

BOOKWORMS LIBRARY VENDING SYSTEM
COMPANY NAME-LENDIT SERVICES

Team -2

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MSIS 2602-INFORMATION SYSTEMS ANALYSIS AND DESIGN

Final Project Report

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1. Problem Statement

Among the service-based industries that were hit badly by the pandemic, Library services are one of them. Despite reopening to in-person services, most of the residents are unwilling to come to highly populated public spaces. To address this problem and to adapt to the “new normal”, LendIt Services is partnering with public/private libraries and retail businesses to augment library services by enabling contact less borrowing and easy access beyond central libraries through Smart Library Station Kiosks.

2&3. Business Description & Scope of the System

It is an 8-foot-tall machine which offers full circulation functionality. With it, visitors can access Wi-Fi, check out, return items, pay fines on overdue items, browse from the library catalog, checkout holds, and even register for upcoming events in library. Kiosks are available in three capacities: 200, 500, or 1,000 items. LendIt will loan items of all types, up to 9.5 inches by 11.5 inches. The county is planning to offer 10 such Kiosks throughout the region for readers to access 24/7.

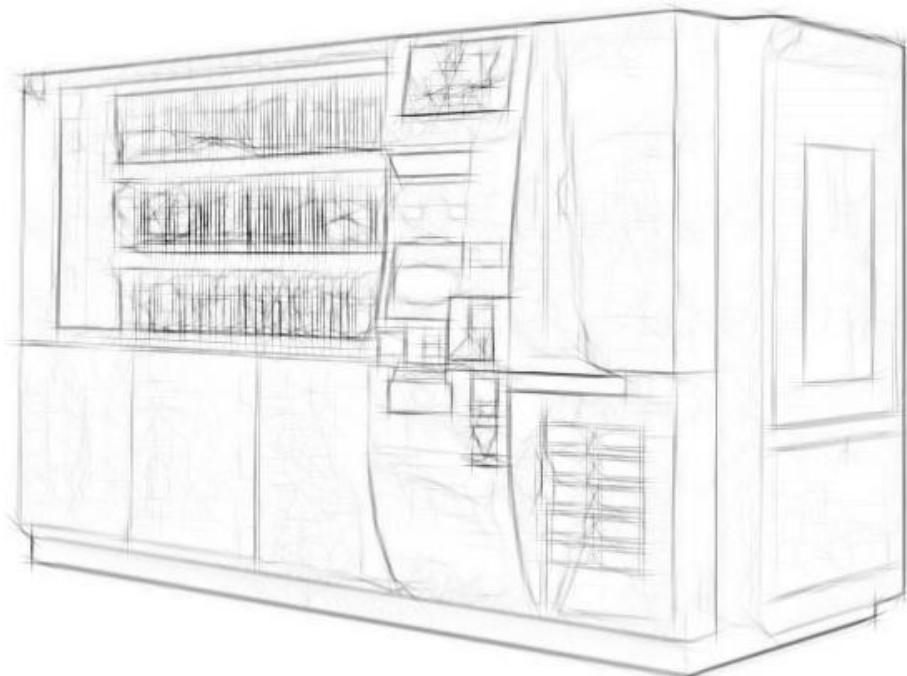


Figure 1 Kiosk System Prototype

4. Gantt Chart

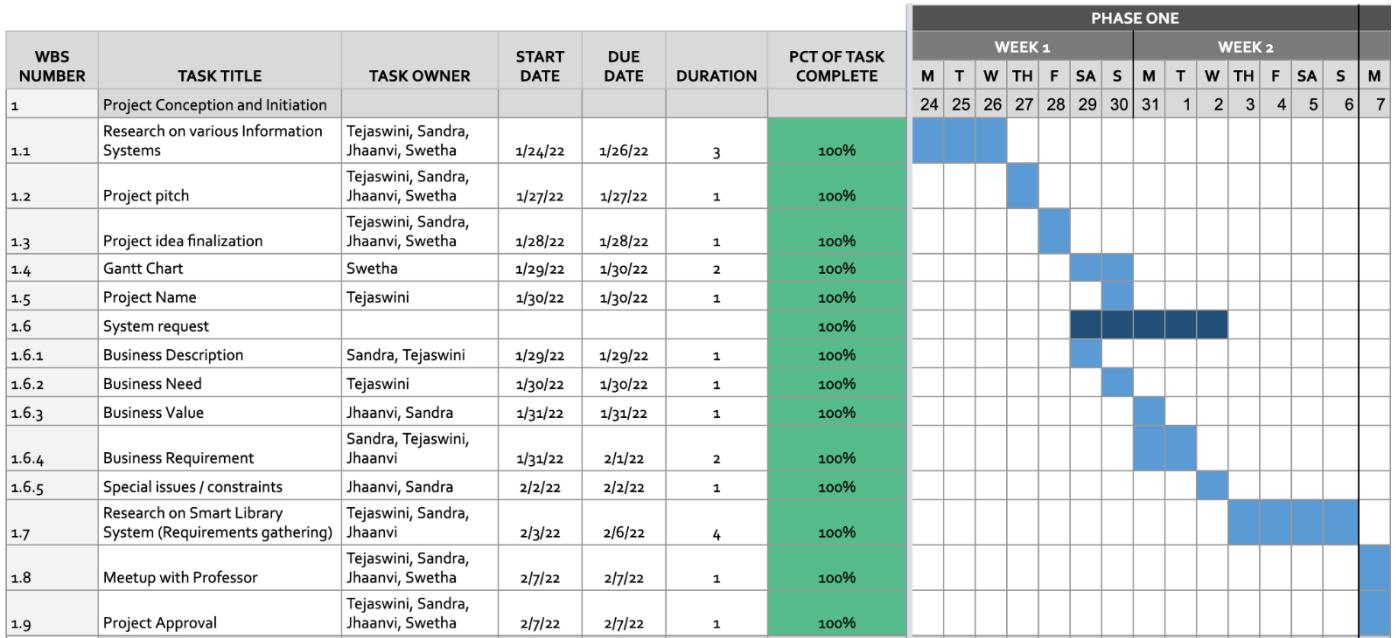


Figure 2 Gantt chart page1

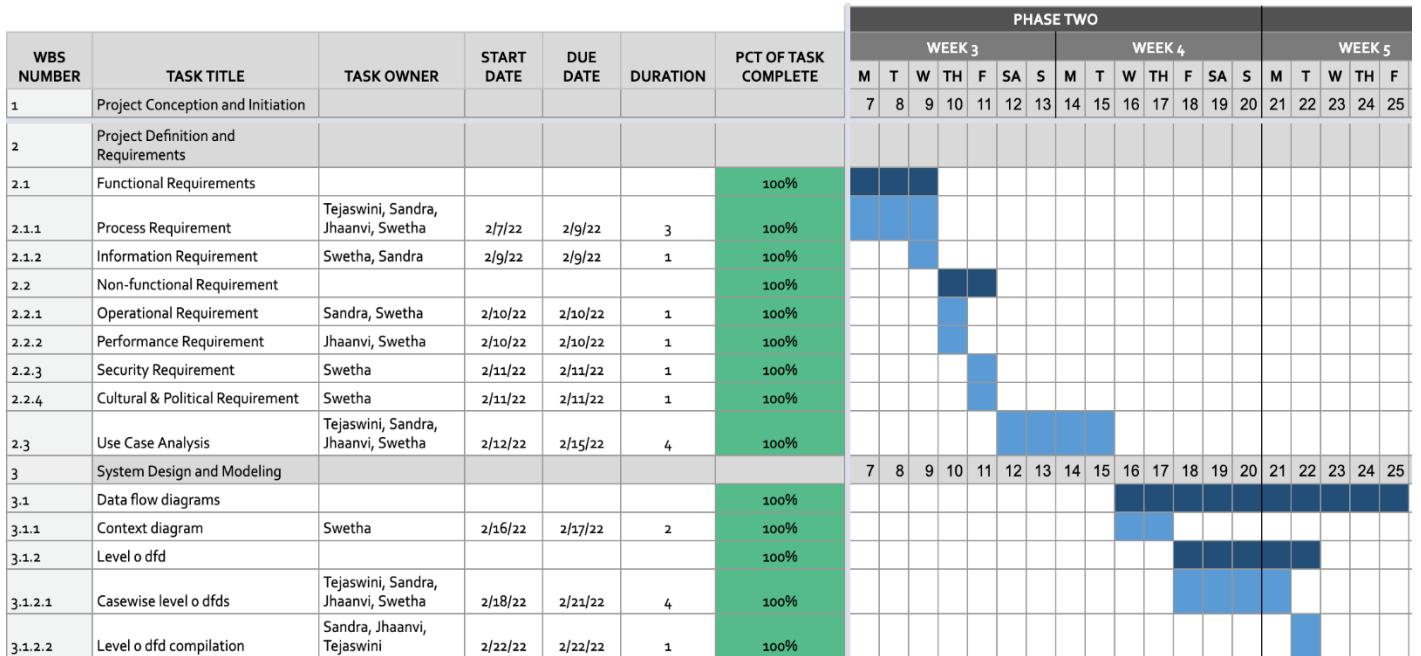


Figure 3 Gantt Chart page2

Gantt Chart Continued

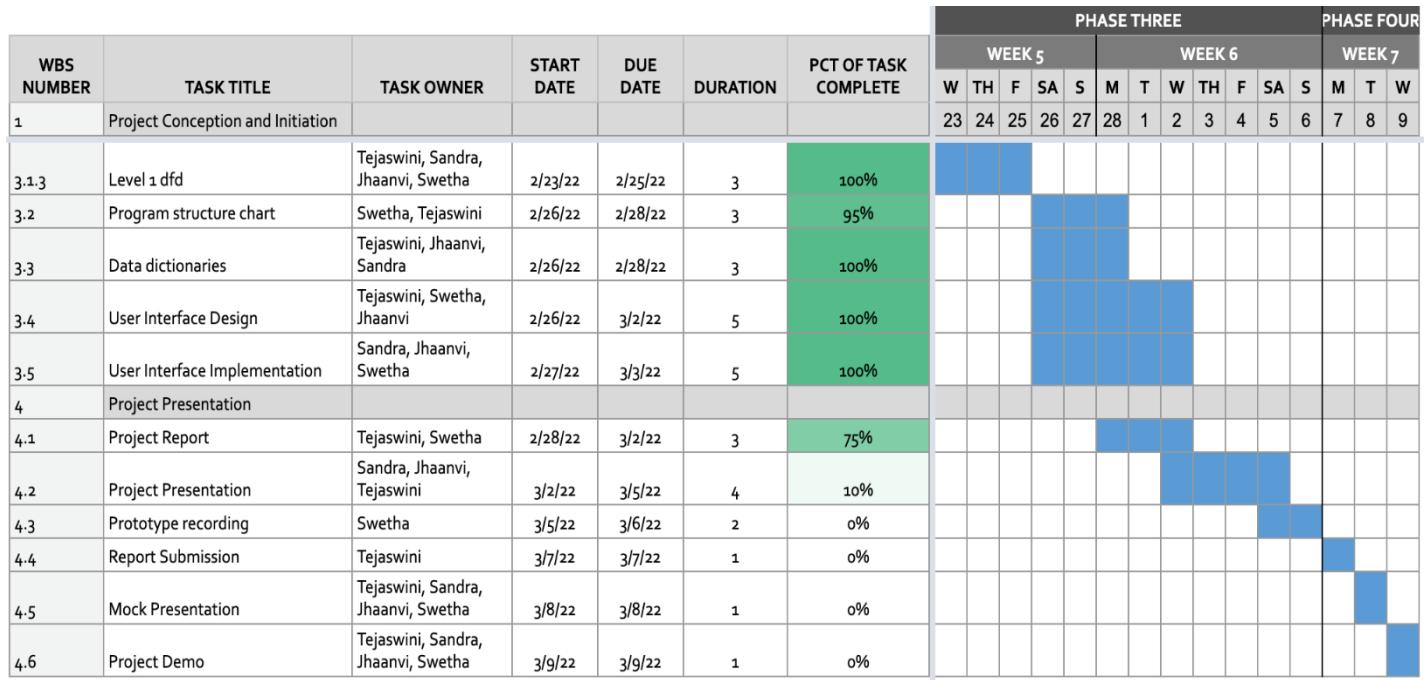


Figure 4 Gantt Chart page 3

5. System Request- Bookworms Project-LendIT Services

Project Sponsor: Vice President, Marketing Department, LendIT Services

Business Need: In an era of drive-thrus, ATMs and cloud services, providing 24/7 access keeps libraries relevant and top of mind in the community without securing new funds for library buildings. Through smart kiosks, libraries can address the following needs:

- Versatility: From community centers and housing complexes to shopping malls and train stations, library services can be accessed throughout the community.
- Outreach: Instead of one central location-based system, distributing several smaller stations in multiple locations will increase the number of users by delivering services to where people live.
- Community partnerships: Builds Strong partnerships with retail owners, city housing, schools, and other stakeholders in the community.

Business Requirements:

1. Patrons should be able to log into their accounts using access cards at any station and view items.
2. Patrons should be able to check out a new item or an item placed on hold
3. Patrons should be able to return materials at a time or should be provided the facility to buy books (in case of Book Store administration).
4. Staff should be able to empty return bins, shelve new items, withdraw items, and collect cash
5. Program Promotion – electronic display(s) can be used to promote library programs and events or Advertisements to promote marketing for few companies.
6. Fine Payment/ purchase of books using a credit card.
7. Streamlined Expired Holds Management – for items that patrons fail to pick up and are past the hold shelf time limit, the system can automatically pull and sort into a dedicated bin.

8. Automated Alerts –the automated system alerts staff of potential issues, including automated alerts (bin full, out of paper, ILS offline, low available items, etc.) as well as critical system alerts.

Business Value:

Intangible:

- Partnering with public libraries will provide access to books and Wi-Fi to sub-urban communities increasing outreach
- Increasing outreach of the library services through kiosks would attract more readers thereby increasing library subscribers.

Tangible:

- The library kiosk system can also be implemented in public as well as private libraries allowing us to cater to a larger market. (Estimated total number of libraries in the US is 116,867)
- Partnering with retail outlets e.g., malls, coffee shops will be a revenue generation stream. Projected increase in revenue through yearly subscription service.
- This product will allow us to connect with libraries around the country and sell our existing library services products including library management software and self-service checkout.

Special Issues and Constraints:

- Accepting only certain denominations of dollar bills can limit the Patrons to use the machine to make payments, delaying fee or fine payments.
- There can be mechanical malfunctions in the machine which may require quick repair or replacement of a part
- 24/7 library kiosks can be a target for theft and vandalism. This can be mitigated by choosing the right location and having security cameras on the machine.

6. Functional Requirements

a. Process- Oriented requirements:

1. Patrons should be able to login and view items:

- System should present the catalog of items to the Patron on different levels of kiosk.
- System should allow users to login to their accounts by scanning their access card or user id and password.
- User should be able to pick what shelf they want to view.

2. Patrons should be able to check out a new item or an item placed on hold:

- System should display user if an item placed on hold is ready for pickup.
- User should be able to enter the shelf number.
- System should display if the book is not available for retrieval if the book is on hold. (Holds shelf will be hidden).
- System should be able to dispense the book.
- The system allows the process to repeat several times until the user has completed retrieving all books.
- System should not allow users to borrow books after the set borrow limit.
- System should print the receipt of the books borrowed along with the loan period.

3. Patrons should be able to return materials:

- System should direct the user how to place the item for return.
- System should reject the item if it's placed incorrectly.
- System should be able validate the returned item.
- System should scan the barcode of the book and should reject it if it's not the correct book.
- The system sends an alert to the library staff if all the bins are full.
- System should change the bin if it reaches its weight threshold.
- System should update the returned books in the datastore.

