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MINISTRY OF EDUCATION AND TRAINING

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Capstone Project Document

Book Library Management With Flycam And Barcode

GSP21SE05	
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Capstone Project code	PAPV

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Definition and Acronyms

Acronym	Definition
BR	Business Rule
ERD	Entity Relationship Diagram
GUI	Graphical User Interface
UC	Use Case
API	Application Programming Interface
FE	Feature

LI	Limitation
EX	Exclusion
WBS	Work Breakdown Structure
JSON	JavaScript Object Notation
QR	Quick Response
CUDA	Compute Unified Device Architecture
IIS	Internet Information Services
PAPV	Book Library Management With Flycam And Barcode System

I. Project Introduction

1. Overview

1.1 Project Information

- Project name: <<Book Library Management With Flycam And Barcode>>
- Project code: <<PAPV>>
- Group name: <<GSP21SE05>>
- Software type: <<Software Type: Web App, Mobile App>>

1.2 Project Team

a. Supervisors

Full Name	Email	Phone Number	Title
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Đoàn Nguyễn Thành Hòa	HoaDNT@fe.edu.vn		Lecturer

Table 1 - Supervisors

b. Team Members

Full Name	Email	Mobile	Role
Nguyễn Huỳnh Phú	PhuNHSE130571@fpt.edu.vn		Leader
Nguyễn Hữu Linh	LinhNHSE130563@fpt.edu.vn		Member
Trần Đăng Khánh	KhanhTDSE130585@fpt.edu.vn		Member
Trịnh Tiến Hoàng	HoangTTSE63415@fpt.edu.vn		Member

Table 2 - Team Members

2. Product Background

In every extensive library, manual management like checking, inspecting, or looking over books can be time-consuming and requires lots of effort. Periodically, librarians have to go through every aisle and section to check whether there is a missing of books or not, and it is a challenge to determine the reason for missing books. Taking a consideration of large libraries with the vast area of sections and many enormous bookshelves, the manual inventory is definitely laborious and can be quite dangerous working environment for librarians (taking into consideration they might hurt themselves from climbing up to the high place).

Meanwhile, the office hours of libraries are limited. The inventory requires time, and other problems arise from it, such as staffs having to work overtime, temporarily shut down, or defer the libraries' opening hours. This problem can make a severe impact on the library's activities.

Moreover, in every traditional library, the most common problem is the loss of library borrowing/returning card templates. Libraries manage books borrowing or returning by using

borrowing card templates always face problems like the card is damaged or loss of card. It takes time and money to register the card over again.

Patrons always face trouble searching and finding books in large libraries. Asking for the assistance of librarians might also take lots of time.

3. Existing Systems

Nowadays, there are still many libraries using manual inventory. Staffs are facing lots of problems in book managing. They have to do the inventory manually, check every bookshelf one by one. This manual operation is laborious and time-consuming. Besides, when facing the problem like high bookshelves, staffs have to climb up and working at the high ground, which can be dangerous, especially for older staffs. Moreover, missing or loss of data is relatively a common problem for managing information manually.

It isn't easy for patrons (borrowing books) to know the category or what books the library has, which book is the most favorite, and they can't view all the feedback and comments about the book from other people.

4. Business Opportunity

Our system is not a new face in the library managing system, but still, it can solve many fundamental problems and automate a lot of work. Throughout conducting many surveys about managing systems from many libraries, our team has realized some limits are still not fully optimized in terms of time and human resources. By that, we will come with the idea to optimize the managing system through this project.

5. Software Product Vision

For the library's activities, managing information will be more effective.

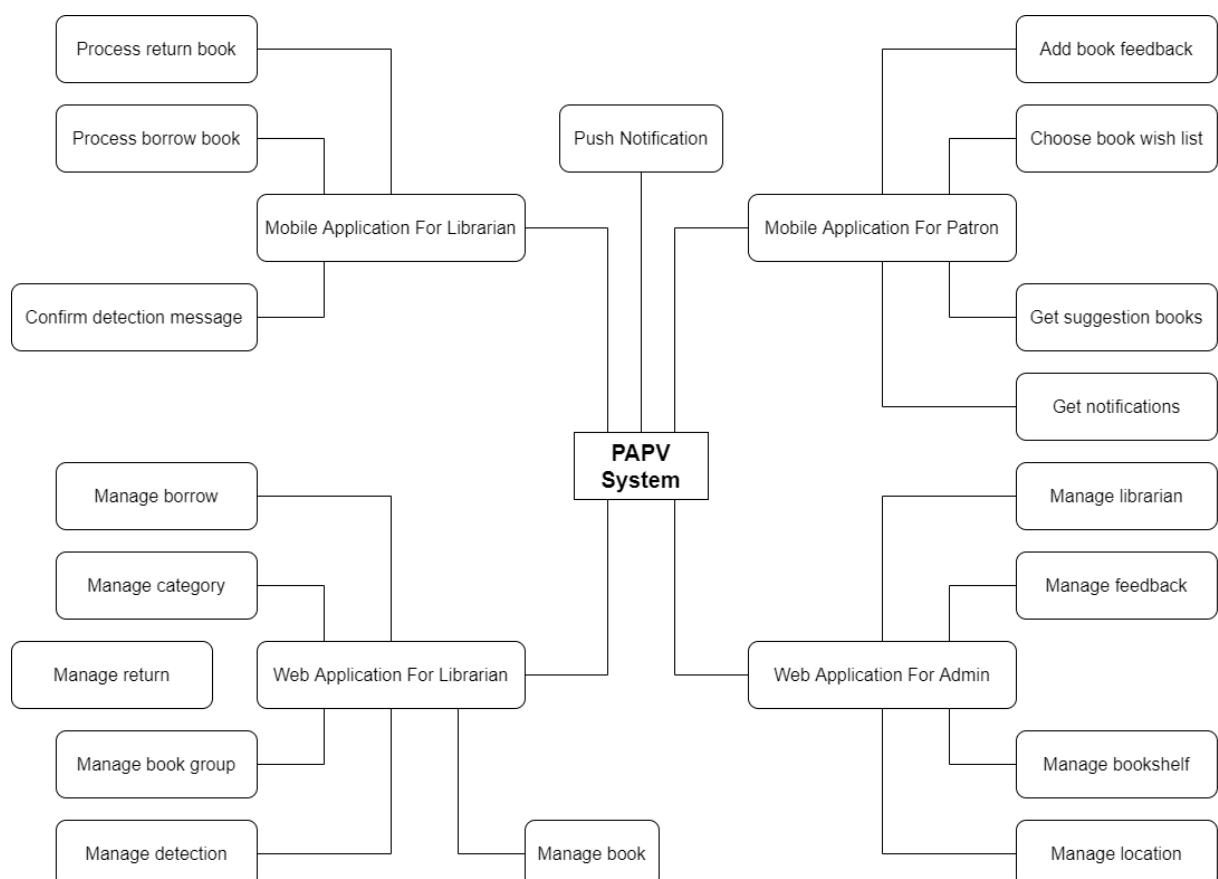
For librarians, it will save more time. With the help of a flycam, it can instigate the books from the high shelf. Better vision, the flycam is able to capture the whole picture of the library from high ground. It can be a useful tool for detecting any missing books or misplacement of books and, therefore, a proper investigation on the reason for that. Also, it can provide a safe working environment for librarians, minimizing the risk of working at high ground, avoid potential serve injuries especially for staffs with ages.

For patrons, borrowing/returning activities will become easier. For example, patrons can choose the list of books they want to borrow before coming to the library. So when they come to the library, it is easier to check whether the books from that list are available in the library or not. It will save time for patrons and also for librarians. Patrons will receive a reminder about the date of returning the books when it is coming closer. It helps patrons to stay alert when the books need to be returned.

6. Project Scope & Limitations

The project is unique because there is a presence of a flycam. It is more versatile. It functions as a civilian mobile camera to detect books from high ground and can also play an essential role in others, such as monitoring the whole library or detecting faces. But there is also a challenge to face. Only large libraries can use this because the price of a flycam is expensive, the maintenance is difficult. Moreover, it requires the right environment to function correctly, such as providing enough light for the camera to detect the code.

6.1 Major Features



[Figure 1- PAPV Major Features](#)

6.1.1 Website Application

- FE-1: Unauthenticated User can login.
- FE-2: Authenticated User can logout.
- FE-3: Admin can manage librarian.
- FE-4: Admin can manage feedback.
- FE-5: Admin can manage bookshelf.
- FE-6: Admin can manage location.
- FE-7: Librarian can manage borrow.

- FE-9: Librarian can manage return.
- FE-10: Librarian can manage category.
- FE-11: Librarian can manage book group.
- FE-12: Librarian can manage detection.
- FE-13: Librarian can manage book.

6.1.2 Mobile Application

- FE-14: Unauthenticated User can login.
- FE-15: Unauthenticated User can sign up.
- FE-16: Authenticated User can logout.
- FE-17: Librarian can process return book.
- FE-18: Librarian can process borrow book.
- FE-19: Librarian can confirm detection message.
- FE-20: Patron can add book feedback.
- FE-21: Patron can choose book wish list.
- FE-22: Patron can get suggestion books.
- FE-23: Patron can get notifications.

6.1.3 System Handler

- FE-24: System Handler can push notification.

6.2 Limitations & Exclusions

- LI-01: The use of flycam requires the right environment to function correctly, like the brightness, spacious environment, separation between bookshelves for the flycam to move freely and safely.
- LI-02: Books have to be organized, barcodes must face outside so flycam can capture the codes.
- LI-03: The PAPV system can't completely replace humans. It can't automate some procedures.
- LI-04: Flycam can't use waypoint automatically.
- EX-01: PAPV system does not include manage import/ export books in library's warehouse.
- EX-02: PAPV system does not include manage human resources in library.

II. Project Management Plan

1. Overview

1.1 WBS & Estimation

#	WBS Item	Complexity	Est. Effort
1	<i>Web Application for Admin</i>		
1.1	Create bookshelf	Simple	1
1.2	Get bookshelves	Simple	1
1.3	Get bookshelf detail	Simple	1

1.4	Delete bookshelf	Medium	2
1.5	Create location	Simple	1
1.6	Get locations	Simple	1
1.7	Get location detail	Simple	1
1.8	Update location	Simple	1
1.9	Delete location	Medium	3
1.10	Get patrons	Simple	1
1.11	Get patron detail	Simple	1
1.12	Create librarian	Simple	1
1.13	Get librarians	Simple	1
1.14	Get librarian detail	Simple	1
1.15	Update librarian	Medium	2
1.16	Delete librarian	Simple	1
1.17	Get patron's feedback	Simple	1
1.18	Delete patron's feedback	Simple	1
1.19	Get book groups	Simple	1
1.20	Get book group detail	Simple	1
1.21	Get books in book group	Medium	2
1.22	Get specific drawers	Medium	2
1.23	Get books in drawer	Medium	2
1.24	Get detections	Medium	2
1.25	Get drawer detections	Medium	2
1.26	Get drawer detection messages	Medium	2
2	<i>Web Application for Librarian</i>		
2.1	Get borrow book history	Medium	2
2.2	Get borrow book history detail	Simple	1
2.3	Get return book history	Medium	2
2.4	Get return book history detail	Simple	1
2.5	Get detections	Medium	2
2.6	Get drawer detections	Medium	2

2.7	Get drawer detection messages	Medium	2
2.8	Confirm drawer detection message	Medium	2
2.9	Create detection	Complex	20
2.10	Process borrow book	Complex	5
2.11	Process return book	Complex	5
2.12	Create book group	Medium	2
2.13	Get book groups	Simple	1
2.14	Get book group detail	Simple	1
2.15	Update book group	Medium	2
2.16	Delete book group	Simple	1
2.17	Get locations	Simple	1
2.18	Get location detail	Simple	1
2.19	Create category	Simple	1
2.20	Get categories	Simple	1
2.21	Delete category	Simple	1
2.22	Add book into a drawer	Medium	2
2.23	Remove book from drawer	Simple	1
2.24	Get bookshelves	Simple	1
2.25	Get bookshelf detail	Simple	1
2.26	Get customer's feedback	Simple	1
2.27	Get specific drawers	Medium	2
2.28	Get books in drawer	Medium	2
2.29	Export Barcode to PDF	Medium	2
2.30	Add book into book group	Medium	2
2.31	Get books in book group	Medium	2
2.32	Remove book from book group	Medium	2
3	<i>Mobile Application for Librarian</i>		
3.1	Get book groups	Simple	1
3.2	Get book group detail	Simple	1
3.3	Get profile	Simple	1

3.4	Get borrow book history	Medium	2
3.5	Get borrow book history detail	Simple	1
3.6	Process borrow book	Medium	2
3.7	Process return book	Medium	2
3.8	Get detections	Medium	2
3.9	Get drawer detections	Medium	2
3.10	Get drawer detection messages	Medium	2
3.11	Confirm drawer detection	Simple	1
4	<i>Mobile Application for Patron</i>		
4.1	Choose book wish list	Medium	2
4.2	Get notification	Medium	2
4.3	Get notification detail	Simple	1
4.4	Get suggestion books	Medium	2
4.5	Add book feedback	Simple	1
4.6	Get book feedback	Simple	1
4.7	Get book groups	Medium	2
4.8	Get book group detail	Simple	1
4.9	Get profile	Simple	1
4.10	Update profile	Simple	1
5	<i>System handler</i>		
5.1	Push notification	Medium	3

Total Estimated Effort (man-days) **144**

1.2 Project Objectives

#	Quality Stage	No. of Defects	% of Defect	Notes
1	Reviewing	3	1.81	
2	Unit Test	91	54.82	
3	User Acceptance Test	72	43.37	
Total		82	100%	

1.3 Project Risks

#	Risk Description	Impact	Possibility	Response Plans
1	Team member drop out	Critical	Low	Reduce scope
2	Host server die	Medium	Low	Change host server

Table 3 - Project Risks

2. Management Approach

Implementing Scrum as an Agile methodology enables PAPV team under a common organization for decision making, allows to see product evolve in real time as we build and adjust them.

2.1 Project Process

SCRUM FRAMEWORK

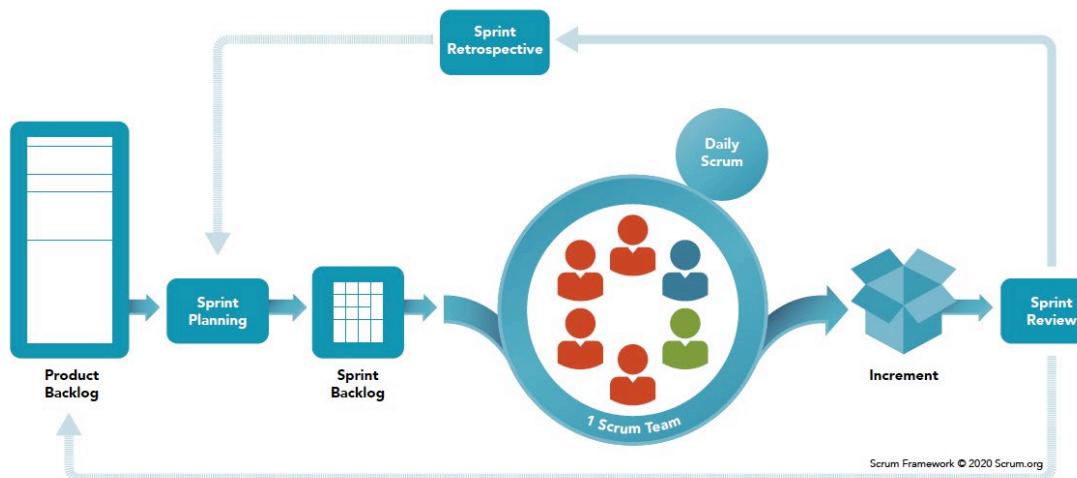


Figure 2 - Scrum Framework

PAPV team apply Scrum Framework for managing project process for the following reasons:

- It's suitable for small or medium size project as PAPV System.
- Project processes are done by the development team simultaneously, that help everything to be flexible and changeable during the life of the project and even after.
- Better visibility into project and minimize risks.

2.2 Quality Management

To improve the project quality, PAPV team apply the following schemes:

- Following available application's design.

- Cohering FU HCM Library information, supervisors' guidance and researching to achieve the best solution.
- Holding daily meeting to follow project's tasks and support each other.

2.3 Training Plan

Training Area	Participants	When, Duration	Waiver Criteria
.NET Core	Everyone	3 days	Mandatory
ReactJS	Everyone	3 days	Mandatory
Dart, Flutter	Everyone	3 days	Mandatory
Microsoft SQL Server	Everyone	1 day	Mandatory
Git, Github	Everyone	1 day	Mandatory
Draw.io	Everyone	1 day	Mandatory

Table 4 - Training Plan

3. Master Schedule

#	Deliverable	Due Date	Deliverable Scope
1	Project Plan	08/01/2021	Make project goal plan
2	Report 1	11/01/2021	Project introduction
3	Report 2	18/01/2021	Project management plan
4	Report 3	01/02/2021	Software requirement specification
5	Report 4	15/02/2021	Software design document
6	Report 5	29/03/2021	Test case document, test documentation
7	Report 6	05/04/2021	Software user guides
8	Report 7	12/04/2021	Final project final
9	Code package 1	21/02/2021	Code, Unit test, System test case
10	Code package 2	08/03/2021	Code, Unit test, System test case
11	Code package 3	01/04/2021	Code, Unit test, System test case
12	Code font-end 1	21/02/2021	Code, design screen
13	Code font-end 2	08/03/2021	Code, design screen
14	Code font-end 3	01/04/2021	Code, design screen
15	Final package	15/04/2021	Final code package and documents

Table 5 – Master Schedule

4. Project Organization

4.1 Team & Structures

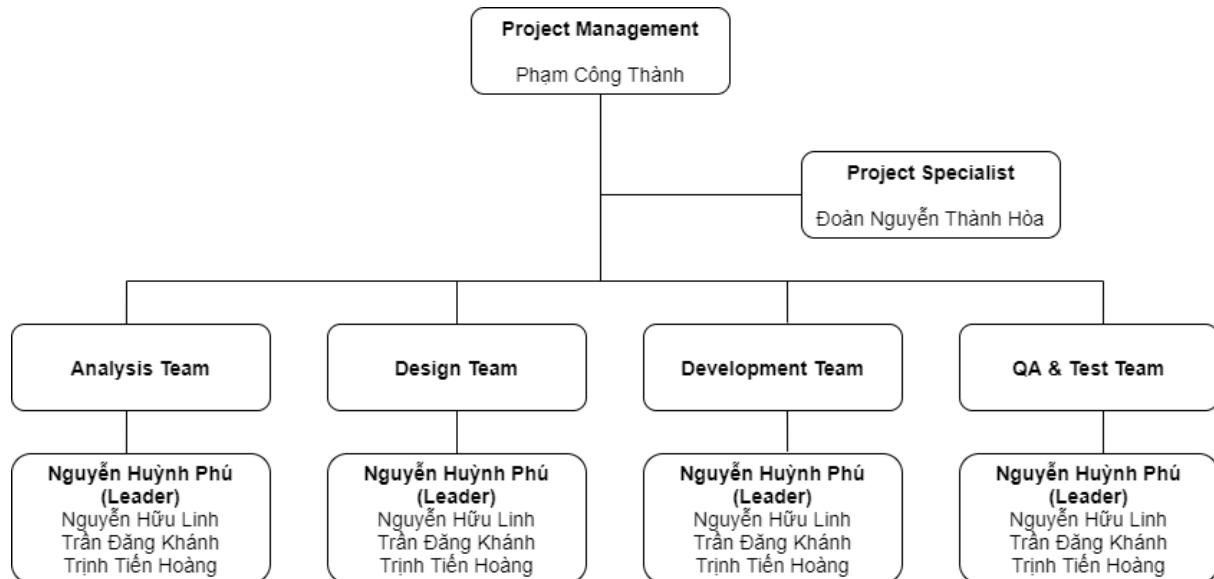


Figure 3 - Project Organization

4.2 Roles & Responsibilities

Role	Responsibility
Project Manager	Give guidance, monitoring and manage the project to be right direction
Project Specialist	Give guidance, support project's solution
Analysis Leader	Give guidance, adjust project's requirements
Analysis Member	Analyze, update project's requirements
Design Leader	Give guidance, control user interface design
Design Member	Design, implement user interface
Technical Leader	Give guidance, discuss about technical solution and design
Test Leader	Give guidance, write test cases and test plan
Test Member	Write test cases and update

Table 6 - Role & Responsibilities

5. Project Communication

5.1 Communication Plan

Communication Item	Who/ Target	Purpose	When, Frequency	Type, Tool, Method (s)

Daily Meeting	Team Members	Internal Communication	Always	Meeting
Weekly Report	Supervisors and Team Members	Discuss project's status, solution, next target	Weekly	Google Meet
Division of duties	Team Members	Control project status	Always	Trello

Table 7 - Communication Plan

5.2 External Interface

a. FU Contacts

Function	Contact Person (name, position)	Contact address (email, telephone)	Responsibility
Supervisor	Phạm Công Thành	ThanhPC3@fe.edu.vn	<ul style="list-style-type: none"> - Provide document template - Give instruction to project team - Review deliverables - Supervise project status
Supervisor	Đoàn Nguyễn Thành Hòa	HoaDNT@fe.edu.vn	<ul style="list-style-type: none"> - Provide document template - Receive project reports - Answer questions about the project

Table 8 - FU Contacts

b. Customer Contacts

Function	Contact Person (name, position)	Contact address (email, telephone)	Responsibility
Supervisor	Phạm Công Thành	ThanhPC3@fe.edu.vn	<ul style="list-style-type: none"> - Provide document template - Give instruction to project team - Review deliverables - Supervise project status
Supervisor	Đoàn Nguyễn Thành Hòa	HoaDNT@fe.edu.vn	<ul style="list-style-type: none"> - Provide document template - Receive project reports - Answer questions about the project

Table 9 - Customer Contacts

6. Configuration Management

6.1 Tools & Infrastructures

Programming languages	C#, TypeScript, Dart
-----------------------	----------------------

Framework	.NET Core 3.1, Entity Framework 5.0, Flutter, ReactJS, Flask Framework, Python 3.8
API	API
DBMS	Microsoft SQL Server
IDEs/Editors	Visual Studio Code, Visual Studio
UML tools	Draw.io
Version Control	Github
Deployment server	IIS, Anaconda
Project management tool	Google Drive, Trello

Table 10 - Tools & Infrastructures

6.2 Document Management

Google Drive is used to manage project's documents.

6.3 Source Code Management

Github is used to manage project's source code.

III. Software Requirement Specification

1. Overall Description

1.1 Product Overview

1.1.1 *Unauthenticated User Requirements*

Unauthenticated User who has not been identified by PAPV System. Unauthenticated User has limited access to the system with the following feature:

- Login
- Signup

1.1.2 *Authenticated User Requirements*

Authenticated User who has identified by PAPV System. Authenticated User has access to system with the following feature:

- Logout

1.1.3 *Patron Requirements*

Patron is a person who accesses to the system as patron role. Patron can use the following functions:

- Choose book wish list
- Get notifications
- View notification detail
- View suggestion books
- Add book feedback

- Get book feedback
- Get book groups
- View book group detail
- Get profile
- Update profile

1.1.4 Librarian Requirements

Librarian is a person who accesses to the system as librarian role. Librarian can use the following functions:

- Get borrow book history
- Get borrow book history detail
- Get return book history
- Get return book history detail
- Get detections
- Get drawer detections
- Get drawer detection messages
- Confirm drawer detection message
- Create detection
- Process borrow book
- Process return book
- Create book group
- Get book groups
- Get book group detail
- Update book group
- Delete book group
- Get locations
- Get location detail
- Create category
- Get categories
- Delete category
- Add book into drawer
- Remove book from drawer
- Get bookshelves
- Get bookshelf detail
- Get patron's feedback
- Get specific drawers
- Get books in drawer
- Export Barcode to PDF
- Add book into book group
- Get books in book group
- Get profile
- Remove book from book group

1.1.5 Admin Requirements

Admin is a person who accesses to the system as admin role. Admin can use the following functions:

- Create bookshelf
- Get bookshelves
- Get bookshelf detail
- Delete bookshelf
- Create location
- Get locations
- Get location detail
- Update location
- Delete location
- Get patrons
- Get patron detail
- Create librarian
- Get librarians
- Get librarian detail
- Update librarian
- Delete librarian
- Get patron's feedback
- Delete patron's feedback
- Get book groups
- Get book group detail
- Get books in book group
- Get specific drawers
- Get books in drawer
- Get detections
- Get drawer detections
- Get drawer detection messages

1.1.6 System Handler Requirements

System Handler deals with internal processes:

- Push notification

1.2 Business Rules

ID	Rule Definition
BR-01	<p>User logs in using username and password are registered. If the username and password are correct, PAPV redirect users to corresponding home page:</p> <ul style="list-style-type: none">- User logs in as role “librarian”, the system will display librarian home page- User logs in as role “admin”, the system will display admin home page- User logs in as role “patron”, the system will display patron home page

BR-02	After logout successfully, user become the “Unauthenticated User” and PAPV will direct to login page.
BR-03	A bookshelf's information requires fields: <ul style="list-style-type: none"> - Book shelf name: must not empty - Row number: must not empty and less than 30 - Column number: must not empty and less than 30 - Location
BR-04	Bookshelf must be in the library before being added to the system.
BR-05	Id will be generated by the system
BR-06	Admin or librarian can search by name with search bar on top
BR-07	Data table contains max 10 items per page
BR-08	Bookshelf has following information: Name of the bookshelf, number of rows in bookshelf, number of columns in bookshelf, name of the location, name of the location where the bookshelf is located
BR-09	In bookshelf detail, admin/librarian will default to see the drawer in row 1, column 1 of bookshelf
BR-10	Admin or librarian can use filter to see more drawer
BR-11	If the bookshelf is deleted, all the drawer in the bookshelf will be deleted, the books in the drawer will also be removed.
BR-12	A location requires fields: <ul style="list-style-type: none"> - Location name: must not empty - Color
BR-13	Location must be in the library before being added to the system.
BR-14	Location has following information: Name of the location, color of the location
BR-15	If the location is deleted, all the bookshelf in the bookshelf will be removed, the drawers in the bookshelf will be removed, the books in the drawer will also be removed.
BR-16	Admin can search by name with search bar on top
BR-17	Librarian can search by name with search bar on top
BR-18	Patron has following information: Name of the patron, address of the patron, created time of the patron, email of the patron, phone of the patron
BR-19	A librarian's information requires fields: <ul style="list-style-type: none"> - Name: between 1-100 characters - Address: between 1-250 characters

	<ul style="list-style-type: none"> - Gender - Date of birth: 18 years old compared to the present - Phone: 10 digits and must be in the correct format - Username: between 1-30 - Email: match regex <code>^(\?([0-9]{3})\?)?[-.]?([0-9]{3})[-.]?([0-9]{4})\$</code> - Password: between 1-36 characters - Confirm password: must be match the password - Avatar: must be in png, jpg, jpeg format
BR-20	Librarian has following information: Name of the librarian, gender of the librarian, username of the librarian, email of the librarian, created time of the librarian, address of the librarian
BR-21	Admin can edit information of librarian but cannot edit username and email of librarian
BR-22	After being removed, the librarian cannot log into the PAPV system
BR-23	Patron's feedbacks have following information: Content of the feedback, rate of the feedback, name of patron who feedback, created date
BR-24	If the feedback has been deleted, it will not show up in the book group feedback list
BR-25	Book group has following information: Name of the book group, rate of the book group, author of the book group, fee of the book group, punish fee of the book group, publish date of the book group, created date, quantity
BR-26	All the books in the book group will be shown, the librarian can delete the book from the book group
BR-27	The selected row and column must be less than the row and column contained in the bookshelf's system.
BR-28	Librarian can remove book from the drawer or add new book to the drawer
BR-29	Admin, librarian can filter by date to date to get detections
BR-30	Admin or librarian can watch the video of this detect, in which the drawer had been detected
BR-31	Admin or librarian can view detail of all drawer in specific detection
BR-32	Drawer detection messages has following information: no, book id, book name, book barcode
BR-33	Admin or librarian can filter issue in drawer
BR-34	Librarian can be confirm or reject issue
BR-35	If the error has been confirmed, it will be filter by confirm filter

BR-36	If the error has been rejected, it will be filter by reject filter
BR-37	If click "Confirm" button, it will be change status to confirmed error
BR-38	If click "Reject" button, it will be change status to rejected issue
BR-39	The distance from the drone to the bookshelf should be 50cm
BR-40	The minimum size of the barcode is: 1cm x 5cm
BR-41	The barcode of drawer must be in the correct format: KSXXXX00 (XXXX is the Id of the drawer in system)
BR-42	The barcode of the book must be in the correct format: <A-Z>XXXX<SUM OF XXXX> (XXXX is the Id of the book in system)
BR-43	The video uploaded to web admin must be 4k quality
BR-44	Patron can borrow books by bringing the book to the librarian
BR-45	If the patron borrows the book with a wish list, the librarian scan and indicate the positions that the book exists for that patron can pick up
BR-46	Patron can choose a return date
BR-47	If the patron borrows the book by bringing the book to the librarian, librarian must choose patron
BR-48	Librarian can search by the patron's name with search bar on the top
BR-49	Patron can only borrow one book per book group
BR-50	If patron don't select return date, the default borrow book period is 7 days
BR-51	After receiving the book, librarian must be put back into the correct drawer when it is borrowed, if it changes the position, it must be updated in the PAPV system.
BR-52	If the patron returns the book after required return date, the punish fee will be charged
BR-53	One day before the deadline to return the book, PAPV will automatically send a notification to the patron 's mobile app to remind
BR-54	If the patron notices that they have lost the book, they must pay the book's price to the library
BR-55	A book group requires fields: <ul style="list-style-type: none"> - Book group name: between 1-250 characters - Author: between 1-100 characters - Quantity: between 1-100 - Fee: between 1-5 - Punish Fee: between 1-5 - Book Price

	<ul style="list-style-type: none"> - Book Image: jpg, png, jpeg - Category
BR-56	After a book group is added, PAPV will automatically add the quantity of books to the book group equal to the number of librarians just imported.
BR-57	Librarian need to prepare books before creating a book group
BR-58	After the book group is deleted, the books in the book group have also been deleted and removed from the drawer
BR-59	A category requires fields: <ul style="list-style-type: none"> - Category name: between 1-50 characters
BR-60	After the category is deleted, which book groups has belonged to it will be have no that category
BR-61	Librarian can add more than one book at a time from a drawer
BR-62	The book must be in the drawer before librarian update into system
BR-63	Librarian can remove more than one book at a time from a drawer
BR-64	The book must be not in the drawer before librarian update into system
BR-65	Sign up information requires fields: <ul style="list-style-type: none"> - Email: match regex <code>^(\?([0-9]{3})\?)[- .]?([0-9]{3})[- .]?([0-9]{4})\$</code> - Name: between 1-100 characters - Gender: should be male, female or other - Phone: should be in Vietnamese format - Address: between 1-250 characters - DoB: valid date - Username: between 8-20 characters - Password: between 6-36 characters - Confirm password: match with password field
BR-66	All information must not be empty when submit
BR-67	Patron's JSON web token will be removed on client side.
BR-68	Patron's cookies will be destroyed on client side.
BR-69	Only one book per book group can be added to your wish list at a time
BR-70	A wish list can contain many books
BR-71	After obtaining the wish list, the patron can create a QR code and bring it to the librarian to borrow the book

BR-72	Each time the patron borrows a book, the patron 's favorite category will be increased by one rate based on the category of the book that the patron borrows.
BR-73	List suggestion books are based on the category most borrowed by the patron
BR-74	A feedback requires fields: <ul style="list-style-type: none"> - Rate: between 1-5 start - Content: must not empty
BR-75	After creating a new librarian successfully, the new librarian can login to web and mobile app to use features
BR-76	Drawer detections has following information: drawer id, drawer name, drawer barcode, number of issues for each drawer
BR-77	Drawer detections messages has following information: no, book id, book barcode
BR-78	Return books has following information: patron name, return time, total fee
BR-79	Borrow books has following information: patron name, start time, end time, quantity, total fee
BR-80	Each drawer can only contain up to 100 books, if more than the system will notify the librarian you want to continue adding or not.
BR-81	If system handler push notification to patron's device error, patron can view notification in PAPV mobile app by press on notification icon
BR-82	Patron information requires fields: <ul style="list-style-type: none"> - Name: between 1-100 characters - Gender: should be male, female or other - Phone: should be in Vietnamese format - Address: between 1-250 characters - DoB: valid date - Password: between 6-36 characters

Table 11 - Business Rules

2. User Requirements

2.1 Overview

2.1.1 Use Case Diagram

a. Web Application

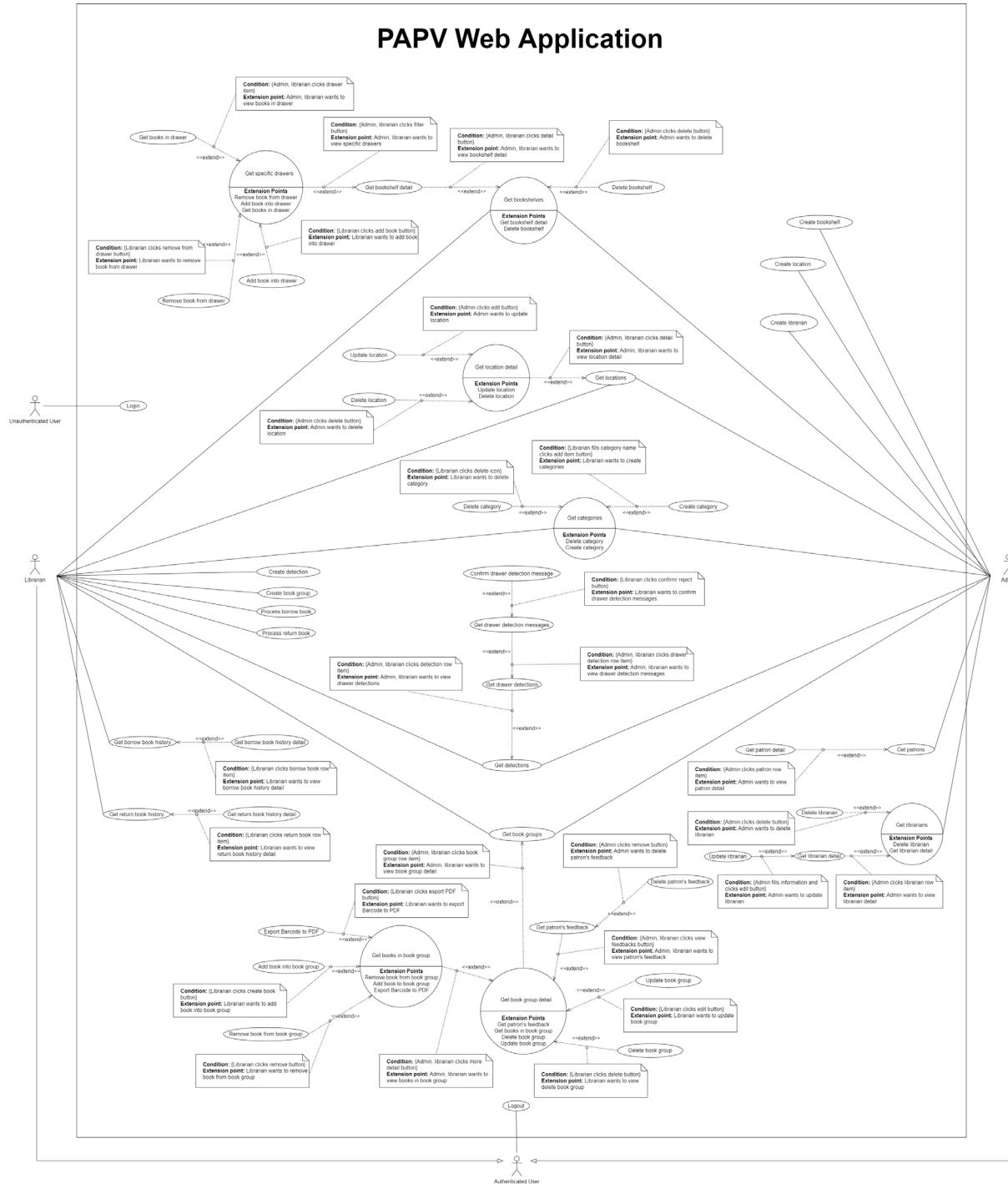


Figure 4 - <Use Case Overview> PAPV Web Application

b. Mobile Application

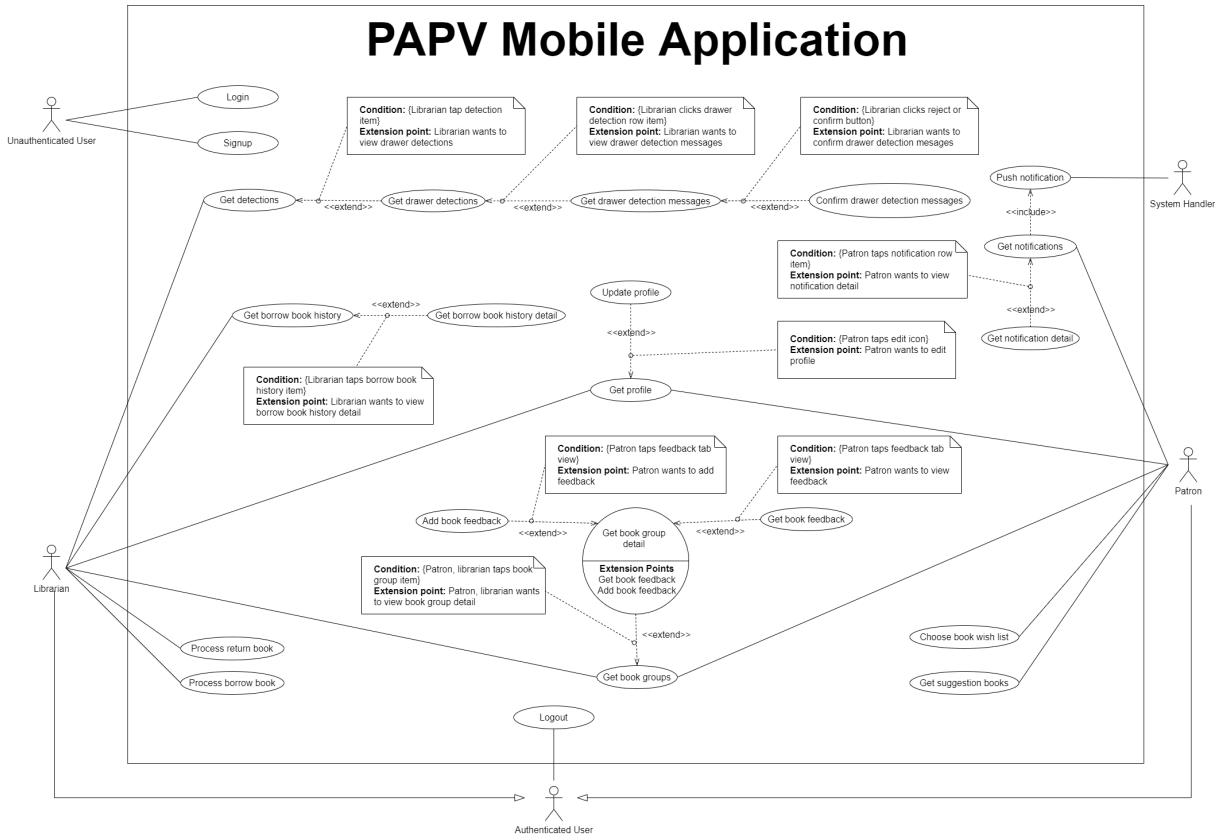


Figure 5 - <Use Case Overview> PAPV Mobile Application

2.1.2 System Actors

#	Actor	Description
1	Unauthenticated User	Unauthenticated User is person who has no account
2	Authenticated User	Authenticated User is person who has account in system (admin, librarian, patron)
3	Patron	Patron borrows and returns book of library
4	Librarian	Librarian manages books in library
5	Admin	Admin manages location, bookshelf, librarian and patron
6	System Handler	System Handler deals with internal processes

Table 12 - System Actors

2.1.3 Use Cases List

ID	Use Case	Primary Actors	Secondary Actors
UC01	Login	Unauthenticated User	N/A

UC02	Logout	Authenticated User	N/A
UC03	Sign up	Unauthenticated User	N/A
UC04	Create bookshelf	Admin	N/A
UC05	Get bookshelves	Admin, Librarian	N/A
UC06	Get bookshelf detail	Admin, Librarian	N/A
UC07	Delete bookshelf	Admin	N/A
UC08	Create location	Admin	N/A
UC09	Get locations	Admin, Librarian	N/A
UC10	Get location detail	Admin, Librarian	N/A
UC11	Update location	Admin	N/A
UC12	Delete location	Admin	N/A
UC13	Get patrons	Admin	N/A
UC14	Get patron detail	Admin	N/A
UC15	Create librarian	Admin	N/A
UC16	Get librarians	Admin	N/A
UC17	Get librarian detail	Admin	N/A
UC18	Update librarian	Admin	N/A
UC19	Delete librarian	Admin	N/A
UC20	Get book groups	Admin, Librarian	N/A
UC21	Get book group detail	Admin, Librarian	N/A
UC22	Get patron's feedback	Admin, Librarian	N/A
UC23	Delete patron's feedback	Admin	N/A
UC24	Get books in book group	Admin, Librarian	N/A
UC25	Get specific drawers	Admin, Librarian	N/A
UC26	Get books in drawer	Admin, Librarian	N/A
UC27	Get detections	Admin, Librarian	N/A
UC28	Get drawer detections	Admin, Librarian	N/A
UC29	Get drawer detection messages	Admin, Librarian	N/A
UC30	Get borrow book history	Librarian	N/A
UC31	Get borrow book history detail	Librarian	N/A
UC32	Get return book history	Librarian	N/A
UC33	Get return book history detail	Librarian	N/A
UC34	Confirm drawer detection messages	Librarian	N/A

UC35	Create detection	Librarian	N/A
UC36	Process borrow book	Librarian	Patron
UC37	Process return book	Librarian	Patron
UC38	Create book group	Librarian	N/A
UC39	Update book group	Librarian	N/A
UC40	Delete book group	Librarian	N/A
UC41	Get categories	Librarian	N/A
UC42	Create category	Librarian	N/A
UC43	Delete category	Librarian	N/A
UC44	Add book into drawer	Librarian	N/A
UC45	Remove books from drawer	Librarian	N/A
UC46	Export Barcode to PDF	Librarian	N/A
UC47	Add books into book group	Librarian	N/A
UC48	Remove book from book group	Librarian	N/A
UC49	Get profile	Patron, Librarian	N/A
UC50	Choose book wish list	Patron	N/A
UC51	Get notifications	Patron	N/A
UC52	Get notification detail	Patron	N/A
UC53	Get suggestion books	Patron	N/A
UC54	Add book feedback	Patron	N/A
UC55	Update profile	Patron	N/A
UC56	Push notification	System Handler	Patron

Table 13 - Use Case List

2.2 Web Application

2.2.1 <Admin> Overview Use Case

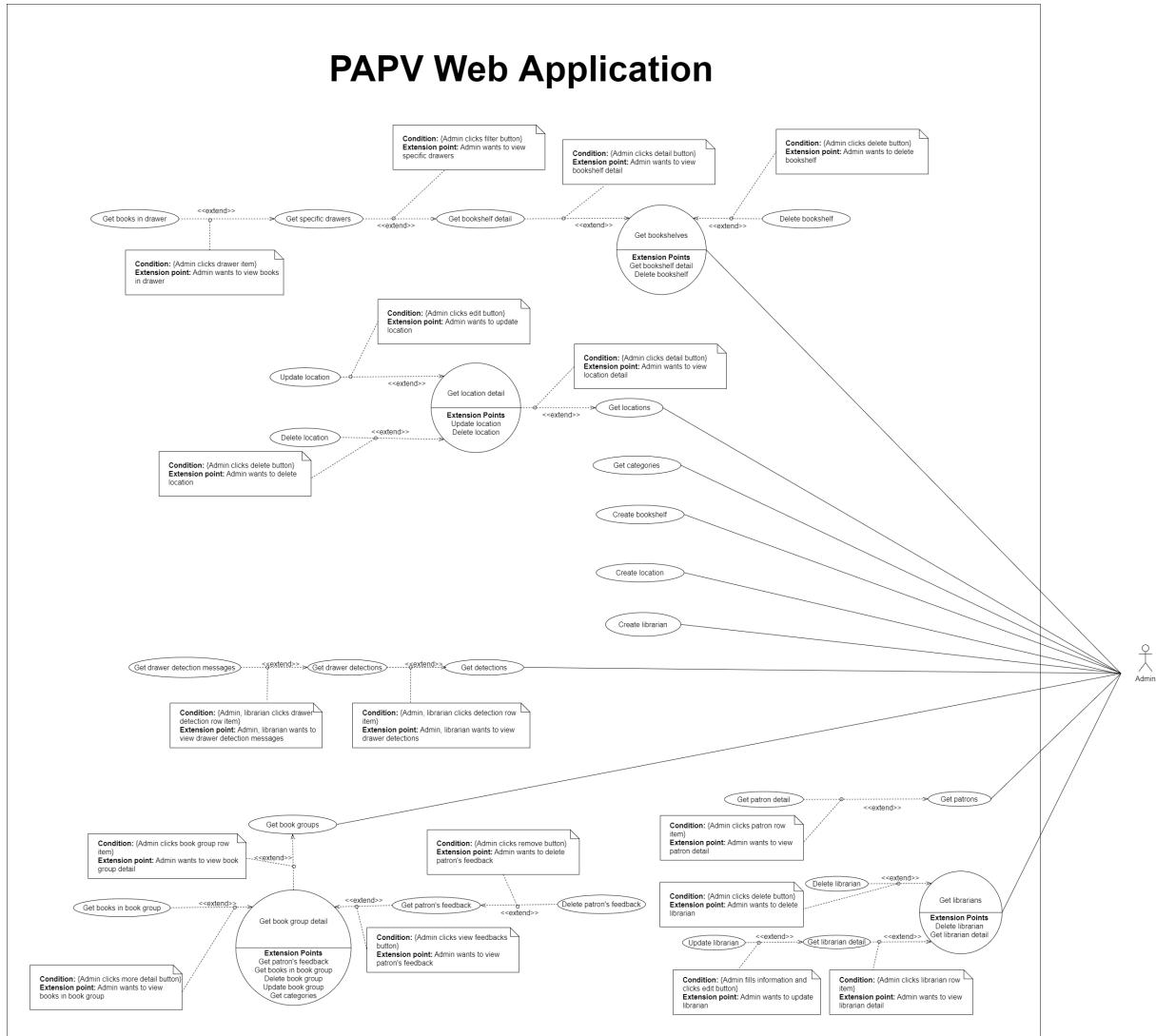


Figure 6 - <Overview Use Case> Admin

2.2.1.1 <Admin> Create Bookshelf

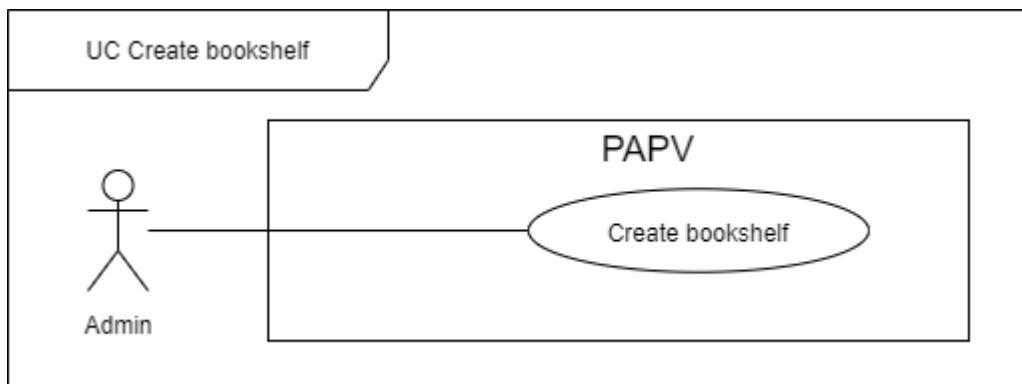


Figure 7 - <Use Case> Create Bookshelf

ID and Name:	UC-04 Create bookshelf		
Created By:	HoangTT	Date Created:	06/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to create a bookshelf.		
Trigger:	Admin send request that they want to create a bookshelf.		
Pre-conditions:	PRE-01. User has logged in the web as admin role.		
Post-conditions:	POST-01. PAPV return a message that bookshelf has been created successfully. PAPV stores bookshelf detail.		
Normal Flow:	<p>4.0 Create a bookshelf</p> <ol style="list-style-type: none"> 1. Admin click “Add new” button to send request to create a bookshelf. 2. PAPV will show a form requires identity information of bookshelf: <ul style="list-style-type: none"> - “Bookshelf name”: text input, blank, required - “Row number”: text input, blank, required - “Column number”: text input, blank, required - “Location”: select, blank, required 3. Admin fills in the book shelf information (see 4.0.E1, 4.0.E2) 4. Admin click “Save” button to send request to create bookshelf. 5. PAPV validates the bookshelf information and stores them 		
Alternative Flows:	N/A		
Exceptions:	<p>4.0.E1 Admin fails to fill in all the requires fields</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill in the missing fields (MSG01, MSG02, MSG03, MSG04) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the create bookshelf process, then PAPV terminates use case <p>4.0.E2 Admin enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG07) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the create bookshelf process, then PAPV terminates use case 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-03, BR-04, BR-05		

Other Information:	In case of internet connection failure, Admin cannot create bookshelf
Assumptions:	N/A

Table 14 - <Use Case> Create Bookshelf

2.2.1.2 <Admin> Get Bookshelves

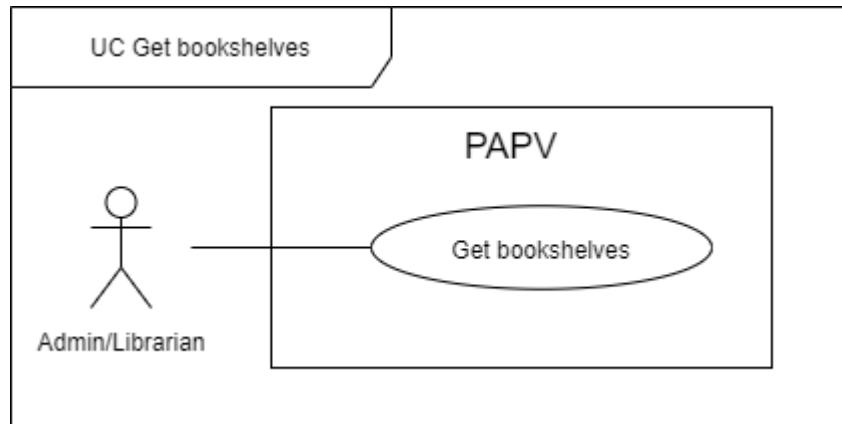


Figure 8 - <Use Case> Get Bookshelves

ID and Name:	UC-05 Get bookshelves		
Created By:	HoangTT	Date Created:	08/01/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get bookshelves that they manage		
Trigger:	Admin, librarian send request to get bookshelves list		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV return bookshelves list		
Normal Flow:	5.0 Get bookshelves <ol style="list-style-type: none"> 1. Admin, librarian send request to get bookshelves 2. PAPV return list bookshelves (see 5.0.E1) 		
Alternative Flows:	N/A		
Exceptions:	5.0.E1 Admin or librarian has no bookshelf to manage <ol style="list-style-type: none"> 1. PAPV returns message: MSG05 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		

Business Rules:	BR-06, BR-07, BR-08
Other Information:	In case of internet connection failure, admin or librarian cannot get bookshelves
Assumptions:	N/A

Table 15 - <Use Case> Get Bookshelves

2.2.1.3 <Admin> Get Bookshelf Detail

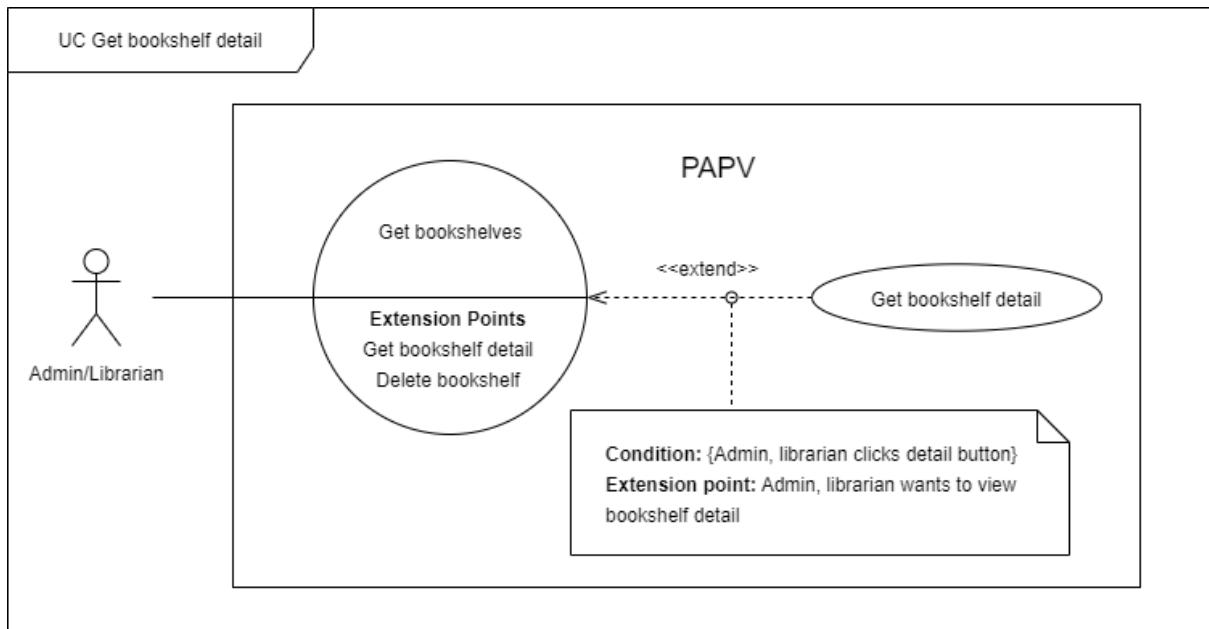


Figure 9 - <Admin> Get Bookshelf Detail

ID and Name:	UC-06 Get bookshelf detail		
Created By:	HoangTT	Date Created:	09/01/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get detailed information of the bookshelf.		
Trigger:	Admin, librarian send request to get bookshelf detail.		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role.		
Post-conditions:	POST-01. PAPV returns detailed information of the bookshelf.		
Normal Flow:	<p>6.0 Get bookshelf detail</p> <ol style="list-style-type: none"> 1. Admin, librarian click "Detail" button or double click on specific bookshelf. 2. PAPV will display popup to view detailed information of bookshelf. 		

Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-09, BR-10
Other Information:	In case of internet connection failure, admin or librarian cannot view bookshelf detail.
Assumptions:	N/A

Table 16 - <Use Case> Get Bookshelf Detail

2.2.1.4 <Admin> Delete Bookshelf

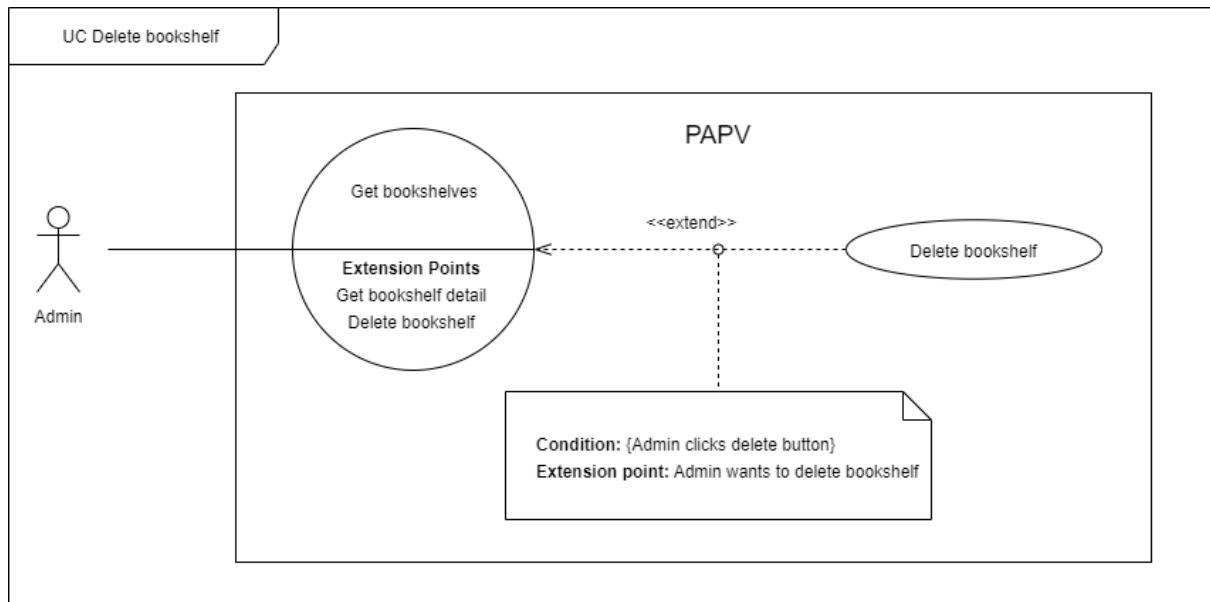


Figure 10 - <Admin> Delete Bookshelf

ID and Name:	UC-07 Delete bookshelf		
Created By:	HoangTT	Date Created:	11/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to delete a bookshelf		
Trigger:	Admin send request to delete a bookshelf		
Preconditions:	PRE-01. User has logged in web as admin role		
Post-conditions:	POST-1. PAPV remove the bookshelf		
Normal Flow:	<p>7.0 Delete bookshelf</p> <ol style="list-style-type: none"> 1. Admin clicks on “Delete” button on row in tables 		

	<p>2. System show delete popup with message: "Are you sure?" and two buttons for admin can select:</p> <ul style="list-style-type: none"> - "Yes" button - "No" button <p>3.1 Admin clicks on "Yes" button, PAPV remove bookshelf</p> <p>3.2 Admin clicks on "No" button, close popup and nothing change</p>
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-11
Other Information:	In case of internet connection failure, Admin cannot delete bookshelf
Assumptions:	N/A

Table 17 - <Use Case> Delete Bookshelf

2.2.1.5 <Admin> Create Location

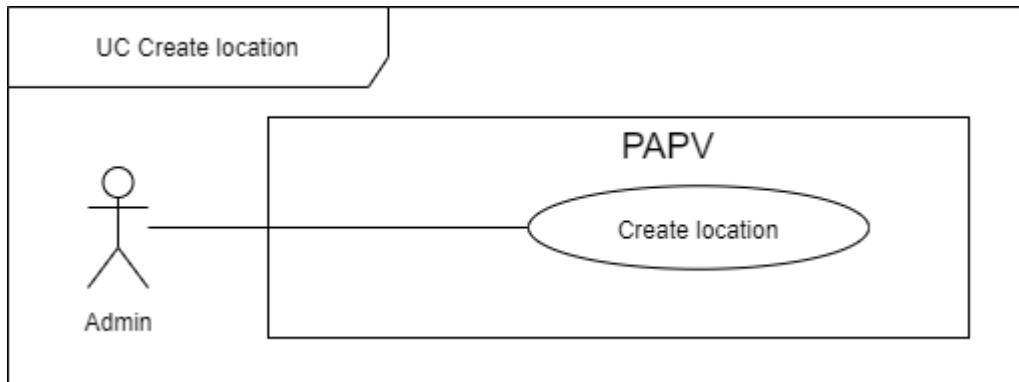


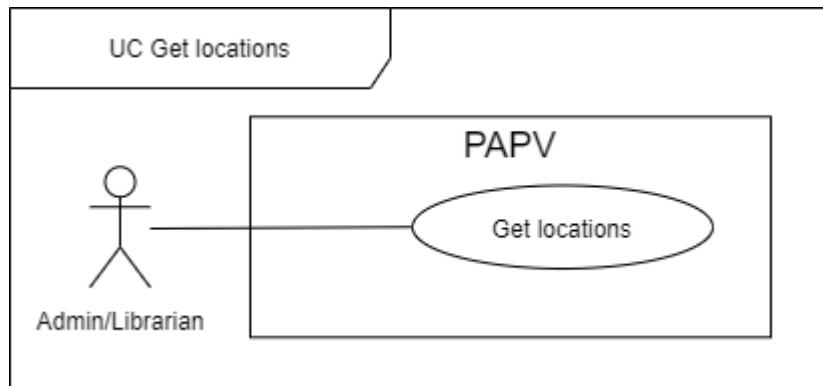
Figure 11 - <Admin> Create Location

ID and Name:	UC-08 Create location		
Created By:	Hoang TT	Date Created:	14/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to create location		
Trigger:	Admin send request to create location		
Pre-conditions:	PRE-01. User has logged in the web as admin role.		

Post-conditions:	POST-01. PAPV return a message that location has been created successfully. PAPV store location detail.
Normal Flow:	<p>8.0 Create location</p> <ol style="list-style-type: none"> 1. Admin click “Add New” button to send request to create a location. 2. PAPV will show a form requires identity information of bookshelf: <ul style="list-style-type: none"> - “Location”: text input, blank, required - “Color”: select, blank, required 3. Admin fills in the location information (see 8.0.E1, 8.0.E2) 4. Admin click “Save” button to send request to create bookshelf. 5. PAPV validates the location information and stores them
Alternative Flows:	N/A
Exceptions:	<p>8.0.E1 Admin fails to fill in all the requires fields</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill in the missing fields (MSG06) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the create location process, then PAPV terminates use case <p>8.0.E2 Admin enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG07) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the create location process, then PAPV terminates use case
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-05, BR-12, BR-13
Other Information:	In case of internet connection failure, Admin cannot create location
Assumptions:	N/A

Table 18 - <Use Case> Create Location

2.2.1.6 <Admin> Get Locations



[Figure 2 - <Use Case> Get Locations](#)

ID and Name:	UC-09 Get locations		
Created By:	HoangTT	Date Created:	16/01/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get locations that they manage		
Trigger:	Admin, librarian send request to get location list		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV return location list		
Normal Flow:	9.0 Get locations <ol style="list-style-type: none"> 1. Admin, librarian send request to get locations 2. PAPV return list locations (see 9.0.E1) 		
Alternative Flows:	N/A		
Exceptions:	9.0.E1 Admin or librarian has no location to manage <ol style="list-style-type: none"> 1. PAPV returns message: MSG05 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-06, BR-07, BR-14		
Other Information:	In case of internet connection failure, admin or librarian cannot get locations.		
Assumptions:	N/A		

[Table 19 - <Use Case> Get Locations](#)

2.2.1.7 <Admin> Get Location Detail

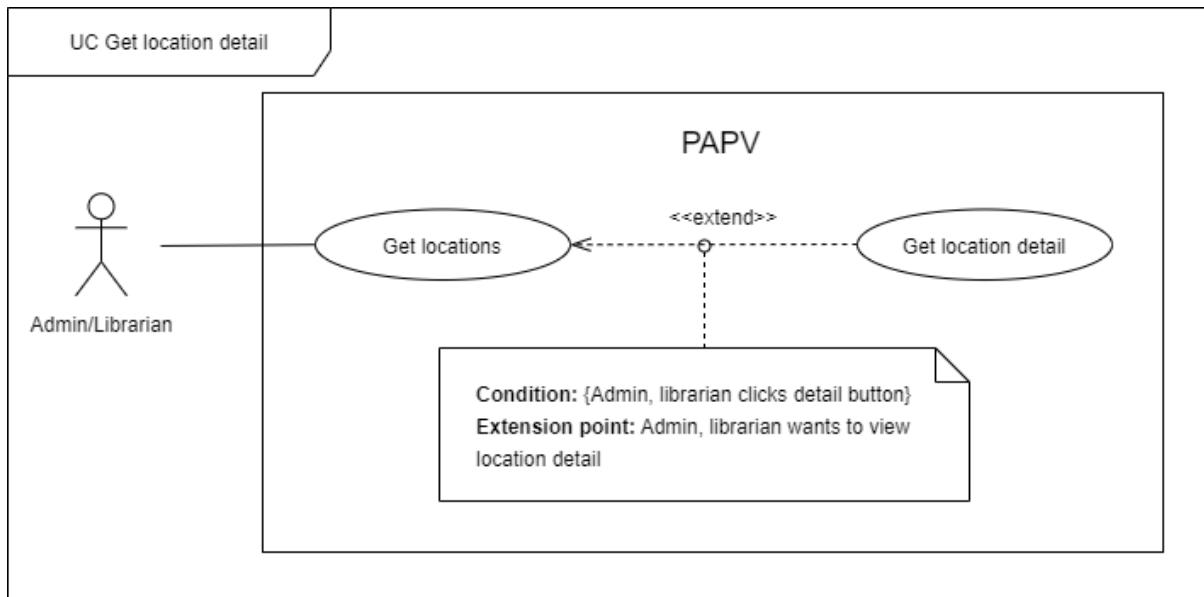


Figure 3 - <Use Case> Get Location Detail

ID and Name:	UC-10 Get location detail		
Created By:	HoangTT	Date Created:	18/01/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get detailed information of the location in library.		
Trigger:	Admin, librarian send request to get location detail.		
Preconditions:	PRE-01. User has logged in web as admin, librarian role.		
Post-conditions:	POST-01. PAPV returns detailed information of the location.		
Normal Flow:	10.0 Get location detail <ol style="list-style-type: none"> 1. Admin, librarian click "Detail" button on specific location. 2. PAPV will display popup to view detailed information of location 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, admin or librarian cannot get location detail.		

