| 10 | 31 Jan 2022 | Edited Subsystem Diagram. Finalized for submission by editing fonts and revising sentences. | John Kucera |
| 11 | 7 Feb 2022 | Edited Subsystem Diagram and descriptions to include “CheckedBooks” table | John Kucera |
| 12 | 27 Feb 2022 | Edited context and Subsystem descriptions; Removed anything involving fines. Identified menus as either Panels or Dialogs. | John Kucera |
| 13 | 28 Feb 2022 | Updated context and subsystem diagrams. | John Kucera |
| 14 | 5 March 2022 | Updated subsystem diagram to match final source code. | John Kucera |

**Project Analysis:**

**Outside system**: the user

**Input/Output/Data Processing Identifications:**

|  |  |  |
| --- | --- | --- |
| **Input Data**  (**Source of all input data** is the User who clicks the GUI buttons and types in GUI text fields) | **Output Data**  (**Destination of all output data** is the User’s GUI where they can see confirmation of the action or change that occurred) | **Data Processing** |
| (Upon program start) | Display GUI with log-in dialog. Log-in dialog has text fields for username and password along with “Log in” button. | Set up GUI characteristics for the Log-in menu. |
| Click the “X” exit button on the GUI | Program is terminated, GUI closes. | Program and GUI will close on User’s system. |
| (Log-in dialog) Username and password typed in text fields, “Log-in” button is clicked. | If log-in is successful, display main GUI (Contains Main Menu bar and Admin Settings bar). GUI has welcome message. If log-in failed, “Username or password is invalid” message is displayed. | Check the user database to match the input username and password. Allow the log-in to that account if the input is valid and dispose of the log-in dialog. Deny the log-in and display message if input has no match. |
| (Main menu bar) Button for “Log Out” is clicked | Display the “Log-in” dialog. | Log the current user out. Set up GUI characteristics for the Log-in dialog. |
| (Main menu bar) Menu item for “Browse Books” is clicked | Display the Browse Books panel, including text fields for “title” and “author”, along with “Search”, “Show Info”, and “Check Out” button. | Set up GUI characteristics for Browse Books panel. |
| (Browse Books panel) Characters are typed into “title/author” text field, and “Search” button is clicked. | In a table, display list of matching books in from books database. | Retrieve list of all books that have title or author that contain the characters input by user. Set up GUI characteristics to display those results in the “results” table. |
| (Browse Books panel) “Show Book Info” button is clicked when selecting a particular book | In a dialog, display book information: title, author, ISBN, total quantity, and quantity available. | Retrieve object fields for the book from the book database. Set up GUI characteristics to display this information in a dialog. |
| (Browse Books panel) “Check Out Book” button is clicked when selecting a particular book | IF BOOK IS UNAVAILABLE: Display message to user that book is unavailable to check out.  IF BOOK IS AVAILABLE: Display message to user indicating that they have checked out the book. | First, retrieve book info from database to determine availability. UNAVAILABLE: Set up GUI characteristics to display “unavailable” message.  AVAILABLE: Set up GUI characteristics to display “confirm” message. Retrieve current user ID from Users Table. Add book to CheckedBooks Table with that user ID. Decrement quantity available in Books table. |
| (Main menu bar) Menu item for “View Checked-out Books” is clicked | Display list of user’s checked-out books and a “Return Book” button. | Retrieve current user ID from Users Table. Retrieve checked-out books (for that user ID) from Checked- Books table with information from Books Table. Set up GUI characteristics for View Checked-out Books panel to display this information. |
| (View Checked-Out books panel) “Return book” is clicked when selecting a particular book. | Display message indicating that book has been returned. | Modify the book’s quantity available in Books Table. Remove book from checked-books database. Set up GUI characteristics for confirmation message. |