4. Staff should be able to shelve new items, withdraw items:

- Staff should be able to scan the barcode of the book and shelve an item and the same should be updated in the mapping datastore.
 - Staff should be able to view the shelf-time of a book and remove if it is not popular.
 - Staff should be able to withdraw a book and the datastore containing the mapping of the shelf and book should be updated.
- 5. Staff should be able to empty return bins and remove cash from the cash box (fine paid by cash into the kiosk):**
- Staff should be able to select a bin they want to empty.
 - Staff should be able to take cash from the cash box.
- 6. Program Promotion and registration – electronic display(s):**
- Library staff should be able to add weekly programs/events to the event datastore.
 - System should collect the information on upcoming events from event datastore.
 - System should display the upcoming events information to the Patron.
 - System should allow Patron to register for the event(s).
 - System should update the event datastore with user registration.
- 7. Pay Fee and Fine:**
- System should allow the user to login via membership card or login credentials.
 - System should check if there are overdue items associated with user's account.
 - System should calculate any outstanding dues for patrons.
 - System must prompt the user to complete the fine payment if the overdue amount has exceeded the threshold limit.
 - System should allow users to make payment via cash, credit, or debit card.
 - System should validate the denominations of cash payments.
 - System should authorize payment from third party service.
- 8. Streamlined Expired Holds Management:**
- System will check if a particular book has been picked up by the respective patron on the pick-up date.
 - System will start the hold timer if the book wasn't picked on the pick-up date and time.
 - System will pull and sort the book if the hold-time has reached the limit.

- The system updates the check out information in the book data store.
- The system updates the inventory.

b. Information – Oriented requirements:

- System must include registered Patron information.
- System must include the barcode, image, description, and details of each book.
- System must include book dimension and weight information.
- System must store the check out and return information in the book data store.
- System must include the shelf time.
- System must include the hold time for books on hold.
- System must include the bin dimensions and weight information.
- System must record the weight threshold for each bin.
- System must include real-time kiosk inventory levels.
- System must include library staff information.
- System must store internal and external activities recorded by camera for 30 days.
- System must store books placed on hold information in the book data store.
- System must store the mapping of the book and its shelf number in the data store.
- System must include the loan period for each type of loan (E.g., Books, CDs, etc.)
- System must include the borrowing limit and hold limit for Patrons (may vary for different libraries).

7. Non-Functional Requirements

a. Operational:

- Library staff should have remote access to the security system.
- The system should be connected to continuous power supply.
- The system should be able to access internet.
- The systems should notify the staff in case of operational malfunctions.
- The screen interface should be 17" wide touch screen and have brightness resistive industrial color.
- The system should support Windows 10 Professional operating system.
- The system should support Barcode scanning of patron card.

b. Performance:

- The system should be up all the time 24 hours daily.
- System should be able to process 100 payment transactions per second in peak load (request from multiple kiosks at a time).
- Scrolling one page up or down the catalog of books shall take at most one second. Searching for a specific keyword/title shall take at most 3 seconds.
- In standard workload, CPU usage must be less than 50 percent leaving 50 percent for background jobs.

c. Security:

- The system must ensure the integrity of the Patron account information.
- System collects personal information such as credit card numbers securely and stores them in an encrypted format in the database.
- The system must keep history of all records (logging) of events and processes executed by the application.

- Users should be able to report any security incidents to the system administrator.
- The system camera should record activities outside the system.
- System must log the user out if the keypad is inactive for more than 1 min.

d. Cultural:

- The system or promotions shall not display religious symbols or words associated with mainstream religions.
- Personal information is protected in compliance with the Data Protection Act.

8. Use Cases

Use Case Name: Users should be able to login and view items	ID: UC-001	Priority: High
Brief Description: User logs in to their library account at the kiosk and searches for products by browsing through the catalog.		
Actor: User		
Trigger: A user searches for an item		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions: <ol style="list-style-type: none"> 1. The patron should have an account with the library. 2. Products should be available on the shelves for viewing. 		
Normal Course: <ol style="list-style-type: none"> 1. System should allow users to scan their library card. 2. System must validate the user id and passcode/ barcode and successfully log the user in. 3. System must check for loan overdue on the item (no overdue) 4. System must display the level the user wants to view to browse through the catalog 		Information for Steps i/p: Username & Password o/p: User Options o/p: Display option i/p: Kiosk Level o/p: Shelf moving prompt
Alternative Courses: <ol style="list-style-type: none"> 1.2. System should allow the users to login to their accounts using valid user id and passcode 2.2. If the login credentials are not valid, users should be able to reset their password by clicking on Forgot Password, branch at 2.1. <ol style="list-style-type: none"> a. If registered email not available 		i/p: Barcode i/p: Forgot Password o/p: Prompt to visit nearest library in person

b. Send email with pin to sign in once 3.2. If patron has overdue payments on an item this jump to UC02	o/p: Pin Generated
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Postconditions: User will be logged in and can search items

Exceptions:

2.3. Account is not valid occurs at Step 2,

- a. System displays Username/password are not valid
- b. System asks patron to reenter username/password or contact library support

Summary:

Inputs	Source	Outputs	Destination
User Id/ Passcode	Patron DS	User Options/Login Error	Patron
Barcode	Patron DS	User Options/Login Error	Patron
Kiosk Level	Patron	Shelf moving prompt	Patron/Display
Forgot Password	Patron	Pin Generated Prompt to visit library	Email Address Patron

Use Case Name: Pay fine fee	ID: UC-002	Priority: High
Brief Description: This use case describes payment of outstanding dues/ late fee by the Patron		
Actor: Patron		
Trigger: A Patron searches for an item		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions:		
<ol style="list-style-type: none"> 1. The Patron should have an account with the library. 2. The Patron has logged in to the account 3. The Patron datastore is up to date and online 		

Normal Course	Information for Steps
<p>1. System checks if there are overdue items associated with user's account</p> <p>2. System calculates and presents the total fine due, to the Patron</p> <p>3. If the overdue amount has exceeded the threshold limit, the system prompts the user to complete the fine payment before proceeding further.</p> <p>4. System allows users to make payment via cash, credit, or debit card.</p> <p>5. If the payment is in cash,</p> <ul style="list-style-type: none"> a. System validates the denominations of cash payments. <p>Otherwise,</p> <ul style="list-style-type: none"> a. System collects credit card information from user b. System authorizes payment from third party service. <p>6. System provides Patron with payment receipt</p> <p>7. System updates the payment information for the Patron in the database</p>	<p>i/p: Overdue item list</p> <p>o/p: Total overdue cost</p> <p>o/p: Payment prompt</p> <p>i/p: Payment Type</p> <p>i/p: Payment Information</p> <p>i/p: Payment Authorization</p> <p>o/p: Payment Receipt</p> <p>o/p: Payment Details</p>

<p>Alternative Courses:</p> <p>1.1 If the overdue amount for the Patron has not exceeded the threshold limit, the system gives an option to the Patron to either complete the fine payment or skip it for now.</p> <p>a. If the Patron chooses to complete the fine payment, return to Normal course step 4</p> <p>b. If the Patron skips to complete the payment, perform Use Case 1(View Item use case)</p>	<p>o/p: Payment prompt</p> <p>i/p: Accept payment prompt</p> <p>i/p: Skip payment prompt</p>		
Postconditions: Patron will be able to search and loan items			
Exceptions:			
<p>E.1 Payment is not authorized (occurs at step 5)</p> <ol style="list-style-type: none"> 1. System displays message that payment is not accepted 2. System asks the Patron to enter new payment information or exit 3. System terminates the use case if the Patron specifies exit otherwise return to normal course step 5 			
Summary:			
Inputs	Source	Outputs	Destination
Overdue item list Payment Prompt Accept payment prompt Skip payment prompt Payment information Payment type Payment authorization	Loan Datastore Patron Patron Patron Patron Patron Third party clearing house	Total overdue cost Payment Receipt Payment Receipt	Patron Payment Datastore Patron

Use Case Name: Patrons should be able to check out a new item or an item on hold	ID: UC-003	Priority: High
Brief Description: Patron selects the item on the kiosk display and should be able to check out the item. The Patron may repeat this process several times until they are satisfied and ready to place their order.		
Actor: Patron		
Trigger: The user checks out an item from the kiosk		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions:		
1. User should be logged into their account		
Normal Course <ol style="list-style-type: none"> 1. System should display user if an item on hold is ready for pickup at the kiosk 2. System should dispense items placed on hold from holds shelf 3. System should allow users to select the shelf number to dispense the item of their choice. 4. System should generate the receipt after the item is loaned with the loan period. 		Information for Steps <p>i/p: Patron id o/p: Item for pickup i/p: Item picked o/p: Item confirmation, hold timer stops, update loan DB i/p: Shelf number i/p: Book Details o/p: Receipt</p>
Postconditions: System will generate the receipt of the items loaned and update the Patron account and loan data store accordingly.		
Exceptions: <ol style="list-style-type: none"> 2.2. if there is a blockage on the conveyor belt <ol style="list-style-type: none"> a. System must alert the staff member for malfunction. 		<p>i/p: Conveyor belt stuck error o/p: System out of order</p>

<p>b. System must also display the out of order message on screen.</p> <p>3.2. If total items borrowed by the user are more than the borrow limit, branch at 3.1:</p> <p>a. System should display “Borrowing Limit Reached” message</p> <p>4.2. If the system is out of receipt paper, it should display an error message.</p>	<p>i/p: Total borrowed items o/p: Borrowing limit prompt o/p: Out of paper.</p>		
Summary:			
Inputs	Source	Outputs	Destination
Patron id	Patron DS	Item for pickup item confirmation	For Pickup DS Loan DS
Item picked	For Pickup DS	Receipt	Patron
Shelf number	Patron	Receipt	Patron
Book Details	Shelf-Item Map DS	Receipt	Patron
Total Borrowed Items	Loan DS	Borrowing limit prompt	Patron

Use Case Name: Patrons should be able return checked out items	ID: UC-004	Priority: High
Brief Description: The patron scans the library card and places the item into the slot which scans the item and sends it into return bins. The patrons may repeat this process several times until all the books they want to return are checked in.		
Actor: Patron		
Trigger: The Patron clicks on returns to check in the item into the kiosk.		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions: <ol style="list-style-type: none"> User should be logged into their account by scanning the library card 		

<p>Normal Course</p> <ol style="list-style-type: none"> 1. System should prompt the patron to place the item barcode side up. (Step 1.1) 2. System should match the barcode of the item to the Patron checked out item. (Step 2.1) 3. System should check for loan overdue on the item (Step 3.1) 4. System should track the next bin by referring weight specifications of the bin (Step 4.1) 5. System should send item to the bin through conveyor belt (Step 5.1) 6. System should generate the receipt after the item is returned within the loan period and allow patrons to choose to print or email receipt 7. System should update the loan database with the return status of the item. 	<p>Information for Steps</p> <p>i/p: Patron id o/p: Return prompt</p> <p>i/p: Item barcode o/p: Item confirmation</p> <p>o/p: Loan details</p> <p>i/p: Item dimensions and weight o/p: bin number</p> <p>i/p: Item o/p: Receipt</p> <p>o/p: Updated Return datastore</p>
<p>Alternative Courses:</p> <ol style="list-style-type: none"> 1.1. If the item is not placed properly Step1 should be repeated until the barcode is available to scan. 3.1. If the item is returned after the loan time, <ol style="list-style-type: none"> a) System should refer to the Pay fine use case. 4.1. if all the bins are full, <ol style="list-style-type: none"> a) System must prompt patron to come back later b) System should notify staff to empty the bins 6.1. if the paper to print receipt ran out, 	<p>o/p: Prompt the right way to place the book</p> <p>o/p: Display fine details</p> <p>o/p: Bins are full. Return later.</p>

a) System should alert staff member b) System should display an error message and allow the user to choose an email receipt.	o/p: Out of paper.
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Postconditions: System will generate the receipt of the items returned and update the Patron account and loan data store accordingly.

Exceptions:

- 2.1. If the scanned item does not match the items in the database, System must throw an error to the patron and reject the book. o/p: Error message
- 5.1. if there is a blockage on the conveyor belt,
 - a) System must alert the LendIT support technician and Library staff for malfunction.
 - b) System must also display the out of order message on screen. o/p: System out of order.

Summary:

Inputs	Source	Outputs	Destination
Patron id	Patron	Return prompt	Display screen
Item barcode	Item datastore	Item confirmation	Return Datastore
Item dimensions and weight	Item datastore	Bin Number	Bin Datastore
Bin number	Bin datastore	Done Prompt	Display screen
Item	Patron	Receipt	Return datastore

Use Case Name: Staff should be able shelve new items, withdraw items in the kiosk	ID: UC-005	Priority: High
Brief Description: The staff scans their admin/staff card and starts shelving the items into their slots or withdraw items from the slot and store the mapping information into the mapping datastore. The staff may repeat the process until all the slots in the Kiosk are full.		
Actor: Staff		
Trigger: The staff chooses to reshelf items into the kiosk or withdraw items from the kiosk.		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions: User should be logged into their account by scanning the library card		
Normal Course 1. System should display staff options to the user. 2. System should allow staff to select slot numbers. 3. System should allow staff to reshelf if empty or withdraw if not popular and map the new item to that slot by scanning barcodes. 4. System should allow staff to remove old item in the slot and update the withdrawn item status in kiosk or mapping database	Information for Steps i/p: Staff id o/p: In process message i/p: Slot number o/p: Display Slot options i/p: Item barcode o/p: Updated Shelf Item map datastore	
Alternative Courses: 3.1. System should not allow more than one book to be mapped to each slot in the kiosk a) System should throw an error when attempting the above scenario.	o/p: Error message. Only one book per slot. o/p: Error message. Book is too large.	

b) System should also display an error when the dimension of the book is larger than the slot dimensions.			
Postconditions: System is ready for patrons to access the newly shelved items in the kiosk.			
Exceptions:			
1. System should not allow items that do not match the records in the item database to be shelved.			
Summary:			
Inputs	Source	Outputs	Destination
Staff id	Staff datastore	Open shelving window	Shelf trigger on
Slot Number	Input Display screen	Display slot options	Display Screen
Item barcode	Item datastore	Mapped items and slots	Updated Shelf Item Map Datastore

Use Case Name: Staff should be able to empty return bins and remove cash from the cash box (fine paid by cash into the kiosk)	ID: UC-006	Priority: Low
Brief Description: The staff scans their admin card to empty return bins or to open a cash box to collect the fines paid through cash.		
Actor: Staff		
Trigger: The Patron checks out an item from the kiosk		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions: Staff should be logged into their account by scanning the admin card.		