Assumptions:	N/A
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Table 20 - <Use Case> Get Location Detail

2.2.1.8 <Admin> Update Location

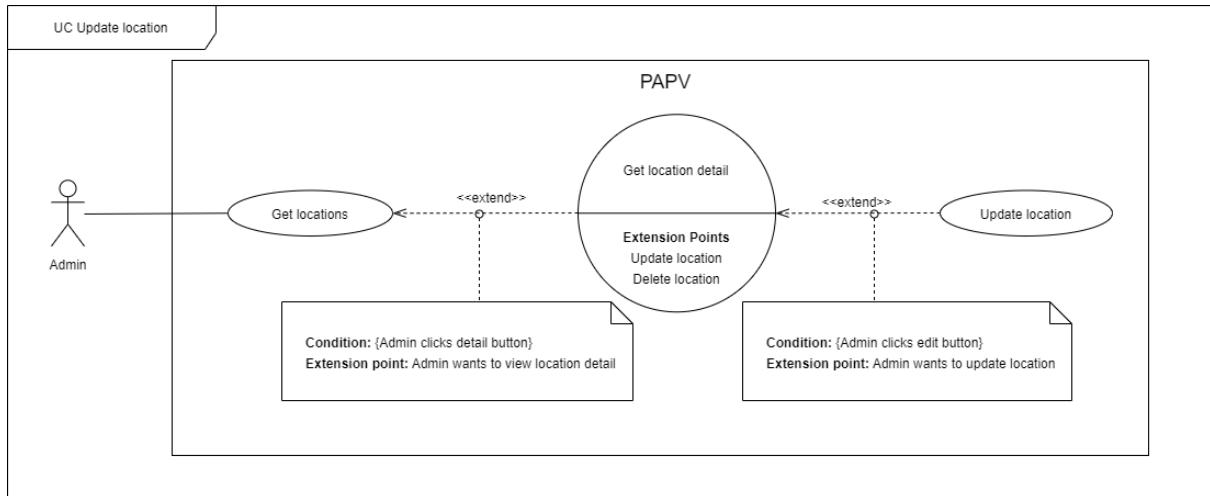


Figure 4 - <Use Case> Update Location

ID and Name:	UC-11 Update location		
Created By:	HoangTT	Date Created:	20/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to update information of the location.		
Trigger:	Admin send request to update location's information.		
Pre-conditions:	PRE-01. User has logged in the web as admin role.		
Post-conditions:	POST-01. Location's information had been updated.		
Normal Flow:	<p>11.0 Update location</p> <ol style="list-style-type: none"> 1. Admin clicks on “Edit” button on pop up of location’s detail 2. PAPV will re-render pop up for update location detail 3. Admin fills in the location’s information detail (see 10.0.E1, 10.0.E2) 4a. Admin clicks on “Save” button 4a.1. PAPV validates the updated location’s information and stores them 4b. Admin clicks on “Cancel” button 4b.1. PAPV close the pop up, nothing changes 		
Alternative Flows:	N/A		
Exceptions:	<p>11.0.E1 Admin fails to fill in all the required fields</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill in the missing fields (MSG06) 		

	<p>2a. If admin input required fields again, return to step 3 of normal flow</p> <p>2b. Else if admin cancels the update location process, then PAPV terminates use case</p> <p>11.0.E2 Admin enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG07) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the update location process, then PAPV terminates use case
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-12
Other Information:	In case of internet connection failure, Admin cannot update location
Assumptions:	N/A

Table 21 - <Use Case> Update Location

2.2.1.9 <Admin> Delete Location

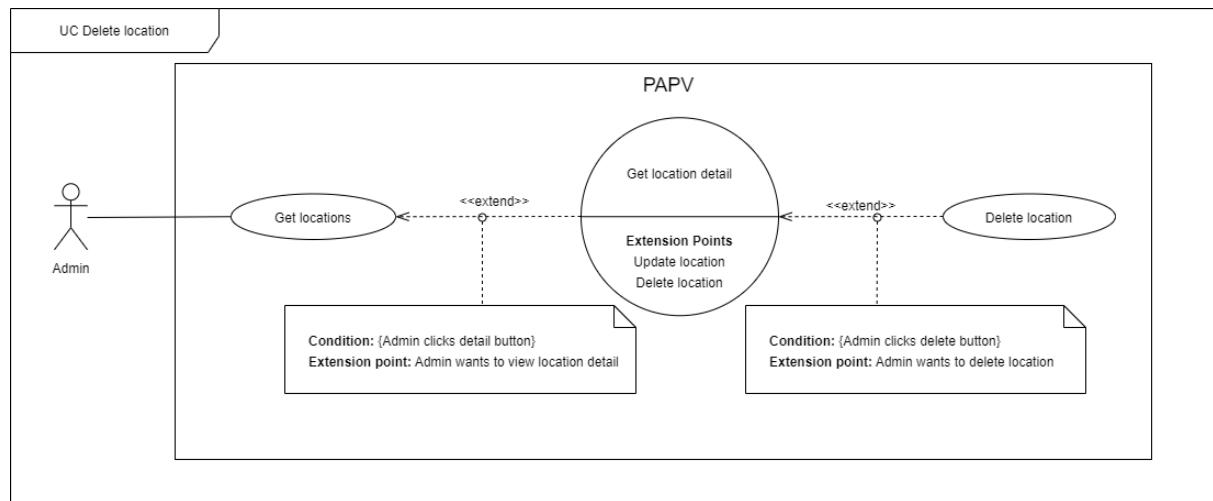


Figure 5 - <Use Case> Delete Location

ID and Name:	UC-12 Delete location		
Created By:	HoangTT	Date Created:	22/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to delete a location		
Trigger:	Admin send request to delete a location		

Preconditions:	PRE-01. User has logged in web as admin role
Post-conditions:	POST-01. PAPV removes the location
Normal Flow:	<p>12.0 Delete location</p> <ol style="list-style-type: none"> 1. Admin clicks “Detail” button in specific location 2. System show location detail with delete button 3.1. Admin clicks on “Delete” button, PAPV remove selected location 3.2. Admin close popup, nothing changes
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-15
Other Information:	In case of internet connection failure, Admin cannot delete location.
Assumptions:	N/A

Table 22 - <Use Case> Delete Location

2.2.1.10 <Admin> Get Patrons

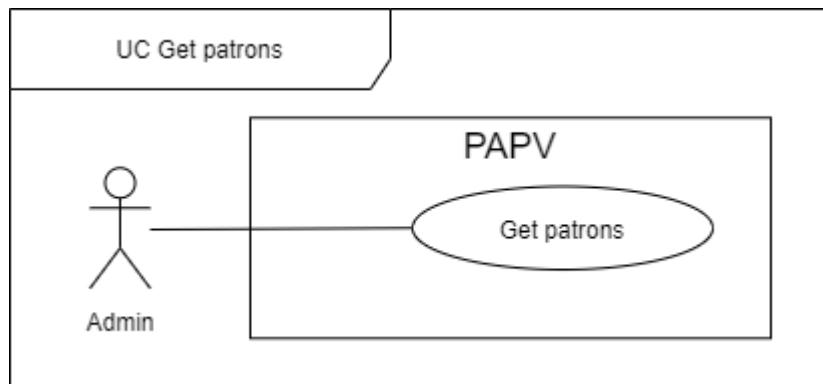


Figure 6 - <Use Case> Get Patrons

ID and Name:	UC-13 Get patrons		
Created By:	HoangTT	Date Created:	23/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to get patrons that they manage.		
Trigger:	Admin send request to get patron list.		
Pre-conditions:	PRE-01. User has logged in the web as admin role		

Post-conditions:	POST-01. PAPV return patron list
Normal Flow:	<p>13.0 Get patrons</p> <ol style="list-style-type: none"> 1. Admin send request to get patrons 2. PAPV return list patron (see 13.0.E1)
Alternative Flows:	N/A
Exceptions:	<p>13.0.E1 Admin has no patron to manage</p> <ol style="list-style-type: none"> 1. PAPV returns message: MSG05
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-07, BR-16, BR-18
Other Information:	In case of internet connection failure, Admin cannot get patrons.
Assumptions:	N/A

Table 23 - <Use Case> Get Patrons

2.2.1.11 <Admin> Get Patron Detail

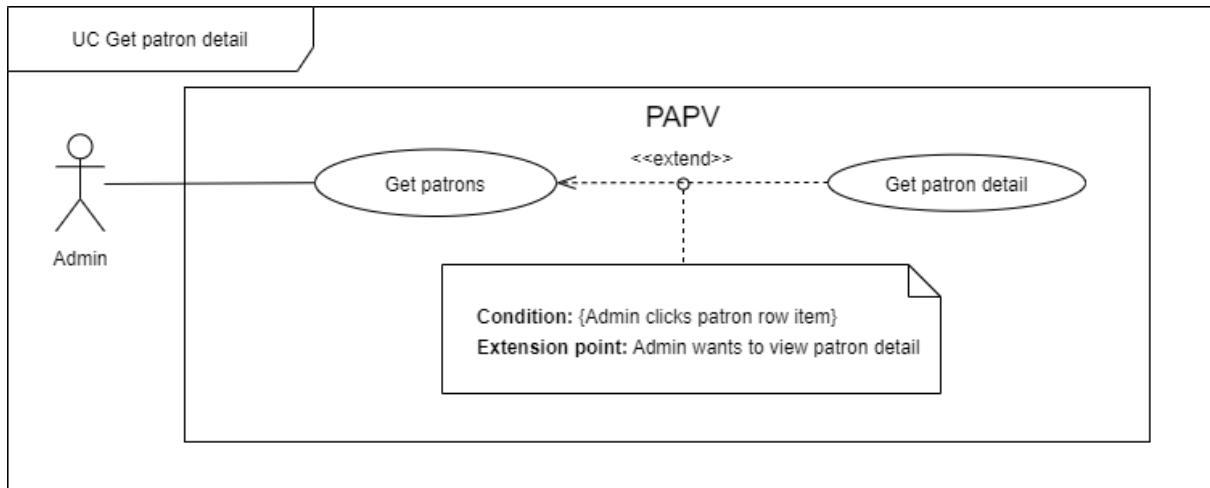


Figure 7 - <Use Case> Get Patron Detail

ID and Name:	UC-14 Get patron detail		
Created By:	HoangTT	Date Created:	25/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin get detailed information of the patron.		
Trigger:	Admin send request to get detailed information of the patron.		
Pre-conditions:	PRE-01. User has logged in the web as admin role.		

Post-conditions:	POST-01. PAPV returns patron's information detail.
Normal Flow:	<p>14.0 Get patron detail</p> <ol style="list-style-type: none"> 1. Admin double click on specific patron. 2. PAPV will display drawer popup to view patron's information details.
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	N/A
Other Information:	In case of internet connection failure, admin cannot get patron detail.
Assumptions:	N/A

Table 24 - <Use Case> Get patron detail

2.2.1.12 <Admin> Create Librarian

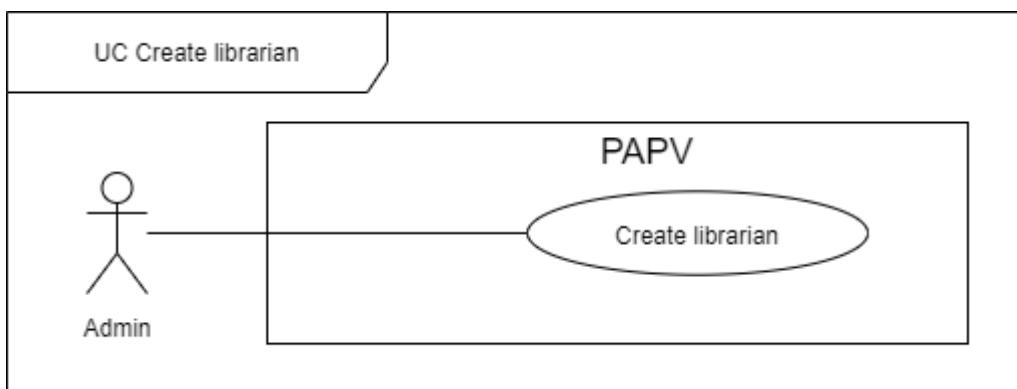


Figure 8 - <Use Case> Create Librarian

ID and Name:	UC-15 Create librarian		
Created By:	PhuNH	Date Created:	26/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to create librarian.		
Trigger:	Admin send request to create librarian.		
Pre-conditions:	PRE-01. User has logged in the web as admin role.		
Post-conditions:	POST-01. PAPV return a message that librarian has been created successfully. PAPV stores librarian detail.		
Normal Flow:	15.0 Create librarian		

	<ol style="list-style-type: none"> 1. Admin click “New Librarian” button to send request to create librarian. 2. PAPV will show a form requires identity information of librarian: <ul style="list-style-type: none"> - “Name”: text input, blank, required - “Address”: text input, blank, required - “Gender”: select, blank, required - “Date of birth”: date picker, blank, required - “Phone”: text input, blank, required - “Username”: text input, blank, required - “Email”: text input, blank, required - “Password”: text input, blank, required - “Confirm password”: text input, blank, required - “Avatar”: file picker, blank, required 3. Admin fills in the librarian information (see 15.0.E1, 15.0.E2, 15.0.E3, 15.0.E4) 4. Admin click “Save” button to send request to create librarian. 5. PAPV validates the librarian information and stores them
Alternative Flows:	N/A
Exceptions:	<p>15.0.E1 Admin fails to fill in all the requires fields</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG01, MSG08, MSG09, MSG10, MSG11, MSG12, MSG13, MSG14) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the create librarian process, then PAPV terminates use case <p>15.0.E2 Admin enters password and confirm password are not matched</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the password or confirm password again (MSG15) 2a. If admin input password or confirm password again, return to step 3 of normal flow 2b. Else if admin cancels the create librarian process, then PAPV terminates use case <p>15.0.E3 Admin enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG07, MSG16, MSG17, MSG19, MSG20, MSG21) 2a. If admin input required fields again, return to step 3 of normal flow

	<p>2b. Else if admin cancels the create librarian process, then PAPV terminates use case</p> <p>15.0.E4 Admin enters username or email of librarian exists in the system</p> <ol style="list-style-type: none"> PAPV returns to admin to fill username or email of librarian again (MSG30) If admin input required information again, return to step 3 of normal flow Else if admin cancels the create librarian process, then PAPV terminates use case
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-05, BR-19, BR-75
Other Information:	In case of internet connection failure, Admin cannot create librarian
Assumptions:	N/A

Table 25 - <Use Case> Create Librarian

2.2.1.13 <Admin> Get Librarians

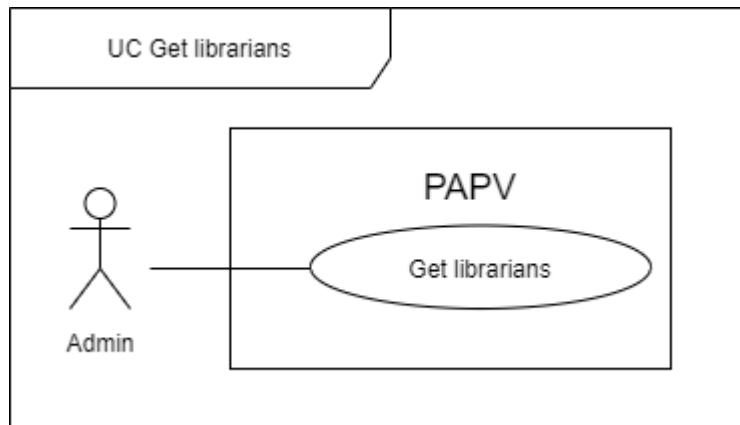


Figure 9 - <Use Case> Get Librarians

ID and Name:	UC-16 Get librarians		
Created By:	HoangTT	Date Created:	28/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to get librarians that they manage		
Trigger:	Admin send request to get librarian list		

Pre-conditions:	PRE-01. User has logged in the web as admin role
Post-conditions:	POST-01. PAPV return librarian list
Normal Flow:	<p>16.0 Get librarians</p> <ol style="list-style-type: none"> 1. Admin send request to get librarians 2. PAPV return list librarian (see 16.0.E1)
Alternative Flows:	N/A
Exceptions:	<p>16.0.E1 Admin has no librarian to manage</p> <ol style="list-style-type: none"> 1. PAPV returns message: MSG05
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-07, BR-16, BR-20
Other Information:	In case of internet connection failure, Admin cannot get librarians.
Assumptions:	N/A

Table 26 - <Use Case> Get Librarians

2.2.1.14 <Admin> Get Librarian Detail

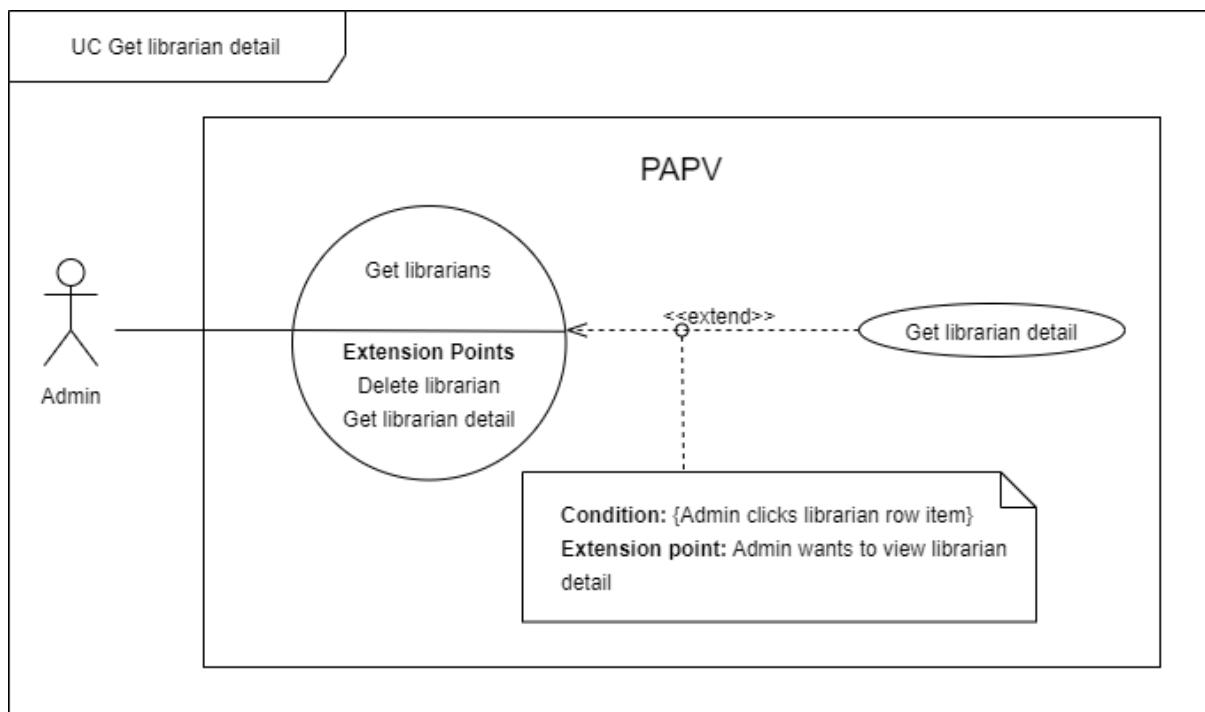


Figure 10 - <Use Case> Get Librarian Detail

ID and Name:	UC-17 Get librarian detail
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Created By:	HoangTT	Date Created:	30/01/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin get detailed information of the librarian.		
Trigger:	Admin send request to get librarian detail.		
Pre-conditions:	PRE-01. User has logged in the web as admin role.		
Post-conditions:	POST-01. PAPV returns librarian's information details		
Normal Flow:	<p>17.0 Get librarian information detail</p> <ol style="list-style-type: none"> 1. Admin clicks on specific librarian 2. PAPV will display drawer pop up to view librarian information details 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, admin cannot get librarian detail.		
Assumptions:	N/A		

Table 27 - <Use Case> Get Librarian Detail

2.2.1.15 <Admin> Update Librarian

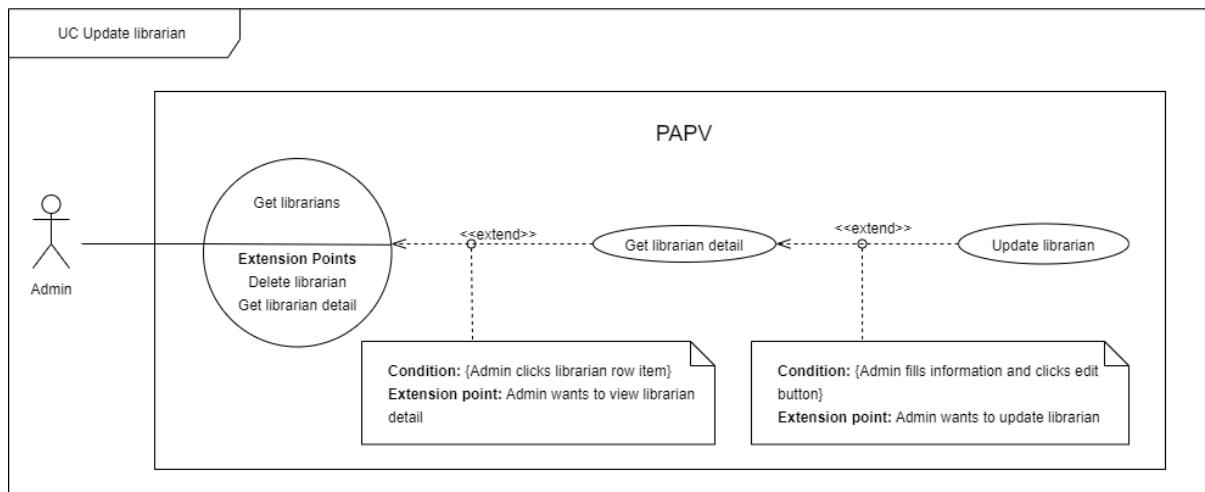


Figure 211 - <Use Case> Update Librarian

ID and Name:	UC-18 Update librarian		
Created By:	PhuNH	Date Created:	18/01/2021

Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to update librarian's information detail		
Trigger:	Admin send request to update information of the librarian		
Preconditions:	PRE-01. User has logged in web as admin role		
Post-conditions:	POST-01. Librarian information has been updated		
Normal Flow:	<p>18.0 Update librarian</p> <ol style="list-style-type: none"> 1. Admin clicks on “Edit” button on pop up of librarian detail 2. PAPV will show popup for edit librarian detail 3. Admin fills in the librarian information detail form (see 18.0.E1, 18.0.E2) 4a. Admin clicks on “Save” button <ul style="list-style-type: none"> 4a.1. PAPV validates the updated librarian information and stores them 4b. Admin clicks on “Cancel” button 4b.1. PAPV close the pop up, nothing changes 		
Alternative Flows:	N/A		
Exceptions:	<p>18.0.E1 Admin fails to fill in all the required fields</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG01, MSG08, MSG09, MSG10, MSG11, MSG12, MSG13, MSG14) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the update librarian process, then PAPV terminates use case <p>18.0.E2 Admin enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to admin to fill the required fields again (MSG07, MSG16, MSG17, MSG19, MSG20, MSG21) 2a. If admin input required fields again, return to step 3 of normal flow 2b. Else if admin cancels the update librarian process, then PAPV terminates use case 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-21		
Other Information:	In case of internet connection failure, Admin cannot update detailed information of librarian.		
Assumptions:	N/A		

Table 28 - <Use Case> Update Librarian

2.2.1.16 <Admin> Delete Librarian

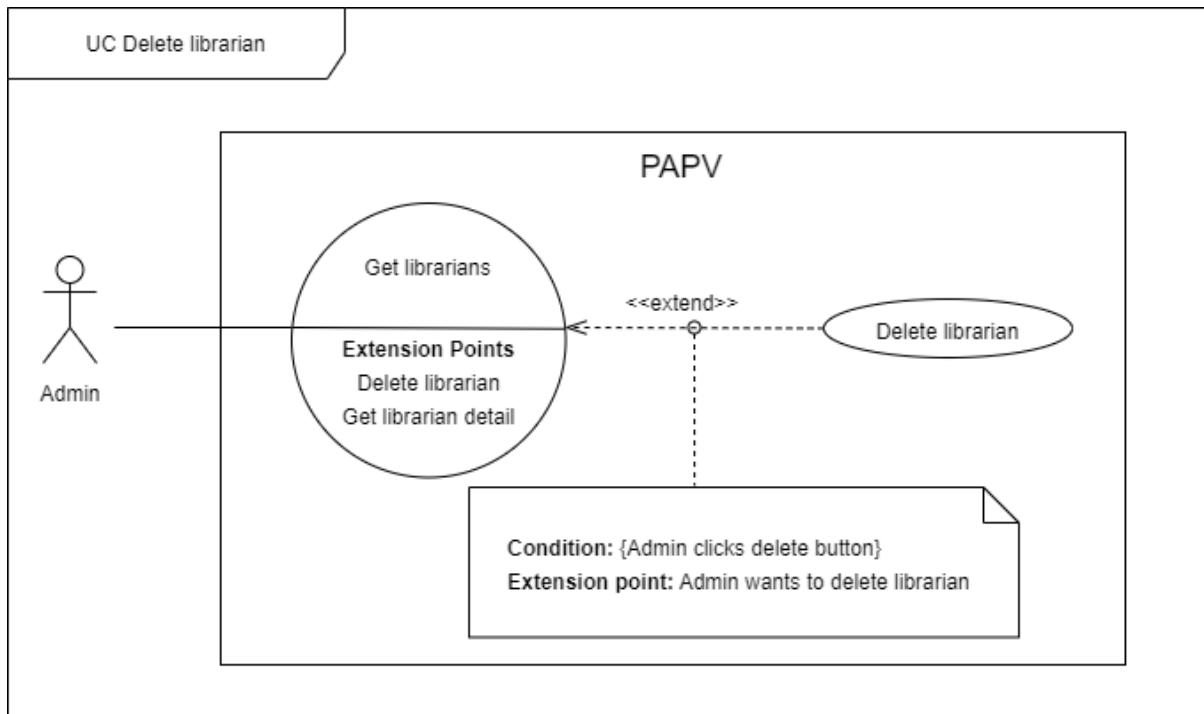


Figure 12 - <Use Case> Delete Librarian

ID and Name:	UC-19 Delete librarian		
Created By:	HoangTT	Date Created:	01/02/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to delete one or more librarian		
Trigger:	Admin send request to delete one or more librarian		
Preconditions:	PRE-01. User has logged in web as admin role		
Post-conditions:	POST-01. PAPV removes the librarian		
Normal Flow:	<p>19.0 Delete librarian</p> <ol style="list-style-type: none"> 1. Admin clicks delete icon on the librarian want to delete 2. System will display popup with message: "Are you sure?" and two buttons for admin can select: <ul style="list-style-type: none"> - "Yes" button - "No" button 3.1. Admin clicks on "Yes" button, PAPV remove selected librarian 3.2. Admin clicks on "No" button, close popup and nothing change 		
Alternative Flows:	N/A		

Exceptions:	N/A
Priority:	Medium
Frequency of Use:	Sometimes.
Business Rules:	BR-22
Other Information:	In case of internet connection failure, admin cannot delete librarian
Assumptions:	N/A

Table 29 - <Use Case> Delete Librarian

2.2.1.17 <Admin> Get Book Groups

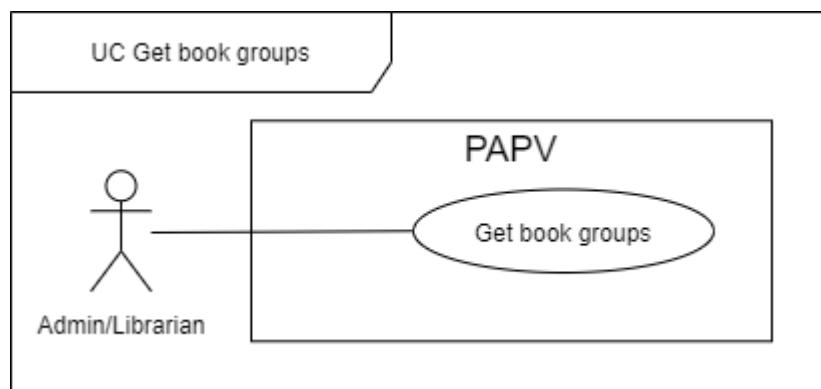


Figure 13 - <Use Case> Get Book Groups

ID and Name:	UC-20 Get book groups		
Created By:	PhuNH	Date Created:	03/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get book groups that they manage		
Trigger:	Admin, librarian send request to get book group list		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV return book groups list		
Normal Flow:	20.0 Get book groups <ol style="list-style-type: none"> 1. Admin, librarian send request to get list book group 2. PAPV return list book groups (see 20.0.E1) 		
Alternative Flows:	N/A		
Exceptions:	20.0.E1 Admin or librarian has no book group to manage <ol style="list-style-type: none"> 1. PAPV returns message: MSG05 		

Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-06, BR-07, BR-25
Other Information:	In case of internet connection failure, admin or librarian cannot get book groups.
Assumptions:	N/A

Table 30 - <Use Case> Get Book Groups

2.2.1.18 <Admin> Get Book Group Detail

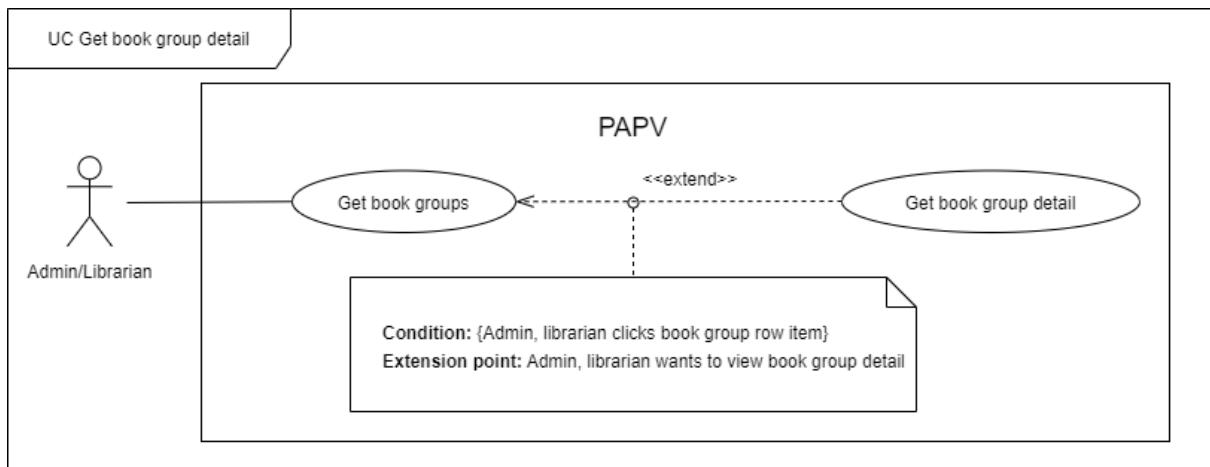


Figure 14 - <Use Case> Get Book Group Detail

ID and Name:	UC-21 Get book group detail		
Created By:	PhuNH	Date Created:	05/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian get detailed information of the book group		
Trigger:	Admin, librarian send request to view book group detail		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV returns book group information details		
Normal Flow:	21.0 Get book group detail <ol style="list-style-type: none"> 1. Admin, librarian click on specific book group on tables 2. PAPV will display drawer popup to view book group information details 		
Alternative Flows:	N/A		
Exceptions:	N/A		

Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	N/A
Other Information:	In case of internet connection failure, admin or librarian cannot get book group detail.
Assumptions:	N/A

Table 31 - <Use Case> Get Book Group Detail

2.2.1.19 <Admin> Get Patron's Feedbacks

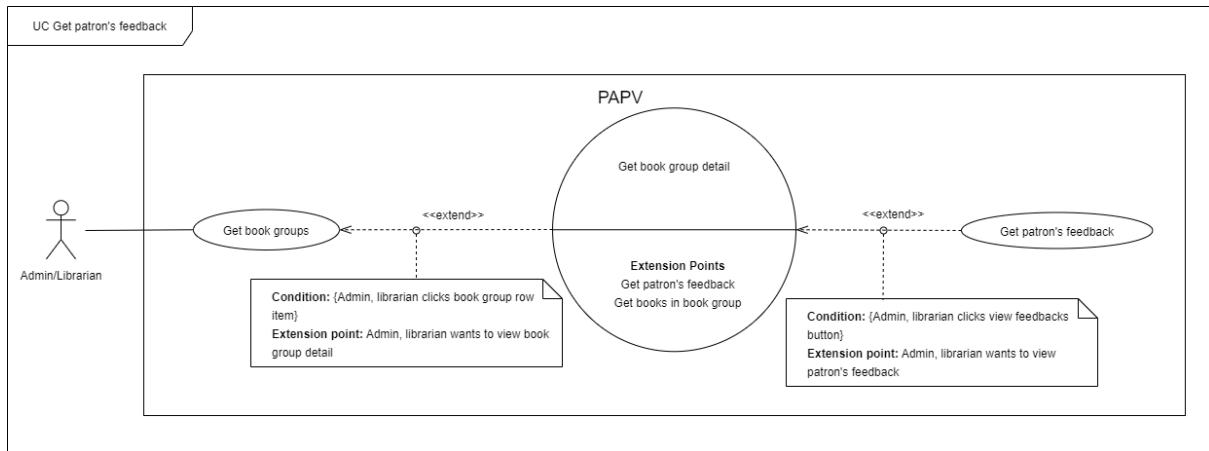


Figure 15 - <Use Case> Get Patron's Feedbacks

ID and Name:	UC-22 Get patron's feedbacks		
Created By:	PhuNH	Date Created:	25/01/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to view patron's feedback of a specific book group that they manage		
Trigger:	Admin, librarian send request to get patron's feedbacks of a specific book group		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV return patron's feedback of selected book group		
Normal Flow:	<p>22.0 Getr patron's feedbacks</p> <ol style="list-style-type: none"> 1. Admin, librarian send request to get all patron's feedback of a selected book group 2. PAPV return list patron's feedbacks (see 22.0.E1) 		
Alternative Flows:	N/A		

Exceptions:	22.0.E1 Selected book group don't have any feedbacks 1. PAPV returns message: MSG05
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-23
Other Information:	In case of internet connection failure, admin or librarian cannot get patron's feedbacks of selected books
Assumptions:	N/A

Table 32 - <Use Case> Get Patron's Feedbacks

2.2.1.20 <Admin> Delete Patron's Feedbacks

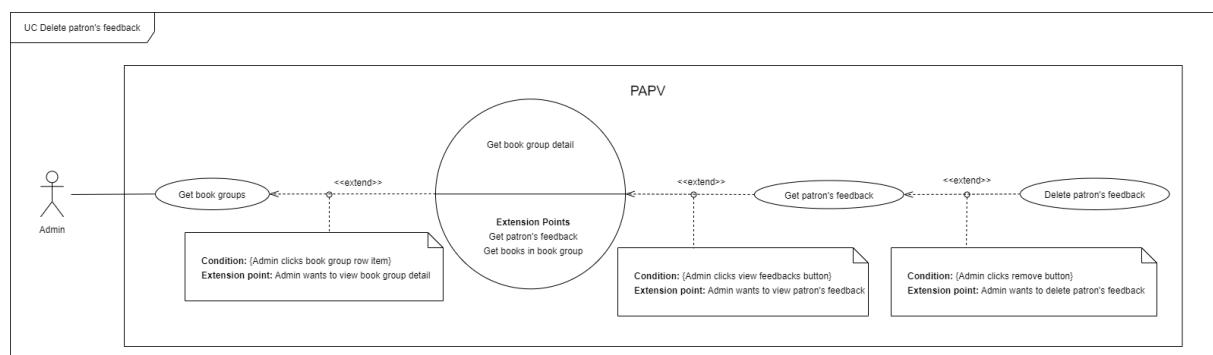


Figure 16 - <Use Case> Delete Patron's Feedbacks

ID and Name:	UC-23 Delete patron's feedback		
Created By:	LinhNH	Date Created:	07/02/2021
Primary Actor:	Admin	Secondary Actors:	N/A
Description:	This feature allows admin to delete patron's feedback of a specific book group		
Trigger:	Admin send request to delete patron's feedbacks of selected book group		
Preconditions:	PRE-01. User has logged in web as admin role		
Post-conditions:	POST-01. PAPV removes the patron's feedbacks in selected book group		
Normal Flow:	<p>23.0 Delete patron's feedbacks</p> <ol style="list-style-type: none"> 1. Admin clicks "Remove" button on specific feedback 2. System show delete popup with message: "Are you sure?" and two buttons for admin can select: <ul style="list-style-type: none"> - "Ok" button - "Cancel" button 		

	<p>3.1. Admin clicks on “Ok” button, PAPV remove feedback of selected book group</p> <p>3.2. Admin clicks on “Cancel” button, close popup and nothing change</p>
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium
Frequency of Use:	Sometimes.
Business Rules:	BR-24
Other Information:	In case of internet connection failure, Admin cannot delete patron's feedbacks of selected book groups.
Assumptions:	N/A

Table 33 - <Use Case> Delete Patron's Feedback

2.2.1.21 <Admin> Get Books In Book Group

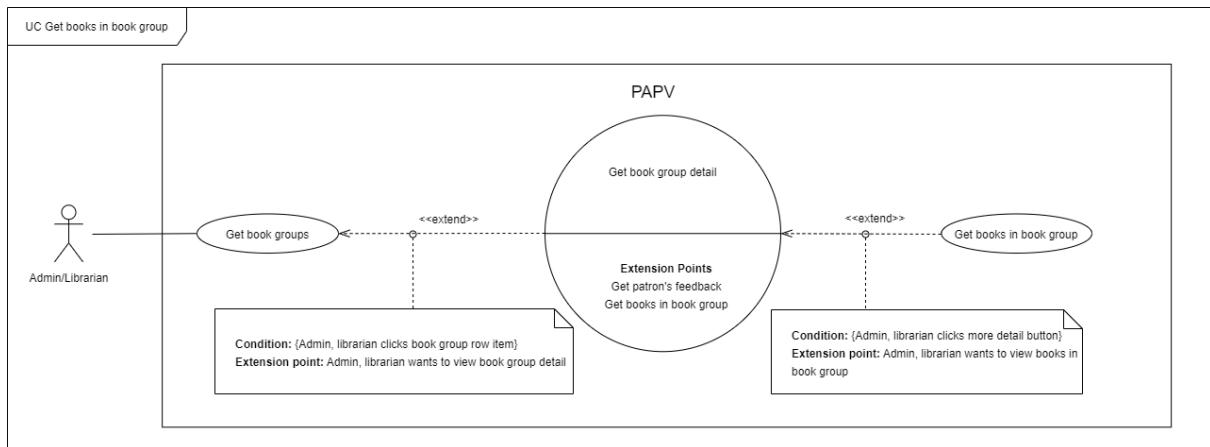


Figure 17 - <Use Case> Get Books In Book Group

ID and Name:	UC-24 Get books in book group		
Created By:	LinhNH	Date Created:	10/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get books in selected book group		
Trigger:	Admin, librarian send request to get books in book group that they wanted		
Preconditions:	PRE-01. User has logged in web as admin, librarian role		
Post-conditions:	POST-01. PAPV returns list books in selected book group		
Normal Flow:	24.0 Get books in book group		

	<ol style="list-style-type: none"> 1. Admin, librarian clicks on specific book group to get detail information of book group 2. Admin, librarian clicks “More detail” button 3. PAPV return list of books in selected book group
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium
Frequency of Use:	Sometimes.
Business Rules:	BR-26
Other Information:	In case of internet connection failure, admin or librarian cannot get books in book group
Assumptions:	N/A

Table 34 - <Use Case> Get Books In Book Group

2.2.1.22 <Admin> Get Specific Drawers

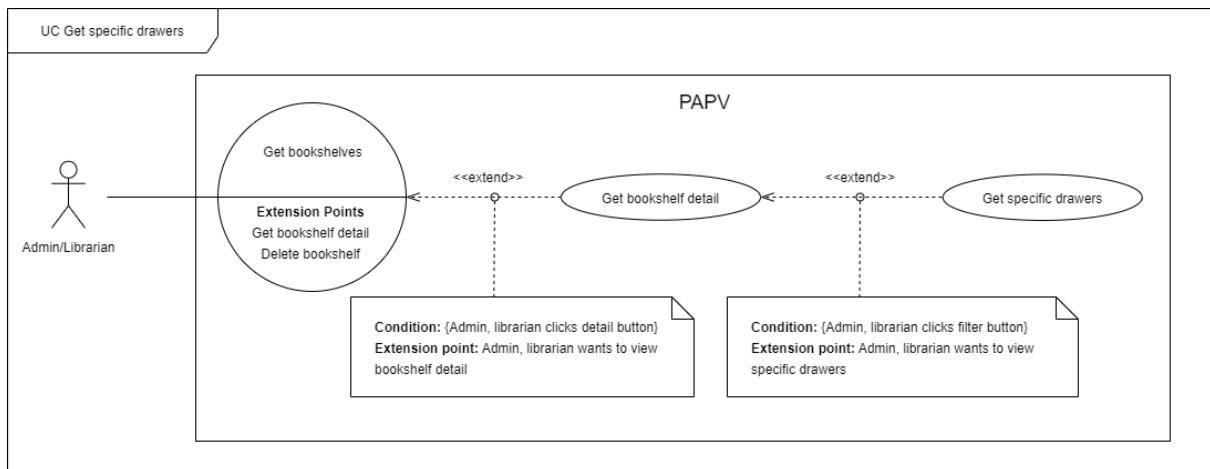


Figure 18 - <Use Case> Get Specific Drawers

ID and Name:	UC-25 Get specific drawers		
Created By:	LinhNH	Date Created:	12/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin or librarian to filter drawer to view specific drawer in a bookshelf		
Trigger:	Admin, librarian send request to get drawer they wanted		
Preconditions:	PRE-01. User has logged in web as admin, librarian role		
Post-conditions:	POST-01. PAPV returns drawers they wanted		

Normal Flow:	25.0 Get specific drawers <ol style="list-style-type: none"> 1. Admin, librarian select row and column in the bookshelf to get the wanted drawers 2. Admin, librarian clicks “Filter” button 3. PAPV return list of drawers by row and column that admin, librarian selected
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium
Frequency of Use:	Sometimes.
Business Rules:	BR-27
Other Information:	In case of internet connection failure, admin or librarian cannot get specific drawers.
Assumptions:	N/A

Table 35 - <Use Case> Get Specific Drawers

2.2.1.23 <Admin> Get Books In Drawer

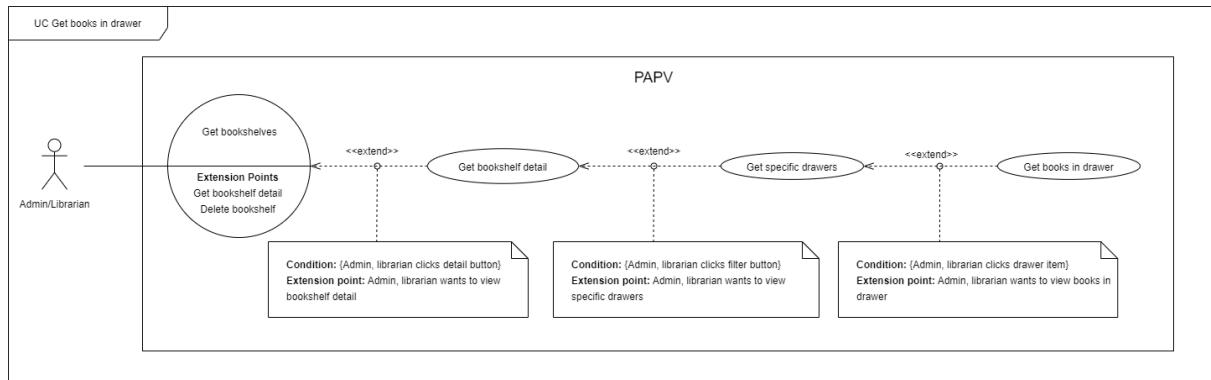


Figure 19 - <Use Case> Get Books In Drawer

ID and Name:	UC-26 Get books in drawer		
Created By:	LinhNH	Date Created:	14/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin or librarian to get all book in a specific drawer that they manage		
Trigger:	Admin, librarian send request to get books in a specific drawer		
Preconditions:	PRE-01. User has logged in web as admin, librarian role		

Post-conditions:	POST-01. PAPV returns book in drawer
Normal Flow:	<p>26.0 Get books in a drawer</p> <ol style="list-style-type: none"> 1. Admin, librarian clicks on a specific drawer (see 26.0.E1) 2. PAPV shows a popup and returns book list in selected drawer
Alternative Flows:	N/A
Exceptions:	<p>26.0.E1 PAPV has no book in selected drawer</p> <ol style="list-style-type: none"> 1. PAPV returns messages: MSG05
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-06, BR-07, BR-28
Other Information:	In case of internet connection failure, admin or librarian cannot get books in specific drawers.
Assumptions:	N/A

Table 36 - <Use Case> Get Books In Drawer

2.2.1.24 <Admin> Get Detections

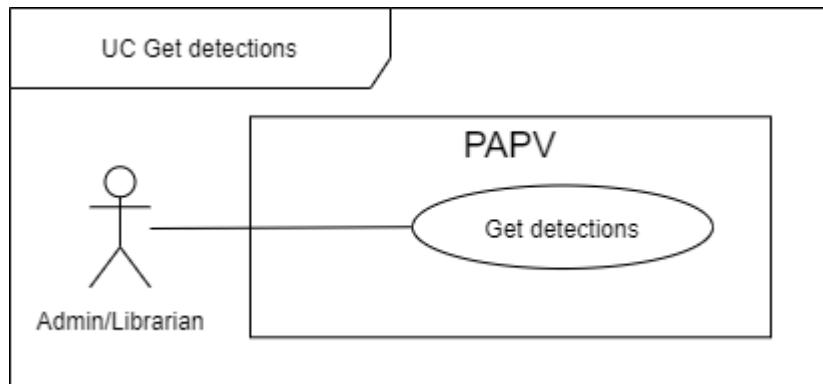


Figure 30 - <Use Case> Get Detections

ID and Name:	UC-27 Get detections		
Created By:	KhanhTD	Date Created:	16/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian to get detections that they manage		
Trigger:	Admin, librarian send request to get detections list		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV return detections list		
Normal Flow:	27.0 Get detections		

	<ol style="list-style-type: none"> 1. Admin, librarian send request to get detections 2. PAPV return list detections (see 27.0.E1)
Alternative Flows:	N/A
Exceptions:	27.0.E1 Admin or librarian has no detections to manage 1. PAPV returns message: MSG05
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-07, BR-29
Other Information:	In case of internet connection failure, admin or librarian cannot get detections
Assumptions:	N/A

Table 37 - <Use Case> Get Detections

2.2.1.25 <Admin> Get Drawer Detections

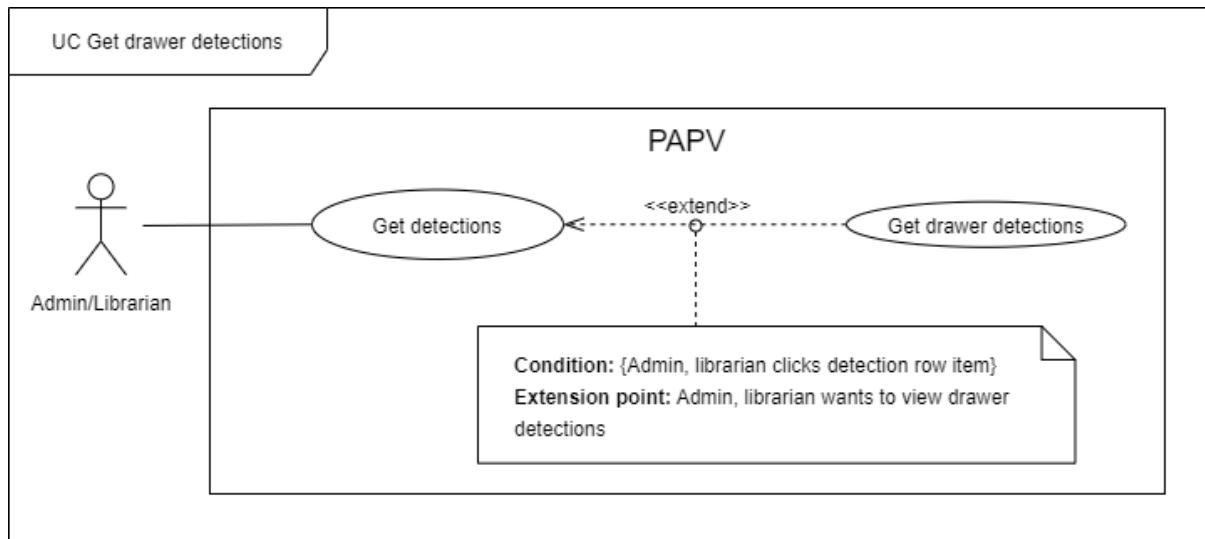


Figure 31 - <Use Case> Get Drawer Detections

ID and Name:	UC-28 Get drawer detections		
Created By:	KhanhTD	Date Created:	19/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian view drawer detections in specific detections.		
Trigger:	Admin, librarian send request to get drawer detections.		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		

Post-conditions:	POST-01. PAPV returns drawer detections information.
Normal Flow:	<p>28.0 Get drawer detections</p> <ol style="list-style-type: none"> 1. Admin, librarian click on specific detection on tables. 2. PAPV will display popup to view drawer detections information.
Alternative Flows:	N/A
Exceptions:	<p>28.0.E1 Admin or librarian has no drawer in this detection to manage</p> <ol style="list-style-type: none"> 1. PAPV returns message: MSG31
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-30, BR-31, BR-76
Other Information:	In case of internet connection failure, admin or librarian cannot get drawer detections.
Assumptions:	N/A

Table 38 - <Use Case> Get Drawer Detection

2.2.1.26 <Admin> Get Drawer Detections Messages

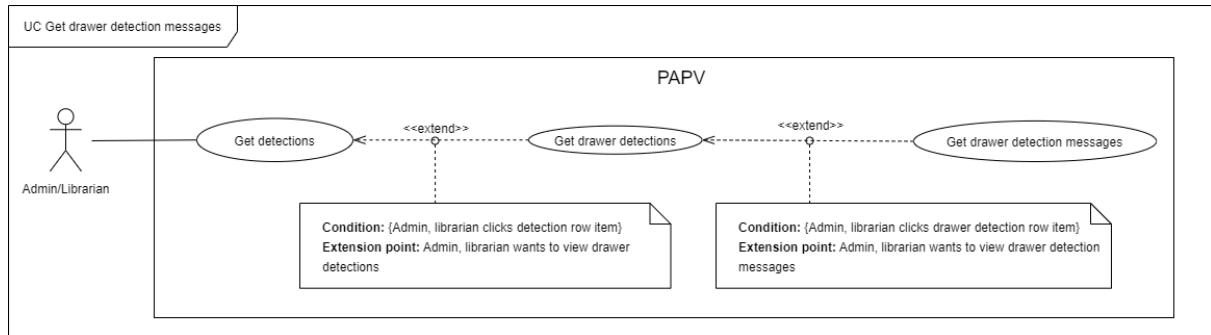


Figure 20 - <Use Case> Get Drawer Detections Messages

ID and Name:	UC-29 Get drawer detection messages		
Created By:	KhanhTD	Date Created:	22/02/2021
Primary Actor:	Admin, Librarian	Secondary Actors:	N/A
Description:	This feature allows admin and librarian view drawer detection messages in specific drawer detection.		
Trigger:	Admin, librarian send request to get drawer detection messages.		
Pre-conditions:	PRE-01. User has logged in the web as admin, librarian role		
Post-conditions:	POST-01. PAPV returns drawer detection messages.		
Normal Flow:	29.0 Get drawer detection messages.		

	<ol style="list-style-type: none"> 1. Admin, librarian click “+” button on specific drawer detection on tables. 2. PAPV will show specific message for each issue in drawer.
Alternative Flows:	N/A
Exceptions:	29.0.E1 Admin or librarian has no drawer detection messages to manage <ol style="list-style-type: none"> 1. PAPV returns message: MSG05
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-32, BR-33, BR-34, BR-35, BR-36, BR-77
Other Information:	In case of internet connection failure, admin or librarian cannot get drawer detection messages.
Assumptions:	N/A

Table 39 - <Use Case> Get Drawer Detection Messages

2.2.2 <Librarian> Overview Use Case

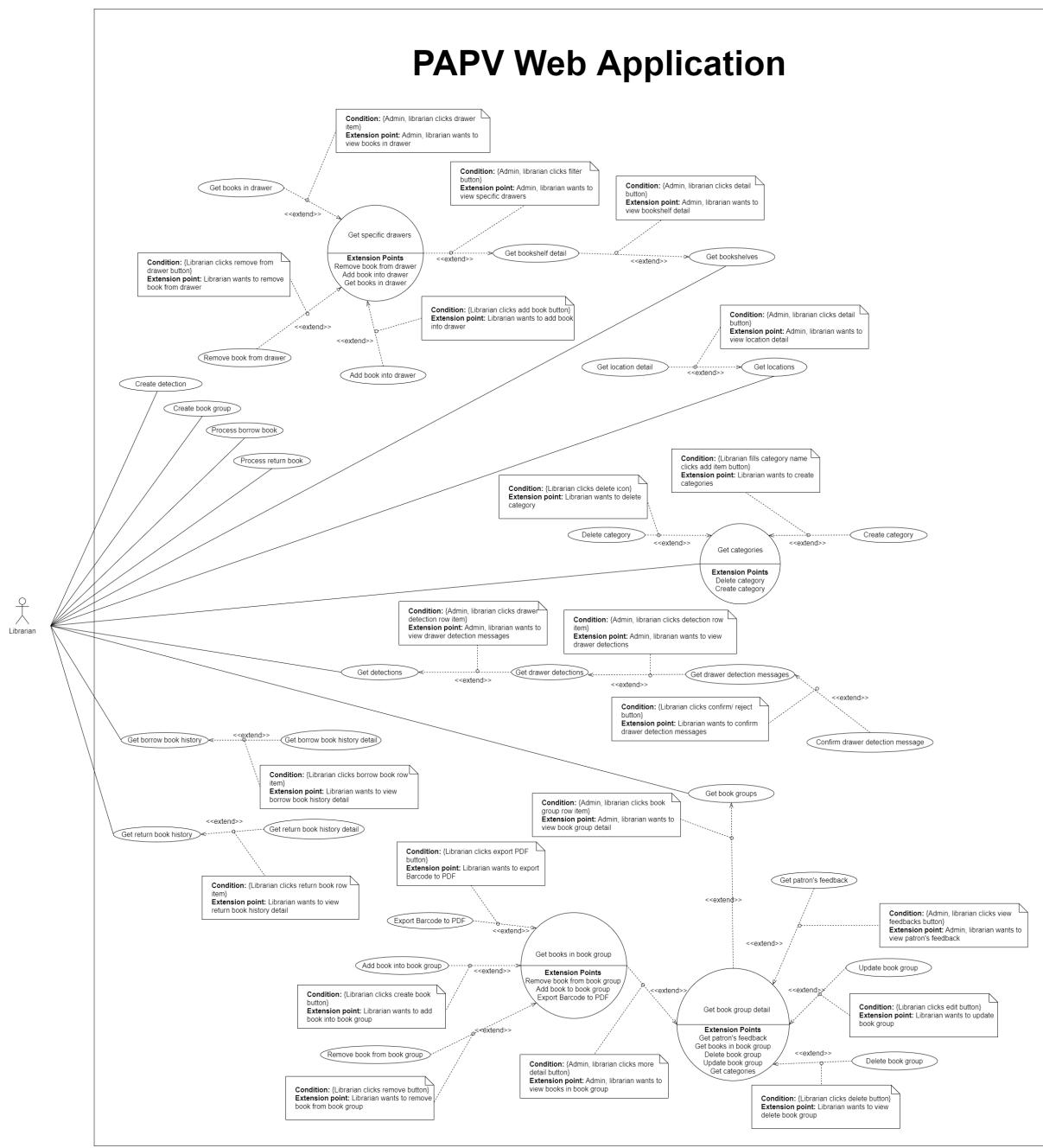


Figure 21 - <Overview Use Case> Librarian

2.2.2.1 <Librarian> Get Borrow Book History

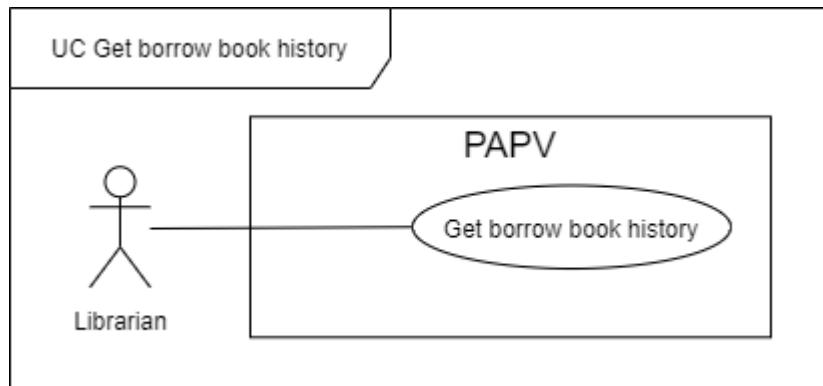


Figure 22 - <Use Case> Get Borrow Book History

ID and Name:	UC-30 Get borrow book history		
Created By:	PhuNH	Date Created:	25/02/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to get all borrow book history of patron		
Trigger:	Librarian send request to get borrow book history list		
Pre-conditions:	PRE-01. User has logged in the web as librarian role		
Post-conditions:	POST-01. PAPV return borrows book history list of all patron		
Normal Flow:	30.0 Get borrow book history <ol style="list-style-type: none"> 1. Librarian send request to get all borrow book history of patron 2. PAPV return all borrow book history in system (see 30.0.E1) 		
Alternative Flows:	N/A		
Exceptions:	30.0.E1 Librarian has no one ever borrowed books <ol style="list-style-type: none"> 1. PAPV returns message: MSG05 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-17, BR-79		
Other Information:	In case of internet connection failure, Librarian cannot get borrow history		
Assumptions:	N/A		

Table 40 - <Use Case>Get Borrow Book History

2.2.2.2 <Librarian> Get Borrow Book History Detail

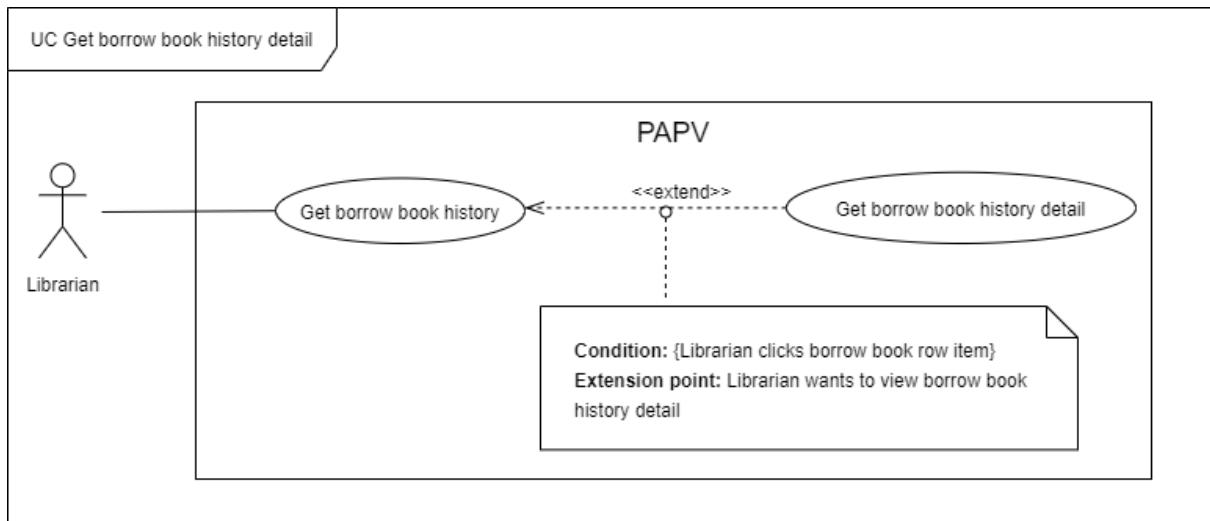


Figure 23 - <Use Case> Get Borrow Book History Detail

ID and Name:	UC-31 Get borrow book history detail		
Created By:	PhuNH	Date Created:	28/02/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to view borrow book detail of a specific borrow book		
Trigger:	Librarian send request to get borrow book history detail of a specific borrow book		
Pre-conditions:	PRE-01. User has logged in the web as librarian role		
Post-conditions:	POST-01. PAPV return borrows book history detail of selected borrow book		
Normal Flow:	<p>31.0 Get borrow book history detail</p> <ol style="list-style-type: none"> 1. Librarian send request to get borrow book detail of selected borrow book 2. PAPV return list borrow detail for this borrow book 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, Librarian cannot get borrow book history detail		

Assumptions:	N/A
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Table 41 - <Use Case> Get Borrow Book History Detail

2.2.2.3 <Librarian> Get Return Book History

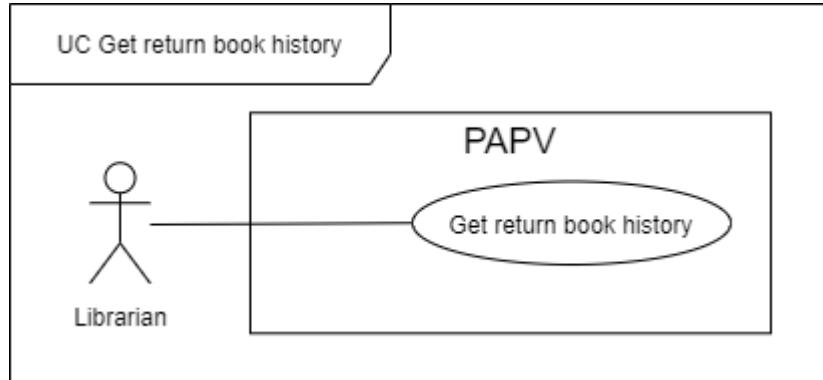


Figure 24 - <Use Case> Get Return Book History

ID and Name:	UC-32 Get return book history		
Created By:	PhuNH	Date Created:	02/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to get all return book history		
Trigger:	Librarian send request to get return book history list		
Pre-conditions:	PRE-01. User has logged in the web as librarian role		
Post-conditions:	POST-01. PAPV return returns book history list of all patron		
Normal Flow:	32.0 Get return book history <ol style="list-style-type: none"> 1. Librarian send request to get all return book history 2. PAPV return all return book history in system (see 32.0.E1) 		
Alternative Flows:	N/A		
Exceptions:	32.0.E1 Librarian has no one ever returned books <ol style="list-style-type: none"> 1. PAPV returns message: MSG05 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-17, BR-78		
Other Information:	In case of internet connection failure, Librarian cannot get all return history in system		
Assumptions:	N/A		

Table 42 - <Use Case> Get Return Book History

2.2.2.4 <Librarian> Get Return Book History Detail

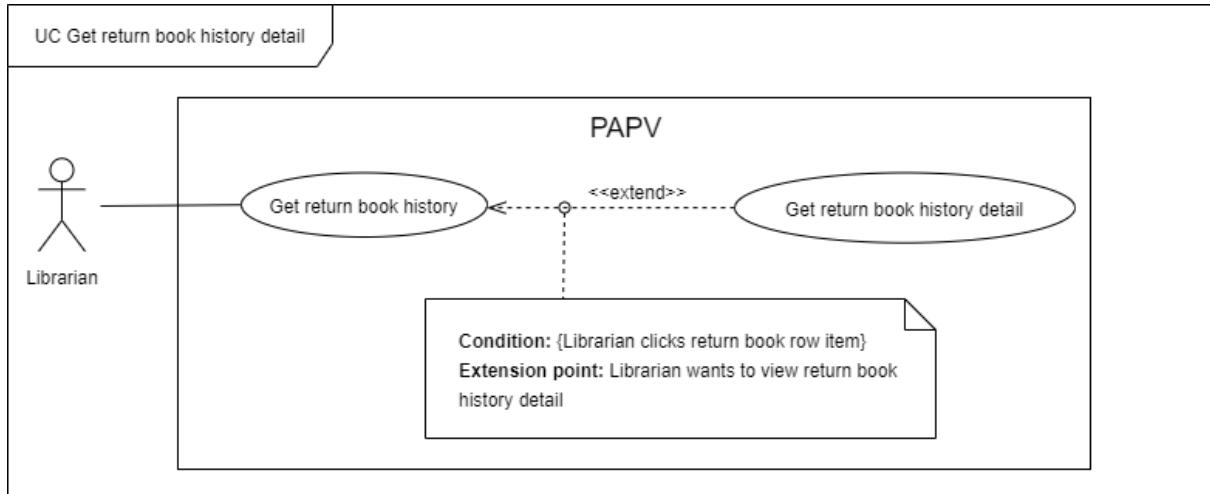


Figure 25 - <Use Case> Get Return Book History Detail

ID and Name:	UC-33 Get return book history detail		
Created By:	PhuNH	Date Created:	05/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to view return book detail of return book		
Trigger:	Librarian send request to get return book detail of return book		
Pre-conditions:	PRE-01. User has logged in the web as librarian role		
Post-conditions:	POST-01. PAPV return returns book history detail of selected return book history		
Normal Flow:	<p>33.0 Get return book history detail</p> <ol style="list-style-type: none"> 1. Librarian send request to get return book detail 2. PAPV return list return book detail for this return book 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, Librarian cannot get return book history detail.		
Assumptions:	N/A		

Table 43 - <Use Case> Get Return Book History Detail

2.2.2.5 <Librarian> Confirm Drawer Detection Messages

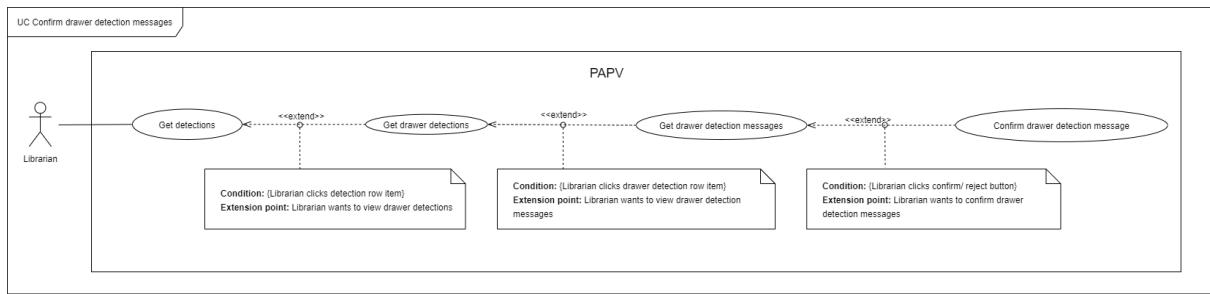
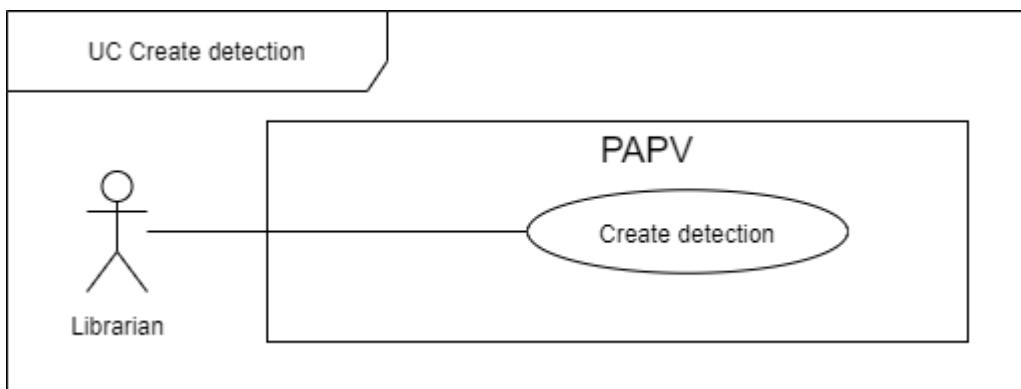


Figure 26 - <Use Case> Confirm Drawer Detection Messages

ID and Name:	UC-34 Confirm drawer detection messages		
Created By:	KhanhTD	Date Created:	07/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to confirm drawer detection messages.		
Trigger:	Librarian send request to confirm drawer detection messages.		
Pre-conditions:	PRE-01. User has logged in the web as librarian role.		
Post-conditions:	POST-01. PAPV will stores according to each type of error.		
Normal Flow:	<p>34.0 Confirm drawer detection messages.</p> <ol style="list-style-type: none"> 1. Librarian click on “Confirm” or “Reject” button on specific drawer detection messages. 2. PAPV will stores according to each type of error. 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-37, BR-38		
Other Information:	In case of internet connection failure, librarian cannot confirm drawer detection messages.		
Assumptions:	N/A		

Table 44 - <Use Case> Confirm Drawer Detection Messages

2.2.2.6 <Librarian> Create Detection



[Figure 27 - <Use Case> Create Detection](#)

ID and Name:	UC-35 Create detection		
Created By:	KhanhTD	Date Created:	10/01/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to create a detection to be able to detect books in the correct position or in the wrong position, if any books are lost		
Trigger:	Admin send request to create detection		
Pre-conditions:	PRE-01. User has logged in the web as librarian role.		
Post-conditions:	POST-01. PAPV returns the video of that detect, what drawers were detected and errors that appeared in that detect.		
Normal Flow:	<p>35.0 Create detection</p> <ol style="list-style-type: none"> 1. Librarian use the drone to record the video bookshelf you want to detect 2. Librarian get video from drone by cable 3. Librarian click “Upload video” button on web admin. 4. Librarian select bookshelf want to detect appear in the dropdown 5. Librarian click or drag file to the area and choose video from computer to upload that video received 6. Librarian click “Process” button to start detect process 7. PAPV will stores detection information detail 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		

Business Rules:	BR-05, BR-39, BR-40, BR-41, BR-42, BR-43
Other Information:	In case of internet connection failure, Librarian cannot create detection
Assumptions:	N/A

Table 45 - <Use Case> Create Detection

2.2.2.7 <Librarian> Process borrow book

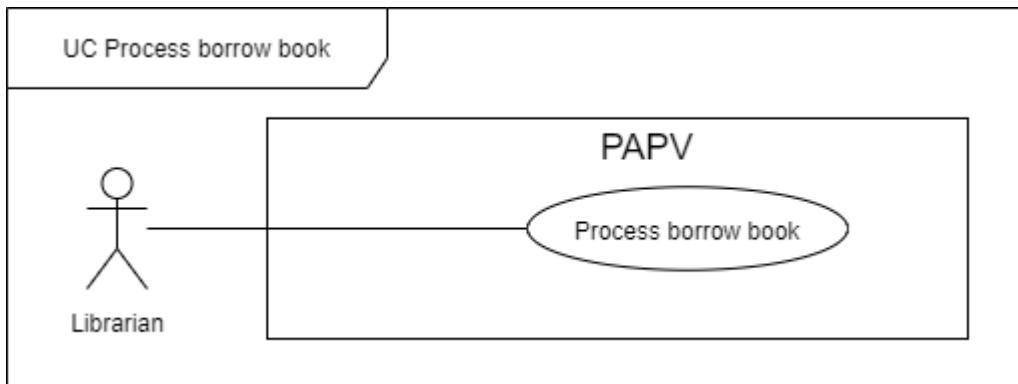


Figure 40 - <Use Case> Process Borrow Book

ID and Name:	UC-36 Process borrow book		
Created By:	PhuNH	Date Created:	08/03/2021
Primary Actor:	Librarian	Secondary Actors:	Patron
Description:	This feature allows librarian will help patrons borrow books by scanning the barcode pasted on the book		
Trigger:	Librarian send request to start borrow book process		
Pre-conditions:	PRE-01. User has logged in the web as librarian role.		
Post-conditions:	POST-01. The patron can borrow the book and the information about it will be stores by the PAPV		
Normal Flow:	<p>36.0 Process borrow book</p> <ol style="list-style-type: none"> 1. Patron chooses the book they want to borrow and brings it to the librarian 2. Librarian click "Borrow Request" button on web admin 3. Librarian click "Start Scanning" button on web admin 4. Librarian scan barcode is on the book 5. Librarian chooses the patron who is want to borrow the book. 6. Librarian click "Confirm" button on web admin to finish process borrow book. 		

Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-44, BR-45, BR-46, BR-47, BR-48, BR-49, BR-50
Other Information:	In case of internet connection failure, Librarian cannot process borrow book
Assumptions:	N/A

Table 46 - <Use Case> Create Detection

2.2.2.8 <Librarian> Process Return Book

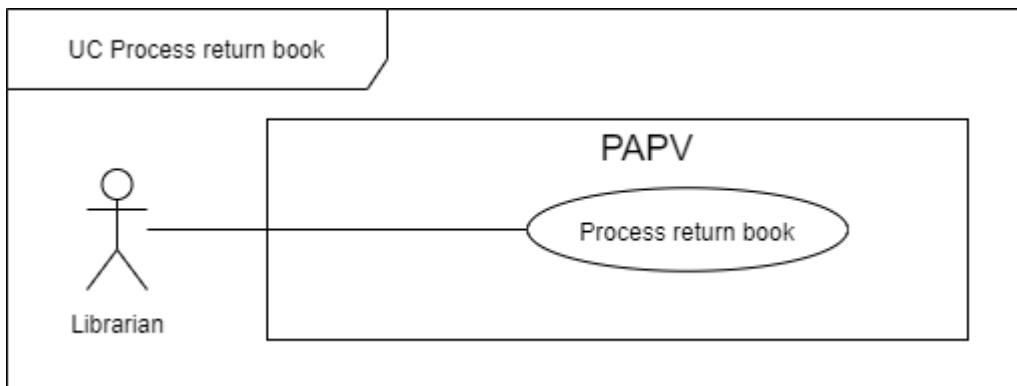


Figure 41 - <Use Case> Process Return Book

ID and Name:	UC-37 Process return book		
Created By:	PhuNH	Date Created:	12/03/2021
Primary Actor:	Librarian	Secondary Actors:	Patron
Description:	This feature allows librarian will help patrons return books by scanning the barcode pasted on the book		
Trigger:	Librarian send request to start return book process		
Pre-conditions:	PRE-01. User has logged in the web as librarian role.		
Post-conditions:	POST-01. The patron can return the book and the information about it will be stores by the PAPV		
Normal Flow:	37.0 Process return book <ol style="list-style-type: none"> 1. Patron bring the book they want to return to the librarian 2. Librarian click "Return Request" button on web admin 3. Librarian click "Start Scanning" button on web admin 		

	<p>4. Librarian scan barcode is on the book</p> <p>5. Librarian click “Confirm” button on web admin.</p> <p>6. Librarian bring the book back to the drawer it was before it was borrowed and finish return process</p>
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-51, BR-52, BR-53, BR-54
Other Information:	In case of internet connection failure, Librarian cannot process return book
Assumptions:	N/A

Table 47 - <Use Case> Process Return Book

2.2.2.9 <Librarian> Create Book Group

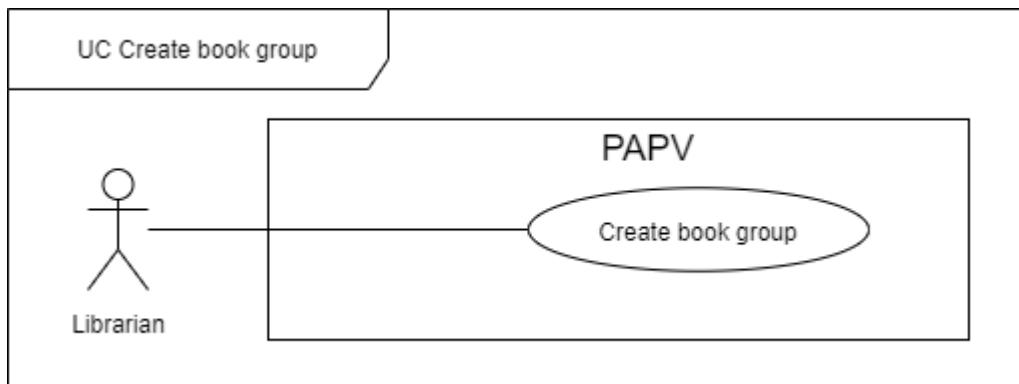


Figure 28 - <Use Case> Create Book Group

ID and Name:	UC-38 Create book group		
Created By:	PhuNH	Date Created:	18/01/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to create book group		
Trigger:	Librarian send request to create book group		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV stores book group details		
Normal Flow:	<p>38.0 Create book group</p> <p>1. Librarian click “New Book” button on web admin.</p>		

	<p>2. PAPV will show a form requires identity information of book group:</p> <ul style="list-style-type: none"> - “Book Group Name”: text input, blank - “Author”: text input, blank - “Page Number”: text input, blank - “Width”: text input, blank - “Height”: text input, blank - “Quantity”: text input, blank - “Fee”: text input, blank - “Punish Fee”: text input, blank - “Category”: text input, blank - “Publishing Company”: text input, blank - “Upload”: button - “Publishing Date”: date picker - “Publishing Number”: text input, blank - “Publishing Palace”: text input, blank - “Publishing Description”: text input, blank - “Book Price”: text input, blank <p>3. Librarian fills in the book group information (see 38.0.E1, 38.0.E2)</p> <p>4. Librarian click “Add Book” button to send request to create book group.</p> <p>5. PAPV validates the book group information and stores them</p>
Alternative Flows:	N/A
Exceptions:	<p>38.0.E1 Librarian fails to fill in all the requires fields</p> <ol style="list-style-type: none"> 1. PAPV returns to librarian to fill the required fields again (MSG01, MSG22, MSG23, MSG24, MSG25, MSG26, MSG32, MSG33) 2a. If librarian input required fields again, return to step 3 of normal flow 2b. Else if librarian cancels the create book group process, then PAPV terminates use case <p>38.0.E2 Librarian enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to librarian to fill the required fields again (MSG07, MSG27, MSG34) 2a. If librarian input required fields again, return to step 3 of normal flow 2b. Else if librarian cancels the create book group process, then PAPV terminates use case

Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-05, BR-55, BR-56, BR-57
Other Information:	In case of internet connection failure, librarian cannot create a book group
Assumptions:	The library must import the books in the storage to create a book group

Table 48 - <Use Case> Create Book Group

2.2.2.10 <Librarian> Update Book Group

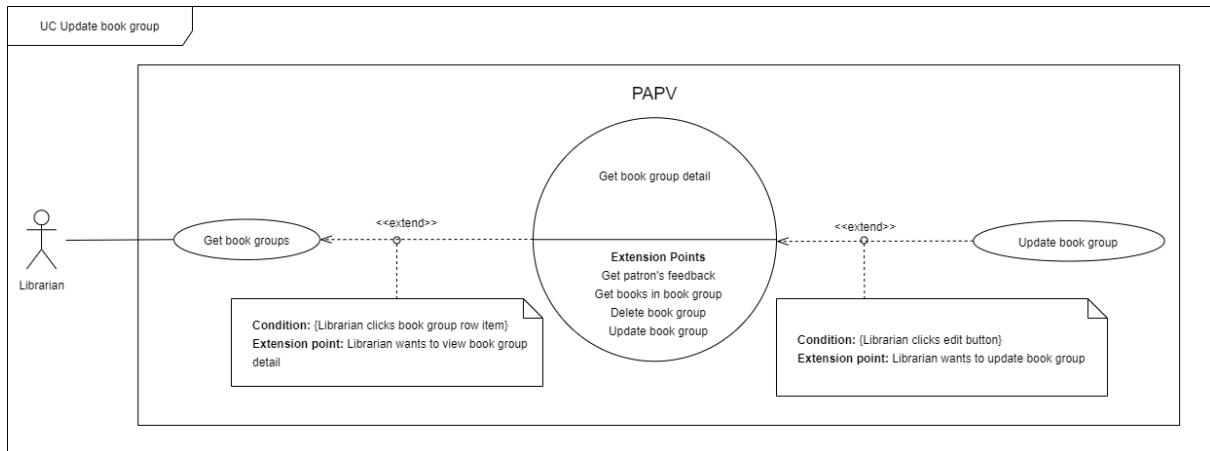


Figure 29 - <Use Case> Update Book Group

ID and Name:	UC-39 Update book group		
Created By:	PhuNH	Date Created:	18/01/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to update book group information		
Trigger:	Librarian send request to update book group information		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV stores the updated book group details		
Normal Flow:	39.0 Update book group <ol style="list-style-type: none"> 1. Librarian clicks on “Edit” button on pop up of book group detail 2. PAPV will show popup for edit information detail 3. Librarian fills in the book group information detail form (see 39.0.E1, 39.0.E2) 4a. Librarian clicks on “Save” button 4a.1. PAPV validates the updated book group information and stores them 		

	<p>4b. Librarian clicks on “Cancel” button</p> <p>4b.1. PAPV close the pop up, nothing changes</p>
Alternative Flows:	N/A
Exceptions:	<p>39.0.E1 Librarian fails to fill in all the required fields</p> <ol style="list-style-type: none"> 1. PAPV returns to librarian to fill the required fields again (MSG01, MSG22, MSG24, MSG25, MSG26, MSG32, MSG33) 2a. If librarian input required fields again, return to step 3 of normal flow 2b. Else if librarian cancels the create book group process, then PAPV terminates use case <p>39.0.E2 Librarian enters required fields not valid</p> <ol style="list-style-type: none"> 1. PAPV returns to librarian to fill the required fields again (MSG07, MSG27, MSG34) 2a. If librarian input required fields again, return to step 3 of normal flow 2b. Else if librarian cancels the create book group process, then PAPV terminates use case
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	N/A
Other Information:	In case of internet connection failure, librarian cannot update book group
Assumptions:	N/A

Table 49 - <Use Case> Update Book Group

2.2.2.11 <Librarian> Delete Book Group

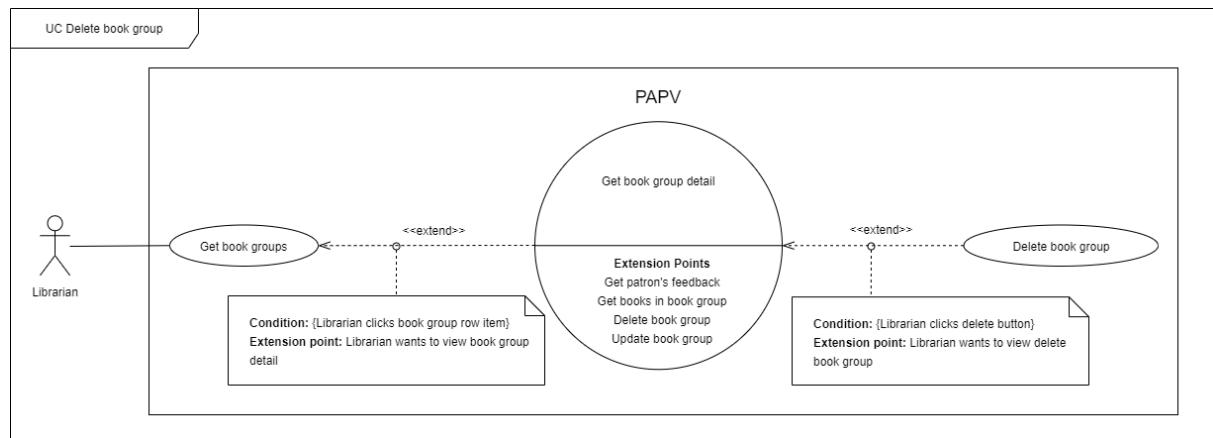
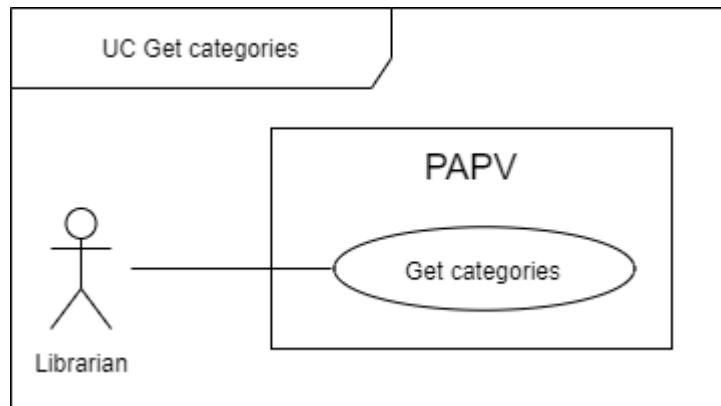


Figure 30 - <Use Case> Delete Book Group

ID and Name:	UC-40 Delete book group		
Created By:	LinhNH	Date Created:	16/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to delete one or more book groups		
Trigger:	Librarian send request to delete one or more book groups		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV removes the book group		
Normal Flow:	<p>40.0 Delete book group</p> <ol style="list-style-type: none"> 1. Librarian clicks on “Delete” button on pop up of book group detail 2. System show delete drawer popup with message “Delete n book group, are you sure?” and two buttons for librarian can select: <ul style="list-style-type: none"> - “Delete” button - “Cancel” button 3. Librarian clicks on “Delete” button, PAPV will remove book group 4. Librarian clicks on “Cancel” button, close popup and nothing change 		
Alternative Flows:	<p>40.1 Delete a book group in system</p> <ol style="list-style-type: none"> 1. Librarian choose one or more book group want to delete on book group table 2. System show delete popup with message: “Are you sure?” and two buttons for admin can select: <ul style="list-style-type: none"> - “Delete” button - “Cancel” button 3. Librarian clicks on “Delete” button, PAPV will remove book group 4. Librarian clicks on “Cancel” button, close popup and nothing change 		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-58		
Other Information:	In case of internet connection failure, Librarian cannot delete book group in system		
Assumptions:	N/A		

Table 50 - <Use Case> Delete Book Group

2.2.2.12 <Librarian> Get Categories



[Figure 31 - <Use Case> Get Categories](#)

ID and Name:	UC-41 Get categories		
Created By:	LinhNH	Date Created:	18/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to get list of categories		
Trigger:	Librarian send request to retrieve list categories		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV returns categories list		
Normal Flow:	41.0 Get categories <ol style="list-style-type: none"> 1. Librarian clicks on “Manage Categories” button (see 41.0.E1) 2. PAPV will show pop up with categories list 		
Alternative Flows:	N/A		
Exceptions:	41.0.E1 PAPV has no category in system <ol style="list-style-type: none"> 1. PAPV returns message: MSG05 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, librarian cannot get categories		
Assumptions:	N/A		

[Table 51 - <Use Case> Get Categories](#)

2.2.2.13 <Librarian> Create Category

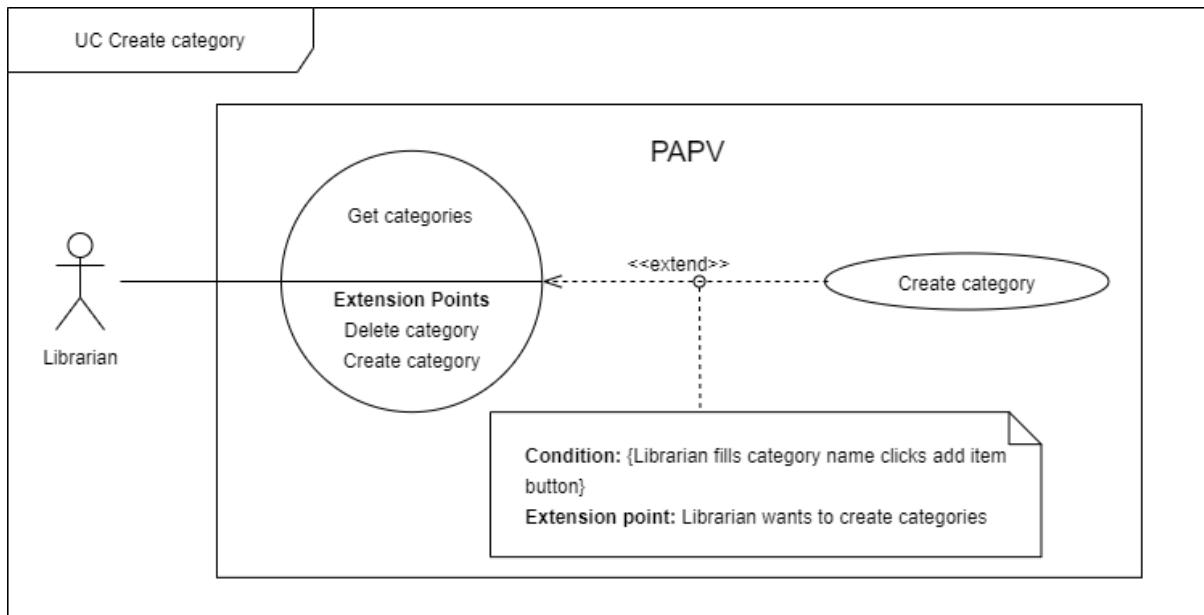


Figure 32 - <Use Case> Create Category

ID and Name:	UC-42 Create category		
Created By:	LinhNH	Date Created:	15/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to create a category		
Trigger:	Librarian send request to create category		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV stores category details		
Normal Flow:	<p>42.0 Create category</p> <ol style="list-style-type: none"> 1. Librarian clicks on “Manage Categories” button 2. PAPV will show pop up to create a category 3. Librarian input the category name (see 42.0.E1) 4. Librarian clicks on “Add item” button 5. PAPV validates the category information and stores them 		
Alternative Flows:	N/A		
Exceptions:	<p>42.0.E1 Librarian fails to fill in all the requires fields</p> <ol style="list-style-type: none"> 1. PAPV returns to librarian to fill the required fields again (MSG26) 2a. If librarian input required fields again, return to step 3 of normal flow 		

	2b. Else if librarian cancels the create category process, then PAPV terminates use case
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-05, BR-59
Other Information:	In case of internet connection failure, Librarian cannot create a category
Assumptions:	N/A

Table 52 - <Use Case> Create Category

2.2.2.14 <Librarian> Delete Category

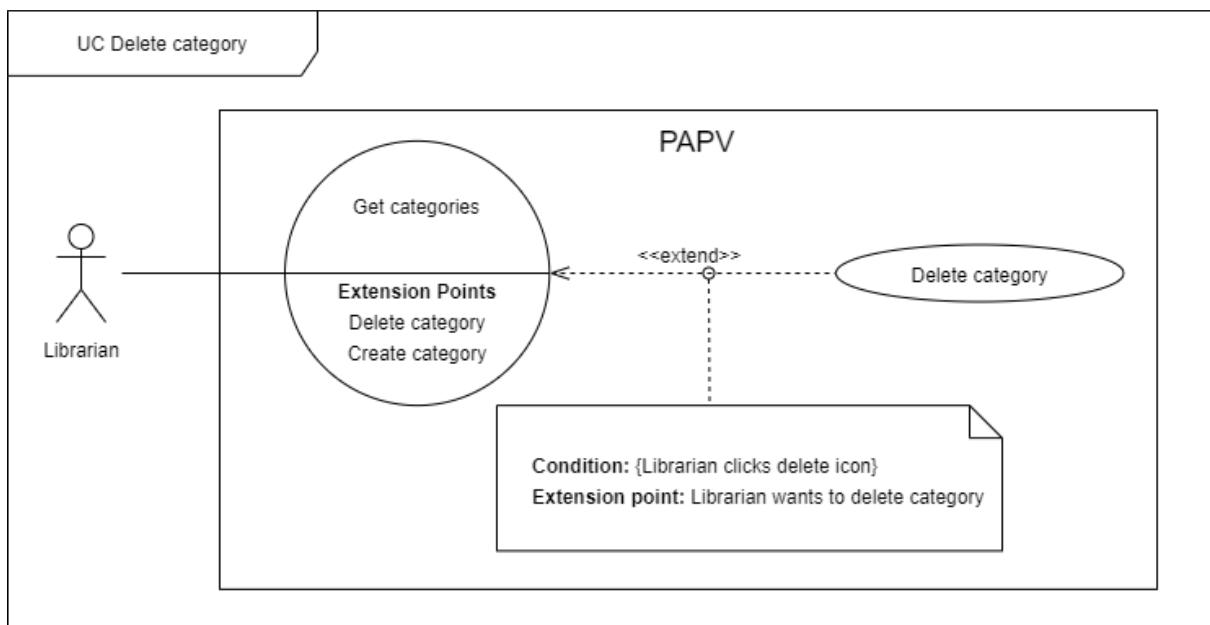


Figure 33 - <Use Case> Delete Category

ID and Name:	UC-43 Delete category		
Created By:	LinhNH	Date Created:	20/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to delete category		
Trigger:	Librarian send request to delete category		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV removes the category		
Normal Flow:	<p>43.0 Delete category</p> <p>1. Librarian clicks on “Manage Categories” button</p>		

	2. PAPV will show pop up with categories list 3. Librarian click "X" icon for delete a specific category
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-60
Other Information:	In case of internet connection failure, Librarian cannot delete category
Assumptions:	N/A

Table 53 - <Use Case> Delete Category

2.2.2.15 <Librarian> Add Book Into Drawer

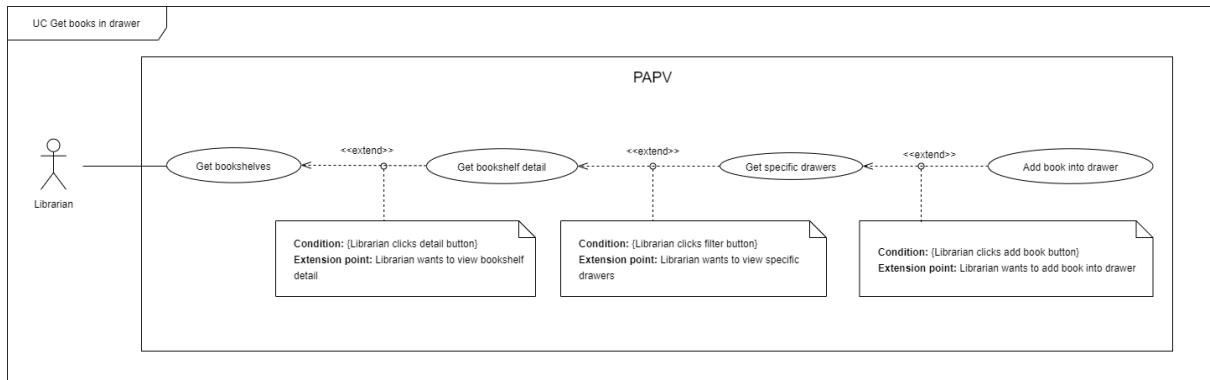


Figure 34 - <Use Case> Add Book Into Drawer

ID and Name:	UC-44 Add book into drawer		
Created By:	LinhNH	Date Created:	22/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows to add one or more book into a specific drawer that they manage		
Trigger:	Librarian send request to add one or more book into drawer		
Preconditions:	PRE-01. User has logged in web as Librarian Role		
Post-conditions:	POST-01. PAPV returns book in drawer		
Normal Flow:	<p>44.0 Add book into drawer</p> <p>1. Librarian clicks to selected one or more book on popup drawer detail to add into drawer</p>		

	<p>2. PAPV clicks “Add books” button on popup drawer detail</p> <p>3. If the drawer has 100 books, the system will show pop up that the librarian wants to continue adding or not</p> <p>3.1 If librarian click “Yes” button, PAPV stores selected books has been added to the drawer</p> <p>3.2 If librarian click “No” button, PAPV close pop up, nothing changes.</p>
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-61, BR-62, BR-80
Other Information:	In case of internet connection failure, Librarian add book into a specific drawer
Assumptions:	N/A

Table 54 - <Use Case> Add Book Into Drawer

2.2.2.16 <Librarian> Remove Book From Drawer

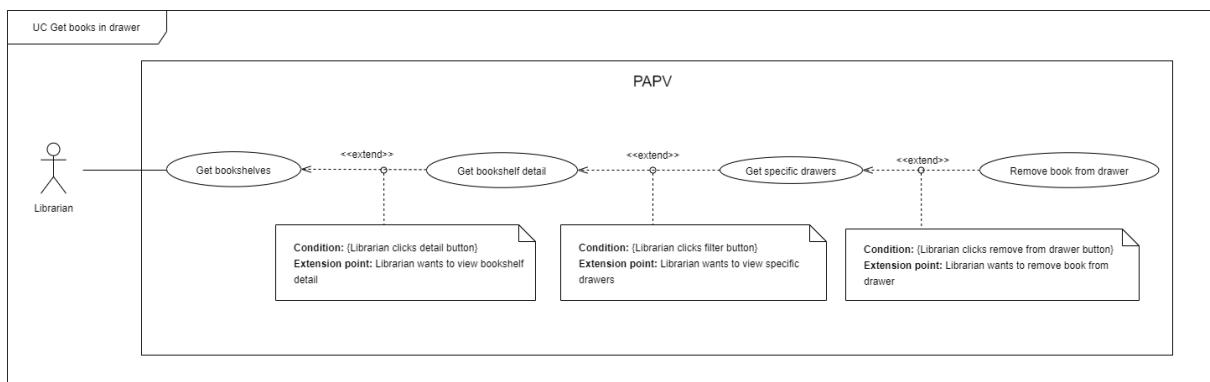


Figure 35 - <Use Case> Remove Book From Drawer

ID and Name:	UC-45 Remove book from drawer		
Created By:	LinhNH	Date Created:	25/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to remove one or more book from a specific drawer that they manage		
Trigger:	Librarian send request to remove one or more book from a drawer		
Preconditions:	PRE-01. User has logged in web as librarian role		

Post-conditions:	POST-01. PAPV remove book from specific drawer
Normal Flow:	<p>45.0 Remove books from drawer</p> <ol style="list-style-type: none"> 1. Librarian clicks to selected one or more book on popup drawer detail to remove books from drawer 2. PAPV clicks “Remove books” button on popup drawer detail 3. PAPV stores selected books has been removed from drawer
Alternative Flows:	N/A
Exceptions:	<p>45.0.E1 PAPV has no book in drawer to remove</p> <ol style="list-style-type: none"> 1. PAPV returns messages: MSG05
Priority:	Medium
Frequency of Use:	Sometimes.
Business Rules:	BR-63, BR-64
Other Information:	In case of internet connection failure, Librarian cannot remove books from drawer
Assumptions:	N/A

Table 55 - <Use Case> Remove Book From Drawer

2.2.2.17 <Librarian> Export Barcode To PDF

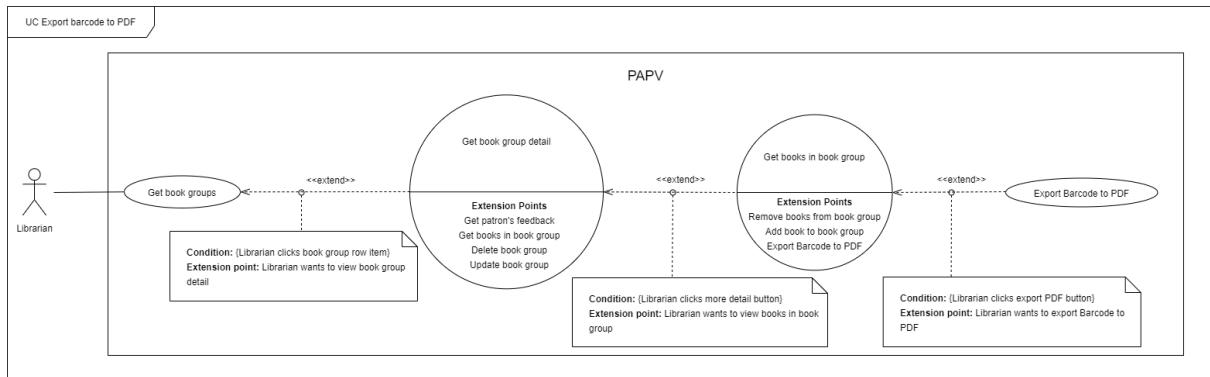


Figure 50 - <Use Case> Export Barcode To PDF

ID and Name:	UC-46 Export Barcode to PDF		
Created By:	LinhNH	Date Created:	28/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to export barcode from book group to PDF		
Trigger:	Librarian send request to export barcode from book group to PDF		
Preconditions:	PRE-01. User has logged in web as librarian role		

Post-conditions:	POST-01. PAPV will create a PDF file to store barcode of books in book group and librarian can stores it
Normal Flow:	<p>46.0 Export Barcode to PDF</p> <ol style="list-style-type: none"> 1. Librarian double click on specific book group to get detail information of book group 2. Librarian clicks “More detail” button 3. PAPV return list of books in selected book group 4. Librarian clicks “Export to PDF” button 5. System show popup with table of book in book group and two buttons for librarian can select: <ul style="list-style-type: none"> - “Cancel” button - “Preview” button 6. Librarian selects books want to export barcode 7. Librarian clicks on “Preview” button, PAPV show preview barcode of book want to export to PDF <ol style="list-style-type: none"> 7.1. System show popup with list image of barcodes and two buttons for librarian can select: <ul style="list-style-type: none"> - “Close” button - “Export” button 7.1.1. Librarian clicks on “Close” button, close popup and nothing change 7.1.2. Librarian clicks on “Export” button, PAPV will store file PDF to librarian’s device 8. Librarian clicks on “Cancel” button, close popup and nothing change
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	N/A
Other Information:	In case of internet connection failure, Librarian cannot export barcode to PDF
Assumptions:	N/A

Table 56 - <Use Case> Export Barcode To PDF

2.2.2.18 <Librarian> Add Book Into Book Group

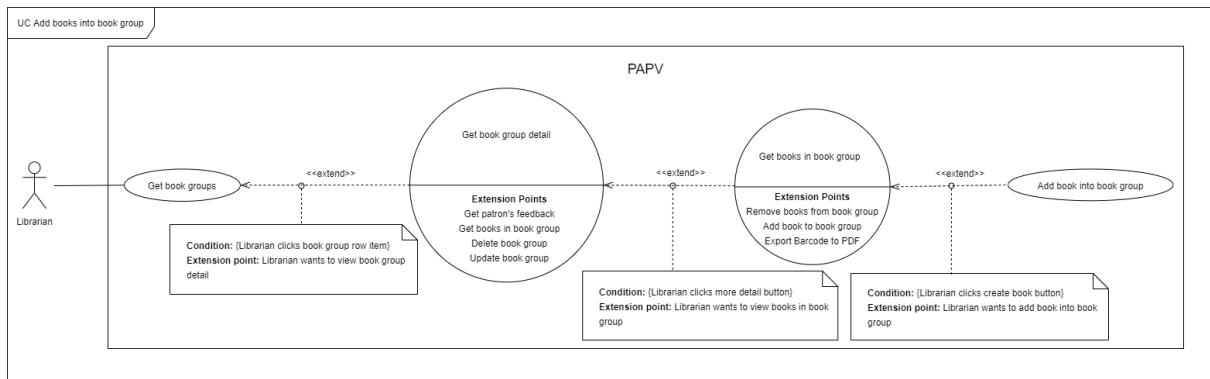


Figure 51 - <Use Case> Add Book Into Book Group

ID and Name:	UC-47 Add book into book group		
Created By:	LinhNH	Date Created:	31/03/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to add books into book group		
Trigger:	Librarian send request to add books into book group		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV add more books into selected book group		
Normal Flow:	<p>47.0 Add book into book group</p> <ol style="list-style-type: none"> 1. Librarian clicks “Create Books” button 2. PAPV input quantity of books want to add into book group 3.1. Librarian clicks on “Close” button, close popup and nothing change 3.2. Librarian clicks on “Create” button, PAPV will create book to book group 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, librarian cannot add more books into book group		
Assumptions:	N/A		

Table 57 - <Use Case> Add Book Into Book Group

2.2.2.19 <Librarian> Remove Book From Book Group

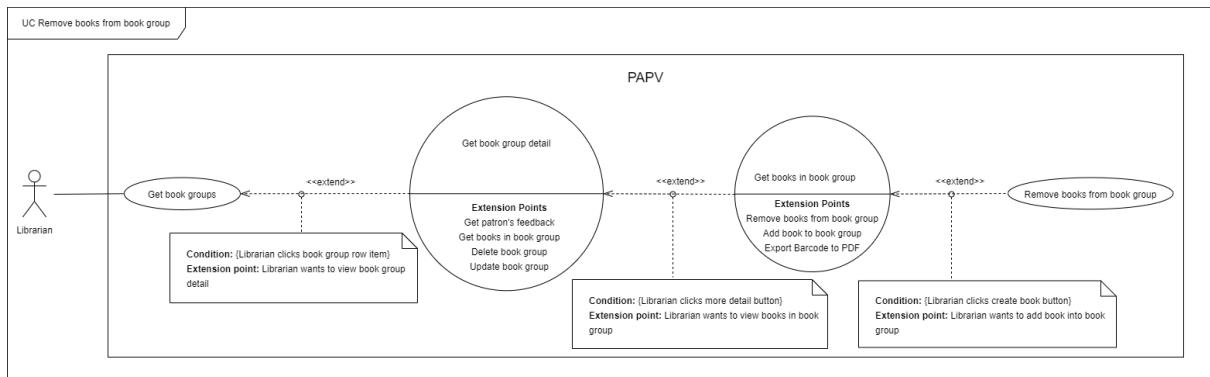


Figure 36 - <Use Case> Remove Book From Book Group

ID and Name:	UC-48 Remove book from book group		
Created By:	LinhNH	Date Created:	02/04/2021
Primary Actor:	Librarian	Secondary Actors:	N/A
Description:	This feature allows librarian to remove book from book group		
Trigger:	Librarian send request to remove book from book group		
Preconditions:	PRE-01. User has logged in web as librarian role		
Post-conditions:	POST-01. PAPV remove book from selected book group		
Normal Flow:	<p>48.0 Remove book from book group</p> <ol style="list-style-type: none"> 1. Librarian click on specific book group to get detail information of book group 2. Librarian clicks “More detail” button 3. PAPV return list of books in selected book group 4. Librarian click “Remove” button on selected book 5. System show delete popup with message: “Are you sure?” and text field for librarian input reason and two buttons for admin can select: <ul style="list-style-type: none"> - “Cancel” button - “Remove” button 6.1 Librarian clicks on “Remove” button, PAPV remove bookshelf 6.2 Librarian clicks on “Cancel” button, close popup and nothing change 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium		

Frequency of Use:	Sometimes.
Business Rules:	N/A
Other Information:	In case of internet connection failure, librarian cannot add more books into book group
Assumptions:	N/A

Table 58 - <Use Case> Remove Book From Book Group

2.3 Mobile Application

2.3.1 <Unauthenticated User> Overview Use Case

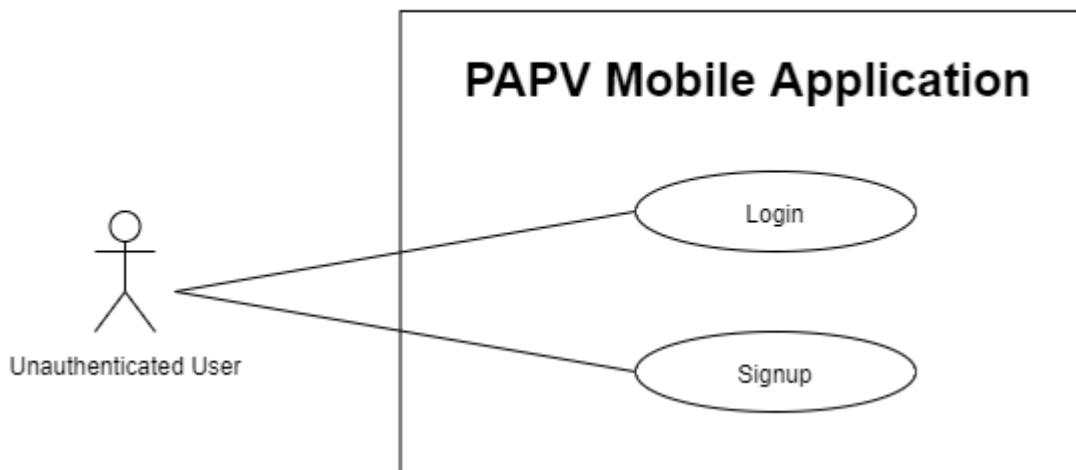


Figure 37 - <Overview Use Case> Unauthenticated User

2.3.1.1 <Unauthenticated User> Login

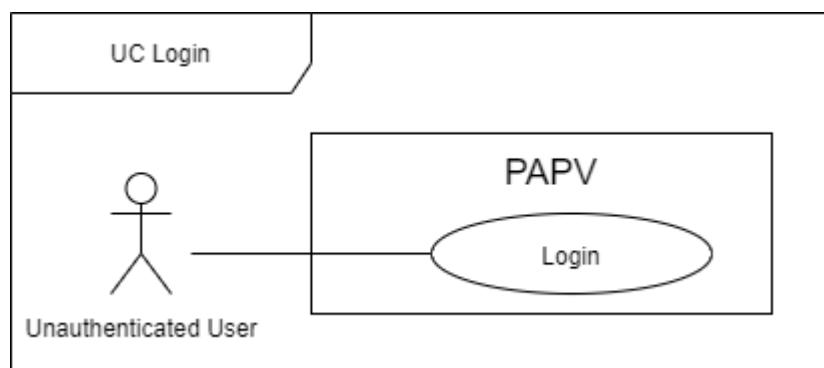


Figure 38 - <Use Case> Login

ID and Name:	UC-1 Login	
Created By:	PhuNH	Date Created: 25/01/2021

Primary Actor:	Unauthenticated User	Secondary Actors:	N/A
Description:	Unauthenticated User login to PAPV to verify role, give them access to more features in the system		
Trigger:	Unauthenticated User request login into PAPV		
Pre-conditions:	PRE-01. User is not logged in		
Post-conditions:	POST-01. User is logged into PAPV system		
Normal Flow:	<p>1.0 Login into PAPV System</p> <ol style="list-style-type: none"> 1. Unauthenticated User send request to log into PAPV system 2. PAPV requires information from Unauthenticated User: <ul style="list-style-type: none"> - “Username”: text input, blank - “Password”: text input, blank 3. Unauthenticated User input to login form: username, password 4. Unauthenticated User click to “Login” button. 5. PAPV validate the username, password 6. PAPV determines user’s identity, role and permission then redirects user to home page (see 1.0.E1, 1.0.E2) 		
Alternative Flows:	N/A		
Exceptions:	<p>1.0.E1 Unauthenticated User fails to fill in all the required fields</p> <ol style="list-style-type: none"> 1. PAPV returns to unauthenticated user to fill in the missing fields (MSG28) 2a. If unauthenticated user input again username and password, return to step 3 of normal flow 2b. Else if unauthenticated user cancels the login process, then PAPV terminates use case <p>1.0.E2 Unauthenticated User enters wrong password with entered username</p> <ol style="list-style-type: none"> 1. PAPV returns to unauthenticated user to fill the password again 2a. If unauthenticated user input password again, return to step 3 of normal flow 2b. Else if unauthenticated user cancels the login process, then PAPV terminates use case 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		

Business Rules:	BR-1
Other Information:	In case of internet connection failure, Unauthenticated User cannot login into PAPV
Assumptions:	N/A

Table 59 - <Use Case> Login

2.3.1.2 <Unauthenticated User> Signup

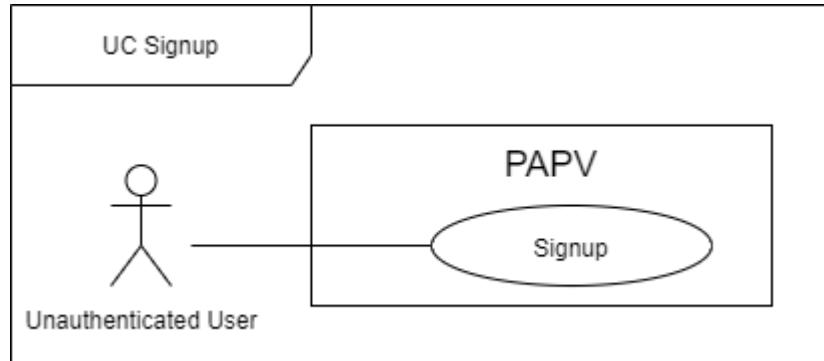


Figure 39 - <Use Case> Signup

ID and Name:	UC-03 Signup		
Created By:	PhuNH	Date Created:	03/02/2021
Primary Actor:	Unauthenticated User	Secondary Actors:	N/A
Description:	This feature allows Unauthenticated User allows to sign up new account to be able to login to PAPV system		
Trigger:	Unauthenticated User request to signup new account in PAPV system		
Pre-conditions:	PRE-01. User is not logged in		
Post-conditions:	POST-01. Unauthenticated User successfully registered an account.		
Normal Flow:	<p>3.0 Sign up</p> <ol style="list-style-type: none"> 1. Unauthenticated User click “Signup” button on screen 2. PAPV requires information from Unauthenticated User: <ul style="list-style-type: none"> - “Email”: text input, blank, required - “Name”: text input, blank, required - “Gender”: dropdown, blank, required - “Phone”: text input, blank, required - “Address”: text input, blank, required - “DoB”: text input, blank, required - “Username”: text input, blank, required 		

	<ul style="list-style-type: none"> - “Password”: text input, blank, required <p>3. Unauthenticated User input to signup form: email, name, gender, phone, address, DoB, username, password</p> <p>4. Unauthenticated User click to “Signup” button.</p> <p>5. PAPV validate the email, name, gender, phone, address, DoB, username, password (see 3.0.E1, 3.0.E2, 3.0.E3, 3.0.E4)</p> <p>6. PAPV will stores information detail and create new account</p>
Alternative Flows:	N/A
Exceptions:	<p>3.0.E1 Unauthenticated User fails to fill in all the required fields</p> <p>1. PAPV returns to unauthenticated user to fill in the missing fields (MSG01, MSG08, MSG09, MSG10, MSG11, MSG12, MSG13)</p> <p>2a. If unauthenticated user input again missing fields, return to step 3 of normal flow</p> <p>2b. Else if unauthenticated user cancels the signup process, then PAPV terminates use case</p> <p>3.0.E2 Unauthenticated User enters password and confirm password are not matched</p> <p>1. PAPV returns to unauthenticated user to fill the password or confirm password again (MSG15)</p> <p>2a. If unauthenticated user input password or confirm password again, return to step 3 of normal flow</p> <p>2b. Else if unauthenticated user cancels the signup process, then PAPV terminates use case</p> <p>3.0.E3 Unauthenticated User enters required fields not valid</p> <p>1. PAPV returns to unauthenticated user to fill the required fields again (MSG07, MSG16, MSG17, MSG20, MSG21)</p> <p>2a. If unauthenticated user input required fields again, return to step 3 of normal flow</p> <p>2b. Else if unauthenticated user cancels the signup process, then PAPV terminates use case</p> <p>3.0.E4 Unauthenticated User enters required information exists in the system</p>

	<p>1. PAPV returns to unauthenticated user to fill required information again (MSG18)</p> <p>2a. If unauthenticated user input required information again, return to step 3 of normal flow</p> <p>2b. Else if unauthenticated user cancels the signup process, then PAPV terminates use case</p>
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-65, BR-66
Other Information:	In case of internet connection failure, Unauthenticated User cannot signup
Assumptions:	N/A

Table 60 - <Use Case> Signup

2.3.2 <Authenticated User> Overview Use Case

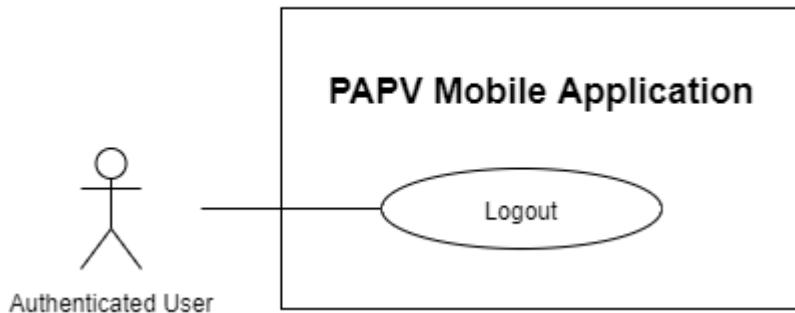


Figure 40 - <Overview Use Case> Authenticated User

2.3.2.1<Authenticated User> Logout

ID and Name:	UC-2 Logout		
Created By:	KhanhTD	Date Created:	05/02/2021
Primary Actor:	Authenticated User	Secondary Actors:	N/A
Description:	This feature allows authenticated user log out from the PAPV system.		
Trigger:	Authenticated User send request to log out from the PAPV system		
Pre-conditions:	PRE-01. User has been authenticated		
Post-conditions:	POST-01. Authenticated user logged out from PAPV system		
Normal Flow:	2.0 Logout the PAPV System		

	<ol style="list-style-type: none"> 1. Authenticated User click “Logout” button. 2. PAPV delete their cookie. 3. PAPV navigates user to login page.
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-67, BR-68
Other Information:	In case of internet connection failure, Authenticated User cannot log out PAPV.
Assumptions:	N/A

Table 61 - <Use Case> Logout

2.3.3 <Librarian> Overview Use Case

2.3.3.1 <Librarian> Get Profile

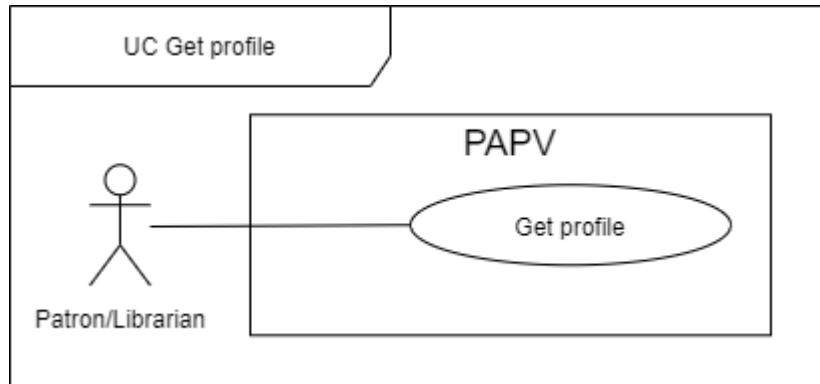


Figure 41 - <Use Case> Get Profile

ID and Name:	UC-55 Get profile		
Created By:	KhanhTD	Date Created:	15/04/2021
Primary Actor:	Patron, Librarian	Secondary Actors:	N/A
Description:	This feature allows patron and librarian to get their profile		
Trigger:	Librarian, patron send request to get their profile		
Pre-conditions:	PRE-01. User has logged in the web as patron, librarian role.		
Post-conditions:	POST-01. PAPV return their profile information		
Normal Flow:	55.0 Get profile		

	<ol style="list-style-type: none"> 1. Patron, librarian send request to get their profile 2. PAPV return profile information
Alternative Flows:	N/A
Exceptions:	N/A
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	N/A
Other Information:	In case of internet connection failure, patron or librarian cannot get their profile
Assumptions:	N/A

Table 62 - <Use Case> Get Profile

2.3.4 <Patron> Overview Use Case

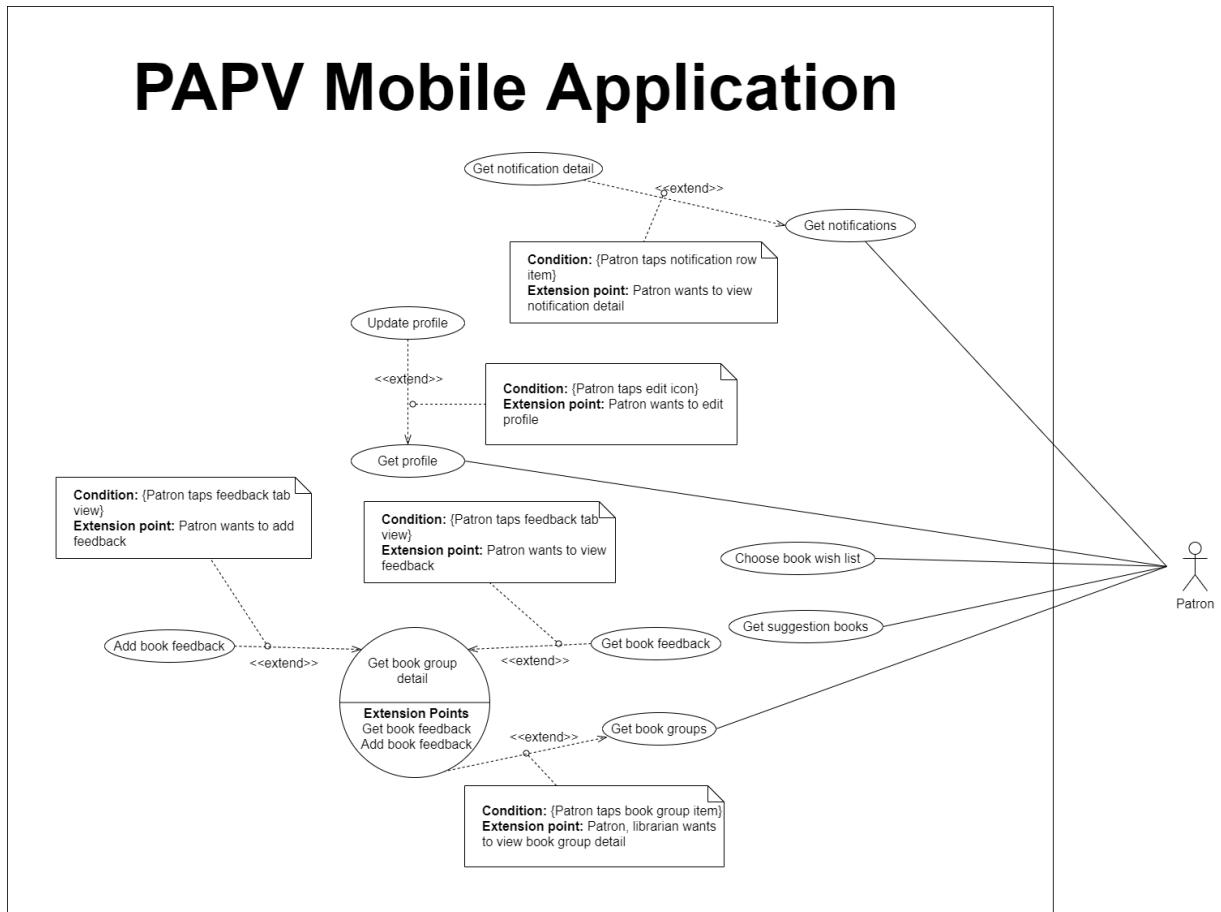


Figure 42 - <Overview Use Case> Patron

2.3.4.1 <Patron> Choose Book Wish List

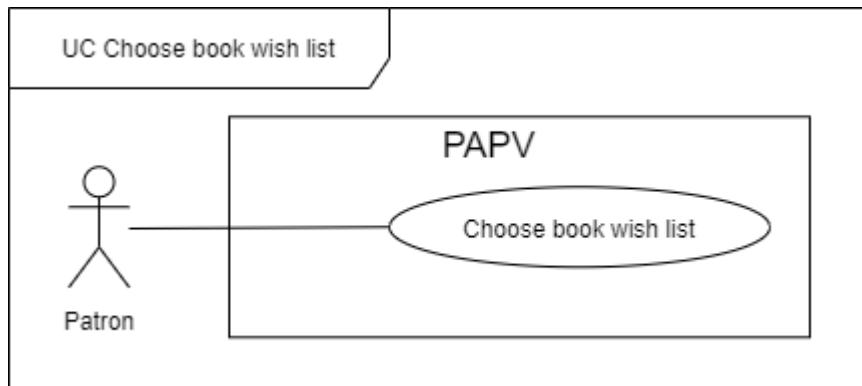
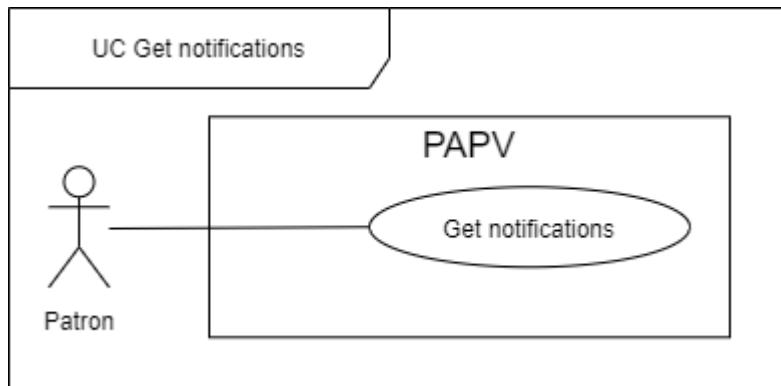


Figure 43 - <Use Case> Choose Book Wish List

ID and Name:	UC-50 Choose book wish list		
Created By:	KhanhTD	Date Created:	10/04/2021
Primary Actor:	Patron	Secondary Actors:	N/A
Description:	This feature allows patron add book to wish list to borrow.		
Trigger:	Patron send request to add book to wish list		
Pre-conditions:	PRE-01. User has logged in the web as patron role		
Post-conditions:	POST-01. PAPV add the book patron selected to wish list		
Normal Flow:	50.0 Choose book wish list <ol style="list-style-type: none"> Patron click “Add to wish list” button on book detail screen PAPV will add and store this selected book to wish list for patron 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-69, BR-70, BR-71, BR-72		
Other Information:	In case of internet connection failure, Patron cannot choose book wish list.		
Assumptions:	N/A		

Table 63 - <Use Case> Choose Book Wish List

2.3.4.2 <Patron> Get Notifications



[Figure 60 - <Use Case> Get Notification](#)

ID and Name:	UC-51 Get notification		
Created By:	KhanhTD	Date Created:	21/04/2021
Primary Actor:	Patron	Secondary Actors:	N/A
Description:	This feature allows patron to get notification from library when the return date is close		
Trigger:	When the return date is only 1 day away, the request will be automatically created to notify the patron		
Pre-conditions:	PRE-01. When the patron has the book close to the return date		
Post-conditions:	POST-01. PAPV send notification to patron mobile to remind about book returns		
Normal Flow:	51.0 Get notification <ol style="list-style-type: none"> When the return date is only 1 day away, PAPV will be automatically created to notify the patron 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, Patron cannot get the notification.		
Assumptions:	N/A		

[Table 64 - <Use Case> Get Notification](#)

2.3.4.3 <Patron> Get Notification Detail

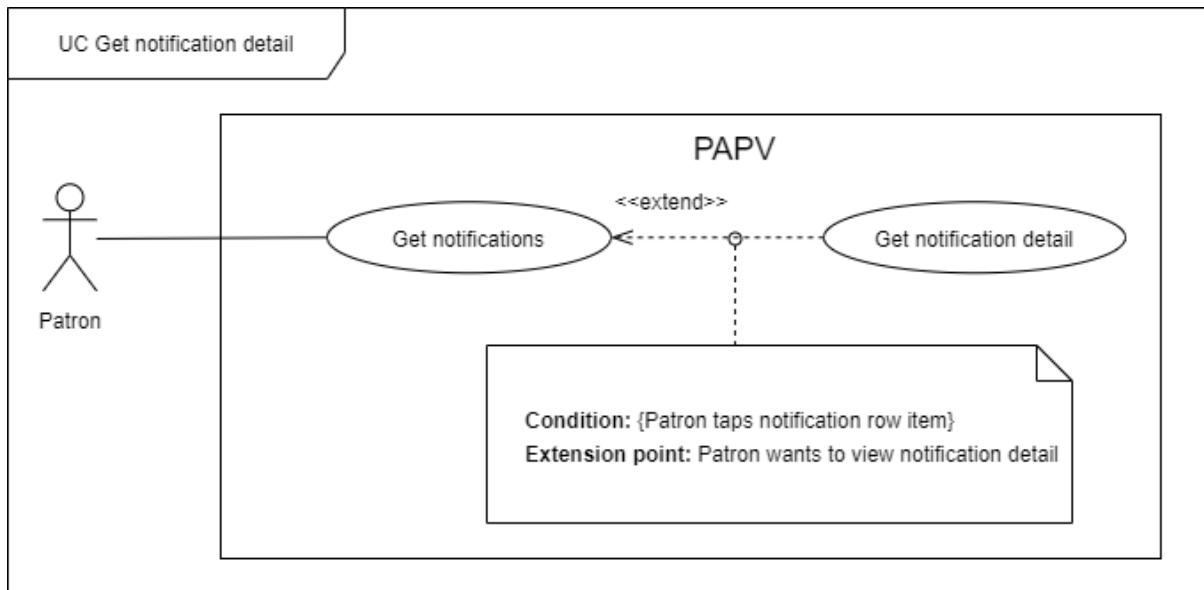
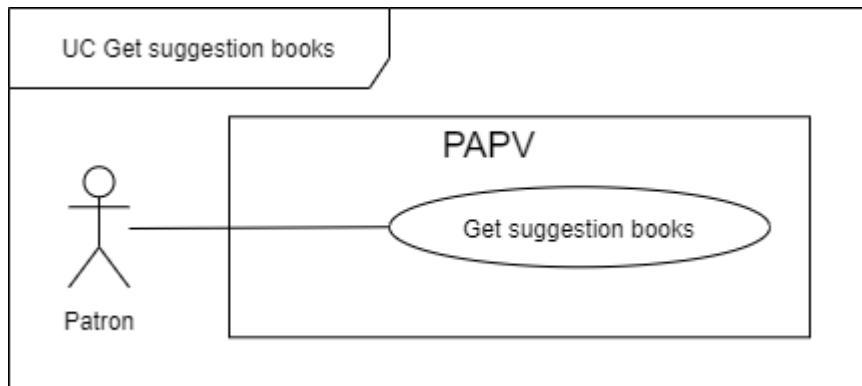


Figure 61 - <Use Case> Get Notification Detail

ID and Name:	UC-52 Get notification detail		
Created By:	KhanhTD	Date Created:	15/04/2021
Primary Actor:	Patron	Secondary Actors:	N/A
Description:	This feature allows patron to get notification detail from PAPV system.		
Trigger:	Patron tap on specific notification on notification list		
Pre-conditions:	PRE-01. User has logged in the web as patron role		
Post-conditions:	POST-01. PAPV will show notification detail		
Normal Flow:	52.0 Get notification detail <ol style="list-style-type: none"> Patron click specific notification on notification screen PAPV will show popup about information detail of selected notification 		
Alternative Flows:	N/A		
Exceptions:	N/A		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	N/A		
Other Information:	In case of internet connection failure, patron cannot view notification detail.		
Assumptions:	N/A		

Table 65 - <Use Case> Get Notification Detail

2.3.4.4 <Patron> Get Suggestion Books



[Figure 44 - <Use Case> Get Suggestion Books](#)

ID and Name:	UC-53 Get suggestion book (base on category that patron often read)		
Created By:	KhanhTD	Date Created:	07/04/2021
Primary Actor:	Patron	Secondary Actors:	N/A
Description:	This feature allows patron to get suggestion book base on category that they often borrow		
Trigger:	Patron send request to get list suggestion book		
Pre-conditions:	PRE-01. User has logged in the web as patron role		
Post-conditions:	POST-01. PAPV return list books base on category that patron often read		
Normal Flow:	53.0 Get suggestion book <ol style="list-style-type: none"> Patron send request to get suggestion book PAPV return list suggestion book 		
Alternative Flows:	N/A		
Exceptions:	53.0.E1 Patron has never borrowed books in PAPV system <ol style="list-style-type: none"> PAPV return message: MSG35 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-72, BR-73		
Other Information:	In case of internet connection failure, Patron cannot get list suggestion books		
Assumptions:	N/A		

[Table 66 - <Use Case> Get Suggestion Books](#)

2.3.4.5 <Patron> Add Book Feedback

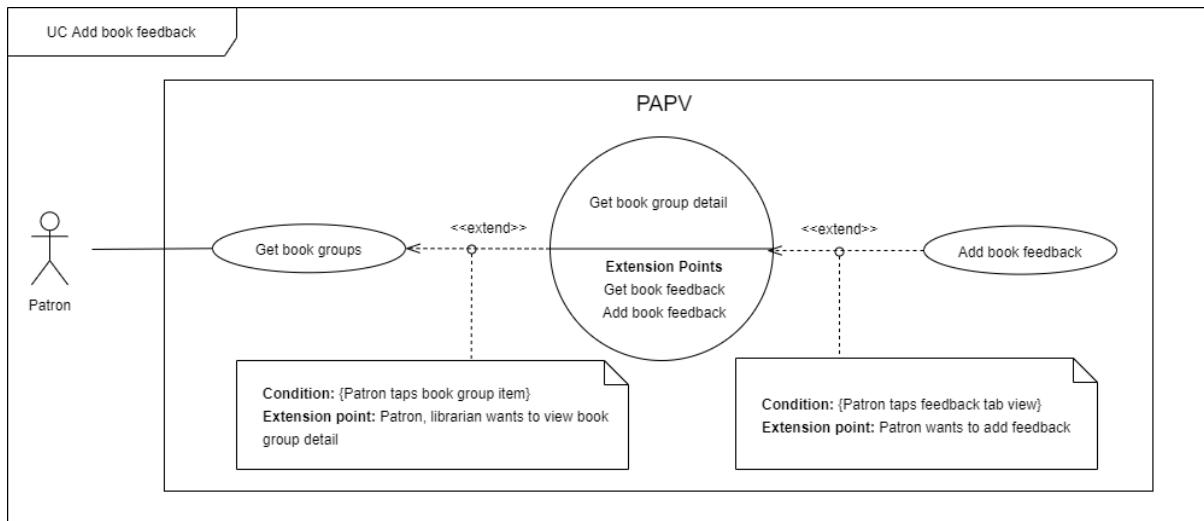


Figure 45 - <Use Case> Add Book Feedback

ID and Name:	UC-54 Add book feedback		
Created By:	KhanhTD	Date Created:	11/04/2021
Primary Actor:	Patron	Secondary Actors:	N/A
Description:	This feature allows patron to add feedback to a specific book group		
Trigger:	Patron send request to add book feedback		
Pre-conditions:	PRE-01. User has logged in the web as patron role. PRE-02. Patron in Book detail screen.		
Post-conditions:	POST-01. PAPV stores feedbacks for book group		
Normal Flow:	54.0 Add book feedback <ol style="list-style-type: none"> Patron input content feedback in text field. Patron choose rate in rating icon Patron click send icon to send feedback to specific book 		
Alternative Flows:	N/A		
Exceptions:	54.0.E1 Patron fails to fill in all the required fields <ol style="list-style-type: none"> PAPV returns to patron to fill in the missing fields (MSG29) 		
Priority:	Medium.		
Frequency of Use:	Sometimes.		
Business Rules:	BR-74		
Other Information:	In case of internet connection failure, Patron cannot add feedback to specific book		

Assumptions:	N/A
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Table 67 - <Use Case> Add Book Feedback

2.3.4.6 <Patron> Update Profile

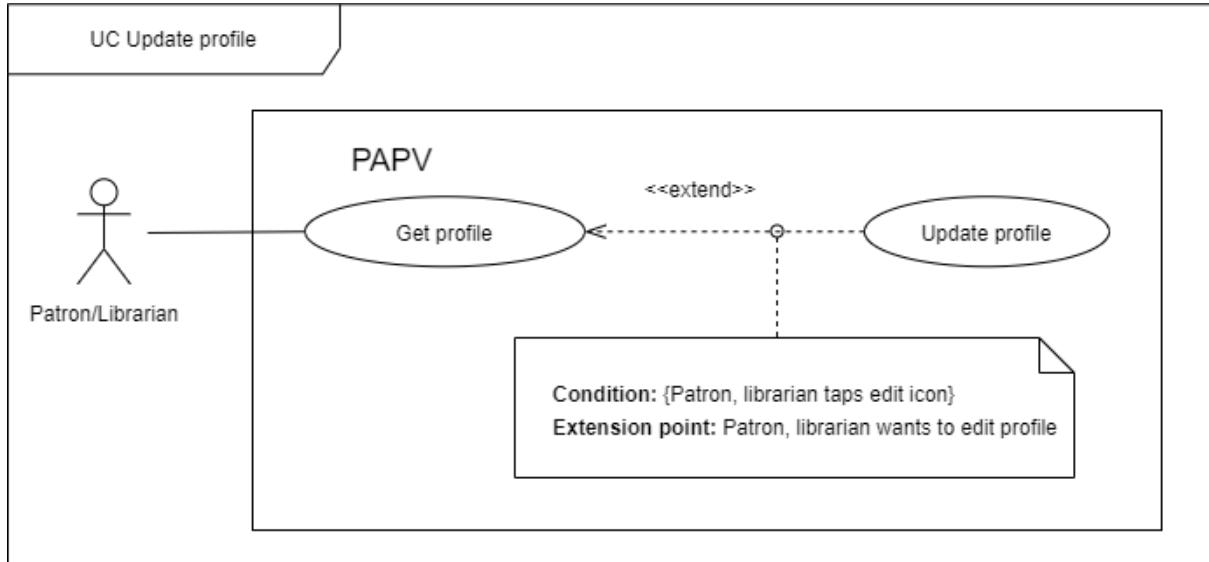


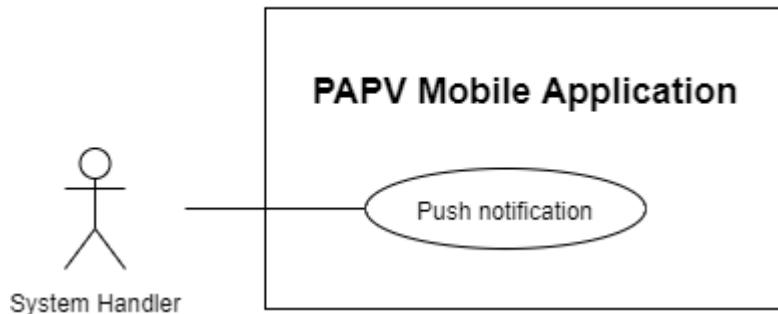
Figure 46 - <Use Case> Update Profile

ID and Name:	UC-55 Update profile		
Created By:	KhanhTD	Date Created:	13/04/2021
Primary Actor:	Patron	Secondary Actors:	N/A
Description:	This feature allows patron to update their profile		
Trigger:	Patron send request to update their profile		
Pre-conditions:	PRE-01. User has logged in the web as patron role.		
Post-conditions:	POST-01. Patron information has been updated		
Normal Flow:	<p>55.0 Update profile</p> <ol style="list-style-type: none"> 1. Patron press on “Edit” button on profile screen 2. PAPV will redirect to edit profile screen 2. PAPV requires information from patron: <ul style="list-style-type: none"> - “Name”: text input, blank, required - “Gender”: dropdown, blank, required - “Phone”: text input, blank, required - “Address”: text input, blank, required - “DoB”: text input, blank, required - “Password”: text input, blank, required 		

	<p>3. Patron input to signup form: name, gender, phone, address, DoB, password</p> <p>4. Patron click to “Update” button.</p> <p>5. PAPV validate the name, gender, phone, address, DoB, password (see 55.0.E1, 55.0.E2)</p> <p>6. PAPV will stores information detail and create new account</p>
Alternative Flows:	N/A
Exceptions:	<p>55.0.E1 Patron fails to fill in all the required fields</p> <p>1. PAPV returns to patron to fill in the missing fields (MSG01, MSG08, MSG09, MSG10)</p> <p>2a. If patron input again missing fields, return to step 3 of normal flow</p> <p>2b. Else if patron cancels the update profile process, then PAPV terminates use case</p> <p>55.0.E2 Patron enters required fields not valid</p> <p>1. PAPV returns to patron to fill the required fields again (MSG07, MSG16, MSG17, MSG20)</p> <p>2a. If patron input required fields again, return to step 3 of normal flow</p> <p>2b. Else if patron cancels the signup process, then PAPV terminates use case</p>
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-66, BR-82
Other Information:	In case of internet connection failure, patron or librarian cannot update their profile
Assumptions:	N/A

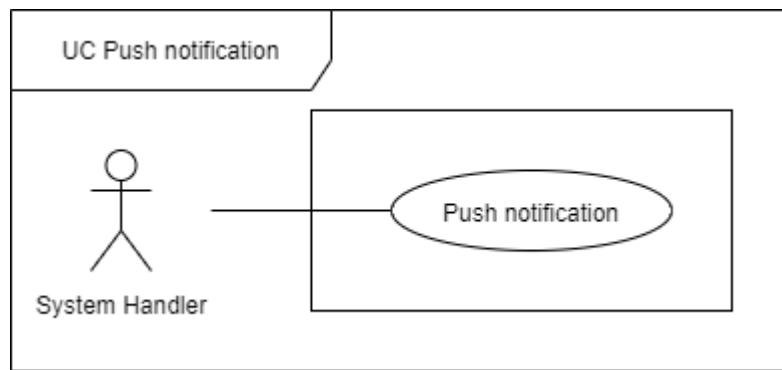
Table 68 - <Use Case> Update Profile

2.3.5 <System Handler> Overview Use Case



[Figure 47 - Overview Use Case <System Handler>](#)

