Chapter 1

Architectural Design

1.0 Introduction

Architectural design represents the structure of data and program components that are required to build a computer-based system. It considers the architectural style that the system will take, the structure and properties of the components that constitute the system and the interrelationships that occur among all architectural components of a system. We follow the following steps in our architectural design process of Library Circulation System.

i. Represent the system in context

ii. Define archetypes

iii. Refine the architecture into components

iv. Describe instantiations of the system

In following sections, we will represent these steps.

1.1 Represent the System in Context

In this step, we have used an architectural context diagram (ACD) to model the manner in which software interacts with entities external to its boundaries.

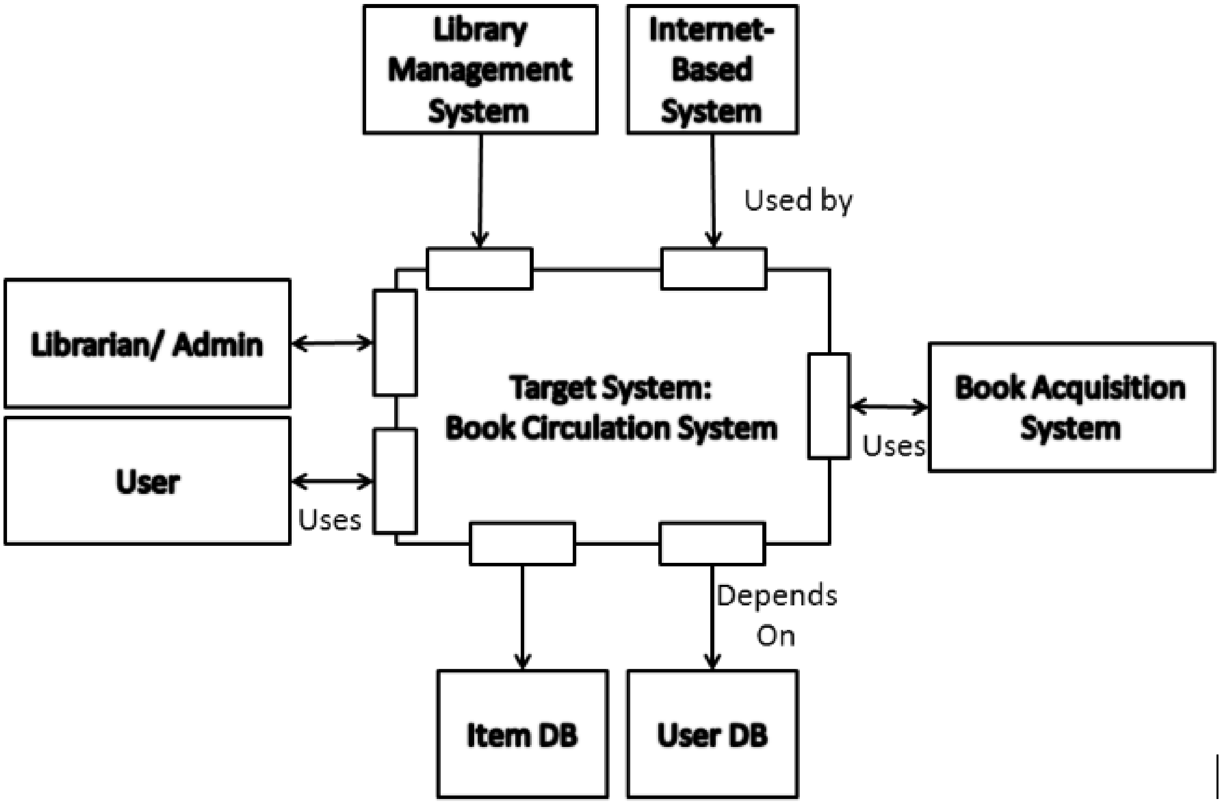


Figure 1: Architectural context diagram (ACD)

1.2 Define Archetypes

An archetype is a pattern that represents a core abstraction that is critical to the design of an architecture for the target system. We have defined the following archetypes for our Library Circulation System.

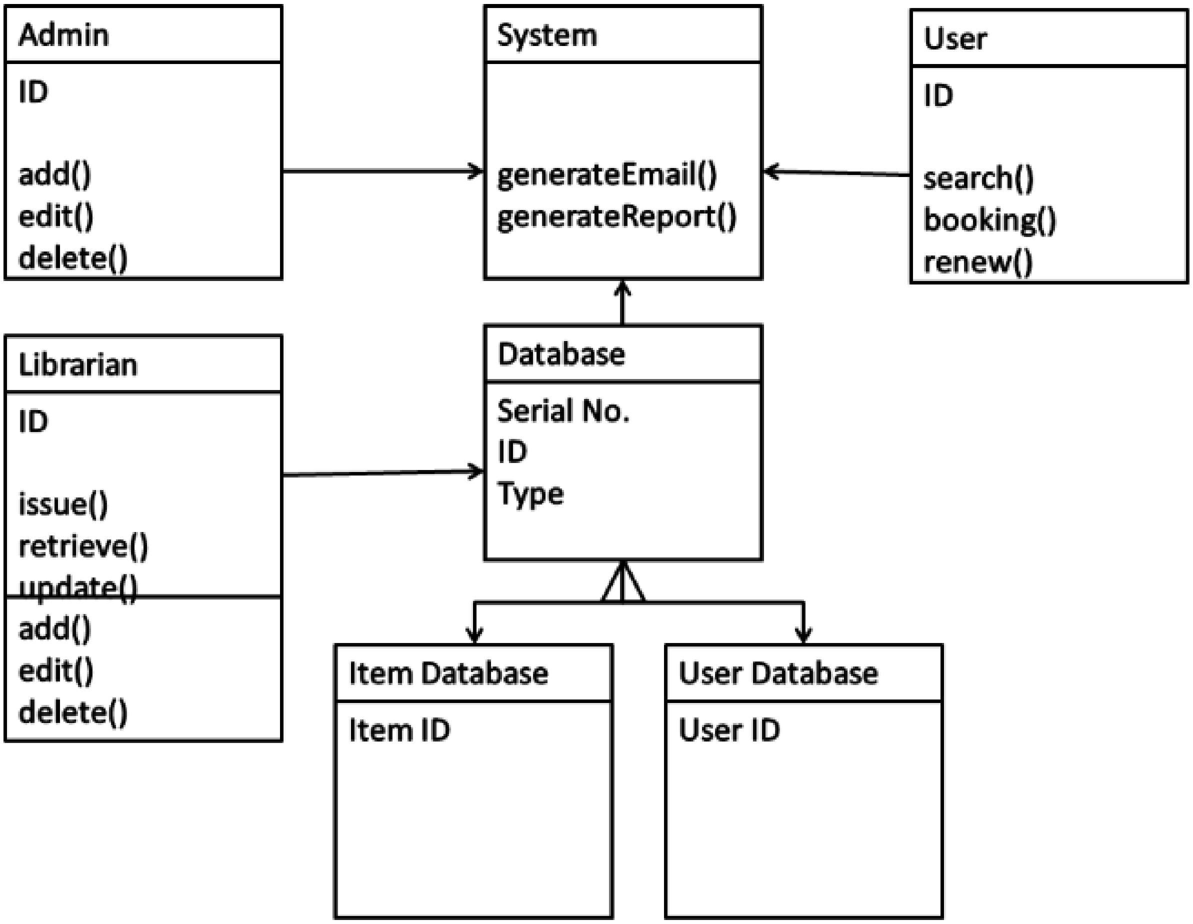


Figure 2: Relationships for LCS archetype

1.3 Refine the Architecture into Components

Based on the archetypes, we refined the software architecture into components to illustrate the overall structure and architectural style of the system

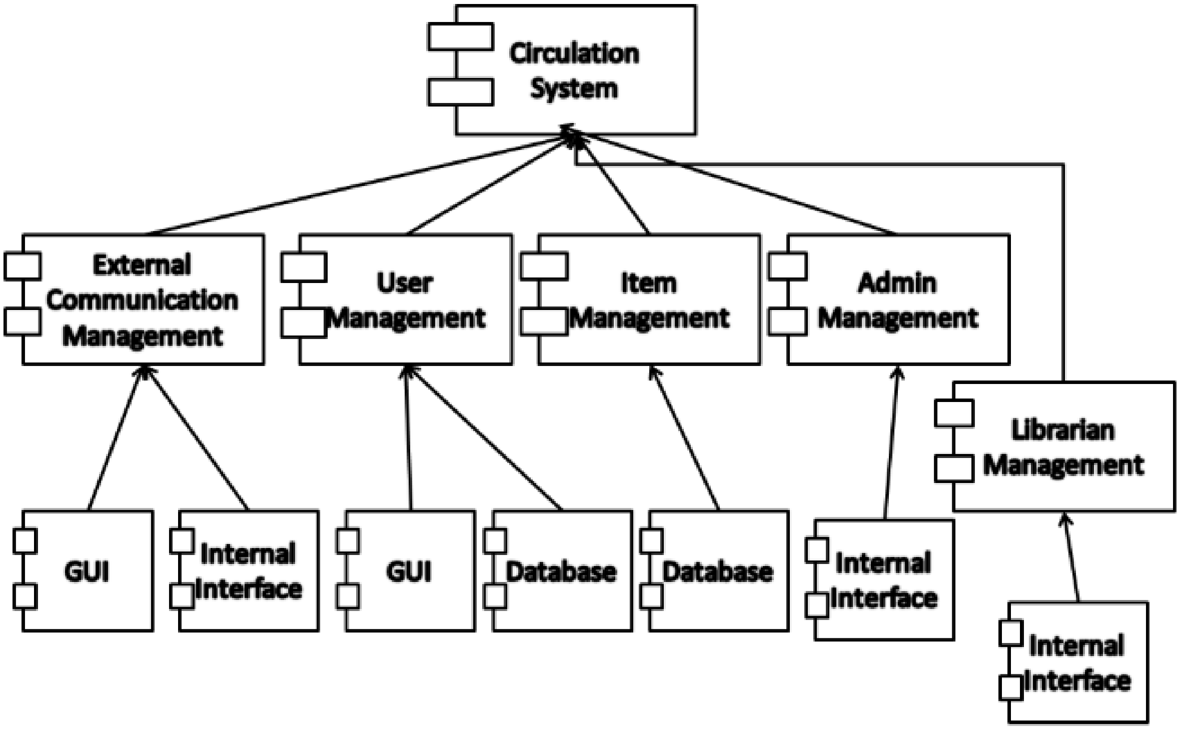


Figure 3: Overall architectural structure for LCS with top-level components

1.4 Describe Instantiations of the System

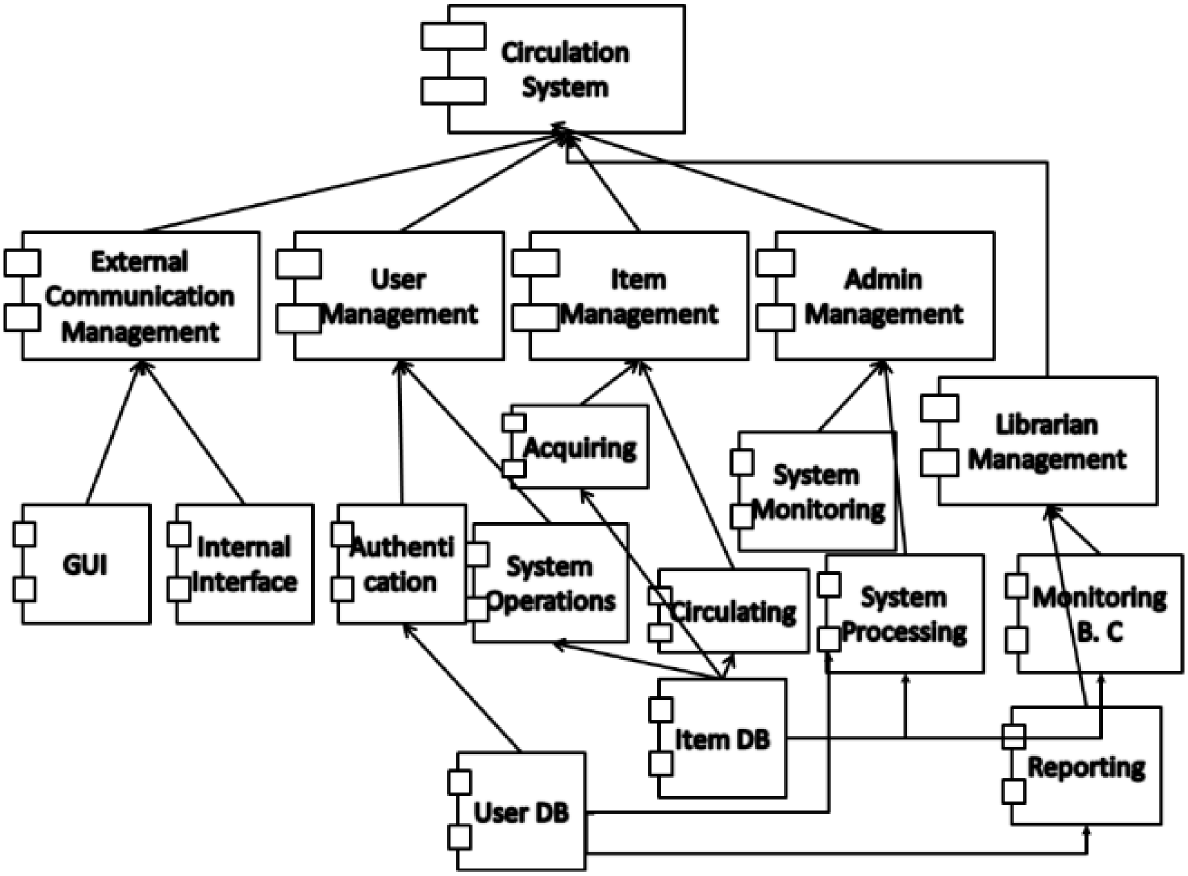


Figure 4: LCS with component elaboration

1.5 Mapping Requirements into a Software Architecture

Level 0

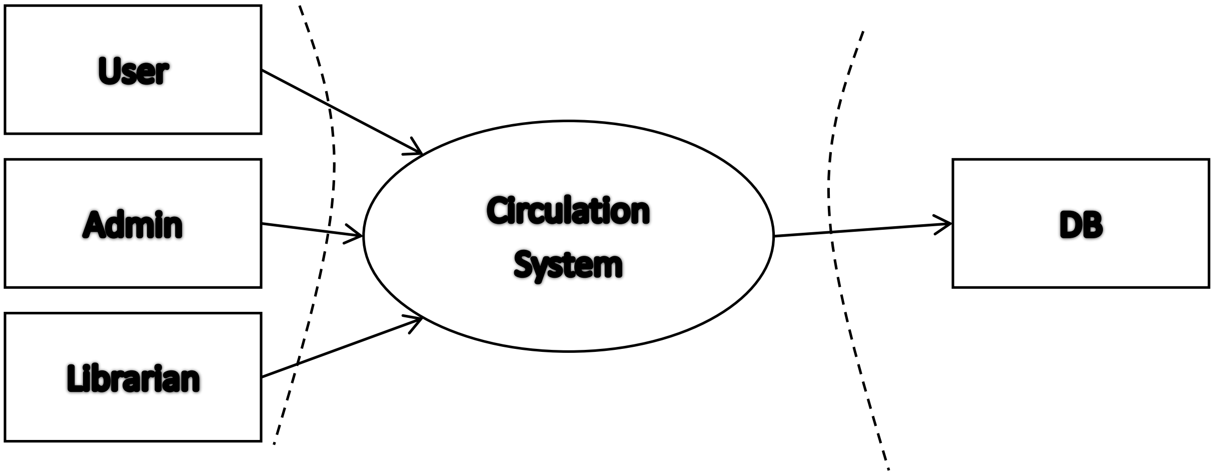


Figure 5: Level 0 DFD

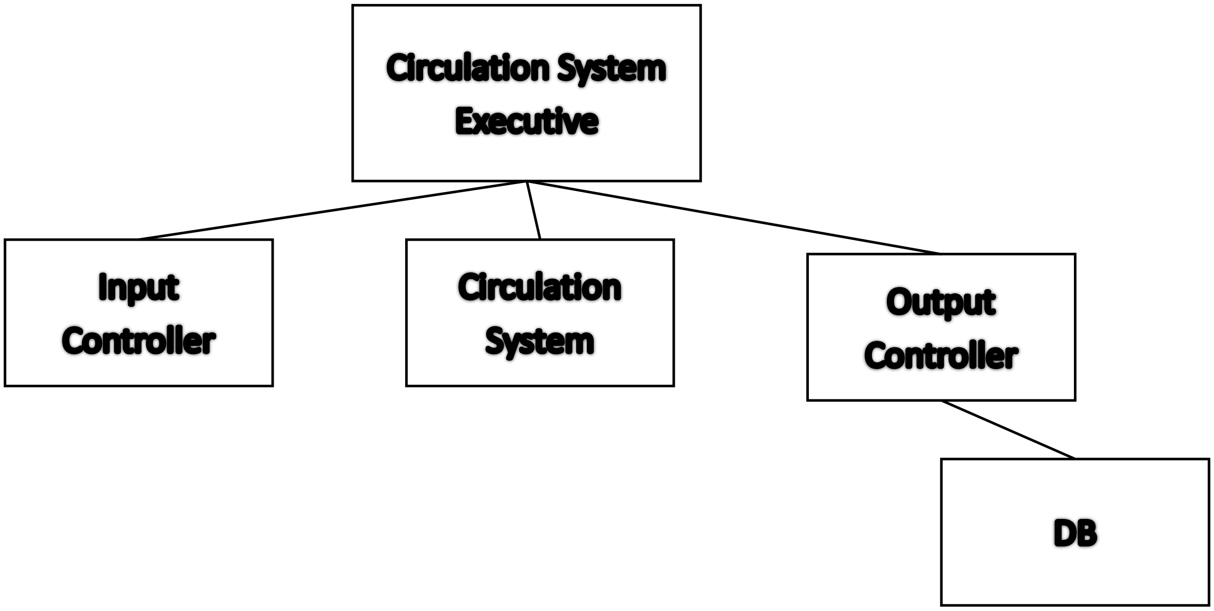


Figure 6: First level factoring

Level 1.1 - User

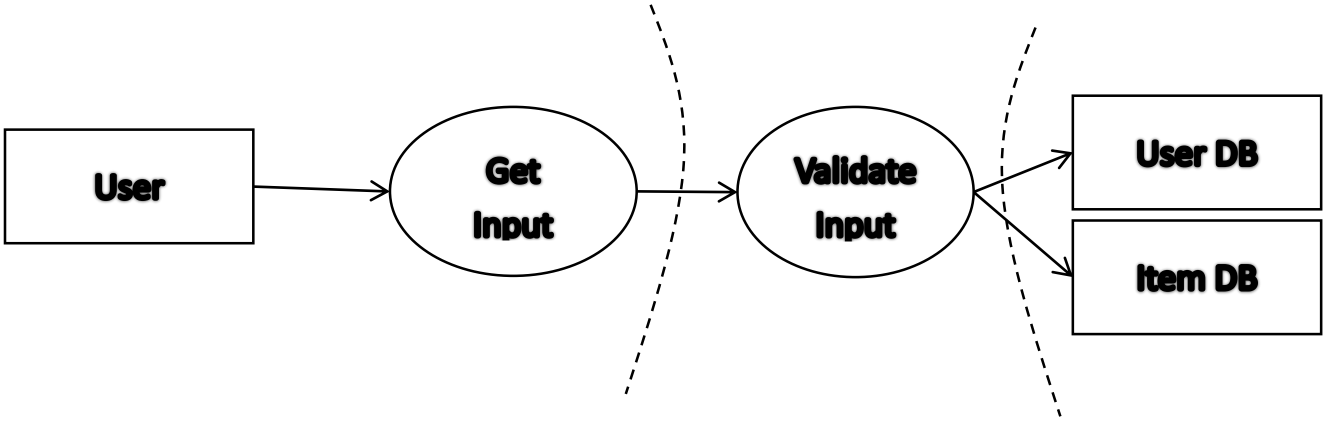


Figure 7: Level 1.1 DFD

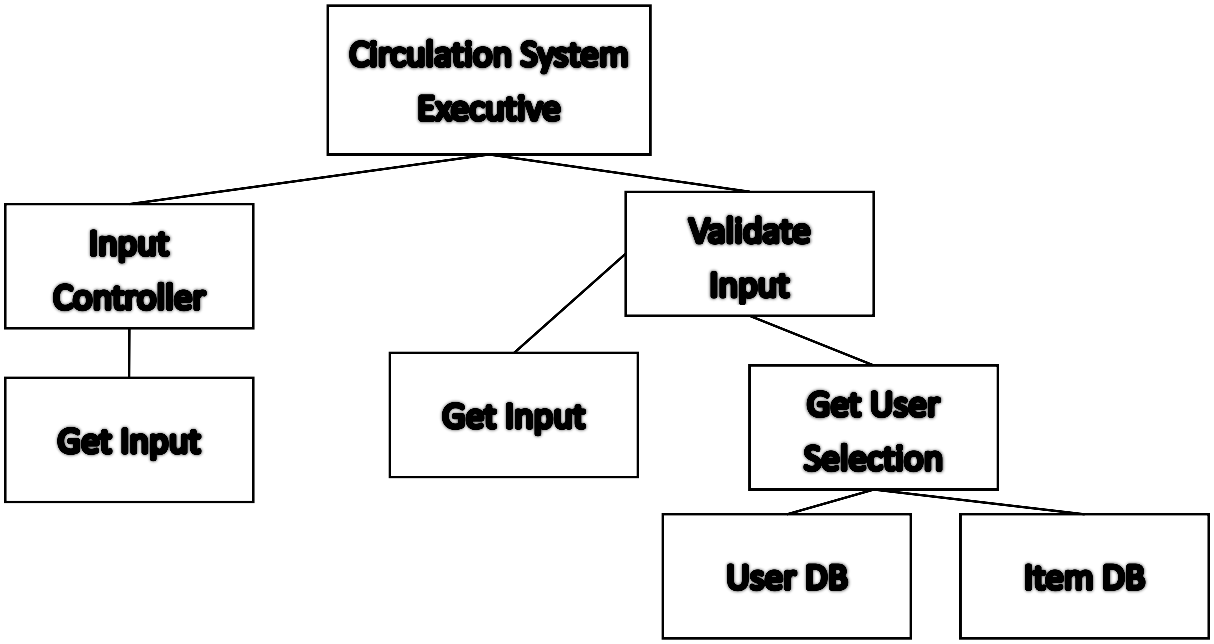


Figure 8: Second level factoring (User)

Level 1.2 Admin

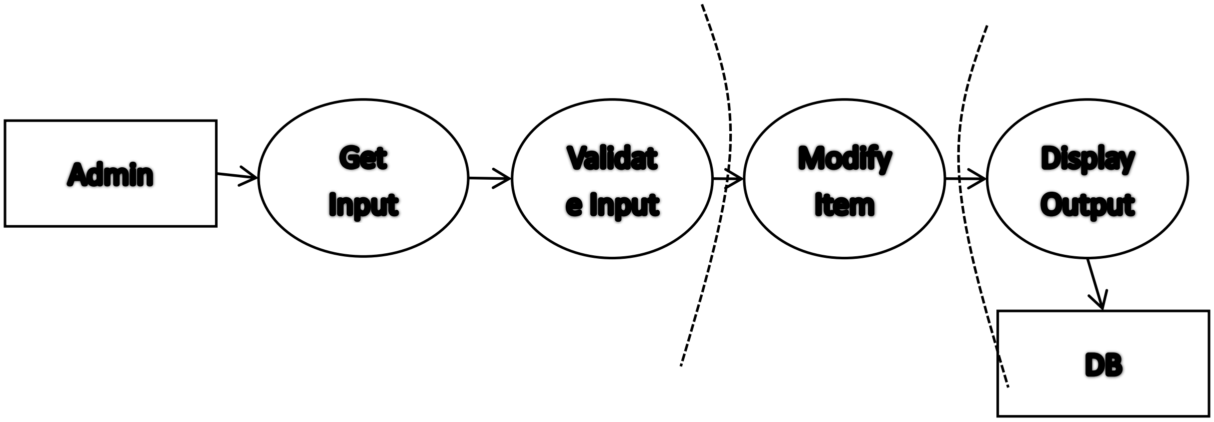


Figure 9: Level 1.2 DFD (Admin)

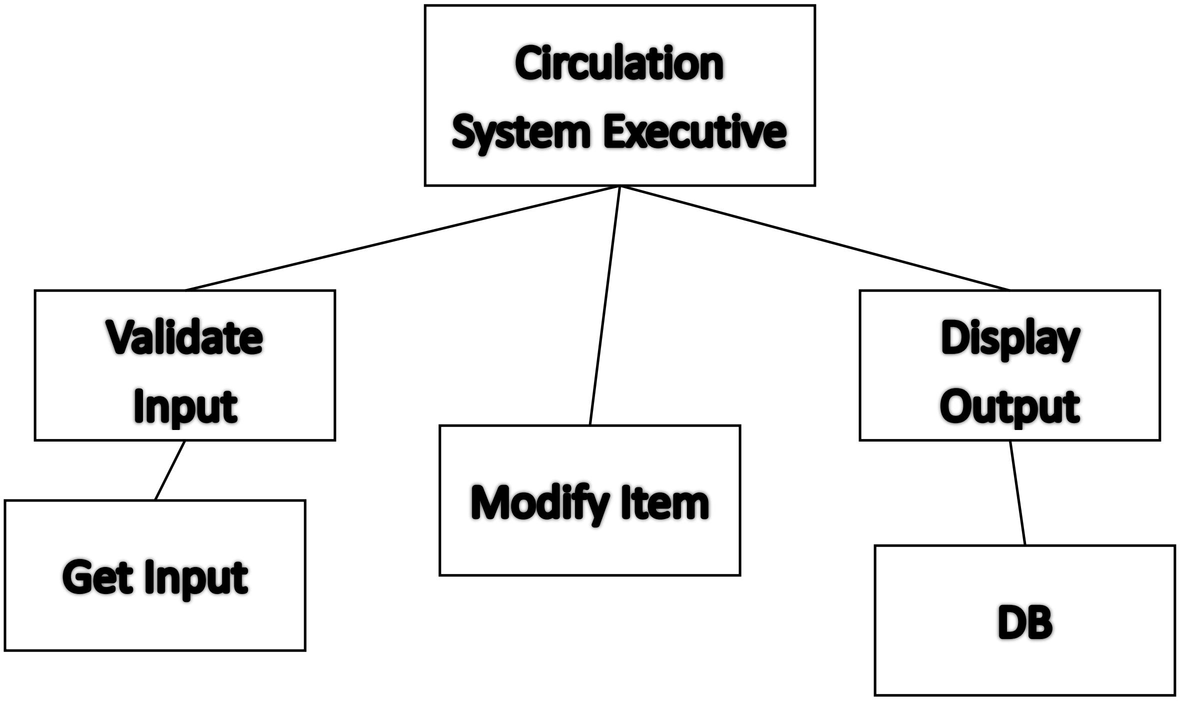


Figure 10: Second level factoring (Admin)