Normal Course	Information for Steps
<ol style="list-style-type: none"> 1. Staff chooses to empty bin options among staff options 2. Staff chooses the bin number to empty and replaces it back. 3. The replaced bin is ready for refill again. 4. Repeat steps 2,3 until all bins are empty and staff clicks on Done. 5. System should display staff options 6. System should allow staff to choose the Cash box option. 7. System should ask staff to validate the amount of cash and match with the amount paid in fines. 	<p>i/p: Staff Id i/p: Bin numbers to empty o/p: Open Bin window o/p: Bin weight reset o/p: Updated Bin weights o/p: Display staff screen i/p: 2 step authentications i/p: fine by cash, amount</p>

Alternative Course(s):

7.1 Systems should check the denominations of cash payment during payment and reject the retrieval.

Postconditions:

1. Bins are ready for patrons to return items.
2. Cash is collected and updated into the Accounts Database.

Exceptions:**Summary:**

Inputs	Source	Outputs	Destination
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Staff Id	Staff datastore	Bin weight reset	Bin Datastore
Bin numbers	Bin Datastore		
2 step authentications	Scanner		
fine by cash, amount	Patron		

Use Case Name: View and register library events	ID: UC-007	Priority: Low
Brief Description: This use case describes the process of how a Patron can view and register for library events.		
Actor: Patron		
Trigger: A Patron clicks on 'Upcoming events' tab		
Type <input checked="" type="checkbox"/> External <input type="checkbox"/> Temporal		
Preconditions:		
<ol style="list-style-type: none"> 1. The Patron has logged in to the account. 2. The event datastore is up to date and online. 		
Normal Course	Information for Steps	
<ol style="list-style-type: none"> 1. System collects the information on upcoming events from event datastore 2. System displays the list of upcoming events information to the Patron 3. Patron selects event(s) to register using 'Register' button 	<p>o/p: List of upcoming events</p> <p>i/p: Selected event</p> <p>i/p: Event datastore</p>	

<p>4. System checks if the seats are available for the selected event.</p> <p>5. System displays registration confirmation on the screen and sends an email to the user (alternative course 1.1).</p> <p>6. System updates the event datastore with user registration and updates the seat availability.</p>	<p>i/p: Choice of event by patron</p> <p>o/p: Email registration details</p> <p>o/p: Registration Details</p> <p>o/p: Update Seat Availability</p>		
<p>Alternative Courses:</p> <p>1.1 System displays the message that seats for the specified event is full and it disables the register button</p> <p>1.1 System displays the message that the seat for the selected event is full</p>	<p>o/p: 'No seat availability' message</p>		
Postconditions: Patron will be registered for the available events			
Exceptions:			
Summary:			
Inputs	Source	Outputs	Destination
Selected event	Patron	List of upcoming events Registration confirmation Email registration details Error message Update Seat Availability Registration Details	Patron Patron Patron Patron Event Datastore Event Datastore

Use Case Name: Streamline Expired Holds Management	ID: UC-008	Priority: High
Brief Description: The library staff removes the holds items that have reached the holds time limit.		
Actor: System		
Trigger: The item has reached the hold time limit		
Type <input type="checkbox"/> External <input checked="" type="checkbox"/> Temporal		
Preconditions:		
<ol style="list-style-type: none"> 1. The patron has placed an order for loaning a book. 2. The library staff has shelved the books the patron has requested. 3. The book is ready to be picked up by the patron. 		
Normal Course <ol style="list-style-type: none"> 1. System starts the hold timer immediately after the library staff shelves the books the patron has requested. 2. System checks if the item has reached the hold timer limit. 3. System updates the patron pickup and holds information if the item has reached the hold time limit. 		Information for Steps <p>i/p Barcode, order details o/p: updated holds information, updated holds slot information, start holds timer prompt i/p: Current holds time, holds timer limit o/p: updated pickup information, updated holds information, stop hold timer prompt, holds expiration message</p>
Alternative Courses:		
Postconditions: Items unpicked are removed by the library staff.		
Exceptions:		

Summary:			
Inputs	Source	Outputs	Destination
Order details	Library staff	Updated holds information	For Pickup Datastore
Barcode	Library staff	Updated holds slot information	Shelf-Item Map Datastore
Current holds time	For Pickup DS	Start holds timer prompt	For Pickup Datastore
Holds timer limit	For Pickup DS	Updated pickup information Updated holds information Stop holds timer prompt Holds expiration message	Loan Datastore For Pickup Datastore For Pickup Datastore Library Staff