2.3.5.1 <System Handler> Push Notification



[Figure 48 - <Use Case> Push Notification](#)

ID and Name:	UC-56 Push notification		
Created By:	LinhNH	Date Created:	22/04/2021
Primary Actor:	System Handler	Secondary Actors:	Patron
Description:	This feature allows system handler push notification to remind patron about return book		
Trigger:	Before deadline return book one day, system handler auto push notification to patron by device token		
Pre-conditions:	PRE-01. Patron already borrow book in system PRE-02. Before deadline return book one day		
Post-conditions:	POST-01. Patron receive notification and can view detail		
Normal Flow:	<p>56.0 Push notification</p> <ol style="list-style-type: none"> 1. Patron borrow book in PAPV system 2. Before deadline return book one day at 9:00AM, system handler will push a notification to patron's device (see 56.0.E1) 		

Alternative Flows:	N/A
Exceptions:	56.0.E1 Notification cannot send to patron's device
Priority:	Medium.
Frequency of Use:	Sometimes.
Business Rules:	BR-81
Other Information:	In case of internet connection failure, patron cannot receive notification
Assumptions:	N/A

Table 69 - <Use Case> Push Notification

3. Functional Requirements

3.1 System Functional Overview

3.1.1 Screen Flow

a. <Admin> Web Application Screen Flow

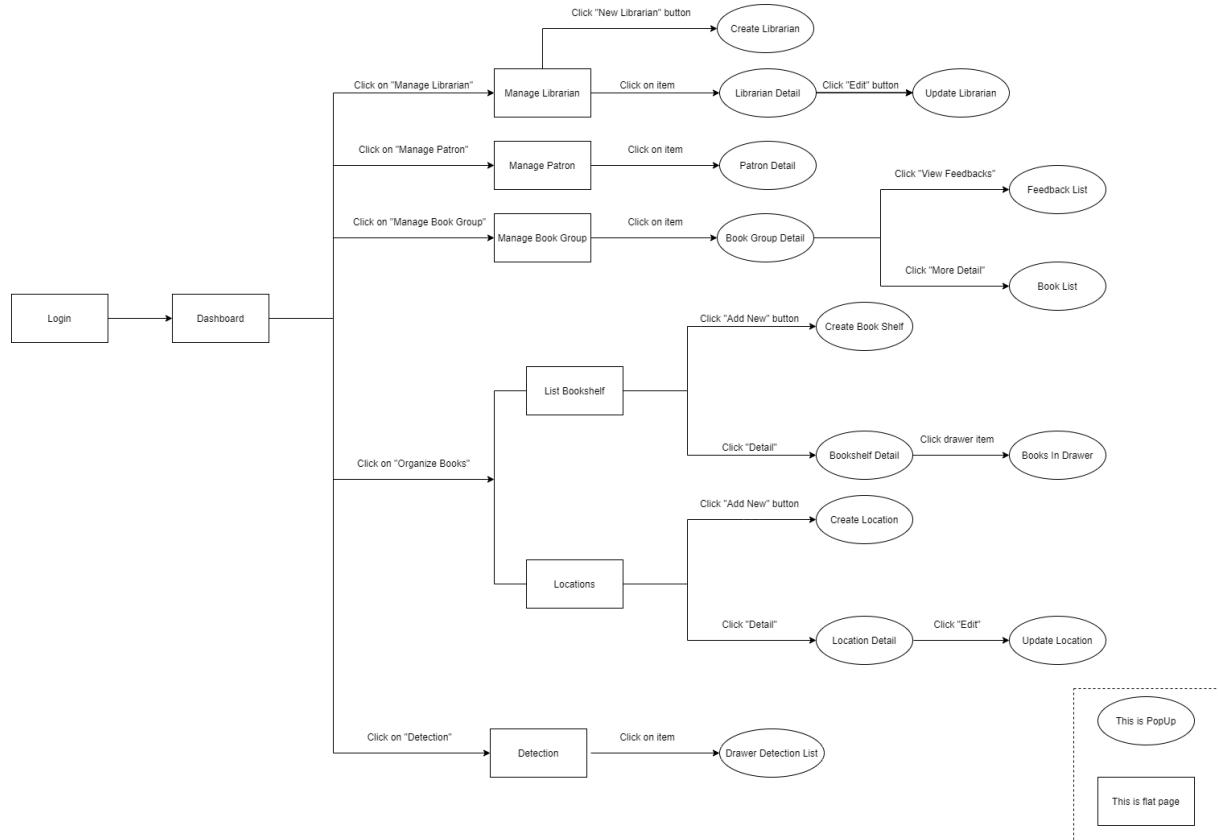


Figure 49 - <Screen Flow Diagram> Admin Web Application

b. <Librarian> Web Application Screen Flow

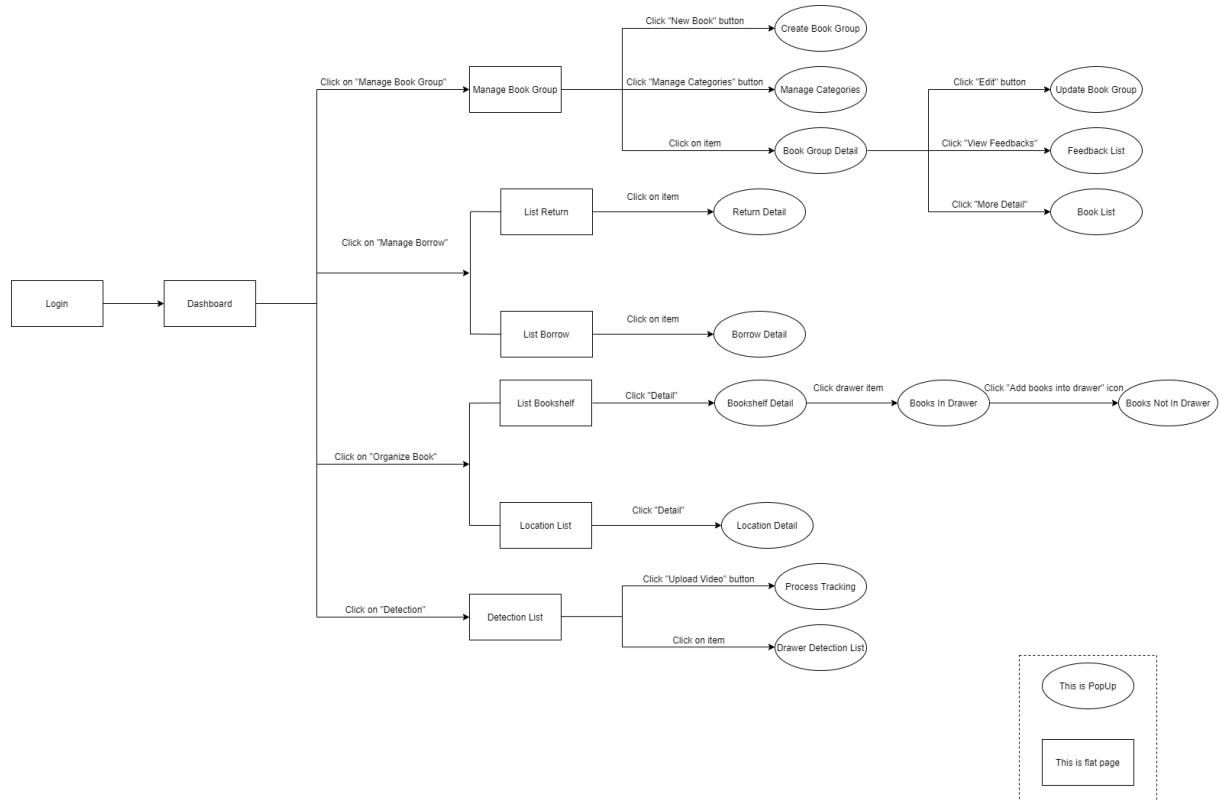


Figure 50 - <Screen Flow Diagram> Librarian Web Application

c. <Librarian> Mobile Application Screen Flow

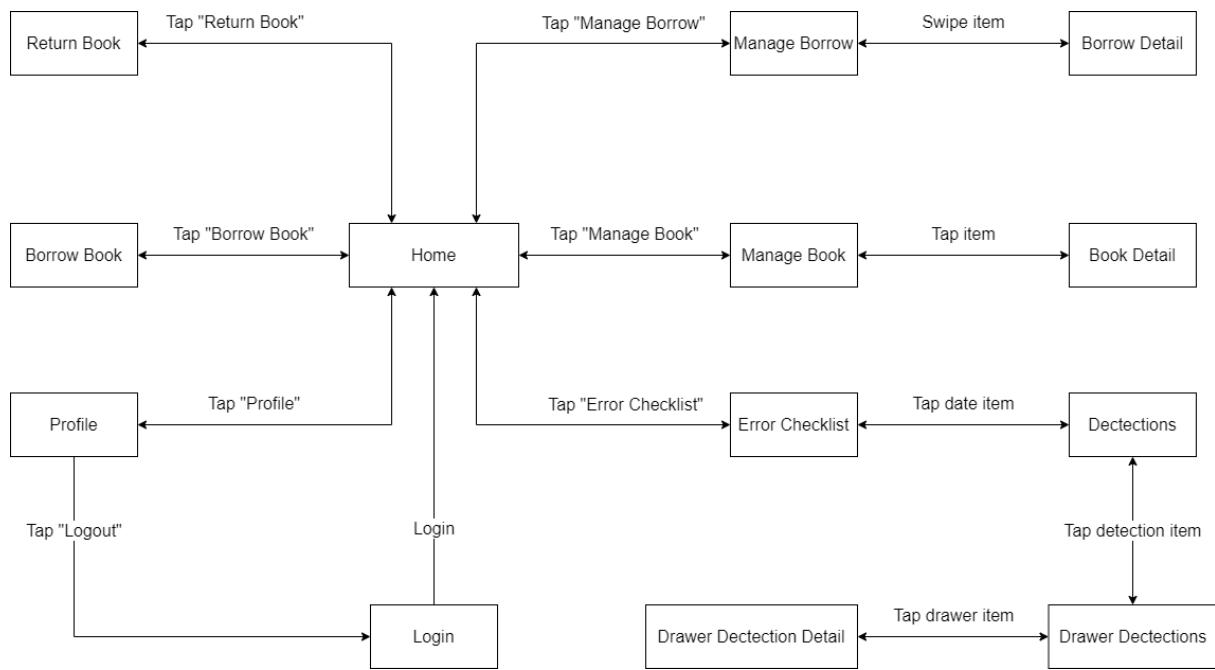


Figure 51 - <Screen Flow Diagram> Librarian Mobile Application

d. <Patron> Mobile Application Screen Flow

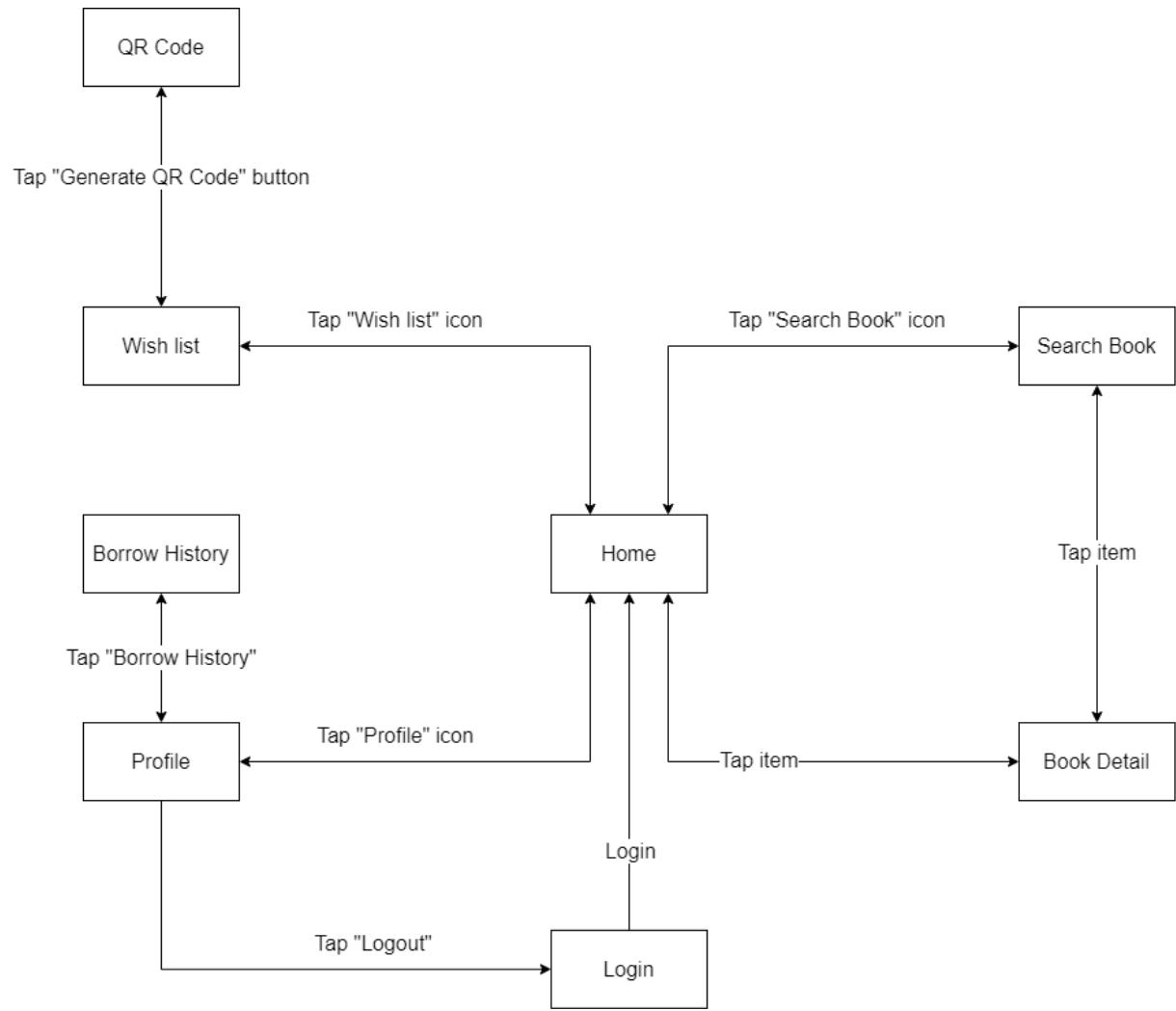


Figure 70 - <Screen Flow Diagram> Patron Mobile Application

3.1.2 Screen Details

3.1.2.1 Web Application Admin Screen Details

Id	Feature	Screen/Popup	Description
1	Login	Login	Login screen includes: username text-input, password password-input, hide/unhide icon, login button
2	Get librarians	Librarian list	Librarian list screen includes: librarian list, new librarian button, search field, search button, delete icon, pagination
3	Create librarian	Create librarian	Create librarian popup includes: name text-input, address text-input, gender drop-down list, date of birth date picker, phone text-input, username text-input, email text-input, password text-input, confirm password text-input, avatar file upload button, cancel button, save button, hide/unhide icon
4	Get librarian detail	Librarian detail	Librarian detail popup includes: edit button, avatar, name, gender, username, email, date of birth, phone, address
5	Update librarian	Update librarian	Update librarian popup includes: name text-input, address text-input, gender drop-down list, date of birth date picker, phone text-input, username, email text-input, avatar upload file button, cancel button, save button
6	Get patrons	Patron list	Patron list screen includes: patron list, search text-input, search button, pagination
7	Get patron detail	Patron detail	Patron detail popup includes: avatar, name, gender, username, email, date of birth, phone, address
8	Get book groups	Book group list	Book group list screen includes: statistics of book group by category, top 5 newest book group list, refresh button, search text-input, search button, book group list, pagination
9	Get book group detail	Book group detail	Book group detail popup includes: rating bar, view feedbacks button, image, book name, book author, category, page number, size, quantity, more details

			button, publish company, publish date, edition, publish place, description
10	Get customer's feedbacks	Feedback list	Feedback list popup includes: feedback list, remove button
11	Get books in book group	Book list	Book list popup includes: book list
12	Get bookshelves and locations	Bookshelf and location list	Bookshelf and location list screen: bookshelf list, location list, bookshelf search text-input, bookshelf search button, location search text-input, location search button, bookshelf add new button, location add new button, pagination, bookshelf detail button, bookshelf delete button, location detail button
13	Get bookshelf detail	Bookshelf detail	Bookshelf detail screen includes: bookshelf name, row, column, location, row filter drop-down list, column filter drop-down list, filter button, drawer list, first drawer in the bookshelf
14	Get books in drawer	Books in drawer	Books in drawer popup includes: book list, search text-input, search button, pagination
15	Create bookshelf	Create bookshelf	Create bookshelf popup includes: name text-input, row number input, column number input, location drop-down list, cancel button, save button
16	Create location	Create location	Create location popup includes: name text-input, color drop-down list, cancel button, save button
17	Get location detail	Get location detail	Get location detail popup includes: location, color, edit button, delete button
18	Update location	Update location	Update location popup includes: location name, color, save button, cancel button
19	Get detections	Detection list	Detection list screen includes: detection list, from date filter date picker, to date filter date picker, filter button, pagination, upload video button
20	Get drawer detections	Drawer detection list	Drawer detection list popup includes: drawer detection list, bookshelf name, date of detection,

			name of the staff upload video, video of the detection
21	Get drawer detections message	Unverified error, verified error list and rejected error list	Drawer detections message screen includes: unverified error list, verified error list, rejected error list

3.1.2.2 Web Application Librarian Screen Details

Id	Feature	Screen/Popup	Description
1	Login	Login	Login screen includes: username text-input, password password-input, hide/unhide icon, login button
2	Get book groups	Book group list	Book group list screen includes: statistics of book group by category, top 5 newest book group list, refresh button, search text-input, search button, new book button, manage categories button, book group list, pagination
3	Create book group	Create book group	Create book group popup includes: book group name text-input, author text-input, page number text-input, width text-input, height text-input, quantity text-input, fee text-input, punish fee text-input, categories drop-down list, publishing company text-input, upload button, publishing date date-picker, edition text-input, publishing palace text-input, description text-area, save button, cancel button
4	Get categories	Category list	Category popup includes: category list, delete icon, name of category text-input, add item button
5	Get book group detail	Book group detail	Book group detail popup includes: rating bar, view feedbacks button, image, book name, book author, category, page number, size, quantity, more details button, publish company, publish date, edition, publish place, description, edit button, delete button
6	Get customer's feedback	Feedback list	Feedback list popup includes: feedback list

7	Update book group	Update book group	Update book group pop up includes: book group name text-input, author text-input, page number text-input, width text-input, height text-input, punish fee text-input, categories drop-down list, publishing company text-input, upload button, publishing date date-picker, edition text-input, publishing palace text-input, description text-area, save button, cancel button
8	Get books in book group	Book list	Book list popup includes: book list, remove button
9	Add books into book group	Create books	Create books popup includes: number of books text-input, close button, create button
10	Export PDF	Export list book barcode to PDF	List book barcode popup includes: tick/untick button, book list, cancel button, preview button
11	Get borrow book and return book history	Borrow and return list	Borrow book and return book list screen: borrow book list, return book list, search text-input, search button, pagination
12	Get borrow history detail	Borrow detail	Borrow detail popup includes: patron name, start time, return time, quantity, total fee, book image, fee, punish fee
13	Get return history detail	Return detail	Return detail popup includes: patron
14	Get bookshelves and locations	Bookshelf and location list	Bookshelf and location list screen: bookshelf list, location list, bookshelf search text-input, bookshelf search button, location text-input, location search button, pagination, bookshelf detail button, location detail button
15	Get bookshelf detail	Bookshelf detail	Bookshelf detail screen includes: bookshelf name, row, column, location, row filter drop-down list, column filter drop-down list, filter button, drawer list, first drawer in the bookshelf

16	Get books in drawer	Books in drawer	Books in drawer popup includes: book list, search text-input, search button, add books to drawer button, tick/untick button, pagination
17	Add books into drawer	Add books into drawer	Add books into drawer popup includes: book list, search book text-input, search button, add to drawer button, tick/untick button, pagination
18	Get location detail	Get location detail	Get location detail popup includes: location, color, edit button, delete button
19	Get detections	Detection list	Detection list screen includes: detection list, from date filter date picker, to date filter date picker, filter button, pagination, upload video button
20	Get drawer detections	Drawer detection list	Drawer detection list popup includes: drawer detection list, bookshelf name, date of detection, name of the staff upload video, video of the detection
21	Get drawer detections message	Unverified error, verified error list and rejected error list	Drawer detections message screen includes: unverified error list, verified error list, rejected error list In unverified error list includes: bookshelf name, barcode, id, error message, reject button, confirm button In verified error list includes: bookshelf name, barcode, id, error message In rejected error list includes: bookshelf name, barcode, id, error message
22	Process borrow book	Borrow book	Borrow book screen includes: start scanning button, book list, patron name, email of patron, address of patron, phone of patron, borrow date date-picker, return date date-picker, confirm button
23	Process return book	Return book	Return book screen includes: book list, return button, name of patron, address of patron, email of patron, phone of patron, borrow date, correct payday, return day, quantity, fee, punish fee, total, confirm button

3.1.2.3 Mobile Application Librarian Screen Details

Id	Feature	Screen	Description
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1	Login	Login	Login screen includes: username text-input, password password-input, hide/unhide icon, login button
2	Manage Book	Book group list	Manage book screen includes: book group list, search text-input, search icon, image of book, book group name, author, fee
3	Book detail	Book detail	Book detail screen includes: image, book name, author, fee, description tab, location tab, feedbacks tab, add to wish list button Location tab includes: location name, bookshelf name, drawer name, Feedback tab includes: rating bar, feedback content text-input, send feedback button, feedback list
4	Manage Borrow	User list	Manage borrow screen includes: user list, search text-input, search icon, avatar of patron, name of patron, username of patron, total fee of patron
5	Borrow and Return History	Borrow and return list	Borrow and return history screen includes: avatar of patron, total fee of patron, current borrow book list, return book list
6	Manage Detection	Daily detection list	Daily detection screen includes: date picker, detection list
7	Manage Drawer Detection	Drawer Detection List	Drawer detection screen includes: drawer detection list
8	Manage Drawer Detection Messages	Error List, Rejected Error List, Confirmed Error List	Manage Drawer Detection Messages screen includes: error list tab, rejected list tab, confirmed list tab
9	Manage Profile	Profile	Profile screen includes: image of patron, name, phone number, email, name, address, birthdate, created time, logout button

3.1.2.4 Mobile Application Patron Screen Details

Id	Feature	Screen	Description
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1	Login	Login	Login screen includes: username text-input, password password-input, hide/unhide icon, login button
2	Signup	Signup	Signup screen includes: email text-input, name text-input, gender dropdown list, phone text-input, address text-input, date of birth date-picker, username text-input, password text-input, signup account
3	Manage Book	Book group list	Manage book screen includes: image of patron, name of patron, notification icon, book group list, image of book, book group name, author, description
4	Wish list	Wish list	Wish list screen includes: name of book, author, fee, image of book, gen QR Code button
4	Search book	Book group list	Search screen includes: list of categories, search icon, search text-input, book group list
6	Manage Profile	Profile	Profile screen includes: image of patron, name, phone number, email, name, address, birthdate, created time, history borrow button, logout button
7	Borrow and Return History	Borrow and return list	Borrow and return history screen includes: avatar of patron, total fee of patron, current borrow books list, return books list
6	Book detail	Book detail	Book detail screen includes: image, book name, author, fee, description tab, location tab, feedbacks tab, add to wish list button Location tab includes: location name, bookshelf name, drawer name, Feedback tab includes: rating bar, feedback content text-input, send feedback button, feedback list

3.1.3 Screen Authorization

3.1.3.1 Web Application Screen Authorization

Screen/Popup	Unauthenticated User	Authenticated User	Admin	Librarian
Login		X	X	X
Dashboard			X	X
Manage book			X	X

Add book group				X
Get categories				X
Book group detail			X	X
Get books in book group			X	X
Add books into book group				X
Export barcode to PDF				X
Get feedback of book group			X	X
Update book group				X
Get borrow and return book			X	X
Borrow detail			X	X
Return detail			X	X
Borrow book				X
Return book				X
Get bookshelf and Location			X	X
Create bookshelf			X	
Create location			X	
Bookshelf detail			X	X
Location detail			X	X
Update location			X	
Get books in drawer			X	X
Add books into drawer				X
Get detections			X	X
Get drawer detections			X	X
Get drawer detection messages			X	X

3.1.3.2 Mobile Application Screen Authorization

Screen	Unauthenticated User	Authenticated User	Librarian	Patron
Register	X			
Login		X	X	X
Librarian home			X	
Patron home				X
Search book				X
Book detail			X	X

Add book group feedback				X
Wish list				X
Get profile		X		
Update profile		X		
Get all borrow and return book history			X	
Borrow and return history detail			X	X
Scan to borrow book				
Scan to return book				
Get detections			X	
Get drawer detections			X	
Get drawer detection messages			X	

In which:

- Unauthenticated User: The user has no account or has not logged in system
- Authenticated User: The user who has logged in system successfully
- Admin: The user who manages location, bookshelf, librarian and patron
- Librarian: The user who manages books in library
- Patron: The user who borrows and returns book of library

3.1.4 Non-Screen Functions

#	System Function	Description
1	Detect Barcode	PAPV detects and reads Barcode
2	Push notification	PAPV sends notification to patron when their borrow book is expiring before one day
3	Create book	PVPV auto generate books by book groups quantity
4	Create drawer	PVPV auto generate drawers by bookshelf's rows and columns

3.1.5 Entity Relationship Diagram

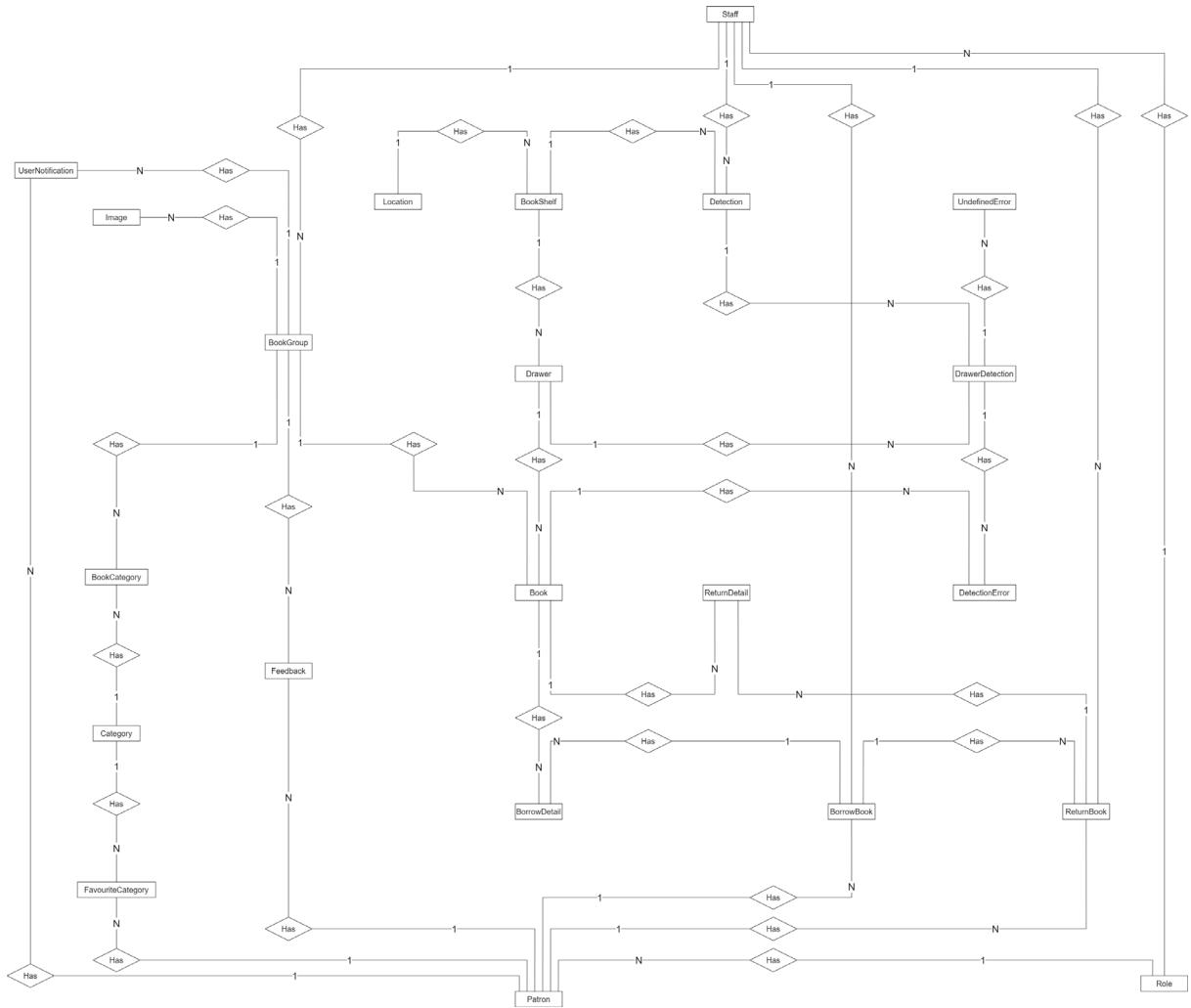


Figure 71 - Entity Relationship Diagram (without attributes)

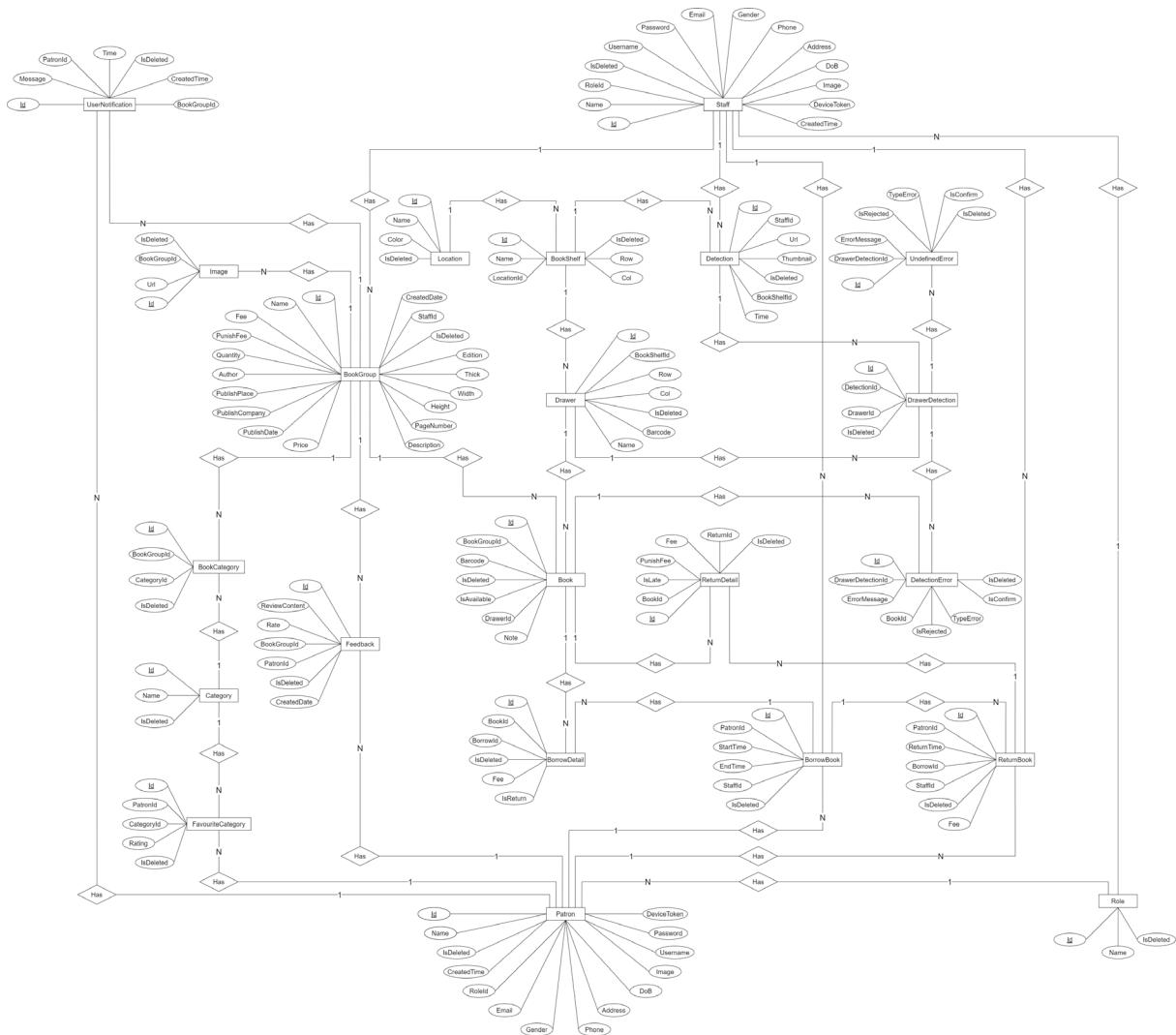


Figure 52 - Entity Relationship Diagram (with attributes)

#	Entity	Description
1	Book	Book is an entity represents book information
2	BookCategory	BookCategory is an entity represents book category information
3	BookGroup	BookGroup is an entity represents book group information
4	BookShelf	BookShelf is an entity represents bookshelf information
5	BorrowBook	BorrowBook is an entity represents borrow book information
6	BorrowDetail	BorrowDetail is an entity represents borrow detail information
7	Category	Category is an entity represents category information
8	Patron	Patron is an entity represents patron information
9	Detection	Detection is an entity represents detection information
10	DetectionError	DetectionError is an entity represents detection error information

11	Drawer	Drawer is an entity represents drawer information
12	DrawerDetection	DrawerDetection is an entity represents drawer detection information
13	FavouriteCategory	FavouriteCategory is an entity represents favourite category information
14	Feedback	Feedback is an entity represents feedback information
15	Image	Image is an entity represents image information
16	Location	Location is an entity represents location information
17	ReturnBook	ReturnBook is an entity represents return book information
18	ReturnDetail	ReturnDetail is an entity represents return book detail information
19	Role	Role is an entity represents role information
20	Staff	Staff is an entity represents staff information that includes admin and librarian
21	UndefinedError	UndefinedError is an entity represents undefined error information
22	UserNotification	UserNotification is an entity represents notification information

Table 70 - Entity Description

4. Non-Functional Requirements

4.1 External Interfaces

4.1.1 *User Interfaces*

- UI-1: GUI has to be friendly to use.
- UI-2: Language used in application is English.
- UI-3: UI can be responsive on multiple screen size.
- UI-4: Mobile application follow Material-UI design.
- UI-5: Web application follow Ant Design.

4.1.2 *Software Interfaces*

- SI-1: File Storage Service

SI-1.1: PAPV can integrate with Firebase Storage Service and use its upload file API.

- SI-2: Real-time Message Transform Service

SI-2.1: PAPV can integrate with SignalR Real-time Message Transform Service to transform message between web application and mobile application.

4.1.3 Hardware Interfaces

PAPV System requires Drone to get video. Like other system, PAPV just requires basic devices for input, output as personal computer or laptop and smartphone. All of devices must have internet permission and camera permission for smartphone.

4.1.4 Communications Interfaces

PAPV System's communication interfaces depend on sending and retrieving data through online protocol to connect between applications.

4.2 Quality Attributes

4.2.1 Usability

- Mobile UI/UX follows Material Design to be friendly with users.
- Web Application follows Ant Design which is clear and easy to use.
- Admin and librarian can use PAPV with less than a day of guidance.
- Patron does not require to have technical knowledge before using.

4.2.2 Reliability

- PAPV failure is less than 5% and availability of the system is over 80%.
- Mean time to hotfix and deploy is less than 6 hours.

4.2.3 Performance

- Librarian's mobile application scan QR Code to get patron's book wish list with real time message transform SignalR needs under 5 seconds.
- Patron's mobile application scan QR Code to check-in needs under 3 seconds.
- PAPV needs under 5 minutes to detect and notify book position tracking.
- All common response time is under 3 seconds.

4.2.4 Dependability

4.2.4.1 Security

- PAPV always checks authorization.
- Each role can only access its own functions.
- Account must be unique and password must be encrypted.

4.2.4.2 Safety

- Librarian cannot change borrow fee of borrowing book.

4.2.3 Supportability

- Beside web application for Librarian, PAPV support a group of functions to Librarian on mobile application.

4.2.5 Design Constraints

- Application language is English.
- Application uses TypeScript to increase maintainability.

4.2.6 *Support Documents*

- PAPV does not support online user documentation.

4.2.7 *Purchased Components*

- IIS Server.
- Firebase Storage.
- Firebase Notification.
- Google Colab.

5. Other Requirements

5.1 Messages List

#	Message code	Message Type	Context	Content
1	MSG01	In line, under input form, red text	Name cannot be null	Name must no empty
2	MSG02	In line, under input form, red text	Row of bookshelf cannot be null	Row must no empty
3	MSG03	In line, under input form, red text	Column of bookshelf cannot be null	Column must no empty
4	MSG04	In line, under input form, red text	Location of bookshelf cannot be null	Location must be choice
5	MSG05	In line, grey text	List has no data	No data
6	MSG06	In line, under input form, red text	Location name cannot be null	Location name must not empty
7	MSG07	In line, under input form, red text	Name must be less than 100 characters	Name must be less than 100 characters
8	MSG08	In line, under input form, red text	Address cannot be null	Address must no empty
9	MSG09	In line, under input form, red text	Date of birth cannot be null	Date of birth must no empty
10	MSG10	In line, under input form, red text	Phone cannot be null	Phone must no empty
11	MSG11	In line, under input form, red text	Username cannot be null	Username must no empty

12	MSG12	In line, under input form, red text	Email cannot be null	Email must no empty
13	MSG13	In line, under input form, red text	Password cannot be null	Password must no empty
14	MSG14	In line, under input form, red text	Avatar cannot be null	Avatar must no empty
15	MSG15	In line, under input form, red text	Password and confirm password must be matched	Password and confirm password must be matched
16	MSG16	In line, under input form, red text	Address must be less than 250 characters	Address must be less than 250 characters
17	MSG17	In line, under input form, red text	Username must be greater than 3 characters and less than 30 characters	Username must be greater than 3 characters and less than 30 characters
18	MSG18	In line, under input form, red text	Username must be unique	Username already exist
19	MSG19	In line, under input form, red text	Librarian must be 18 years old	Librarian is less than 18 years old
20	MSG20	In line, under input form, red text	Phone number must be have 10 digits	Phone number must be have 10 digits
21	MSG21	In line, under input form, red text	Email must be correct format	Email must be correct format
22	MSG22	In line, under input form, red text	Author cannot be null	Author must no empty
23	MSG23	In line, under input form, red text	Quantity cannot be null	Quantity must no empty
24	MSG24	In line, under input form, red text	Fee cannot be null	Fee must no empty
25	MSG25	In line, under input form, red text	Punish fee cannot be null	Punish fee must no empty

26	MSG26	In line, under input form, red text	Category cannot be null	Category must be choice
27	MSG27	In line, under input form, red text	Author must be less than 100 characters	Author must be less than 100 characters
28	MSG28	In line, under input form, red text	Username and password cannot be null	Please enter username or password again
29	MSG29	In line, under input form, red text	Content cannot be null	Content must no empty
30	MSG30	In line, under input form, red text	Email must be unique	Email already exist
31	MSG31	In line, black text	List has no data	No drawer was found
32	MSG32	In line, under input form, red text	Book Price cannot be null	Book Price must no empty
33	MGS33	In line, under input form, red text	Book Image cannot be null	Book Image must no empty
34	MSG34	In line, under input form, red text	Invalid file	File invalid
35	MSG35	In line, grey text	Patron has ever borrowed books in PAPV system	Please borrow book to get suggest

Table 71 - Messages List

IV. Software Design Description

1. Overall Description

1.1 Assumptions

This system is designed basing on these following assumptions:

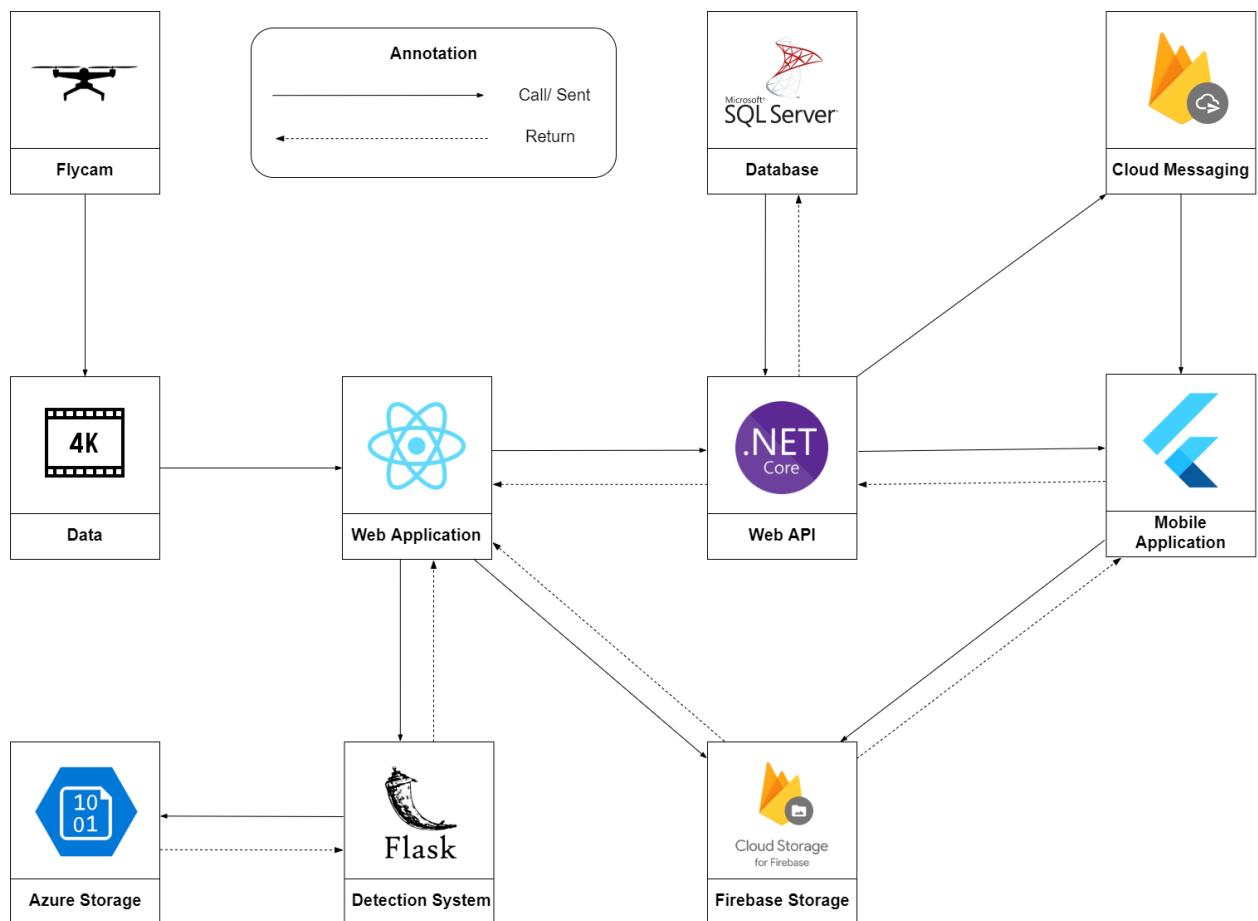
- Windows 10.
- Google Chrome 88.
- Android 6 or higher.
- SSMS 18.
- End-user has basic mobile and website knowledge.

1.2 Design Constraints

This system depends on network connection.

2. System Architecture Design

2.1 Overall Architecture

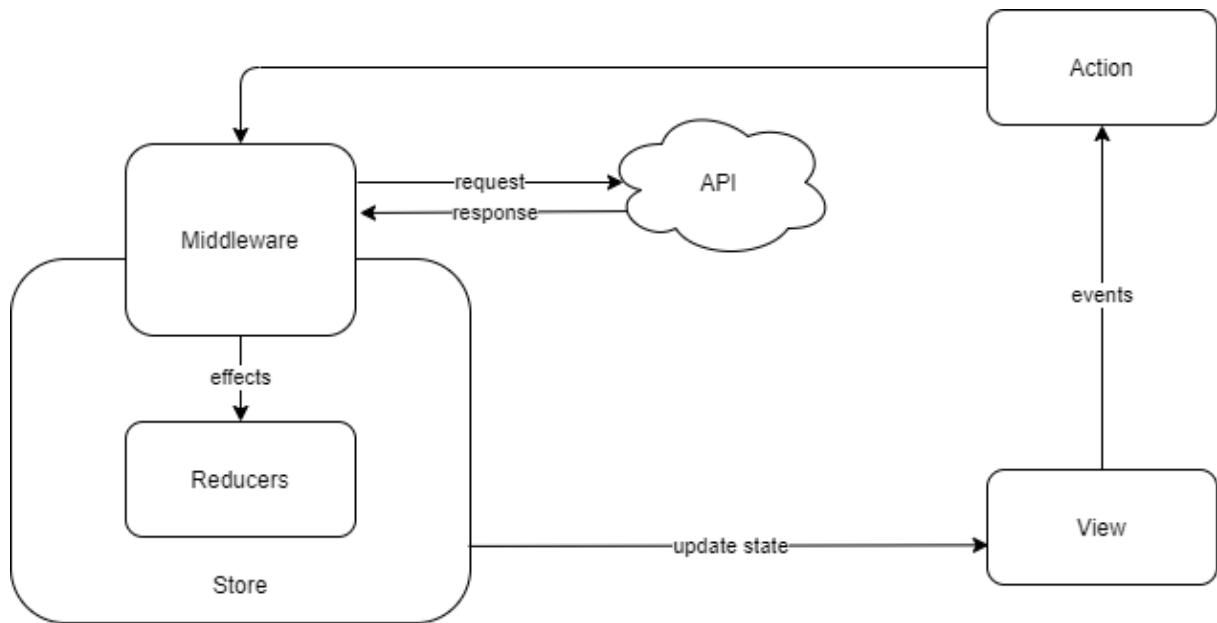


[Figure 53 - Overall Architecture Design](#)

- PAPV system consists of three components, the .NET Core web server provides APIs, Flutter is used for mobile application. Mobile application is used by librarian role and patron role. ReactJS is used for web application. Web application is provided for admin role and librarian role.
- PAPV System uses several third-party services as Firebase Storage to storage avatar and book's image, Firebase Messaging for push notification to patron mobile application and Azure Blob Storage for storage detection videos.
- PAPV System uses Flask Framework to build Python server to communicate with APIs.

2.2 System Architecture

2.2.1 Web Application Architecture

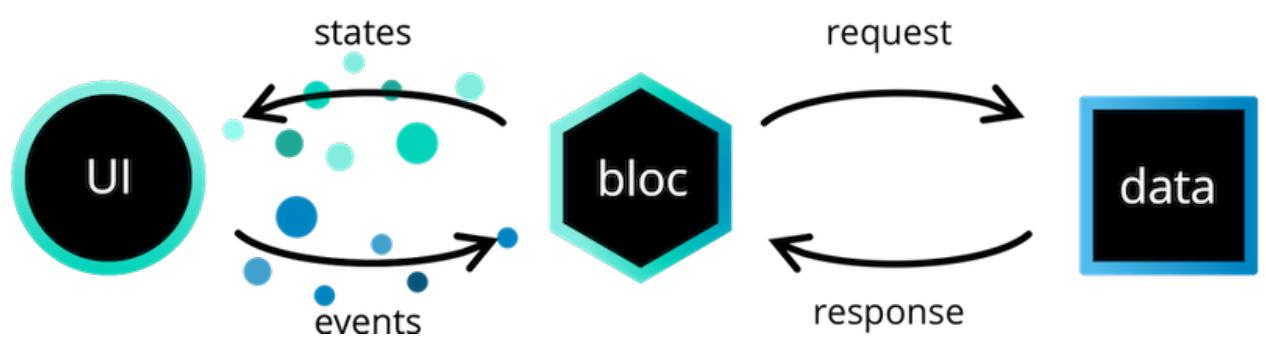


[Figure 54 - Web Application Architecture](#)

Using UMI JS – Ant Design Pro library allows us to organize PAPV Web Application as:

- **View:** responsibility is to find out how to render itself based on one or more model states. Further, it should handle application lifecycle events and user input
- **Action:** responsibility is to handle user event in view and dispatch to process model
- **Middleware:** responsibility is to provide ability for configure request to server, process authenticate and get back data from one or more sources
- **Reducers:** responsibility is to find out how component states should be based on received data from effect. Then, re-render view fit action

2.2.2 Mobile Application Architecture



[Figure 55 - Mobile Application Architecture](#)

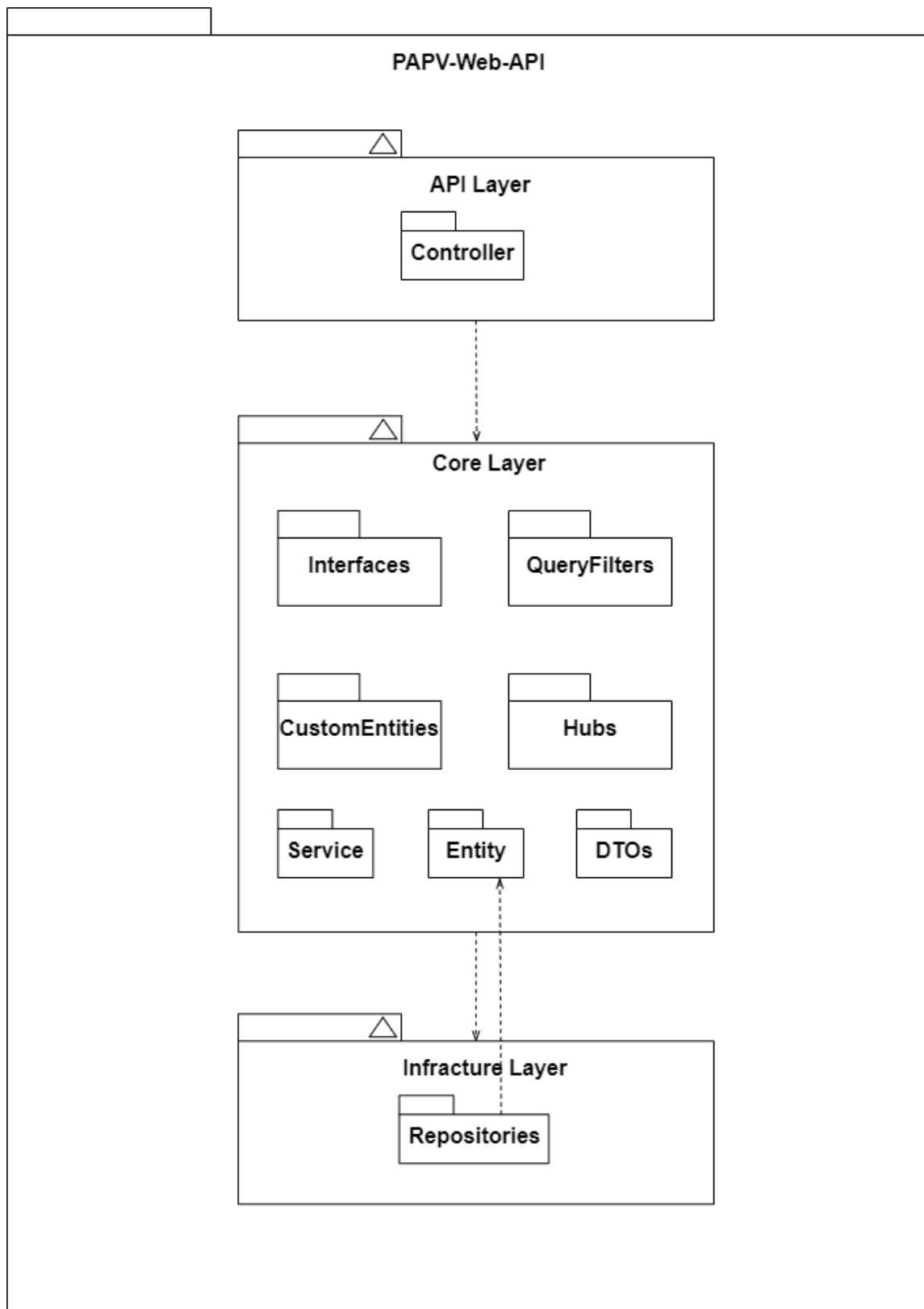
Using the BLOC library allows us to separate PAPV Mobile Application into three layers:

- **Presentation Layer:** responsibility is to find out how to render itself based on one or more bloc states. Further, it should handle application lifecycle events and user input.

- **Business Logic Layer:** responsibility for responding the presentation layer with new states, depends on one or more repositories to get back needed data.
- **Data Layer:** responsibility is to get back data from one or more sources.

2.3 Package Diagram

2.3.1 Web API Package Diagram

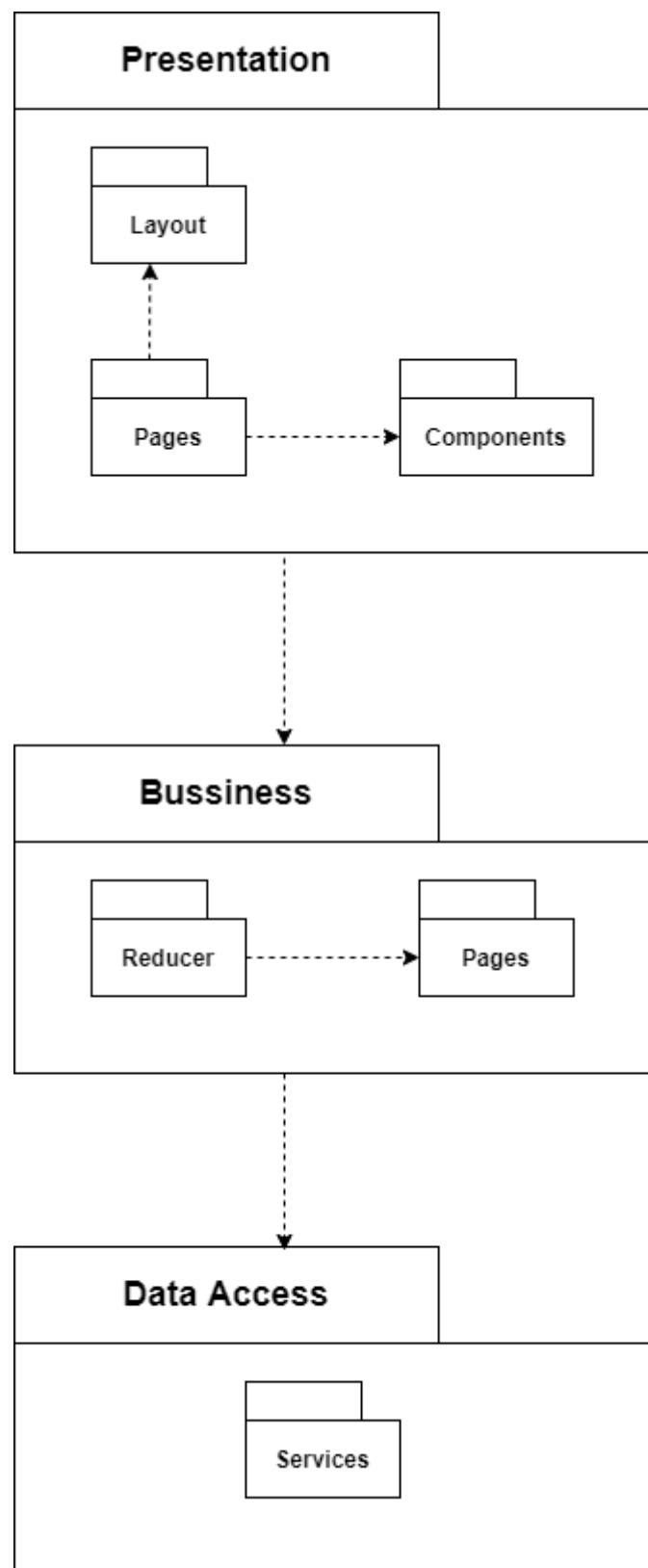


[Figure 56 - Web API Package Diagram](#)

No	Package	Description
01	Controller	<ul style="list-style-type: none"> - Package contains classes responsible for handling Http request and return responses with values.
02	Service	<ul style="list-style-type: none"> - Package contains classes responsible for handling business logic, validation and communicate with repository.
03	Entity	<ul style="list-style-type: none"> - Package contains classes represents the business logic entities, also responsible for entity framework database first.
04	DTOs	<ul style="list-style-type: none"> - Package contains classes responsible for shaping the data to return to clients.
05	CustomEntities	<ul style="list-style-type: none"> - Package contains classes responsible for paging the data to return to clients.
06	Hubs	<ul style="list-style-type: none"> - Package contains classes responsible for open socket to mobile app and web app.
07	Interfaces	<ul style="list-style-type: none"> - Package contains interfaces of service and repository classes.
08	QueryFilters	<ul style="list-style-type: none"> - Package contains classes responsible for filter data to return to clients per entity.
09	Repositories	<ul style="list-style-type: none"> - Package contains classes responsible for executing query and communicate with database.

Table 72 - Web API Package Diagram Description

2.3.2 Web Application Package Diagram



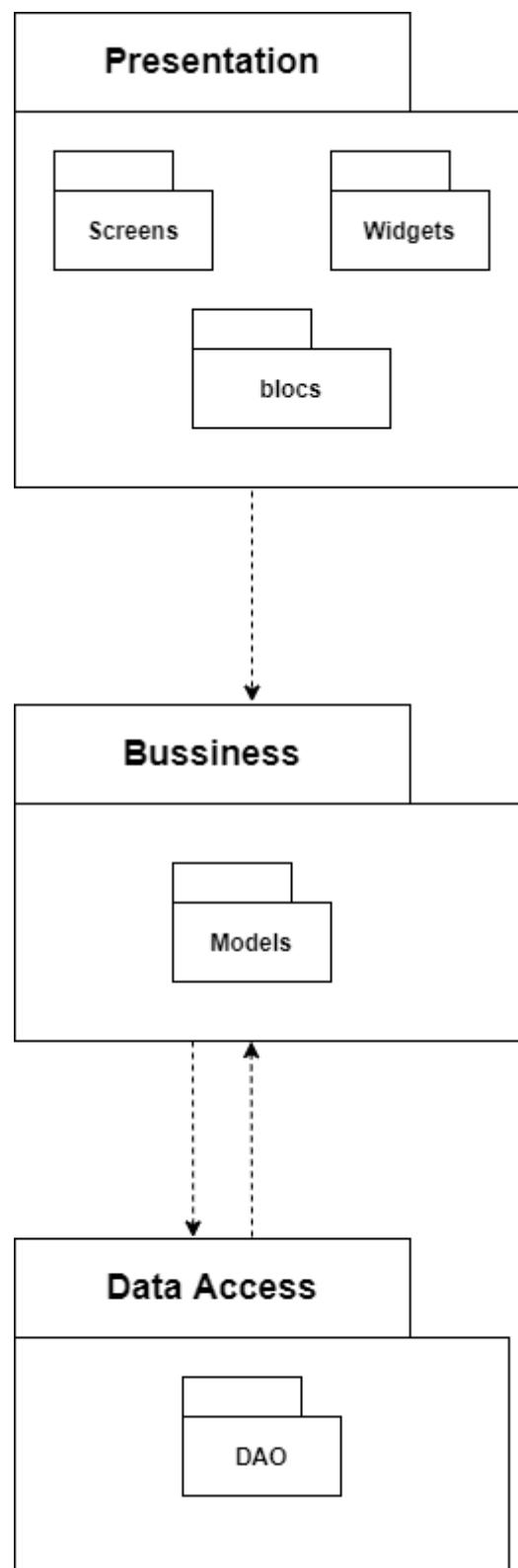
[Figure 57 - Web Application Package Diagram](#)

No	Package	Description
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01	Layout	<ul style="list-style-type: none"> - Package contains classes responsible for routing pages based on purpose.
02	Pages	<ul style="list-style-type: none"> - Package contains classes responsible for grouping components into complete interface and handling specific method.
03	Components	<ul style="list-style-type: none"> - Package contains classes responsible for handling interface components.
04	Reducer	<ul style="list-style-type: none"> - Package contains classes responsible for handling data from service and notify for pages to render interface.
05	Services	<ul style="list-style-type: none"> - Package contains classes responsible for handling HTTP request and return responses with values.

Table 73 - Web Application Package Diagram Description

2.3.3 Mobile Application Package Diagram



[Figure 58 - Mobile Application Package Diagram](#)

No	Package	Description
----	---------	-------------

01	Screens	<ul style="list-style-type: none"> - Package contains classes responsible for rendering to user interface.
02	Widgets	<ul style="list-style-type: none"> - Package contains classes responsible for handling interface components..
03	Blocs	<ul style="list-style-type: none"> - Package contains classes responsible for managing states and events through data stream and handling logic business.
04	Models	<ul style="list-style-type: none"> - Package contains classes responsible for receiving data and converting data to object.
05	DAO	<ul style="list-style-type: none"> - Package contains classes responsible for handling HTTP request and return responses with values.