| (Main menu bar) “Change password” menu item is clicked | Display Change password panel, including text fields for “Current password”, “New Password”, “Confirm new password”, and a button for “Confirm Password Change”. | Set up GUI characteristics for the Change password panel. |
| (Change password panel) Invalid current password is typed, “Confirm Password Change” button is clicked | Display message indicating that current password is incorrect. | Retrieve current password from user database and determine that it does not match input. Set up GUI characteristics for the message. |
| (Change password panel) “New password” and “Confirm new password” are typed and do not match, “Confirm Password Change” button is clicked. | Display message indicating that the new password and new password confirmation do not match. | Determine that the two inputs do not match. Set up GUI characteristics for the message. |
| (Change password panel) All valid information is input, “Confirm Password Change” button is clicked | Display message indicating that password has been changed. | Retrieve current password from user database and confirm that all input is valid. Modify user’s password in the user database. Set up GUI characteristics for the message. |
| (Admin Settings menu bar) “Add User” menu item is clicked | Display Add User menu, which prompts user to information with “Username”, “Password”, and full name text fields, “Admin” checkbox, and “Confirm Add” button. | Set up GUI characteristics for Add User panel. |
| (Add User panel) Valid user information is typed, “Confirm Add” button is clicked | In a dialog, display message indicating that user has been added. | Modify user database to append an entry with the new user’s information. Set up GUI characteristics for message in a dialog. |
| (Admin Settings menu bar) “List Users” menu item is clicked. | Display List Users panel, which lists all users and whether they are a Member of an Admin. “Remove user” button is next to the table. | Retrieve information from user database on all users. Set up GUI characteristics for List All Users panel to display said information. |
| (List Users panel) “Remove user” button is clicked for a particular user. | In a dialog, display message indicating that said user has been removed. | Modify user database to remove said user and their information from the database. Set up GUI characteristics to display message in a dialog. |
| (Admin Settings menu bar) “Add book” menu item is clicked | Display Add Book panel, prompting user with book information to input: title, author, ISBN, total quantity, and quantity available. Also include a “Confirm Add” button. | Set up GUI characteristics to display Add Book panel. |
| (Add book panel) Type in book information, click “Confirm Add” button. | In a dialog, display message indicating that book has been added. | Modify book database to append an entry with input book information. Set up GUI characteristics to display confirmation dialog. |
| (Admin Settings menu bar) “List Books” menu item is clicked | Display List Books panel, which includes list of all books’ titles and authors, in addition to “Remove Book” and “Edit Book Info” buttons. | Retrieve title and author information from inventory database on all books. Set up GUI characteristics to display List Books panel. |
| (List Books panel) “Remove Book” button is clicked when selecting a particular book. | Display message indicating that said book has been removed. | Modify book database to remove entry for the said book. Set up GUI characteristics to display confirm message. |
| (List Books panel)  “Edit Book Info” button is clicked when selecting a particular book. | In a dialog, display book information in editable text fields: title, author, ISBN, total quantity, and quantity available. | Retrieve object fields for the book from the book database. Set up GUI characteristics to display this information in a dialog. |
| (Edit Book Info Dialog)  Information in text fields is edited, “Confirm edits” button is clicked. | Close Dialog, returning to the List Books panel. | Store new values for book fields into the Books Table. Dispose of Swing Dialog. |