9. Context Diagram

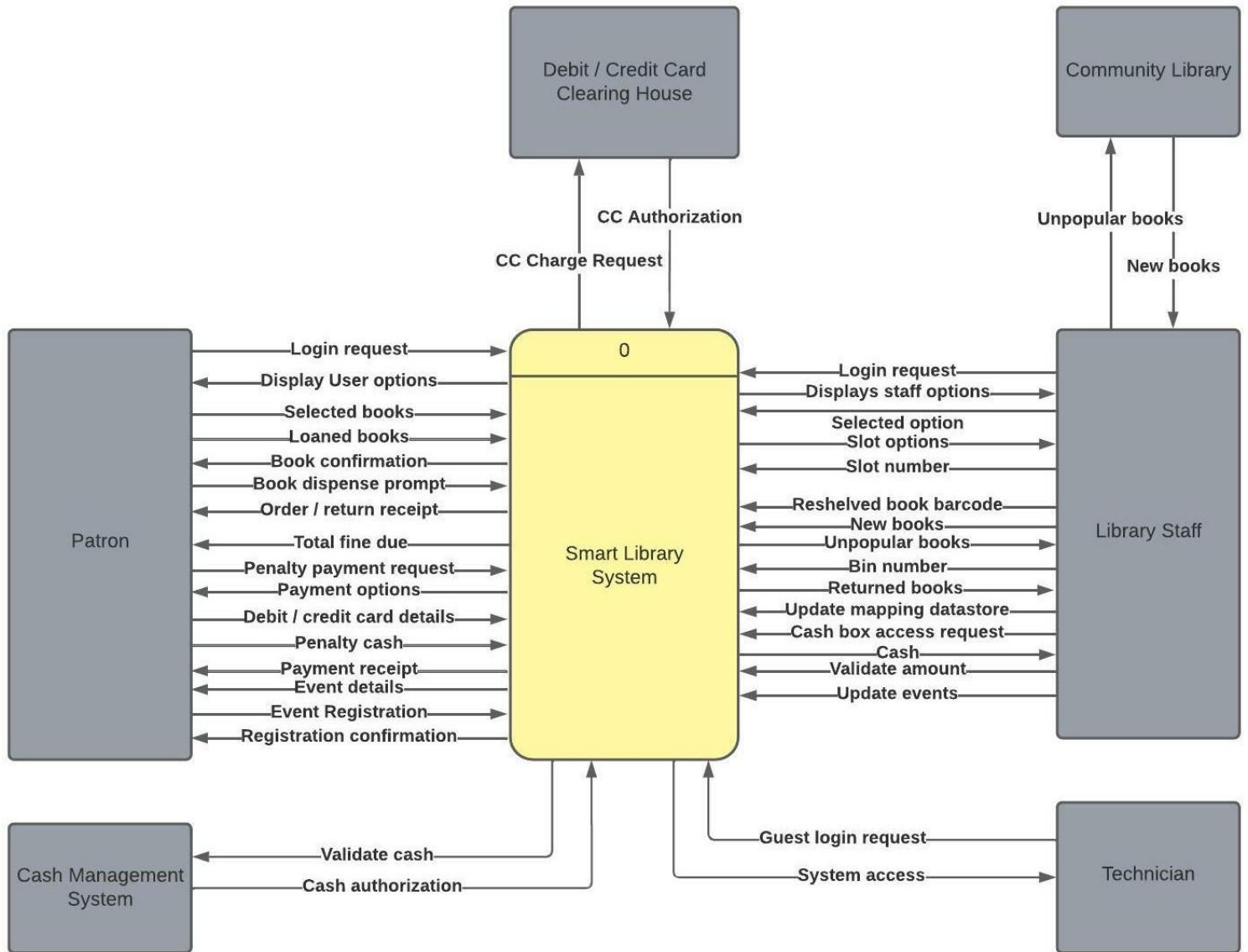


Figure 5 Context Diagram

10. Level 0 Data Flow Diagram

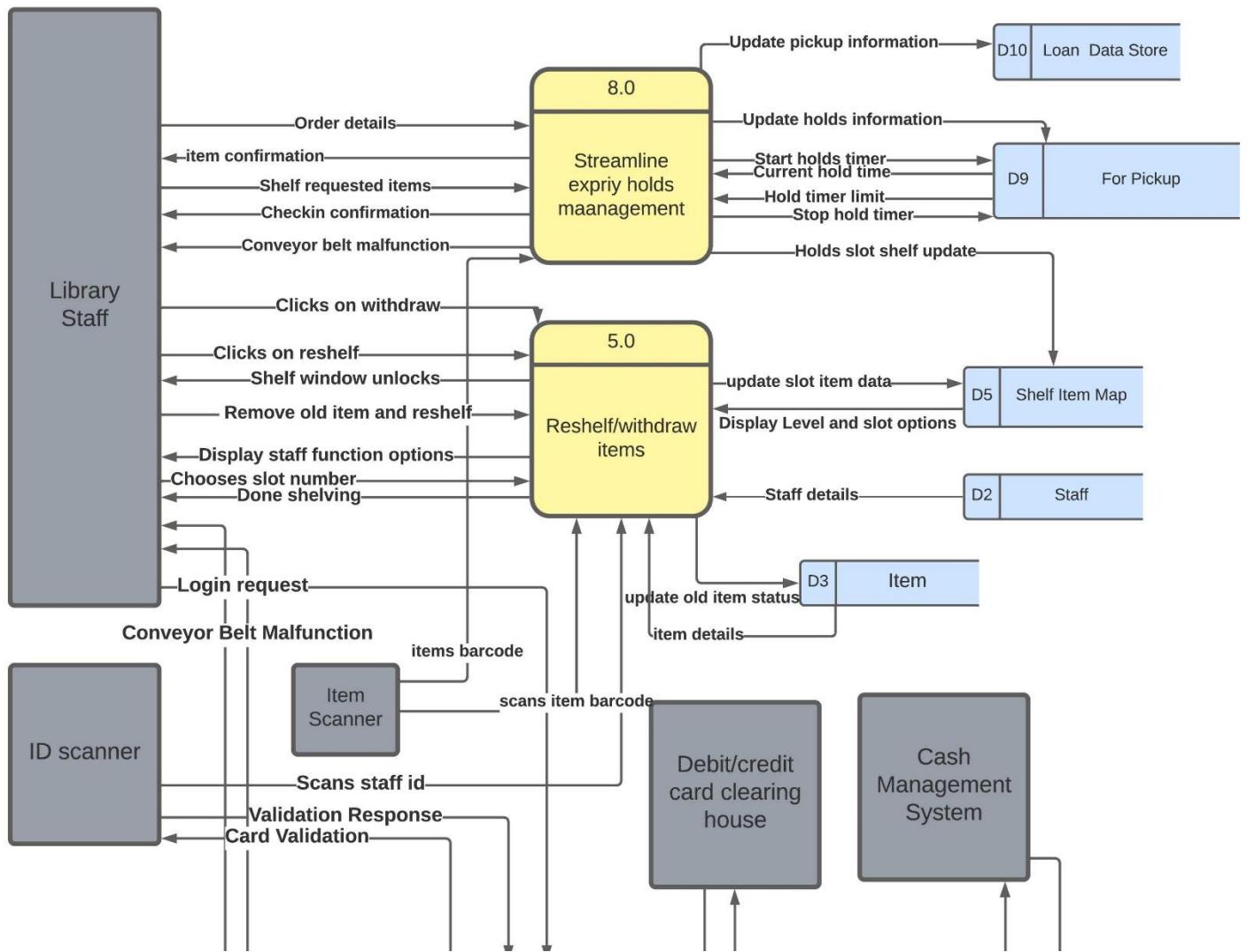


Figure 6 Level 0 DFD page1

LEVEL 0 DFD CONTINUED

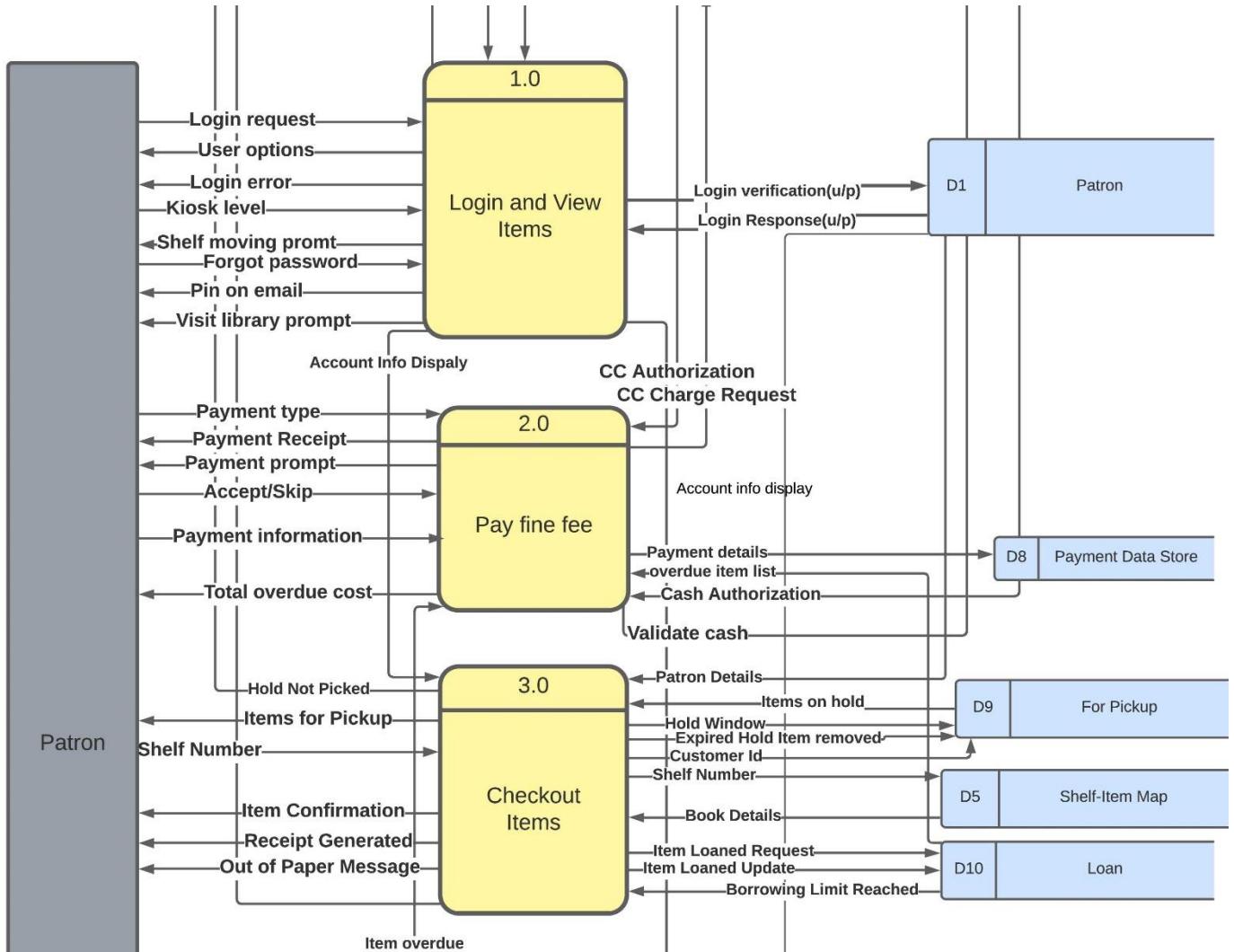


Figure 7 Level 0 DFD page2

LEVEL 0 DFD CONTINUED

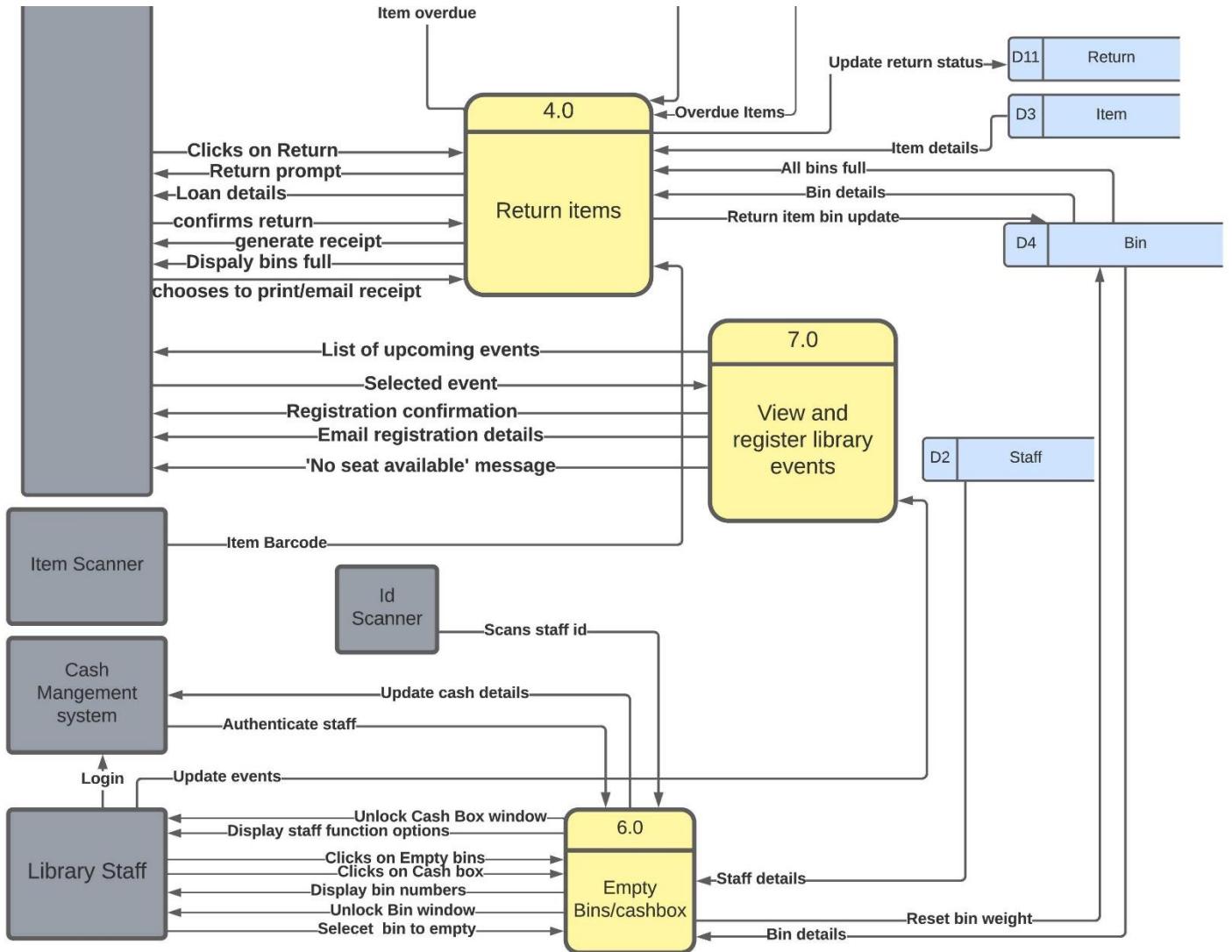


Figure 8 Level 0 DFD page3

11. Level 1 Data Flow Diagrams

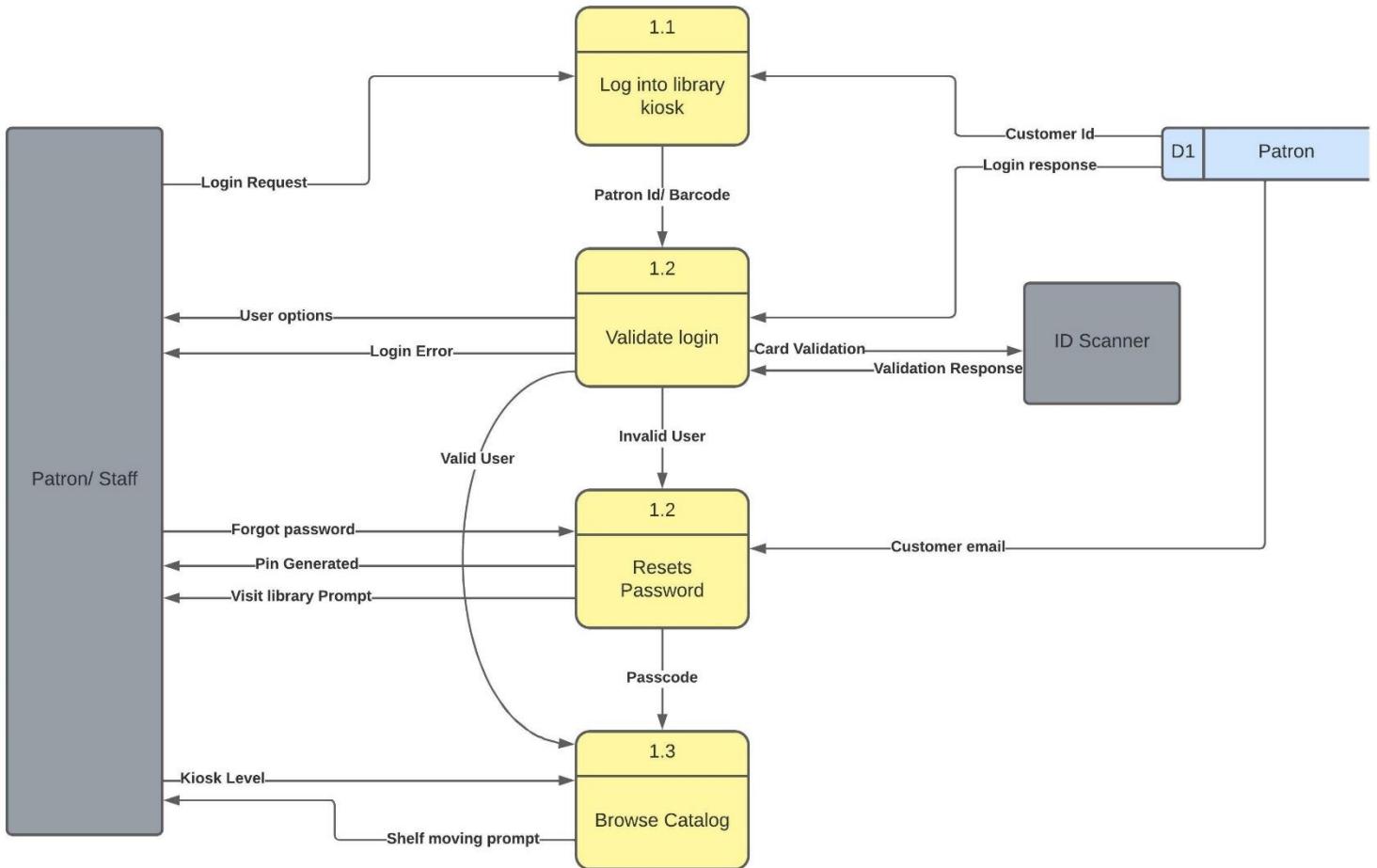


Figure 9 UC-001

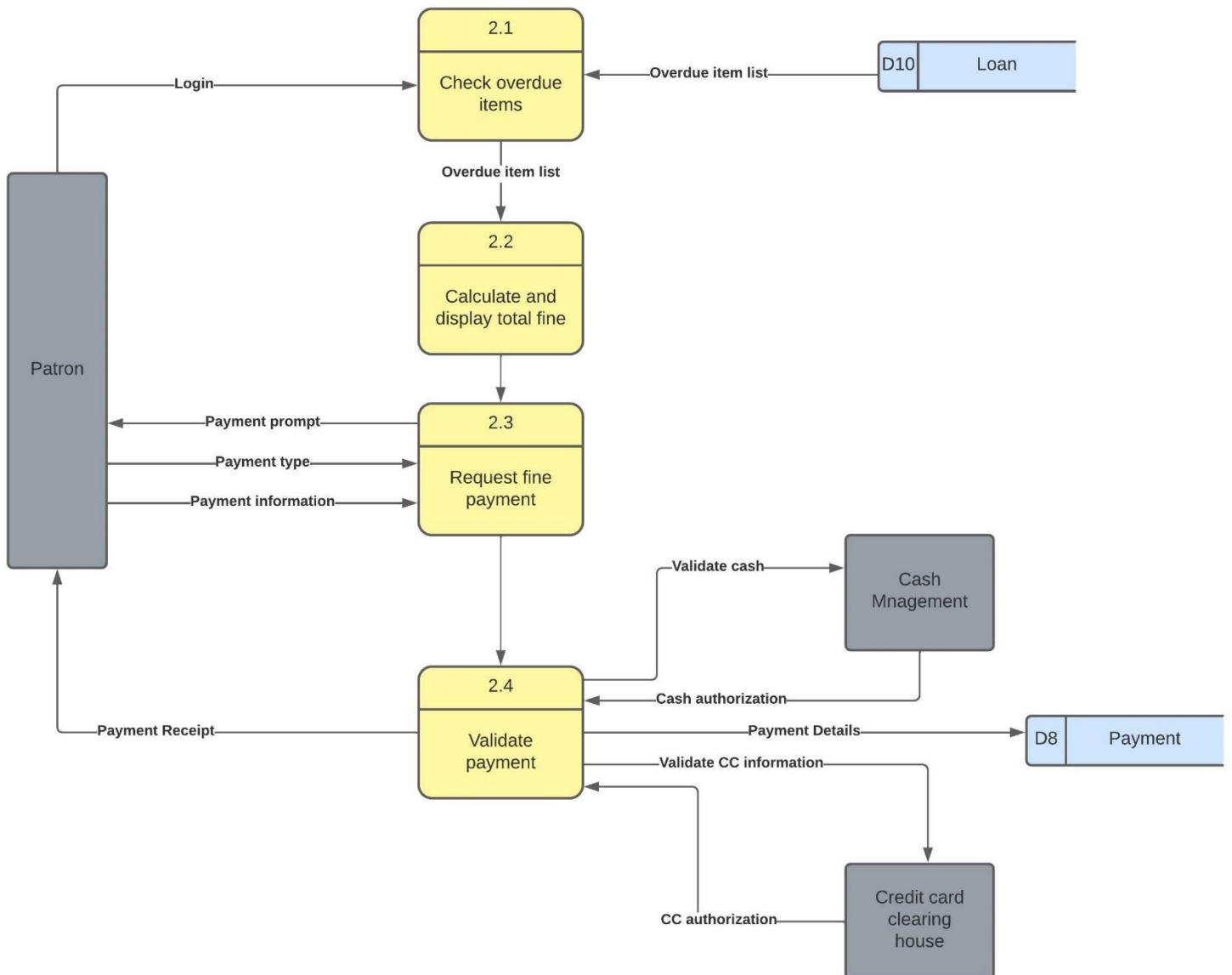


Figure 10 UC-002

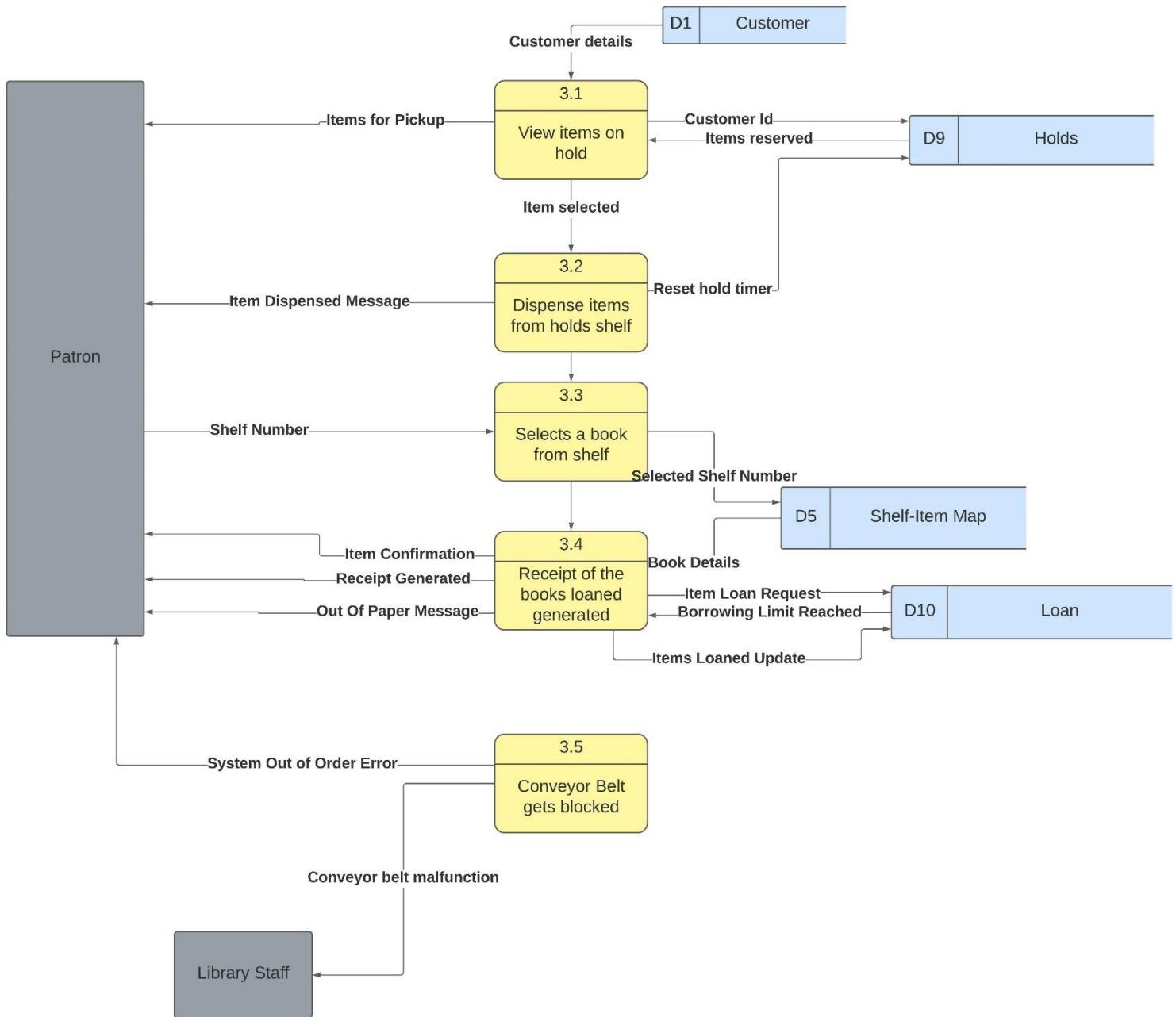


Figure 11 UC-003

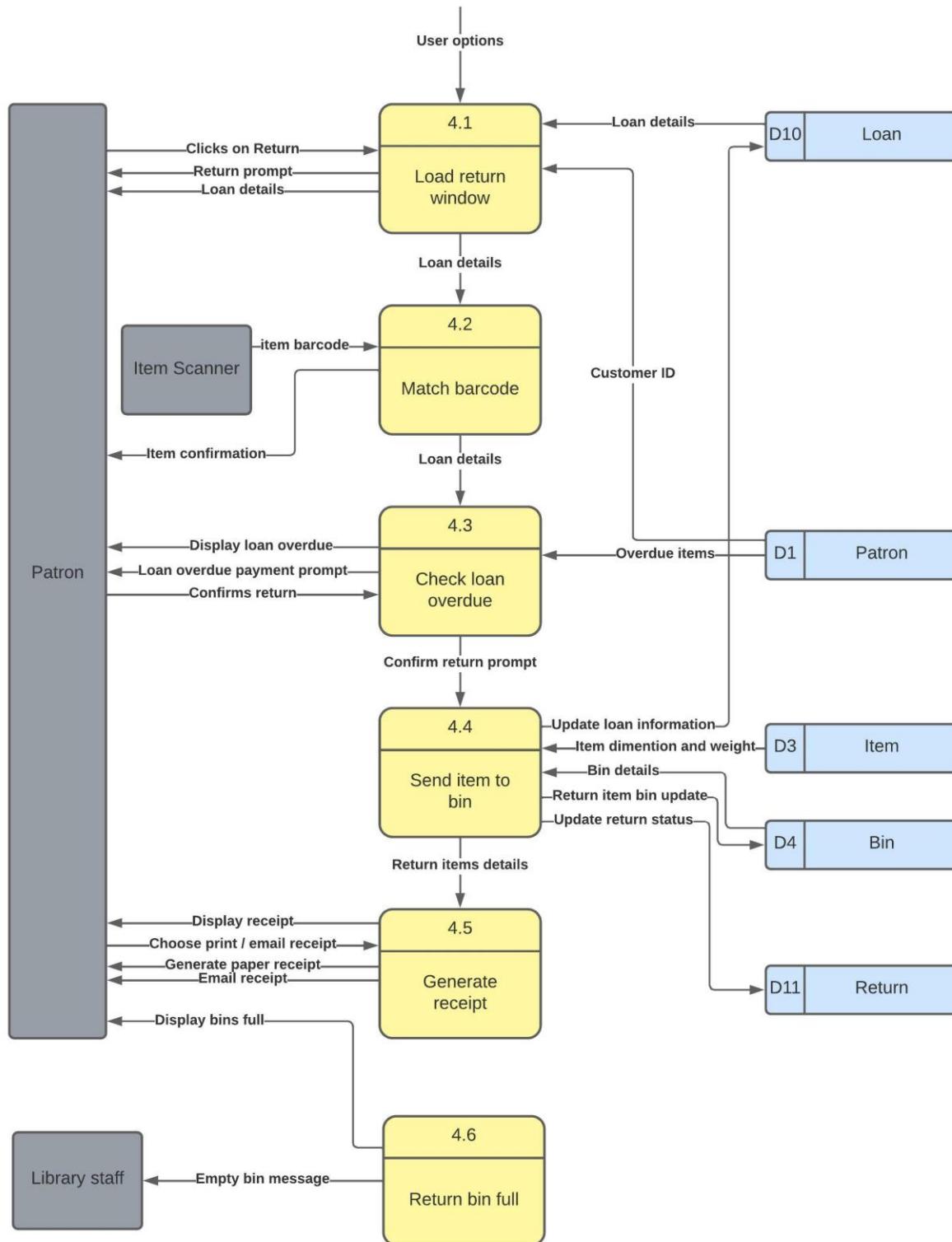


Figure 12 UC-004

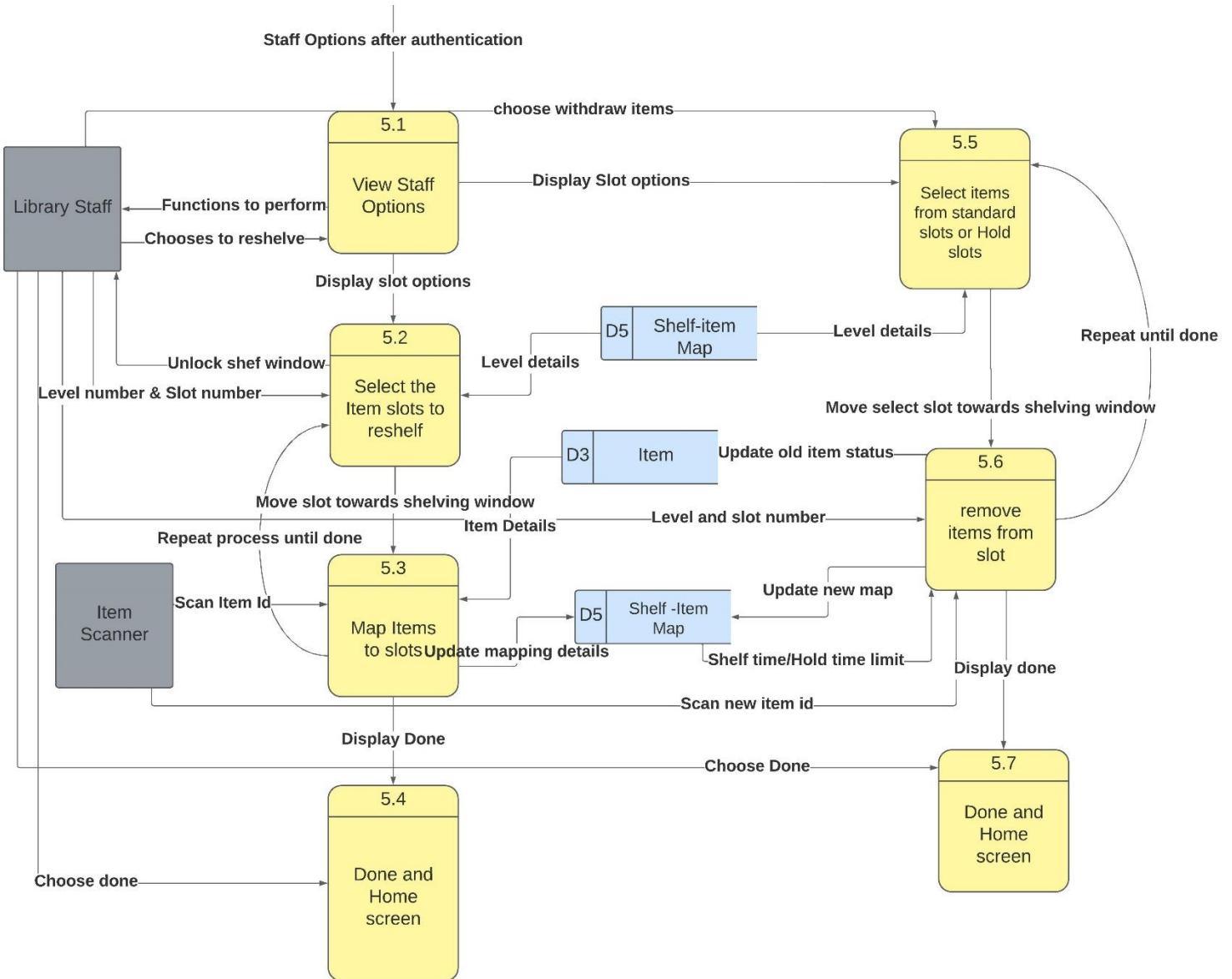


Figure 13 UC-005

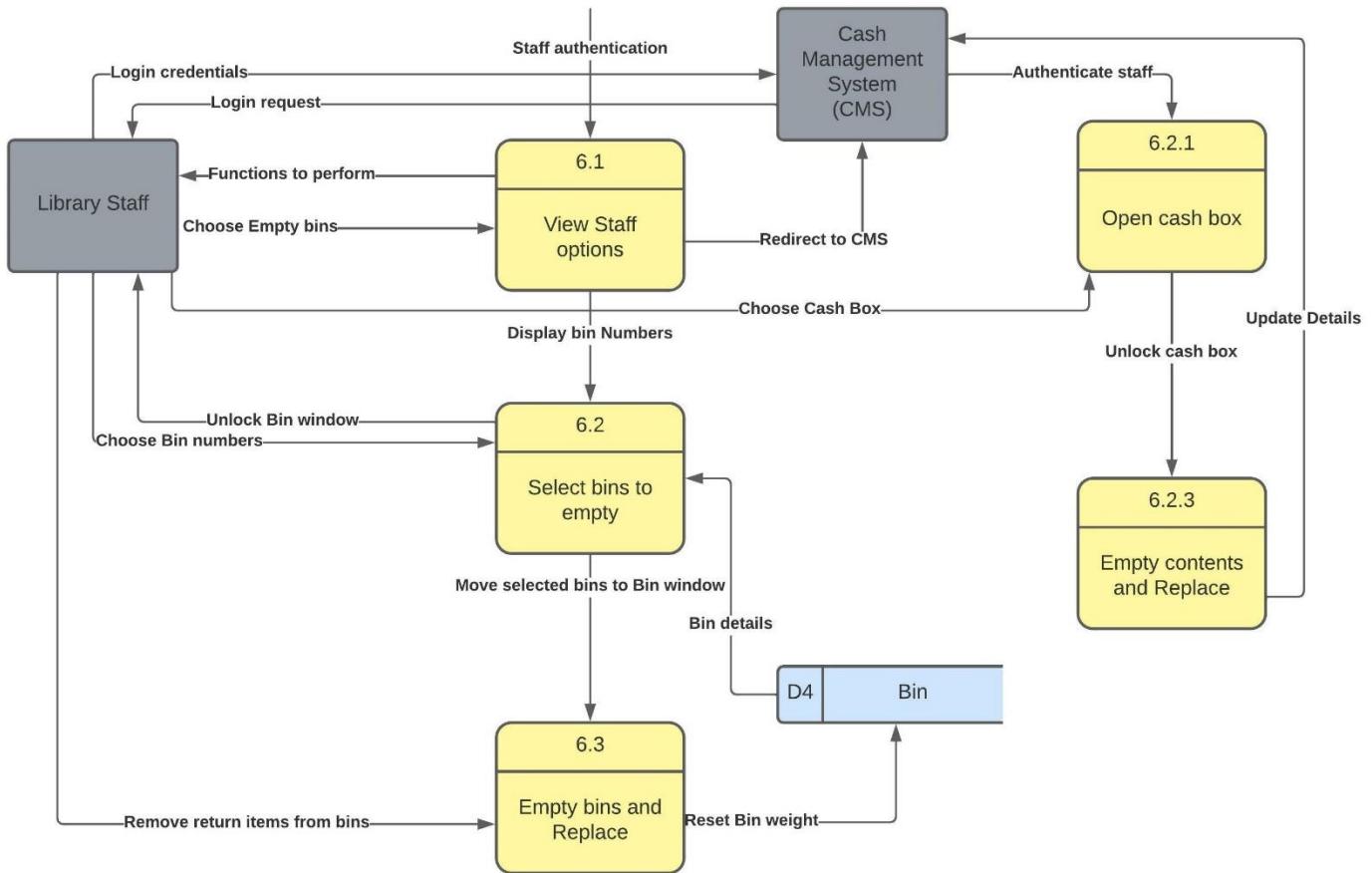


Figure 15 UC-006

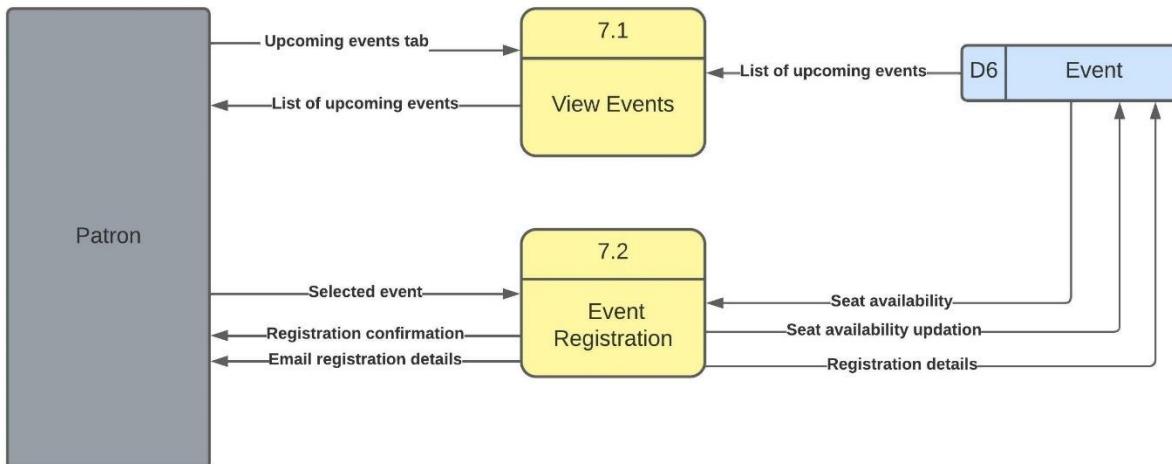


Figure 14 UC - 007

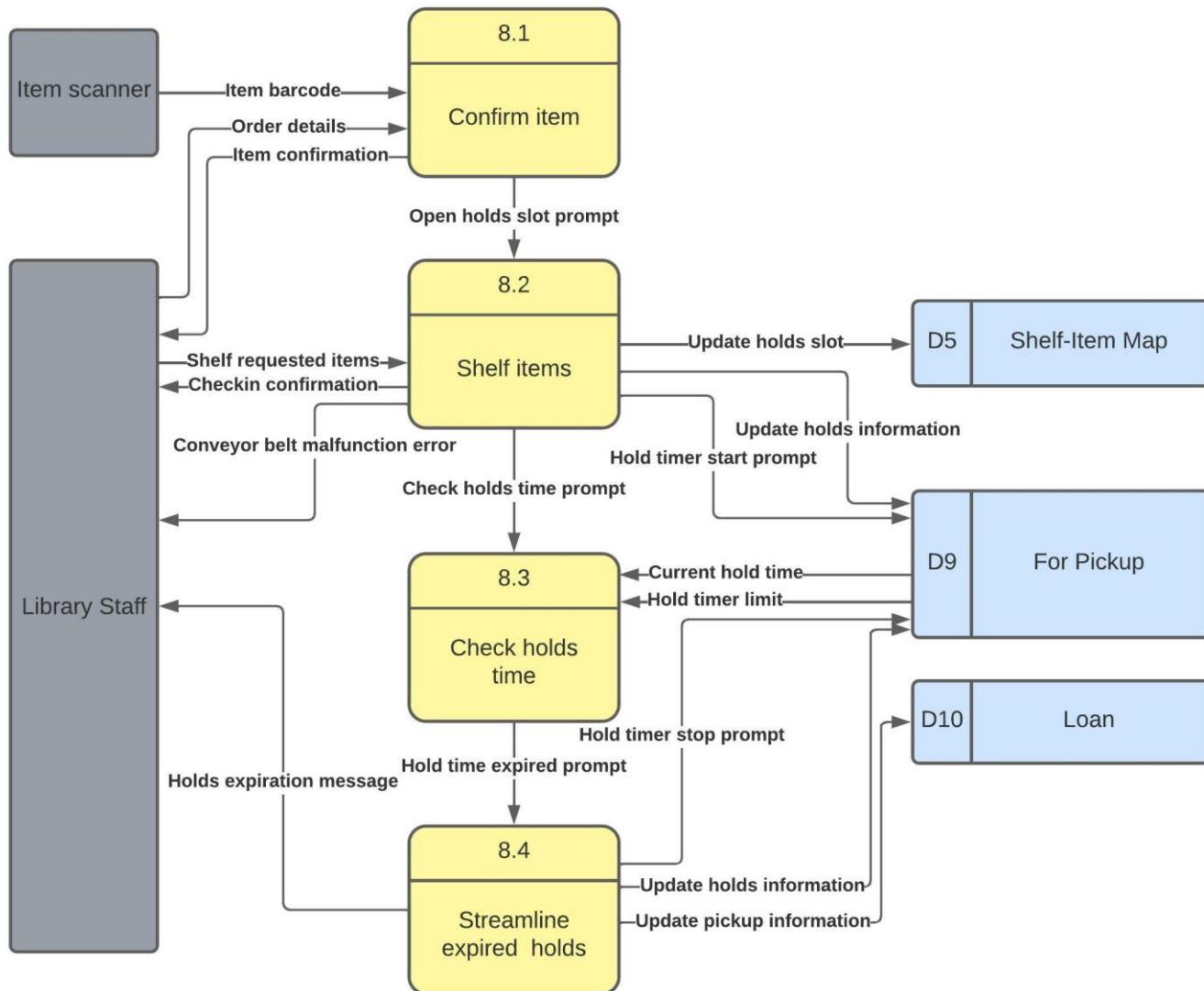


Figure 16 UC-008

12. Data Dictionary

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValue
D1	Patron	Patron_id	Employee id of Staff	Integer	Integer (0-9)	Required
		First_name	Staff first name	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Last_name	Staff last name	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Address_line1	street address	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Address_line2	Apt number	Varchar	Varchar (A-Z, a-z, special characters)	Optional
		Postal_code	Zip code of address	Varchar	Varchar (A-Z, a-z, special characters)	Required
		City	City Name	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Country	Country	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Contact Number	Staff contact number	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Email_id	Staff email address	Varchar	Varchar (A-Z, a-z, special characters)	Required