Table 74 - Mobile Application Package Diagram Description

3. System Detailed Design

3.1 Overall

a. *Class Diagram*

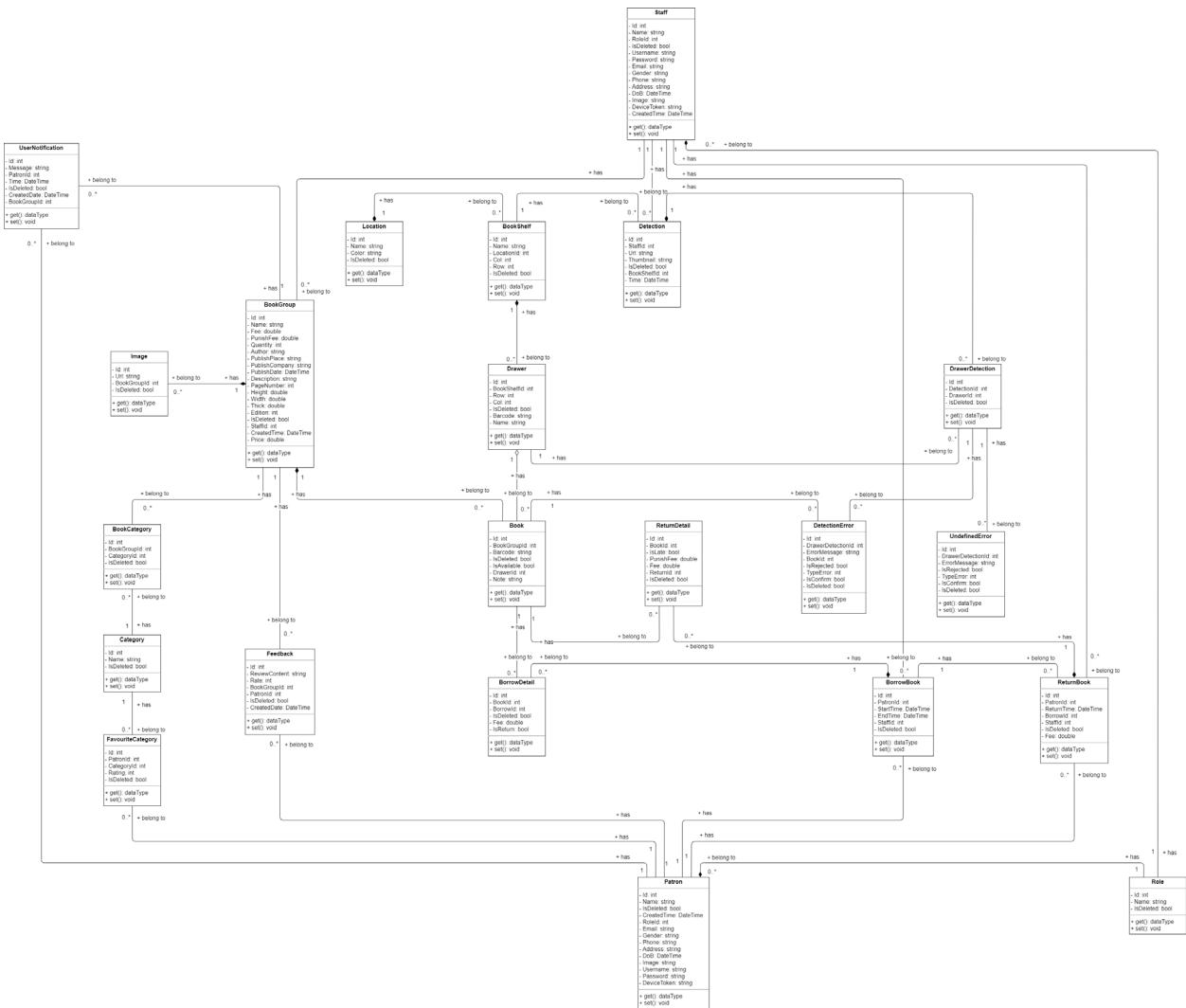


Figure 59- Class Diagram

b. Class Specification

b1. Book

Field name	Type	Description
Id	int	Unique identifier of book
BookGroupId	int	The identifier of book group
Barcode	string	Contains barcode information of book
IsDeleted	bool	Contains delete status of book
IsAvailable	bool	Contains available status of book
DrawerId	int	The identifier of drawer
Note	string	Contains note information of book

Table 75 - <Class Diagram Attributes> Book

Method	Return type	Description

get	data type	Get attribute value
set	void	Set value of attribute

Table 76 - <Class Diagram Methods> Book

b2. BookCategory

Field name	Type	Description
Id	int	Unique identifier of book category
BookGroupId	int	The identifier of book group
CategoryId	int	The identifier of category
IsDeleted	bool	Contains delete status of book category

Table 77 - <Class Diagram Attributes> BookCategory

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 78 - <Class Diagram Methods> BookCategory

b3. BookGroup

Field name	Type	Description
Id	int	Unique identifier of book group
Name	string	Contains name information of book group
Fee	double	Contains fee information of book group
PunishFee	double	Contains punish fee information of book group
Quantity	int	Contains quantity information of book group
Author	string	Contains author information of book group
PublishPlace	string	Contains publish place information of book group
PublishCompany	string	Contains publish company information of book group
PublishDate	DateTime	Contains publish date information of book group
Description	string	Contains description information of book group
PageNumber	int	Contains page number information of book group
Height	double	Contains height information of book group
Width	double	Contains width information of book group
Thick	double	Contains thick information of book group
Edition	int	Contains edition information of book group
IsDeleted	bool	Contains delete status of book group
StaffId	int	The identifier of staff

CreatedDate	DateTime	Contains created time information of book group
Price	double	Contains price of book group

Table 79 - <Class Diagram Attributes> BookGroup

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 80 - <Class Diagram Methods> BookGroup

b4. Bookshelf

Field name	Type	Description
Id	int	Unique identifier of bookshelf
Name	string	Contains name information of bookshelf
LocationId	int	The identifier of location
Col	int	Contains column information of bookshelf
Row	int	Contains row information of bookshelf
IsDeleted	bool	Contains delete status of bookshelf

Table 81 - <Class Diagram Attributes> Bookshelf

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 82 - <Class Diagram Methods> Bookshelf

b5. BorrowBook

Field name	Type	Description
Id	int	Unique identifier of borrow book
PatronId	int	The identifier of patron
StartTime	DateTime	Contains start time information of borrow book
EndTime	DateTime	Contains end time information of borrow book
StaffId	int	The identifier of staff
IsDeleted	bool	Contains delete status of borrow book

Table 83 - <Class Diagram Attributes> BorrowBook

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 84 - <Class Diagram Methods> BorrowBook

b6. BorrowDetail

Field name	Type	Description
Id	int	Unique identifier of borrow detail
BookId	int	The identifier of book
BorrowId	int	The identifier of borrow
IsDeleted	bool	Contains delete status of borrow detail
Fee	double	Contains fee information of borrow detail
IsReturn	bool	Contains return status of borrow detail

Table 85 - <Class Diagram Attributes> BorrowDetail

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 86 - <Class Diagram Methods> BorrowDetail

b7. Category

Field name	Type	Description
Id	int	Unique identifier of category
Name	string	Contains name information of category
IsDeleted	bool	Contains delete status of category

Table 87 - <Class Diagram Attributes> Category

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 88 - <Class Diagram Methods> Category

b8. Patron

Field name	Type	Description
Id	int	Unique identifier of patron
Name	string	Contains information of patron
IsDeleted	bool	Contains delete status of patron
CreatedTime	DateTime	Contains created time information of patron
RoleId	int	The identifier of role
Email	string	Contains email information of patron
Gender	string	Contains gender information of patron
Phone	string	Contains phone information of patron

Address	string	Contains address information of patron
DoB	DateTime	Contains date of birth information of patron
Image	string	Contains image information of patron
Username	string	Contains username information of patron
Password	string	Contains password information of patron
DeviceToken	string	Contains device token information of patron

Table 89 - <Class Diagram Attributes> Patron

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 90 - <Class Diagram Methods> Patron

b9. Detection

Field name	Type	Description
Id	int	Unique identifier of detection
StaffId	int	The identifier of staff
Url	string	Contains URL information of detection
Thumbnail	string	Contains thumbnail information of detection
IsDeleted	bool	Contains delete status of detection
BookShelfId	int	The identifier of bookshelf
Time	DateTime	Contains time information of detection

Table 91 - <Class Diagram Attributes> Detection

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 92 - <Class Diagram Methods> Detection

b10. DetectionError

Field name	Type	Description
Id	int	Unique identifier of detection error
DrawerDetectionId	int	The identifier of drawer detection
ErrorMessage	string	Contains error message information of detection error
BookId	int	The identifier of book
IsRejected	bool	Contains rejected status of detection error
TypeError	int	Contains type error information of detection error

IsConfirm	bool	Contains confirm status of detection error
IsDeleted	bool	Contains delete status of detection error

Table 93 - <Class Diagram Attributes> DetectionError

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 94 - <Class Diagram Methods> DetectionError

b11. Drawer

Field name	Type	Description
Id	int	Unique identifier of drawer
BookShelfId	int	The identifier of bookshelf
Row	int	Contains row information of drawer
Col	int	Contains column information of drawer
IsDeleted	bool	Contains delete status of drawer
Barcode	string	Contains barcode information of drawer
Name	string	Contains name information of drawer

Table 95 - <Class Diagram Attributes> Drawer

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 96 - <Class Diagram Methods> Drawer

b12. DrawerDetection

Field name	Type	Description
Id	int	Unique identifier of drawer detection
DetectionId	int	The identifier of detection
DrawerId	int	The identifier of drawer
IsDeleted	bool	Contains delete status of drawer detection

Table 97 - <Class Diagram Attributes> DrawerDetection

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 98 - <Class Diagram Methods> DrawerDetection

b13. FavouriteCategory

Field name	Type	Description
Id	int	Unique identifier of favourite category
PatronId	int	The identifier of patron
CategoryId	int	The identifier of category
Rating	int	Contains rating information of favourite category
IsDeleted	bool	Contains delete status of favourite category

Table 99 - <Class Diagram Attributes> FavouriteCategory

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 100 - <Class Diagram Methods> FavouriteCategory

b14. Feedback

Field name	Type	Description
Id	int	Unique identifier of feedback
ReviewContent	string	Contains review content information of feedback
Rate	int	Contains rating information of feedback
BookGroupId	int	The identifier of book group
PatronId	int	The identifier of patron
IsDeleted	bool	Contains delete status of feedback
CreatedDate	DateTime	Contains created date information of feedback

Table 101 - <Class Diagram Attributes> Feedback

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 102 - <Class Diagram Methods> Feedback

b15. Image

Field name	Type	Description
Id	int	Unique identifier of image
Url	string	Contains URL information of image
BookGroupId	int	The identifier of book group
IsDeleted	bool	Contains delete status of image

Table 103 - <Class Diagram Attributes> Image

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 104 - <Class Diagram Methods> Image

b16. Location

Field name	Type	Description
Id	int	Unique identifier of location
Name	string	Contains name information of location
Color	string	Contains color information of location label
IsDeleted	bool	Contains delete status of location

Table 105 - <Class Diagram Attributes> Location

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 106 - <Class Diagram Methods> Location

b17. ReturnBook

Field name	Type	Description
Id	int	Unique identifier of return book
PatronId	int	The identifier of patron
ReturnTime	DateTime	Contains return time information of return book
BorrowId	int	The identifier of borrow
StaffId	int	The identifier of staff
IsDeleted	bool	Contains delete status of return book
Fee	double	Contains fee information of return book

Table 107 - <Class Diagram Attributes> ReturnBook

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 108 - <Class Diagram Methods> ReturnBook

b18. ReturnDetail

Field name	Type	Description
Id	int	Unique identifier of return detail
BookId	int	The identifier of book
IsLate	bool	Contains late status of return detail

PunishFee	double	Contains punish fee information of return detail
Fee	double	Contains fee information of return detail
ReturnId	int	The identifier of return
IsDeleted	bool	Contains delete status of return detail

Table 109 - <Class Diagram Attributes> ReturnDetail

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 110 - <Class Diagram Methods> ReturnDetail

b19. Role

Field name	Type	Description
Id	int	Unique identifier of role
Name	string	Contains name information of role
IsDeleted	bool	Contains delete status of role

Table 111 - <Class Diagram Attributes> Role

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 112 - <Class Diagram Methods> Role

b20. Staff

Field name	Type	Description
Id	int	Unique identifier of staff
Name	string	Contains name information of staff
RoleId	int	The identifier of role
IsDeleted	bool	Contains delete status of staff
Username	string	Contains username information of staff
Password	string	Contains password information of staff
Email	string	Contains email information of staff
Gender	string	Contains gender information of staff
Phone	string	Contains phone information of staff
Address	string	Contains address information of staff
DoB	DateTime	Contains date of birth information of staff
Image	string	Contains image information of staff

DeviceToken	string	Contains device token information of staff
CreatedTime	DateTime	Contains created time information of staff

Table 113 - <Class Diagram Attributes> Staff

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 114 - <Class Diagram Methods> Staff

b21. UndefinedError

Field name	Type	Description
Id	int	Unique identifier of undefined error
DrawerDetectionId	string	The identifier of drawer detection
ErrorMessage	int	Contains error message information of undefined error
IsRejected	DateTime	Contains rejected status of undefined error
TypeError	int	Contains error type information of undefined error
IsConfrim	bool	Contains confirm status of undefined error
IsDeleted	bool	Contains delete status of undefined error

Table 115 - <Class Diagram Attributes> UndefinedError

Method	Return type	Description
get	data type	Get attribute value
set	void	Set value of attribute

Table 116 - <Class Diagram Methods> UndefinedError

b22. UserNotification

Field name	Type	Description
Id	int	Unique identifier of user notification
Message	string	Contains message information of user notification
PatronId	int	The identifier of patron
Time	DateTime	Contains time information of user notification
IsDeleted	bool	Contains delete status of user notification
CreatedDate	DateTime	Contains created date information of user notification
BookGroupId	int	The identifier of book group

Table 117 - <Class Diagram Attributes> UserNotification

Method	Return type	Description
get	data type	Get attribute value

set	void	Set value of attribute
-----	------	------------------------

Table 118 - <Class Diagram Methods> UserNotification

c. Sequence Diagram(s)

c1 <Librarian> Sequence Diagram(s)

c1.1 <Librarian> Create Book Group

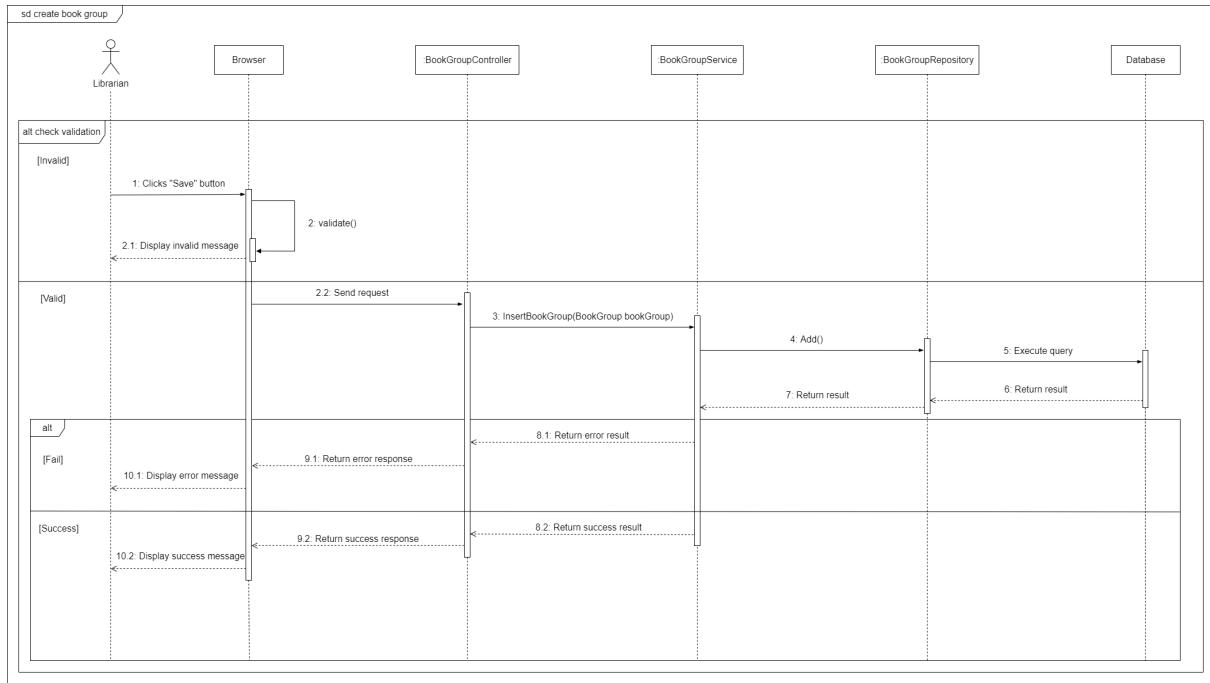


Figure 80 - <Sequence Diagram> Create Book Group

c1.2 <Librarian> Update Book Group

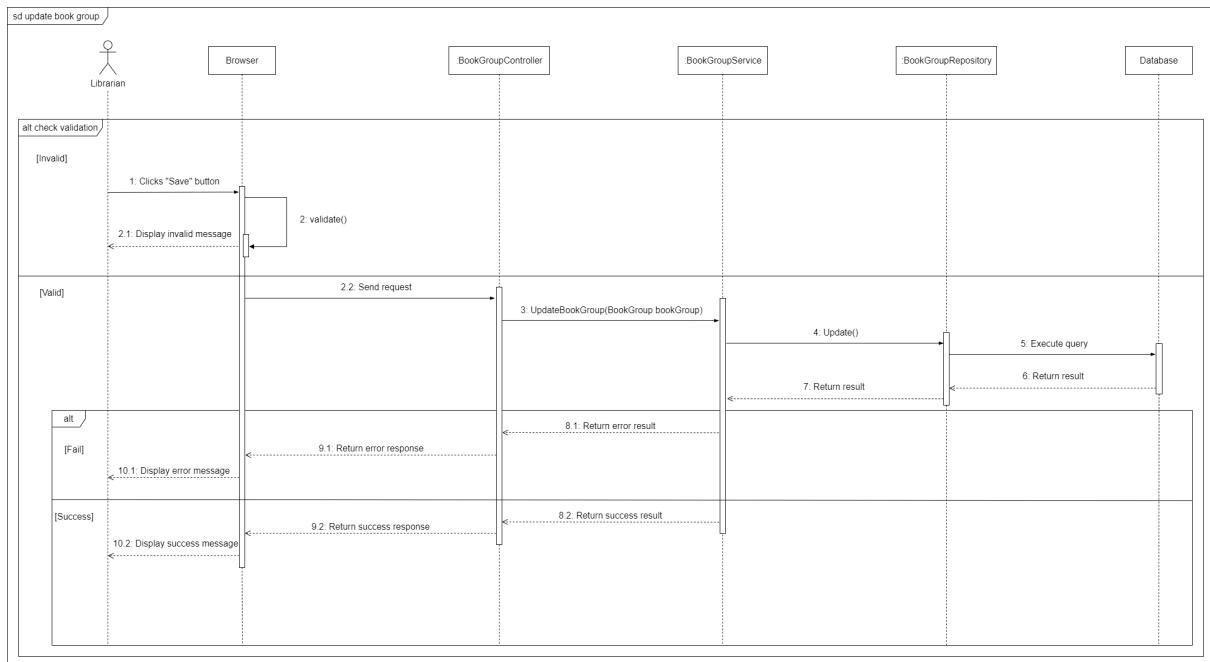


Figure 81 - <Sequence Diagram> Update Book Group

c1.3 <Librarian> Delete Book Group

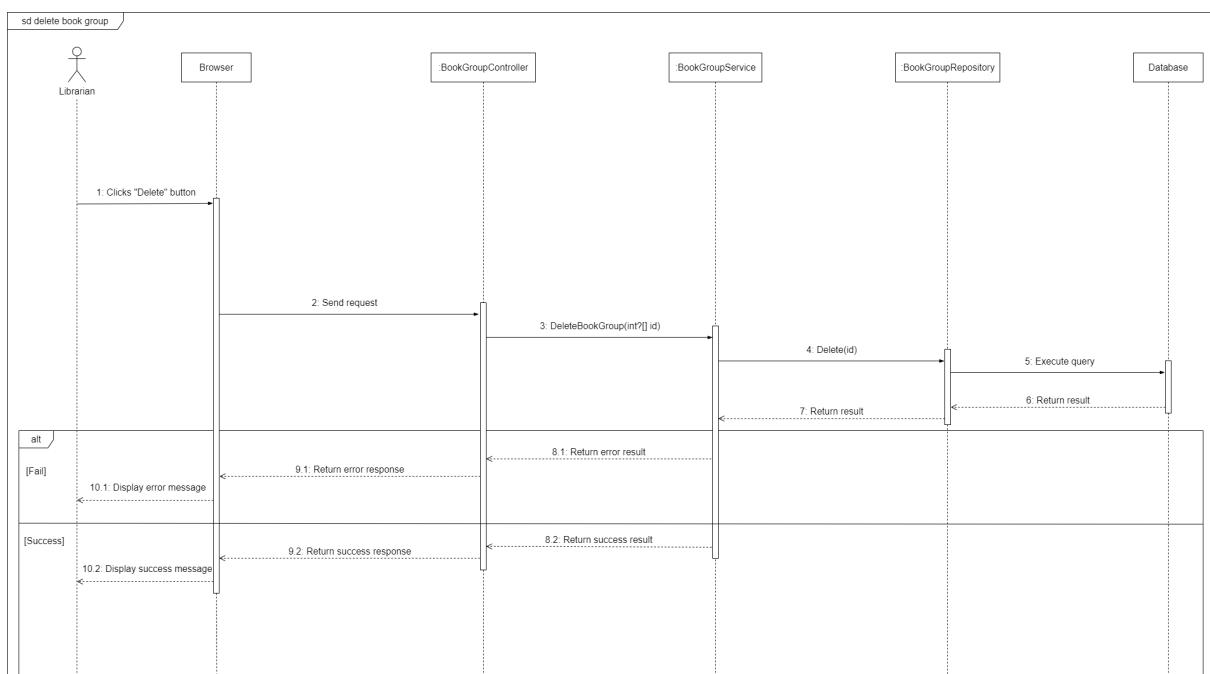


Figure 60 - <Sequence Diagram> Delete Book Group

c1.4 <Librarian> Get Book Groups

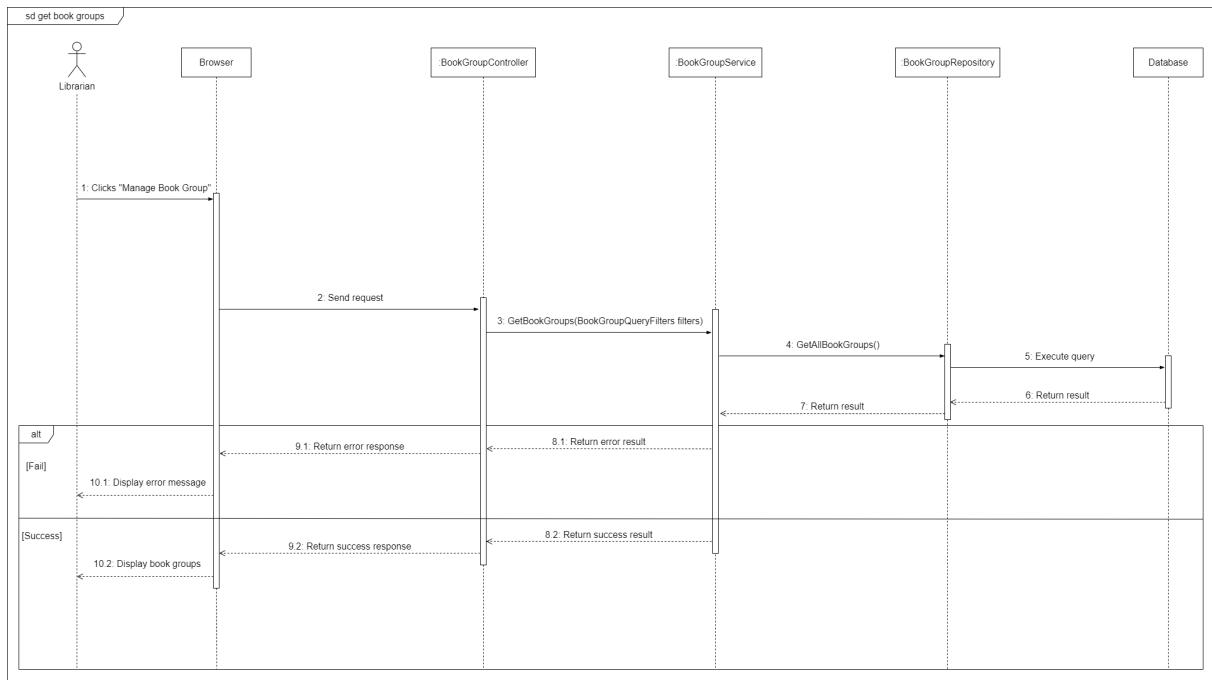


Figure 61 - <Sequence Diagram> Get Book Groups

c1.5 <Librarian> Add Book Into Drawer

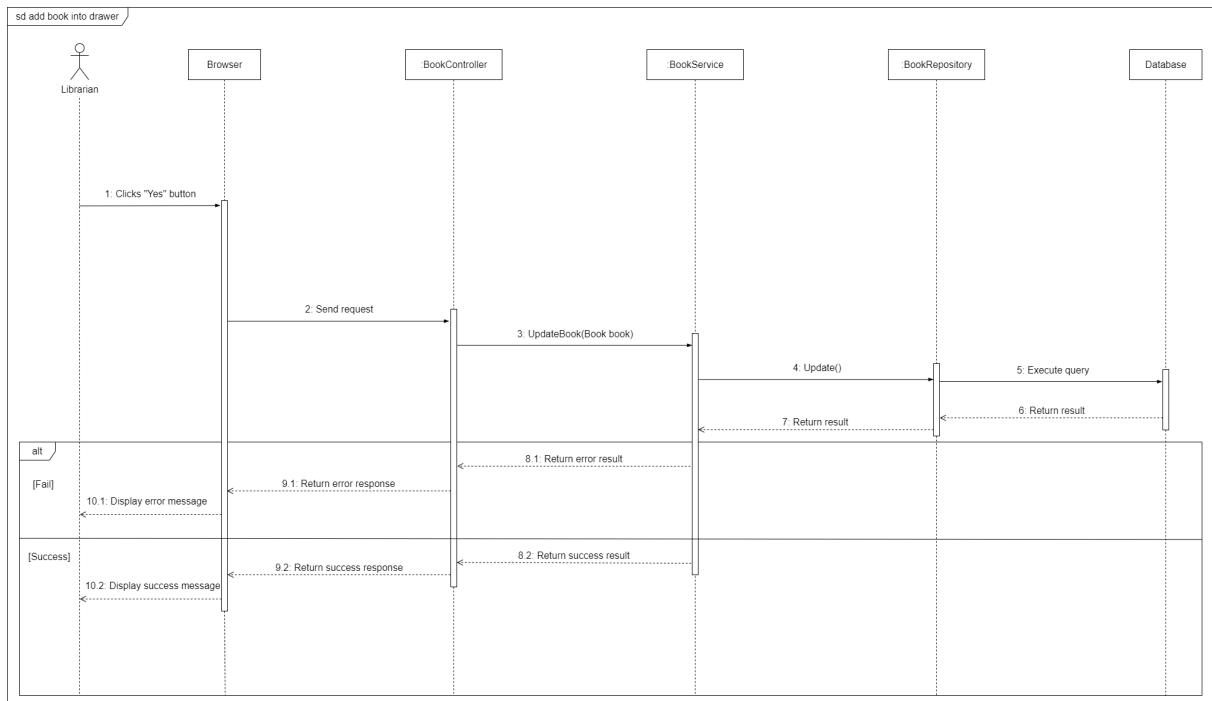


Figure 62 - <Sequence Diagram> Add Book Into Drawer

c1.6 <Librarian> Create Category

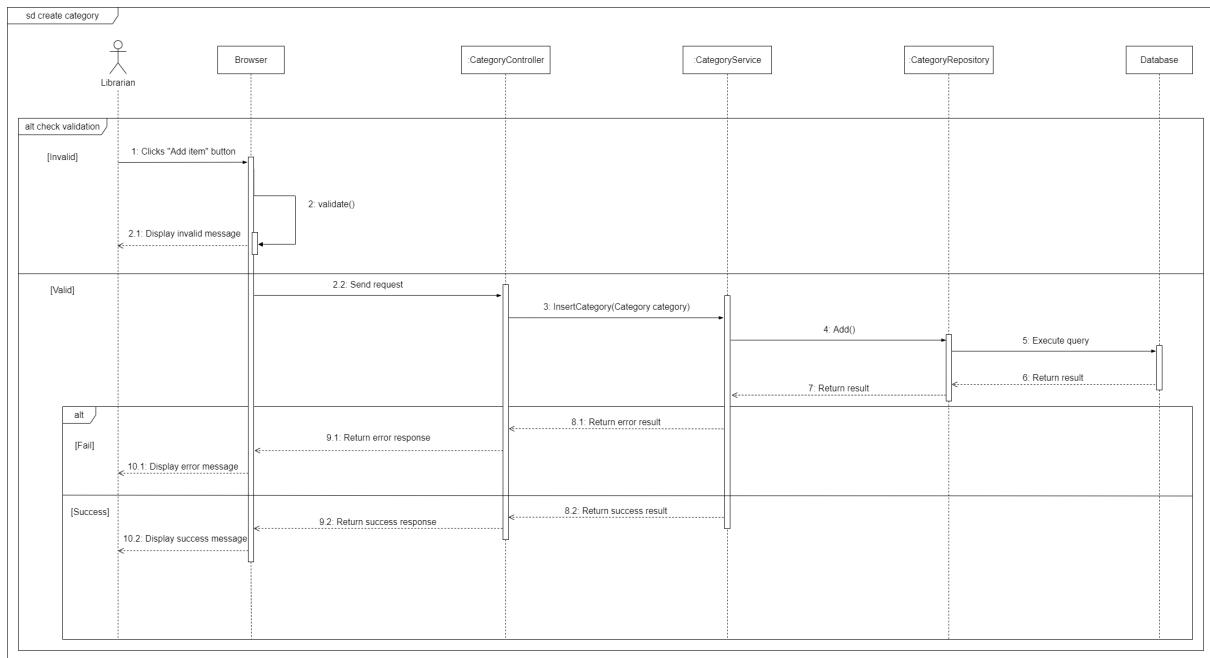


Figure 63 - <Sequence Diagram> Create Category

c1.7 <Librarian> Delete Category

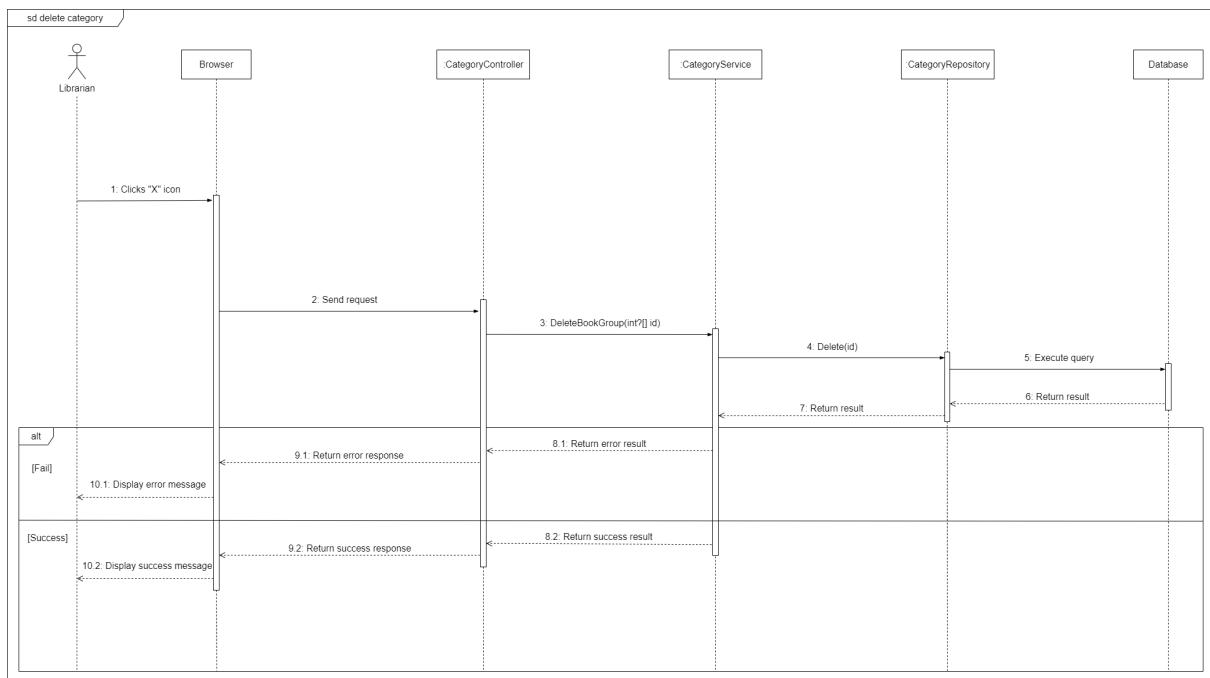


Figure 64 - <Sequence Diagram> Delete Category

c2 <Admin> Sequence Diagram(s)

c2.1 <Admin> Create Bookshelf

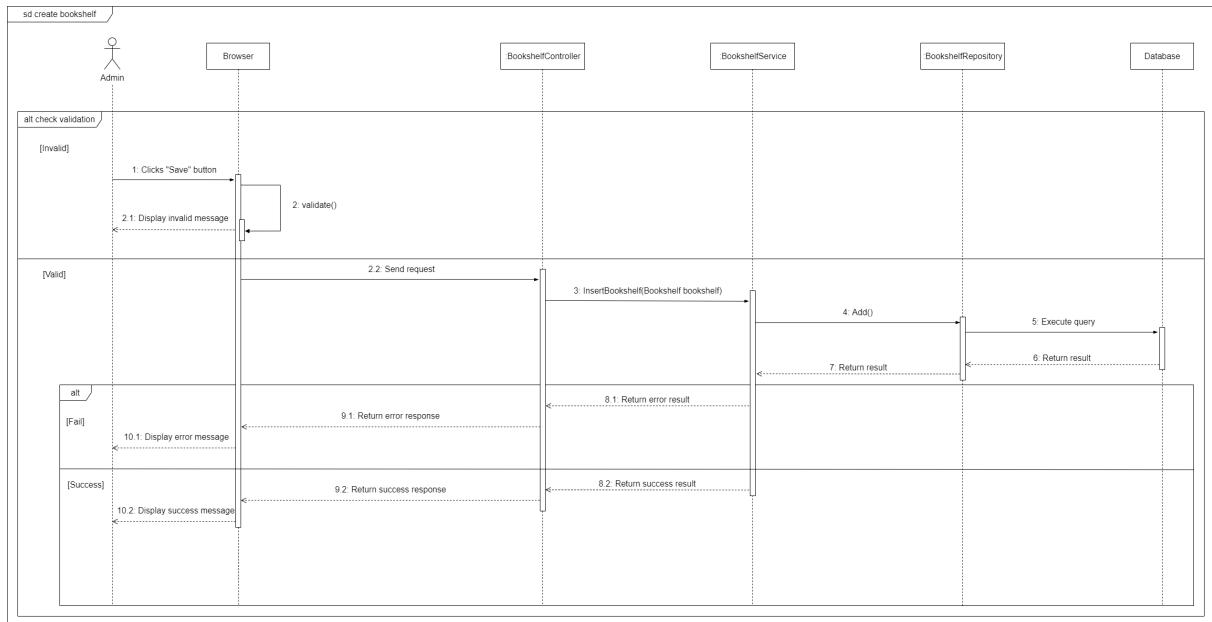


Figure 65 - <Sequence Diagram> Create Bookshelf

c2.2 <Admin> Update Librarian

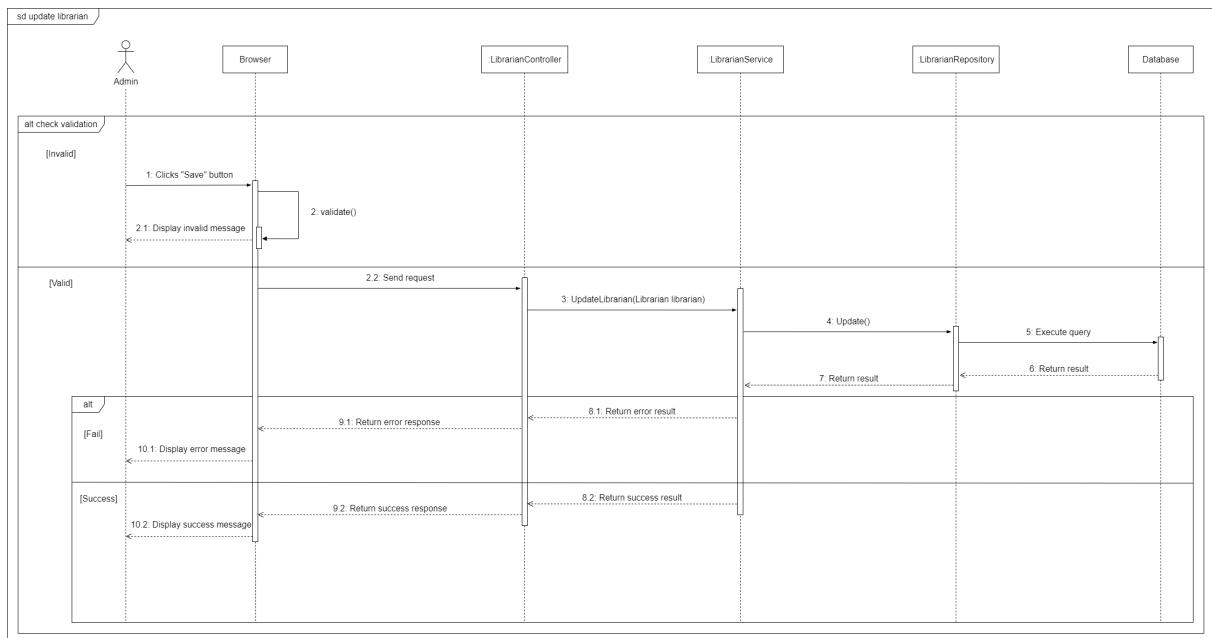


Figure 66 - <Sequence Diagram> Update Librarian

c2.3 <Admin> Delete Bookshelf

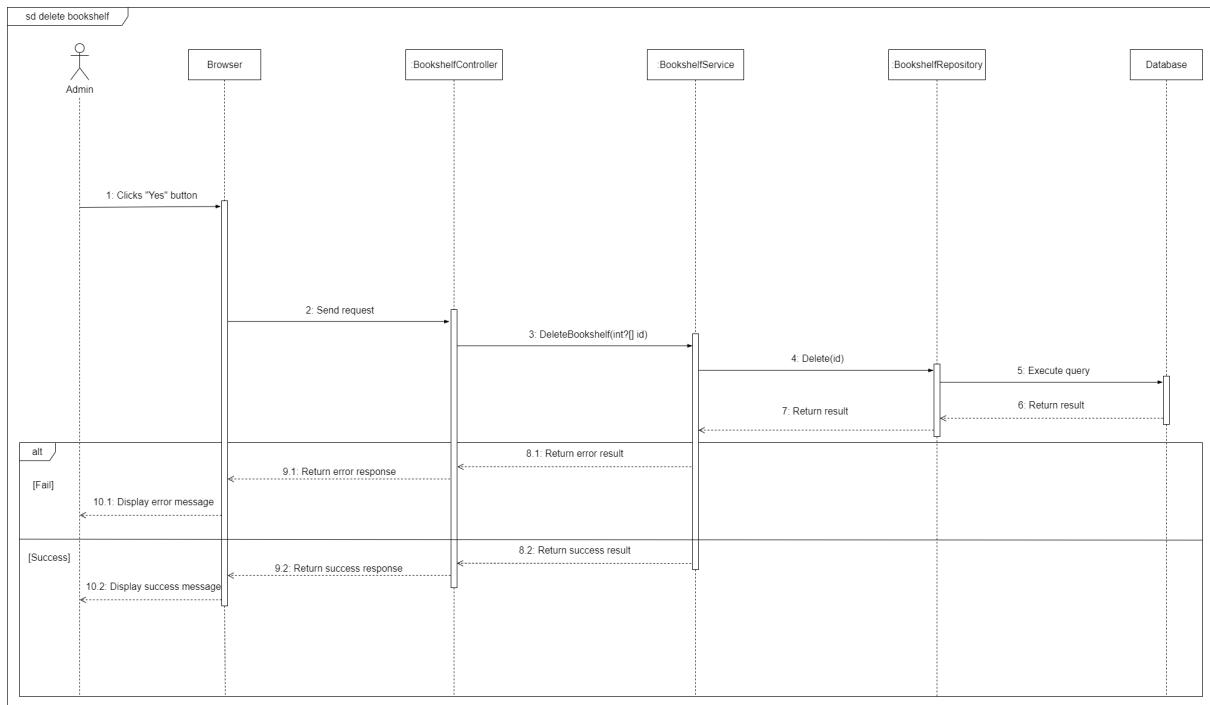


Figure 67 - <Sequence Diagram> Delete Bookshelf

c2.4 <Admin> Get Bookshelves

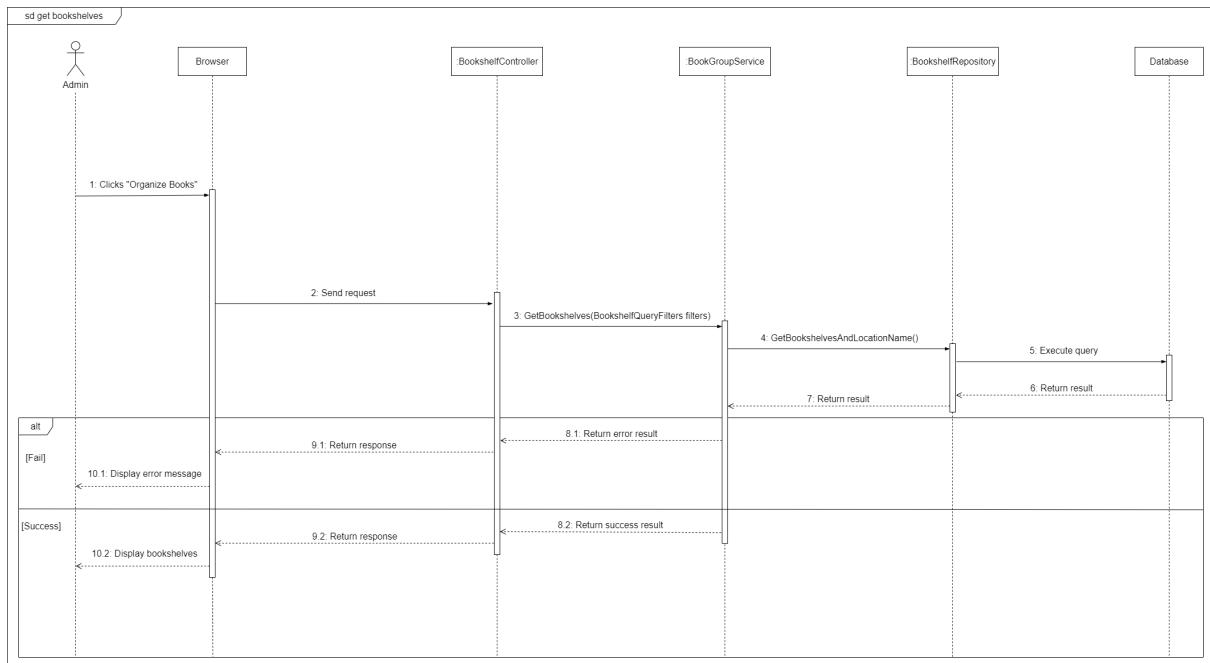


Figure 90 - <Sequence Diagram> Get Bookshelves

c2.5 <Admin> Create Location

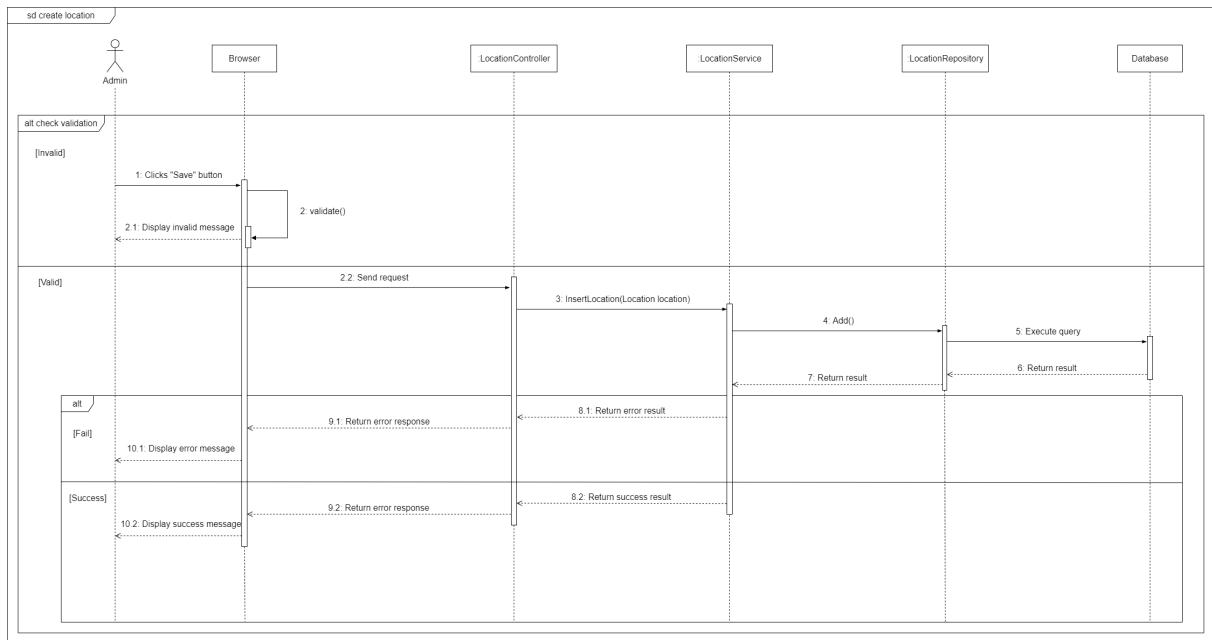


Figure 91 - <Sequence Diagram> Create Location

c2.6 <Admin> Update Location

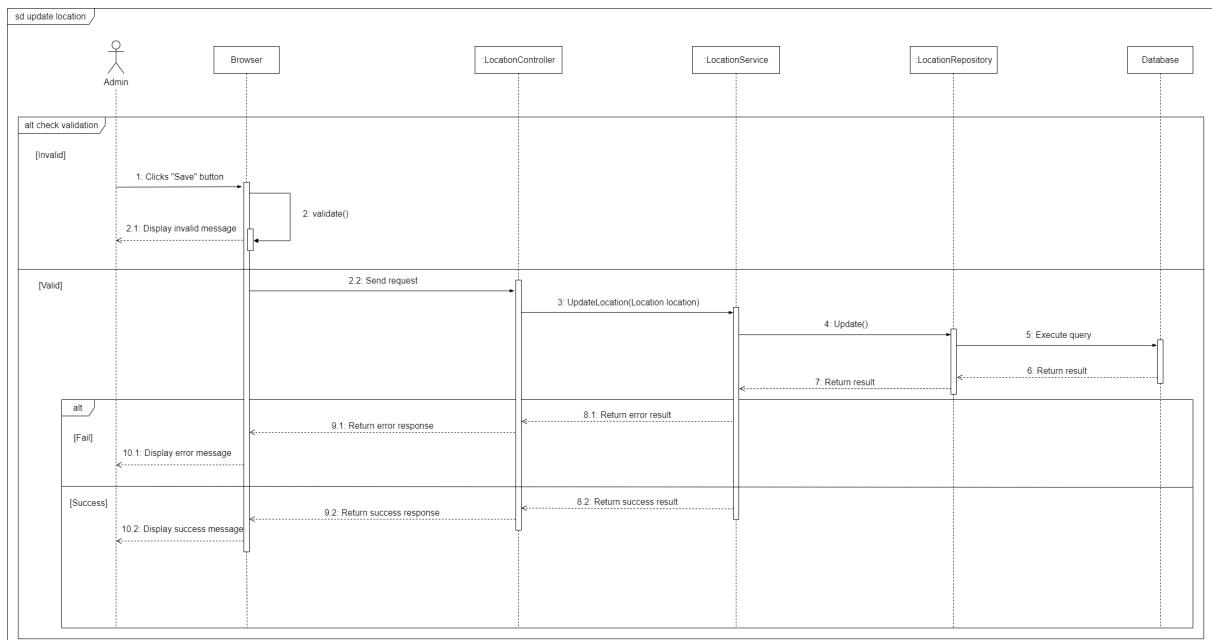


Figure 68 - <Sequence Diagram> Update Location

c2.7 <Admin> Delete Location

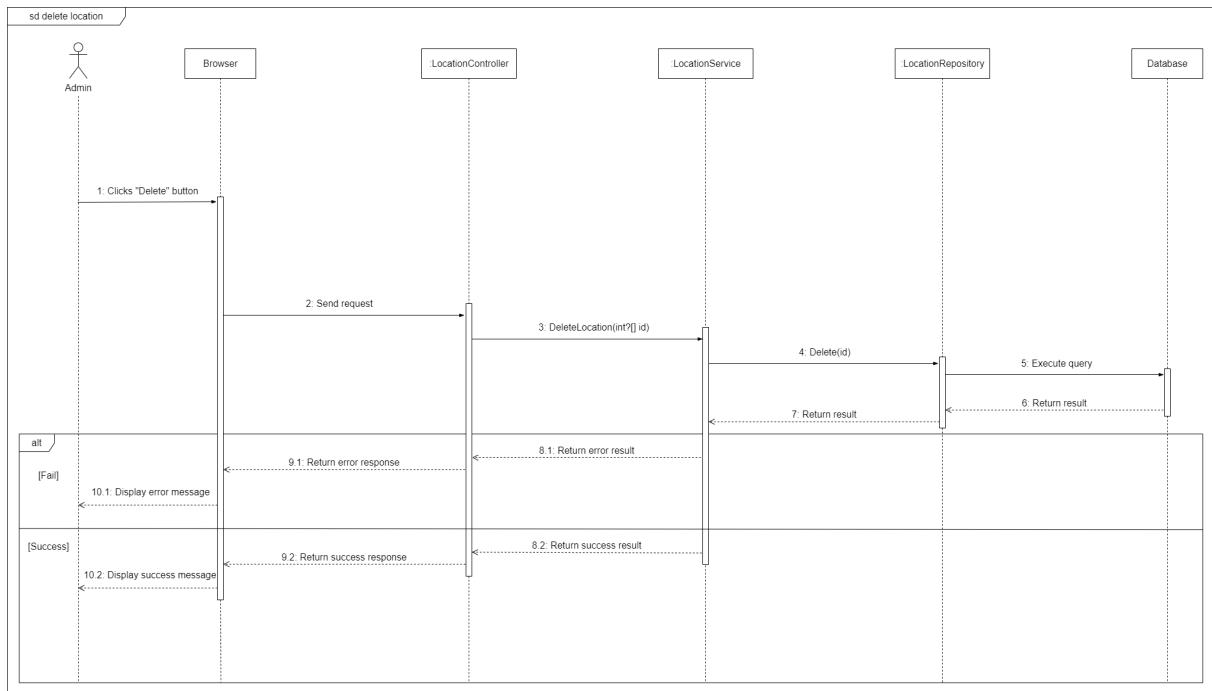


Figure 69 - <Sequence Diagram> Delete Location

c2.8 <Admin> Get Locations

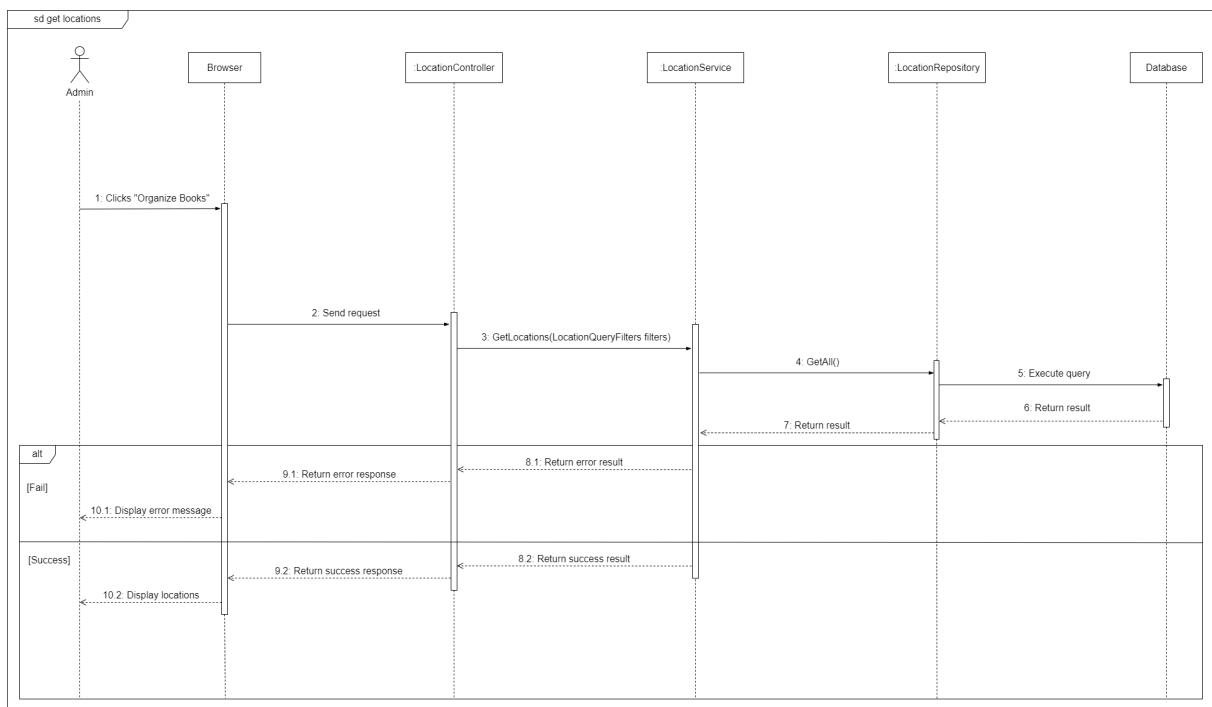


Figure 70 - <Sequence Diagram> Get Locations

d. Activity Diagram(s)

d1. <Unauthenticated User> Activity Diagram(s)

d1.1 <Unauthenticated User> Login

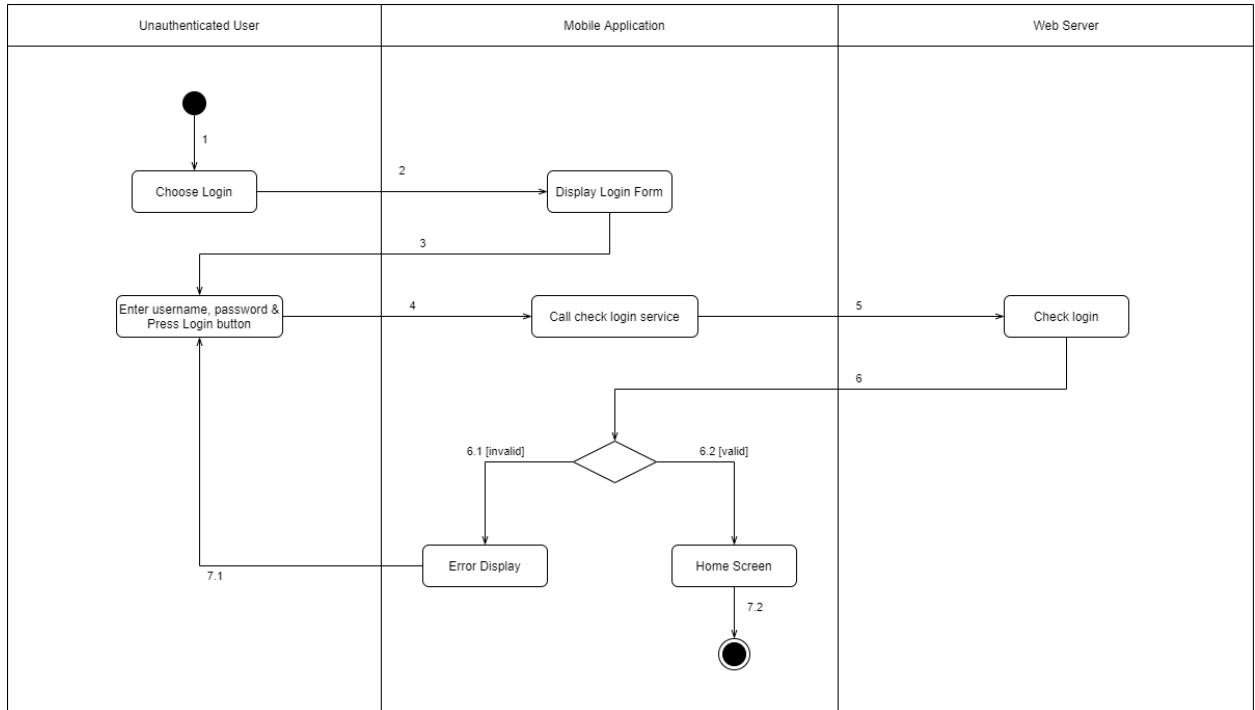


Figure 71 - <Activity Diagram> Login

d1.2 <Unauthenticated User> Signup

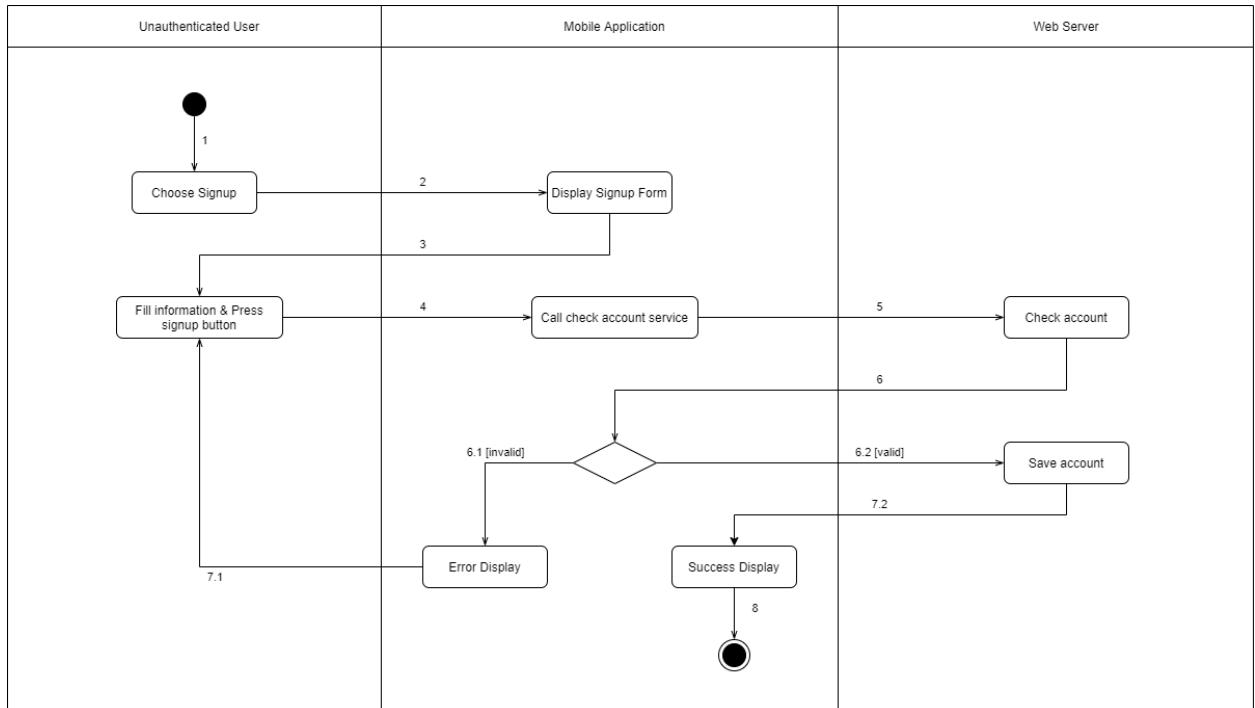
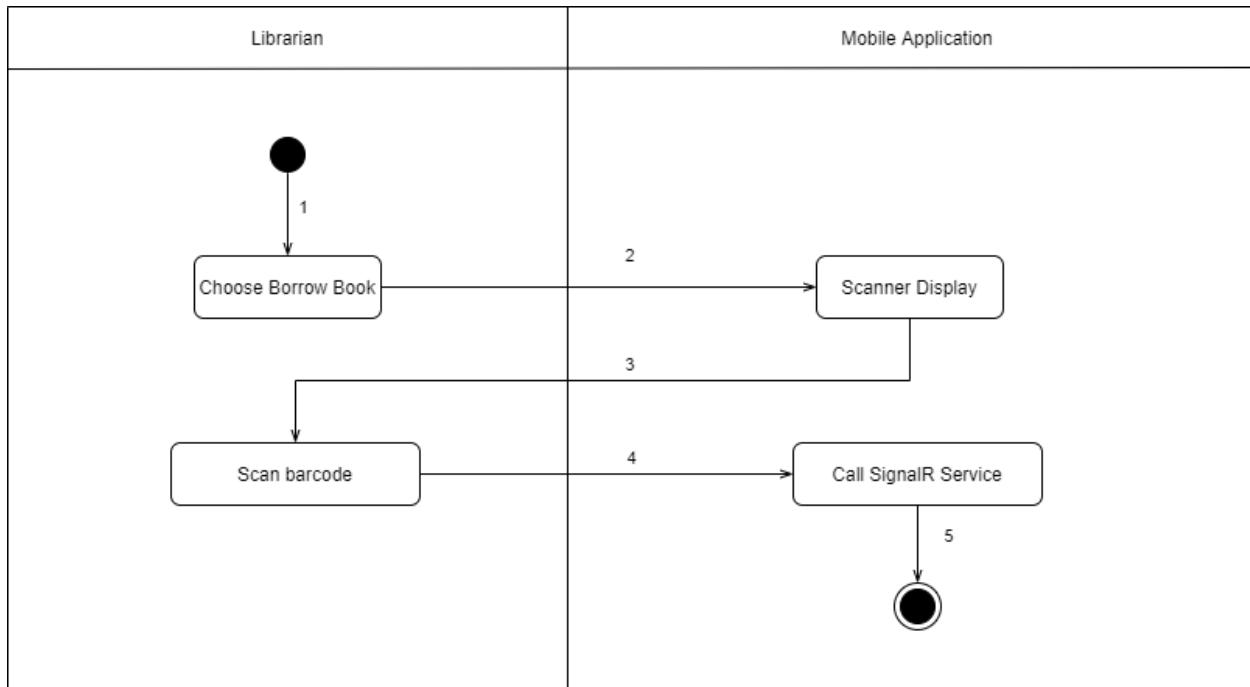


Figure 72 - <Activity Diagram> Signup

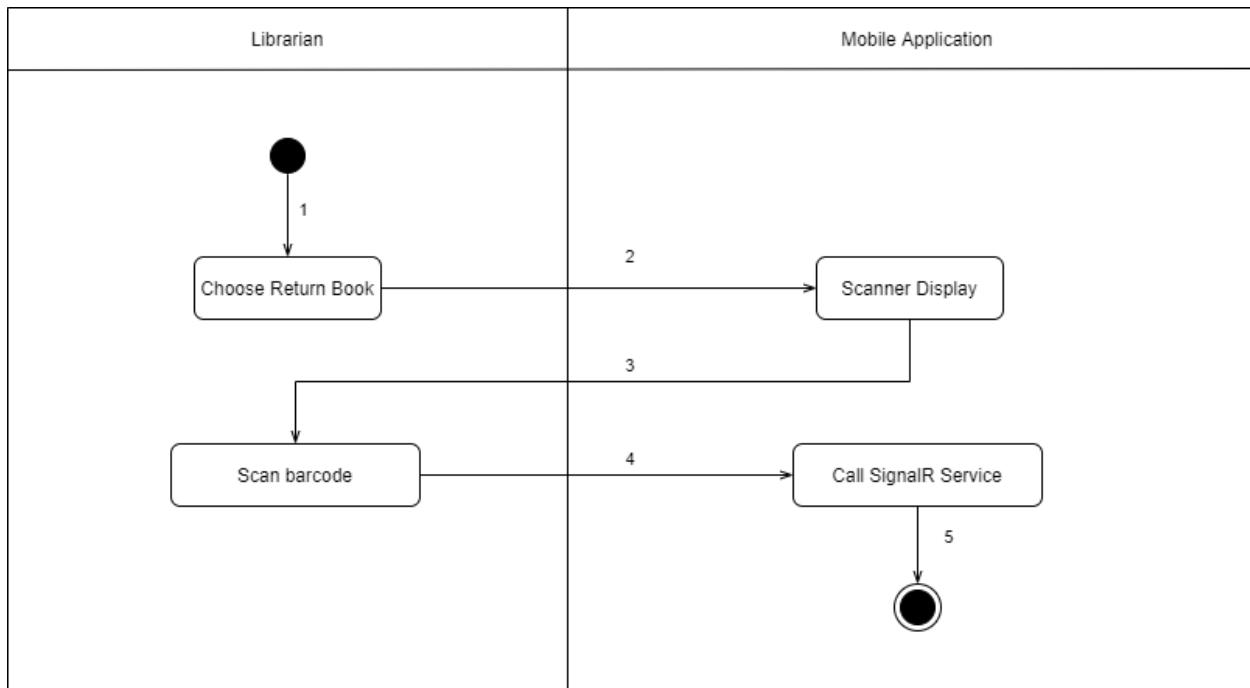
d2. <Librarian> Activity Diagram(s)

d2.1 <Librarian> Process Borrow Book



[Figure 73 - <Activity Diagram> Process Borrow Book](#)

d2.2 <Librarian> Process Return Book



[Figure 74 - <Activity Diagram> Process Return Book](#)

d2.3 <Librarian> Confirm Drawer Detection

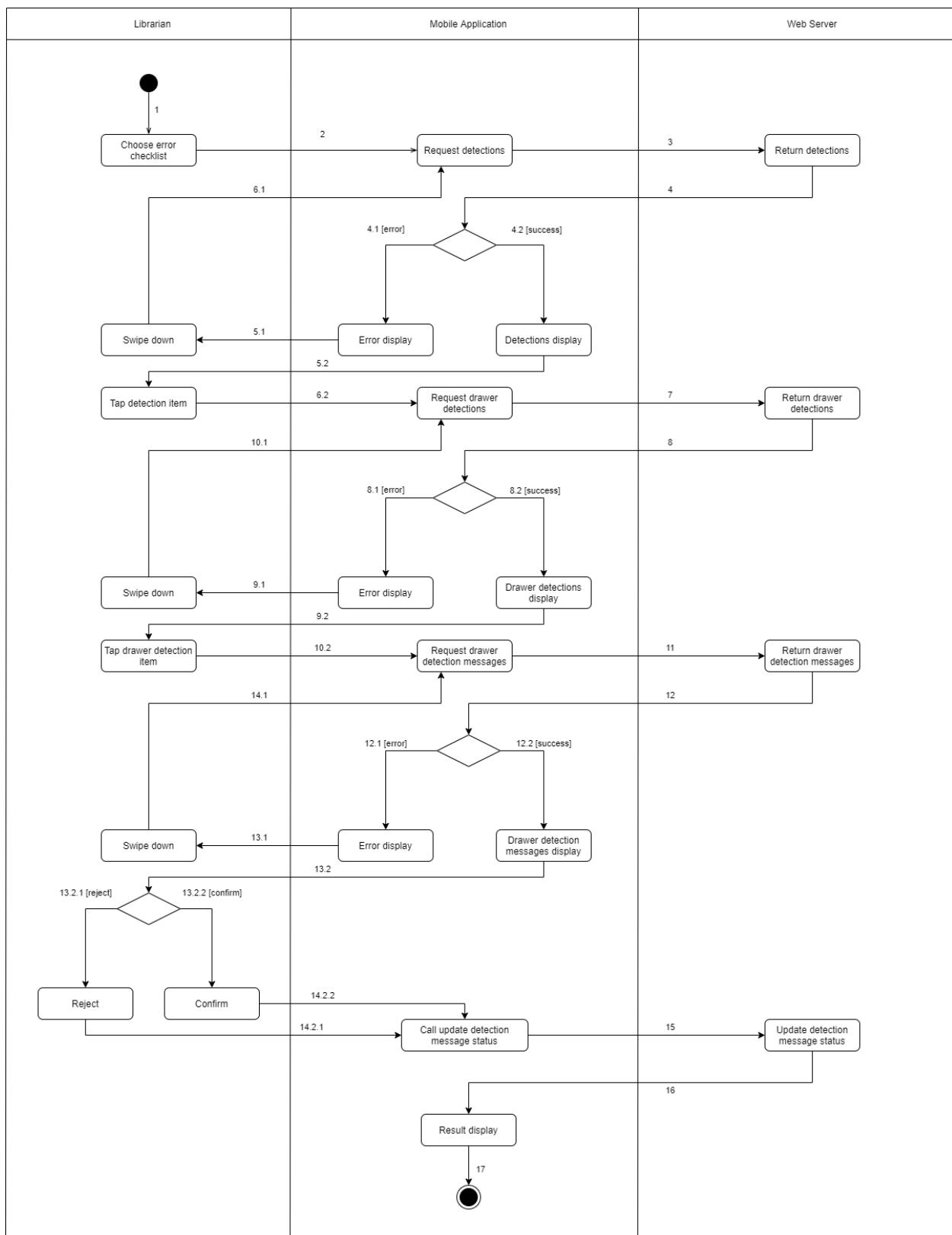


Figure 75 - <Activity Diagram> Confirm Drawer Detection

d3. <Patron> Activity Diagram(s)

d3.1 <Patron> View Book Group Detail

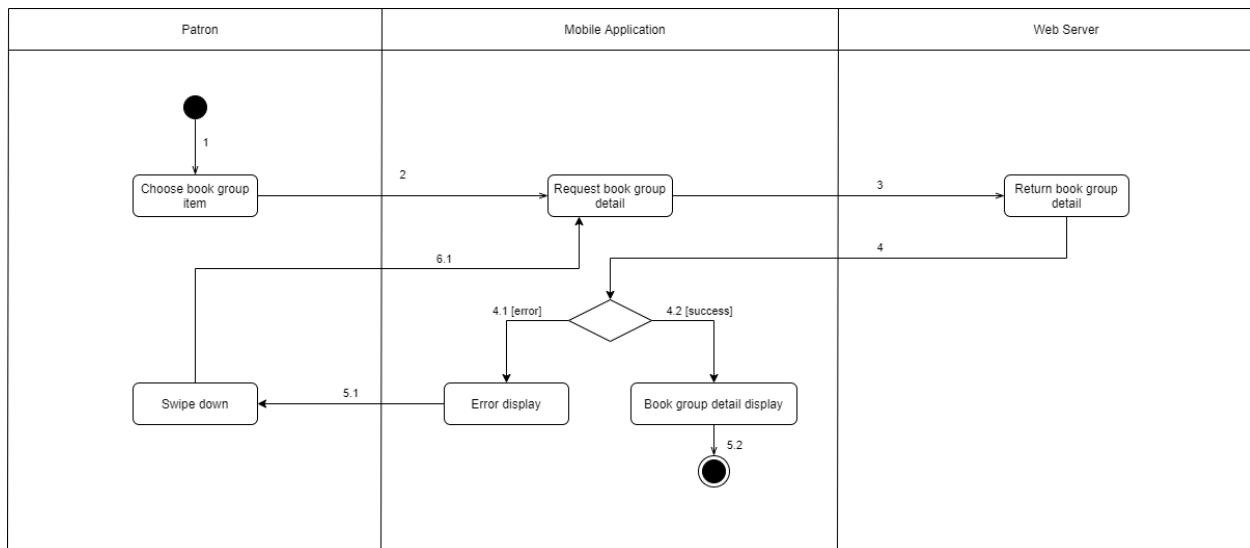


Figure 100 - <Activity Diagram> View Book Group Detail

d3.2 <Patron> Update Profile

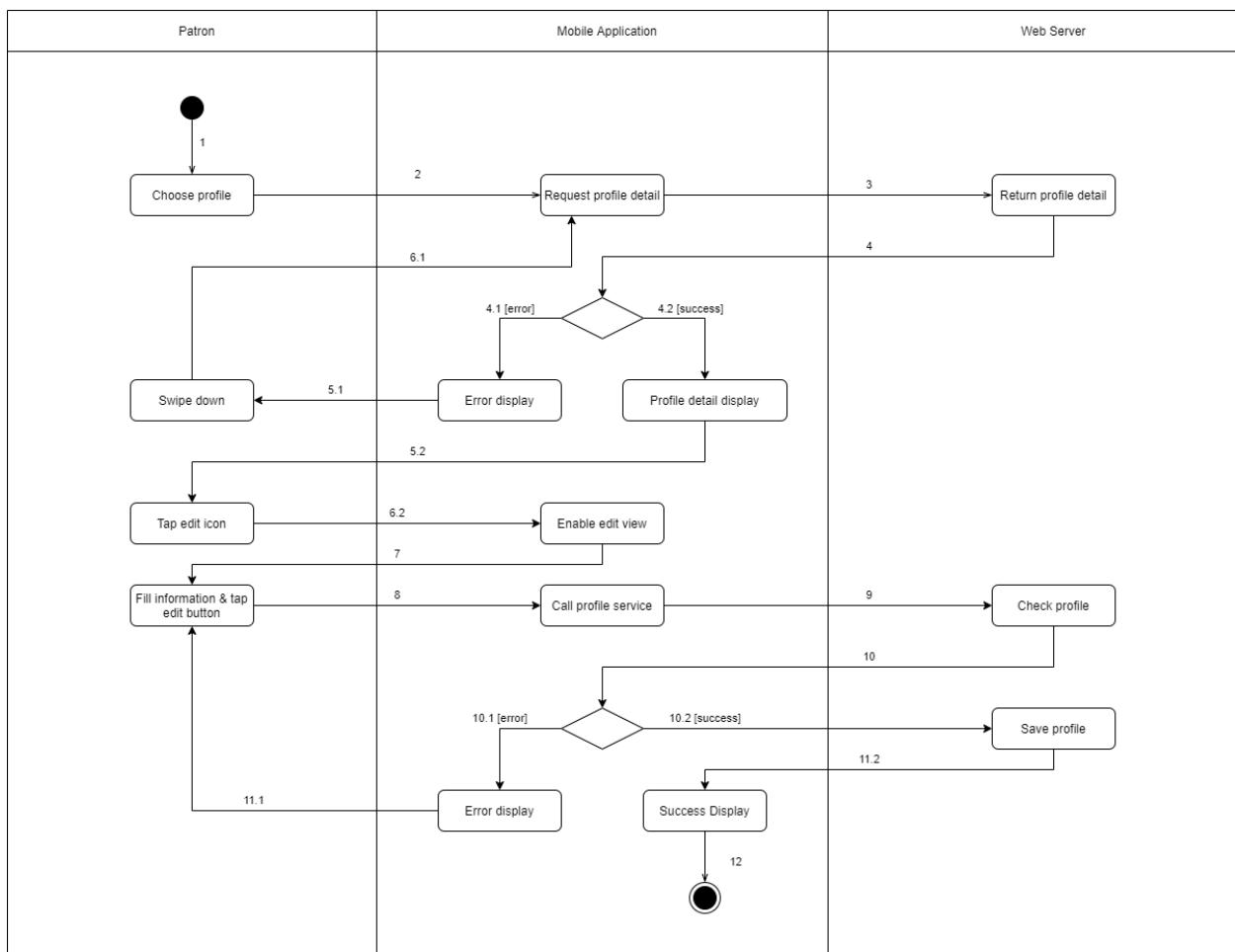
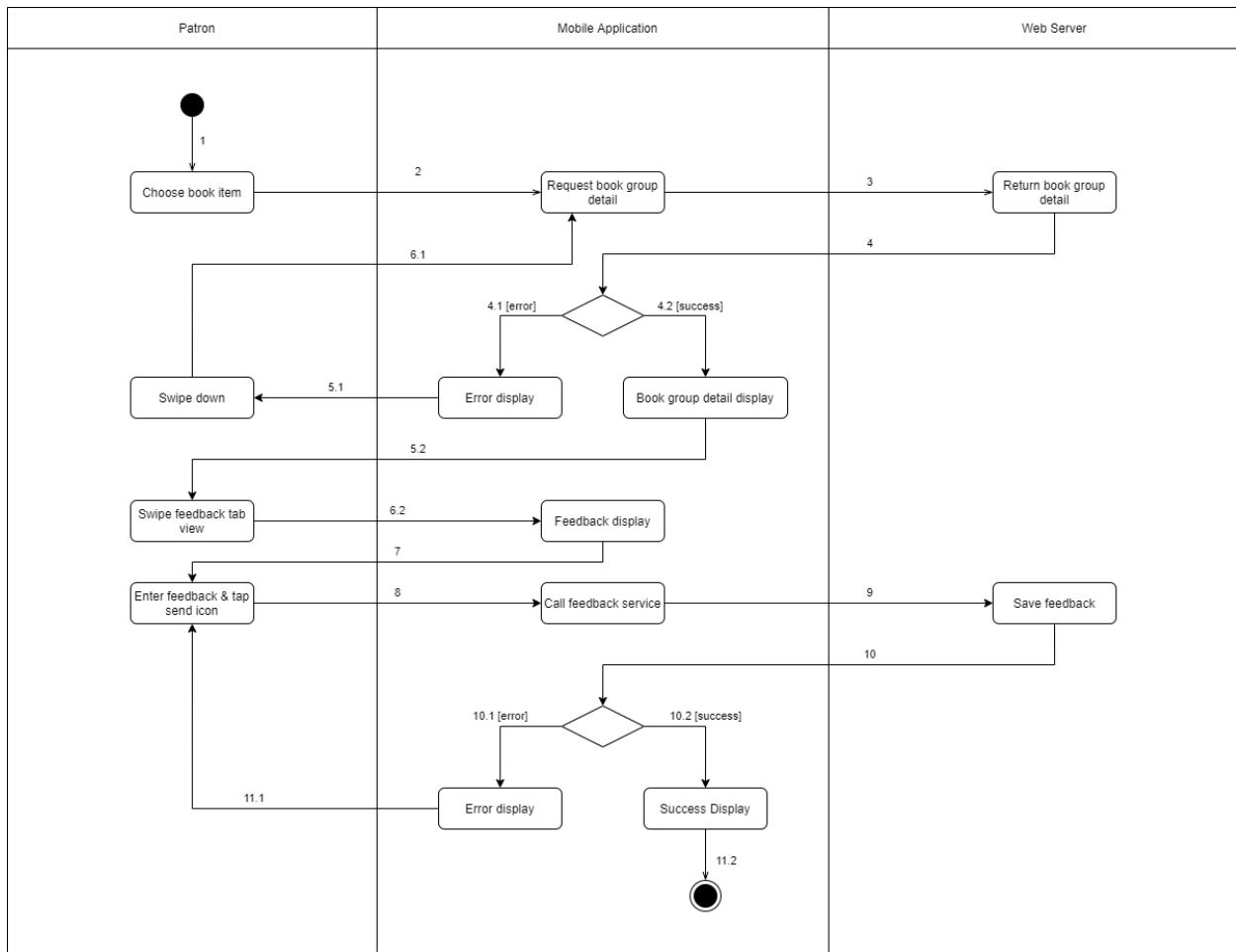


Figure 101 - <Activity Diagram> Update Profile

d3.3 <Patron> Add Book Feedback

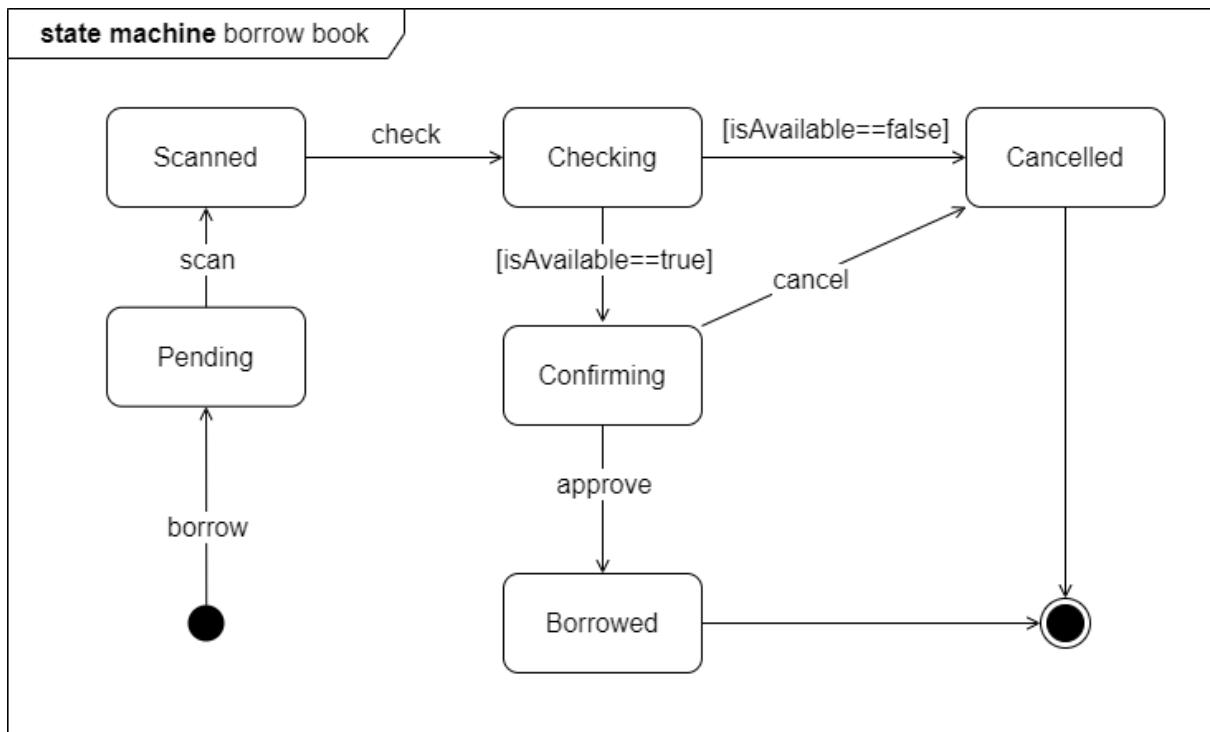


[Figure 76 - <Activity Diagram> Add Book Feedback](#)

e. State Machine Diagram(s)

e1. Borrow Book

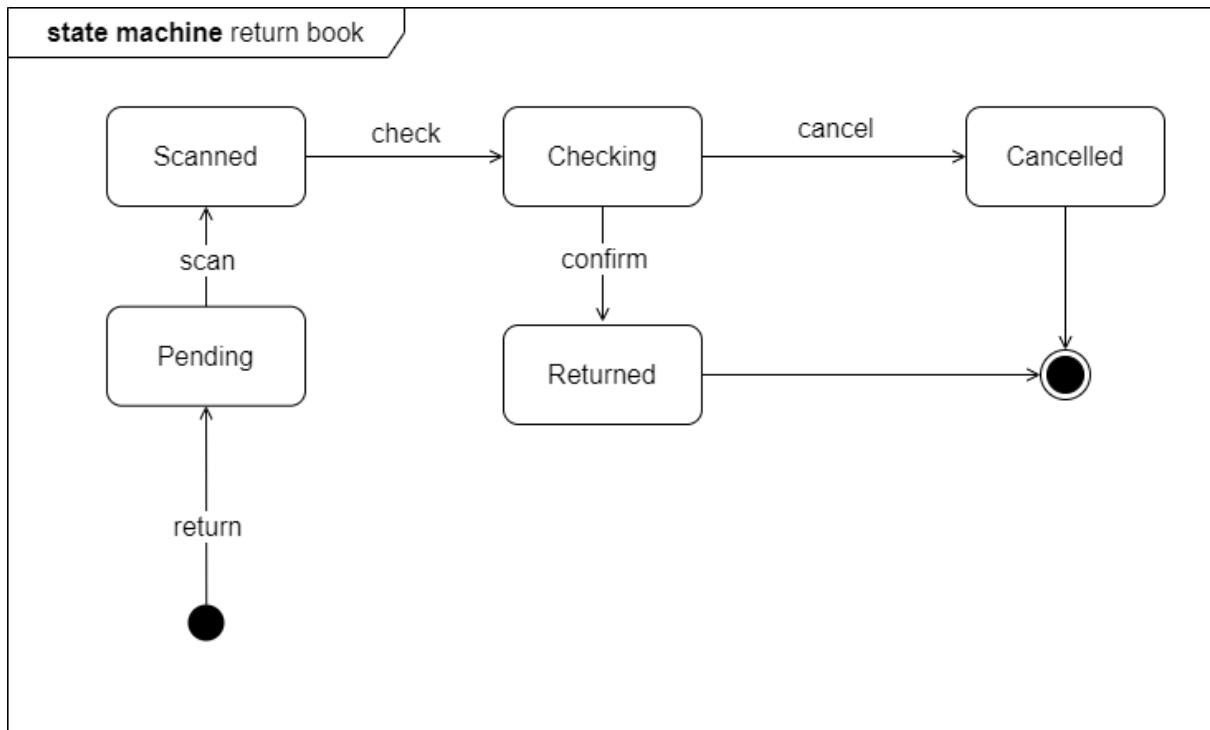
This state machine diagram describes states of borrow book from start to done



[Figure 77 - <State Machine Diagram> Borrow Book](#)

e2. Return Book

This state machine diagram describes states of return book from start to done.