Level 1.3 Librarian

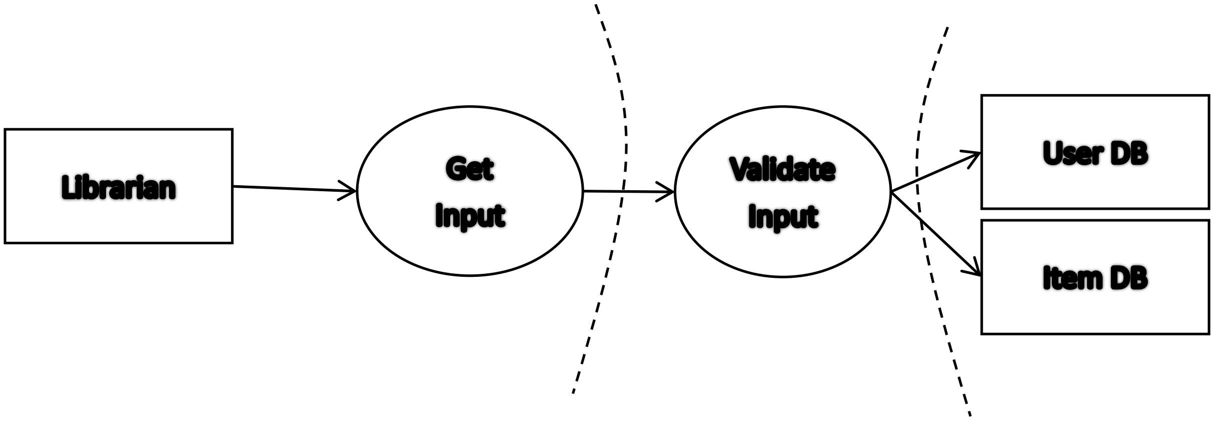


Figure 11: Level 1.3 DFD

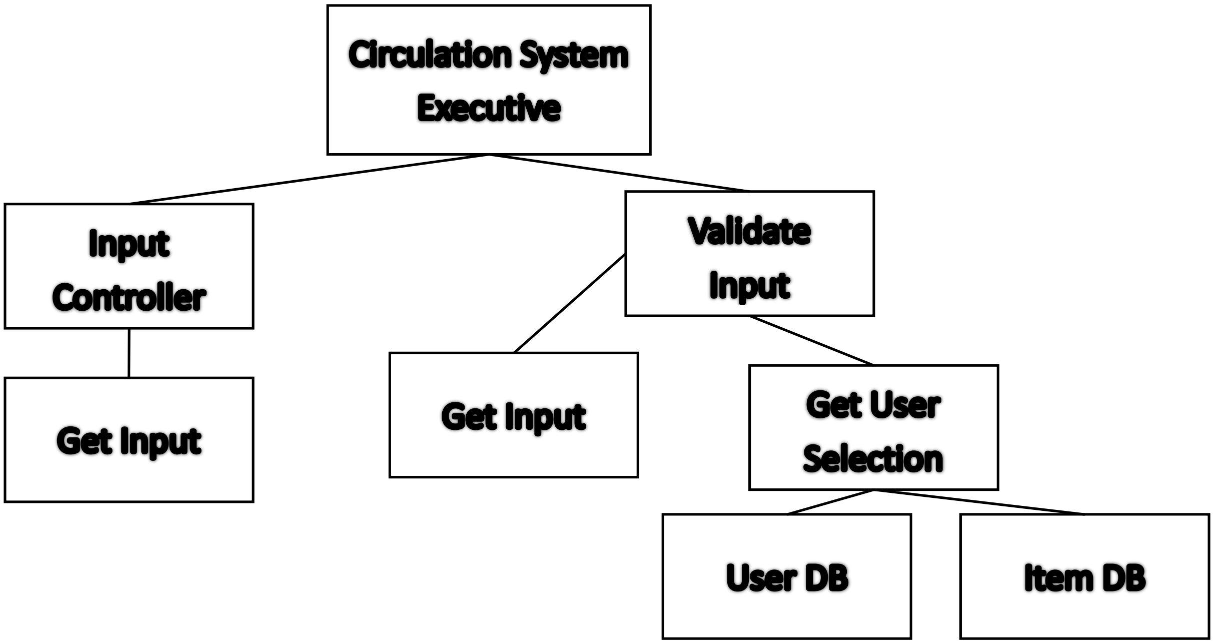


Figure 12: Second level factoring (Librarian)

Level 2.1 User

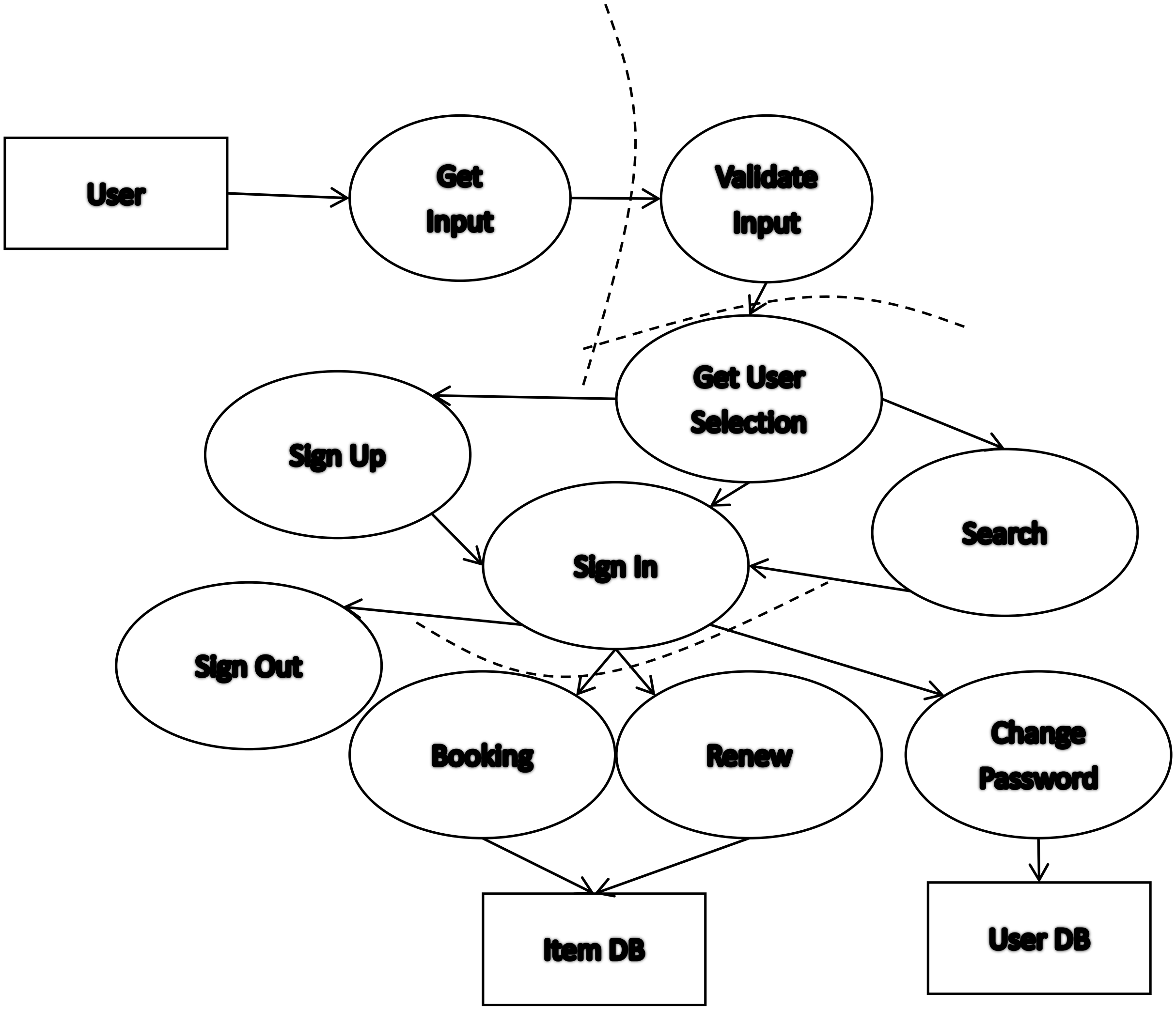


Figure 13: Level 2.1 DFD

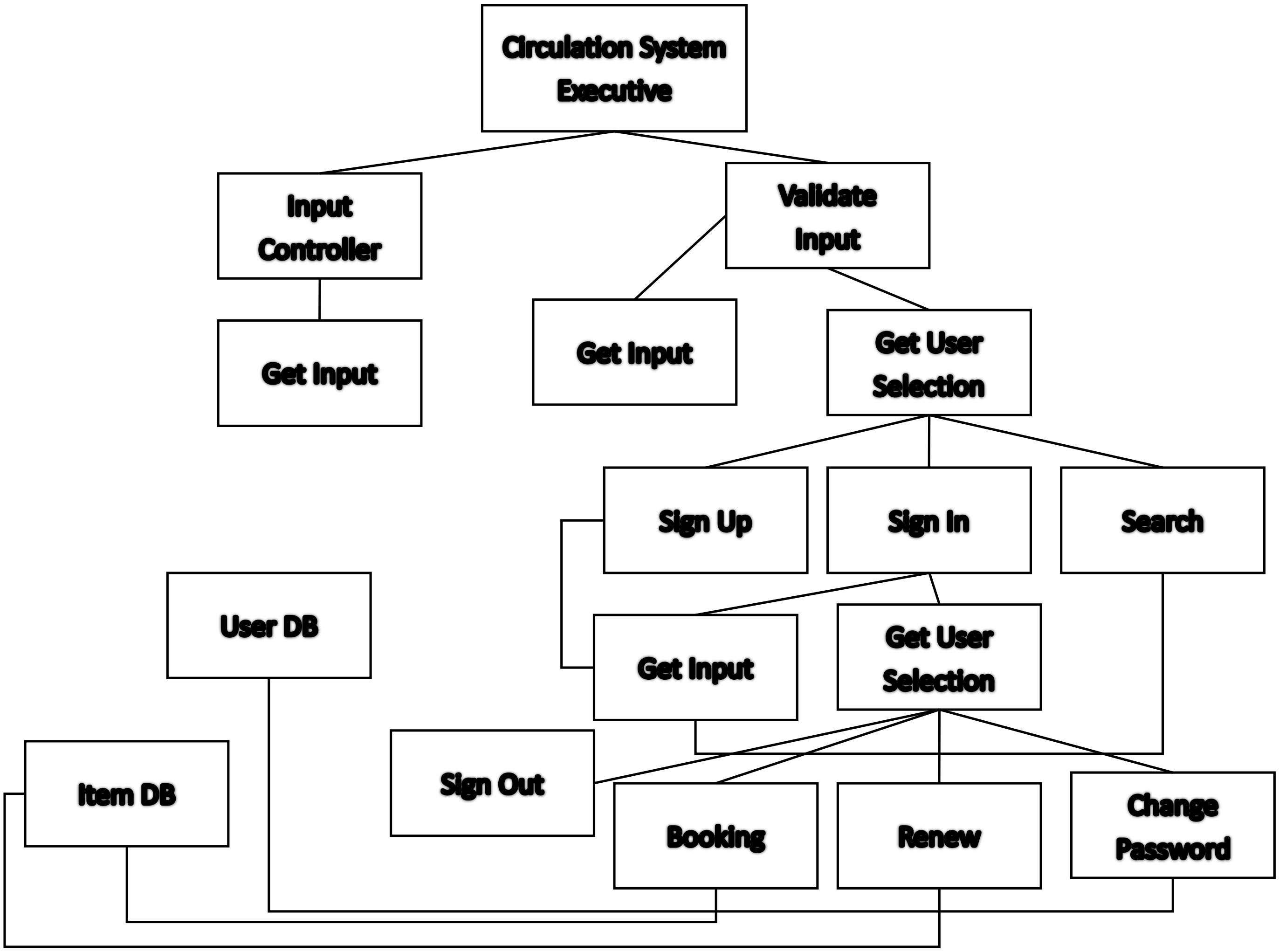


Figure 14: Third level Factoring (User)

Level 2.2 Librarian

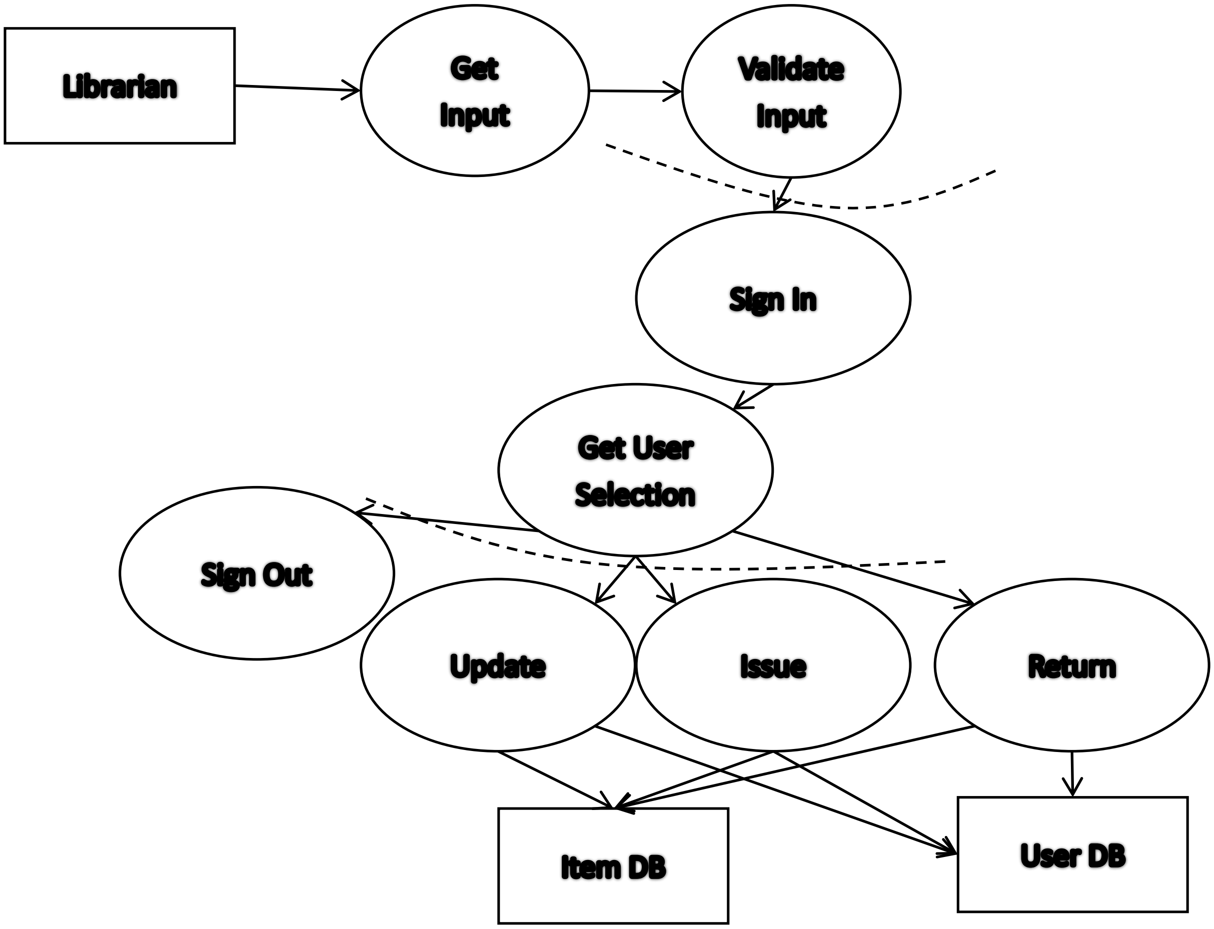


Figure 15: Level 2.2 DFD

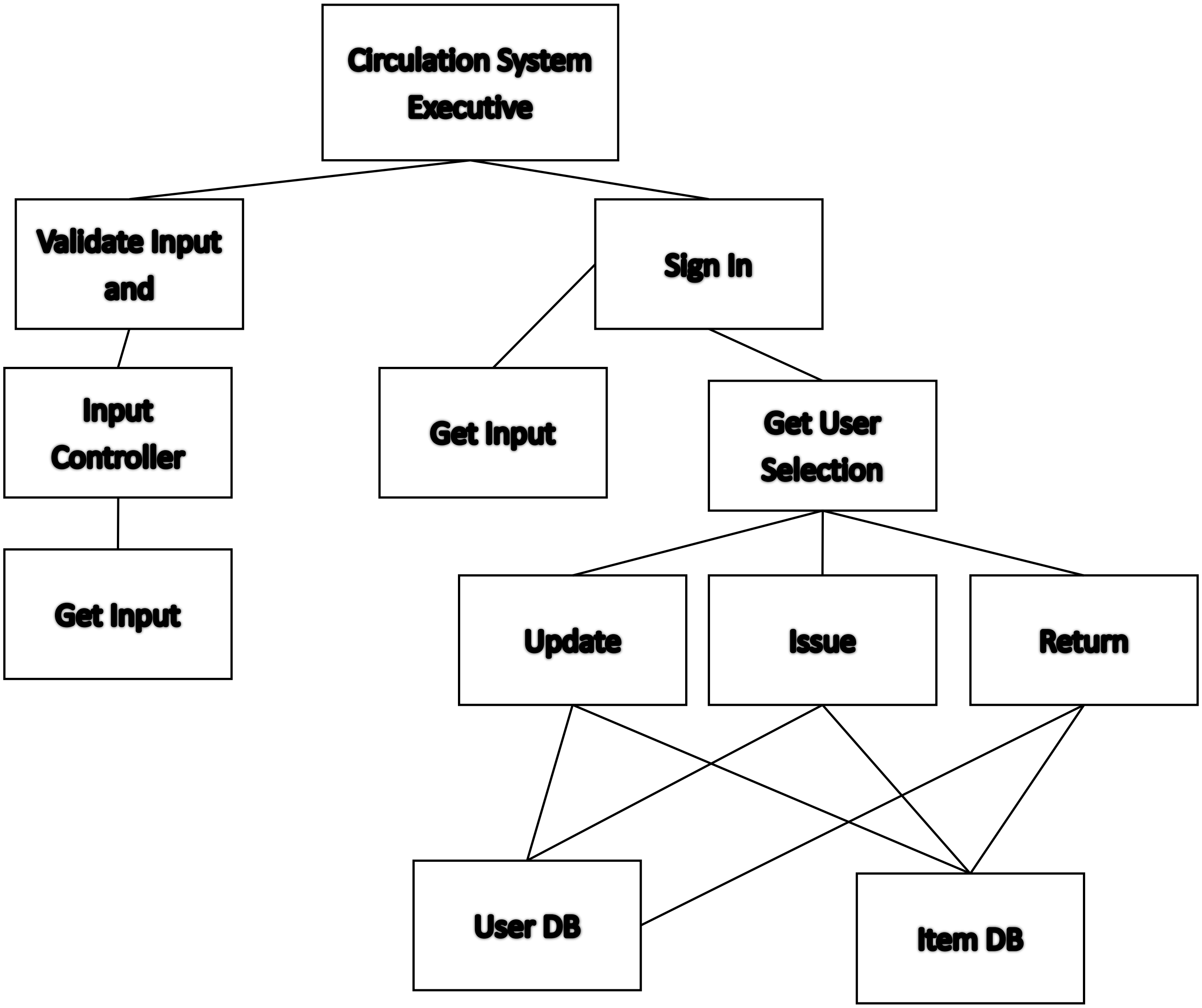


Figure 16: Third level factoring (Librarian)

Chapter 2

Component Level Design

2.0 Introduction

Component level design defines the data structures, algorithms, interface characteristics and communication mechanisms allocated to each software components. We follow the following steps in the component level design of our Library circulation system.

i. Identify all design classes that correspond to the problem domain
ii. Identify all design classes that correspond to the infrastructure domain
iii. Elaborate all design classes
iv. Describe persistent data sources (databases and files) and identify the classes required to manage them
v. Develop and elaborate behavioral representations for a class or component
vi. Elaborate deployment diagrams to provide additional implementation detail