**Context Diagram**:

Timeline

Description automatically generated

**Description of Context Diagram**:

The Context diagram above shows the input and output interaction between the users and the Library Management Program that includes the GUI and databases. The users will include the members as well as admin users.

**Subsystems Diagram (ZOOM IN TO READ TEXT)**:

Diagram, schematic

Description automatically generated

**ARROWS THAT PHYSICALLY CANNOT FIT IN DIAGRAM IMAGE:**

* **View Checked-Out Books Panel → Users Table**: Request current User Id
* **Users Table → View Checked-Out Books Panel**: Return current User Id
* **View Checked-Out Books Panel → Books Table**: Request book title/author, Request book quantity increment
* **Books Table** → **View Checked-Out Books Panel**: Return book title/author
* **Browse Books Panel → Users Table**: Request current User Id
* **Users Table → Browse Books Panel**: Return current User Id

**Subsystem Diagram Notes:**

* We are counting the Database tables as subsystems in the Library Management Program.
* Blue Arrows are Input, Red Arrows are Output.
* Although the different panels are split into subsystems, they are ultimately always inside the GUI Frame (Input Subsystem). This means that all input and output arrows are still interactions between “User” and “GUI” (excluding interactions with database tables).

**Descriptions of Subsystems**:

* **GUI (Input Subsystem):** This subsystem receives all input data, including button clicks and typed characters, from the user. It is also where output information is returned and displayed to the user. The GUI will be a Java Swing JFrame and is the container of all other Dialog and Panel subsystems (each of which are accessed from the GUI’s JMenuBar).
* **Login Dialog:** This subsystem will function as the entry point to the Library Management Program. It will accept a username and password combination that will be authenticated from the User Table. Users with failed attempts will be prompted to try again. After a successful login, the dialog will close. Login Dialog will be a Java Swing JDialog.
* **Change Password Panel:** Accessed from the main menu bar, this subsystem will allow users to change their account’s password. After confirming their new password in the prompt, the subsystem will update the relevant information in the User Table. Change Password Panel will be a Java Swing JPanel.
* **Browse Books Panel:** Accessed from the main menu bar, this subsystem will allow users to browse the books stored in Books Table by prompting the user to enter a title or author. Upon searching, books with a title or author containing the input are listed in a “results” table. Users can select books to either show more information or check out the book. Browse Books Panel will be a Java Swing JPanel.
* **View Checked-Out Books Panel:**  Accessed from the main menu bar, this subsystem will allow users to view their checked-out books and return books upon selection. This subsystem will retrieve information from the Checked-Books Table. View Checked-Out Books Panel will be a Java Swing JPanel.
* **(Admin Settings) Add User Panel:** Accessed from the Admin Settings menu bar, this subsystem allows Admin users to add a user to the Users Table upon providing the username, password, full name, and whether they are an admin. Add User Panel will be a Java Swing JPanel.
* **(Admin Settings) List Users Panel:** Accessed from the Admin Settings menu bar, this subsystem allows Admin users to view a list of users in Users Table. By interfacing with the Users Table, they also have the option to remove a user. List Users Panel will be a Java Swing JPanel.
* **(Admin Settings) Add Book Panel:** Accessed from the Admin Settings menu bar, this subsystem allows Admin users to add a book to the Books Table upon providing the book information: title, author, ISBN, total quantity, and quantity available. Add Book Panel will be a Java Swing JPanel.
* **(Admin Settings) List Books Panel:** Accessed from the Admin Settings menu bar, this subsystem allows Admin users to view a list of books in Books Table. By interfacing with the Books Table, they also have the option to remove or modify information of a book. List Books Panel will be a Java Swing JPanel.
* **Books Table:** This table contains all the information about the books being stored in the Library Management Program. Various subsystems interface with this table by retrieving and modifying book information. These records store: title, author, ISBN, total quantity, and quantity available.
* **Users Table:** This table contains all the information about the users that have access to the Library Management Program. Various subsystems interface with this table by retrieving and modifying user information. These records store username, password, first name, last name, and admin status.
* **Checked-Books Table:** This table contains all the information about the books checked out by users in the Library Management Program. These records store book title, author, check-out date, and check-out period.

**Mapping Subsystems to Requirements**:

*(This is the Requirements Table provided from its respective document. It is copied here to read the referenced requirements more easily in the following Mapping table.)*

|  |  |
| --- | --- |
| **Requirement#** | **Description** |
| 1 | This Library Management Program (LMP) shall require authentication for users on a Login dialog when they first access the GUI. Username and Password will be required. After successful authentication, the program proceeds to the GUI with a main menu bar and admin settings menu bar. |
| 2 | This LMP, in the main menu bar, shall allow the user to Browse All Books in library. |
| 3 | This LMP, upon Browsing, shall allow the user to search for a book by typing title or author. |
| 4 | This LMP, upon book selection and clicking “Show Book Info” button by a user, shall display book information, including title, author, ISBN, total quantity, and quantity available. |
| 5 | This LMP, upon book selection by a user, shall NOT allow the user to check out a book that is currently unavailable. |
| 6 | This LMP, upon book selection by a user, shall allow the user to click “Check Out” Button to check out a book that is available. |
| 7 | This LMP, upon allowing user to check out a book, shall record the check-out in the checked-books database. |
| 8 | This LMP, in the main menu bar, shall allow the user to view their Checked-out books and allow them to select a book and return it. |
| 9 | This LMP, upon allowing a user to return a book, shall record the return in the books and checked-books database and update the quantity available in book info. |
| 10 | This LMP, in the main menu bar, shall allow users to change their password. Users must provide their old password first. |
| 11 | This LMP, in the main menu bar, shall allow users to log out. Upon logging out, the GUI will return to the Login dialog. |
| 12 | This LMP shall designate users as either Members or Admins. Library Members will be the borrowers/customers. Admins will be the library Staff and will have access to both the Members options plus the ability to click “Admin Settings” menu bar. |
| 13 | This LMP shall NOT allow Library Members to have access to “Admin Settings”. The “Admin Settings” menu bar will be disabled for Members. |
| 14 | This LMP, in Admin Settings, shall allow admins to add users. |
| 15 | This LMP, upon user addition by an Admin, shall prompt for the new user’s username, full name, password, and if they will be a Member or an Admin. |
| 16 | This LMP, in Admin Settings, shall allow admins to view a list of all users. This list will display all user’s fines and if they are a Member or an Admin. |
| 17 | This LMP, upon displaying the list of users, shall allow admins to remove a user. |
| 18 | This LMP, in Admin Settings, shall allow admins to add a book into the library database and will provide a form for admins to fill out book information. The form will prompt for: title, author, ISBN, total quantity, and quantity available. |
| 19 | This LMP, in Admin Settings, shall allow admins to list all books in the library. |
| 20 | This LMP, upon listing all books in the library and selection by a user, shall allow admins to remove a book from the book database. |
| 21 | This LMP, upon listing all books in the library and selection by a user, shall allow admins to edit a book’s information. |