		Barcode_number	Unique card barcode	Integer	Integer (0-9)	Required
		Card_pin	Card Pin set by staff	Integer	Integer (0-9)	Required

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValue s
D2	Library Staff	Staff_id	Employee id of Staff	Integer	Integer (0-9)	Required
		First_name	Staff first name	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Last_name	Staff last name	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Address_line1	street address	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Address_line2	Apt number	Varchar	Varchar (A-Z, a-z, special characters)	Optional
		Postal_code	Zip code of address	Varchar	Varchar (A-Z, a-z, special characters)	Required
		City	City Name	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Country	Country	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Contact Number	Staff contact number	Varchar	Varchar (A-Z, a-z, special characters)	Required

					characters)	
	Email_id	Staff email address	Varchar	Varchar (A-Z, a-z, special characters)	Required	
	Barcode_number	Unique card barcode	Integer	Integer (0-9)	Required	
	Card_pin	Card Pin set by staff	Integer	Integer (0-9)	Required	

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValue s
D3	Item	item_id	Unique identifier	Integer	Integer (0-9)	Required
		Book_format	Paperback, Hardcover, DVD/CD, Audiobook, ebook	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Item_title	Title of the book	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Item_ISBN	Unique Product Identifier	Integer	Integer (0-9)	Required
		Location_id	Library Id or Kiosk Id	Integer	Boolean (True/False)	Required
		Item_description	Book Synopsis	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Item_publisher	Publisher details	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Item_author	Author details	Varchar	Varchar (A-Z, a-z, special characters)	Required

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValues
D4	Bin	bin_id	Unique identifier	Integer	Integer (0-9)	Required
		Bin_number	Bin number	Integer	Integer (0-9)	Required
		Bin_threshold_weight	Amount of weight bin can hold	Decimal	Decimal (p,s) precision→0-38 scale→0-p	Required
		Current_weight	updates with every return	Decimal	Decimal (p,s) precision→0-38 scale→0-p	Required (Default 0.0)
		Get_bin_weight_status	Checks if current weight is equals threshold weight	Boolean	Boolean (True/False)	Required (False)

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValueS
D5	Shelf Item Map	Shelf_item_id	Unique identifier	Integer	Integer (0-9)	Required
		Item_id	Item identifier	Integer	Integer (0-9)	Required
		Uploaded_date	Date of upload	DateTime	MM/DD/YY YY HH:MM:SS	Optional
		Slot_number	Slot number	Integer	Integer (0-9)	Required
		Level_number	Level Number	Integer	Integer (0-9)	Optional
		Slot_type	Standard, Wide, Hold type of slots	Varchar	Varchar (A-Z, a-z, special characters)	Required
		Expiration_date	date when the item needs to be replaced in the shelf	DateTime	MM/DD/YY YY HH:MM:SS	Required
		Shelf_time_limit	expiration date-upload date	Integer	Integer (0-9)	Required
		Shelf_time_check	checks for the item expiration	Boolean	Boolean (True/False)	Required

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValueS
D6	Event	event_id	Unique identifier	Integer	Integer (0-9)	Required

				9)	
	Name	Name of the event	Varchar	Varchar (A-Z, a-z, special characters)	Required
	Description	Description of the event	Varchar	Varchar (A-Z, a-z, special characters)	Optional
	event_date	Date and time of the event	Date time	MM/DD/YY YY HH:MM:SS	Required
	total_seats	Total number of seats for event	Integer	Integer (0-9)	Required
	booked_seats	Seats booked for event	Integer	Integer (0-9)	Required

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValue s
D7	Event Registration	registration_id	Unique identifier for registration	Integer	Integer (0-9)	Required
		event_id	Unique identifier for event	Integer	Integer (0-9)	Required
		patron_id	Unique identifier for customer who booked event	Integer	Integer (0-9)	Required
		registration_time	Time when event registration was made	Datetime	MM/DD/YY YY HH:MM:SS	Required

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValues
D8	Payment	payment_id	Unique identifier for payment	Integer	Integer (0-9)	Required
		item_id	Unique identifier for item	Integer	Integer (0-9)	Required
		customer_id	Unique identifier for customer	Integer	Integer (0-9)	Required
		payment_type	Type of payment: Cash/Credit Card/ Debit Card	VARCHAR	Varchar (A-Z, a-z)	Required
		payment_status	Success/Failure status for the payment	VARCHAR	Varchar (A-Z, a-z)	Required
		Amount	amount paid	DOUBLE	[0-9]. [0-9]	Required

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValues
D9	For Pickup	pickup_id	Unique identifier for pickup item			
		shelf_item_id	Slot mapping on which the item on hold is placed when available	Integer	Integer (0-9)	Required
		customer_id	Unique identifier for customer	Integer	Integer (0-9)	Required

		Item_id	Item Number	Integer	Integer (0-9)	Required
		hold_dt	Date when item was available for pickup on hold shelf	DateTime	MM/DD/YY YY HH:MM: SS	Required
		hold_days	Number of days item is on holds shelf	Integer	Integer (0-7)	Required
		pickup_dt	Date when item was picked from holds shelf	DateTime	MM/DD/YY YY HH:MM: SS	Optional

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValue s
D10	Loan	Item_id	Item Number	Integer	Integer (0-9)	Required
		customer_id	Unique identifier for customer	Integer	Integer (0-9)	Required
		loaned_dt	Date on which item was loaned	DateTime	MM/DD/YY YY HH:MM: SS	Required
		return_dt	Date on which item will be due	DateTime	MM/DD/YY YY HH:MM: SS	Optional
		borrowed_items	Total number of borrowed items	Integer	Integer (0-9)	Optional
		current_status	Current status of the item (Borrowed, Overdue, returned, hold)	Varchar	Varchar (A-Z, a-z, special characters)	Required
		fine_amount	amount to be payed for overdue items	Decimal	Decimal (p, s) precision→ 0-38	Optional (Default 0.00)

					scale→ 0-p	
--	--	--	--	--	------------	--

DataStore	Name	Attribute	Description	DataType	Domain	DefaultValueS
D11	Return	return_id item_id patron_id return_date return_time loan_id	Unique return identifier item identifier to connect to item datastore patron account identifier date of return time of return loan details of item	Integer Integer Integer DateTime DateTime Integer	Integer (0-9) MM/DD/YY YY HH:MM:SS	Required Required Required Required Required Required

13. Program Structure Chart

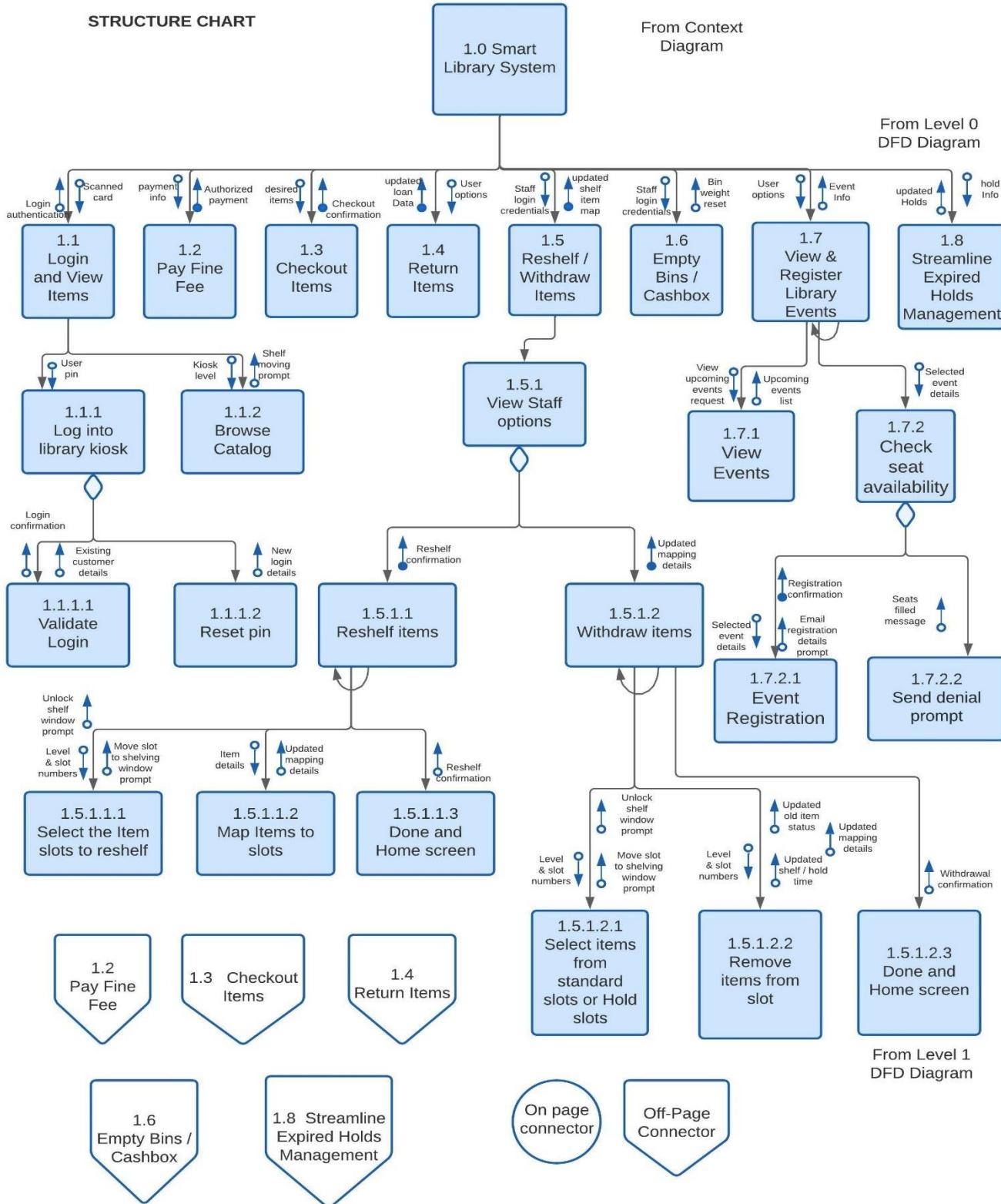


Figure 17
Structure Chart

STRUCTURE CHART CONTD..

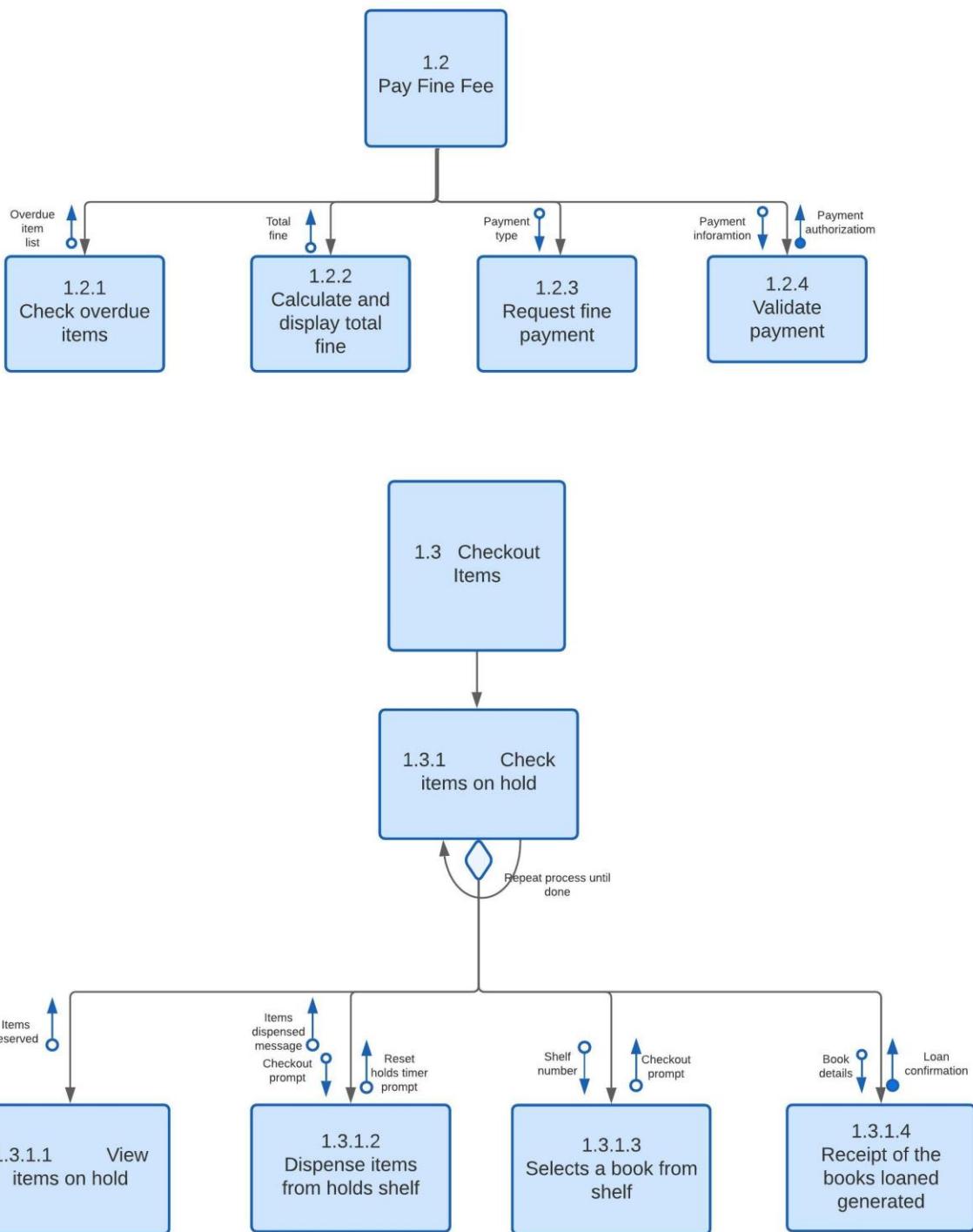


Figure 18 Off page processes

STRUCTURE CHART CONTD..