2.1 Identify All Classes that Correspond to Problem Domain

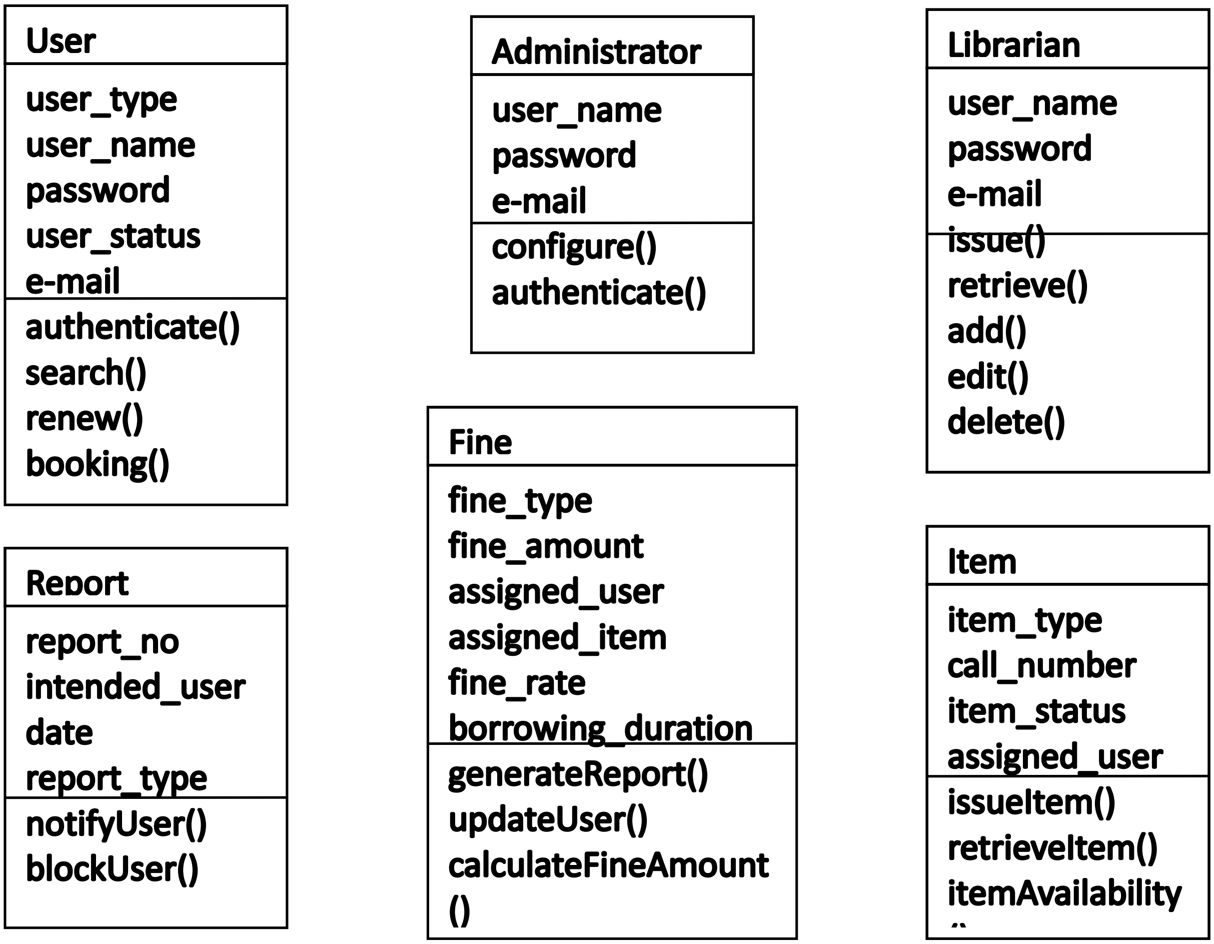


Figure 17: Problem domain classes

2.2 Identify All Classes that Correspond to Infrastructure Domain

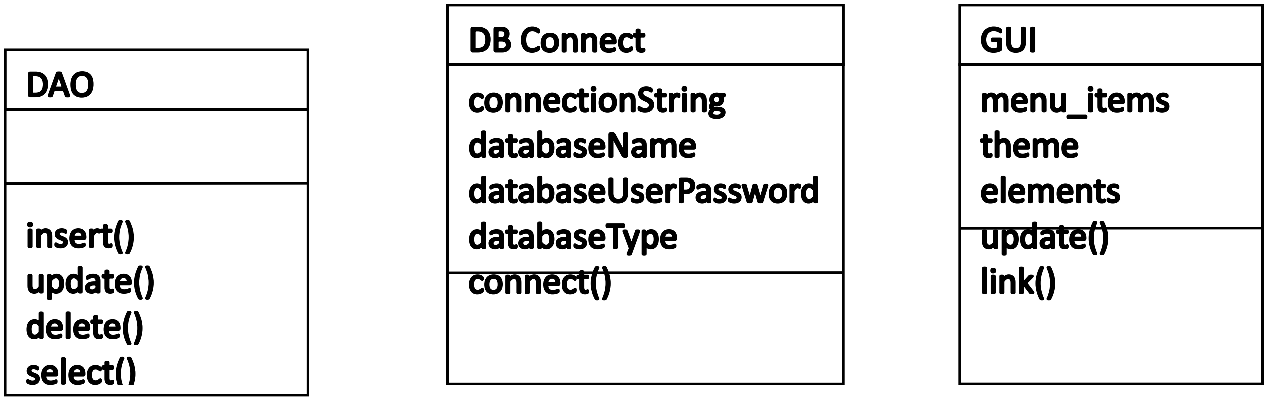


Figure 18: Infrastructure Domain Classes

2.3 Elaborate All Design Classes that are not acquired as Reusable Components

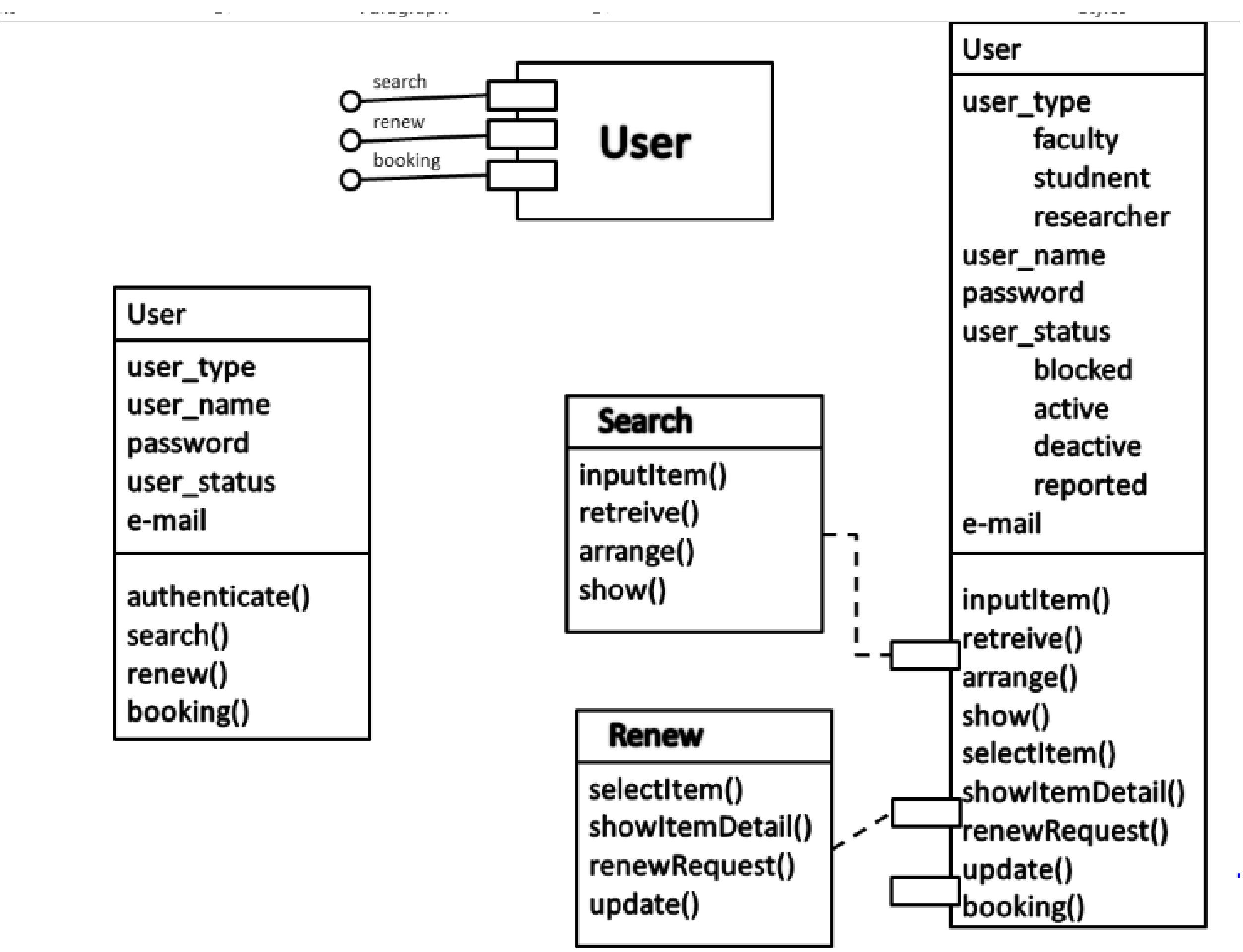


Figure 19: Class elaboration

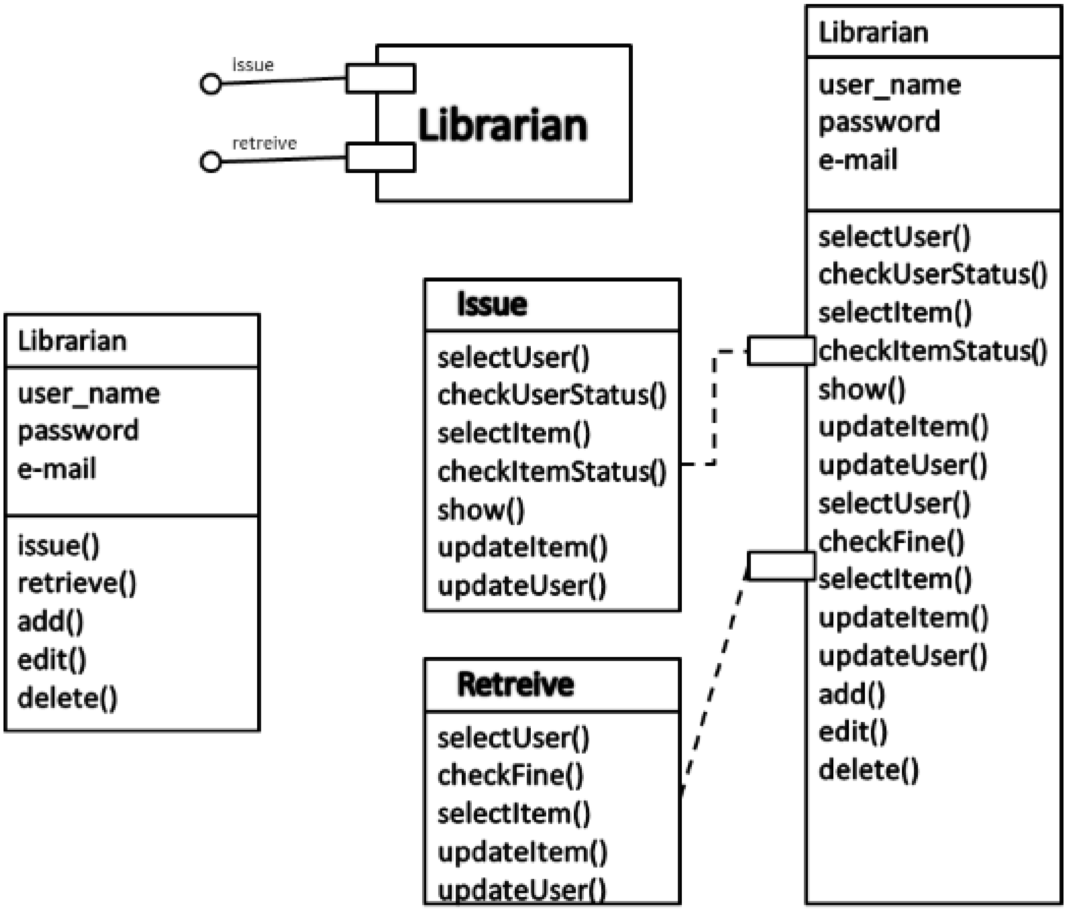


Figure 20: Class elaboration

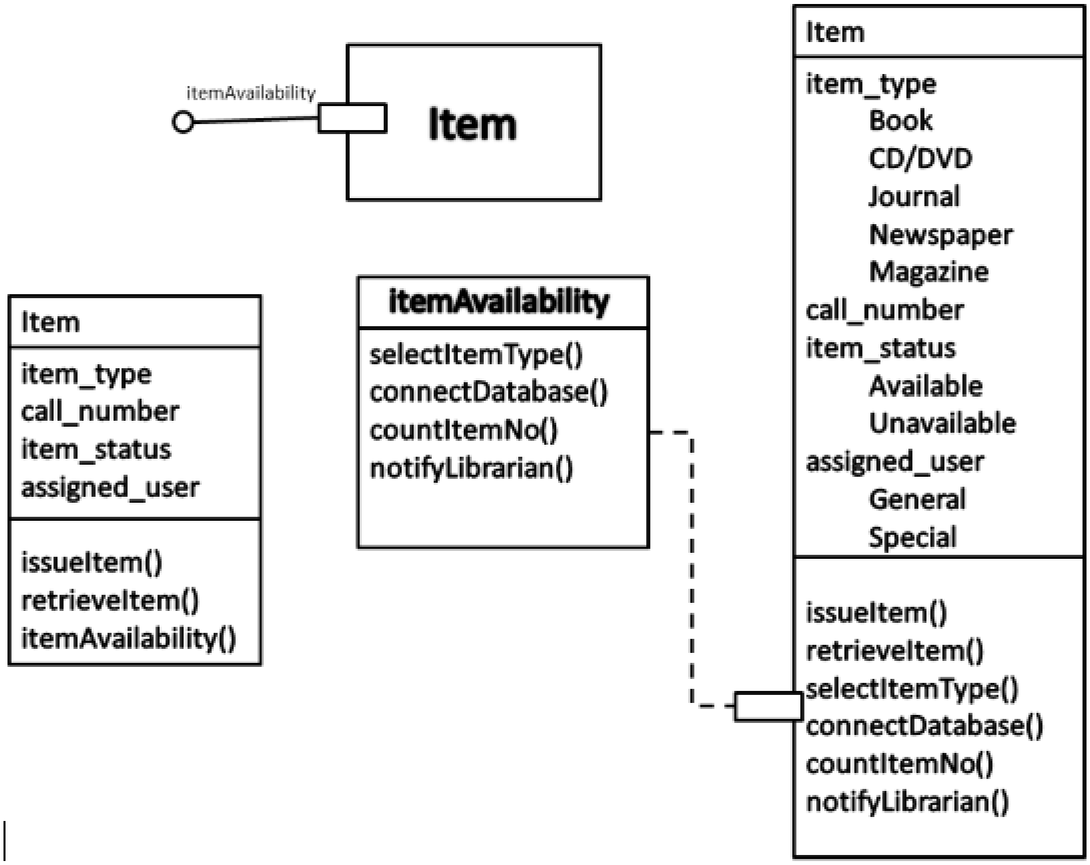


Figure 21: Class elaboration

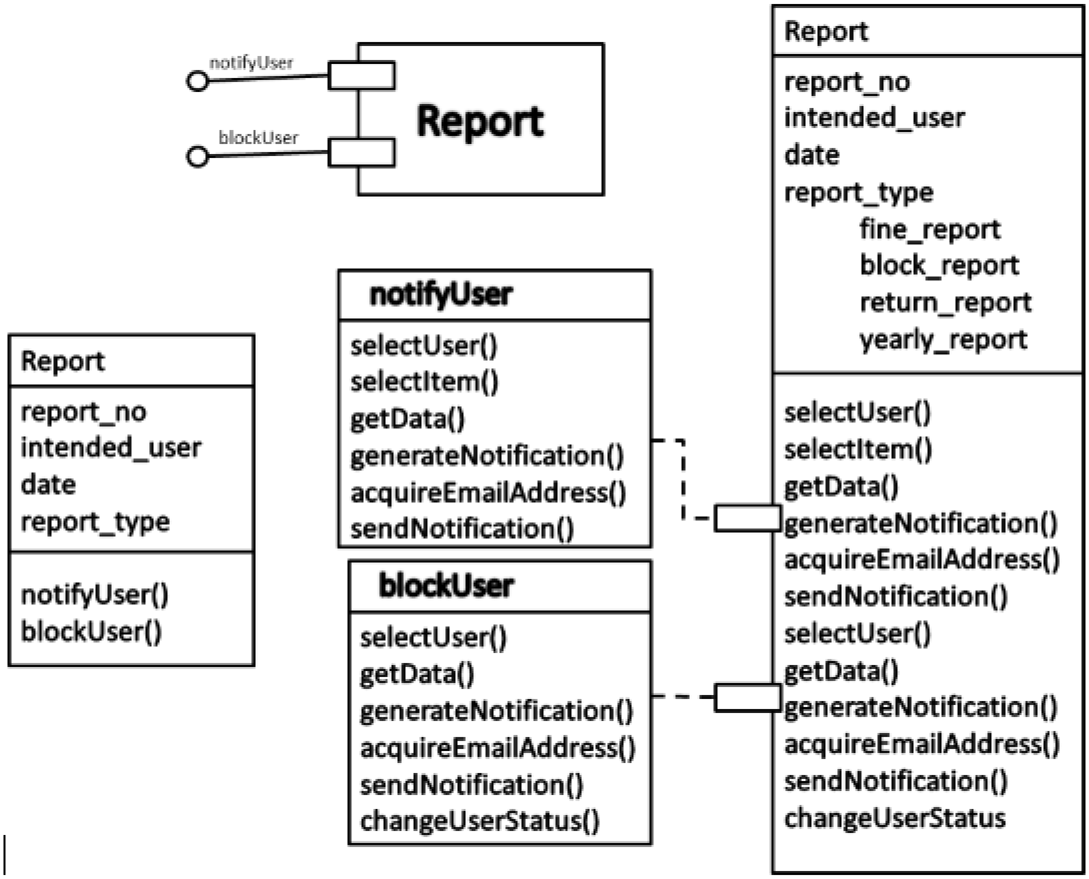


Figure 22: Class elaboration

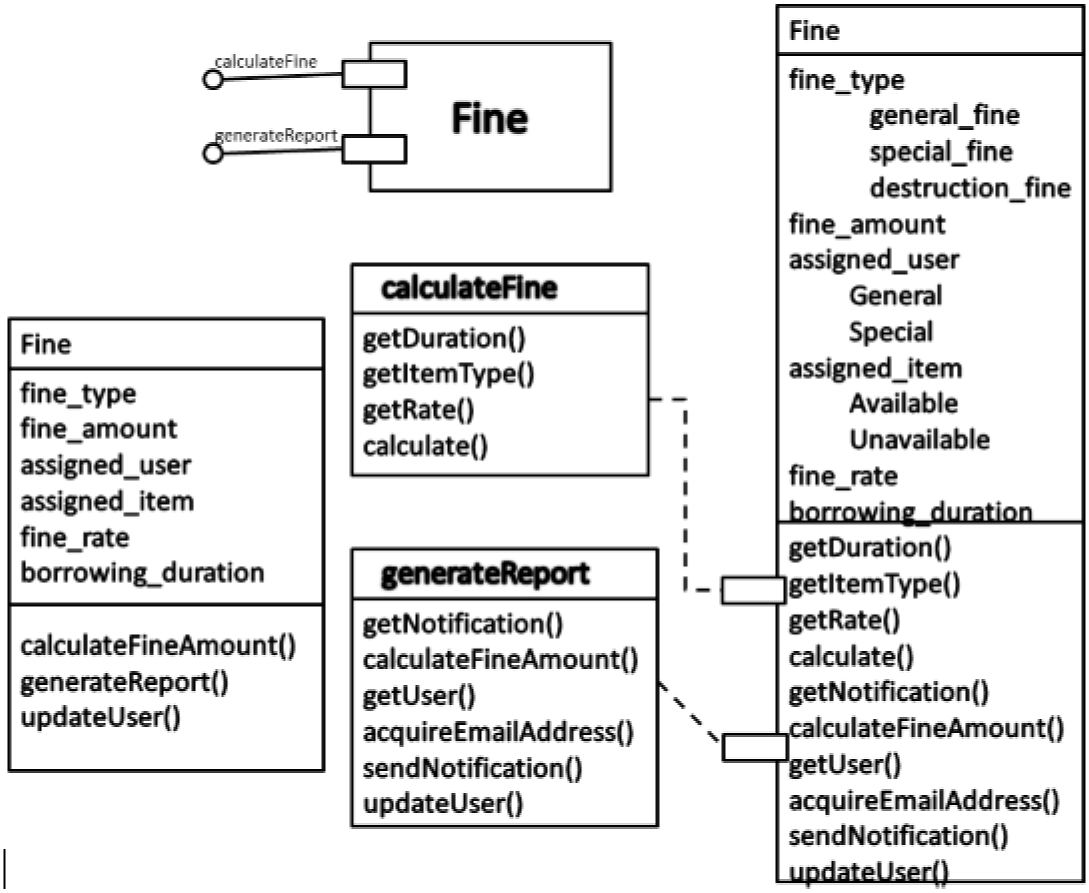
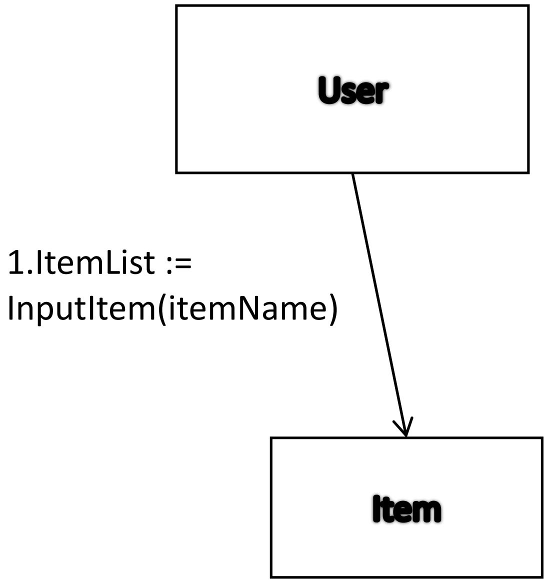


Figure 23: Class elaboration

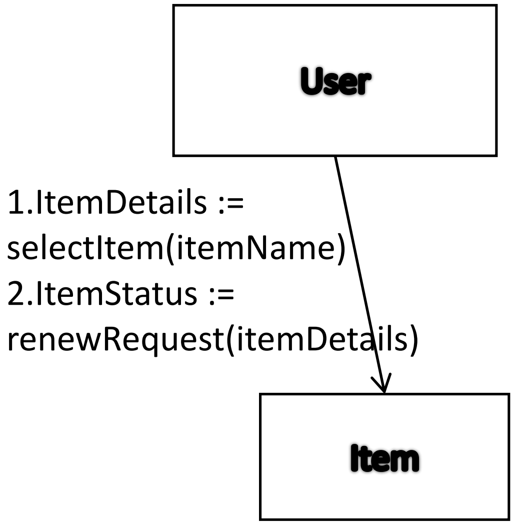
Step- III(a)

Specify Message Details when Classes or Components Collaborate

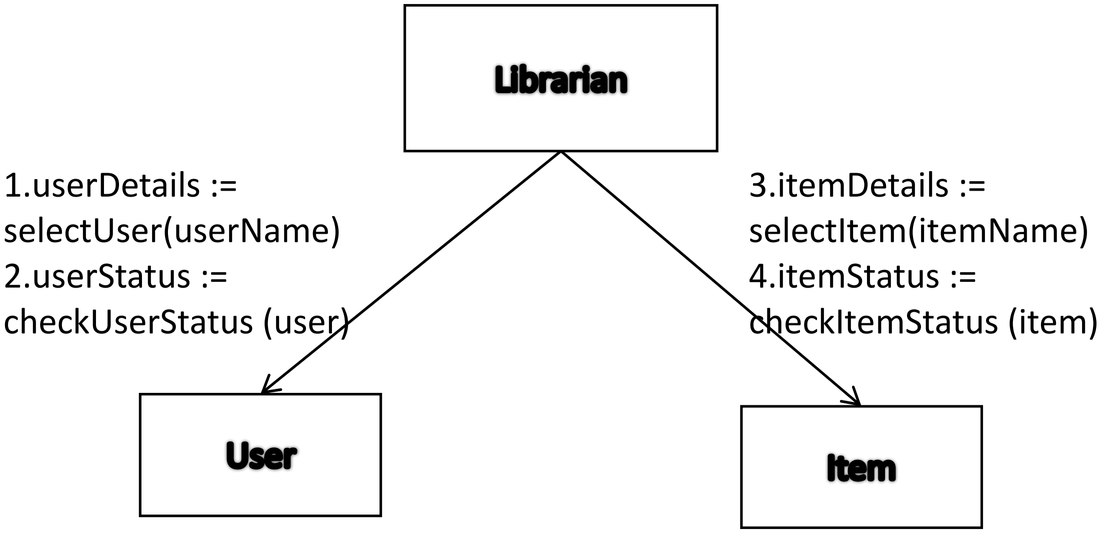
Search



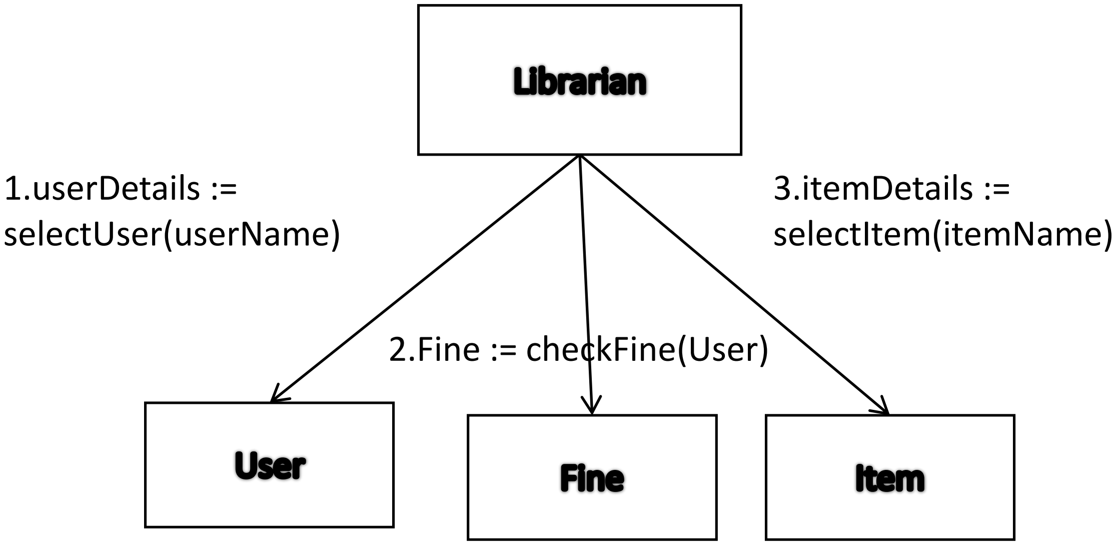
Renew



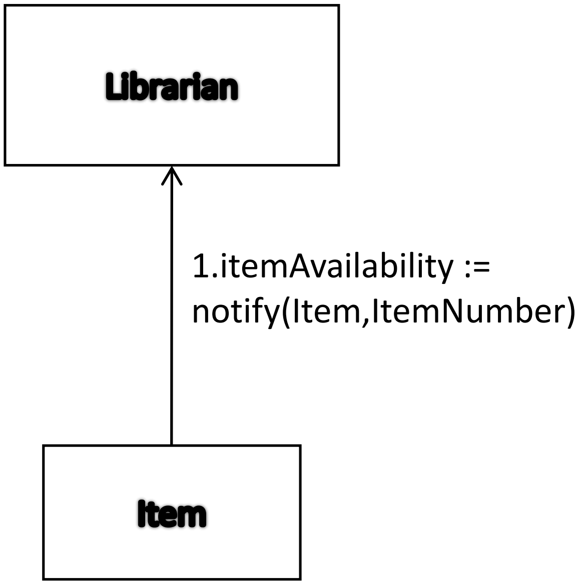
Issue



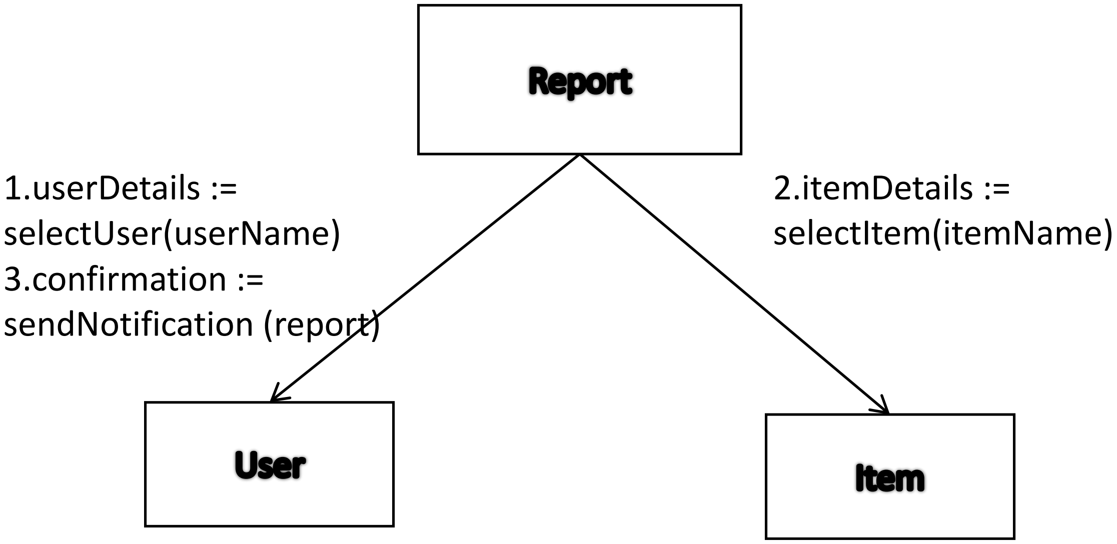
Retreive



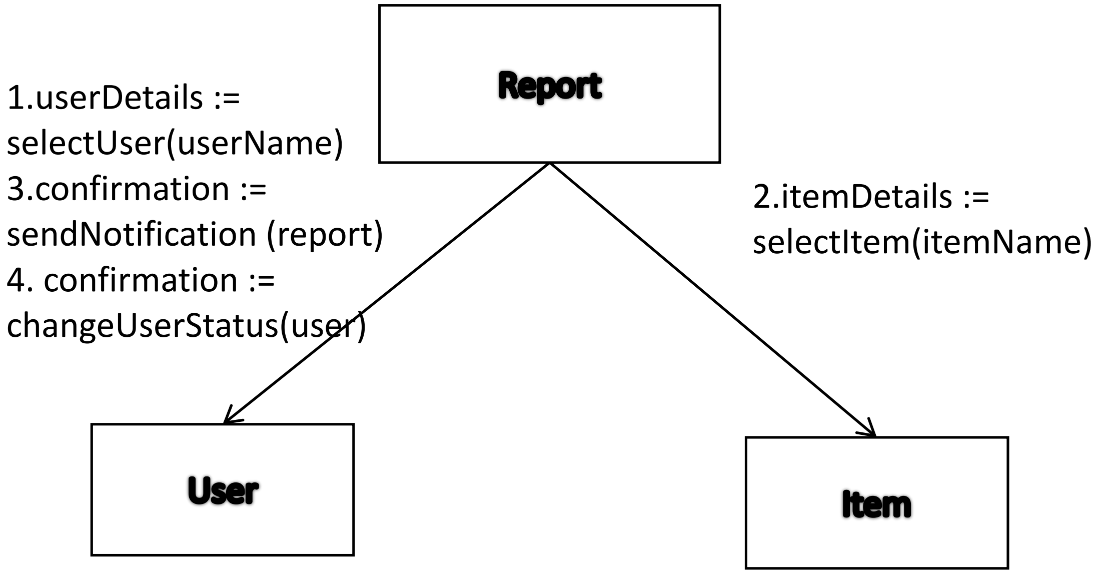
ItemAvailability



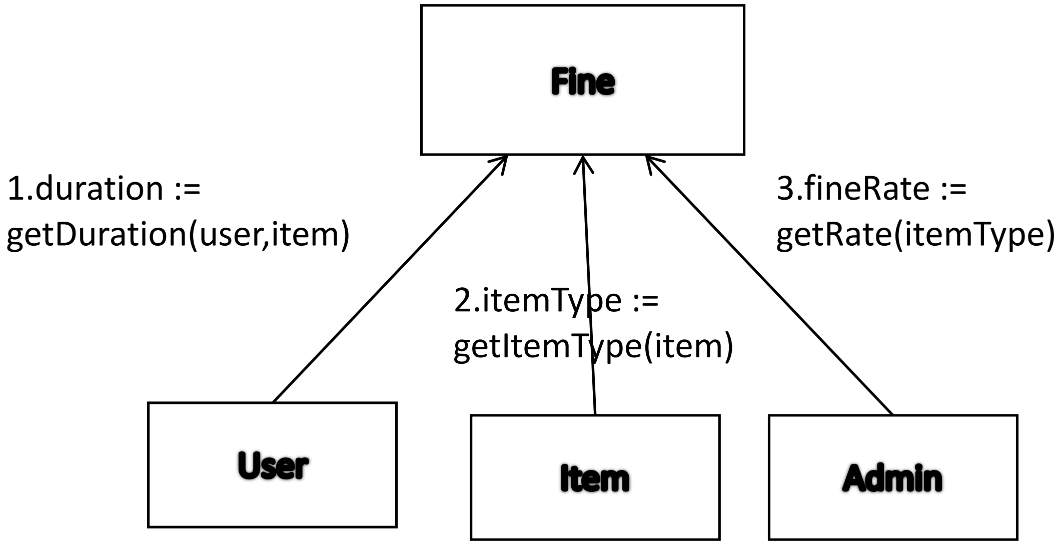
NotifyUser



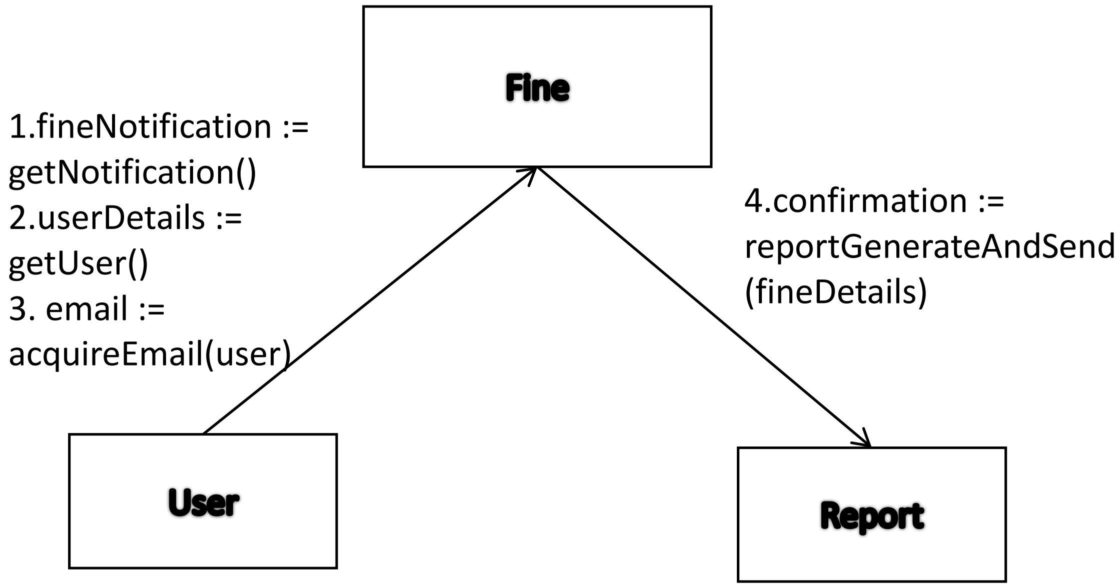
BlockUser


Report
1.userDetails := selectUser(userName)
3.confirmation := sendNotification (report)
4. confirmation := changeUserStatus(user)
2.itemDetails := selectItem(itemName)
User
Item

calculateFine


Fine
1.duration := getDuration(user,item)
2.itemType := getItemType(item)
3.fineRate := getRate(itemType)
User
Item
Admin

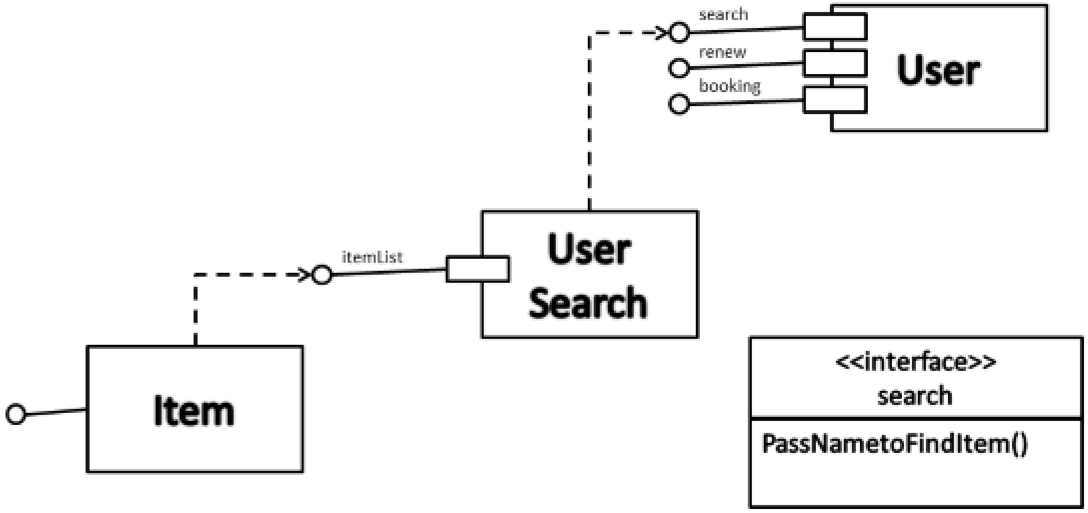
generateReport


Fine
1.fineNotification := getNotification()
2.userDetails := getUser()
3. email := acquireEmail(user)
4.confirmation := reportGenerateAndSend (fineDetails)
User
Report

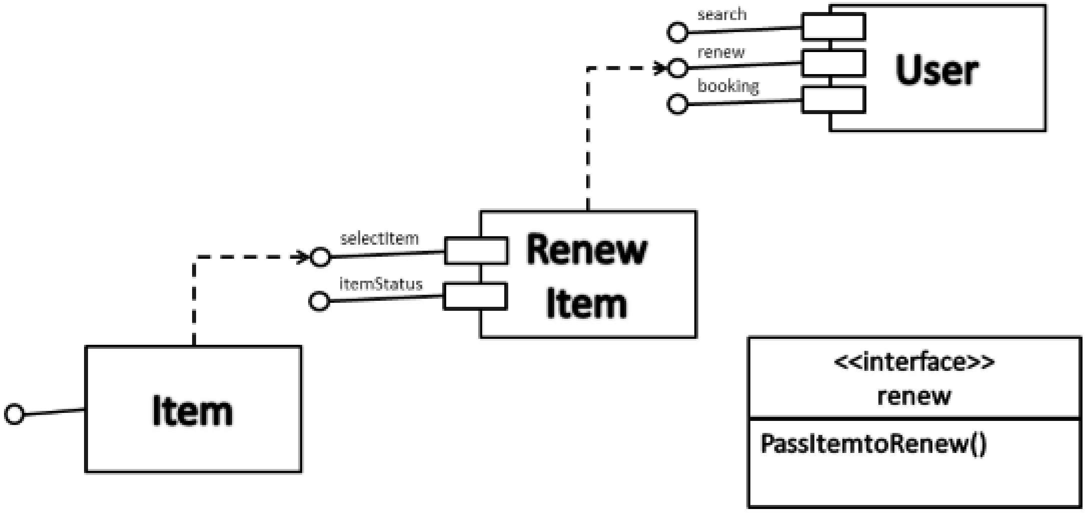
Step-III(b)