**Table for Mapping Requirements to Subsystems:**

|  |  |
| --- | --- |
| **Requirement #** | **Subsystems** |
| 1 | GUI (Input Subsystem), Login Dialog |
| 2 | GUI (Input Subsystem), Browse Book Panel, Books Table |
| 3 | GUI (Input Subsystem), Browse Book Panel, Books Table |
| 4 | GUI (Input Subsystem), Browse Book Panel, Books Table |
| 5 | GUI (Input Subsystem), Browse Book Panel, Books Table |
| 6 | GUI (Input Subsystem), Browse Book Panel, Books Table |
| 7 | GUI (Input Subsystem), Browse Book Panel, Books Table, Checked-Books Table |
| 8 | GUI (Input Subsystem), View Checked-Out Books Panel, Checked-Books Table |
| 9 | GUI (Input Subsystem), View Checked-Out Books Panel, Checked-Books Table |
| 10 | GUI (Input Subsystem), Change Password Panel, Users Table |
| 11 | GUI (Input Subsystem), Login Dialog |
| 12 | GUI (Input Subsystem), Users Table |
| 13 | GUI (Input Subsystem), Users Table |
| 14 | GUI (Input Subsystem), (Admin Settings) Add User Panel, Users Table |
| 15 | GUI (Input Subsystem), (Admin Settings) Add User Panel, Users Table |
| 16 | GUI (Input Subsystem), (Admin Settings) List Users Panel, Users Table |
| 17 | GUI (Input Subsystem), (Admin Settings) List Users Panel, Users Table |
| 18 | GUI (Input Subsystem), (Admin Settings) Add Book Panel, Books Table |
| 19 | GUI (Input Subsystem), (Admin Settings) List Books Panel, Books Table |
| 20 | GUI (Input Subsystem), (Admin Settings) List Books Panel, Books Table |
| 21 | GUI (Input Subsystem), (Admin Settings) List Books Panel, Books Table |

**Possible Enhancements**:

* Add a waiting list for users who want to check out books that are currently unavailable.
* Add a “Preview Book” action where the GUI will display the first few, or specifically selected, pages from a selected book.
* Add a Dewey-decimal system to sort the books.
* Adding a Wishlist feature for users to tag books that they are interested in.
* Adding a limit to the number of books that a user is allowed to check out at a time.
* Adding a kid’s section in the GUI and a kids user profile setting that only allows children’s books to be searched for. This would add an age rating tag to each book.
* Adding extra tables to our database for other types of media that the library could have on hand such as movies, boardgames, periodicals.
* Add a GUI for messaging the library with book suggestions or general comments.
* Add a schedule function for admins to add events to the library to that a user can reference to see upcoming events.
* Add a way for users to reserve study rooms or spaces in the library.
* Add a way for multiple Library Management Programs to interact to allow geographically separated libraries to share resources with each other.
* Add a function for users to login with their library cards.

**Risks and Risk Mitigation**:

* The program might not function efficiently on a system with older and weaker components – for example, a slow CPU, a RAM with little memory, a hard disk that full of other programs that slow the system down. **Possible Risk Mitigation**: Acquire and install components that better fit the intended operating platform, indicated in Project Plan. Alternatively, find a different system entirely that is closer to the intended operating platform.
* Another possible risk is the leaking of authentication information for users. **Possible Risk Mitigation**: Protect the username/password database with its own password to enter. Encrypt all usernames and passwords so they are unreadable by the human eye.
* The system doesn’t currently have any built-in way to back up its data and if the system were to become corrupted all its data would be lost. **Possible Risk Mitigation**: Add an automatic back-up of each of the database tables that could be used to recover data.
* The ability to create or remove people as admins is shared by all admin accounts. While convenient, this means that any singular admin account can completely lock out every other account. **Possible Risk Mitigation**: Add a management account to handle the creation of Admin accounts to prevent malicious users from locking out other admins.
* Since we are using a SQL database, SQL injection is a possible intrusion method into our data particularly the database’s user table. **Possible Risk Mitigation**: A mitigation for this would be ensuring all data be used in queries is parameterized and has been input validated before being acted upon.
* Currently the system only uses a password for authenticating the user. **Possible Risk Mitigation**: Adding a multifactor authentication system that could use a user’s library card or email address to confirm the user’s authenticity and increase account security.