[Figure 78 - <State Machine Diagram> Return Book](#)

e3. Confirm Drawer Detection Message

This state machine diagram describes states of confirm drawer detection message from start to done.

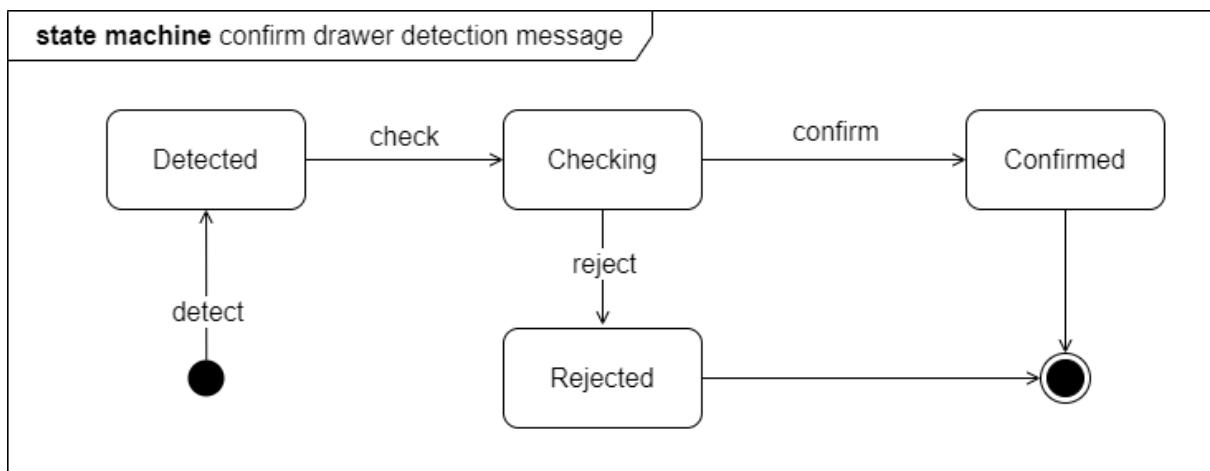


Figure 79 - <State Machine Diagram> Confirm Drawer Detection Message

4. Data & Database Design

4.1 Database Design

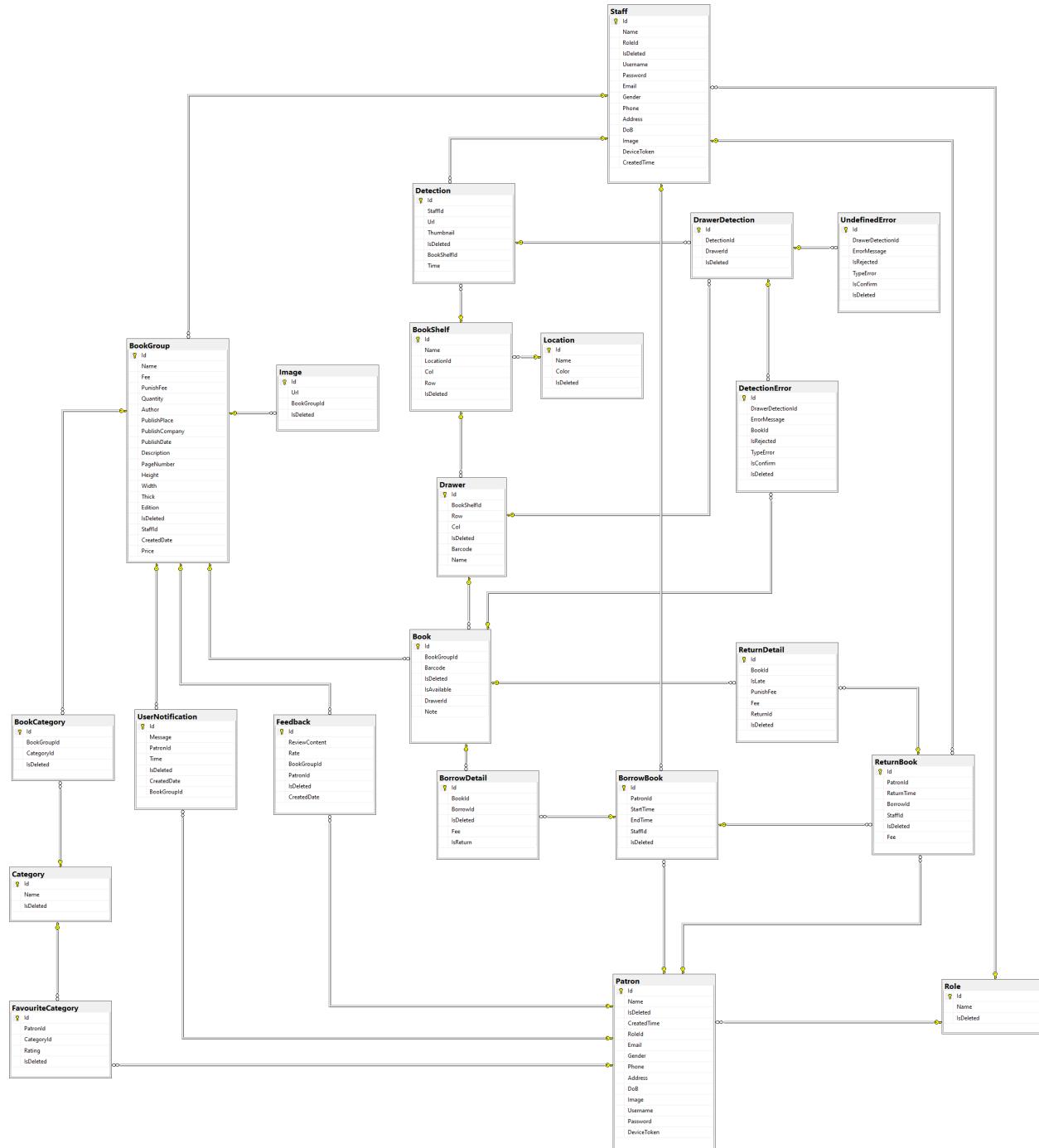


Figure 80 - Database Design

4.1.1 Book

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
BookGroupId	int			FK	

Barcode	varchar(200)				
IsDeleted	bit				
IsAvailable	bit				
DrawerId	int		X	FK	
Note	varchar(MAX)		X		

Table 119 - <Physical Diagram> Book

4.1.2 BookCategory

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
BookGroupId	int			FK	
CategoryId	int			FK	
IsDeleted	bit				

Table 120 - <Physical Diagram> BookCategory

4.1.3 BookGroup

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(MAX)				
Fee	float				
PunishFee	float				
Quantity	int				
Author	nvarchar(MAX)		X		
PublishPlace	nvarchar(MAX)		X		
PublishCompany	nvarchar(MAX)		X		
PublishDate	date		X		
Description	nvarchar(MAX)		X		
PageNumber	int		X		
Height	float		X		
Width	float		X		
Thick	float		X		
Edition	int		X		
IsDeleted	bit				
StaffId	int			FK	
CreatedDate	date				

Price	float		X		
-------	-------	--	---	--	--

Table 121 - <Physical Diagram> BookGroup

4.1.4 Bookshelf

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(MAX)				
LocationId	int			FK	
Col	int				
Row	int				
IsDeleted	bit				

Table 122 - <Physical Diagram> Bookshelf

4.1.5 BorrowBook

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
PatronId	int			FK	
StartTime	date				
EndTime	date				
StaffId	int			FK	
IsDeleted	bit				

Table 123 - <Physical Diagram> BorrowBook

4.1.6 BorrowDetail

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
BookId	int			FK	
BorrowId	int			FK	
IsDeleted	bit				
Fee	float				
IsReturn	bit				

Table 124 - <Physical Diagram> BorrowDetail

4.1.7 Category

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(50)				

IsDeleted	bit					
-----------	-----	--	--	--	--	--

Table 125 - <Physical Diagram> Category

4.1.8 Patron

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(250)				
IsDeleted	bit				
CreatedTime	date				
RoleId	int			FK	
Email	nvarchar(250)				
Gender	nvarchar(50)		X		
Phone	nvarchar(50)				
Address	nvarchar(250)				
DoB	date		X		
Image	nvarchar(MAX)				
Username	nvarchar(MAX)				
Password	nvarchar(MAX)				
DeviceToken	nvarchar(MAX)		X		

Table 126 - <Physical Diagram> Patron

4.1.9 Detection

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
StaffId	int			FK	
Url	nvarchar(MAX)				
Thumbnail	nvarchar(MAX)		X		
IsDeleted	bit				
BookShelfId	int			FK	
Time	date				

Table 127 - <Physical Diagram> Detection

4.1.10 DetectionError

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
DrawerDetectionId	int			FK	

ErrorMessage	nvarchar(MAX)				
BookId	int			FK	
IsRejected	bit				
TypeError	int				
IsConfirm	bit				
IsDeleted	bit		X		

Table 128 - <Physical Diagram> DetectionError

4.1.11 Drawer

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
BookShelfId	int			FK	
Row	int				
Col	int				
IsDeleted	bit				
Barcode	nchar(20)				
Name	nvarchar(20)				

Table 129 - <Physical Diagram> Drawer

4.1.12 DrawerDetection

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
DetectionId	int			FK	
DrawerId	int			FK	
IsDeleted	bit				

Table 130 - <Physical Diagram> DrawerDetection

4.1.13 FavouriteCategory

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
PatronId	int			FK	
CategoryId	int			FK	
Rating	int				
IsDeleted	bit				

Table 131 - <Physical Diagram> FavouriteCategory

4.1.14 Feedback

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
ReviewContent	nvarchar(MAX)			FK	
Rate	int				
BookGroupId	int			FK	
PatronId	int			FK	
IsDeleted	bit				
CreatedDate	date		X		

Table 132 - <Physical Diagram> Feedback

4.1.15 Image

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Url	nvarchar(MAX)				
BookGroupId	int			FK	
IsDeleted	bit				

Table 133 - <Physical Diagram> Image

4.1.16 Location

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(100)				
Color	nvarchar(100)		X		
IsDeleted	bit				

Table 134 - <Physical Diagram> Location

4.1.17 ReturnBook

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
PatronId	int			FK	
ReturnTime	datetime				
BorrowId	int			FK	
StaffId	int			FK	
IsDeleted	bit				
Fee	float				

Table 135 - <Physical Diagram> ReturnBook

4.1.18 ReturnDetail

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
BookId	int			FK	
IsLate	bit				
PunishFee	float				
Fee	float				
ReturnId	int			FK	
IsDeleted	bit				

Table 136 - <Physical Diagram> ReturnDetail

4.1.19 Role

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(50)				
IsDeleted	bit				

Table 137 - <Physical Diagram> Role

4.1.20 Staff

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Name	nvarchar(250)				
RoleId	int			FK	
IsDeleted	bit		X		
Username	nvarchar(MAX)				
Password	nvarchar(MAX)				
Email	nvarchar(MAX)				
Gender	nvarchar(MAX)		X		
Phone	nvarchar(MAX)				
Address	nvarchar(MAX)		X		
DoB	date				
Image	nvarchar(MAX)				
DeviceToken	nvarchar(MAX)		X		
CreatedTime	date		X		

Table 138 - <Physical Diagram> Staff

4.1.21 *UndefinedError*

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
DrawerDetectionId	int			FK	
ErrorMessage	nvarchar(MAX)				
IsRejected	bit				
TypeError	int				
IsConfirm	bit				
IsDeleted	bit		X		

Table 139 - <Physical Diagram> *UndefinedError*

4.1.22 *UserNotification*

Field name	Type	Unique	Allow Nulls	PK/FK	Notes
Id	int	X		PK	
Message	nvarchar(MAX)				
PatronId	int			FK	
Time	datetime				
IsDeleted	bit				
CreatedDate	date		X		
BookGroupId	int			FK	

Table 140 - <Physical Diagram> *UserNotification*

4.2 Data File Design

We use Firebase Storage to store images and Azure Storage to store videos.

#	File Name	Type	Notes
1	Patron avatar	Image	path: "/{patronname}/{patron-image-name}"
2	Book group image	Image	path: "/{bookgroupname}/{uid}-{image-name}"
3	Detection video	Video	path: "/video/{filevideoname.mp4}"

Table 141 - Data File Design

5. Algorithm

5.1 Detect Barcode

5.1.1 *Define Problem*

- Give a video and find all barcode appear in video.
- We were use Pyzbar for detect and recognize but in a big image have many barcode adjacent to each other Pyzbar not working well, just recognize about 30 percent.

5.1.2 Requirement

- Time detect process should be fast.
- All barcodes must be detected.

5.1.3 Solution

- To solve this problem, we use machine learning techniques to detect barcode. More specifically we use YOLO (You Only Look Once) model, version 5.
- YOLO is model object detection has speed process fast (near real time), but the accuracy is not too reduced compared to the top models.

5.1.3.1 Base Concept

- Simple understanding machine learning we can be a math function $y = f(x)$, x is input; y is output we want; f is the process transform x to y (or model in machine learning).

5.1.3.2 Concept in YOLO

- YOLO architecture include: Base Network and Extra Layers.
- Base Network is use for extract feature maps. In Base Network have CNN, Flatten, Fully Connected.

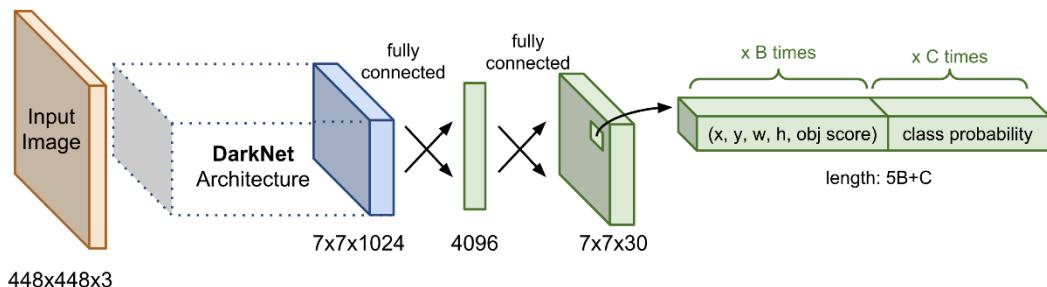
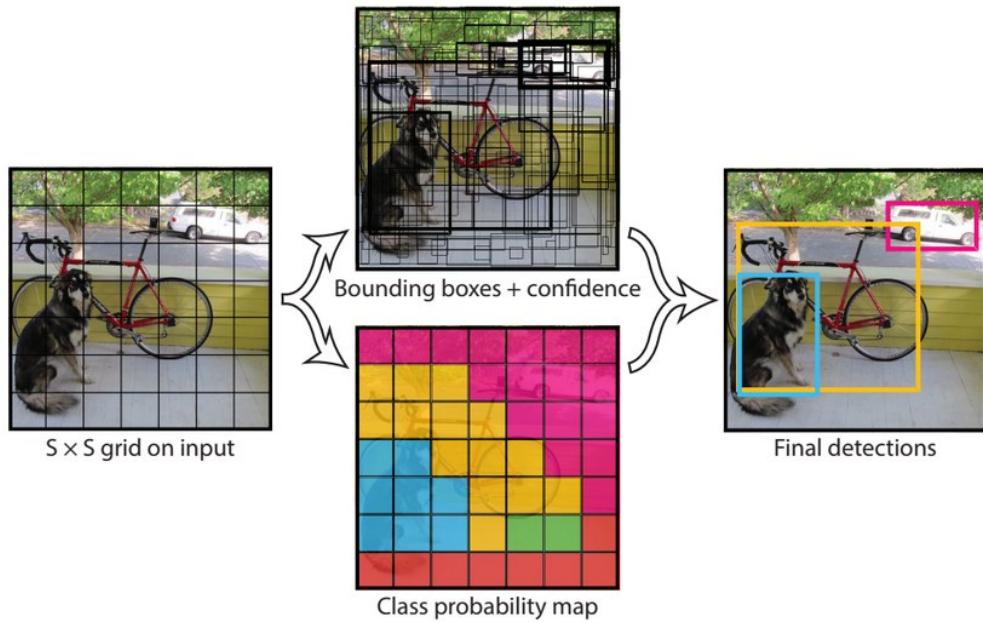


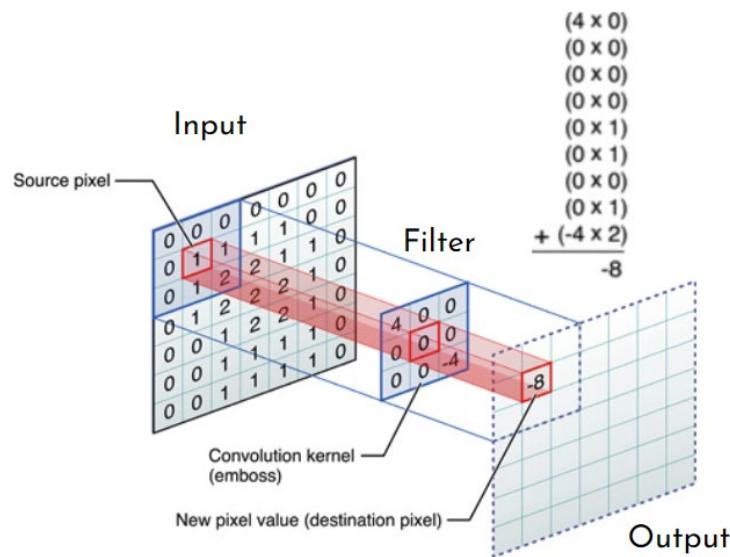
Figure 81 – Base Network

- Extra Layers are applied to detect the object on the feature map of the base network.

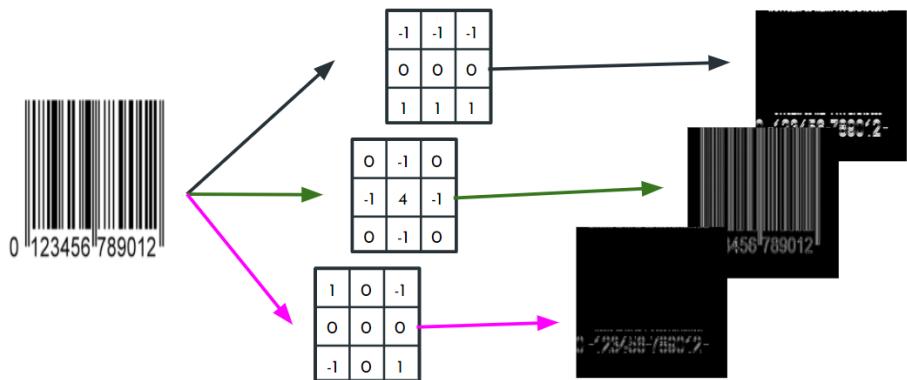


[Figure 82 – Extra Layer](#)

- **CNN (Convolutional Neural Network):** This is a neural network that applies Convolutional layers to help extract image features better. In CNN have three main type layers: Conv, Pooling, ReLu.
- **Conv (Convolutional Layer):** This layer is use for extract image features by a filter (matrix).

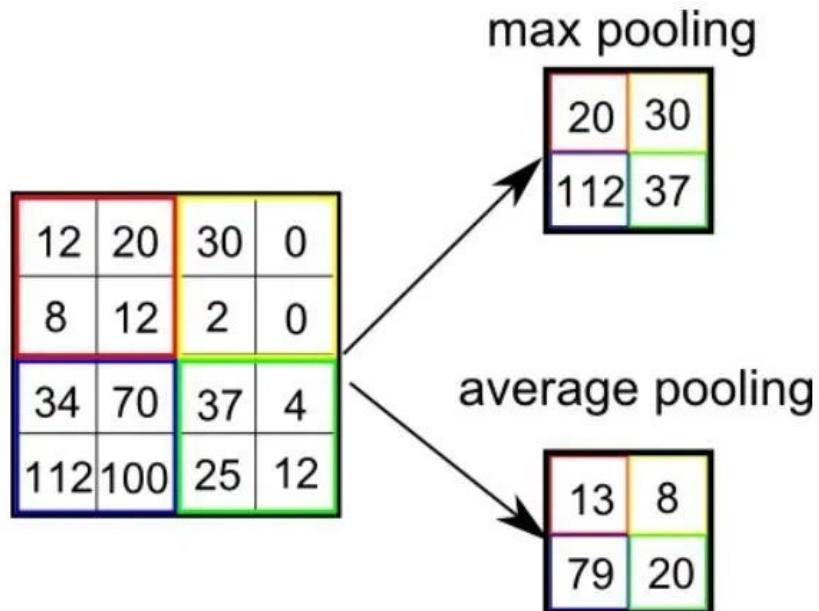


[Figure 83 – Convolution](#)

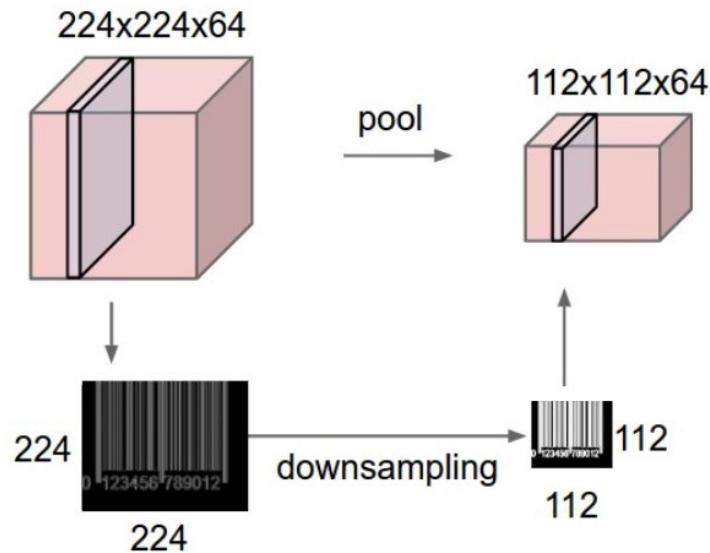


[Figure 84 - Convolution Example In Process](#)

- Pooling (Pooling Layer): This layer is use for down scale two dimension (width, height) of a feature but still hold the core of feature.

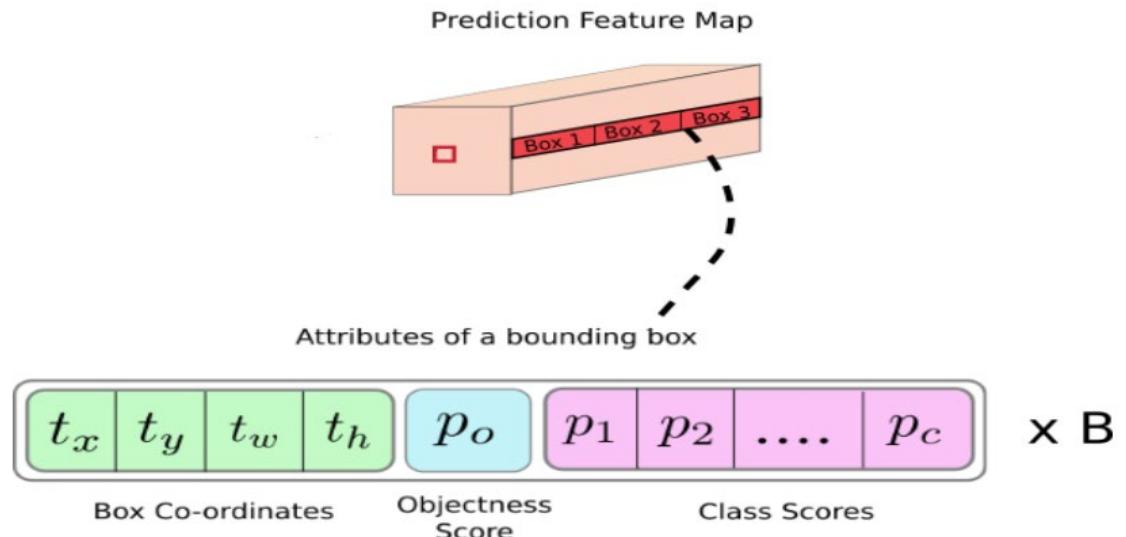


[Figure 85 – Pooling](#)



[Figure 86 - Pool Example In Process](#)

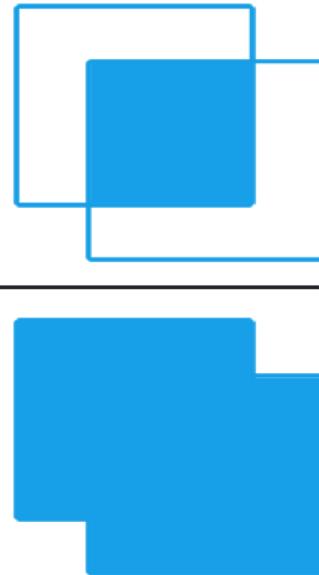
- **ReLU:** The transform class adopts the ReLU trigger function to activate the nonlinearity, use for convert negative number to zero.
- **Flatten:** is use for convert matrix to array.
- **Fully Connected:** is use to detect and classify by giving weights.
- **Feature map:** contain information of a bounding box.



[Figure 87 - Feature Map](#)

- **Non-max suppression:** is use to reduce redundant anchor box.
- **IOU (Intersection Over Union):** is the ratio measuring the level of intersection between two bounding box. It uses for reduce redundant bounding box and evaluate model.

$$\text{IoU} = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$



[Figure 88 - IOU](#)

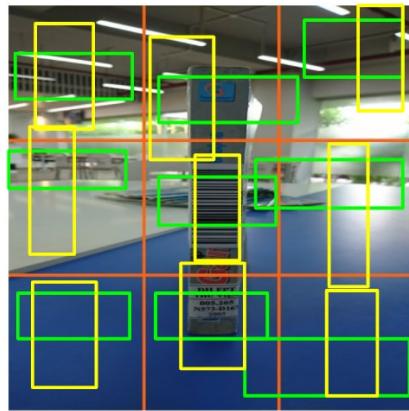
5.1.3.3 Process in YOLO

- YOLO divide an image to many grid with formula grid = image size / d. (d) can be a number in [32, 16, 8]. Example we divide grid with size 3x3.



[Figure 89 - YOLO Grid 3x3](#)

- On each grid will run process in Base Network to get a feature map.
- Base on feature map will prediction object in grid and extract anchor boxes (start Extra Layer).



[Figure 90 - YOLO Prediction On Each Grid](#)

- Non-max suppression to reduce redundant anchor box and return box (position) and class of the object:
 - o First remove anchor boxes have low confidence has object inside.
 - o Second with each class will calculate IOU to define that boxes are contain the same object and just hold the box have highest percent contain object.



[Figure 91 - YOLO Final Result](#)

5.1.3.4 Prepare data and train process

- The data we collect will have:
 - o Vertical, horizontal, diagonal, small for model can get the feature of barcode.
 - o Cluster for model can get more than one barcode in an image. Lack of light, bright enough for model can have many view about barcode.
 - o Many different shooting angles to simulate the camera of Drones.



[Figure 92 - Single Image](#)



[Figure 93 - Cluster Image](#)



[Figure 94 - Simulate The Camera Of Drone](#)

- About 2000 for train, 500 for validate, 500 for test.
- Train 62 epochs about 5 hours.

5.1.3.5 Evaluate Model

- We evaluate model base on mAP, recall, loss.

- mAP (mean Average Precision): it uses for evaluate the ability to predict correct object.
 - o Precision: number of correct predictions out of the total number of predictions.
 - o mAP_0.5 is mAP base on IOU = 0.5.
- **Recall:** Evaluate the ability to search all objects. Number of correct predictions out of the total number of actual objects.
- **Loss:** Error functions in YOLO are calculated in prediction and label the model for calculation. More specifically, it is the total error rate of the following 3 subcomponents:
 - o **cls_loss:** the degree error of the classification.
 - o **box_loss (Localization loss):** the degree of error of the limit box position degree.
 - o **obj_loss:** the degree error of the prediction has object.

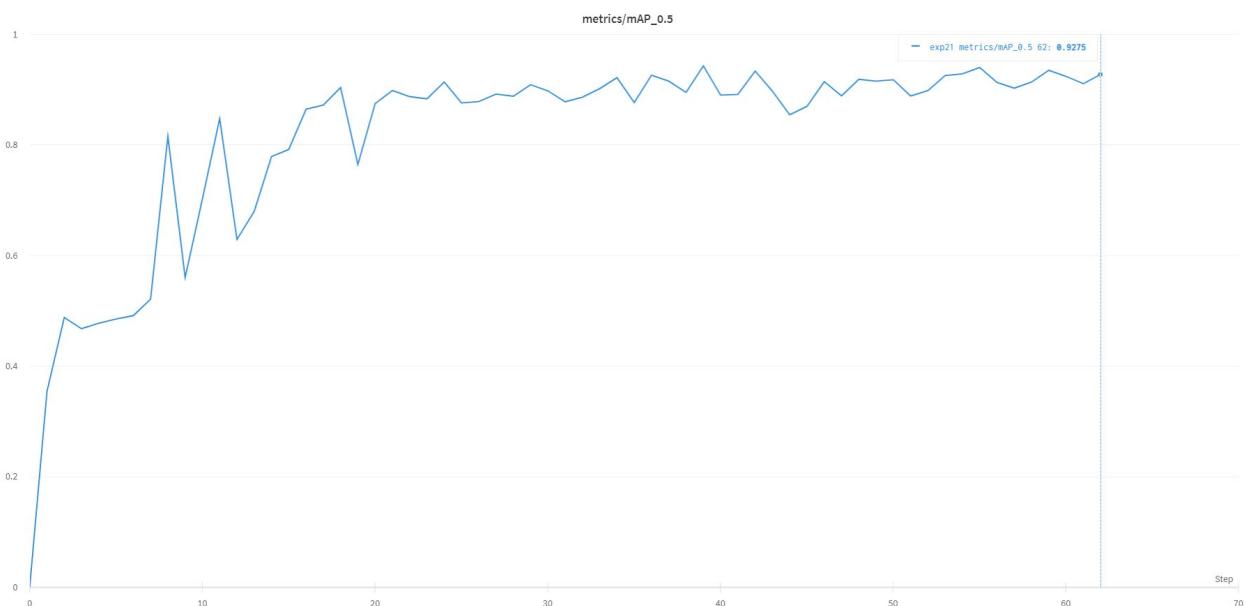
$$Precision = \frac{TP}{TP + FP} = \frac{\text{Number prediction correct}}{\text{Total time prediction}}$$

$$Recall = \frac{TP}{TP + FN} = \frac{\text{Number prediction correct}}{\text{Number of possible identifications}}$$

TP: True Positive
TN: True Negative

FP: False Positive
FN: False Negative

[Figure 95 - Precision And Recall](#)



[Figure 96 - mAP_0.5](#)

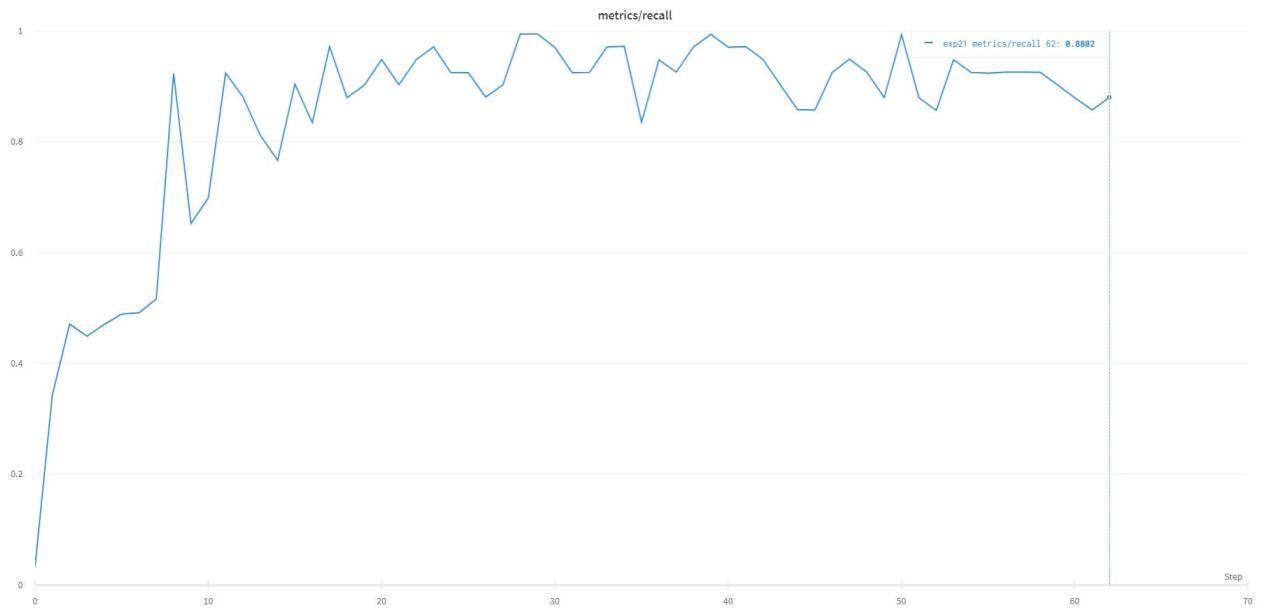


Figure 97 - Recall

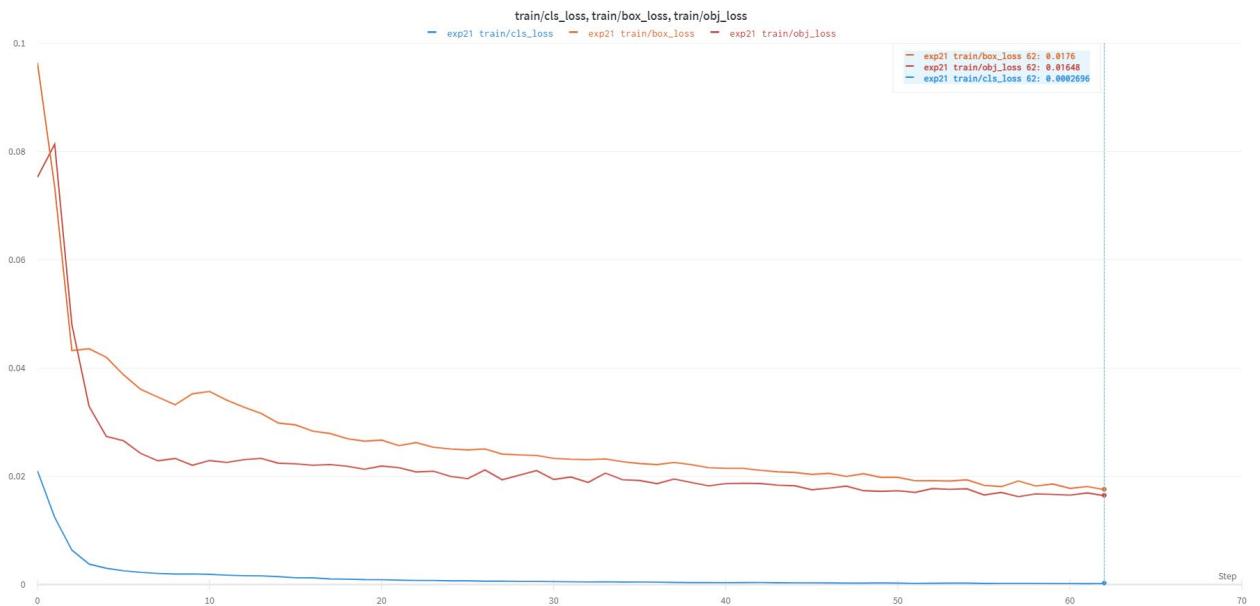


Figure 98 - Loss

- **After train:**
 - o mAP = 0.92
 - o recall = 0.88
 - o box_loss = 0.01
 - o obj_loss = 0.016
 - o cls_loss = 0.0002
- **Conclusion:** In conclusion our model achieves about 80 percent accuracy at this acceptable precision. The loss parameters are at 0.01 or less so the error is not too high

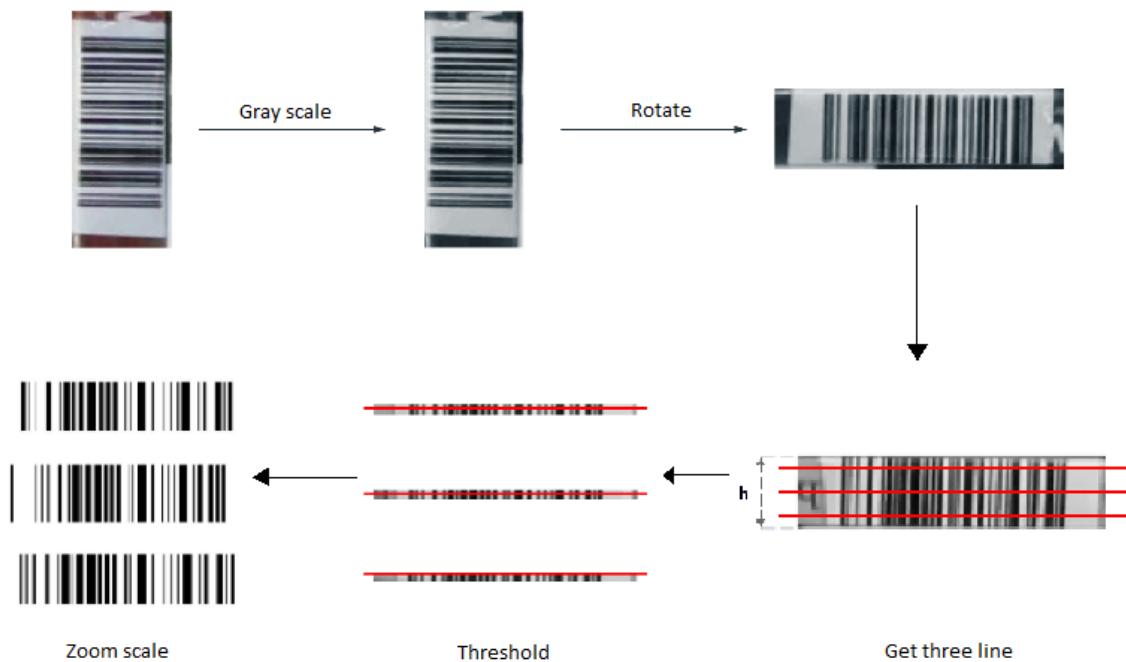
5.2 Recognize Barcode

5.2.1 Define Problem

- We use Pyzbar (lib of Python) to read barcode, but sometime it can't read because noise, blur, and detects.

5.2.2 Solution

- Read barcode is linear scan a line of barcode. So that we take 3 line of barcode with 3 positions difference and read them.
- Implement:
 1. Gray scale and rotate for barcode horizontal.
 2. Get 3 line from barcode with position dependent height of barcode, the position has ratio $1/6h$, $1/2h$, $5/6h$. With those three positions also helps to avoid the three lines being affected by the same agent.
 3. On each line we threshold to get the line just have black and white.
 4. Zoom Scale each lines to create new barcodes.



[Figure 99 - Steps To Make Barcode Sharper](#)

5.3 Grouping

5.3.1 Define Problem

- Barcode reading does not reach 100%
- How to know a barcode was appeared? (appeared mean this barcode has been read).
- How to know this barcode belongs to which drawer?

5.3.2 Solution

- The idea is that instead of having to know exactly whatever barcode belongs to any drawer, create a set that negates those barcodes as false in that drawer

5.3.2.1 Regulation

- Drones fly from left to right
- All barcodes in a frame are arranged in order from left to right

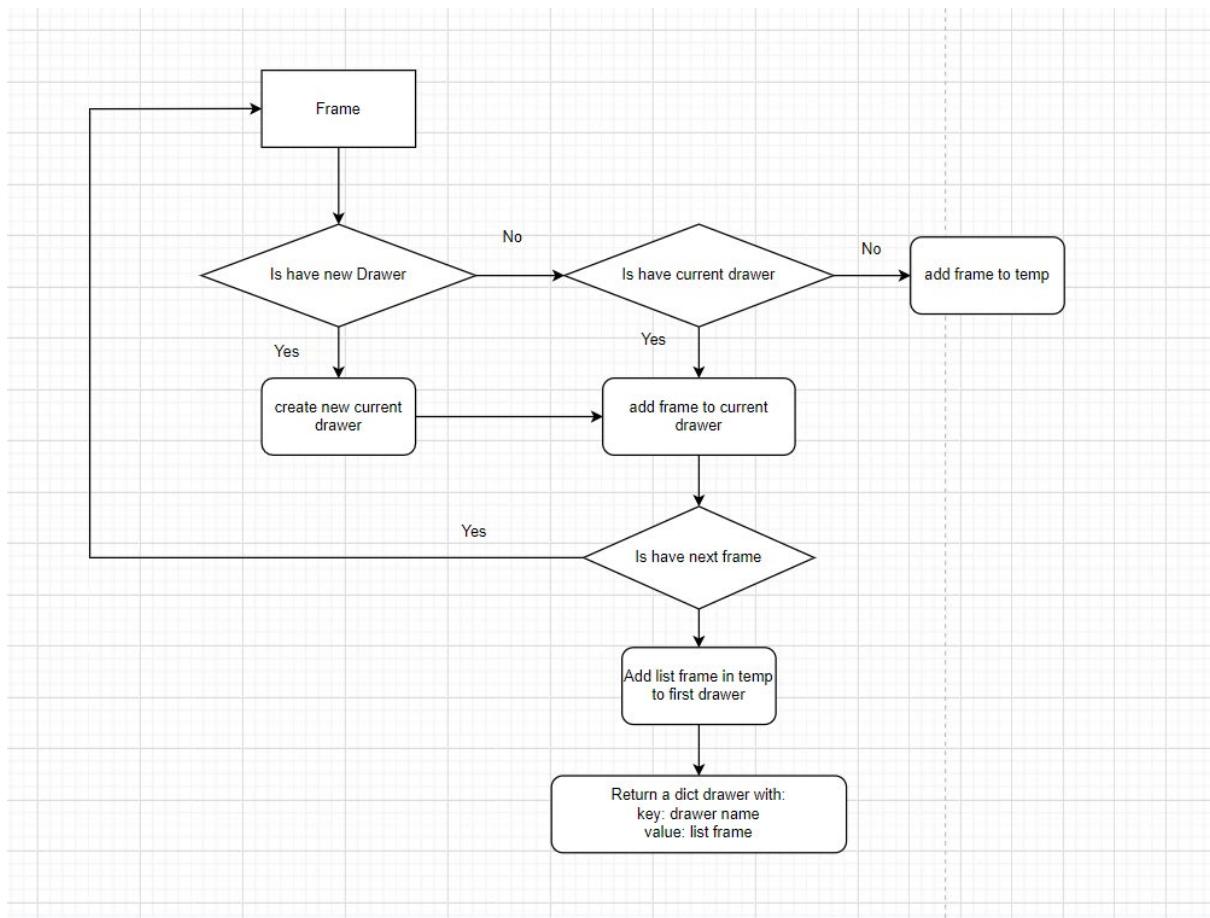
5.3.2.2 Concept

- **Frame:** It is essentially a list of the barcodes readable in that frame and arranged in order of position from left to right
- **Drawer:** barcode have format of drawer. Example KS002000
- **curDrawer:** drawer currently used to browse for example, browse frames in shelf A, then curDrawer is A
- **preDrawer:** the drawer that has just been browsed in the past
- **ListError:** negative sets of barcodes are not in a drawer
- **ListBook:** set of barcodes can be on the drawer

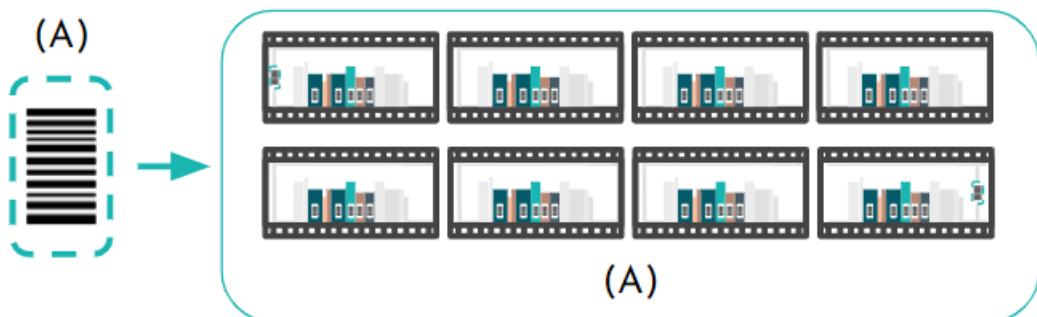
5.3.2.3 Implement

1. *Distribute frame for each drawer*

- **Why we need this step?**
 - Input is a list of frames and have many drawers in that list of frames. So for easier to process we distribute list frame for each drawer
- **How to implement?**
 - We find barcode of drawer in each frame.
 - If this is new drawer, next frames will belong to this drawer.
 - Have an issue that barcode of first drawer not read in first frames and barcode of first drawer was read in frames after. To solve that issue we have list temp to add barcode when don't have any drawer and finally add list temp in to the first drawer
- **What we get after this step?**
 - We get a dictionary of drawers. In each drawer is a list of frames that belong to this drawer



[Figure 100 - Distribute Frame For Each Drawer](#)

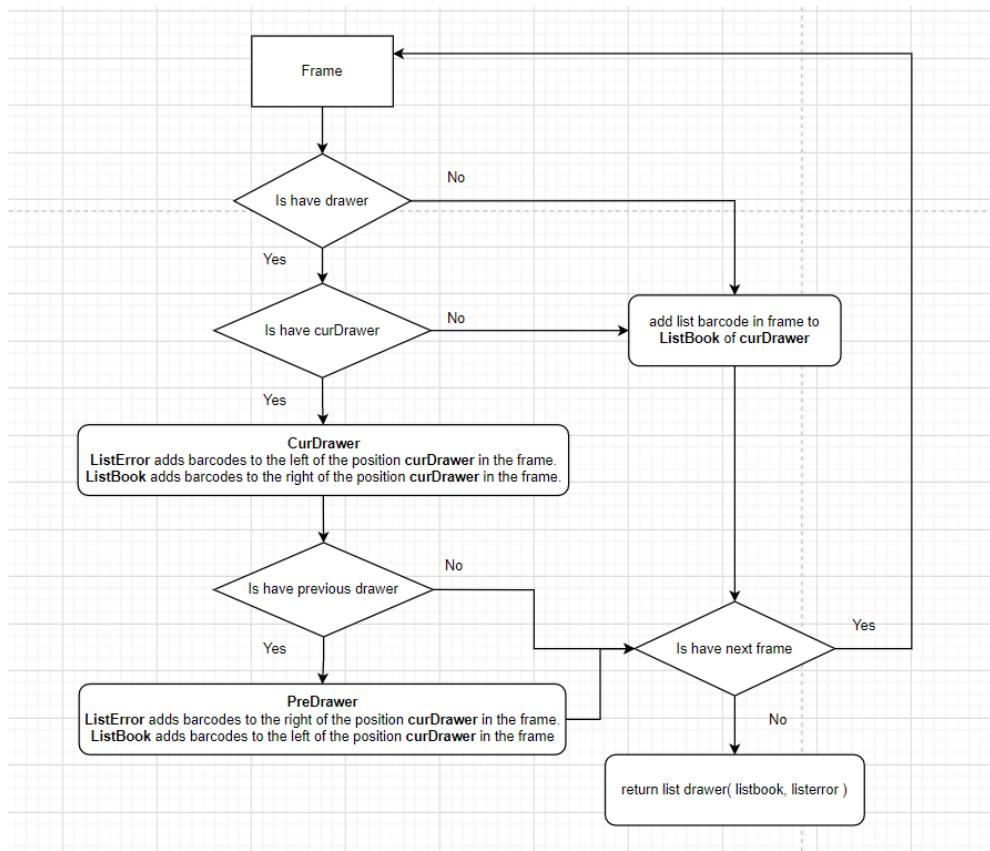


[Figure 101 - Drawer A And List Frame Of Drawer A](#)

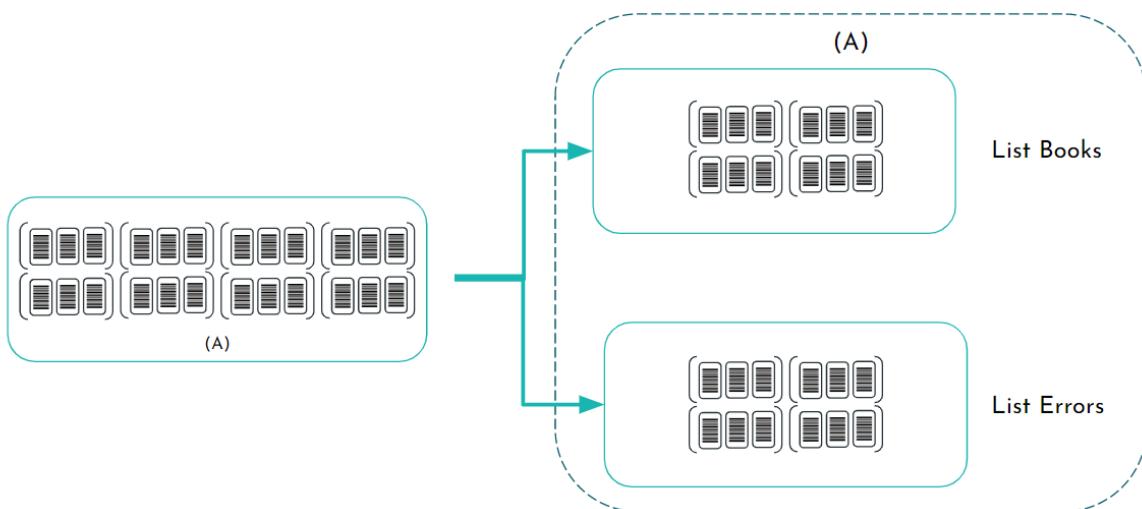
2. Create a set of barcodes that can belong to the drawer and a set of negative that contain barcodes not belong to the drawer

- **Why we need this step?**
 - We need to find set of negative that contain barcodes not belong to the drawer
 - We need to create set of barcodes that can belong to the drawer
- **How to implement?**

- We browse each drawer from step 1:
 - We need to create set of barcodes that can belong to the drawer
 - If this frame contains curDrawer
 - Barcodes on left side will add to listError of curDrawer
 - Barcodes on right side will add to listBook of curDrawer
 - If have preDrawer
 - Barcodes on left side will add to listBook of preDrawer
 - Barcodes on right side will add to listError of preDrawer
 - If this frame not contain curDrawer, all barcode in this frame will add to listBook of curDrawer
- **What we get after this step?**
- We get dictionary of drawer. With each drawer will contain 2 list:
 - We need to create set of barcodes that can belong to the drawer
 - If this frame contains curDrawer
 - Barcodes on left side will add to listError of curDrawer
 - Barcodes on right side will add to listBook of curDrawer
 - If have preDrawer:
 - Barcodes on left side will add to listBook of preDrawer
 - Barcodes on right side will add to listError of preDrawer
 - If this frame not contain curDrawer, all barcode in this frame will add to listBook of curDrawer:
 - **listError:** set of negative that contain barcodes not belong to the drawer
 - **listBook:** set of barcodes that can belong to the drawer



[Figure 102 - Create listError And listBook For Each Drawer](#)

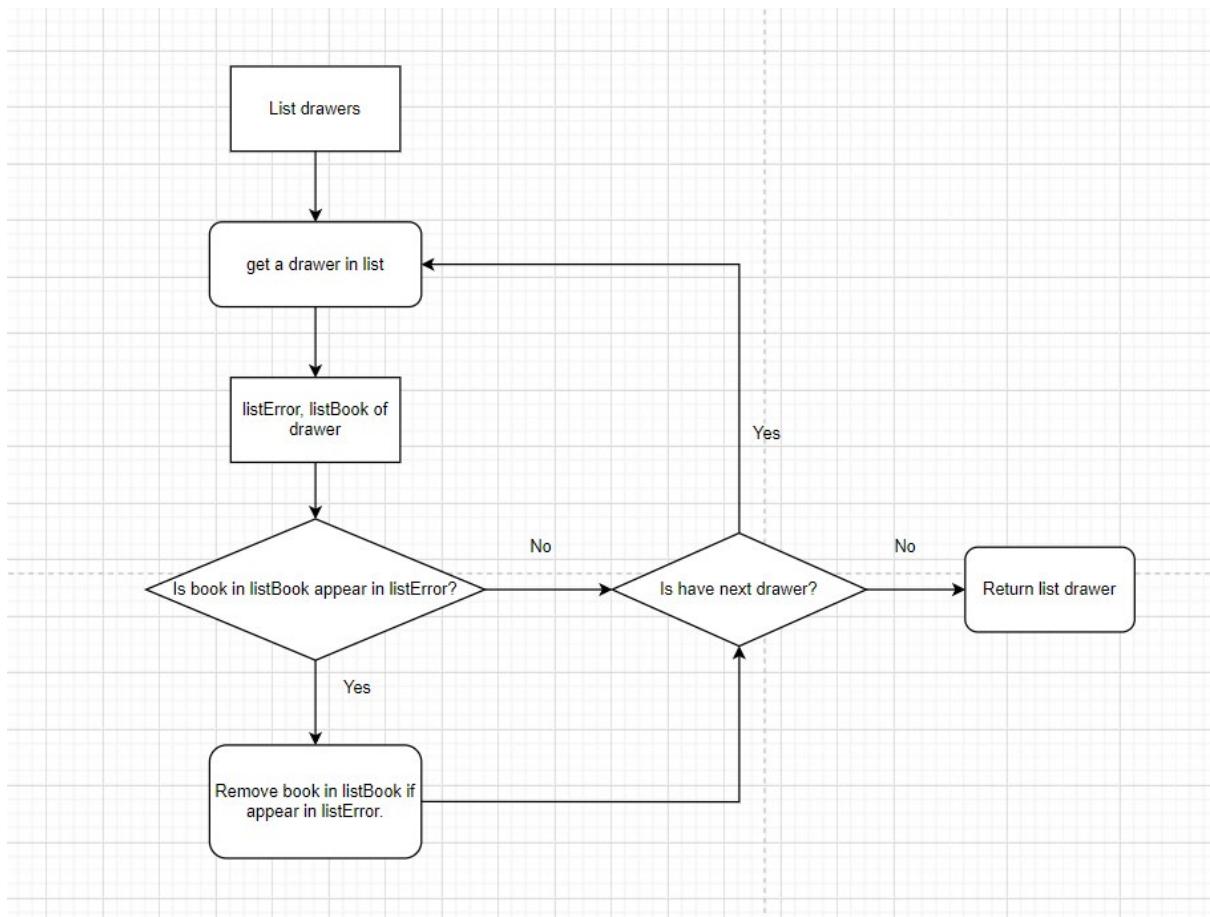


[Figure 103 - Result After Step 2](#)

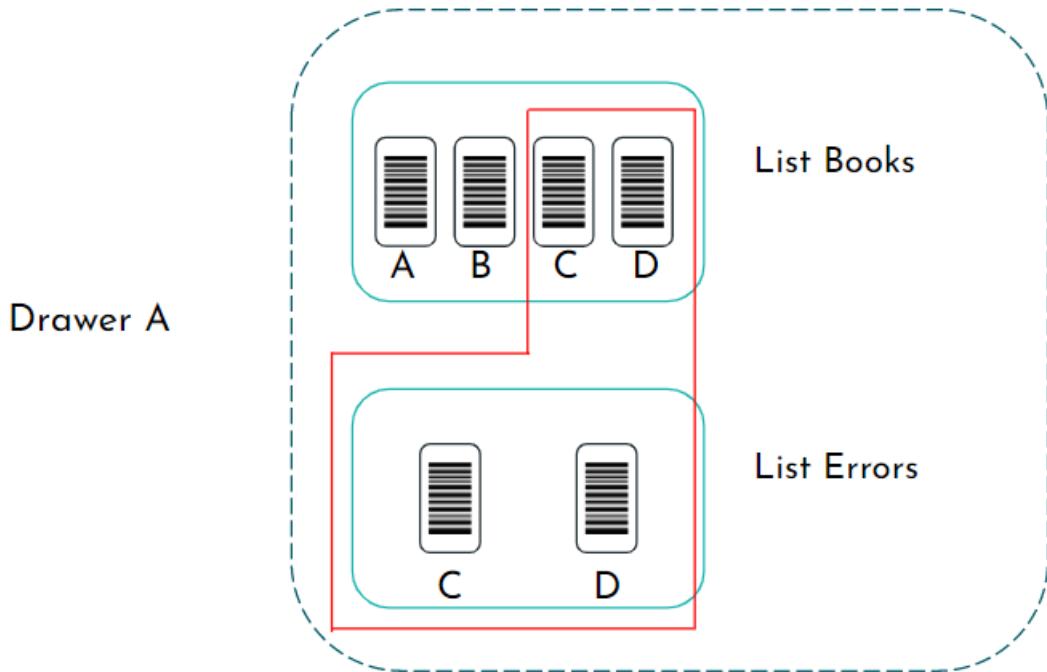
3. Filter the barcodes according to the negative set

- **Why we need this step?**
- This step will remove all book wrong position base on listError and listBook of a drawer.

- **How to implement?**
 - Filter by removing barcodes in the listBook if they are in the listError.
 - Filter as above for each drawer.
- **Why we need this step?**
 - List of drawers. Each drawer is a list of the barcode of the book belong to that drawer.



[Figure 104- Filter Error Book In List Book](#)



[Figure 105 - Filter Error](#)

4. Filter barcodes to remove duplicate barcodes

- **Why we need this step?**
 - Because after filtering the error books, there are still cases where 1 barcode appears in 2 different shelves.
 - But we know the first shelf is always the right shelf. Since it only shipped with the 2nd shelf and all the error cases were eliminated in step 3. So we choose first drawer to start filter.
- **How to implement?**
 - Start with first drawer.
 - Get two drawers for each step filter.
 - Drawer 1: is drawer have correct barcode in side.
 - Drawer 2: is drawer next to from right of Drawer 1.
 - Barcodes on left side will add to listError of curDrawer.
 - Barcodes on right side will add to listBook of curDrawer.
 - If Drawer 2 contain barcode in Drawer 1, this barcode will be remove from Drawer 2.
 - Filter until end list of drawer.
- **Why we need this step?**
 - List drawer. Each drawer contain a list of barcode have correct position.