Identify Appropriate Interfaces for each Component

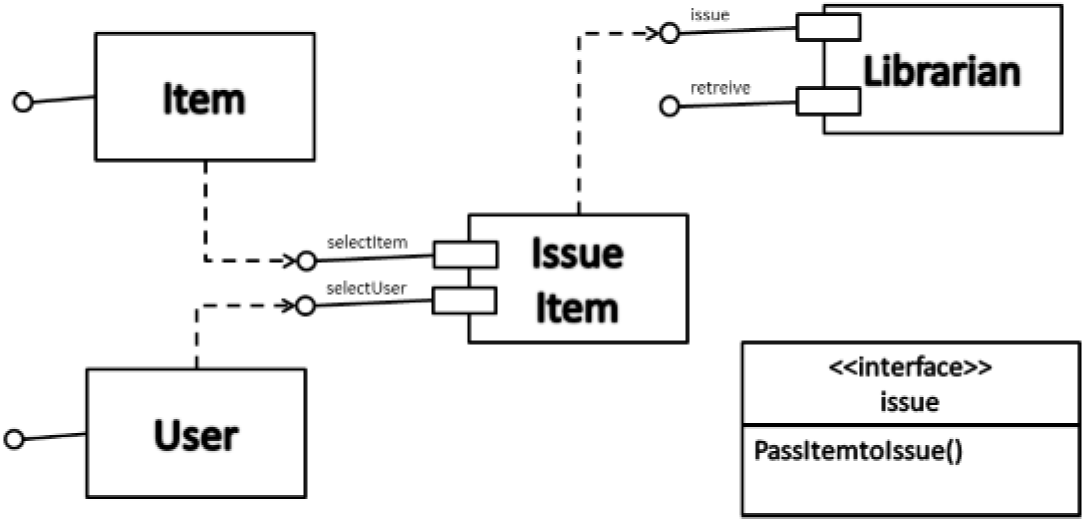
Search



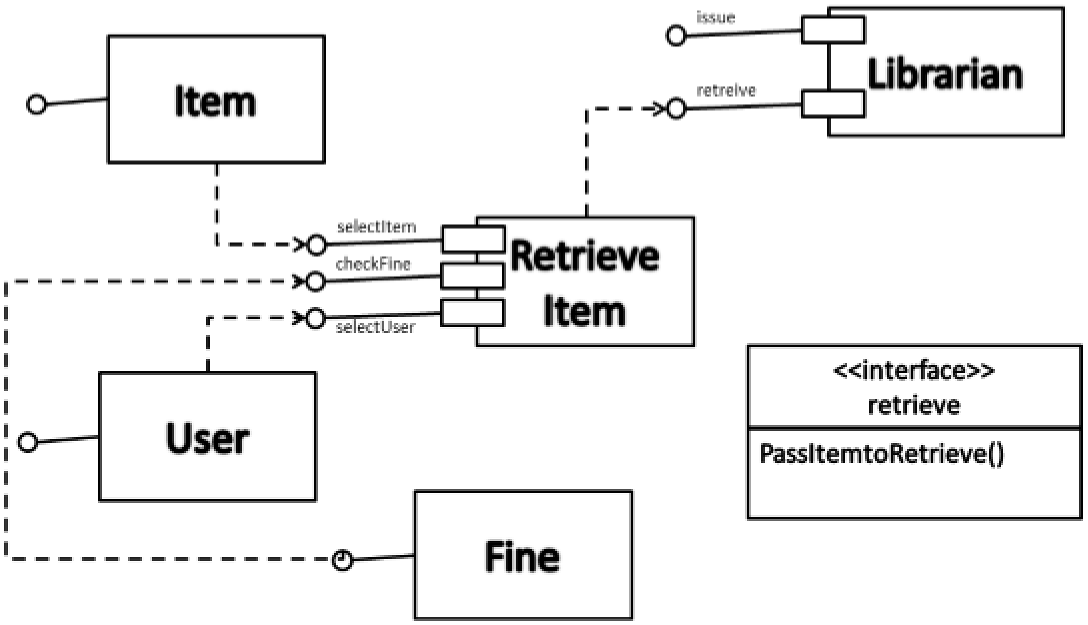
Renew


search
renew
booking
User
selectItem
itemStatus
Renew Item
Item
<<interface>>
renew
PassItemtoRenew()

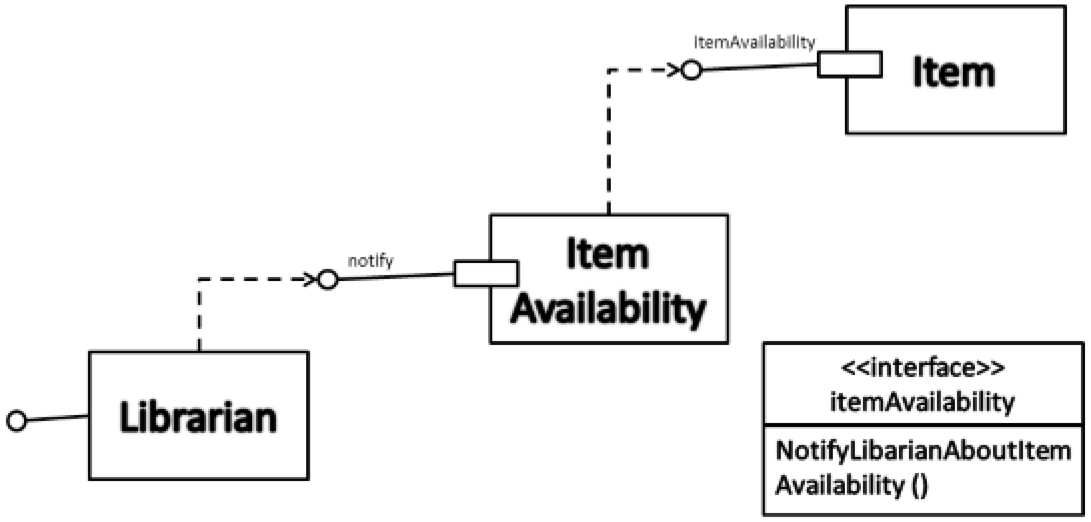
Issue


issue
retreive
Librarian
Item
selectItem
selectUser
Issue Item
User
<<interface>>
issue
PassItemtoIssue()

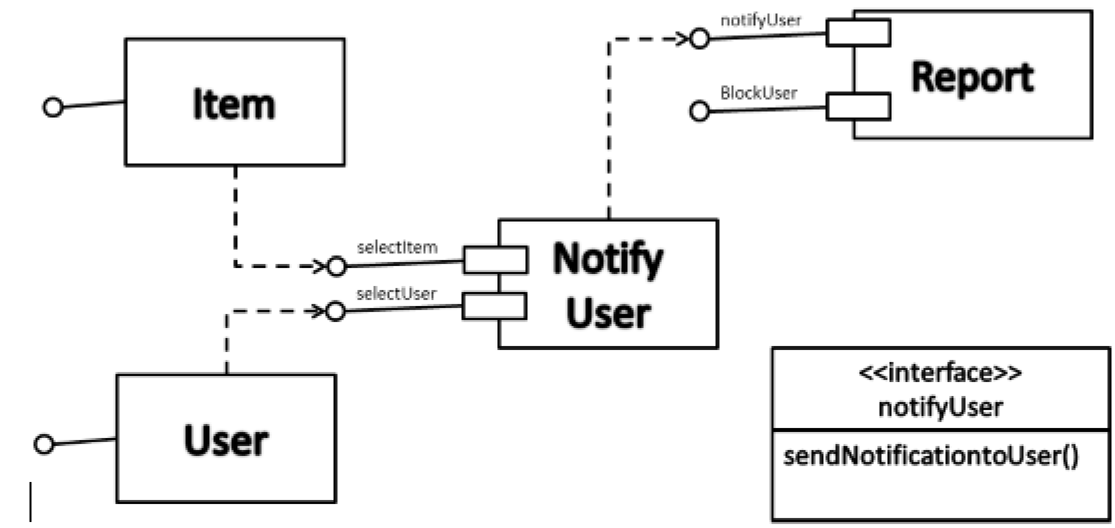
Retrieve



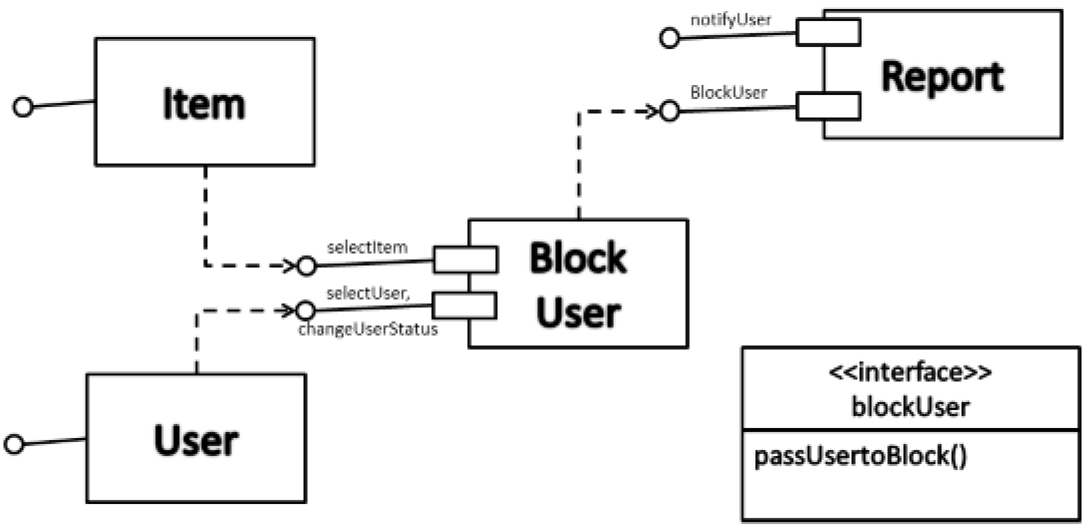
ItemAvailability



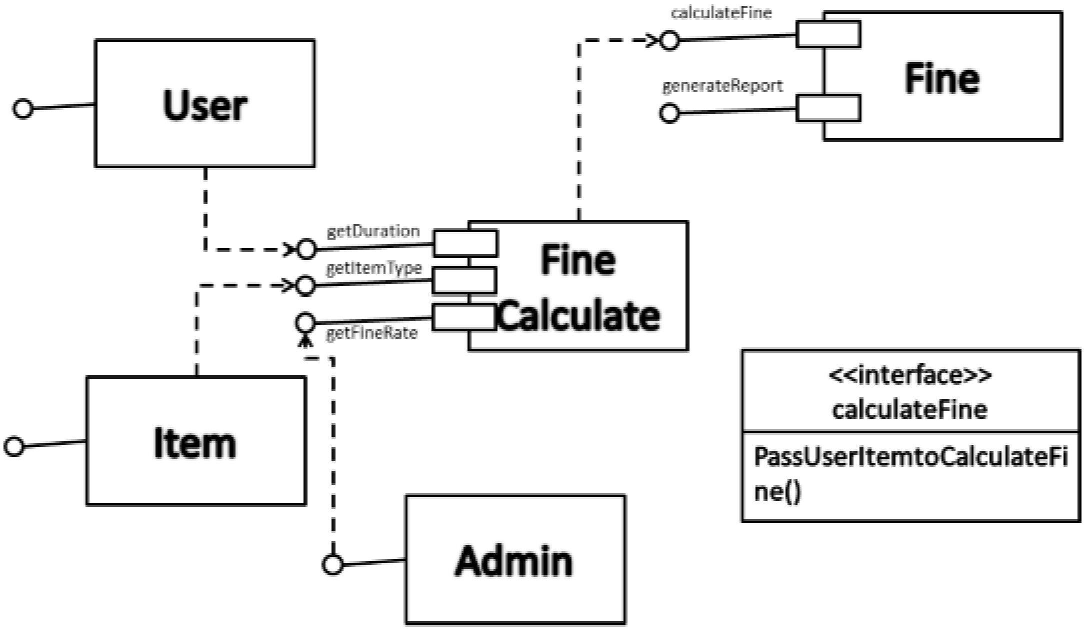
NotifyUser



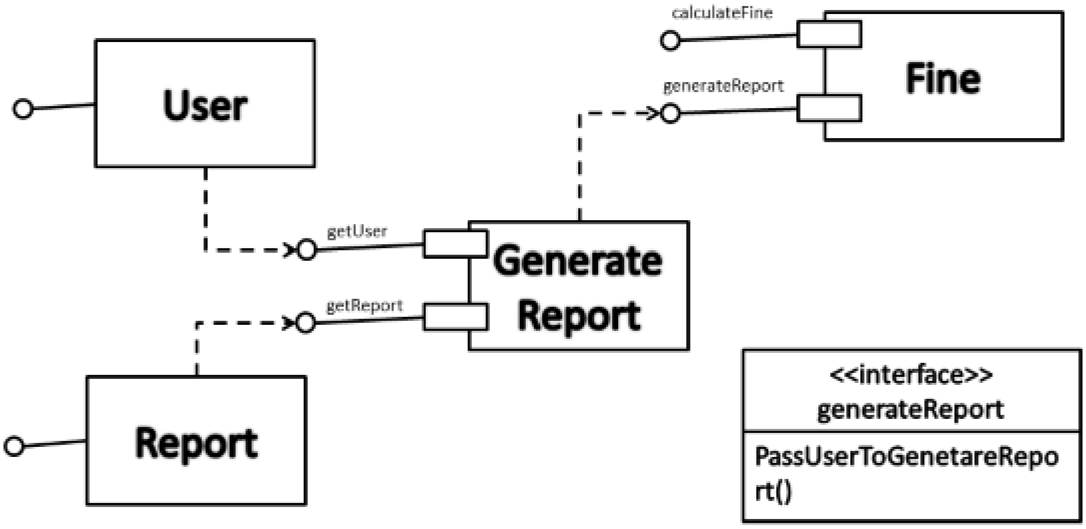
BlockUser



CalculateFine



GenerateReport



Step-III(c)

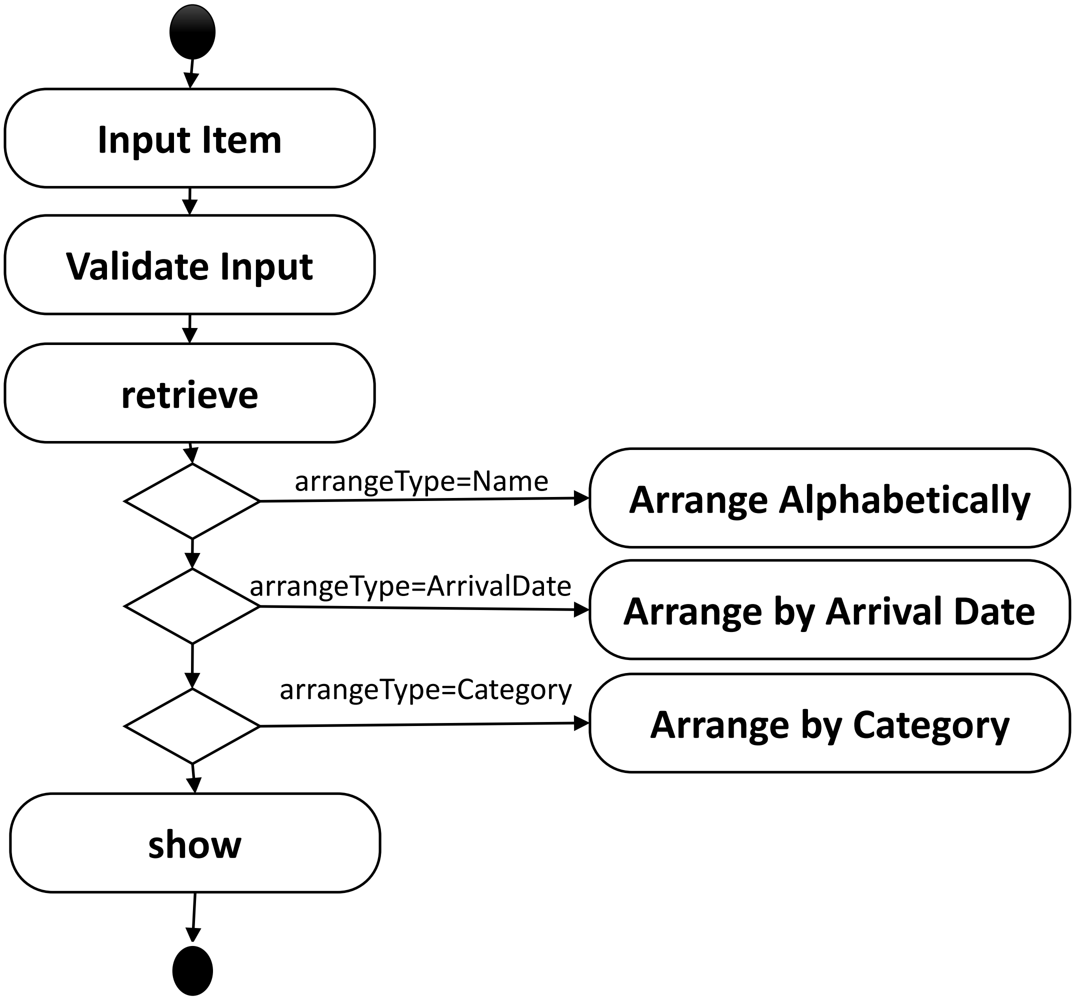
Elaborate Attributes and Define Data Types and Data Structures Required to Implement them

Attribute Name	Class	Data Type/Data Structure
user_type	user	enum
user_name	user,administrator,librarian	string
password	user,administrator,librarian	string
user_status	user	enum
e-mail	user,administrator,librarian	string
report_no	report	int
intended_user	report	int
date	report	date
report_type	report	enum
fine_type	fine	Enum
fine_amount	fine	Int
assigned_user	fine, item	Int
assigned_item	fine	Int
fine_rate	fine	Double
borrowing_duration	fine	Int
item_type	item	Enum
call_number	item	Int
item_status	item	Enum

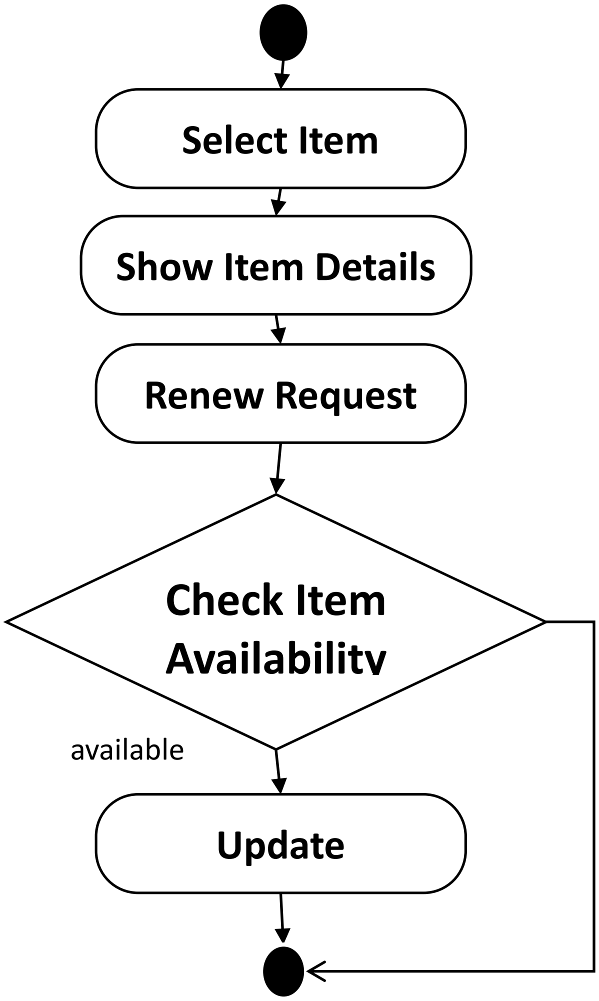
Step-III(d)

Describe Processing Flow within each Operation in Detail

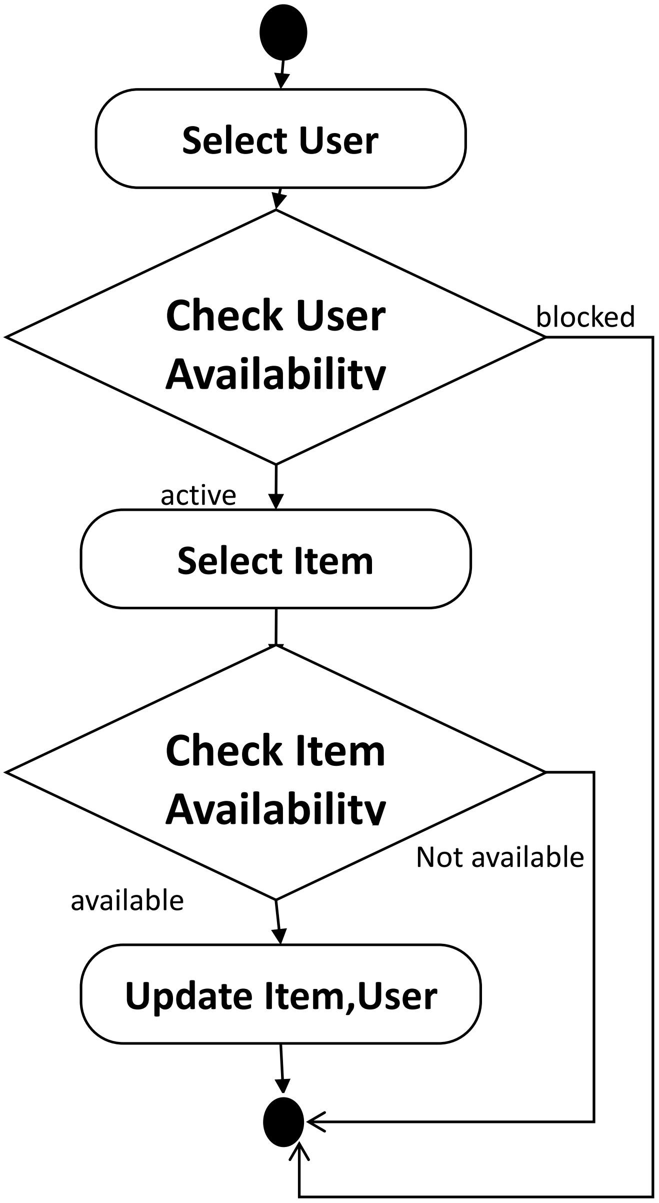
Search



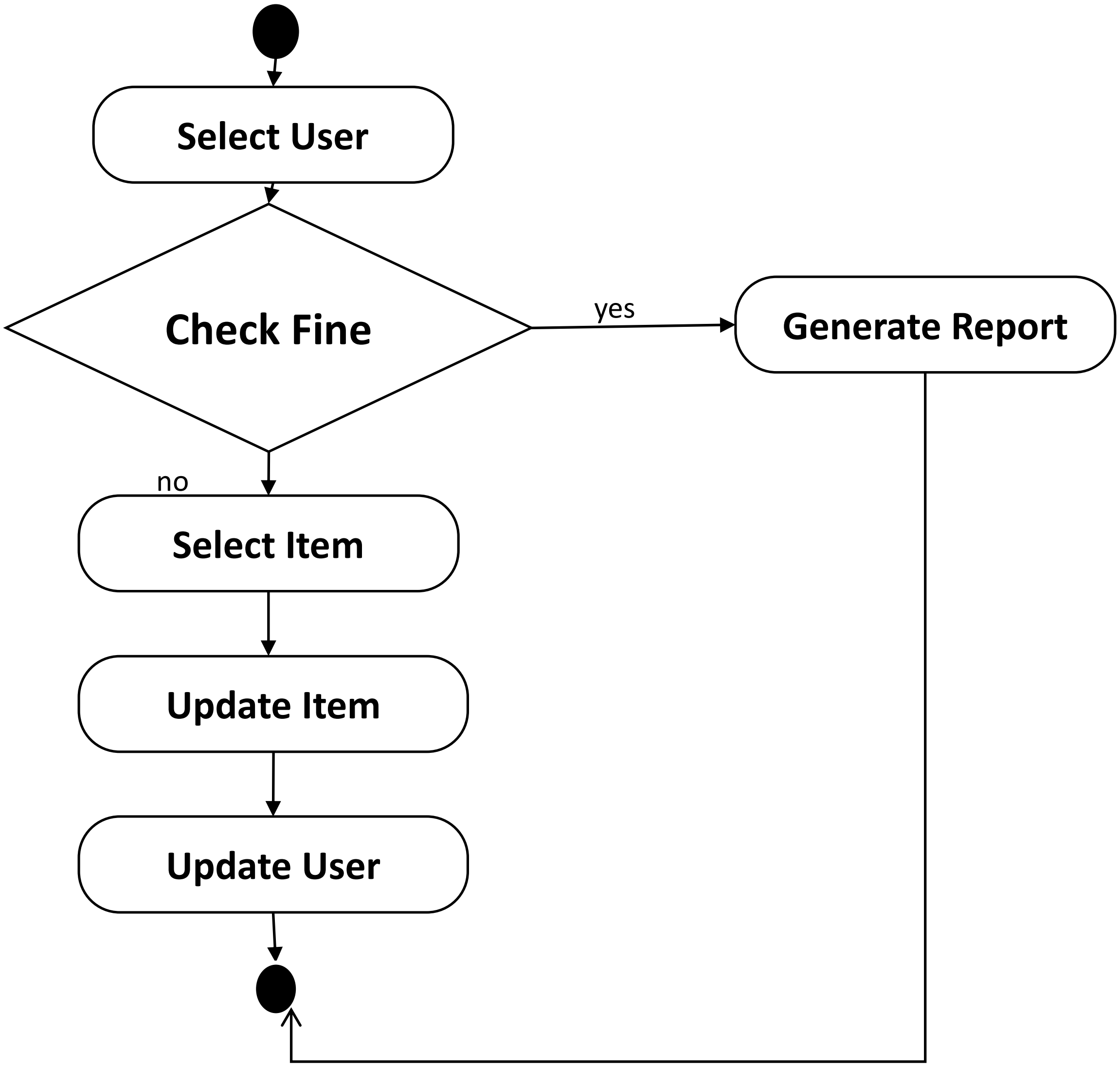
Renew


Select Item
Show Item Details
Renew Request
Check Item Availabilitv
available
Update

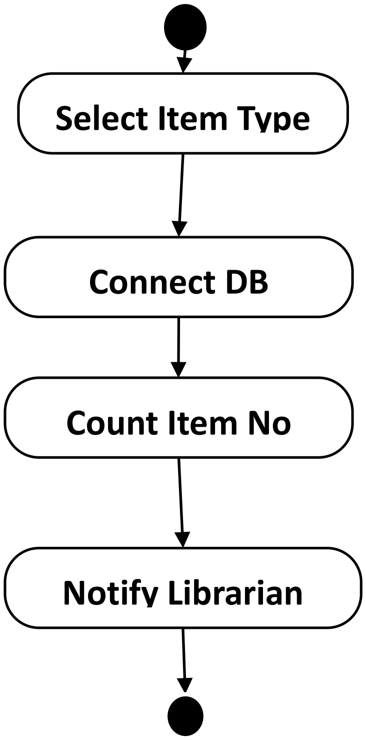
Issue


Select User
Check User Availabilitv
blocked
active
Select Item
Check Item Availabilitv
Not available
available
Update Item,User

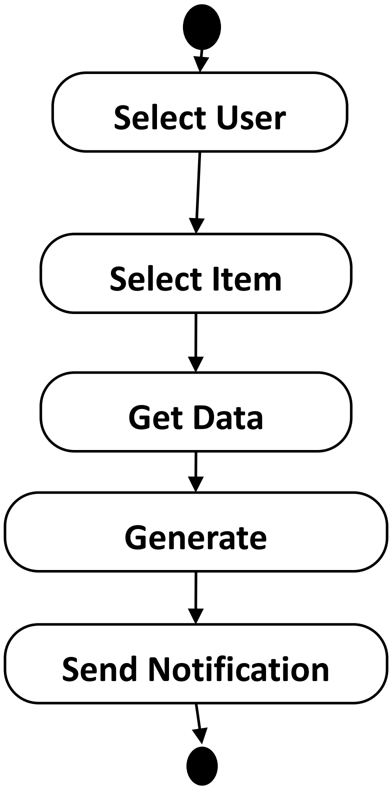
Retreive


Select User
Check Fine
yes
Generate Report
no
Select Item
Update Item
Update User