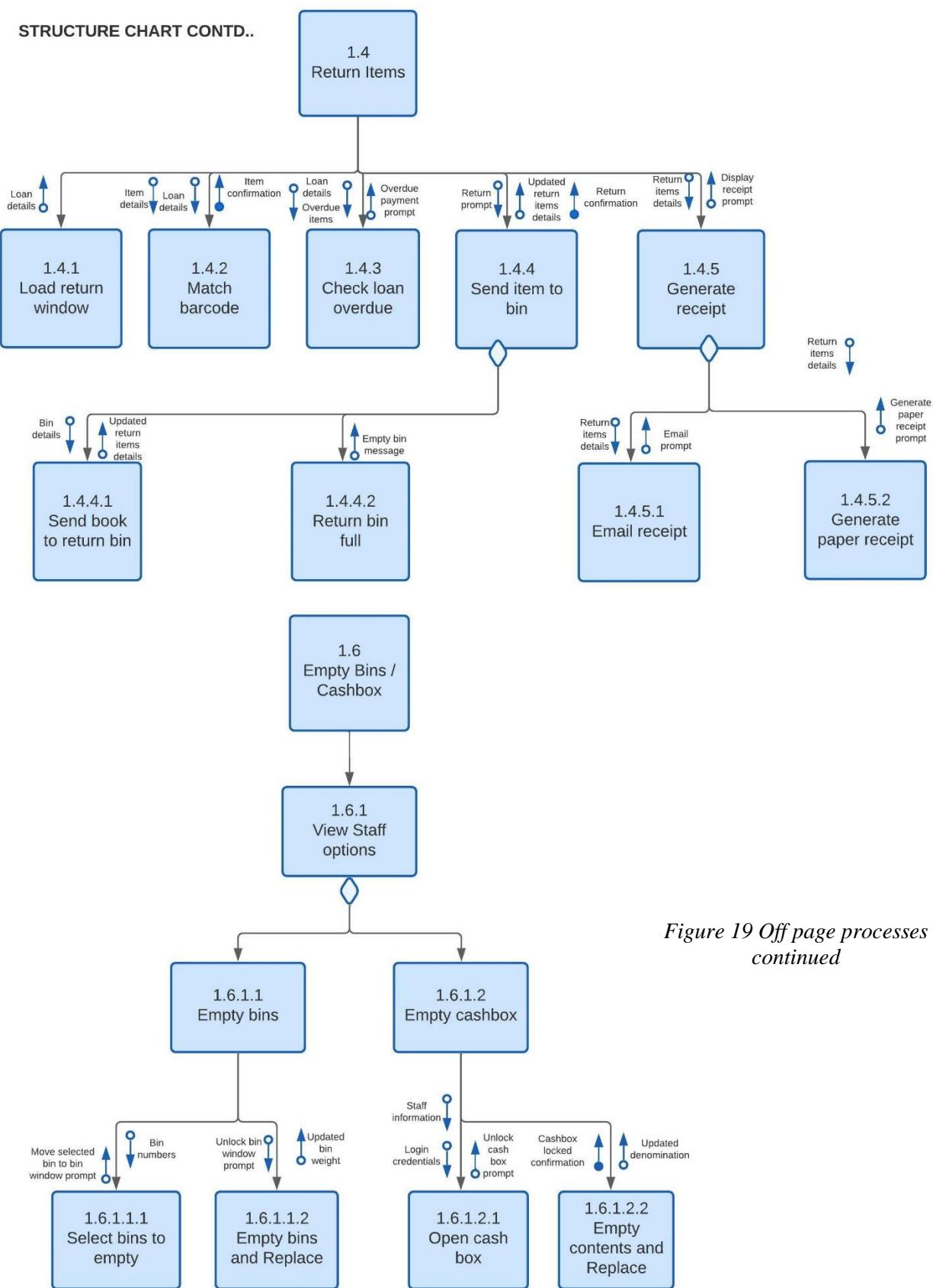


Figure 19 Off page processes continued

STRUCTURE CHART CONTD..

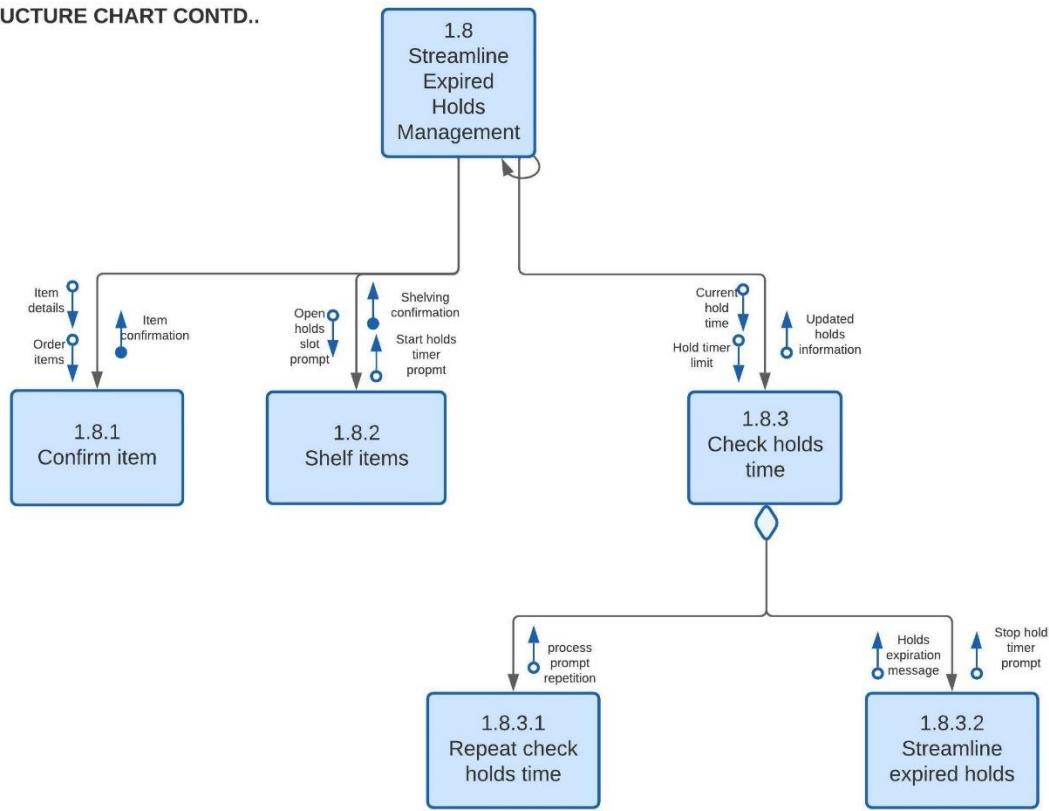


Figure 20 Off page process continued

14. Screenshots of GUI for external users

1. Login:

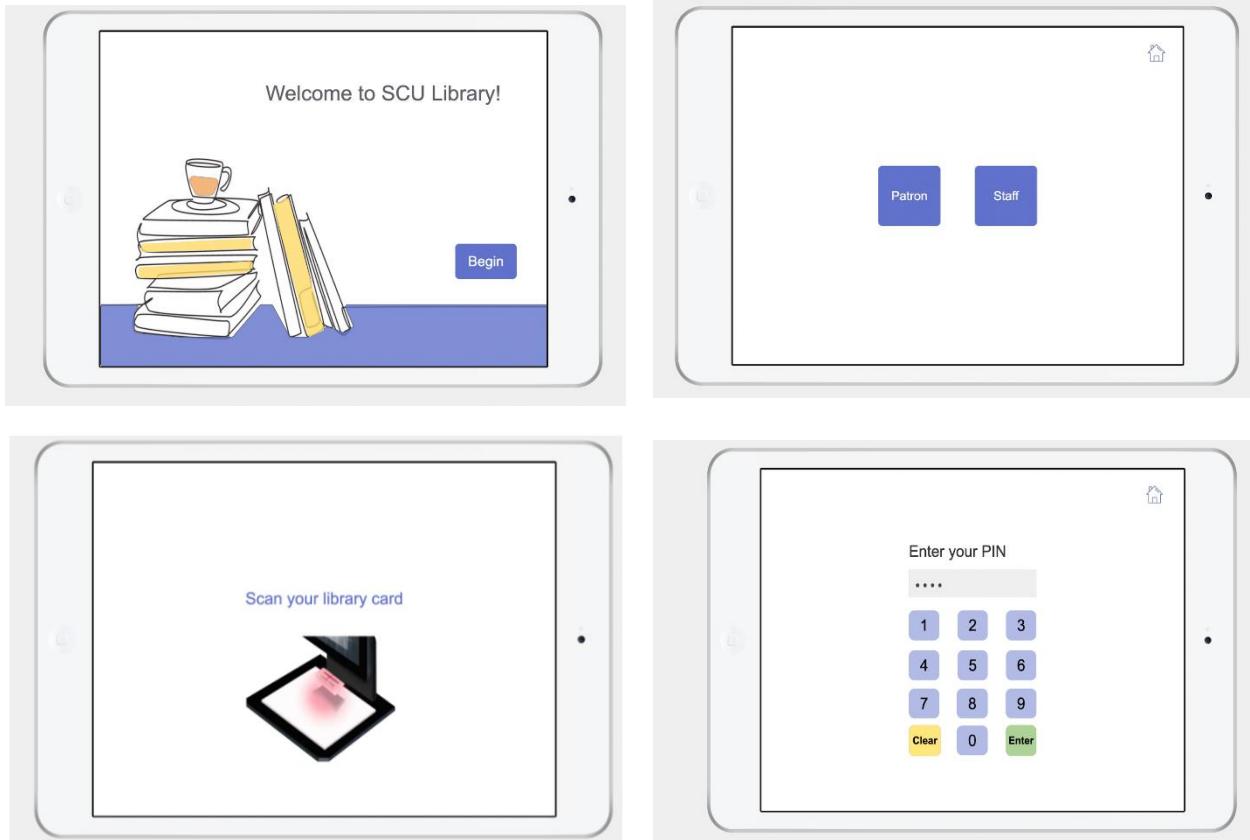


Figure 21 Login Input/Output Screens

2. Account Information:

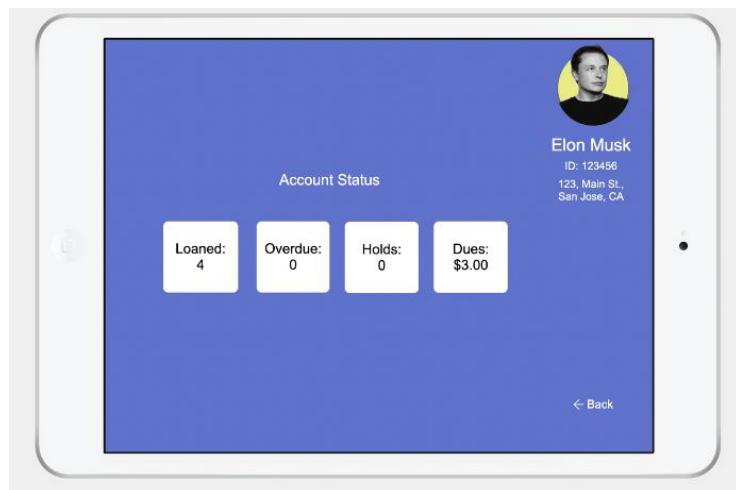


Figure 22 Patron Account screen

3. Loan from Kiosk:

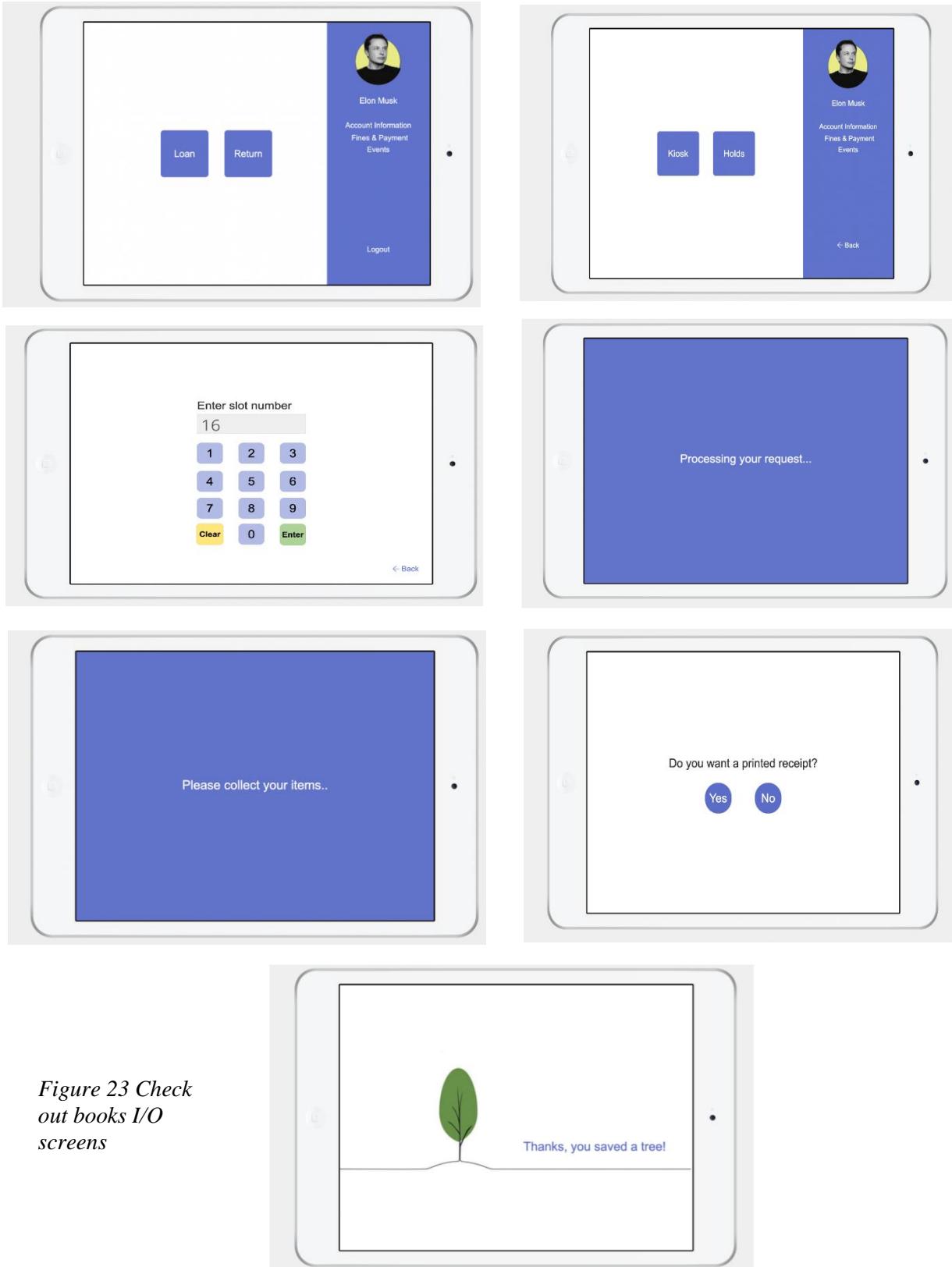
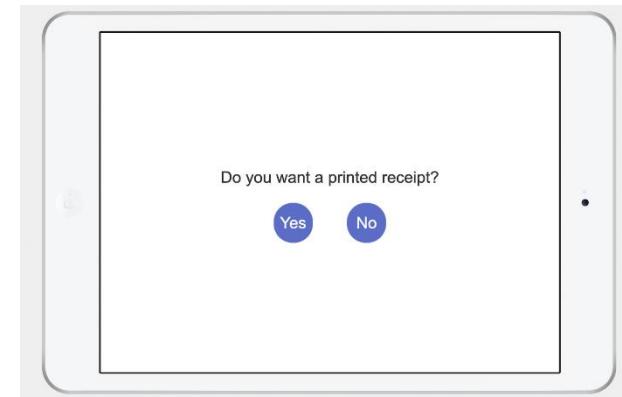
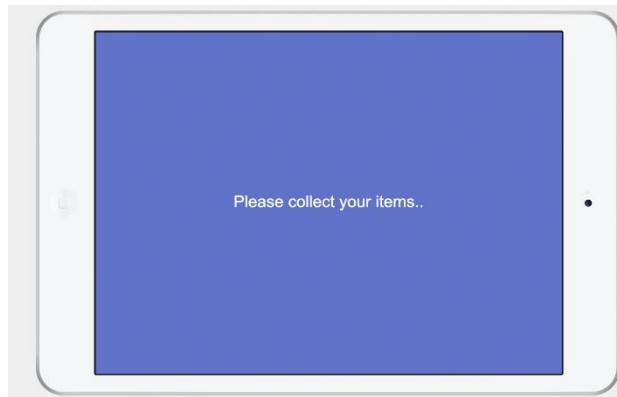
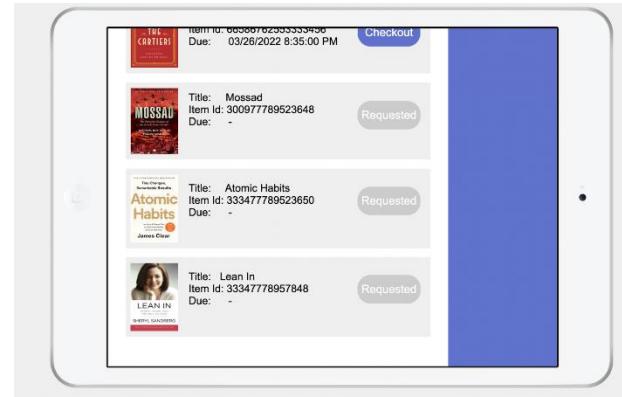
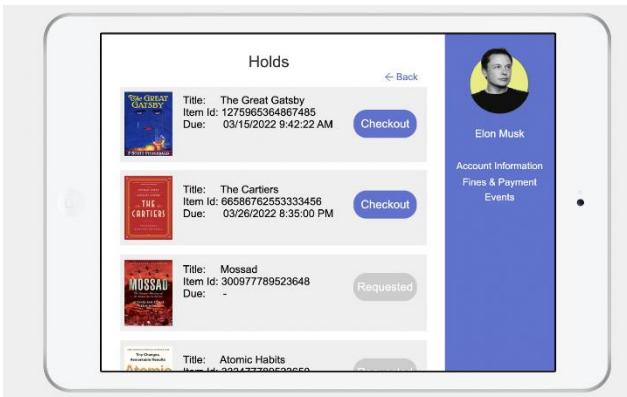
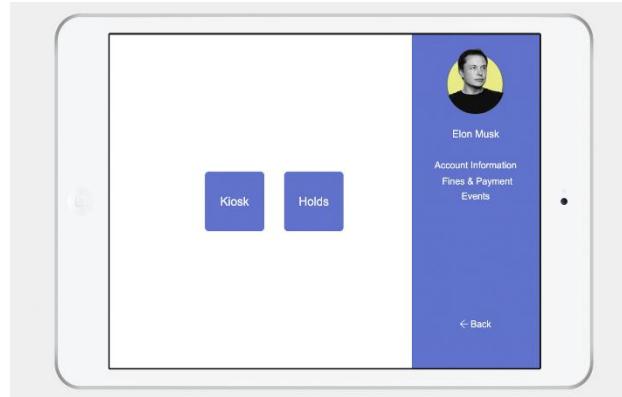
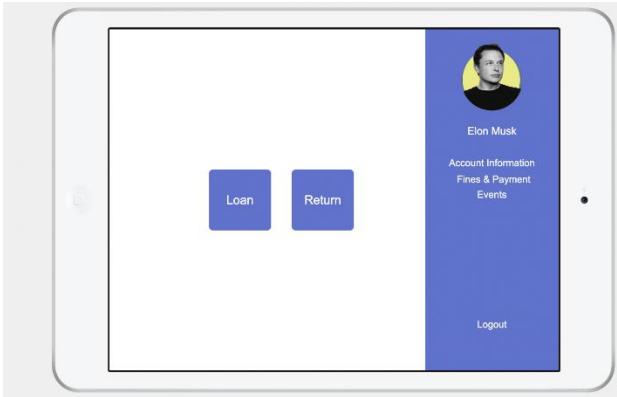