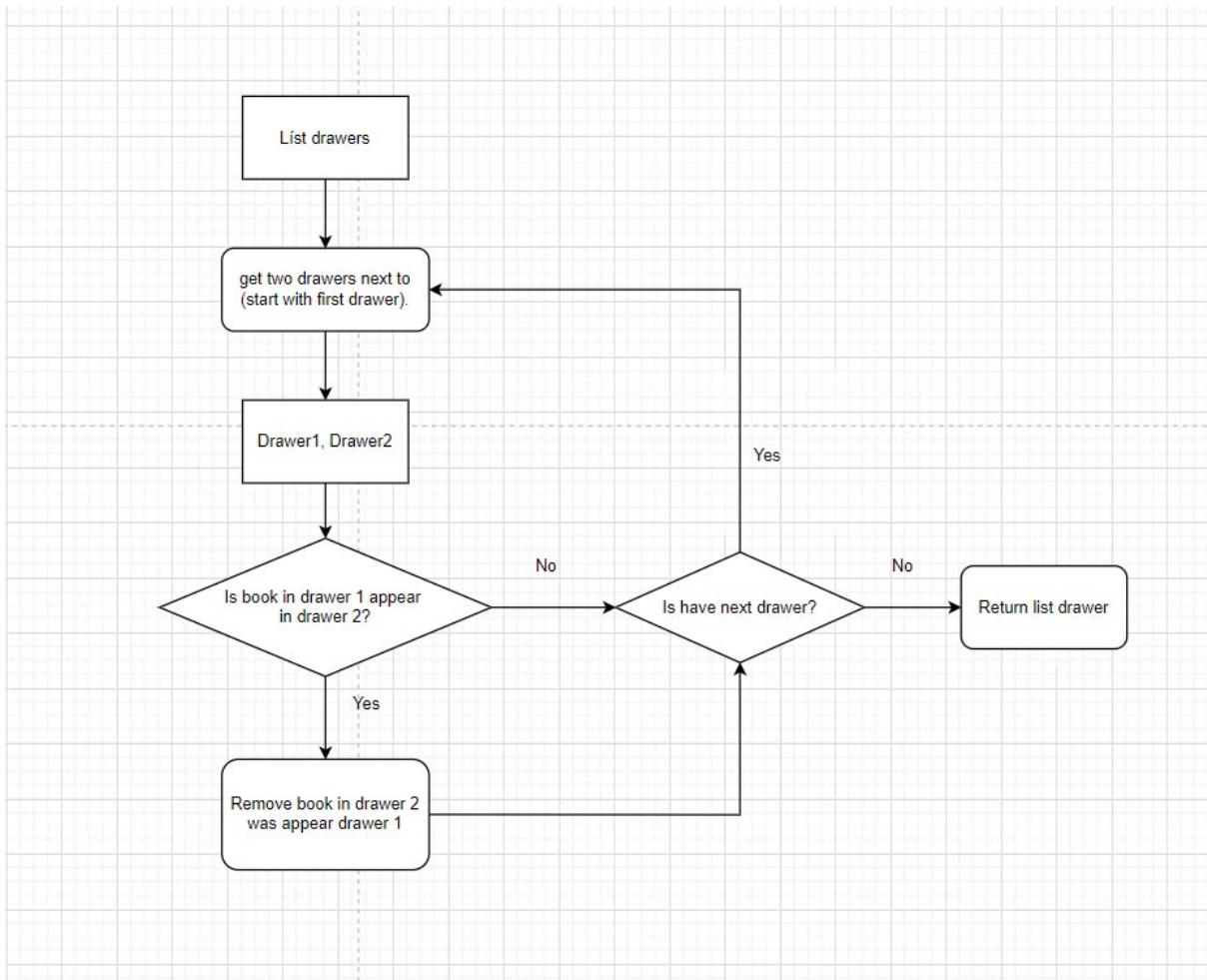


Figure 106 - Filter Duplicate

V. Software Testing Documentation

1. Overall Description

1.1 Test Model

In PAPV project, we apply Agile testing for many purposes:

- We believe that continuous testing will detect errors in the system early to quickly provide solutions and avoid the consequences that follow.
- Suitable for the constantly changing requirements.

1.2 Testing Levels

There are some testing levels that is applied in PAPV:

- Unit testing: use for participation flow such as create bookshelf, delete bookshelf, create location, create book group, create librarian, create detection, update book group.
- Acceptance testing: we work thoroughly with Library of FPT University to determine whether the system reaches stable level for release.

2. Test Plan

2.1 Test Stages

Type of Test	Stage of Test			
	Unit	Integration	System	Acceptance
Function Testing	X			
User Interface Testing				X

Table 142 - Test Stages

2.2 Resources

a. Human Resources

Worker/Doer	Role	Specific Responsibilities/Comments
Nguyễn Huỳnh Phú	Leader	Planning, verifying test deliverables
Nguyễn Hữu Linh	Member	Do unit testing/interface testing as planned
Trần Đăng Khánh	Member	Do unit testing/interface testing as planned
Trịnh Tiến Hoàng	Member	Do unit testing/interface testing as planned

Table 143 - Human Resources

2.3 Test Milestones

Milestone Task	Effort (md)	Start Date	End Date
Organize Book	2	14/04/2021	17/04/2021
Manage Librarian	2	14/04/2021	17/04/2021
Manage Book	2	14/04/2021	17/04/2021
Detect			
Manage Borrow	2	14/04/2021	17/04/2021
Unit test			

Table 144 - Test Milestones

3. Test Cases

[PAPV_Report5_Test Case Document.xlsx](#)

4. Test Reports

[PAPV_Report5_Unit Test Case.xls](#)

VI. Release Package & User Guides

1. Deliverable Package

1.1 Source codes & documents

No.	Items	Sub-Items	Type	Version
Code Package				
1	Web Service	papv_webapi	New	1.0
2	Mobile App	papv_mobile_app	New	1.0
3	Web App	papv_web_app	New	1.0
4	Python Server		New	1.0
5	.Net Server		New	1.0
Database				
1	Tables	Staff.sql	New	1.0
		Role.sql	New	1.0
		Notification.sql	New	1.0
		Device.sql	New	1.0
		Customer.sql	New	1.0
		BookDetect.sql	New	1.0
		ErrorMessage.sql	New	1.0
		Drawer.sql	New	1.0
		Bookshelf.sql	New	1.0
		Location.sql	New	1.0
		BookDrawer.sql	New	1.0
		Book.sql	New	1.0
		ReturnDetail.sql	New	1.0
		ReturnBook.sql	New	1.0
		BorrowBook.sql	New	1.0
		BorrowDetail.sql	New	1.0
		BookGroup.sql	New	1.0
		Image.sql	New	1.0
		BookCategory.sql	New	1.0
		Category.sql	New	1.0
		FavouriteCategory.sql	New	1.0

No.	Items	Sub-Items	Type	Version
		Feedback.sql	New	1.0
Documents				
1	Introduction	PAPV_Report1_Project Introduction.docx	New	1.0
2	Management Plan	PAPV_Report2_Project Management Plan.docx	New	1.0
3	Requirement Specification	PAPV_Report3_System Requirement Specification.docx	New	1.0
4	Software Design	PAPV_Report4_Software Design Document.docx	New	1.0
5	Testing	PAPV_Report5_Test Case Document.xlsx	New	1.0
		PAPV_Report5_Test Documentation.docx	New	1.0
		PAPV_Report5_Unit Test Case.xls	New	1.0
6	User Guides	PAPV_Report6_Software User Guides.docx	New	1.0
7	Final	PAPV_Report7_Final Project Report.docx	New	1.0

Table 145 - Source Code & Document

1.2 Known Issues, Limitations & Restrictions

- 4K video quality required.

2. Installation Guides

2.1 System Requirements

2.1.1 Hardware requirements

- For PC:

PC	Minimum Requirements	Recommended
Internet Connection	Cable, Wi-Fi (4 Mbps)	Cable, Wi-Fi (8 Mbps)
Operating System	Windows 7	Windows 10
Computer Processor	Intel® Core i3 1.4GHz	Intel® Core i5 2.50GHz
Computer Memory	1GB RAM	2GB RAM or more
Web Browser	Chromes (v69 or higher)	Chrome latest stable version

Table 146 - <System Requirements > Hardware Requirements For PC

- For Android Devices:

Operating system	Android 6.0 or higher
------------------	-----------------------

Processor	Intel Atom® Processor Z2520 1.2 GHz, or faster processor
Storage	Between 850 MB and 1.2 GB, depending on the language version
RAM	Minimum of 1 GB, 2 GB is recommended
Hard Disk	2 GB of available hard-disk space for installation

Table 147 - <System Requirements > Hardware Requirements For Android Devices

2.1.2 Software requirements

Software	Name / Version	Description
Operation System	Windows 7, Windows 10	Operating system and platform for development
Web browser	Chrome 69 or above	For web app
Android System	Android 6.0 or higher	For mobile app

Table 148 - <System Requirements > Software Requirements

2.2 Setup Files

 papv_mobile.apk 4/22/2021 10:09 AM APK File 46,238 KB

Figure 107 - papv_mobile.apk

2.3 Installation Instruction

- We guide how to installation mobile app with file apk release:
1. Install PAPV mobile app with file apk release by press “Install” button.

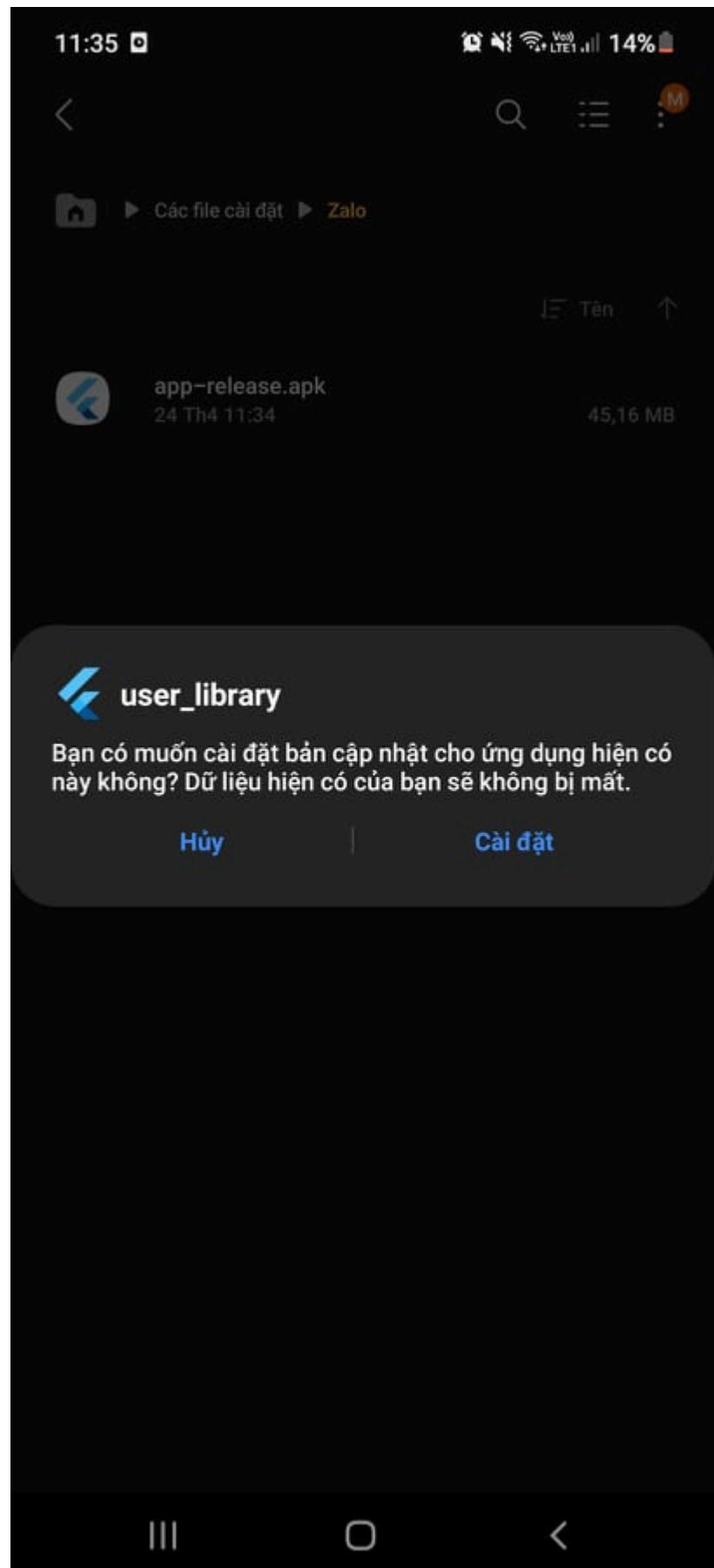


Figure 133 - Installation (Step 1)

2. PAPV mobile app will install into your device.

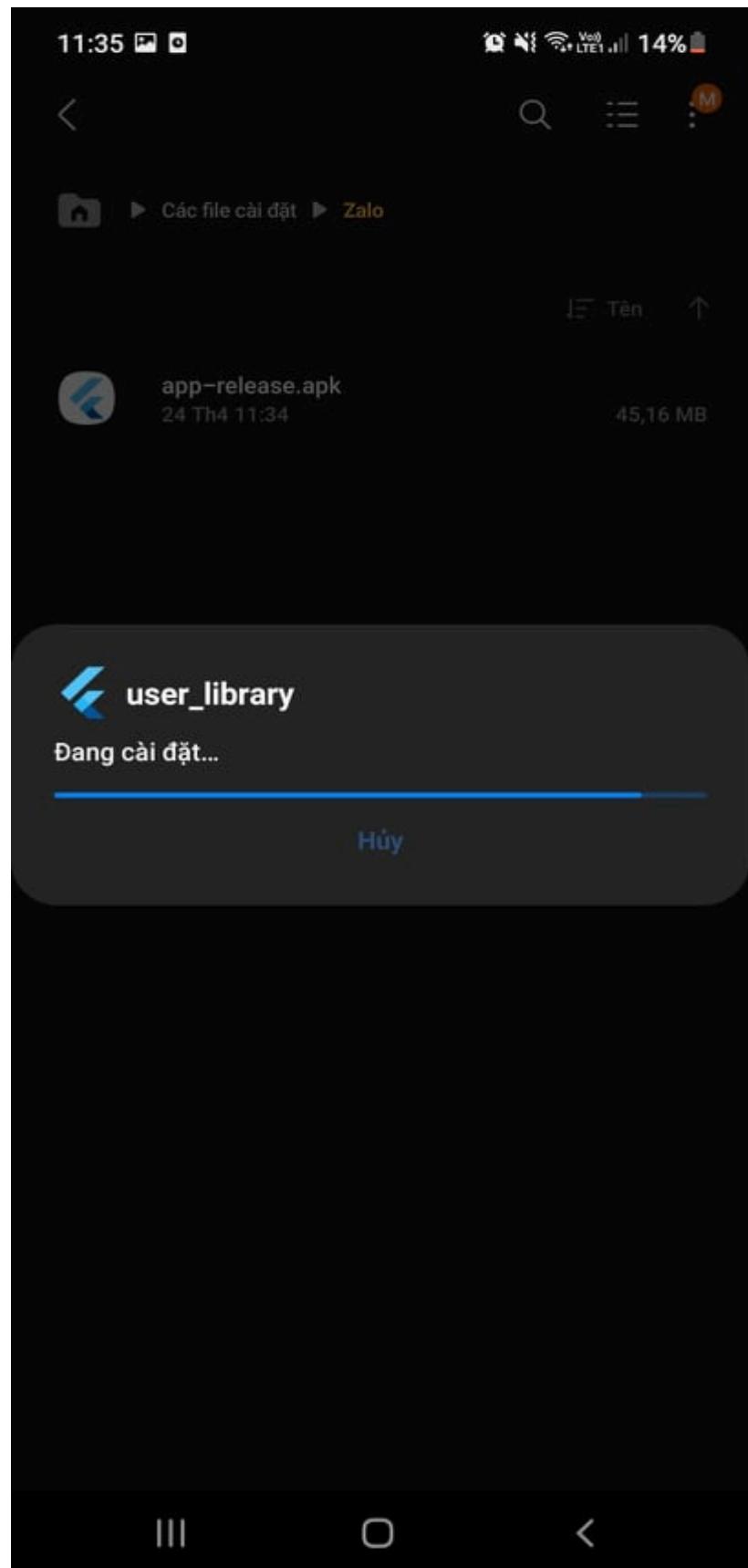


Figure 134 - Installation (Step 2)

3. Press “Mở” to start the PAPV mobile app.

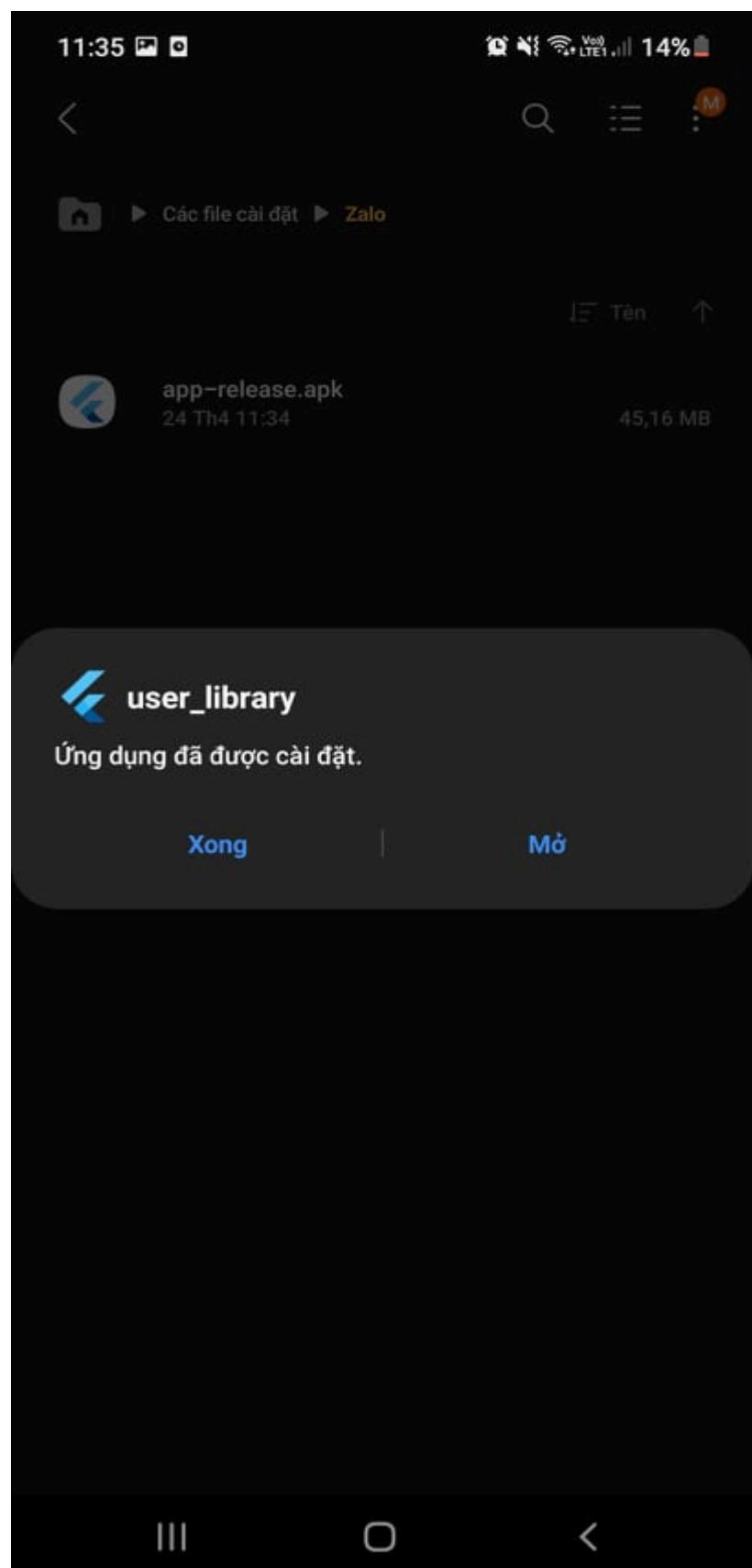


Figure 135 - Installation (Step 3)

2.4 Server-side Deployment

2.4.1. Prepare deployment packages

- Create a folder to contains deployment packages, for example:
C:\Users\Admin\Documents\Capstone
- Copy the Web Service deployment package (about 161MB) to a folder, for example:
C:\Users\Admin\Documents\Capstone\Capstone_Deploy\CapstoneService

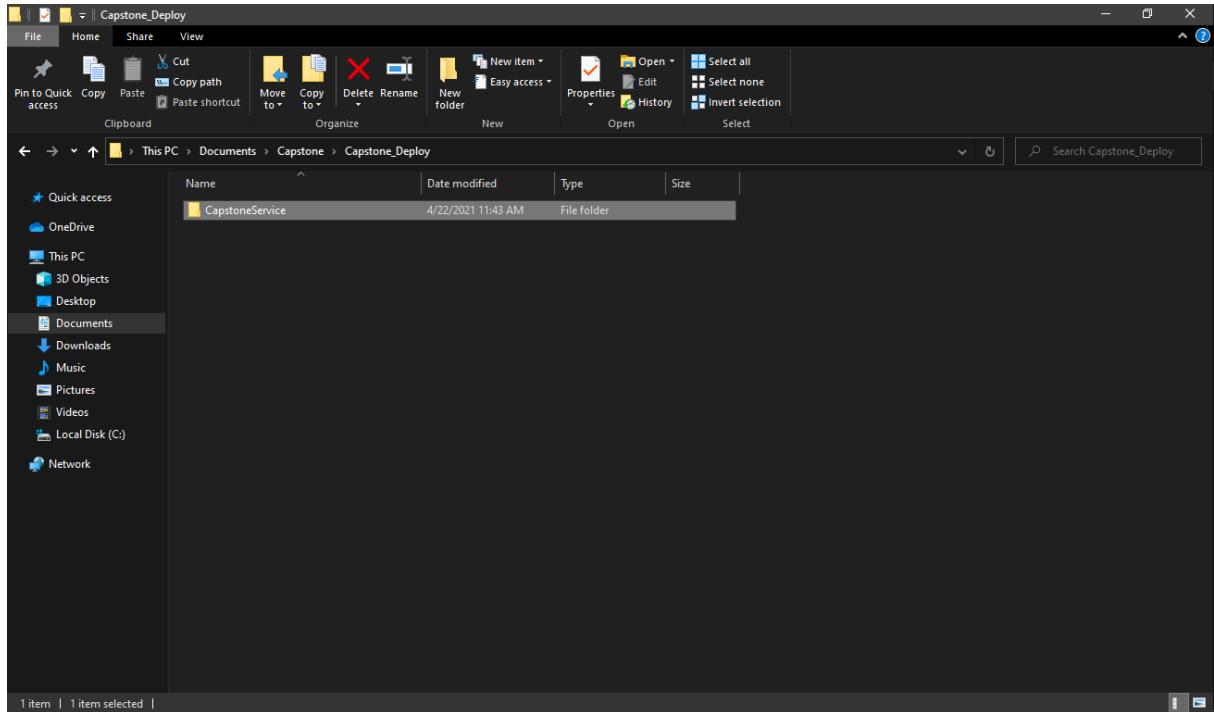
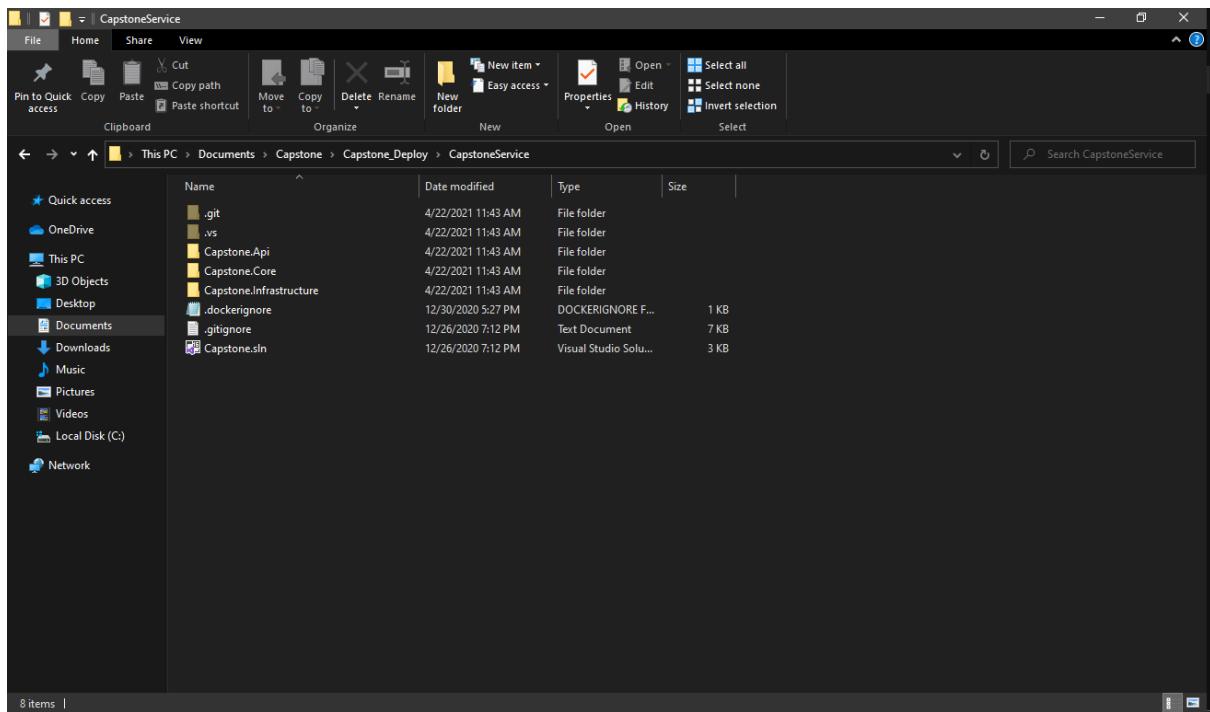


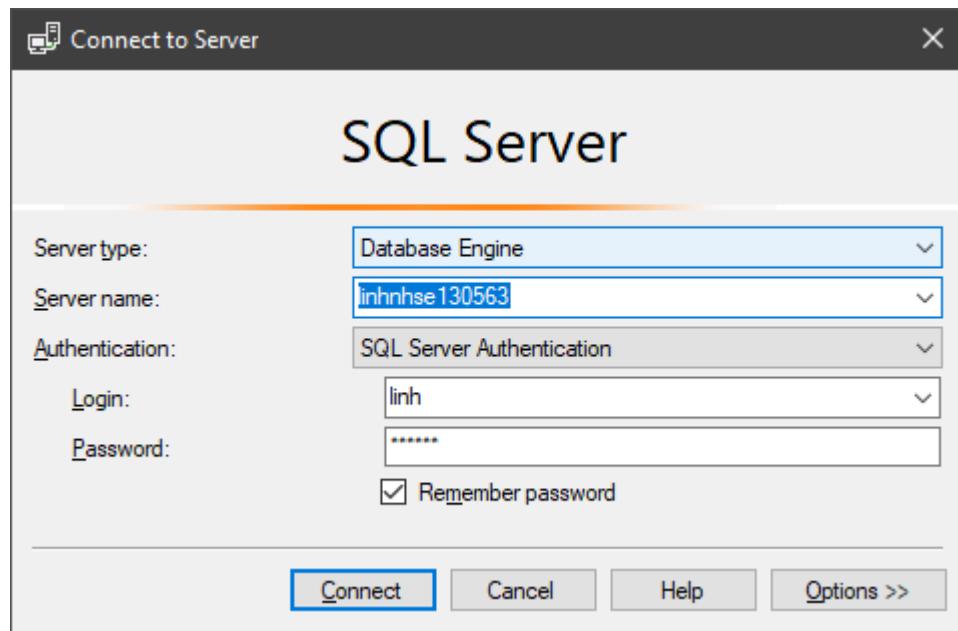
Figure 108 - Prepare Deployment Packages Folders



[Figure 109 - Prepare Deployment Packages Folders For Web Service](#)

2.4.2 Deploy SQL Server

- Open Microsoft SQL Server Management Studio.
- Server name: default server name is your computer name or the host server IPv4 address or SQL instance name of the computer.
- Login: username of the account.
- Password: password of the account.



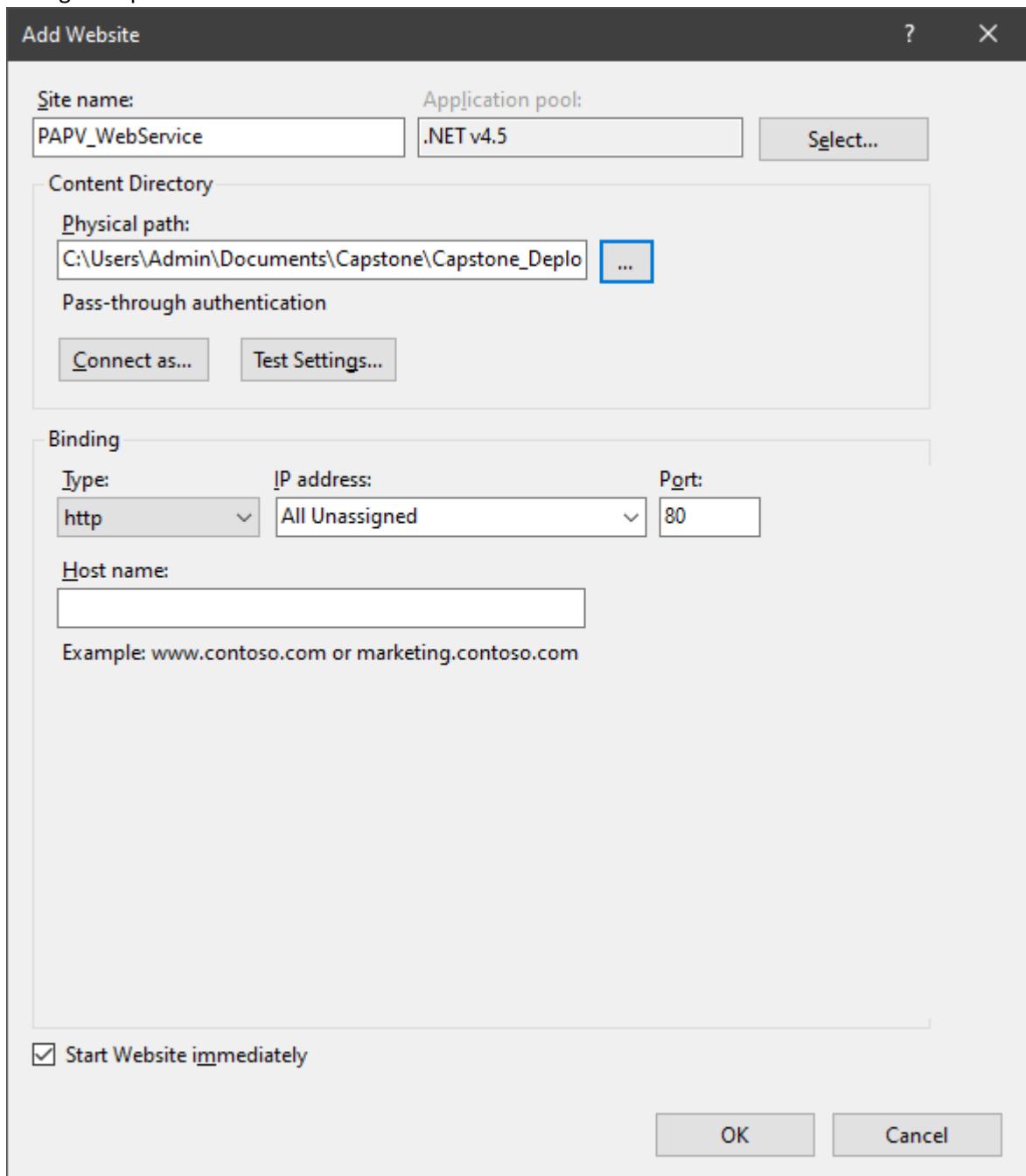
[Figure 110 - SQL Server](#)

- Open papv.script file.

- Execute script file.
- Check the database named Capstone with 22 tables to complete.

2.4.3. Deploy web service on server

- Open the Internet Information Services (IIS) Manager.
- Right click at Sites. Choose “Add Website...”.
- Enter site name. Choose Application Pool as .NET v4.5.
- In the physical path, select the path as the folder
C:\Users\Admin\Documents\Capstone\Capstone_Deploy\CapstoneService
- Change the port if needed.



[Figure 111 - Add Web Service To IIS](#)

- Press ok to finish the process.

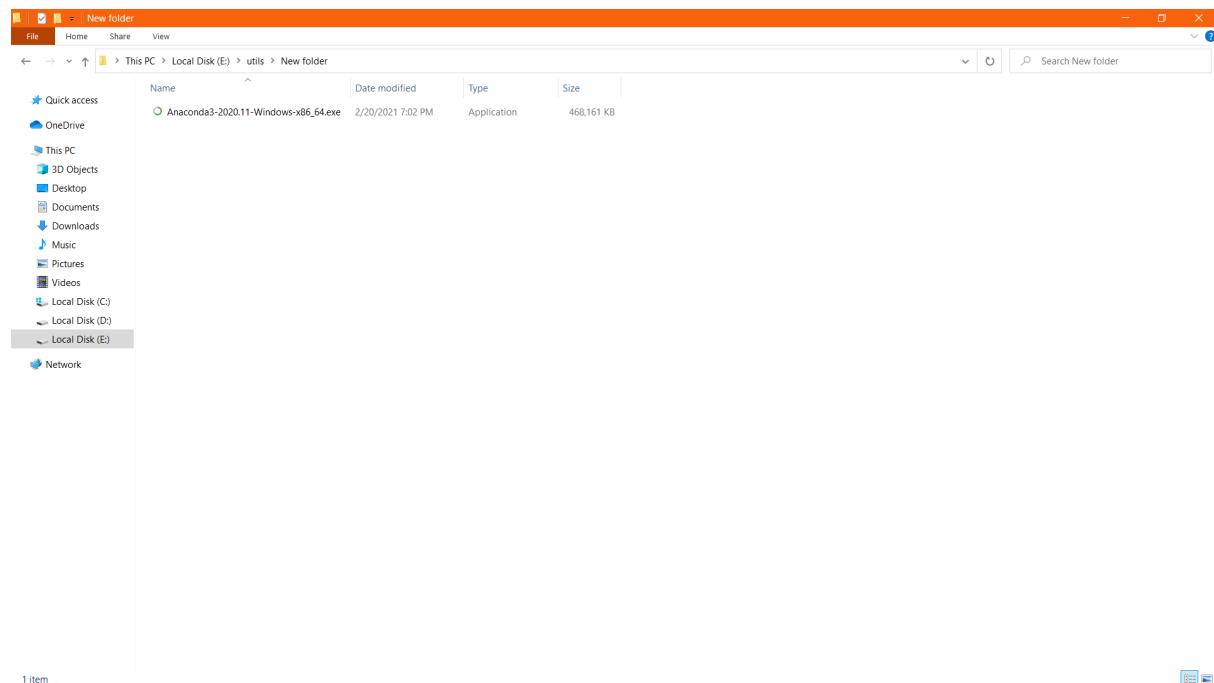
2.4.4. Prepare environment at client side

- The client devices need to have Google Chrome browsers to access the website.

2.5 Server Detection Setup Environment

2.5.1 Install environment Anaconda

1. Download the Anaconda installer.
2. Double click the installer to launch.



[Figure 140 - Anaconda Installation \(Step 2\)](#)

3. Click Next.

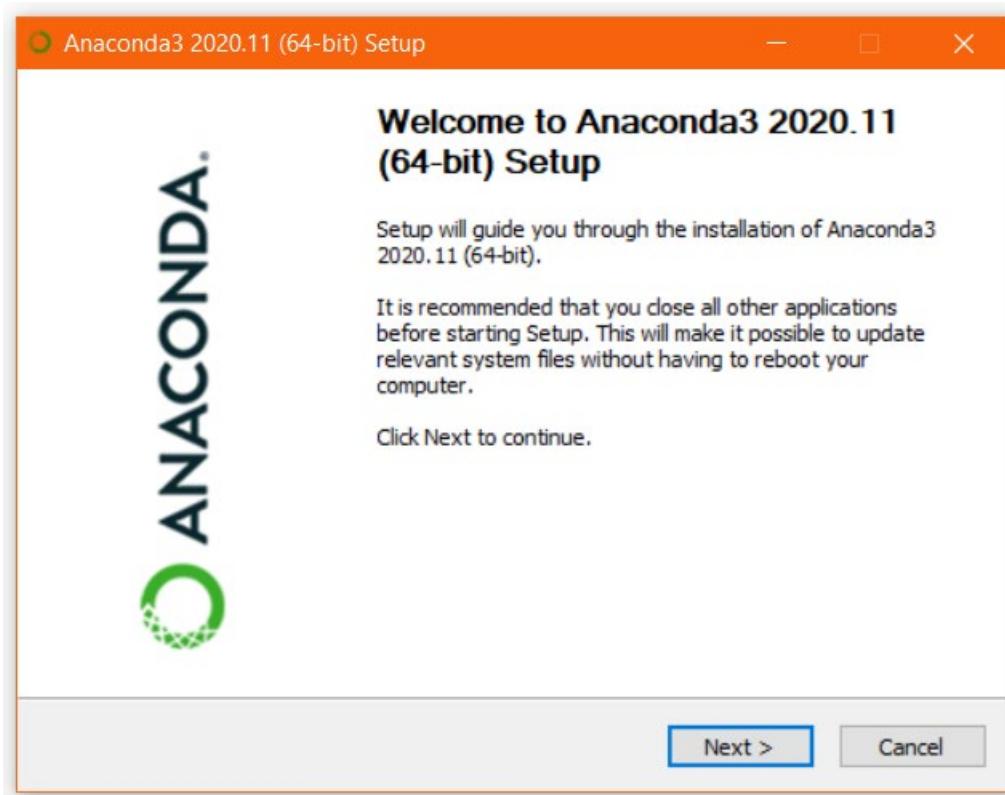


Figure 141 - Anaconda Installation (Step 3)

4. Read the licensing terms and click "I Agree".

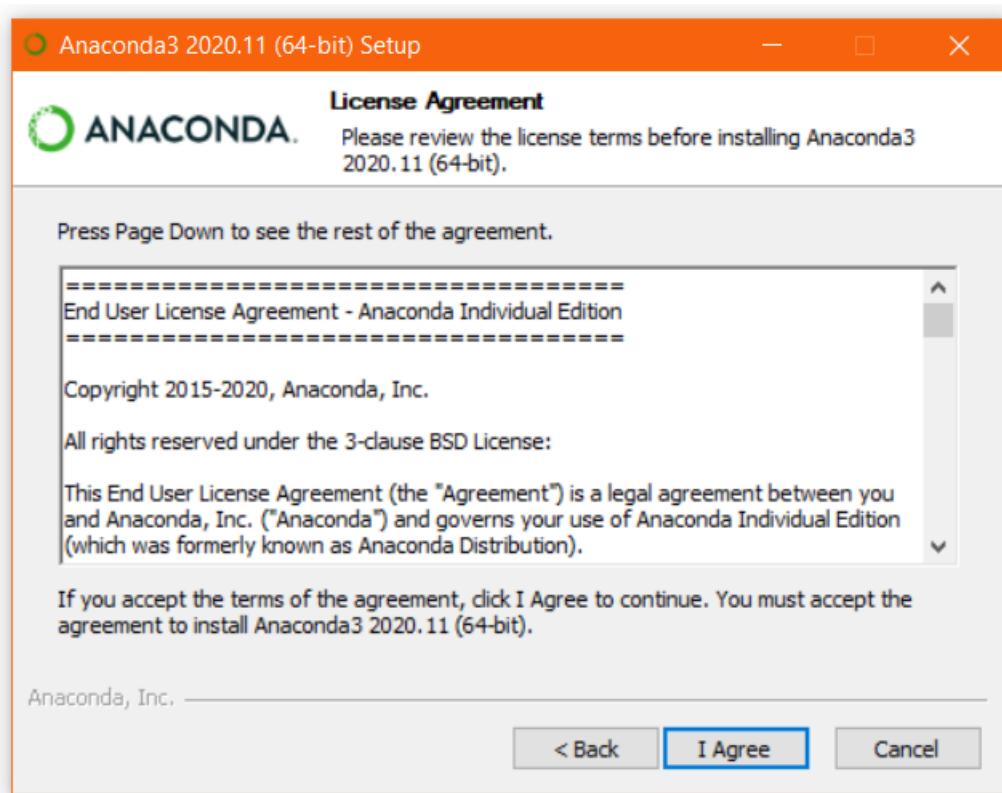


Figure 112 - Anaconda Installation (Step 4)

5. Select an install for "Just Me" and click Next.

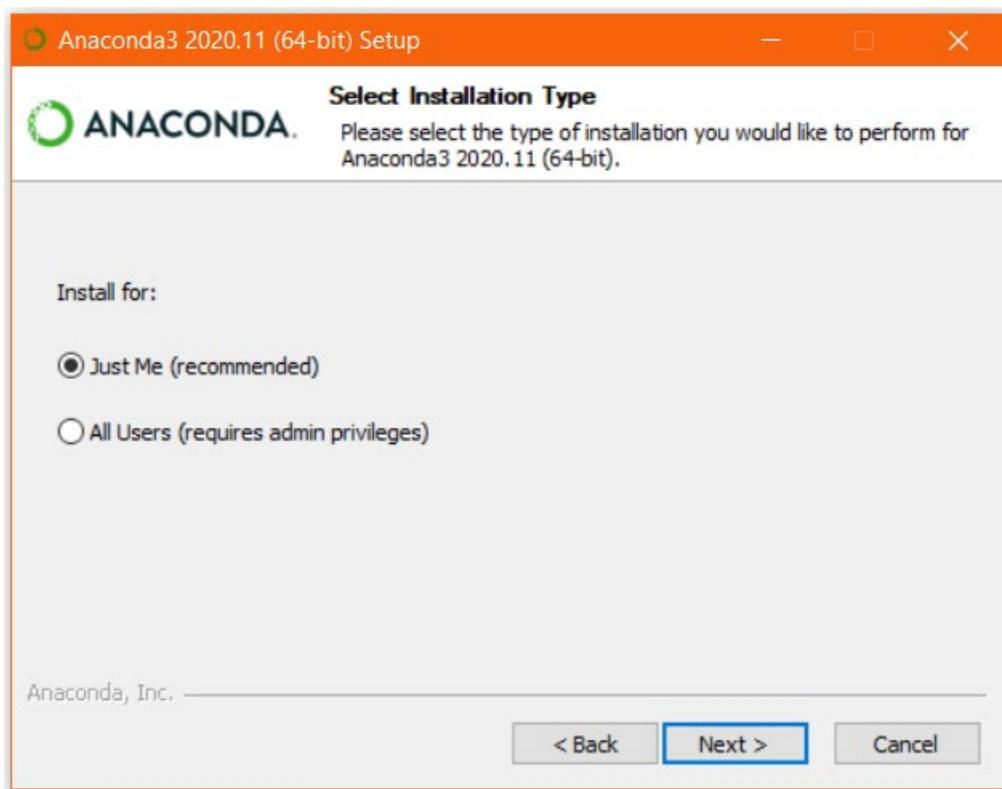


Figure 113 - Anaconda Installation (Step 5)

6. Select save folder

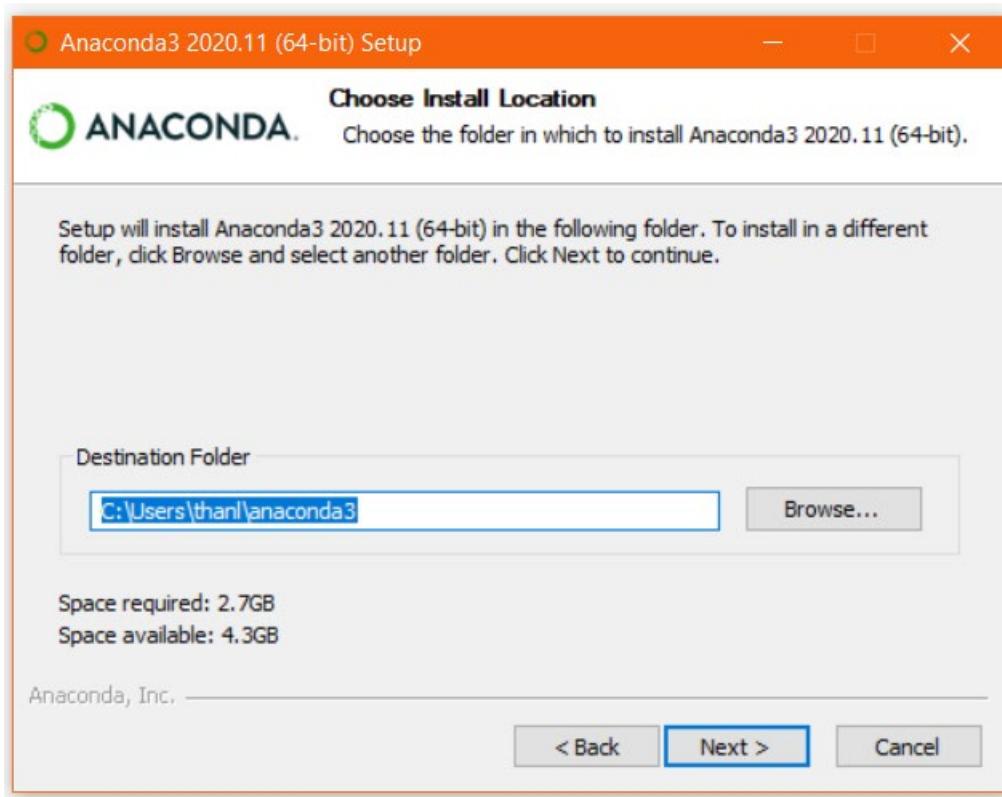


Figure 114 - Anaconda Installation (Step 6)

7. Select “Register Anaconda3 as my default Python 3.8” my python version is 3.8

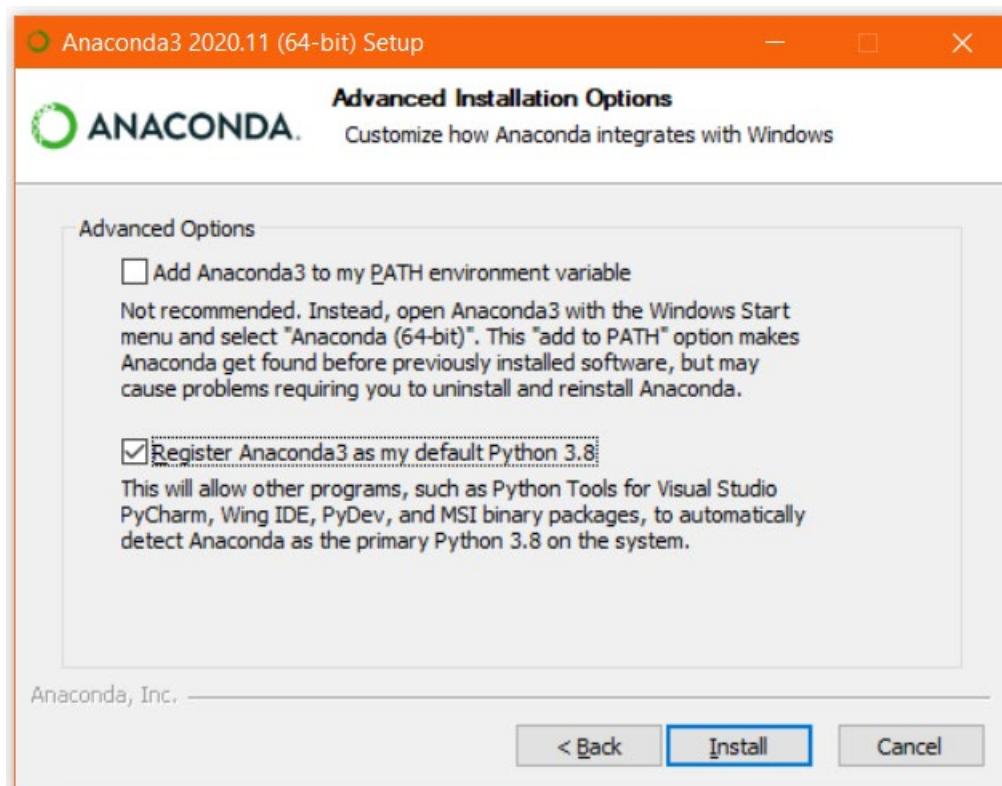


Figure 115 - Anaconda Installation (Step 7)

8. Wait for complete

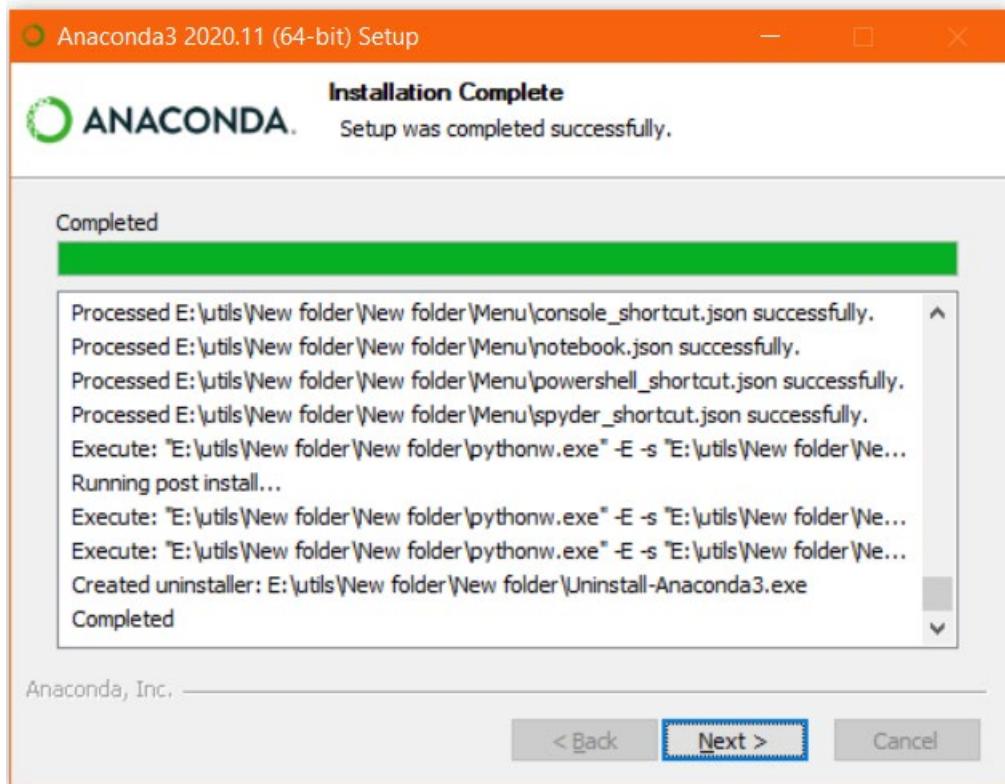


Figure 116 - Anaconda Installation (Step 8)

9. Click “Next”.

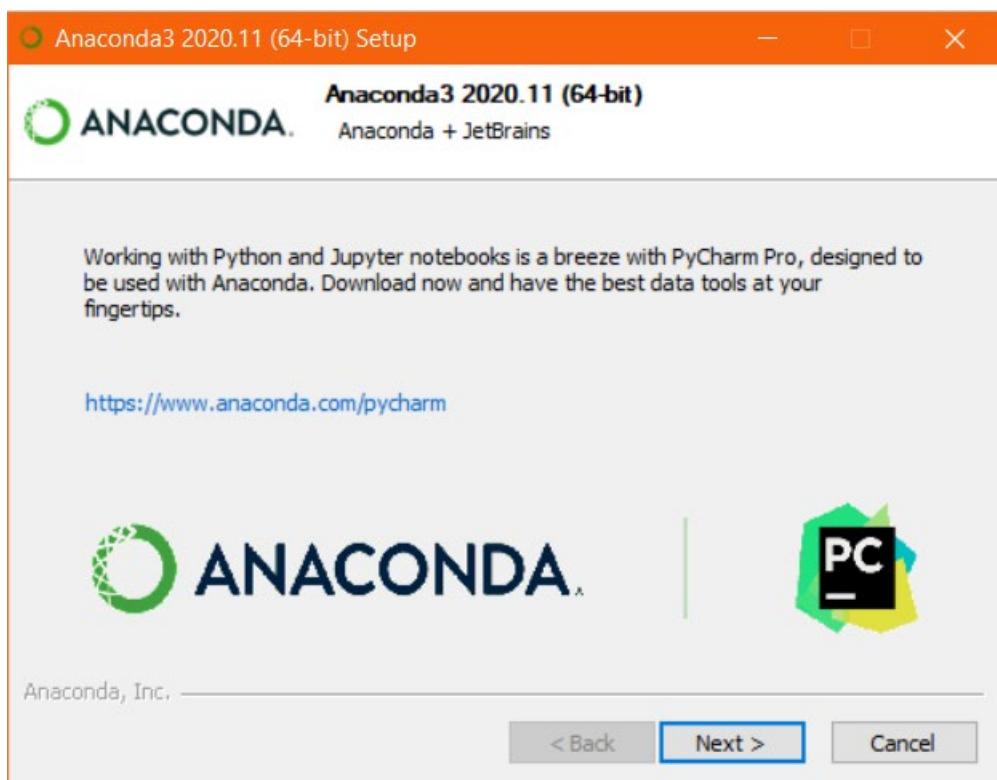


Figure 117 - Anaconda Installation (Step 9)

10. Click “Finish”.

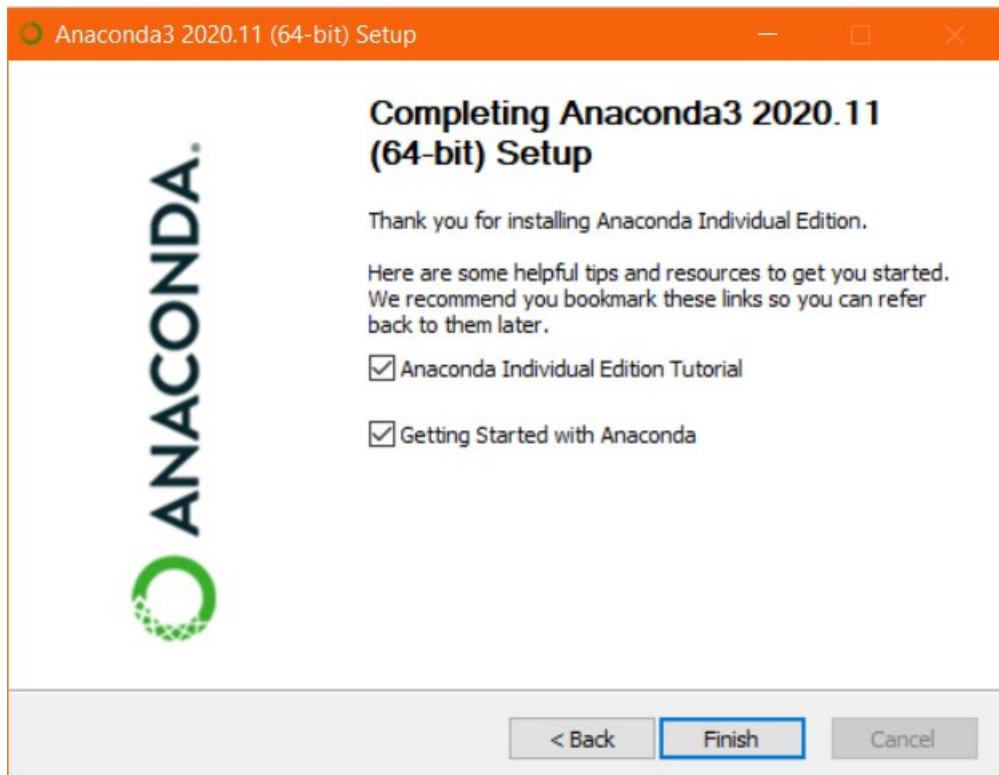


Figure 118 - Anaconda Install (Step 10)

2.5.2 Setting Run NVIDIA GPU

2.5.2.1 Requirements

- Have GPU NVIDIA support CUDA core.
- Upgrade to the latest version driver for GPU.

2.5.2.2 Install CUDA Toolkit

1. Download the CUDA Toolkit 10.2 for Win10.
2. Double click the installer to launch.

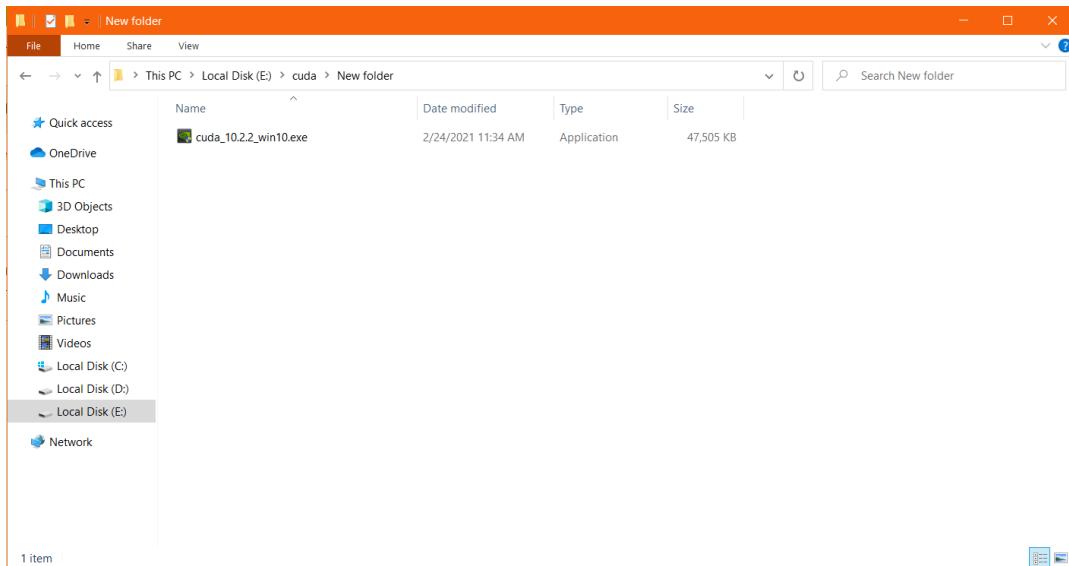


Figure 119 - CUDA Installation (Step 2)

3. Choose save folder and click “OK”.

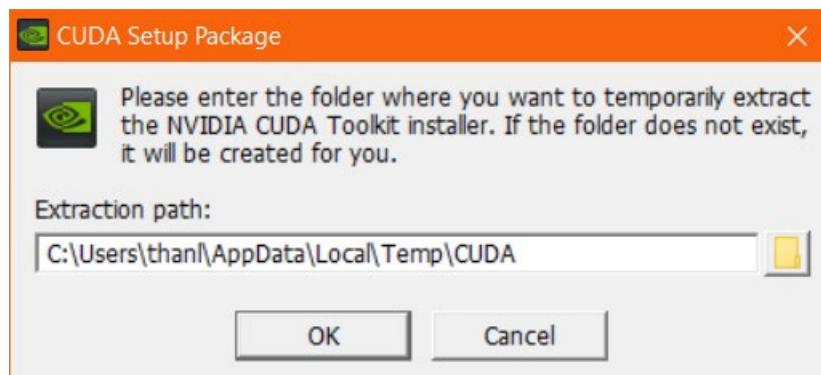


Figure 120 - CUDA Installation (Step 3)

4. Click “AGREE AND CONTINUE”.



Figure 121 - CUDA Installation (Step 4)

5. Choose “Express” and click “NEXT”.

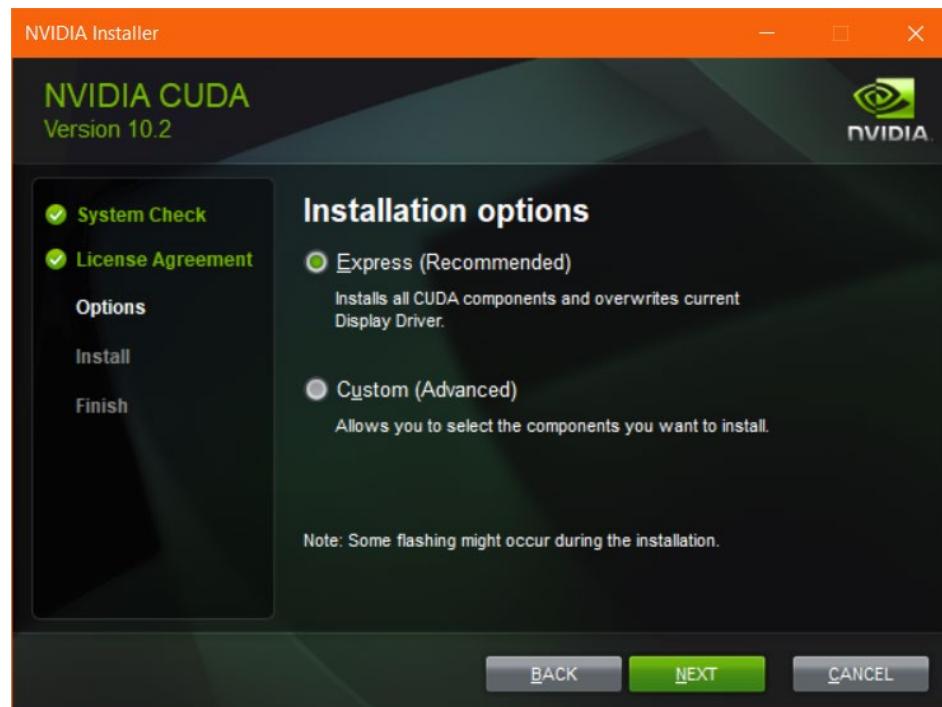


Figure 152 - CUDA Installation (Step 5)

6. Click “INSTALL” and wait for installed.

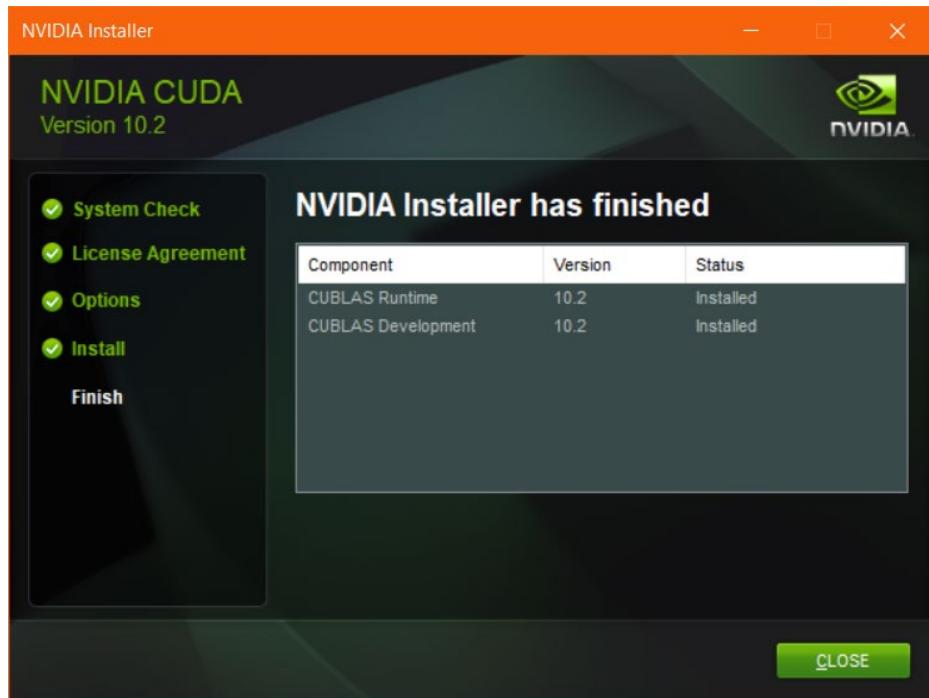


Figure 153 - CUDA Installation (Step 6)

3. User Manual

3.1 Terms and definitions

- PAPV Mobile Application is installed in mobile or tablet devices. It uses for librarian and patron.
- PAPV Web Application is run by PAPV.

3.2 System Requirements

3.2.1 Hardware Requirements

- **For PC:**

PC	Minimum Requirements	Recommended
Internet Connection	Cable, Wi-Fi (4 Mbps)	Cable, Wi-Fi (8 Mbps)
Operating System	Windows 7	Windows 10
Computer Processor	Intel® Core i3 1.4GHz	Intel® Core i5 2.50GHz
Computer Memory	1GB RAM	2GB RAM or more
Web Browser	Chromes (v69 or higher)	Chrome latest stable version

Table 149 - <User Manual> Hardware Requirements For PC

- **For Android Devices:**

Operating system	Android 6.0 or higher
------------------	-----------------------

Processor	Intel Atom® Processor Z2520 1.2 GHz, or faster processor
Storage	Between 850 MB and 1.2 GB, depending on the language version
RAM	Minimum of 1 GB, 2 GB is recommended
Hard Disk	2 GB of available hard-disk space for installation

Table 150 - <User Manual> Hardware Requirements For Android Devices

3.2.2 Software Requirements

Software	Name / Version	Description
Operation System	Windows 7, Windows 10	Operating system and platform for development
Web browser	Chrome 69 or above	For web app
Android System	Android 6.0 or higher	For mobile app

Table 151 - <User Manual> Software Requirements For PC

3.3 Application Usage

3.3.1 Overview

- Patron mobile application allows patron to choose book wish list, find book's position in library and view list of return book or borrow book. Patron can search books by name or author also patron can view books by category. In addition, patron mobile application allows patron to view and update profile.
- Librarian mobile application allows librarian scan patron's book wish list through QR Code. Librarian can scan book's Barcode when process return or borrow book. Librarian mobile application supports librarian to view and confirm detection issue messages.
- PAPV System also supports web application for librarian to manage books, organize books. Librarian can process return or borrow book. Librarian web application allows librarian import video to get book detection tracking result.
- Admin web application allows admin to manage bookshelf and location. Admin also can manage librarian.

3.3.2 Features

3.3.2.1 Web Application

a. Manage Book Group

- **Purpose:**
 - Allow librarian to manage book group.
- **Function:**

- View Book Group.
- View Book Group Detail.
- Create Book Group.
- Update Book Group.
- Delete Book Group.

- **User Interfaces:**

List Book Group								
All book group in system								
Type book group name		Search			Manage Categories			
□	Name	Quantity	Author	Rate	Created Date	Fee	Punish Fee	Publish Date
□	 The Women of the Bible Speak : The W...	5	Shannon Bream	0.00 ★	2021-04-23	0.5 €	1 €	2021-03-03
□	 Woman Evolve : Break Up with Your Fe...	5	Sarah Jakes Roberts	0.00 ★	2021-04-23	0.5 €	1 €	2021-04-01
□	 The Bomber Mafia Autographed	5	Malcolm Gladwell	0.00 ★	2021-04-23	0.5 €	1 €	2021-04-01
□	 Antitrust Autographed	5	Amy Klobuchar	0.00 ★	2021-04-23	0.5 €	1 €	2021-04-01
□	 Every Day Is a Gift Autographed	5	Tammy Duckworth	0.00 ★	2021-04-23	0.5 €	1 €	2021-03-01
□	 Finding Ashley	5	Danielle Steel	0.00 ★	2021-04-23	0.5 €	1 €	2021-04-01
□	 Neighbors	5	Danielle Steel	0.00 ★	2021-04-23	0.5 €	1 €	2021-01-01
□	 The Wife Upstairs	5	Rachel Hawkins	0.00 ★	2021-04-23	0.5 €	1 €	2021-01-01
□	 The Woman in the Window	5	A. J. Finn	0.00 ★	2021-04-23	0.5 €	1 €	2021-03-01

Figure 122 - View Book Group

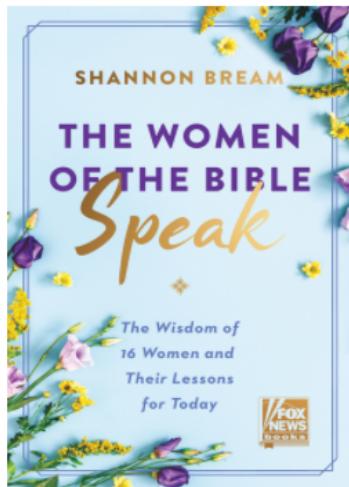
Book Group Detail



0.00

[View Feedbacks >](#)[Edit](#)[Delete](#)

Overview



Name: The Women of the Bible Speak : The Wisdom of 16 Women and Their Lessons for Today

Author: Shannon Bream

Categories:

Page Count: 14

Size: 8.4x5.5

Quantity: 5

[More detail >](#)

Publish Company: Harper Collins

Publish Date: 2021-03-03

Edition: 14

Publishing Place:

Description

The women of the Bible lived timeless stories--by examining them, we can understand what it means to be a woman of faith. People unfamiliar with Scripture often assume that women play a small, secondary role in the Bible. But in fact, they were central figures in numerous Biblical tales. It was Queen Esther's bravery at a vital point in history which saved her entire people. The Bible contains warriors like Jael, judges like Deborah, and prophets like Miriam. The first person to witness Jesus' resurrection was Mary Magdalene, who promptly became the first Christian evangelist, eager to share the news which would change the world forever. In *The Women of the Bible Speak*, Fox News Channel's Shannon Bream opens up the lives of sixteen of these Biblical women, arranging them into pairs and contrasting their journeys. In pairing their stories, Shannon helps us reflect not only on the meaning of each individual's life, but on how they relate to each other and to us. From the shepherdesses of ancient Israel who helped raise the future leaders of the people of God, to the courageous early Christians, the narrative of the Bible offers us many vivid and fascinating female characters. In their lives we can see common struggles to resist bitterness, despair, and pride, and to instead find their true selves in faith, hope, and love. In studying these heroes of the faith, we can find wisdom and warnings for how to better navigate our own faith journeys. *The Women of the Bible Speak* outlines the lessons we can take from the valor of Esther, the hope of Hannah, the audacity of Rahab, and the faith of Mary. In broadening each woman's individual

[Figure 123 - View Book Group Detail](#)

Create a new book group

X

* Book Group Name

* Author

Page Number

Width

Height

* Quantity

* Fee

* Punish Fee

* Book Price

Publishing Company

* Category

Publishing Date

Edition

Upload

Publishing Palace

Description

Cancel

Save

Figure 124- Create Book Group

Edit book detail

X

* Book Group Name

The Women of the Bible Speak : The Wisdom of 16

* Author

Shannon Bream

Page Number

14

Width

8.4

Height

5.5

* Fee

0.5

* Punish Fee

1

* Book Price

Please enter book price

Publishing Company

Harper Collins

* Category

Please select

Publishing Date

2021-03-03

Edition

14

Upload



Picture 0



Publishing Palace

Please enter publishing place

Description

The women of the Bible lived timeless stories--by examining them, we can understand what it means to be a woman of faith.