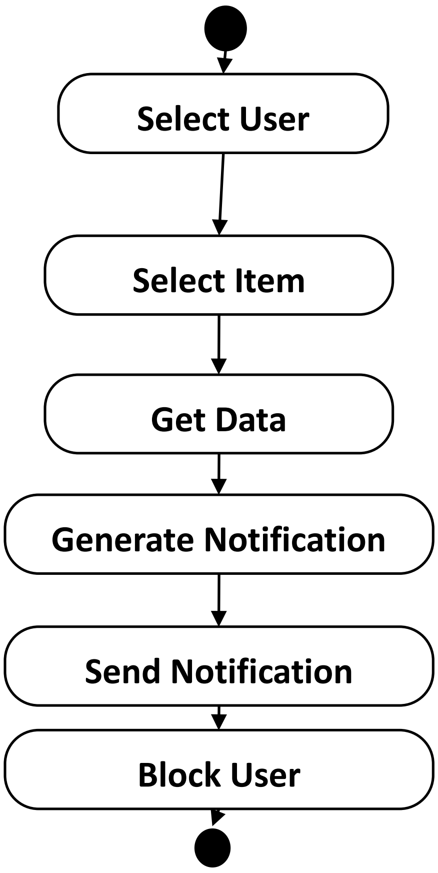
Item Availability



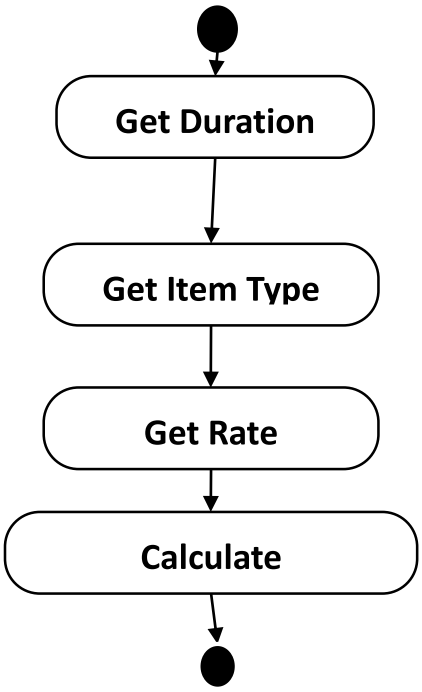
Notify User



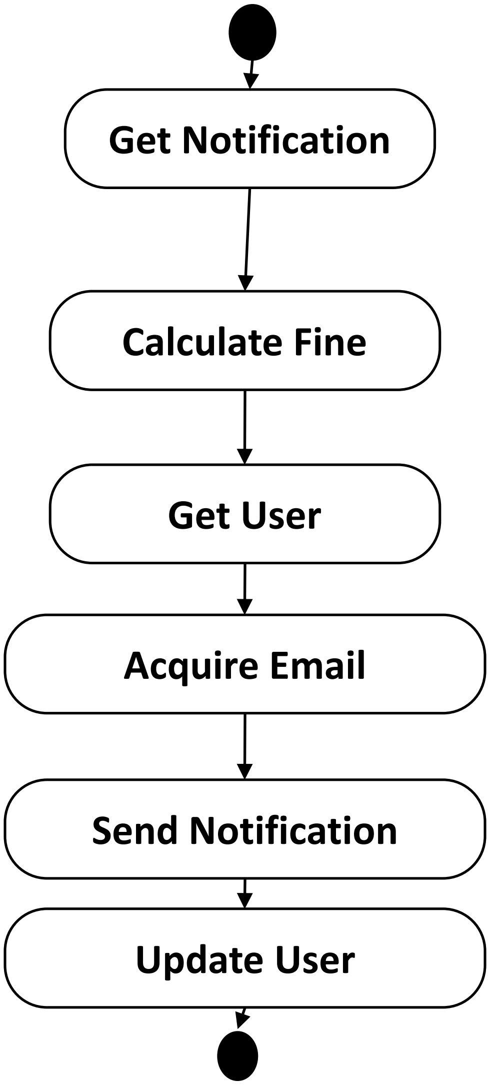
Block User



Calculate Fine

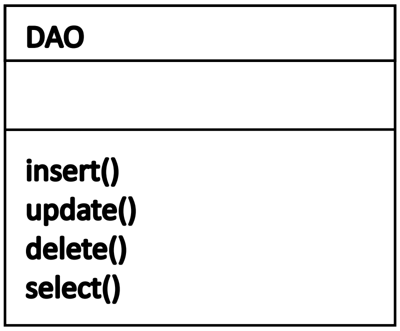


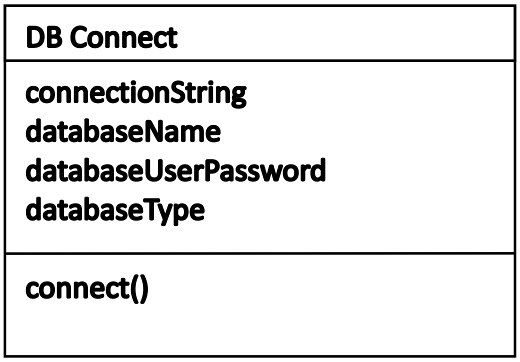
Generate Report



2.4 Describe Persistent Data Sources and Identify the Classes Required to Manage them

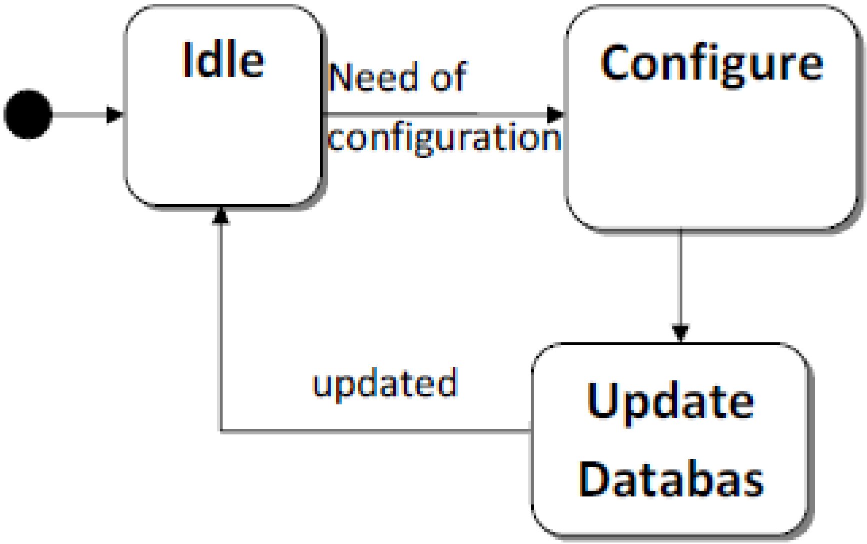
- Date Source
  - User Database
  - Item Database
- Required Class
  - DB Connect
  - DAO



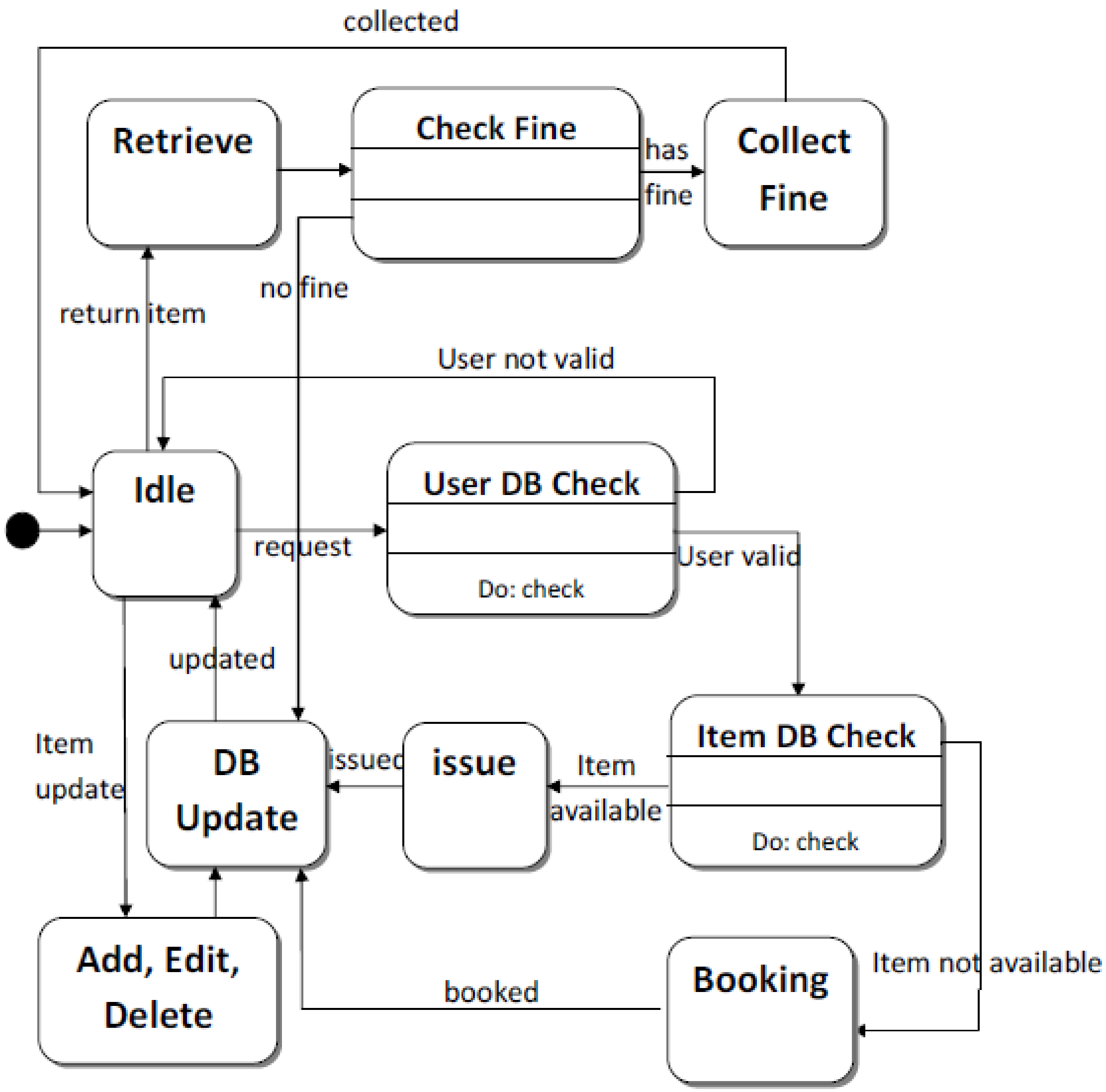


2.5 Develop and Elaborate Behavioral Representations for a Class or Component

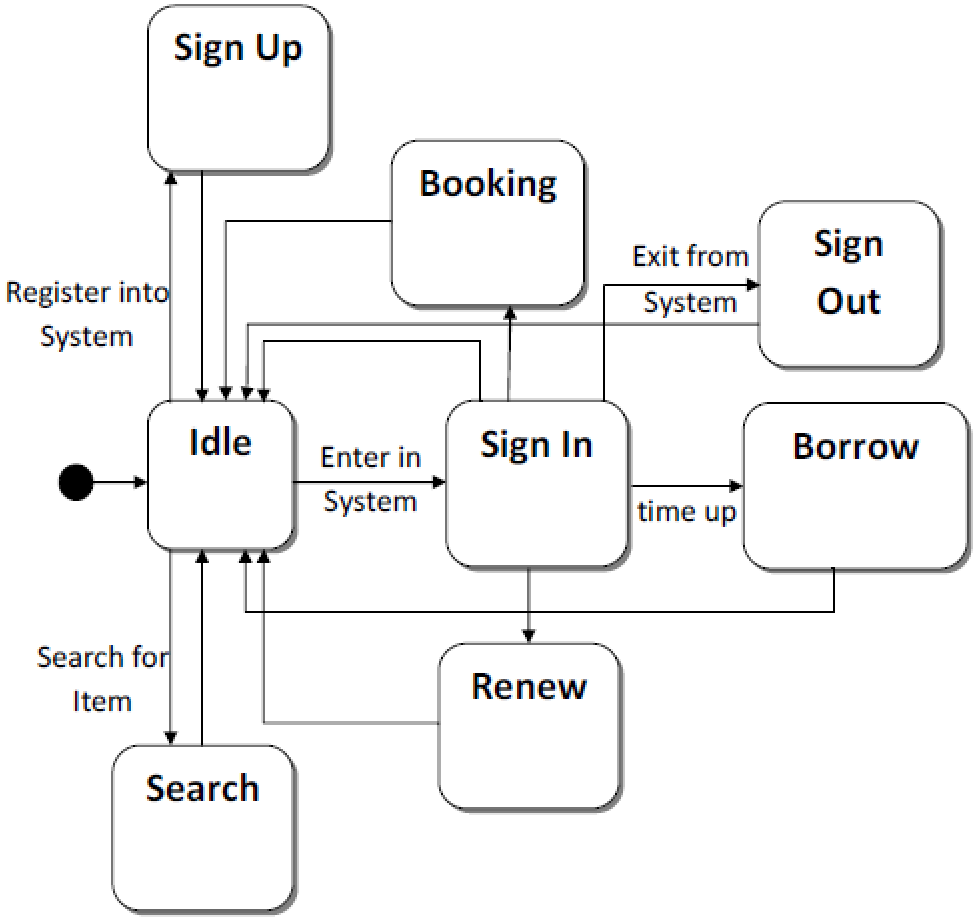
Administrator



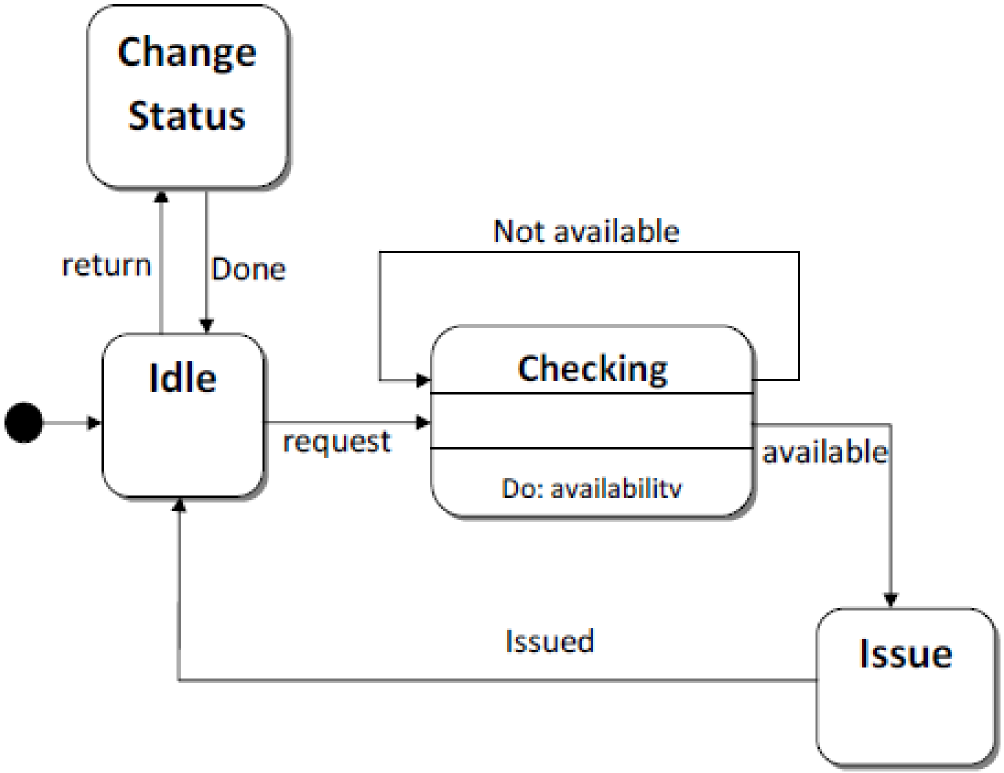
Librarian


collected
Retrieve
Check Fine
has
fine
Collect
Fine
return item
no fine
User not valid
Idle
User DB Check
request
User valid
Do: check
updated
Item
update
DB
Update
issued
issue
Item
available
Item DB Check
Do: check
Add, Edit,
Delete
booked
Booking
Item not available

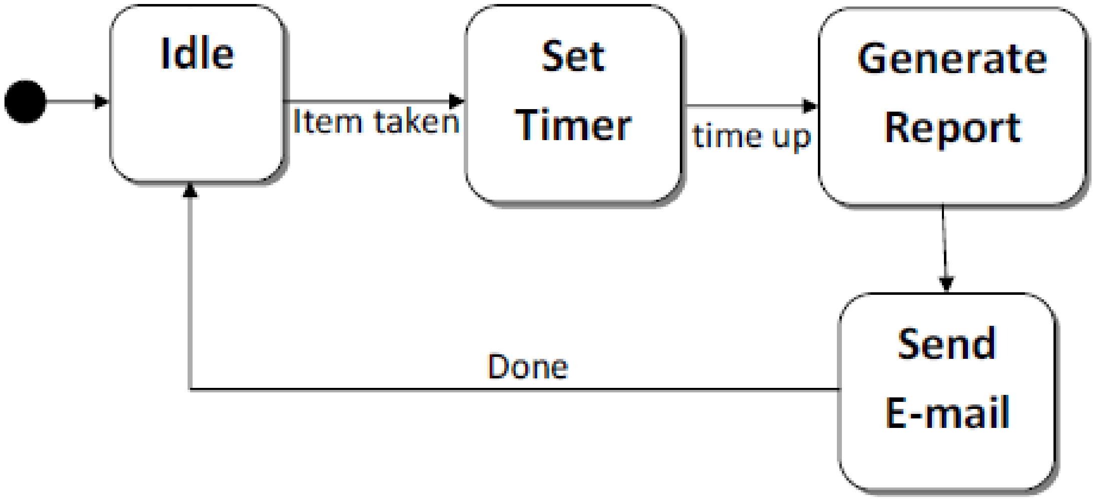
User


Sign Up
Booking
Sign Out
Exit from System
Register into System
Idle
Enter in System
Sign In
Borrow
time up
Search for Item
Renew
Search

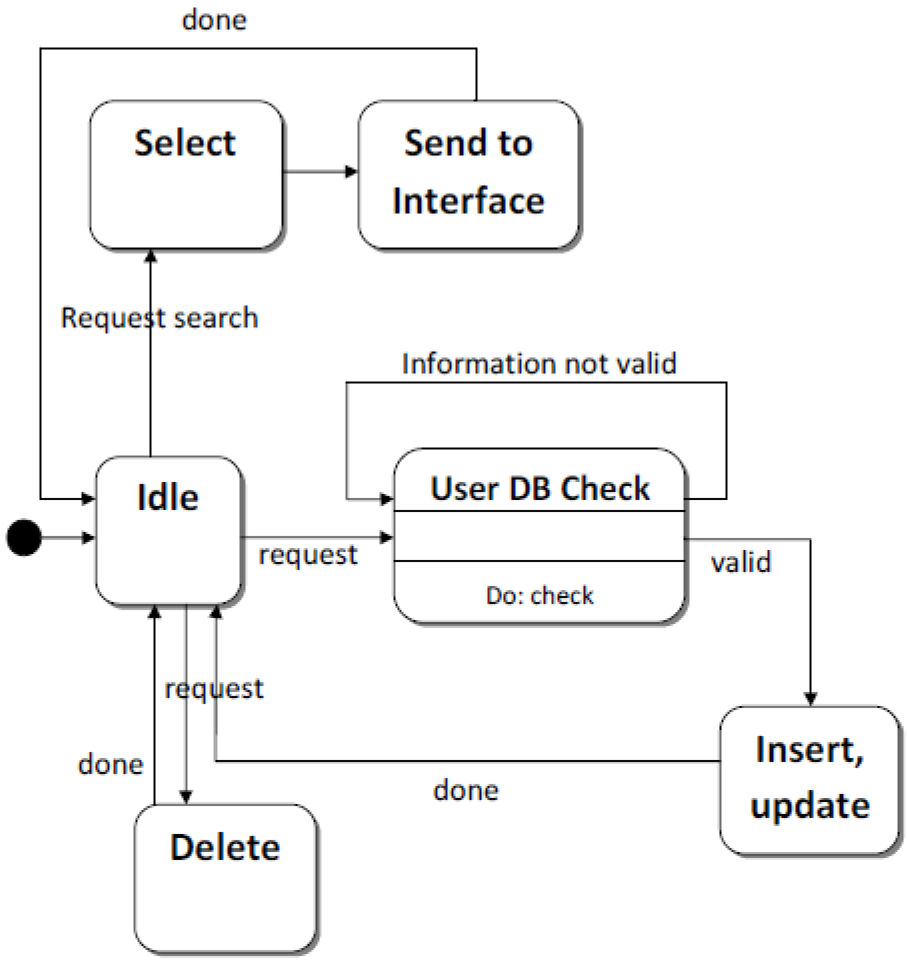
Item


Change
Status
return
Done
Not available
Idle
Checking
request
available
Do: availabilitv
Issued
Issue

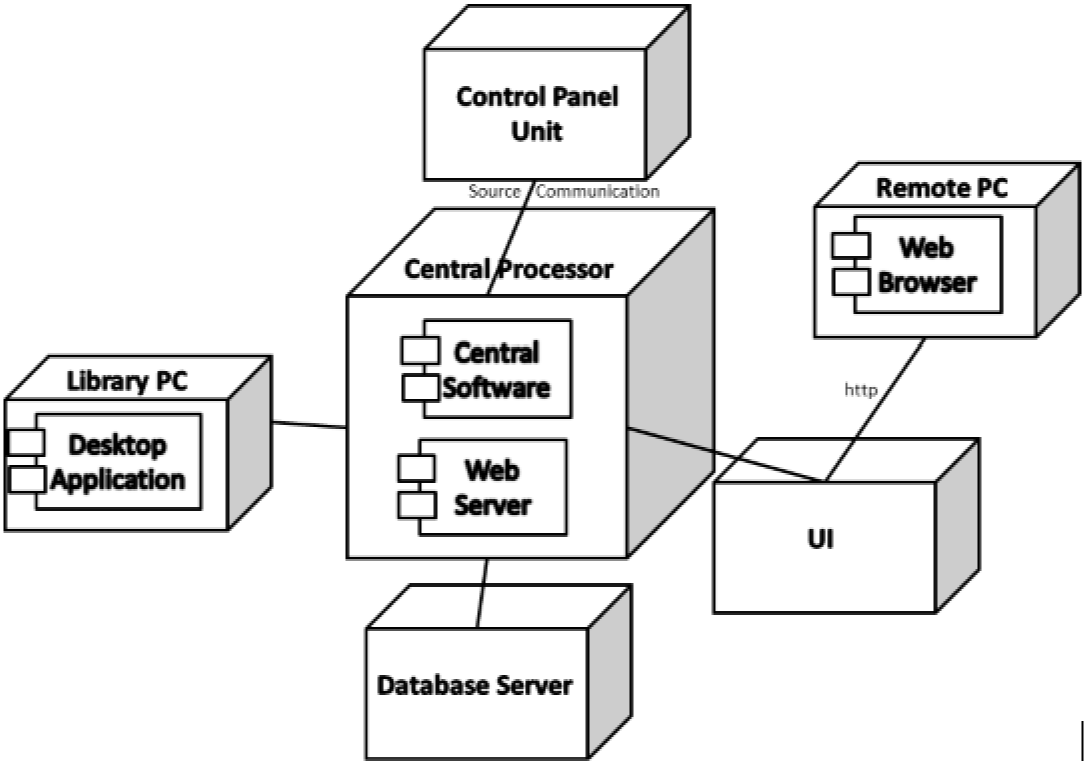
Report


Idle
Item taken
Set
Timer
time up
Generate
Report
Done
Send
E-mail

DAO


done
Select
Send to Interface
Request search
Information not valid
Idle
User DB Check
Do: check
request
valid
request
done
done
Insert, update
Delete

2.6 Elaborate Deployment Diagrams to Provide Additional Implementation Detail



Chapter 3

User Interface Design

3.0 Introduction

User interface design creates an effective communication medium between a human and a computer. The interface has to be right because it models a user's perception of the software. As we know that a key tenet of all software engineering process models is "understand the problem before you attempt to design a solution", we analysis the interface before starting the design steps.

3.1 Interface Analysis

We divide interface analysis into following parts:

i. User Analysis
ii. Task Analysis

3.1.1 User Analysis

In this part we follow two steps:

a. Identify user
b. Know user

Identify user

From the requirements specification we have identified following four user categories.

1. Librarian
2. Student
3. Faculty
4. Admin

Know user

We collect following information about the users.

Librarian

Age: 30-50

Work type: Clerical

Skills: Average

Domain expert: Yes

Application expert: No

Office hour: Normal

Frequency of use: Very frequently

Consequence of a mistake: High

General computer experience: Yes

Student

Age: 20-30

Skills: Average

Frequency of use: Occasionally

Consequence of a mistake: Low

General computer experience: Yes

Teacher

Age: 30-60

Skills: Above Average

Frequency of use: Occasionally

Consequence of a mistake: Low

General computer experience: Yes

3.1.2 Task Analysis

In this step we identify and analyze the tasks of every users separately.

Librarian: Librarian has following tasks.

1. Issue

Goal: Issue the requested item
Precondition:

- User must be eligible for taking requested item
- Item is available

Sub-task:

i. Check user status
ii. Check item status

iii. Update user status
iv. Update item status

2. Retrieve

Goal: Receive borrowed item
Precondition:

- Item must be issued for the particular user

Sub-task:

i. Update user status
ii. Update item status

Student and Faculty:

1. Search

Goal: Search an item

2. Renew

Goal: Renew an item

Precondition:

- Logged in as valid user
- Item must be available

Sub-task: Logged in

3. Booking

Goal: Booking an item

Precondition:

- Valid User
- Valid but unavailable Item at the particular time

Sub-task:

- Check item status
- Send request

Admin:

1. Configure the Due Date for an Item

Goal: Change the Due Date for an Item

Precondition:

- Valid Item

Sub-task:

- Search user

2. Configure the Fine for Overdue Item:

Goal: Change the Due Date for an Item

Sub-task:

- Search item

3. Change user type

Goal: Change the user type

Precondition:

- Valid User

Sub-task:

- Update user status

3.2 Interface Design Steps

We follow the following steps to design the Library Circulation System (LCS) user interface.

i. Define interface objects and actions
ii. Define events that will cause the state of the user interface to change
iii. Depict each interface state as it look to end user

3.2.1 Define interface objects and actions

We identified following objects and actions for the user interface.