Figure 23 Check out books I/O screens

4. Holds:



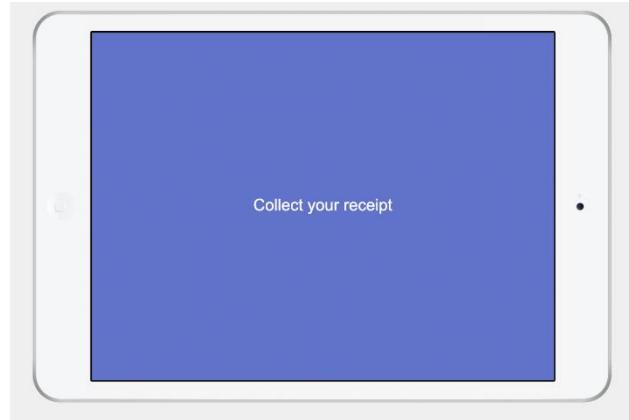


Figure 24 Holds I/O Screens

5. Returns:

The figure displays four screenshots of the library vending system's user interface, specifically for returns:

- Screenshot 1 (Left):** Shows a main menu with "Loan" and "Return" buttons on the left, and a profile section for "Elon Musk" with "Logout" at the bottom.
- Screenshot 2 (Right):** Displays a message "Please place 1 item at a time in the return window" above an image of a hand placing a book into a return slot, with a "Back" button at the bottom.
- Screenshot 3 (Bottom Left):** Shows a "Returned Items" section with a thumbnail of "Diary of a Wimpy Kid" and its details: Title: Diary of a Wimpy Kid, Item Id: 300977789523648, Due Date: 03/15/2022 9:42:22 AM. It includes "Scan" and "Done" buttons.
- Screenshot 4 (Bottom Right):** Shows a "Returned Items" section with a thumbnail of "Gone With the Wind" and its details: Title: Gone With the Wind, Item Id: 46875893523611, Due Date: 03/12/2022 12:12:22 PM. It includes "Scan" and "Done" buttons.

6. Fines & Payments:

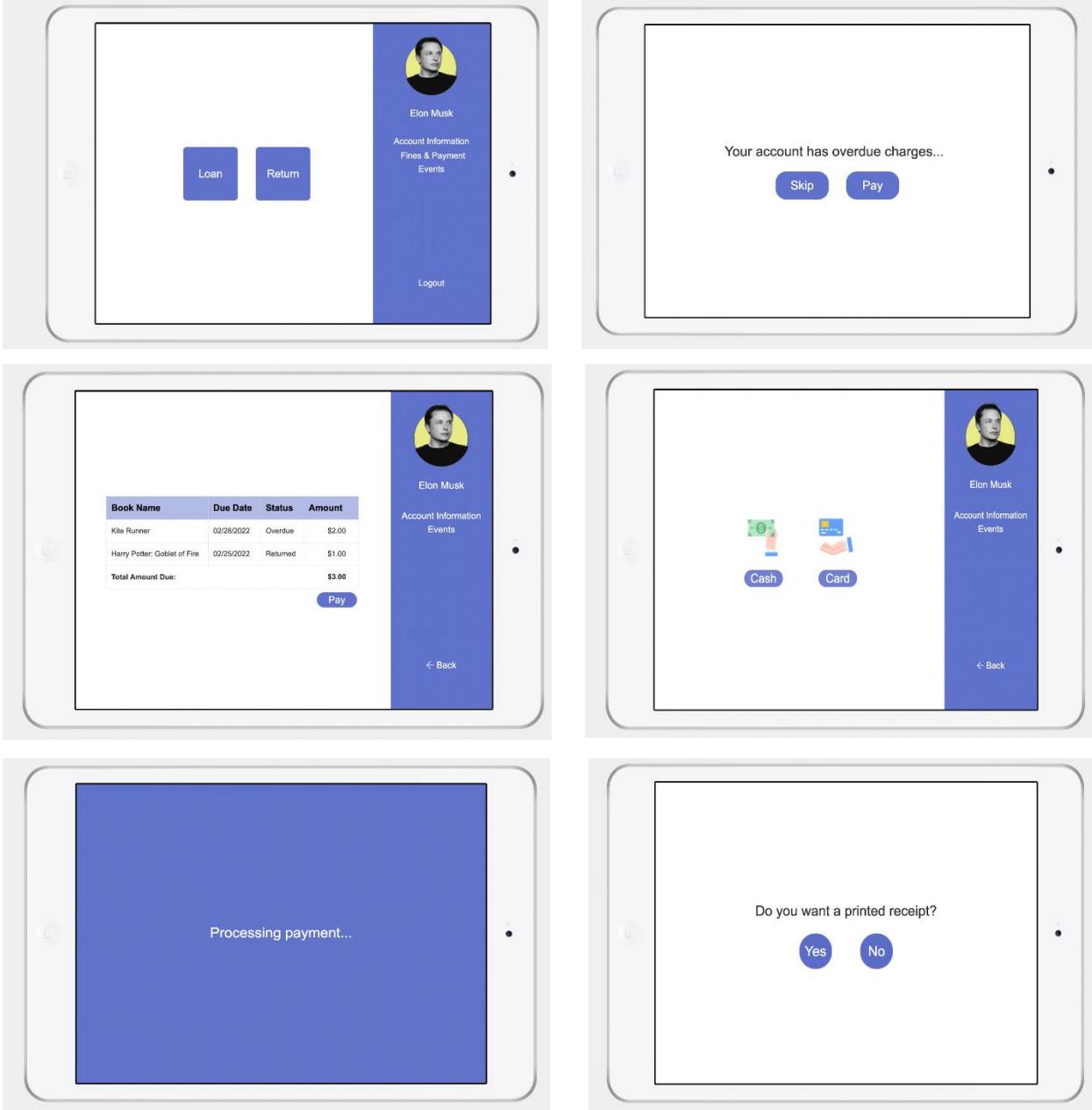




Figure 25 Fines and Payments UI screens

7. Events & Registration:

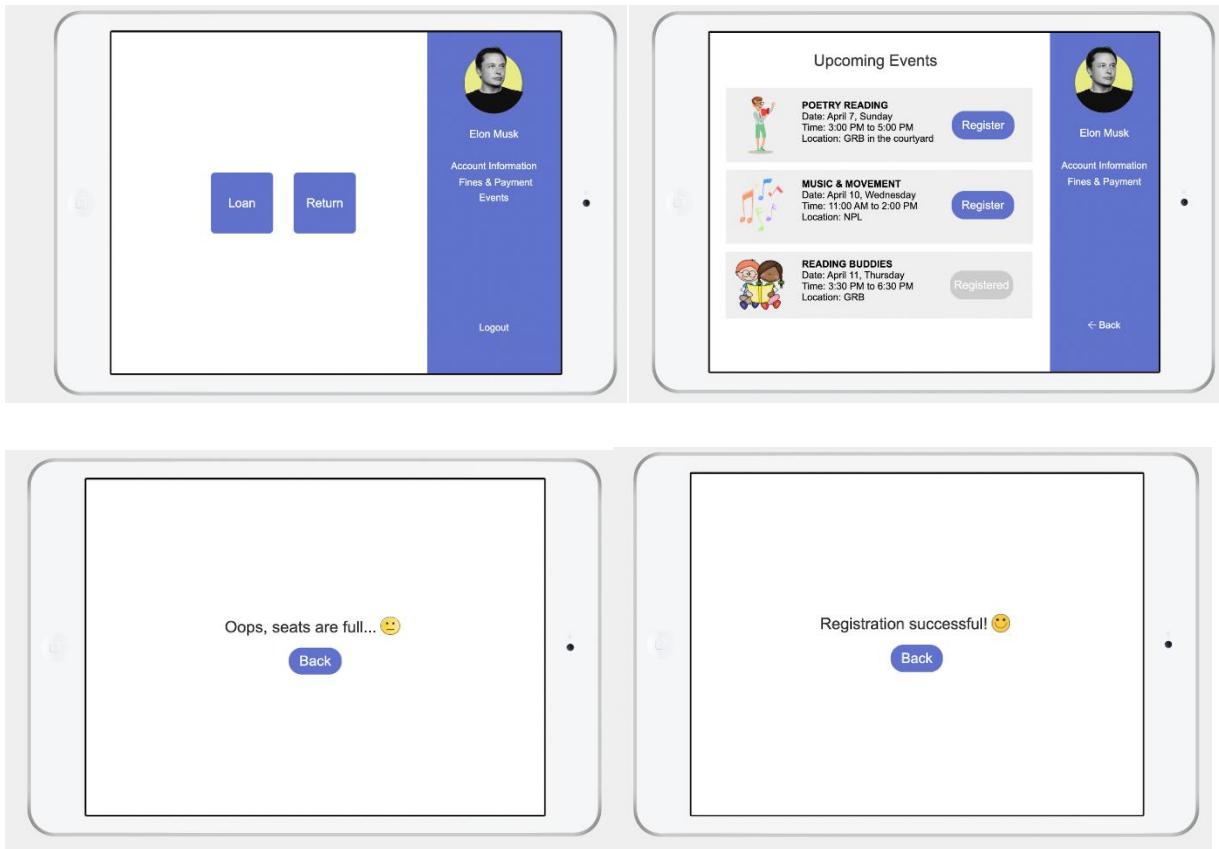


Figure 26 Event Registration screens

15. Future Scope

1. eBook and Audiobook Integration – patrons can check out electronic materials, expanding the available collection to over 1,000,000 items.
2. ADA Accessibility – a separate wheelchair-height display makes operation easy and safe. Voice prompts further enhance the accessibility of the system.
3. Integrated Security – built-in cameras record activities inside and outside the system and maintain history for up to 30 days (configurable). Library staff can remotely access the security system and Support can view the inner workings to quickly diagnose any transport issue.

16. Conclusion

1. Library Vending System by LendIt Services acts as a full-service solution that would be ideal for busy residential and commercial neighborhoods without a library or Bookstores in nearby locations.
2. The Kiosk can be installed at public parks, community centers, shopping malls, and wherever people spend time in a community.
3. The Vending System provides libraries a full-service at a fraction of cost and without the stress of building project. It also helps reduce maintenance, utilities, supplies, staffing and other operating expenses.
4. As it is intuitive to use and easy to maintain, this kiosk vending system enables patrons to
 - a. Check out and return materials.
 - b. Pick up holds.
 - c. Register for Library Upcoming events
 - d. Pay overdue Fines

References:

1. An article on library vending machine from Daily Bulletin magazine.
<https://www.dailypbulletin.com/2021/09/24/rancho-cucamonga-adds-library-vending-machine-a-first-for-sanbernardino-county/>
2. Envisionware 24-Hour Library Demonstration
<https://www.envisionware.com/24-hour-library-videos/>
3. UI Design tutorials.
https://www.justinmind.com/community/topic/how_to_create_an_on_screen_keyboard
4. Product ideas and brainstorming with the article from global vending group
<https://www.globalvendinggroup.com/book-vending-machine/>
5. Library management systems design requirements.
<https://www.educative.io/courses/grokking-the-object-oriented-design-interview/RMIM3NgjAyR>
6. Detailed Context, Level 0, Level 1 Data flow Diagrams, and Structure charts are made in Lucid Chart and can be found under the below link.
https://lucid.app/lucidchart/8e5b5961-60b3-463f-9047-bd0a2fdf25da/edit?invitationId=inv_54e3c827-8722-40c0-b556-a75d2402a983
7. User Interface demonstration in the following link.
<https://www.youtube.com/watch?v=w1EGYPawkwQ>