A. External
   a. Home

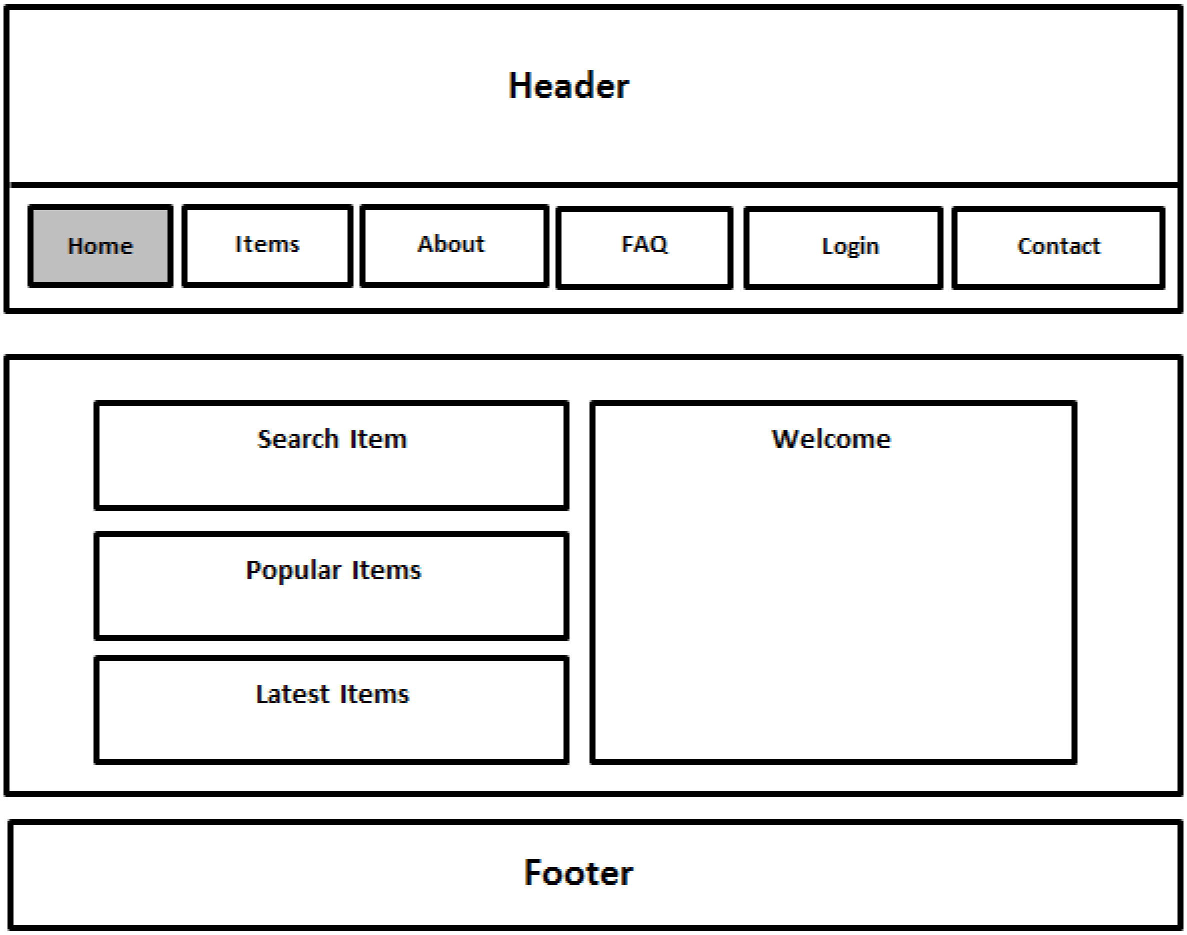


Figure 31: External Home

b. Items

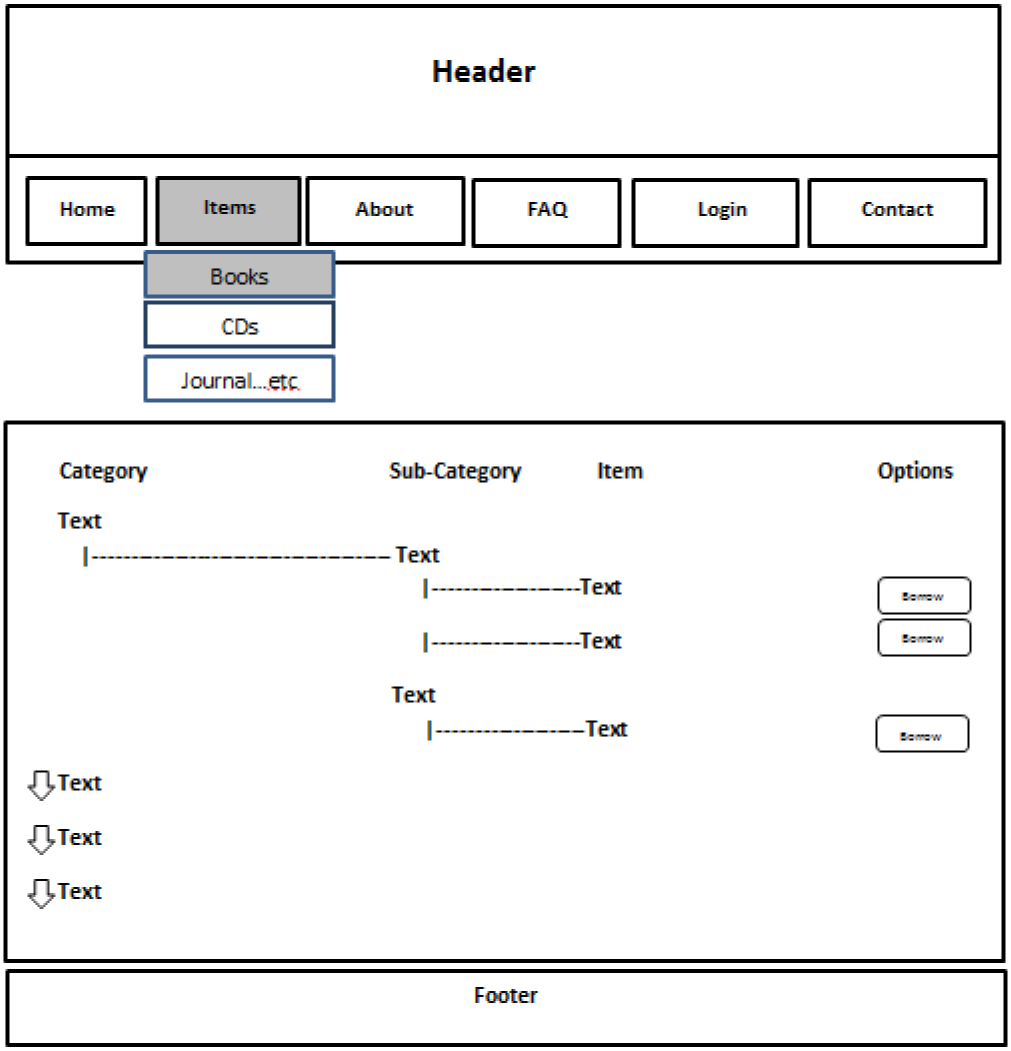


Figure 32: External Items

c. About
d. FAQ
e. Login
f. Contact

B. Internal : Librarian

a. Dashboard

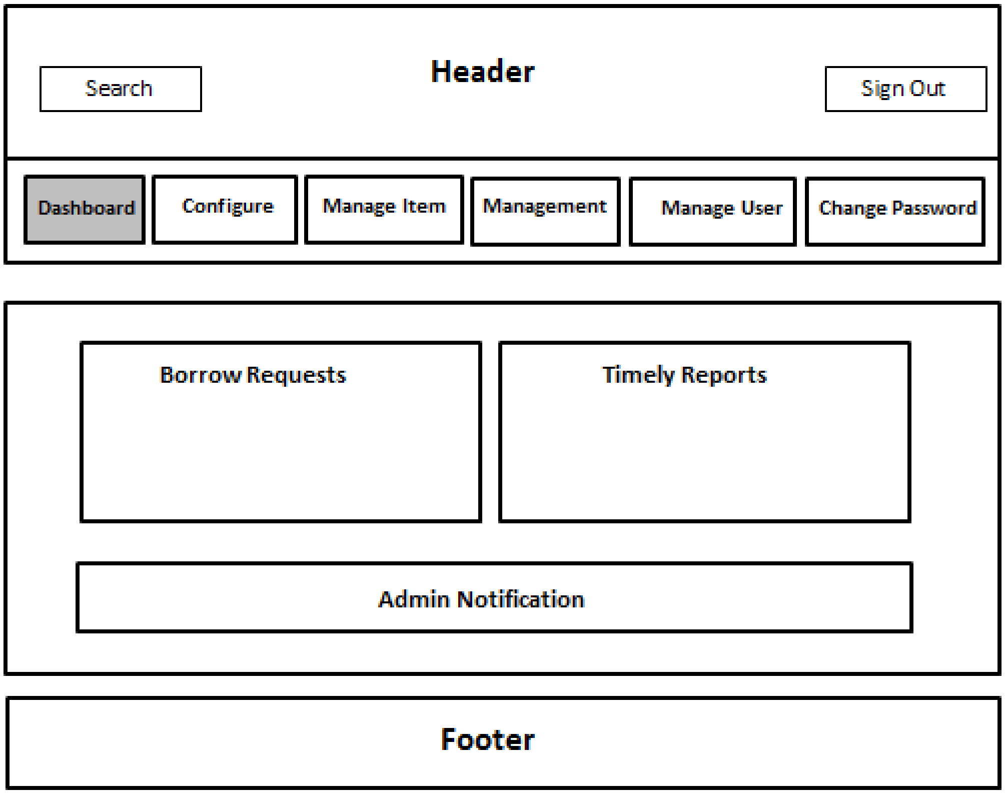
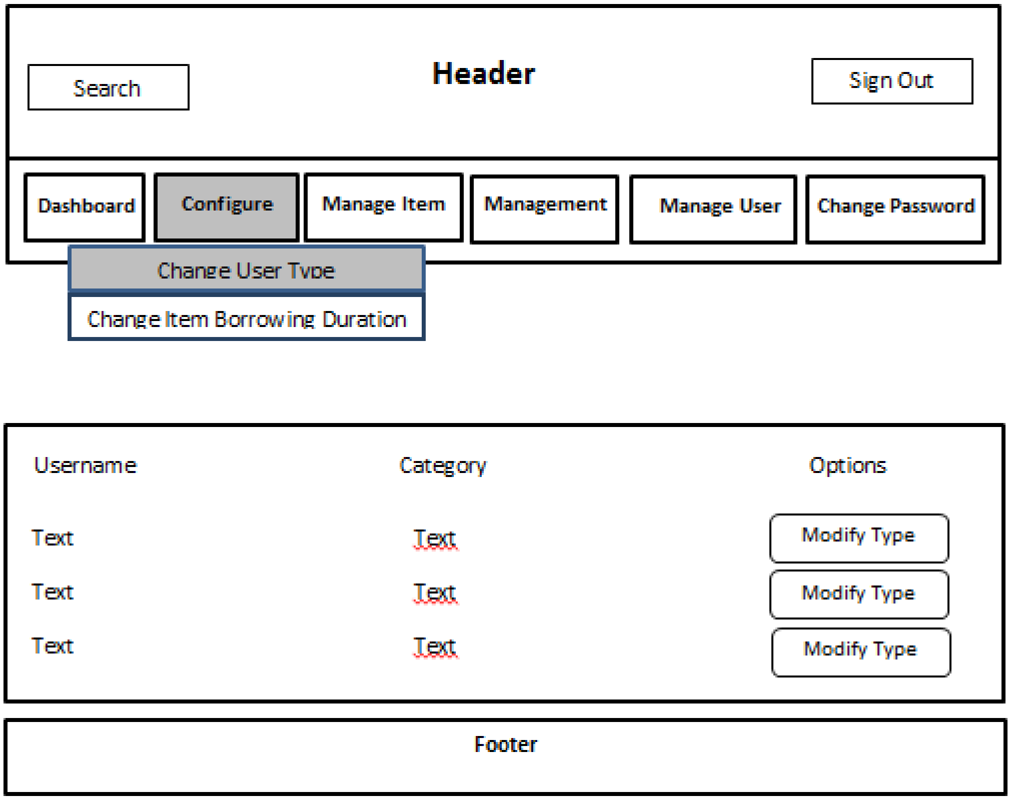


Figure 33: Librarian Dashboard

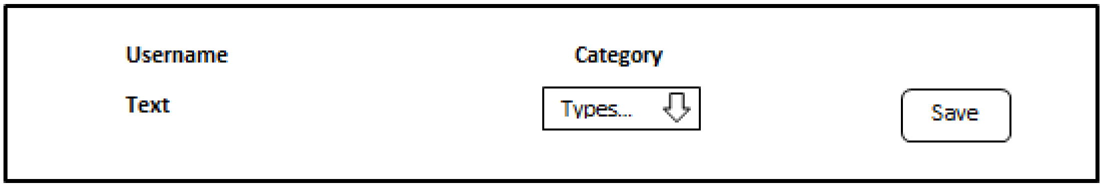
b. Configure : Change user type



Username	Category	Options
Text	Text	Modify Type
Text	Text	Modify Type
Text	Text	Modify Type

Figure 34: Change user type (Librarian)

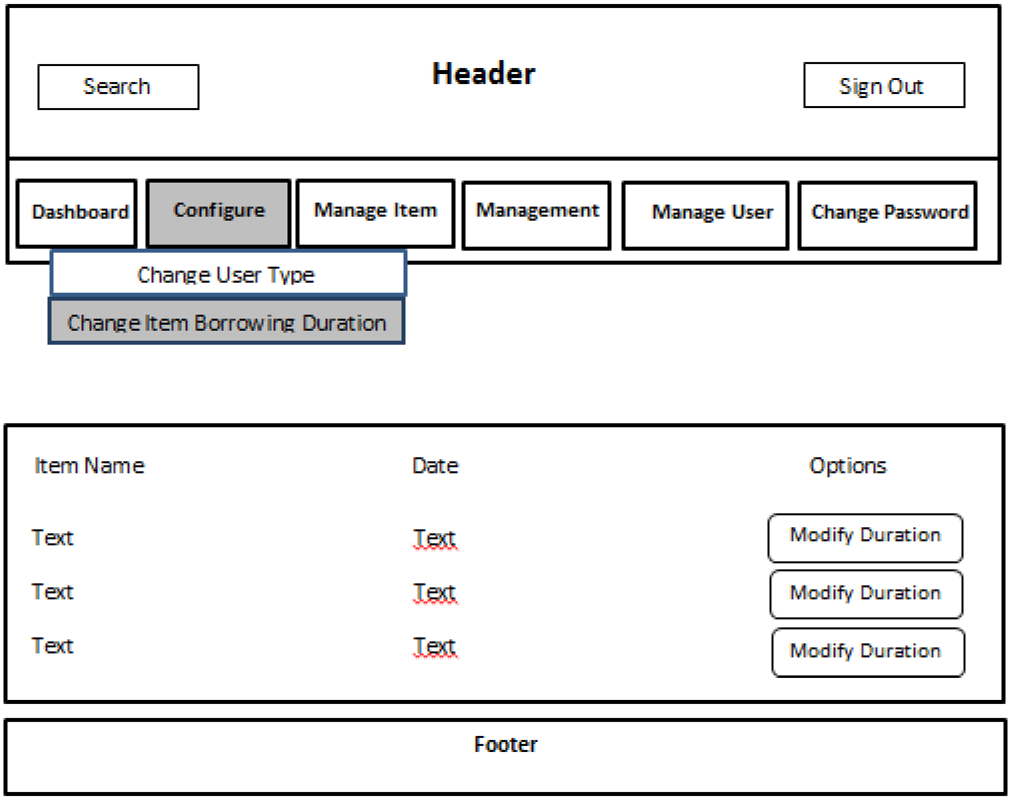
c. Change user type : Modify



Username	Category
Text	Types...

Figure 35: Change user type: Modify (Librarian)

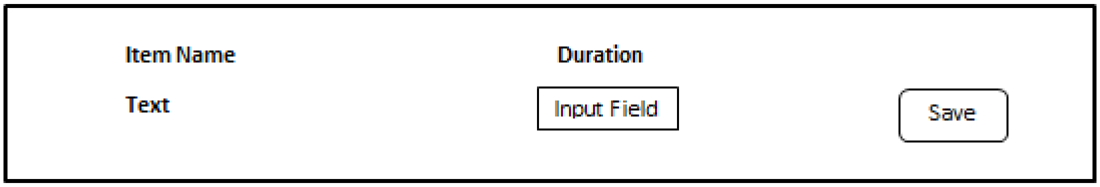
d. Change Item Borrowing Duration



Item Name	Date	Options
Text	Text	Modify Duration
Text	Text	Modify Duration
Text	Text	Modify Duration

Figure 36: Change Item Borrowing Duration (Librarian)

e. Change Item Borrowing Duration: Modify



Item Name	Duration
Text	Input Field

Figure 37: Change Item Borrowing Duration: Modify(Librarian)

f. Manage Item: Add/Edit Item

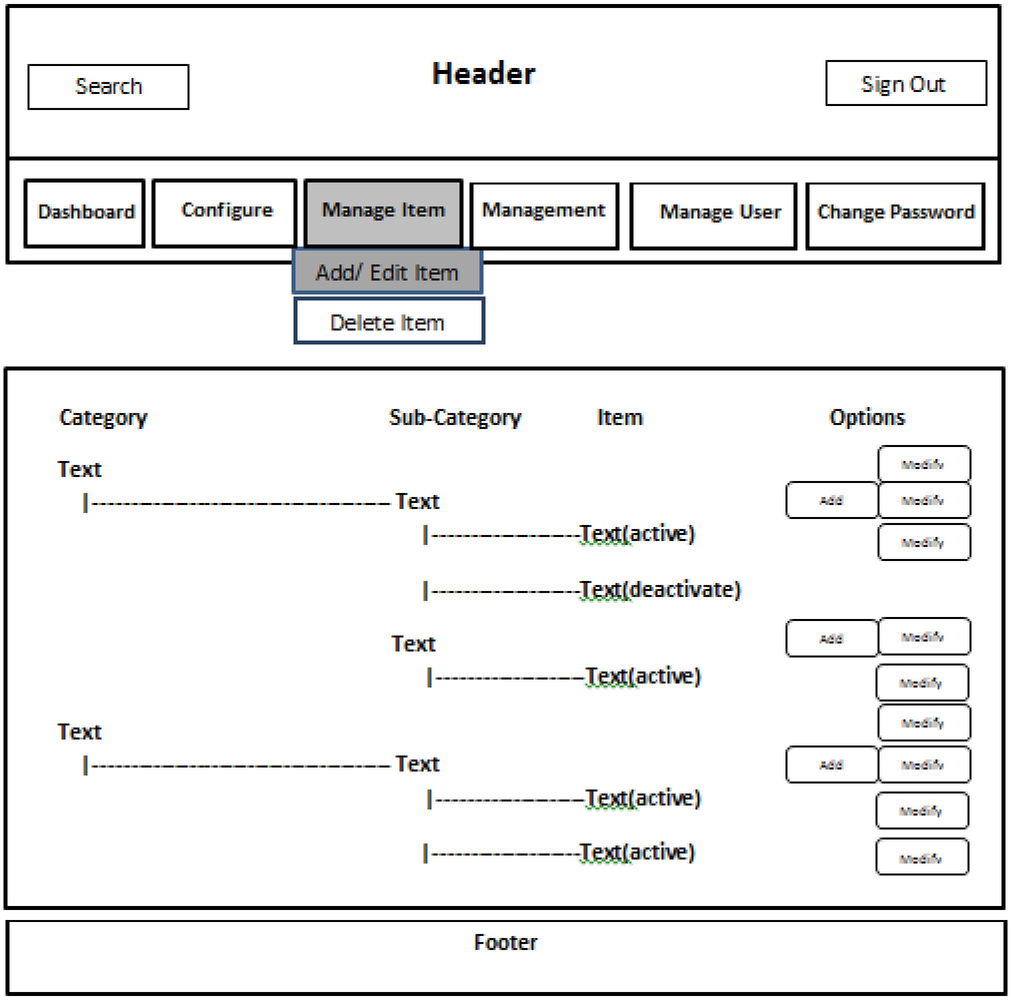

Search
Header
Sign Out
Dashboard
Configure
Manage Item
Management
Manage User
Change Password
Add/ Edit Item
Delete Item
Category
Sub-Category
Item
Options
Text
|-------------------------------- Text
|----------------Text(active)
|----------------Text(deactivate)
Text
|----------------Text(active)
Text
|-------------------------------- Text
|----------------Text(active)
|----------------Text(active)
Modify
Add
Modify
Modify
Add
Modify
Modify
Modify
Add
Modify
Modify
Modify
Footer

Figure 38: Manage Item: Add/Edit Item

g. Manage Item: Add/Edit Item: Add

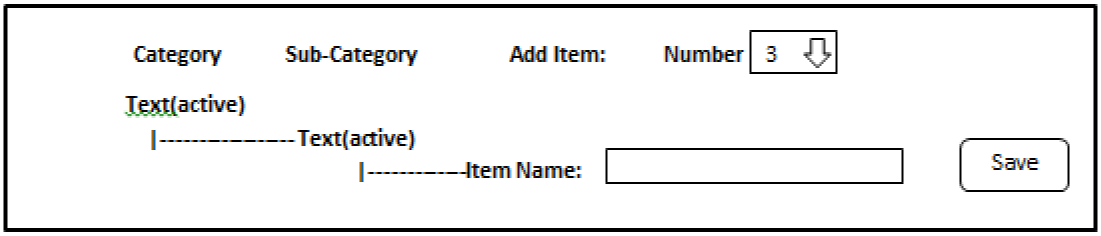


Figure 39: Manage Item: Add/Edit Item: Add

h. Manage Item: Add/Edit Item: Modify

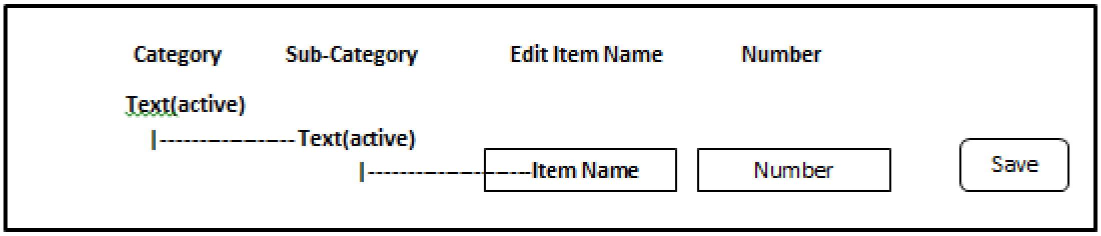


Figure 40: Manage Item: Add/Edit Item: Modify

i. Manage Item: Delete Item

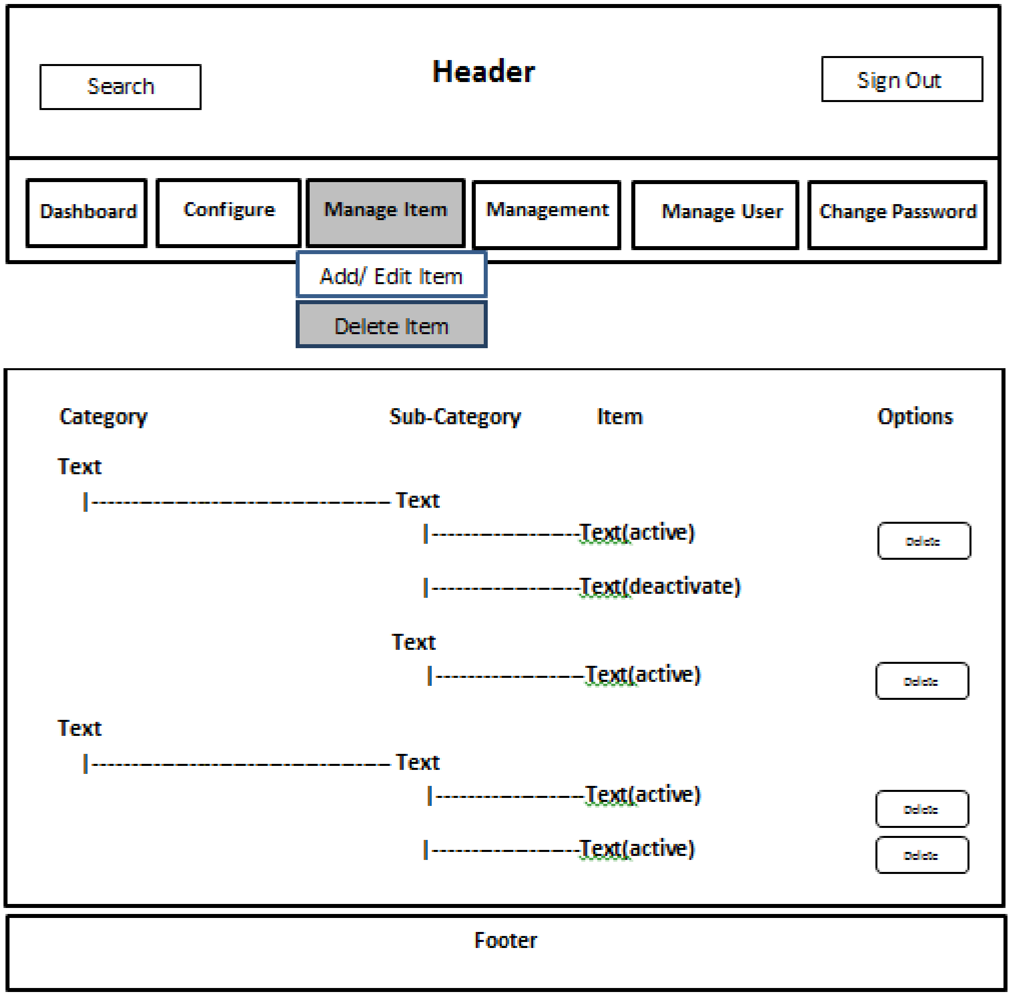
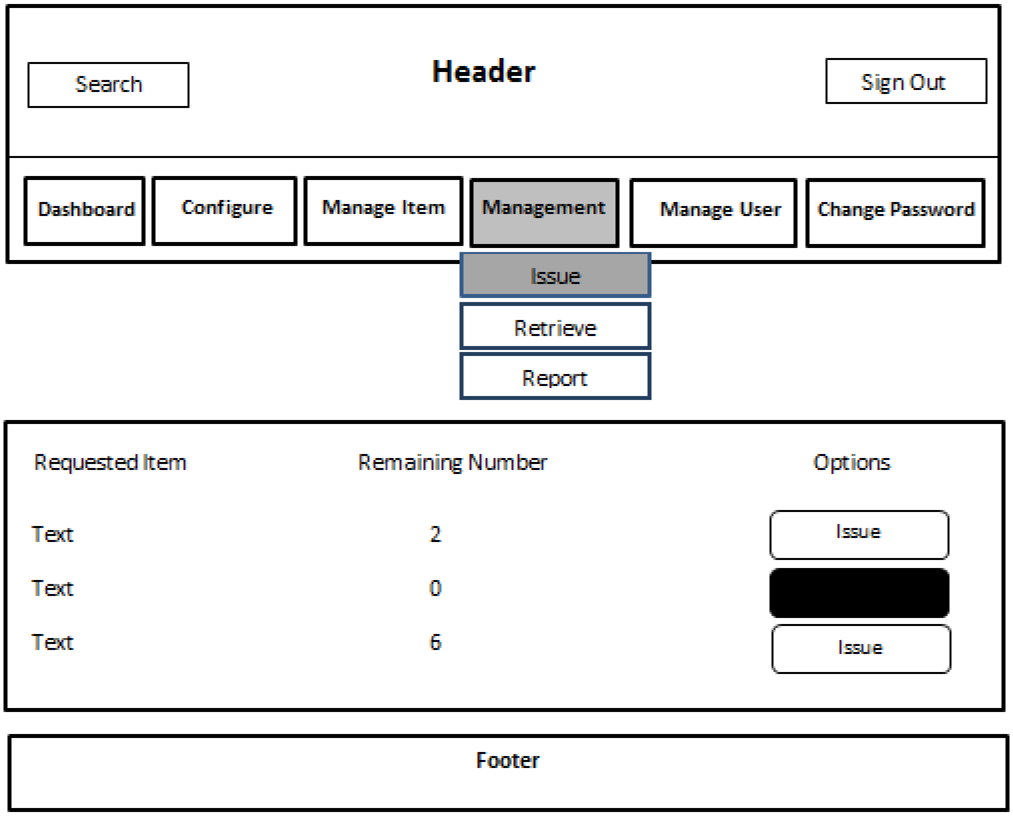

Search
Header
Sign Out
Dashboard
Configure
Manage Item
Management
Manage User
Change Password
Add/ Edit Item
Delete Item
Category
Sub-Category
Item
Options
Text
|--------------------------- Text
|-------------Text(active)
Delete
|-------------Text(deactivate)
Text
|-------------Text(active)
Delete
Text
|--------------------------- Text
|-------------Text(active)
Delete
|-------------Text(active)
Delete
Footer

Figure 41: Manage Item: Delete Item

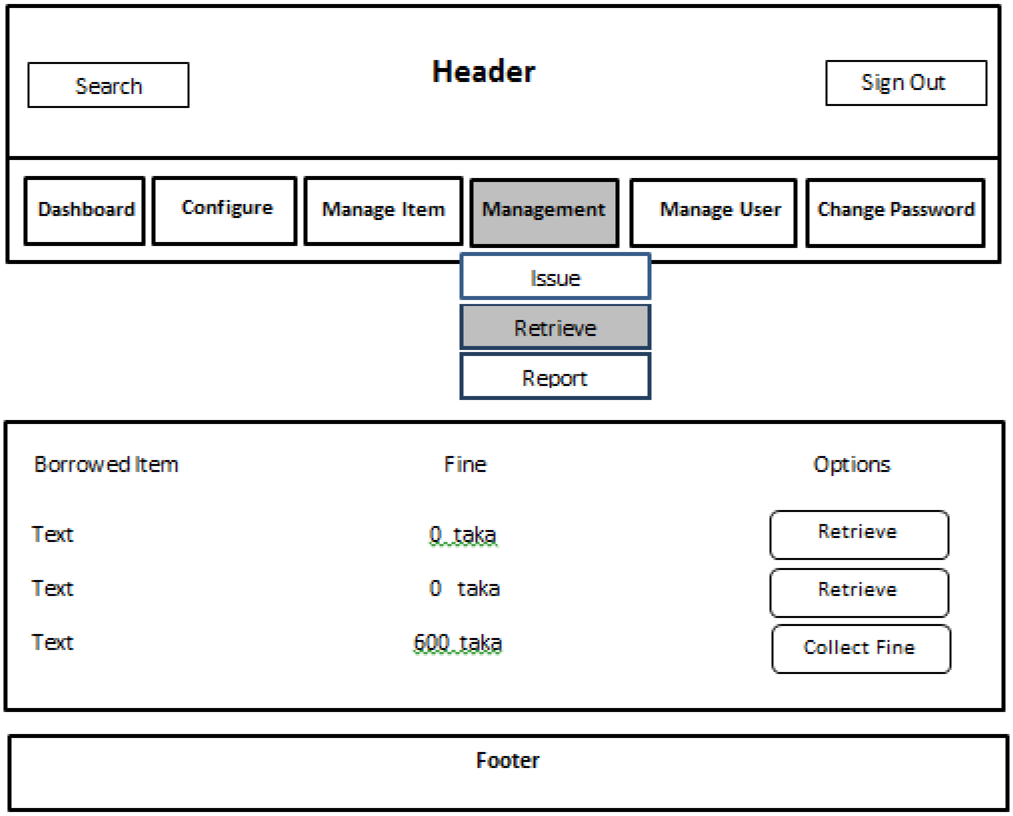
j. Management: Issue



Requested Item	Remaining Number	Options
Text	2	Issue
Text	0	■
Text	6	Issue

Figure 42: Management: Issue

k. Management: Retrieve



Borrowed Item	Fine	Options
Text	0 taka	Retrieve
Text	0 taka	Retrieve
Text	600 taka	Collect Fine

Figure 43: Management: Retrieve

l. Management: Return

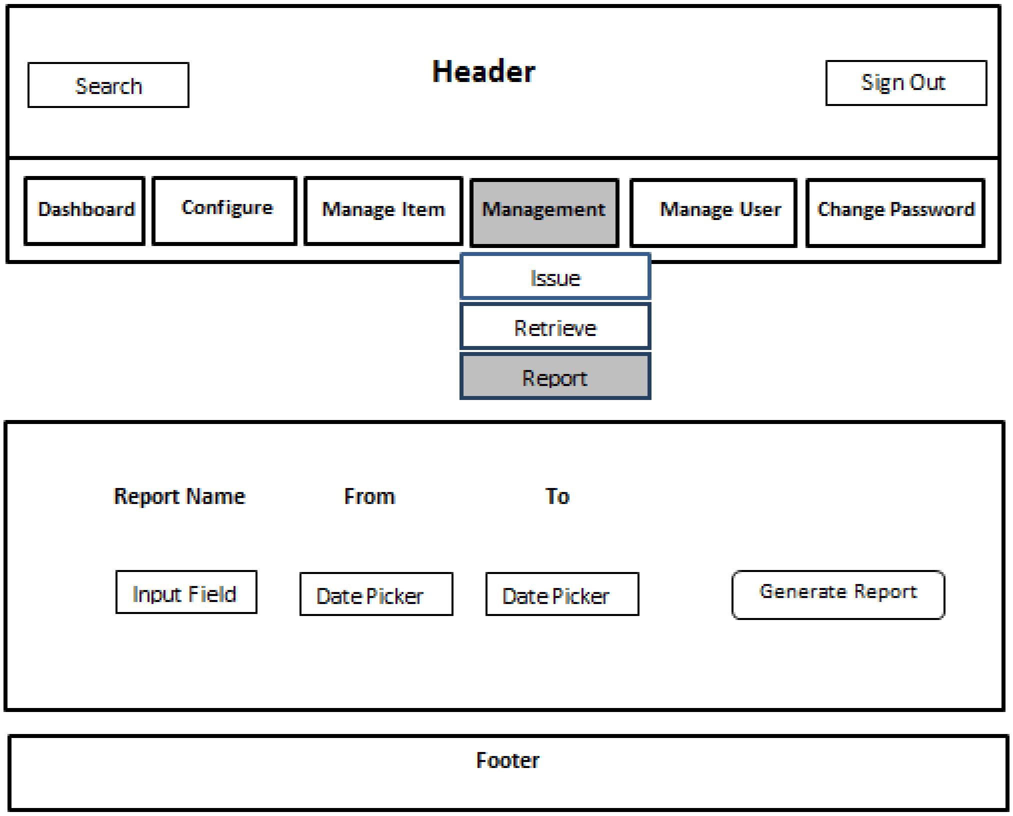


Figure 44: Management: Return

m. Manage User

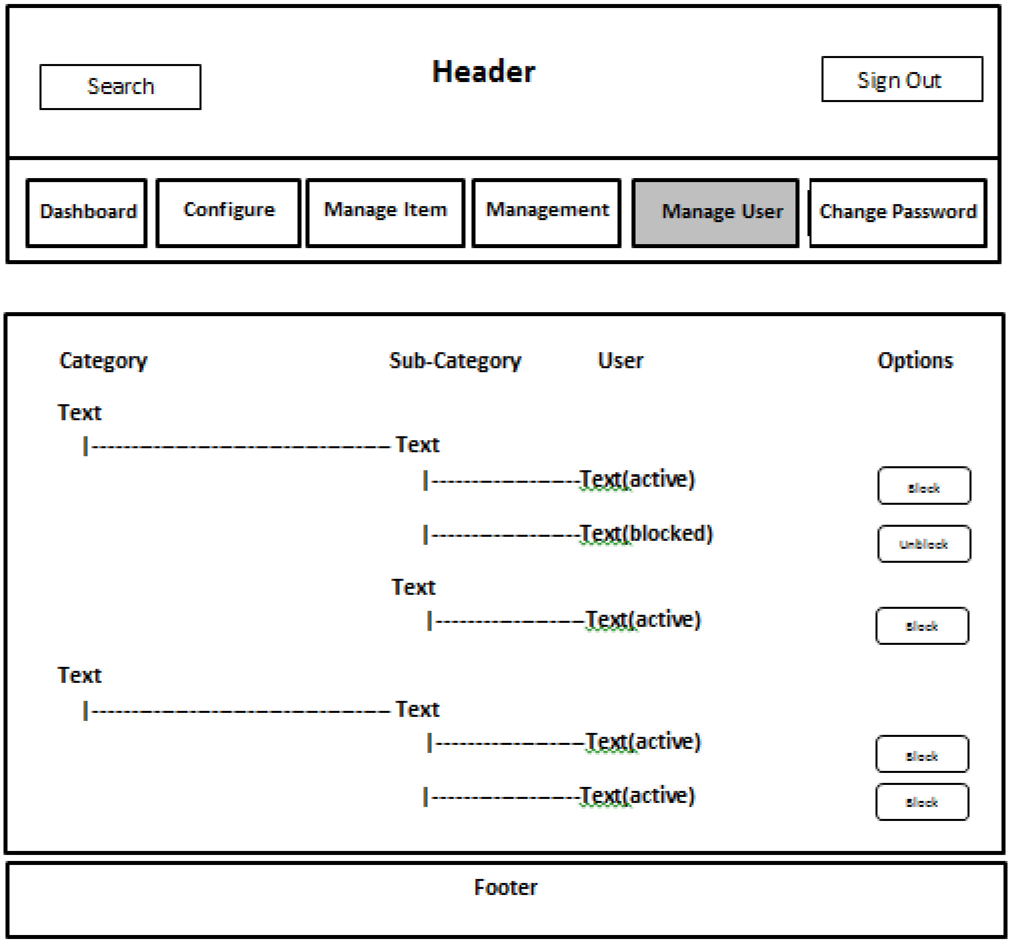

Search
Header
Sign Out
Dashboard
Configure
Manage Item
Management
Manage User
Change Password
Category
Sub-Category
User
Options
Text
|------------------------------ Text
|---------------Text(active)
Block
|---------------Text(blocked)
Unblock
Text
|---------------Text(active)
Block
Text
|------------------------------ Text
|---------------Text(active)
Block
|---------------Text(active)
Block
Footer

Figure 45: Manage User

n. Change Password

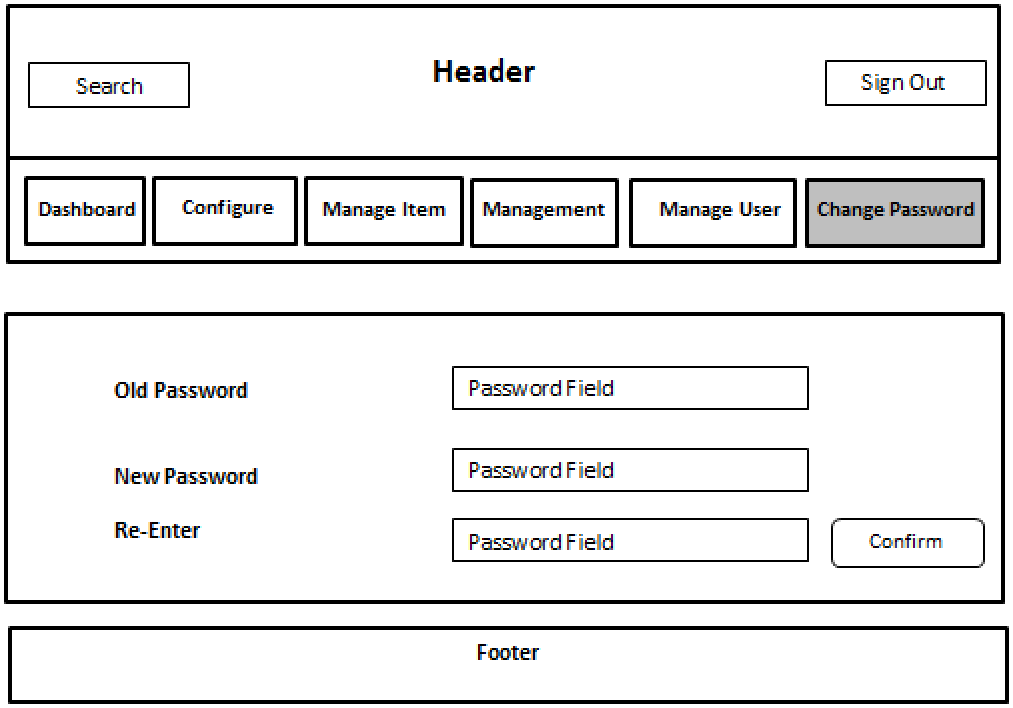


Figure 46: Change Password

C. Internal: User

a. Dashboard

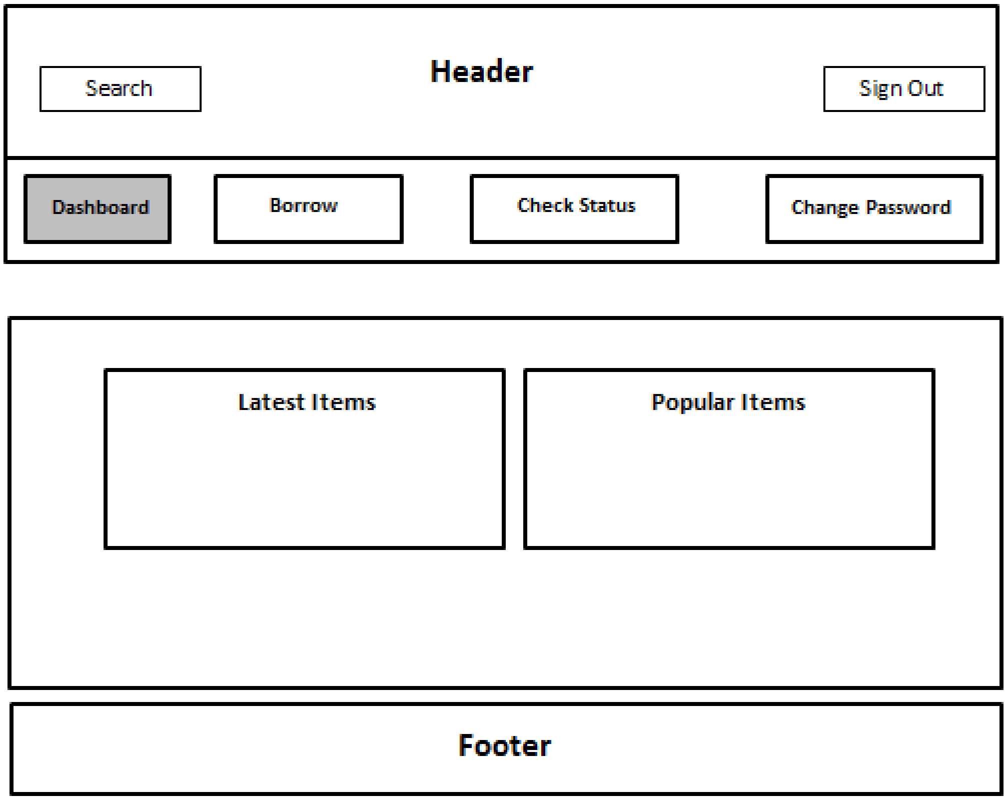


Figure 47: Dashboard (User)

b. Borrow: New Item

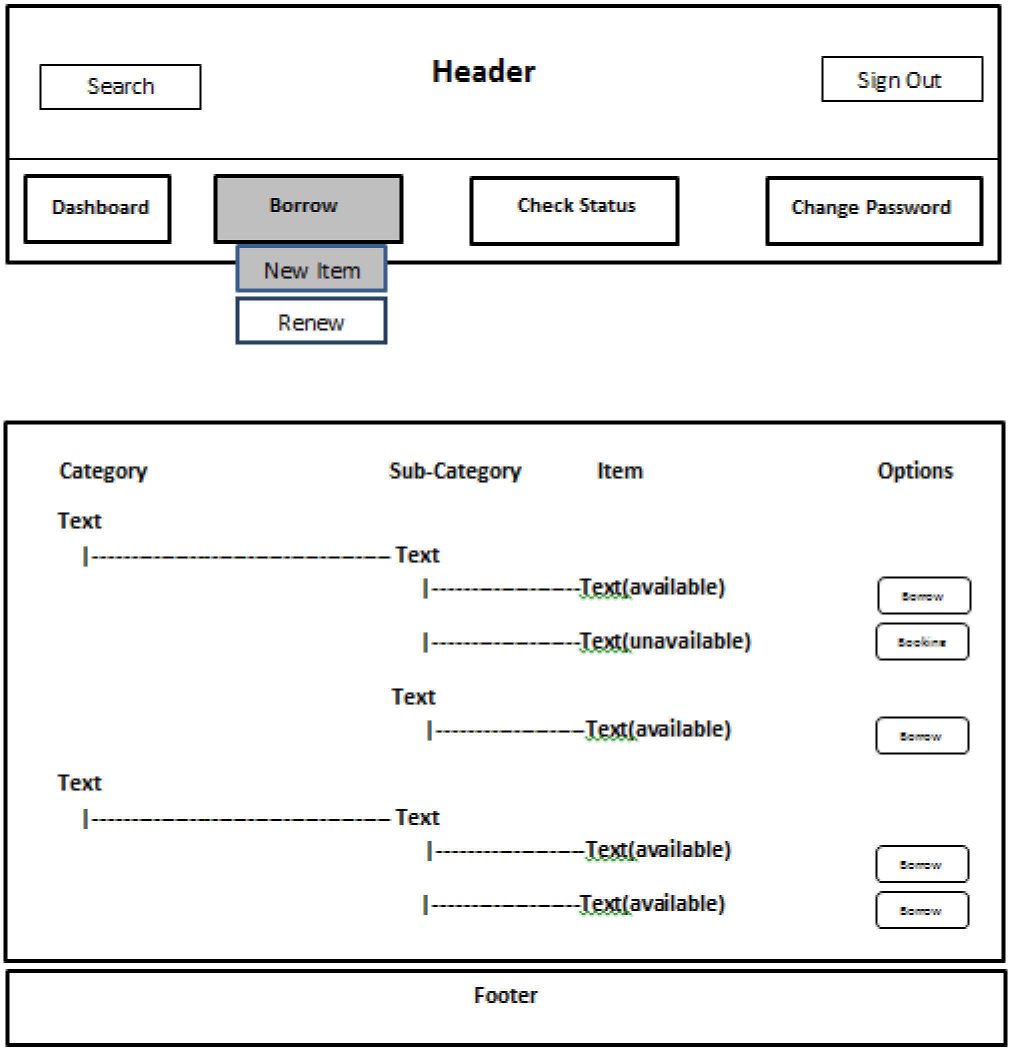
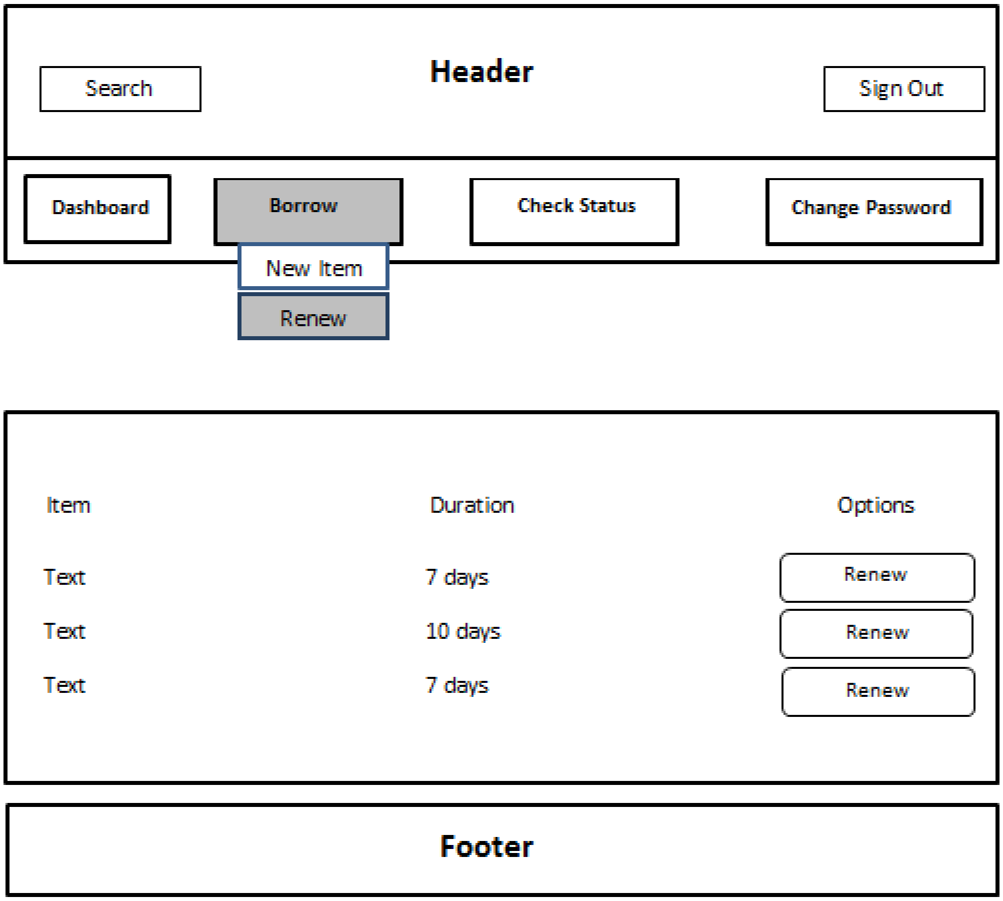

Search
Header
Sign Out
Dashboard
Borrow
Check Status
Change Password
New Item
Renew
Category
Sub-Category
Item
Options
Text
|------------------------------ Text
|---------------Text(available)
Borrow
|---------------Text(unavailable)
Booking
Text
|---------------Text(available)
Borrow
Text
|------------------------------ Text
|---------------Text(available)
Borrow
|---------------Text(available)
Borrow
Footer

Figure 48: Borrow: New Item

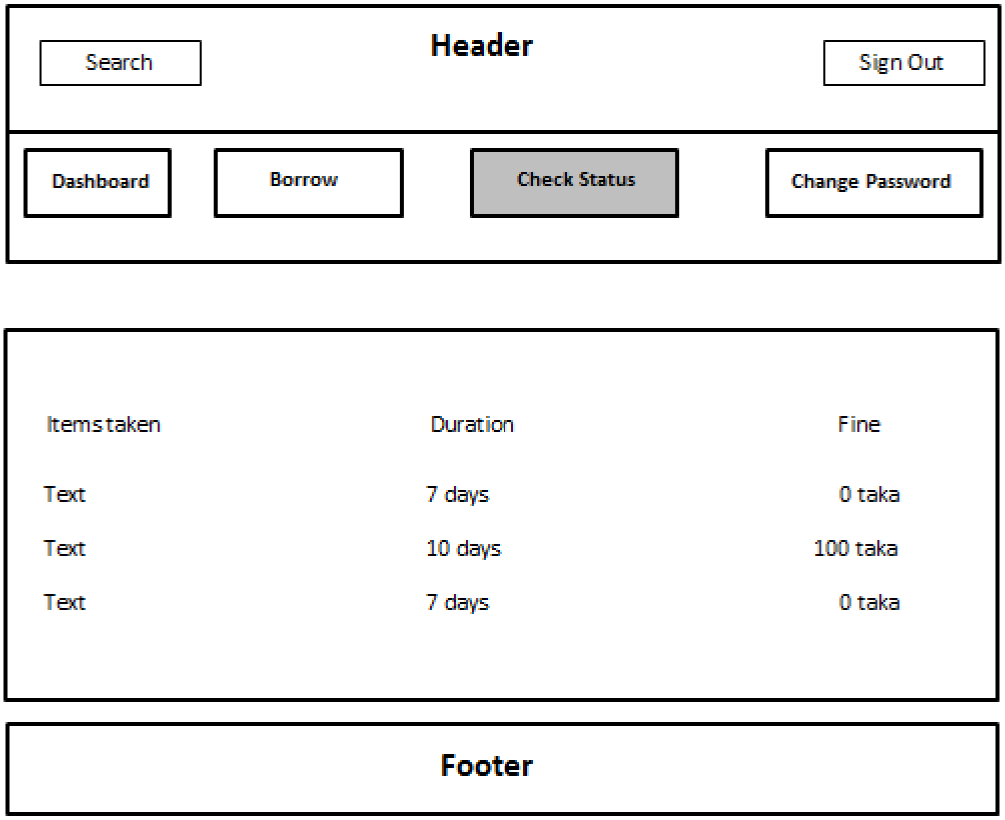
c. Borrow: Renew



Item	Duration	Options
Text	7 days	Renew
Text	10 days	Renew
Text	7 days	Renew

Figure 49: Borrow: Renew

d. Check Status



Items taken	Duration	Fine
Text	7 days	0 taka
Text	10 days	100 taka
Text	7 days	0 taka

Figure 50: Check Status

e. Change Password

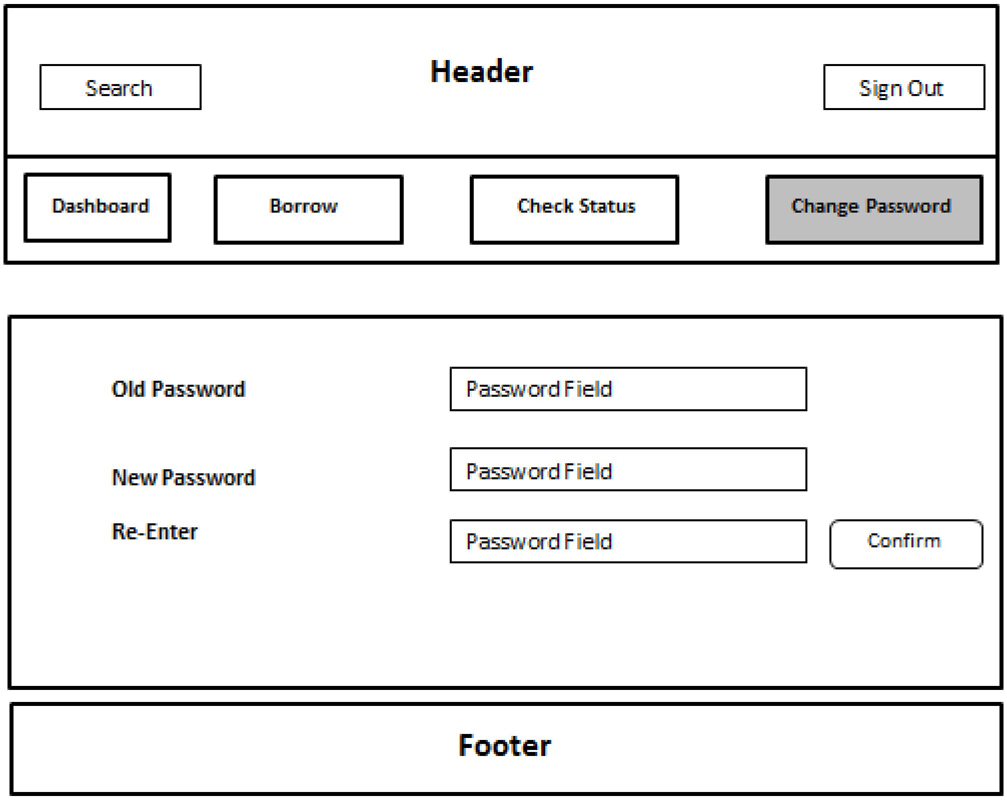


Figure 51: Change Password

D. Internal : Admin

a. Dashboard

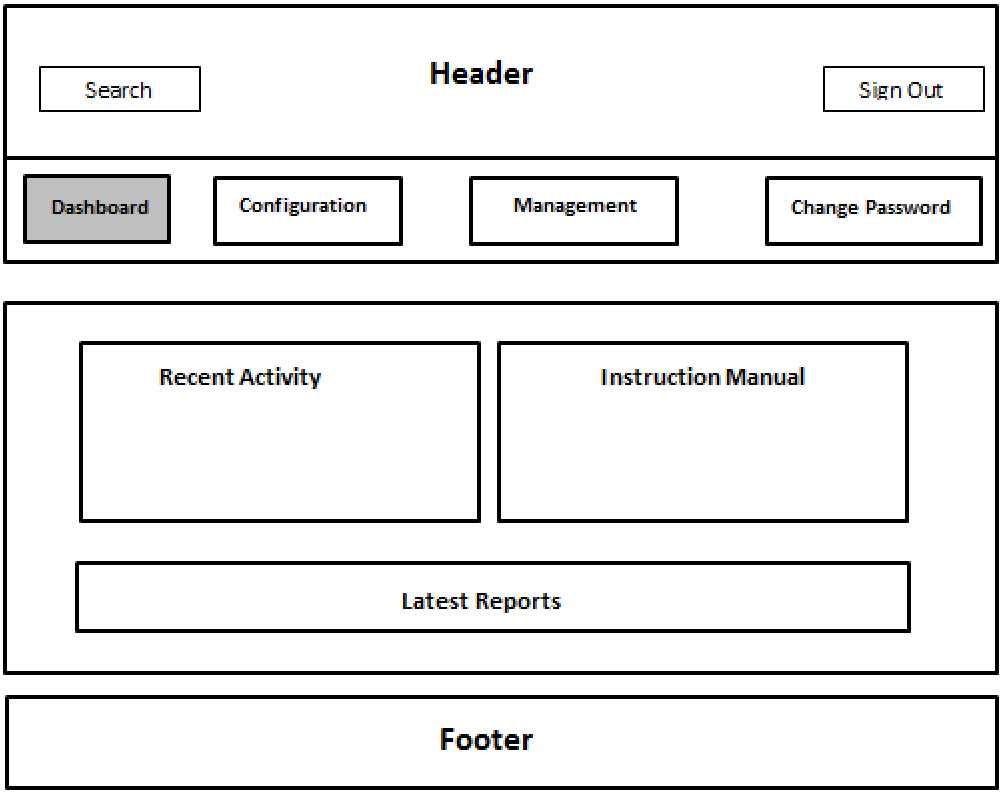


Figure 52: Dashboard

b. Configuration: User Management

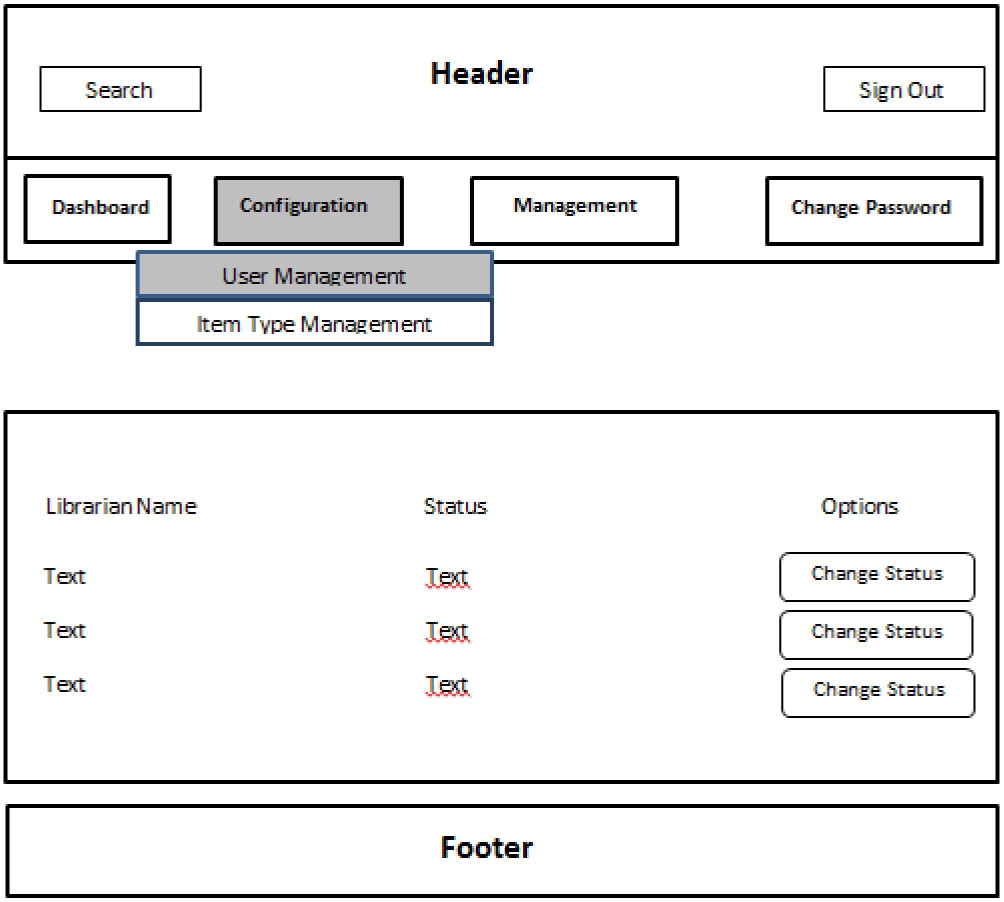


Figure 53: Configuration: User Management

c. Configuration: Item Type Management

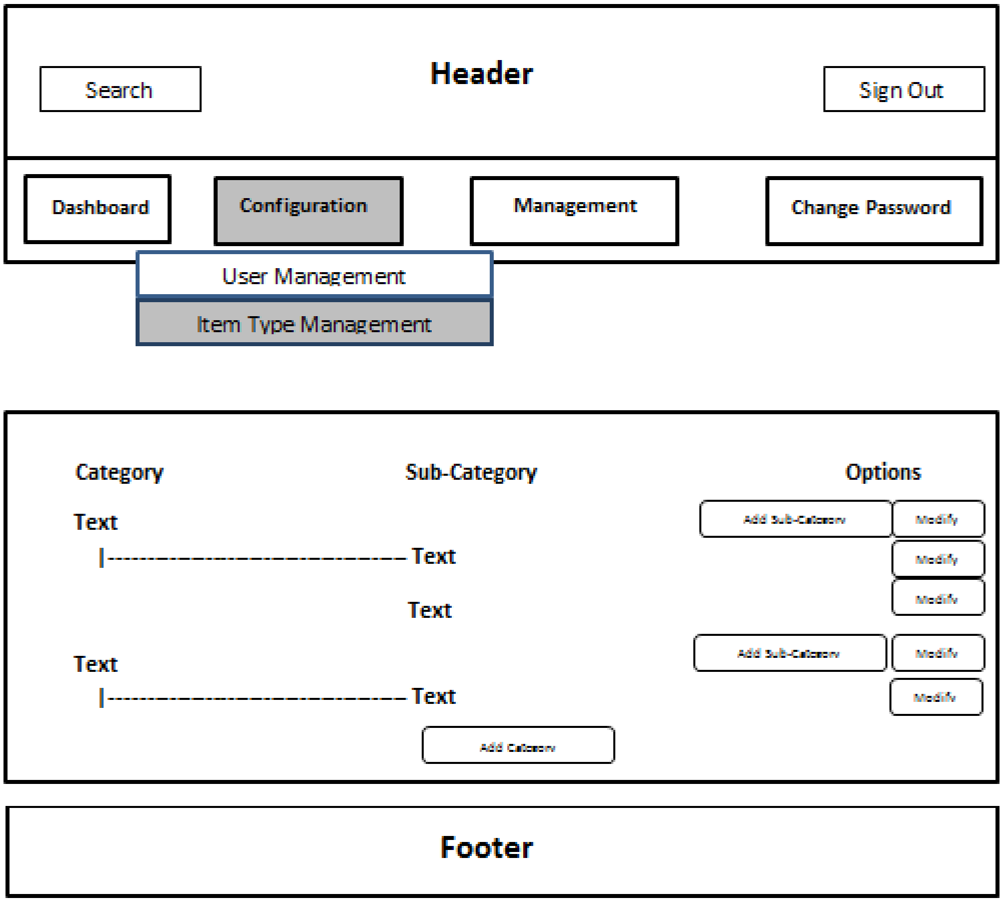
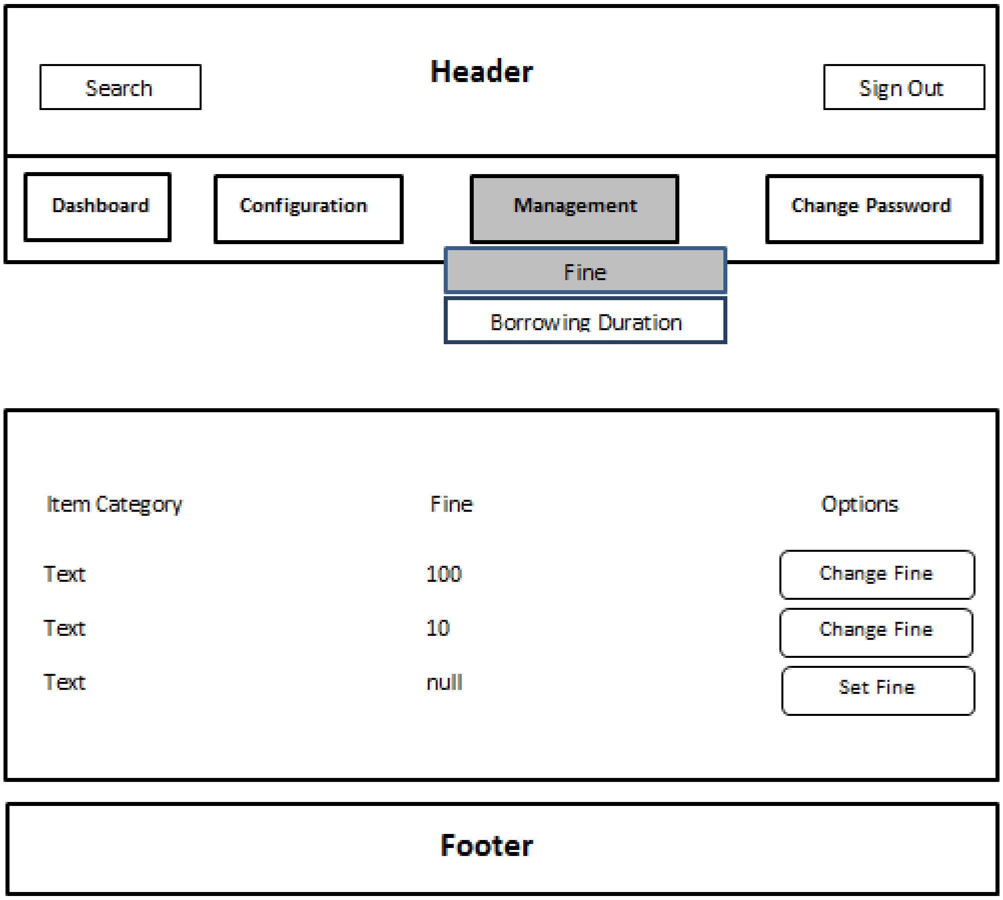


Figure 54: Configuration: Item Type Management

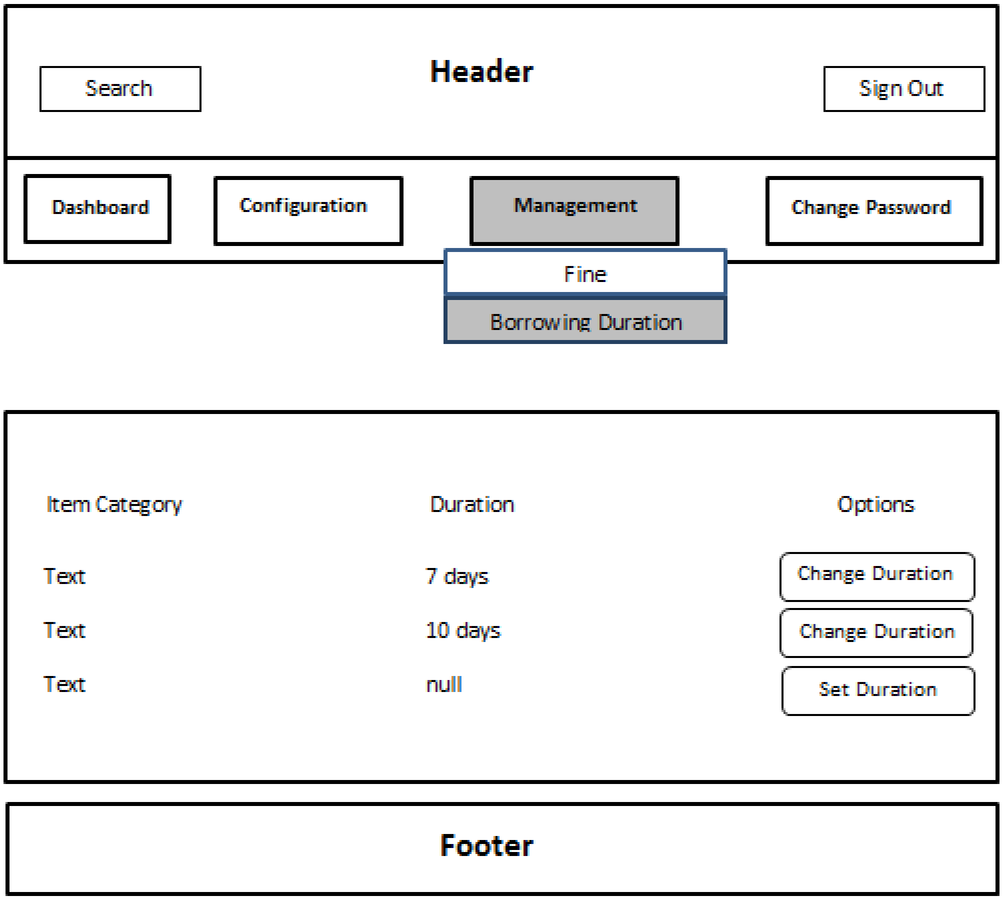
d. Management: Fine



Item Category	Fine	Options
Text	100	Change Fine
Text	10	Change Fine
Text	null	Set Fine

Figure 55: Management: Fine

e. Management: Borrowing Duration



Item Category	Duration	Options
Text	7 days	Change Duration
Text	10 days	Change Duration
Text	null	Set Duration

Figure 56: Management: Borrowing Duration

f. Change Password

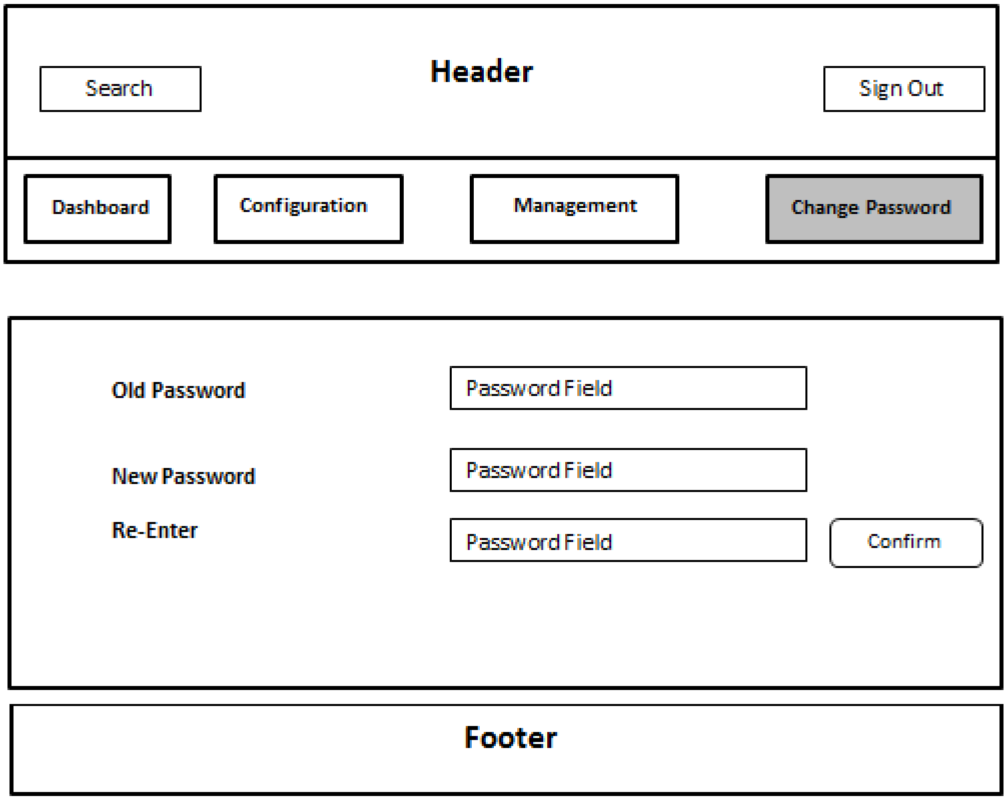


Figure 57: Change Password

3.2.2 Define events that will cause the state of the user interface to change

Change password of Admin :

Login form → Admin panel → Change password $\xrightarrow{\text{fill up password form}}$ Confirm

Configure Item type management :

Login form → Admin panel → Configure → Item type management $\xrightarrow{\text{category/subcategory/options}}$ Add Sub-Category/Modify

→ Add Category

Configure User management :

Login form → Admin panel → Configuration → User Management $\xrightarrow{\text{Librarian Name/Status} \rightarrow \text{options}}$ Change Status → Idle

Admin Dashboard:

Login form → Admin panel → DashBoard → View Admin Panel (with all activity of Admin)

Management Borrowing Duration:

Login form → Admin panel → Management → Borrowing Duration $\xrightarrow{\text{Item category/Duration} \rightarrow \text{Options}}$ Change Duration/Set Duration

Fine Management:

Login form → Admin panel → Management → Fine $\xrightarrow{\text{Item category/Fine} \rightarrow \text{Options}}$ Change Fine/Set Fine

Manage Item Add edit Item Add:

Login form → Librarian panel → Manage Item → Add/Edit category-subcategory-Item → Options → Add Input(category,subcategory,Add Item:number(Int)) → Save

Manage Item Add edit Item Modify:

Login form → Librarian panel → Manage Item → Add/Edit category-subcategory-Item → Options → Edit Input(category,subcategory,Edit item name,number(int)) → Save

Manage Item Delete Item:

Login form → Librarian panel → Manage Item → Delete Item category-subcategory-Item → Options → Delete

Issue Management:

Login form → Librarian panel → Management → Issue requested item-roaming Item → Options → Issue

Report Management:

Login form → Librarian panel → Management → Report input(reportname,from,to) → Generate Report

Retrieve Management:

Login form → Librarian panel → Management → Retrieve Management borrowed item-fine,options → Retrieve/Collect Fine

Configure Change User Type Modify:

Login form → Librarian panel → Configure → Change User Type User Name+Category → options → Modify Type User Name+Category → Save

Librarian Dashboard:

Login form → Librarian panel → DashBoard → View Librarian Panel (with all activity of Librarian)

Manage Item Add edit Item:

Login form → Librarian panel → Manage Item → Add/Edit Item category-subcategory-Item → Options → Add/Modify

External Home:

Hit to our online library web page (Enter address) → Home → HomePage (External user can search item here)

External All Items:

Enter website → Item → Books category-subcategory-Item → Options → Borrow

Change password of Librarian:

Login form → Librarian panel → Change password fill up password form → Confirm.

Configure Change Item Borrowing Duration :

Login form → Librarian panel → Configure → Change Item Borrowing Duration Item Name-Date → options → Modify Duration

Configure Change Item Borrowing Duration Modify:

Login form → Librarian panel → Configure → Change Item Borrowing Duration Item Name-Date → options → Modify Duration Item Name + Duration → Save

Configure Change User Type:

Login form → Librarian panel → Configure → Change User Type User Name+Category → options → Modify Type

Manage User (User Management):

Login form → Librarian panel → Manage User requested category-subcategory → Options → Block/Unblock

Borrow new Item by User:

Login form → User panel → Borrow → New Item category-subcategory → Options → Borrow

Item Renew by User:

Login form → User panel → Borrow → Renew item-duration → options → Renew

Change password of User :

Login form → User panel → Change password fill up password form → Confirm

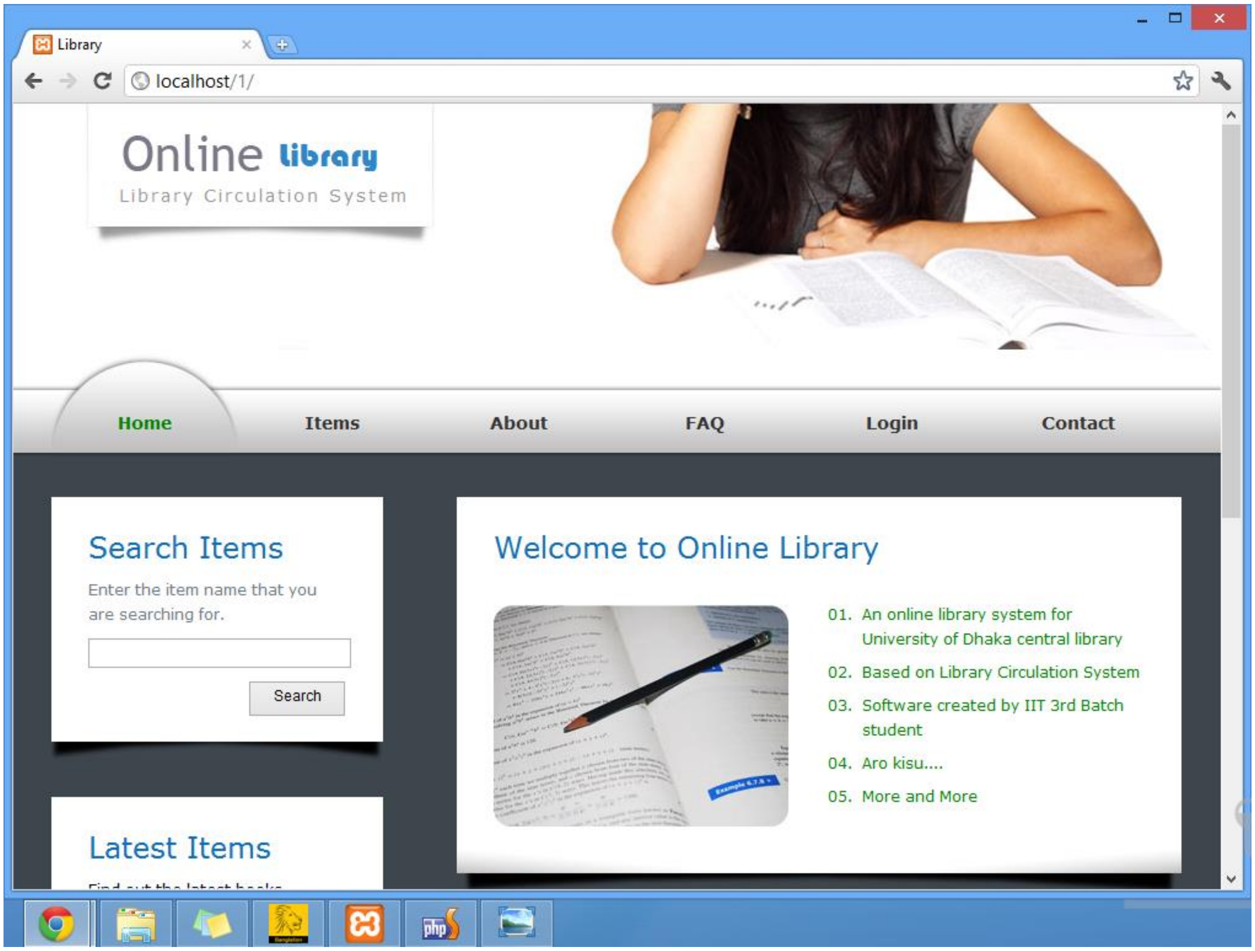
User Check Status:

Login form → User panel → Check Status view status (item taken,duration,fine) → Idle

User Dashboard:

Login form → User panel → Dash Board view dash board (latest item,poular item) → Idle

3.2.3 Depict each interface state as it look to end user



Search Items

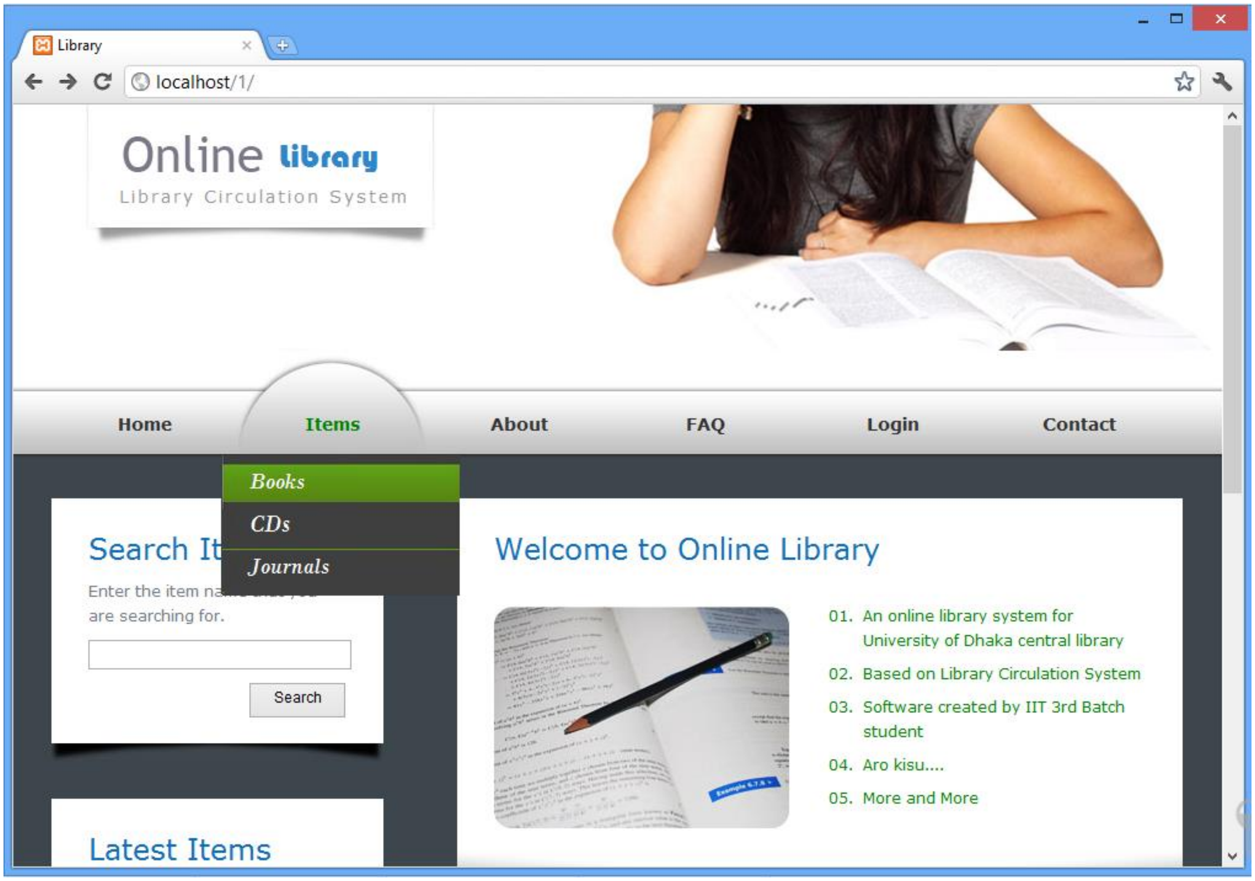
Enter the item name that you are searching for.

Welcome to Online Library

01. An online library system for University of Dhaka central library
02. Based on Library Circulation System
03. Software created by IIT 3rd Batch student
04. Aro kisu....
05. More and More

Latest Items

Figure 59: Home



Online library

Library Circulation System

Search It

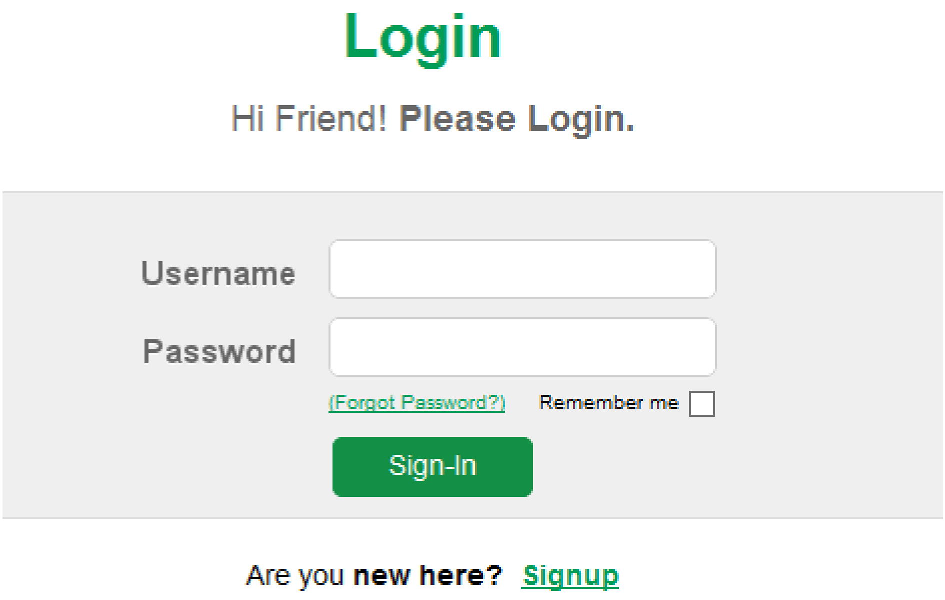
Enter the item na… are searching for.

Latest Items

Welcome to Online Library

01. An online library system for University of Dhaka central library
02. Based on Library Circulation System
03. Software created by IIT 3rd Batch student
04. Aro kisu....
05. More and More

Figure 60: Items

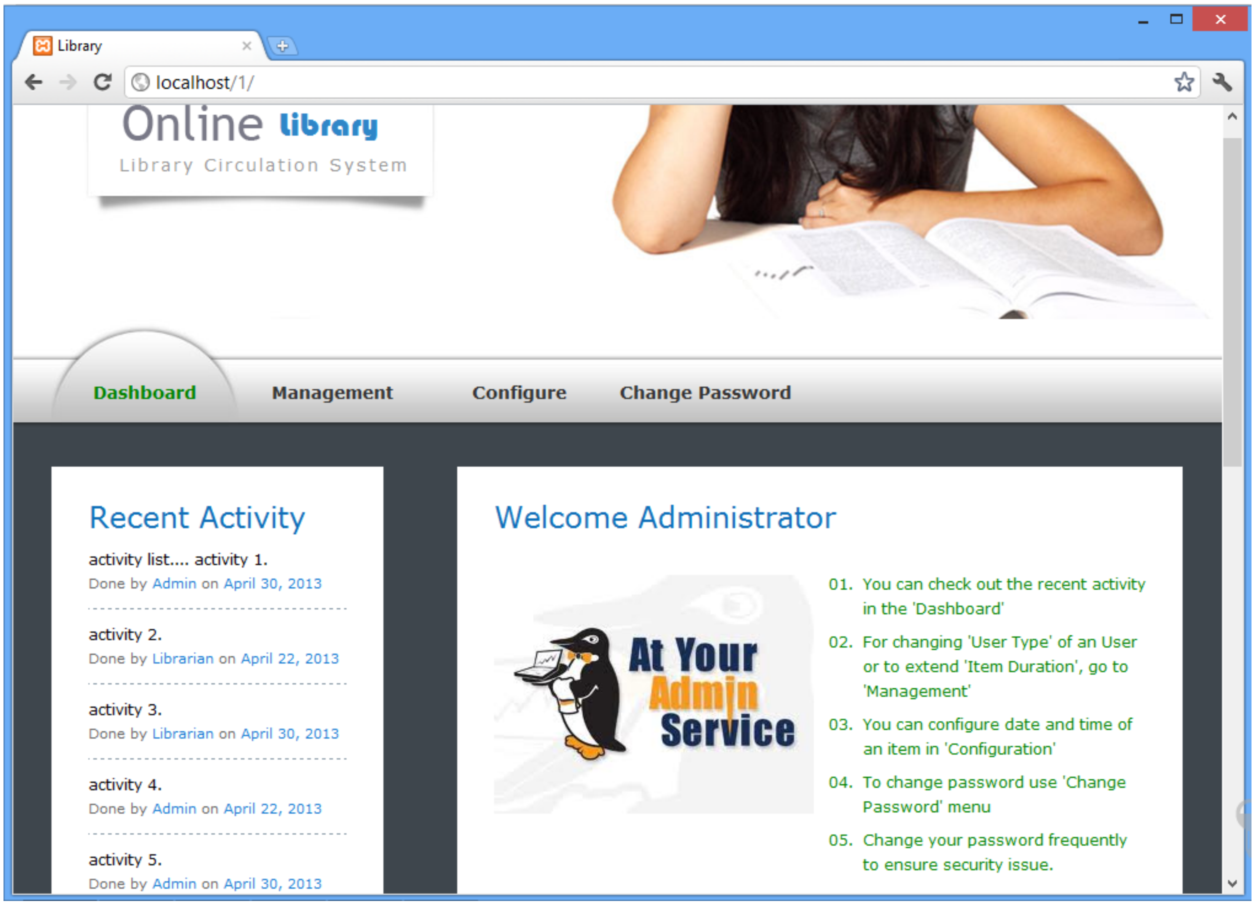


Login

Hi Friend! **Please Login.**

Are you **new here?** Signup

Figure 61: Login Form



Recent Activity

activity list.... activity 1.
Done by Admin on April 30, 2013

activity 2.
Done by Librarian on April 22, 2013

activity 3.
Done by Librarian on April 30, 2013

activity 4.
Done by Admin on April 22, 2013

activity 5.
Done by Admin on April 30, 2013

Welcome Administrator

01. You can check out the recent activity in the 'Dashboard'
02. For changing 'User Type' of an User or to extend 'Item Duration', go to 'Management'
03. You can configure date and time of an item in 'Configuration'
04. To change password use 'Change Password' menu
05. Change your password frequently to ensure security issue.

Figure 62: Admin Dashboard

Chapter 4

Conclusion

We are pleased to submit the final Software Design and Analysis report on Library circulation system. From this, the readers will get a clear and easy view of library circulation system. To improve Library System efficiency, library management needs to automate the acquisition and circulation tasks. A library with automated software system is more effective than paper based manual system. This document can be used effectively to maintain software development cycle. It will be very easy to conduct the whole project using it. Hopefully, this document can also help our junior BSSE batch students. We tried our best to remove all dependencies and make effective and fully designed document. We believe that reader will find it in order.

Appendix

References

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Engineering

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