People unfamiliar with Scripture often assume that women play a small, secondary role in the Bible. But in

Cancel

Save

Figure 125 - Update Book Group

The screenshot shows the 'List Book Group' page of the PAPV System. The table lists books with columns for Name, Quantity, Author, Rate, Created Date, Fee, Punish Fee, and Publish Date. The first book in the list, 'The Women of the Bible Speak : The W...', has a checked checkbox in the first column. A confirmation dialog at the bottom left asks 'Do you want to delete 1 items ?' with 'Delete' and 'Cancel' buttons.

	Name	Quantity	Author	Rate	Created Date	Fee	Punish Fee	Publish Date
<input checked="" type="checkbox"/>	The Women of the Bible Speak : The W...	5	Shannon Bream	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-03-03
<input type="checkbox"/>	Woman Evolve : Break Up with Your Fe...	5	Sarah Jakes Roberts	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-04-01
<input type="checkbox"/>	The Bomber Mafia Autographed	5	Malcolm Gladwell	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-04-01
<input type="checkbox"/>	Antitrust Autographed	5	Amy Klobuchar	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-04-01
<input type="checkbox"/>	Every Day is a Gift Autographed	5	Tammy Duckworth	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-03-01
<input type="checkbox"/>	Finding Ashley	5	Danielle Steel	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-04-01
<input type="checkbox"/>	Neighbors	5	Danielle Steel	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-01-01
<input type="checkbox"/>	The Wife Upstairs	5	Rachel Hawkins	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-01-01
<input type="checkbox"/>	The Woman in the Window	5	A. J. Finn	0.00 ★	2021-04-23	0.5 ₫	1 ₫	2021-03-01

Figure 126 - Delete Book Group

b. Manage Bookshelf

- **Purpose:**
 - Allow admin to manage bookshelf.
- **Function:**
 - View Bookshelf.
 - View Bookshelf Detail.
 - Create Bookshelf.
 - Delete Bookshelf.
- **User Interface:**

List Bookshelf					
List all bookshelf in system <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 10px;"> <div style="border: 1px solid #ccc; padding: 2px 10px; margin-right: 10px;">Search by name</div> <div style="border: 1px solid #0072bc; color: #0072bc; padding: 2px 10px; border-radius: 4px; background-color: #f0f0f0;">Search</div> <div style="border: 1px solid #0072bc; color: #0072bc; padding: 2px 10px; border-radius: 4px; background-color: #f0f0f0;">+ Add New</div> </div>					
Name	Rows	Columns	Location		
Fairy Tail - 2	3	5	Floor 2 - Zone C	Detail	Delete
Fairy Tail - 1	3	5	Floor 2 - Zone C	Detail	Delete
General	3	6	Floor 3 - Zone D	Detail	Delete
Finance	5	7	Floor 1 - Zone C	Detail	Delete
History - 2	7	6	Floor 2 - Zone A	Detail	Delete
History - 1	7	6	Floor 2 - Zone A	Detail	Delete
Animals and Natural	7	6	Floor 2 - Zone D	Detail	Delete
Animals	6	7	Floor 2 - Zone B	Detail	Delete
Cultural and Art	6	7	Floor 3 - Zone A	Detail	Delete
Mystery and Detective - 3	5	5	Floor 3 - Zone D	Detail	Delete

< 1 2 >

Figure 127 - View Bookshelf

Organize Book

Details

Bookshelf Name: Mystery and Detective - 3

Row: 5 Column: 5

Location: Floor 3 - Zone D

Filter

Row ~

Column ~

Filter

A1	A1	A1
Row: 1 Column: 1 Code: #KS4025	Row: 1 Column: 2 Code: #KS4047	Row: 1 Column: 3 Code: #KS4046
A1	A1	B2
Row: 1 Column: 4 Code: #KS4045	Row: 1 Column: 5 Code: #KS4044	Row: 2 Column: 1 Code: #KS4043
B2	B2	B2
Row: 2 Column: 2 Code: #KS4042	Row: 2 Column: 3 Code: #KS4041	Row: 2 Column: 4 Code: #KS4040
B2	C3	C3
Row: 2 Column: 5 Code: #KS4039	Row: 3 Column: 1 Code: #KS4038	Row: 3 Column: 2 Code: #KS4048
C3	C3	C3
Row: 3 Column: 3 Code: #KS4037	Row: 3 Column: 4 Code: #KS4035	Row: 3 Column: 5 Code: #KS4034
D4	D4	D4
Row: 1 Column: 1	Row: 1 Column: 2	Row: 1 Column: 3

Drawer: #4025

Books in Drawer

#ID	Book Name	Barcode
No Data		

Figure 128- View Bookshelf Detail

Create Bookshelf

* Bookshelf Name

* Row Number

* Column Number

* Location



Figure 129 - Create Bookshelf

General	3	6	Floor 3 - Zone D	Detail	Delete
Finance	5	7	Floor 1 - Zone C	Detail	Delete
History - 2	7	6	Floor 2 - Zone A	Detail	Delete
History - 1	7	6	Floor 2 - Zone A	Detail	Delete

Figure 130 - Delete Bookshelf

c. Organize Book

- Purpose:**
 - Allow librarian to organize book
- Function:**
 - Add book into drawer
 - Remove book from drawer
- User Interface:**

Books In System
All books in system

#ID	Book Name	Barcode
1210	The Wife Upstairs	A121004
1209	The Wife Upstairs	A120912
1208	The Wife Upstairs	A120811
1207	The Wife Upstairs	A120710
1206	The Wife Upstairs	A120609
1205	Neighbors	A120508
1204	Neighbors	A120407
1203	Neighbors	A120306
1202	Neighbors	A120205
1201	Neighbors	A120104
1200	Finding Ashley	A120003
1199	Finding Ashley	A119920
1198	Finding Ashley	A119819

Drawer: #4328
Books in Drawer

#ID	Book Name	Barcode
1215	The Woman in the Window	A121509
1214	The Woman in the Window	A121408
1213	The Woman in the Window	A121307
1212	The Woman in the Window	A121206
1211	The Woman in the Window	A121105

Figure 131 - Add Book Into Drawer

Organize Book

Details

Bookshelf Name: Fairy Tail - 2
Row: 3 Column: 5
Location: Floor 2 - Zone C

Filter

Row: 1 ~ 3
Column: 1 ~ 5

A1
Row: 1 Column: 1
Code: #KS4328

A1
Row: 1 Column: 4
Code: #KS4331

B2
Row: 2 Column: 2
Code: #KS4334

B2
Row: 2 Column: 5
Code: #KS4337

C3
Row: 3 Column: 3
Code: #KS4340

Books In System
All books in system

#ID	Book Name	Barcode
1210	The Wife Upstairs	A121004
1209	The Wife Upstairs	A120912
1208	The Wife Upstairs	A120811
1207	The Wife Upstairs	A120710
1206	The Wife Upstairs	A120609
1205	Neighbors	A120508
1204	Neighbors	A120407
1203	Neighbors	A120306
1202	Neighbors	A120205
1201	Neighbors	A120104
1200	Finding Ashley	A120003
1199	Finding Ashley	A119920
1198	Finding Ashley	A119819

< 1 >

Drawer: #4328
Books in Drawer

#ID	Book Name	Barcode
1215	The Woman in the Window	A121509
1214	The Woman in the Window	A121408
1213	The Woman in the Window	A121307
1212	The Woman in the Window	A121206
1211	The Woman in the Window	A121105

Remove From Drawer

[Figure 132 - Remove Book From Drawer](#)

d. Manage Borrow

- **Purpose:**
 - Allow librarian to manage borrow book
- **Function:**
 - View borrow book
 - View borrow book 's detail
 - Create borrow book
- **User Interface:**

List Borrow

List borrow detail

Type patron name



Search

Name	Start Time	End Time	Quantity	Total
Nguyen Huynh Phu	2021-04-22	2021-04-29	1	30
Nguyen Huu Linh	2021-04-22	2021-04-29	3	50
vovann	2021-04-21	2021-04-28	1	10
Haruki	2021-04-21	2021-04-28	1	10
Haruki	2021-04-20	2021-04-27	3	50
Haruki	2021-04-20	2021-04-27	2	40
Haruki	2021-04-20	2021-04-27	3	50
Nguyen Huynh Phu	2021-04-20	2021-04-27	1	10
Haruki	2021-04-18	2021-04-25	1	10
Nguyen Huu Linh	2021-04-18	2021-04-25	1	10

< 1 2 3 4 5 6 7 >

Figure 133 - View Borrow Book

Borrow Detail

Patron Name	Haruki
Start Time	2021-04-20
Return Time	2021-04-27 •
Quantity	3 
Total Fee	50 



The Other Emily

[Book Detail](#)

Fee: 5 

Punish Fee: 15 

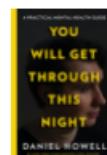


The Hill We Climb : An Inaugural Poem for the Country

[Book Detail](#)

Fee: 15 

Punish Fee: 25 



You Will Get Through This Night

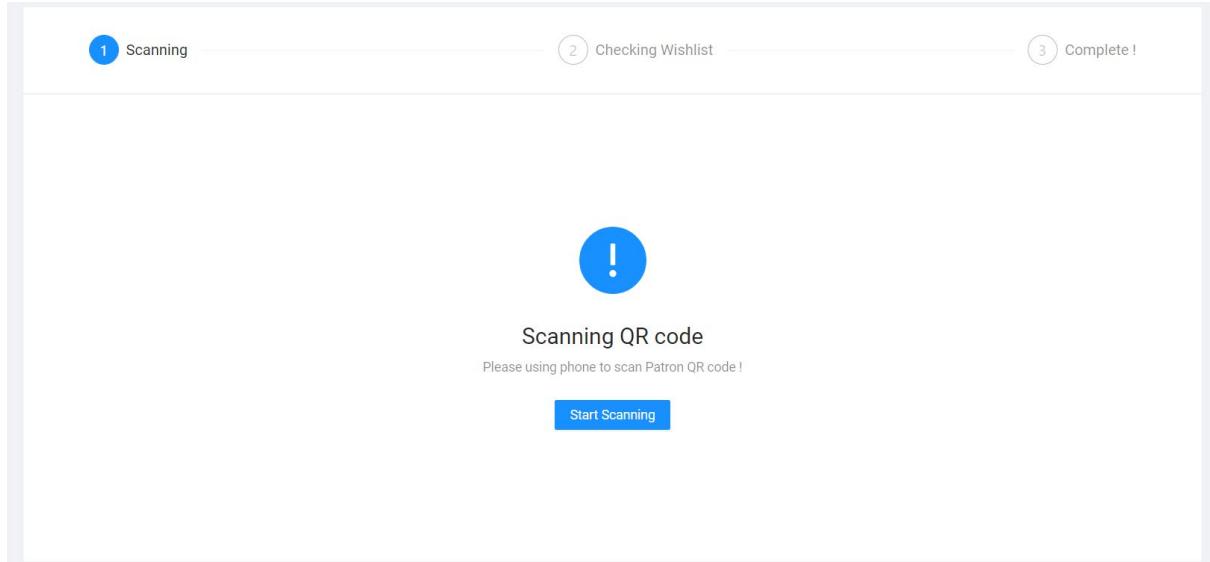
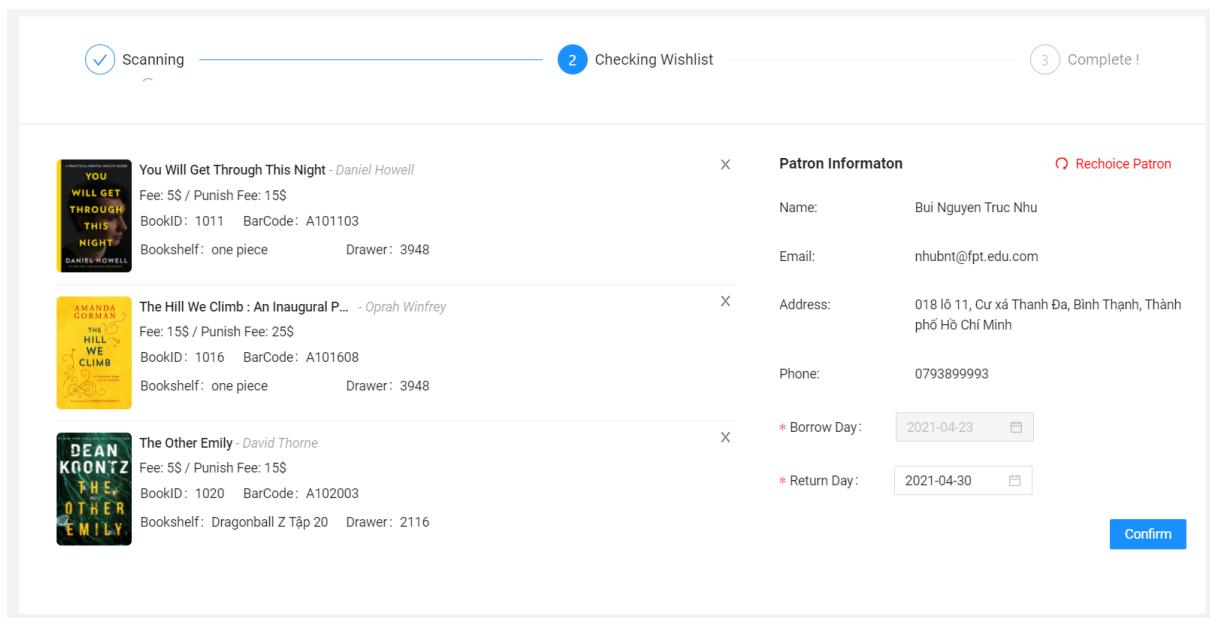
[Book Detail](#)

Fee: 5 

Punish Fee: 15 

[Figure 134 - View Borrow Detail](#)

Manage Borrow

[Return Request](#)[Borrow Request](#)Figure 135 - Create Borrow Book (Step 1)Figure 136 - Create Borrow Book (Step 2)Figure 137 - Create Borrow Book (Step 3)

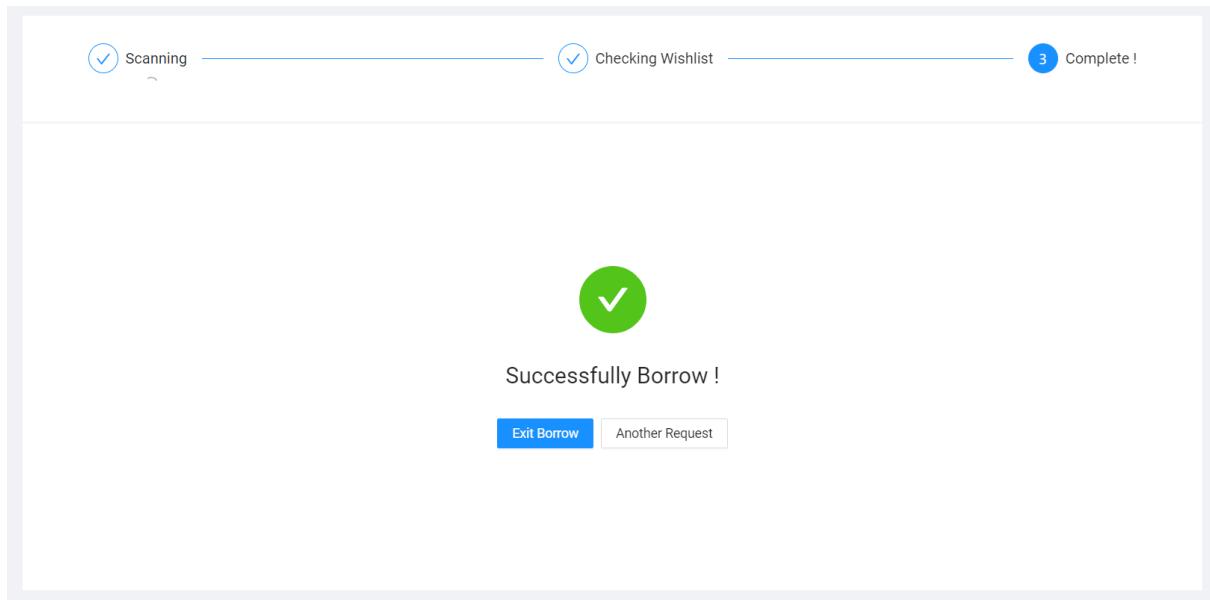


Figure 138 - Create Borrow Book (Step 4)

e. Manage Return

- **Purpose:**
 - Allow librarian to manage return book
- **Function:**
 - View return book
 - View return book 's detail
 - Create return book
- **User Interface:**

List Return		Type patron name	Search
<i>List return detail</i>			
Name	Return Time	Total	
 Nguyen Huynh Phu	2021-04-22	40	
 Nguyen Huu Linh	2021-04-22	80	
 Haruki	2021-04-22	130	
 Haruki	2021-04-20	60	
 Haruki	2021-04-19	25	
 Haruki	2021-04-17	0	
 Haruki	2021-04-16	575	
 Haruki	2021-04-16	0	
 Haruki	2021-04-16	575	
 Haruki	2021-04-16	495	

< 1 2 3 4 >

Figure 139 - View Return Book

Return Detail

Patron Name	Haruki	User Name	haruky
Return Time	2021-04-22	Quantity	
Librarian	Nguyễn Hữu Linh 	Total Fee	130 



You Will Get Through... - Daniel Howell

BookID: 1011 #

Fee: 15  Punish Fee: 15 



The Other Emily - David Thorne

BookID: 1020 #

Fee: 15  Punish Fee: 15 



The Hill We Climb : A... - Oprah Winfrey

BookID: 1016 #

Fee: 45  Punish Fee: 25 

Home / Book Group / Manage Borrow

Manage Borrow

Return Request **Borrow Request**

Figure 141 - Create Return Book (Step 1)

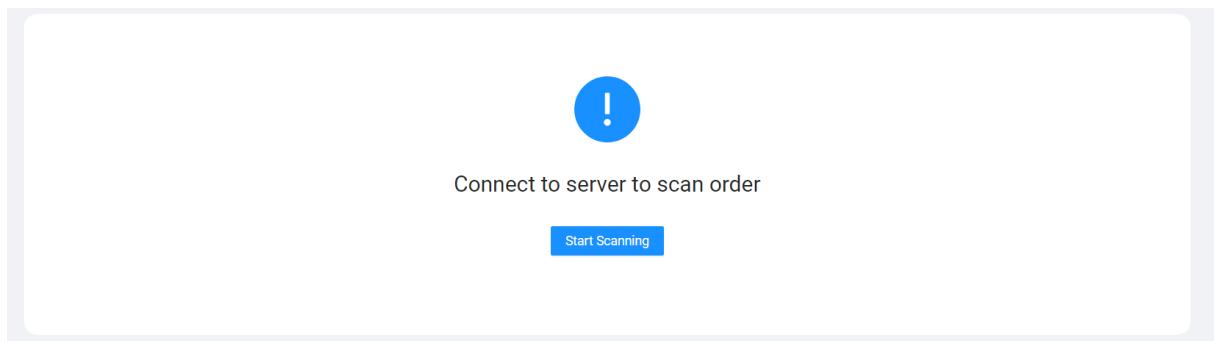


Figure 142 - Create Return Book (Step 2)

You Will Get Through This Night - Daniel Howell

BookID: 1011 Barcode: #A101103

Fee: 5\$/day Punish Fee: 15\$/day

Returned

The Other Emily - David Thorne
BookID: 1020 Barcode: #A102003
Fee: 5\$/day Punish Fee: 15\$/day

Return

+ 5\$

The Hill We Climb : An Inaugural P... - Oprah Winfrey
BookID: 1016 Barcode: #A101608
Fee: 15\$/day Punish Fee: 25\$/day

Returned

Patron Information

Name: Nguyen Minh Viem Email: viemnm@fpt.edu.com

Address: đường Phan Văn Trị, Quận Gò Vấp, TP. Hồ Chí Minh

Phone: 0919522592

Detail

Borrow Day:	23/04/2021
Correct payday:	30/04/2021
Return Day:	23/04/2021
Quantity:	3 books
Fee:	+ 0 \$
Punish Fee:	+ 0 \$

Total: 0\$

Confirm

Figure 143 - Create Return Book (Step 3)

f. Manage Detection

- **Purpose:**
 - Allow librarian to manage book detection.
- **Function:**
 - View detection.
 - View detection detail.
 - Create detection.
- **User Interface:**

List Detection

[Upload Video](#)

All detection in system

Start date

End date

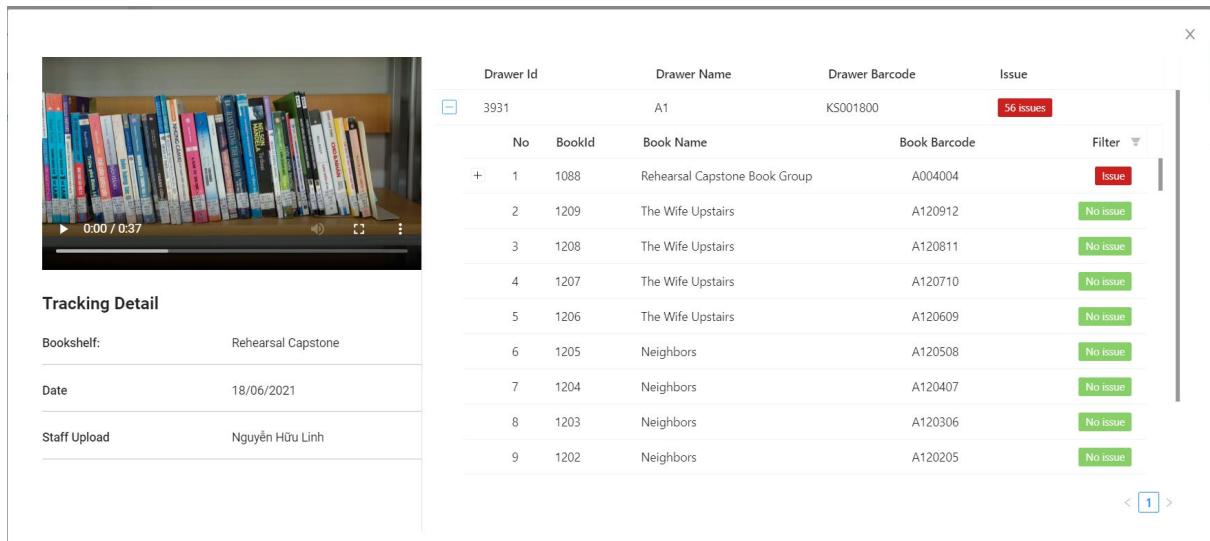


[Filter](#)

#	Bookshelf	Staff Uploaded	Date Uploaded
105	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-23
104	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-23
103	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-20
102	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-20
101	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-19
100	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-17
99	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-17
98	Rehearsal Capstone	Test JWT	2021-04-13
97	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-13
96	Rehearsal Capstone	Nguyễn Hữu Linh	2021-04-12

< 1 >

[Figure 144 - View Detection](#)



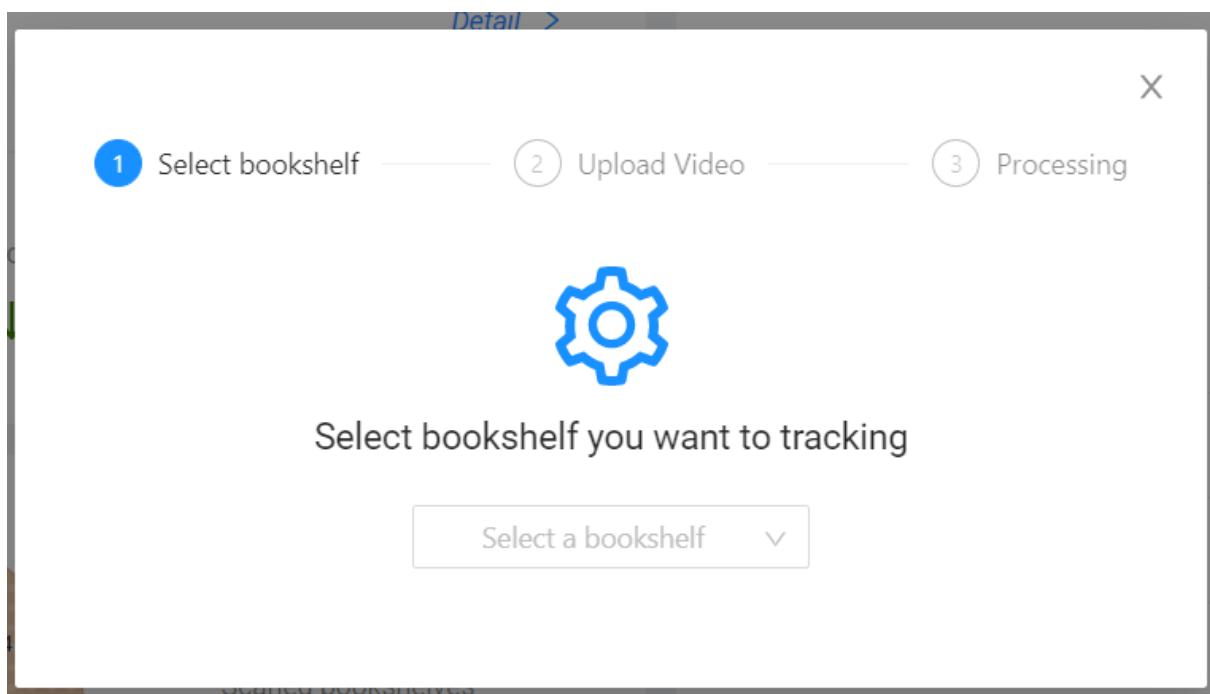
The screenshot shows a software interface for tracking bookshelves. On the left, there is a video player showing a bookshelf filled with books. Below the video player, there is a section titled "Tracking Detail" with the following information:

Bookshelf:	Rehearsal Capstone
Date	18/06/2021
Staff Upload	Nguyễn Hữu Linh

On the right, there is a table with the following columns: Drawer Id, Drawer Name, Drawer Barcode, and Issue. The table contains 9 rows of data:

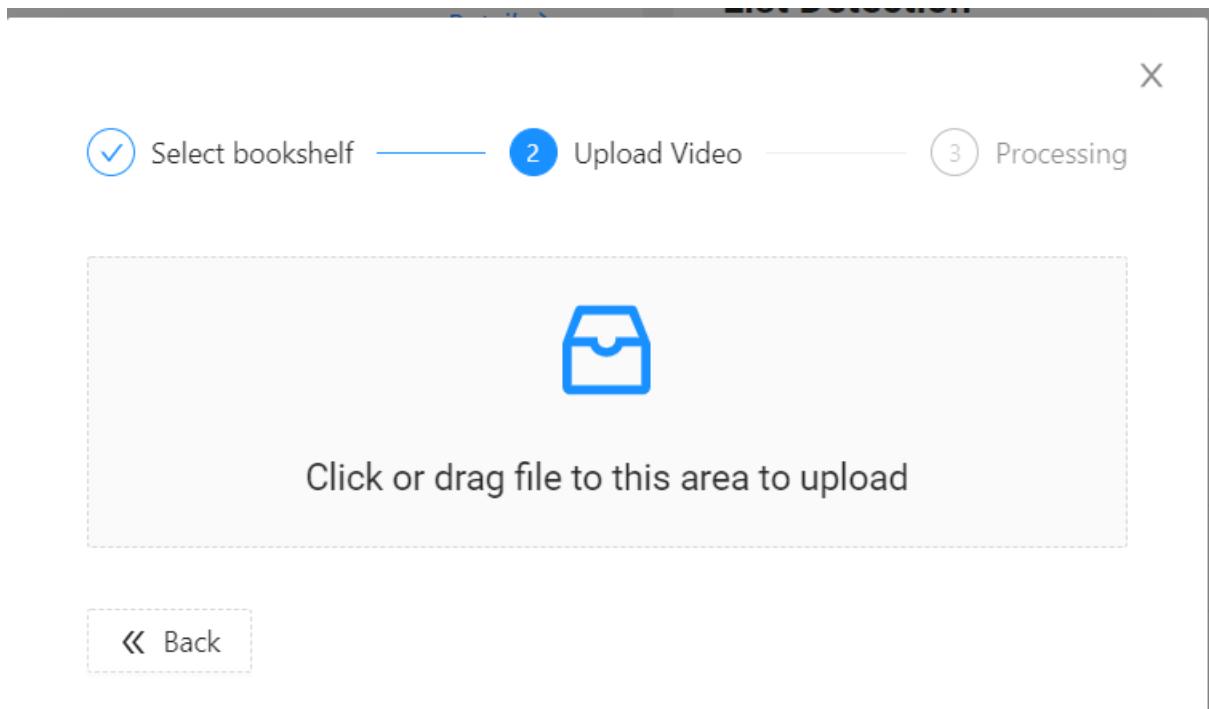
Drawer Id	Drawer Name	Drawer Barcode	Issue
3931	A1	KS001800	56 issues
No	BookId	Book Name	Book Barcode
1	1088	Rehearsal Capstone Book Group	A004004
2	1209	The Wife Upstairs	A120912
3	1208	The Wife Upstairs	A120811
4	1207	The Wife Upstairs	A120710
5	1206	The Wife Upstairs	A120609
6	1205	Neighbors	A120508
7	1204	Neighbors	A120407
8	1203	Neighbors	A120306
9	1202	Neighbors	A120205

Figure 145 - View Detection Detail

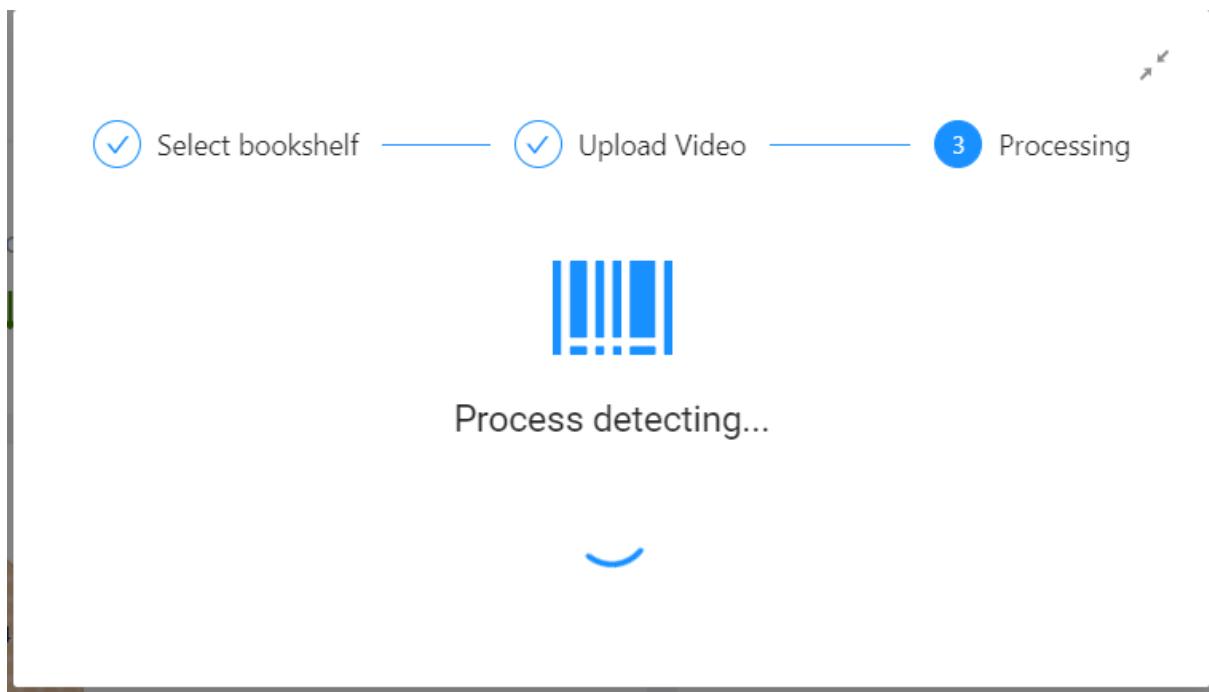


The screenshot shows a software interface for creating a new detection. At the top, there is a progress bar with three steps: 1. Select bookshelf, 2. Upload Video, and 3. Processing. Step 1 is highlighted with a blue circle. Below the progress bar, there is a large blue gear icon. Below the gear icon, there is a text instruction: "Select bookshelf you want to tracking". Below the instruction, there is a dropdown menu with the placeholder text "Select a bookshelf". At the bottom of the screen, there is a bar with the text "Scanned BOOKSHELVES".

Figure 146 - Create Detection (Step 1)



[Figure 147 - Create Detection \(Step 2\)](#)



[Figure 148 - Create Detection \(Step 3\)](#)

3.3.2.2 Mobile Application

a. Login

- **Purpose:**
 - Allow user to sign in.
- **Function:**
 - Sign in with PAPV account.
- **User Interfaces:**

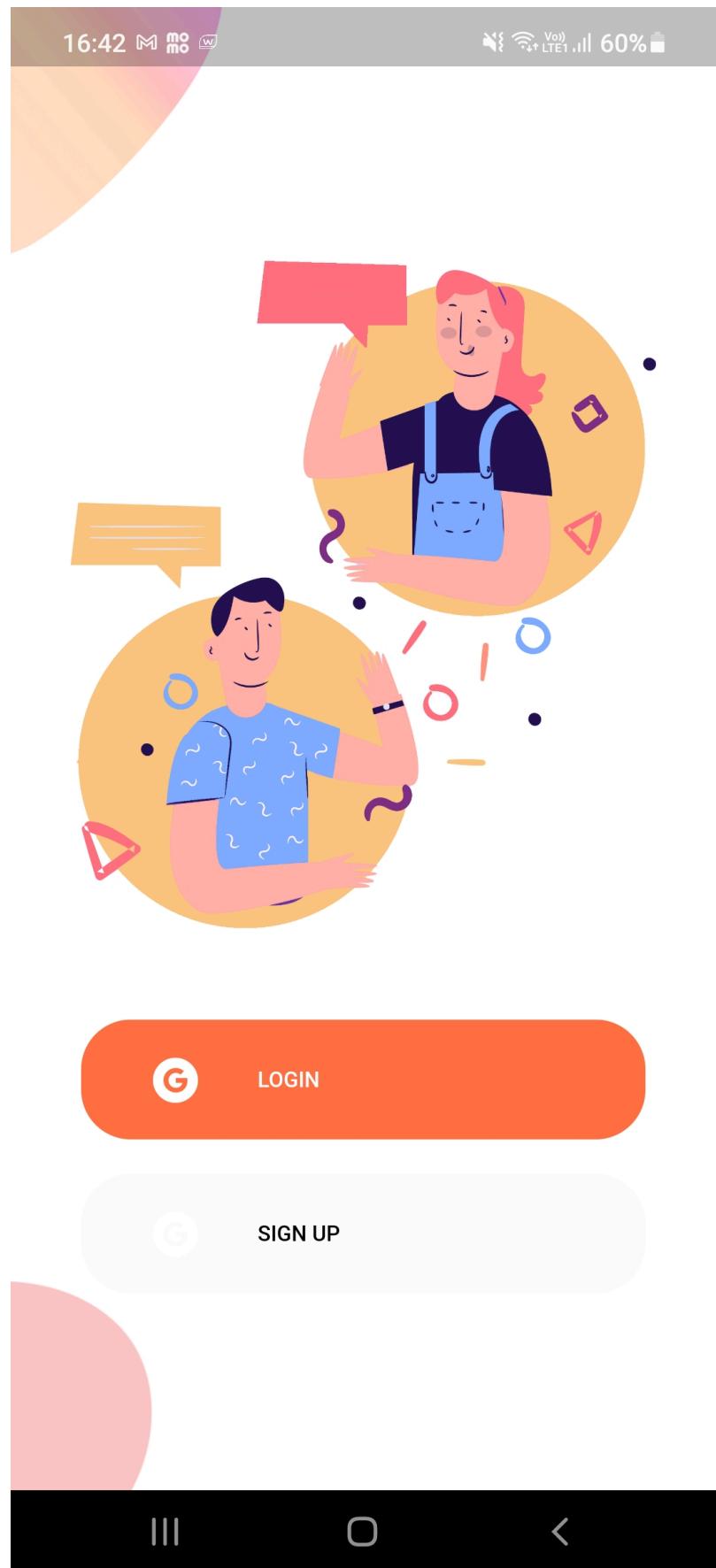


Figure 14981 - Login Screen

b. Sign Up

- **Purpose:**
 - Create patron's account.
- **Function:**
 - Register for patron account at PAPV.
- **User Interfaces:**

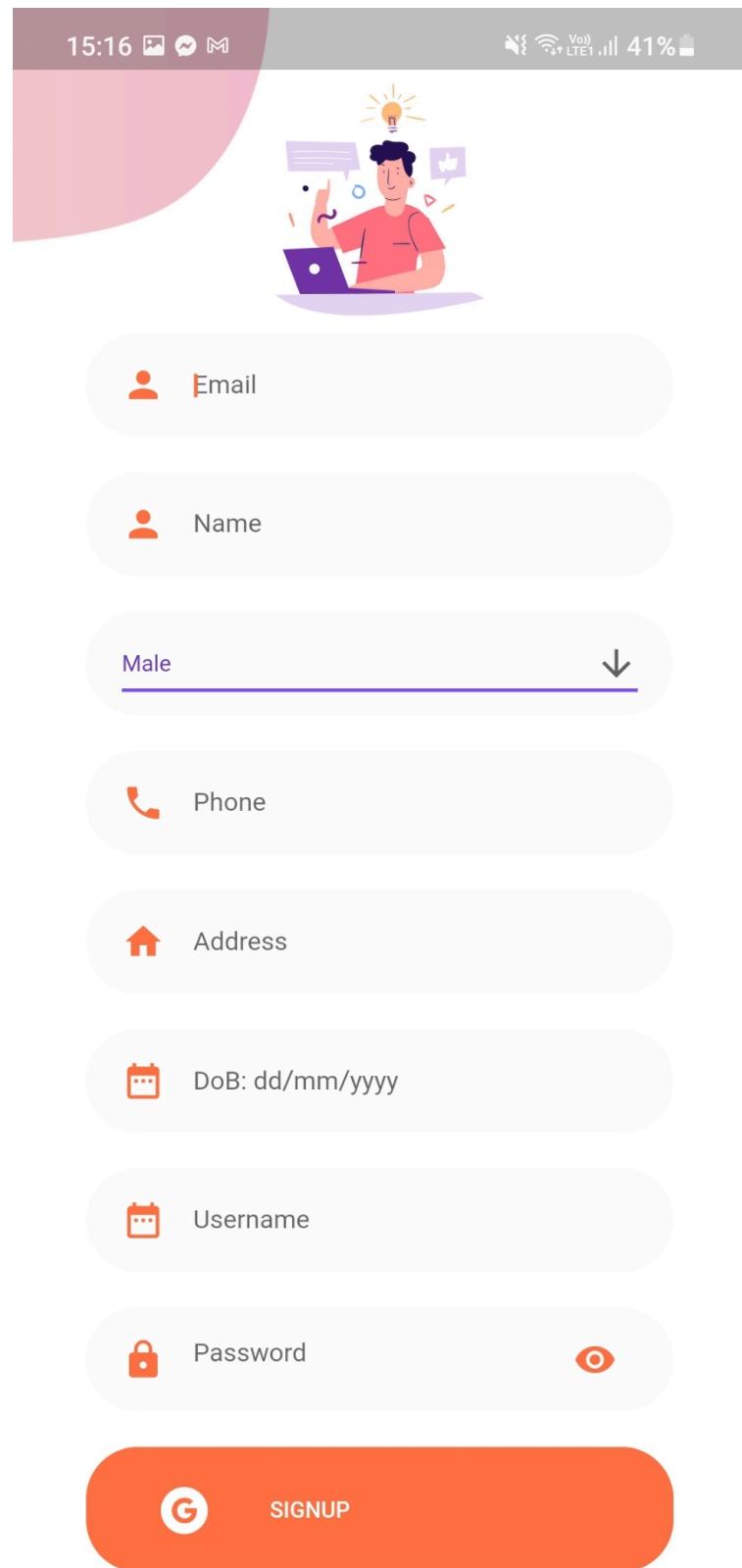


Figure 18150 - Sign Up

c. Suggestion Book

- **Purpose:**
 - Allows patrons to view books suggested by the library as well as new books from the library.
- **Function:**
 - View suggested books for patrons based on history borrow.
 - View newest books of the library.
- **User Interfaces:**

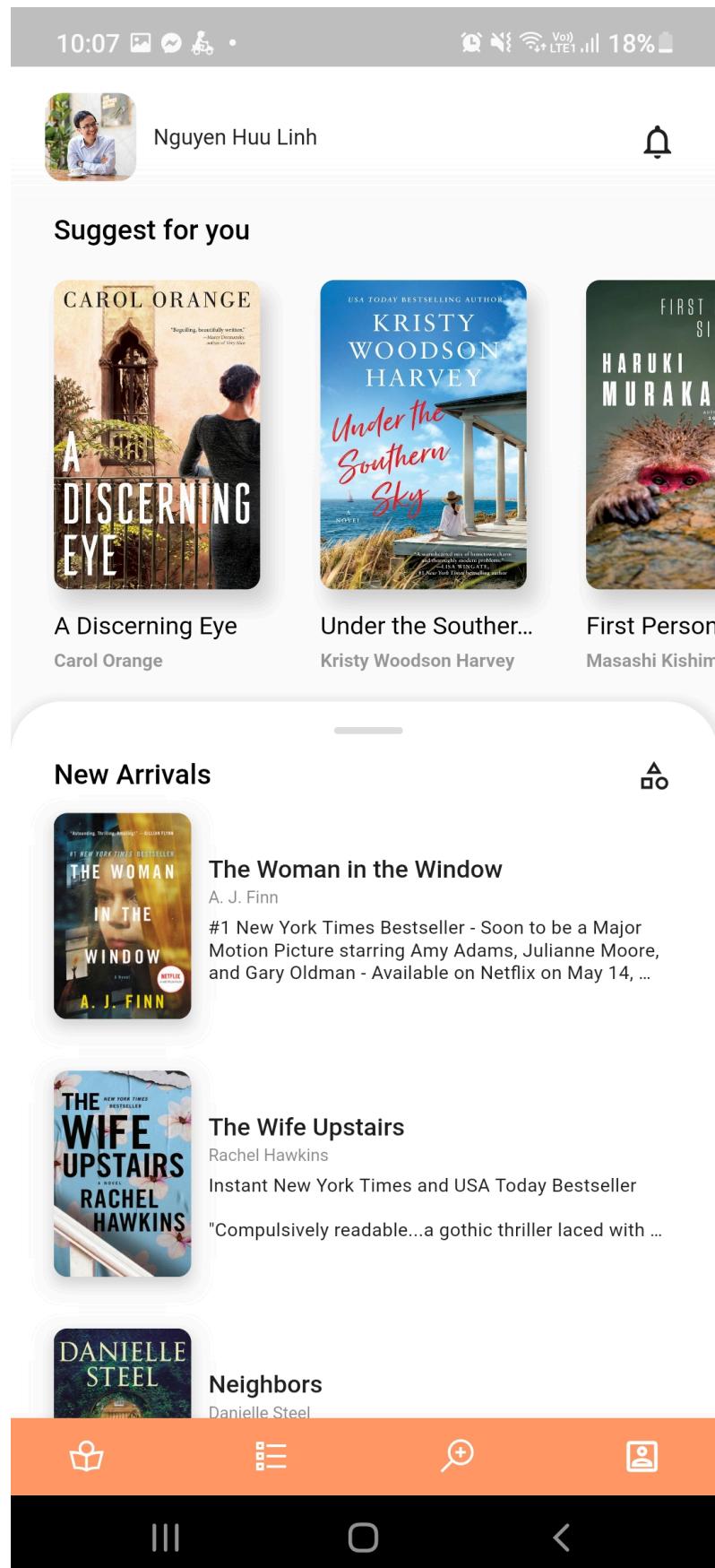


Figure 18151 – Suggestion Book

d. View Notification

- **Purpose:**
 - Allows patrons to view list of notifications about return book from the library.
 - Allows patrons to view detail of notifications about return book from the library.
- **Function:**
 - View list of notifications.
 - View detail of notifications.
- **User Interfaces:**



Notification

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow



Figure 18152 - Notification Screen

10:34

15%

Notification

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow

Remind to return the book



2021-04-16

The book Rehearsal Capstone Book Group need to return tomorrow

Close

The book Rehearsal Capstone Book Group need to return tomorrow

2021-04-16

Remind to return the book



The book Rehearsal Capstone Book Group need to return tomorrow



Figure 18153 - Notification Popup Detail

e. Search Book

- **Purpose:**
 - Allows patrons to find books based on name, author, and category.
- **Function:**
 - View list of books.
 - Search on the name of the book.
 - Search on the author of the book.
 - Search on the category of the book.
- **User Interfaces:**

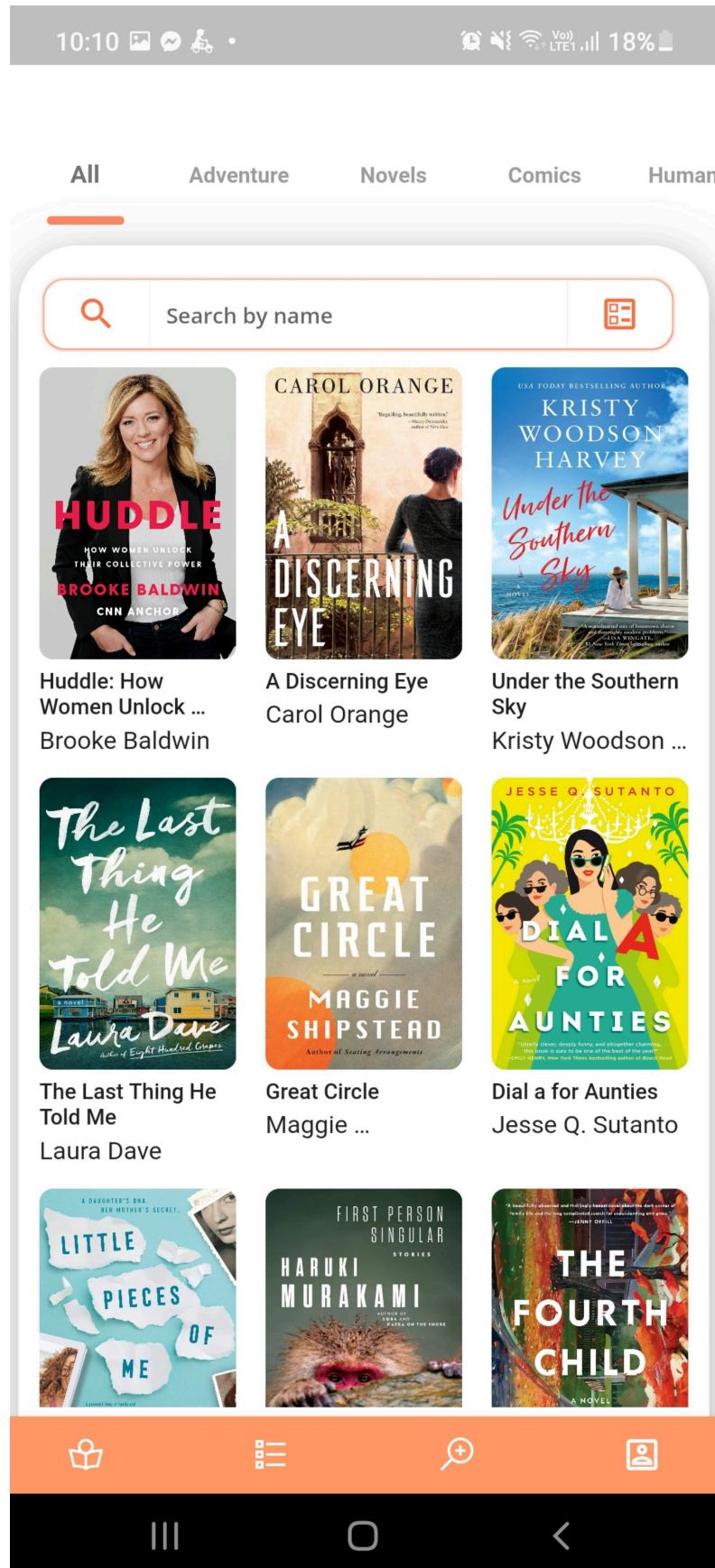
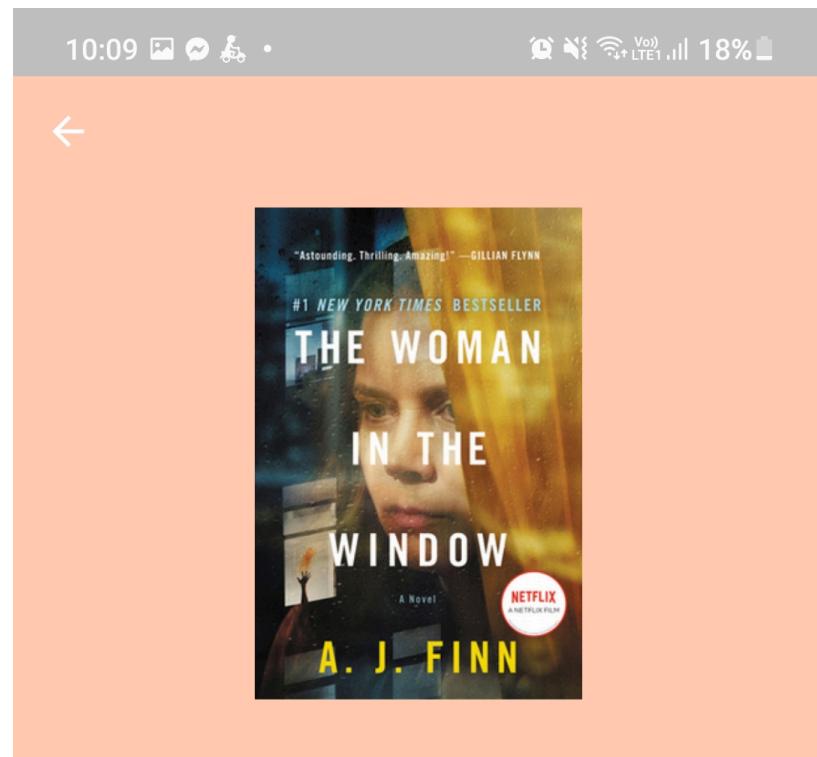


Figure 18154 - Search Book

f. Book Detail

- **Purpose:**
 - Allows patrons to view more details the information about the book.
 - Allows patrons to view locations of the book in the library.
 - Allows patrons to view and send feedback about book.
 - Allows patrons to add or remove book to wish list.
- **Function:**
 - View details the information of the book.
 - View locations of the book in the library.
 - View feedbacks of the book.
 - Send feedback about the book.
 - Add the book to the wish list.
 - Remove the book from the wish list.
- **User Interfaces:**



The Woman in the Window

A. J. Finn

\$0.5

Description

Locations

Feedbacks

#1 New York Times Bestseller - Soon to be a Major Motion Picture starring Amy Adams, Julianne Moore, and Gary Oldman - Available on Netflix on May 14, 2021

"Astounding. Thrilling. Amazing." --Gillian Flynn

"Unputdownable." --Stephen King

"A dark, twisty confection." --Ruth Ware

"Absolutely gripping." --Louise Penny

For readers of Gillian Flynn and Tana French comes one of the decade's

[Remove from wishlist](#)



Figure 18155 - Book Detail (Step 1)



The Woman in the Window

A. J. Finn

\$0.5

Description

Locations

Feedbacks

Location: Floor 2 – Zone C

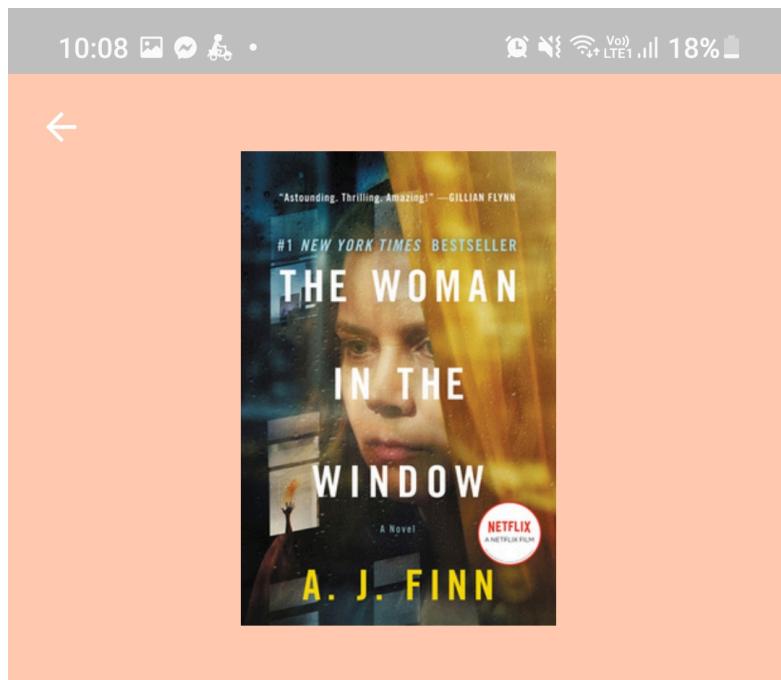
Shelf: Fairy Tail – 2

Drawer: A1

Add to wishlist



Figure 18156 - Book Detail (Step 2)



The Woman in the Window

A. J. Finn

\$0.5

Description

Locations

Feedbacks



Share your feel



Nguyen Huu Linh
2021-04-24

women should read



Add to wishlist



Figure 18157 – Book Detail (Step 3)

g. Wish List

- **Purpose:**
 - Allow patron to view wish list.
 - Allow patron to remove a book from the wish list.
 - Allow user generate wish list to QR-code.
- **Function:**
 - View wish list.
 - Remove a book from the wish list.
 - Generate wish list to QR-code.
- **User Interfaces:**



Wishlist

Finding Ashley Danielle Steel \$ 0.5	
The Woman in the ... A. J. Finn \$ 0.5	

Gen QRcode

☰ ⌂ 🔍 🚙

☰ ⌂ 🔍 🚙

Figure 158 - Wish List



Figure 159 - Generate QR Code

h. View Profile

- **Purpose:**
 - Allow patron view detail profile.
- **Function:**
 - View profile detail of patron.
 - Log out.
- **User Interfaces:**



Profile



Nguyen Huu Linh

0382567825

Email

huulinhnguyen99@gmail.com

Name

Nguyen Huu Linh

Address

182 Lã Xuân Oai

Birthdate

9/13/1999

Created Time

5/12/2020

History borrow



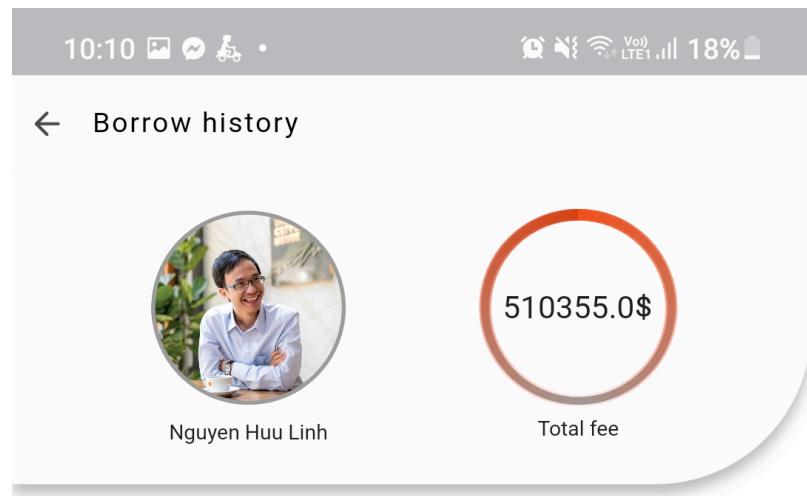
Log out



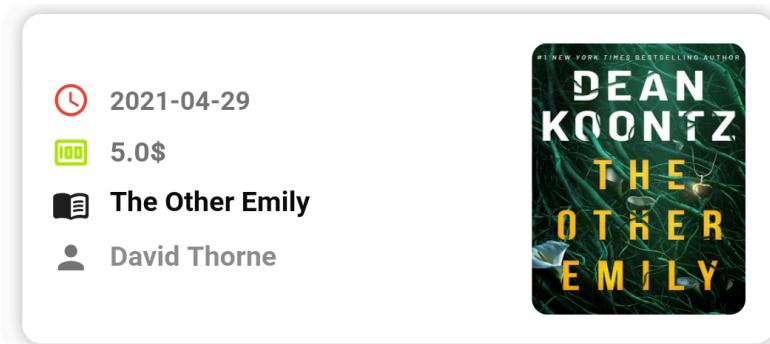
Figure 160 - Profile Screen

i. Borrow History

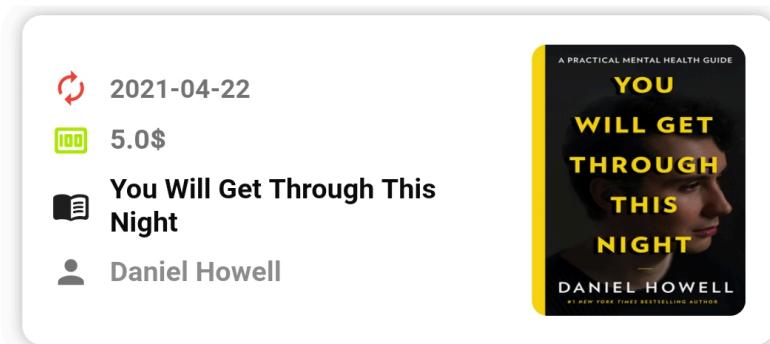
- **Purpose:**
 - Allow patron view history borrow book.
- **Function:**
 - View history borrow book of the patron.
- **User Interfaces:**



Current borrow books: 20



Return books



Bản cập nhật phần mềm đã sẵn sàng để
cài đặt.



Figure 161 - History Borrow Of Patron

j. Librarian Dashboard

- **Purpose:**
 - Show all function librarian can do on mobile.
- **Function:**
 - View all function librarian can do on mobile.
 - Return book scanner
 - Borrow book scanner
- **User Interfaces:**



Welcome, Phú Huynhf

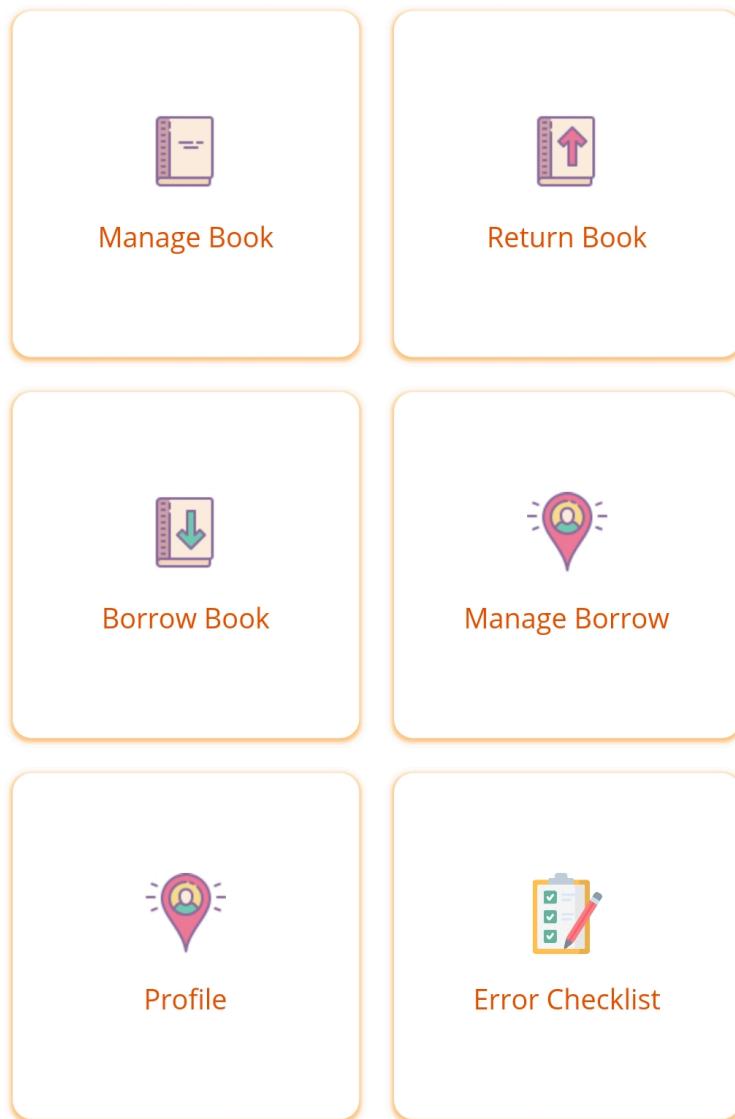


Figure 162 - Dashboard

k. List Patron Borrow

- **Purpose:**
 - Allow librarian to view list of patron borrow book.
- **Function:**
 - View list of patron borrow book.
- **User Interfaces:**

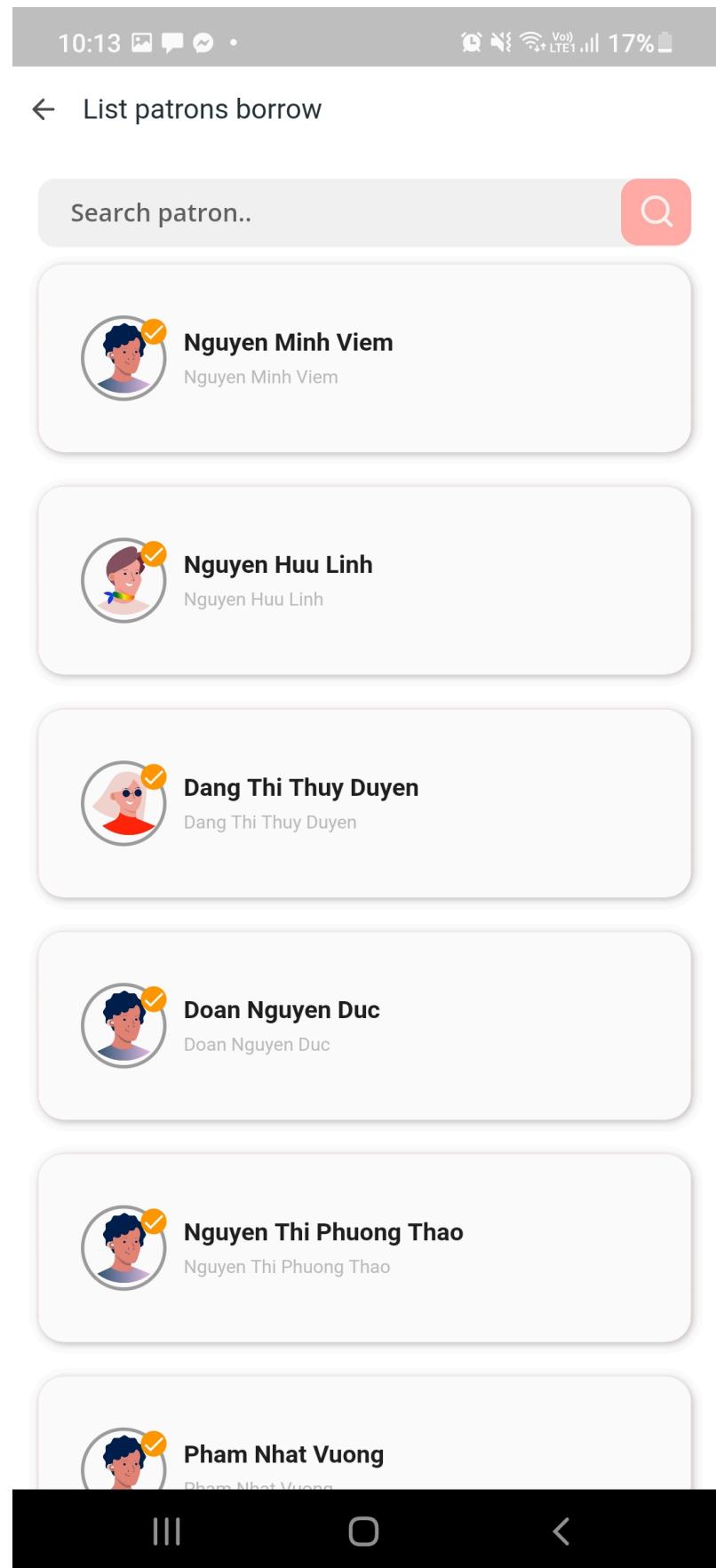
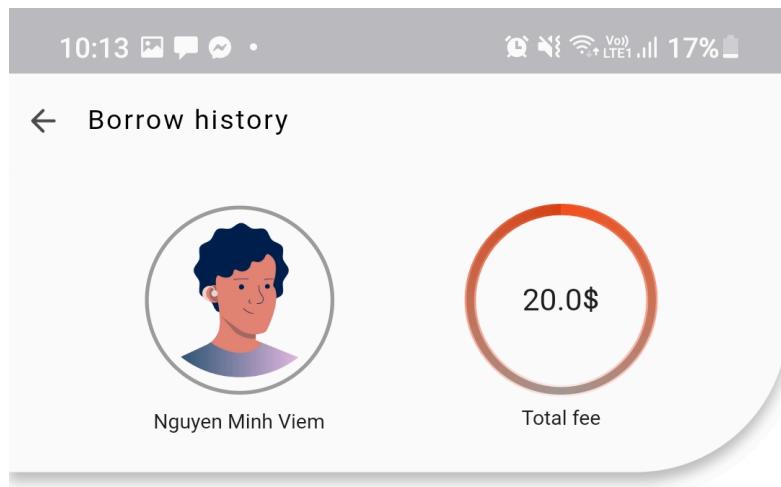


Figure 163 - List Patron Borrow Book

m. History Patron Borrow

- **Purpose:**
 - Allow librarian to view history borrow of patron.
- **Function:**
 - View history borrow of patron.
- **User Interfaces:**



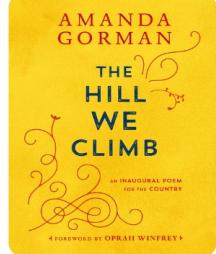
Current borrow books: 4

⌚ 2021-04-30

₹ 15.0\$

📖 The Hill We Climb : An Inaugural Poem for the ...

👤 Oprah Winfrey



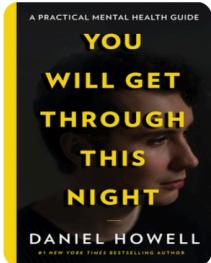
Return books

⌚ 2021-04-23

₹ 5.0\$

📖 You Will Get Through This Night

👤 Daniel Howell



[Figure 164 - History Borrow of Patron](#)

n. Daily Detection

- **Purpose:**
 - Allow librarian to view a list of the bookshelf was detected per day.
- **Function:**
 - View a list of the bookshelf was detected per day.
- **User Interfaces:**

10:14

17%

← Daily Detection

APR

20

TUE

APR

21

WED

APR

22

THU

APR

23

FRI

APR

24

SAT

APR

25

SUN



Rehearsal Capstone



Rehearsal Capstone



Figure 165 – Detection By Date

o. Drawer Detection

- **Purpose:**
 - Allow librarian to view the staff who responsible to this detection.
 - Allow librarian to view a list of the drawer was detected, and information about number of book, number of error on this drawer.
- **Function:**
 - View a list of the drawer was detected.
 - View the staff who responsible to this detection.
- **User Interfaces:**



← Drawers in detection



Staff: **Nguyễn Hữu Linh**
Shelf: **Rehearsal Capstone**

KS001800

Drawer	Books	Error
A1	151	56

KS001300

Drawer	Books	Error
A2	10	1

KS000700

Drawer	Books	Error
A3	10	3



Figure 166 - Drawers In Detection

p. Detection Error Message

- **Purpose:**
 - Allow librarian to view list of error message, list of confirmed, list of rejected.
 - Allow librarian to confirm and reject error message.
- **Function:**
 - View list of error message.
 - View list of error confirmed.
 - View list of error rejected.
 - Confirm error message.
 - Reject error message.
- **User Interfaces:**

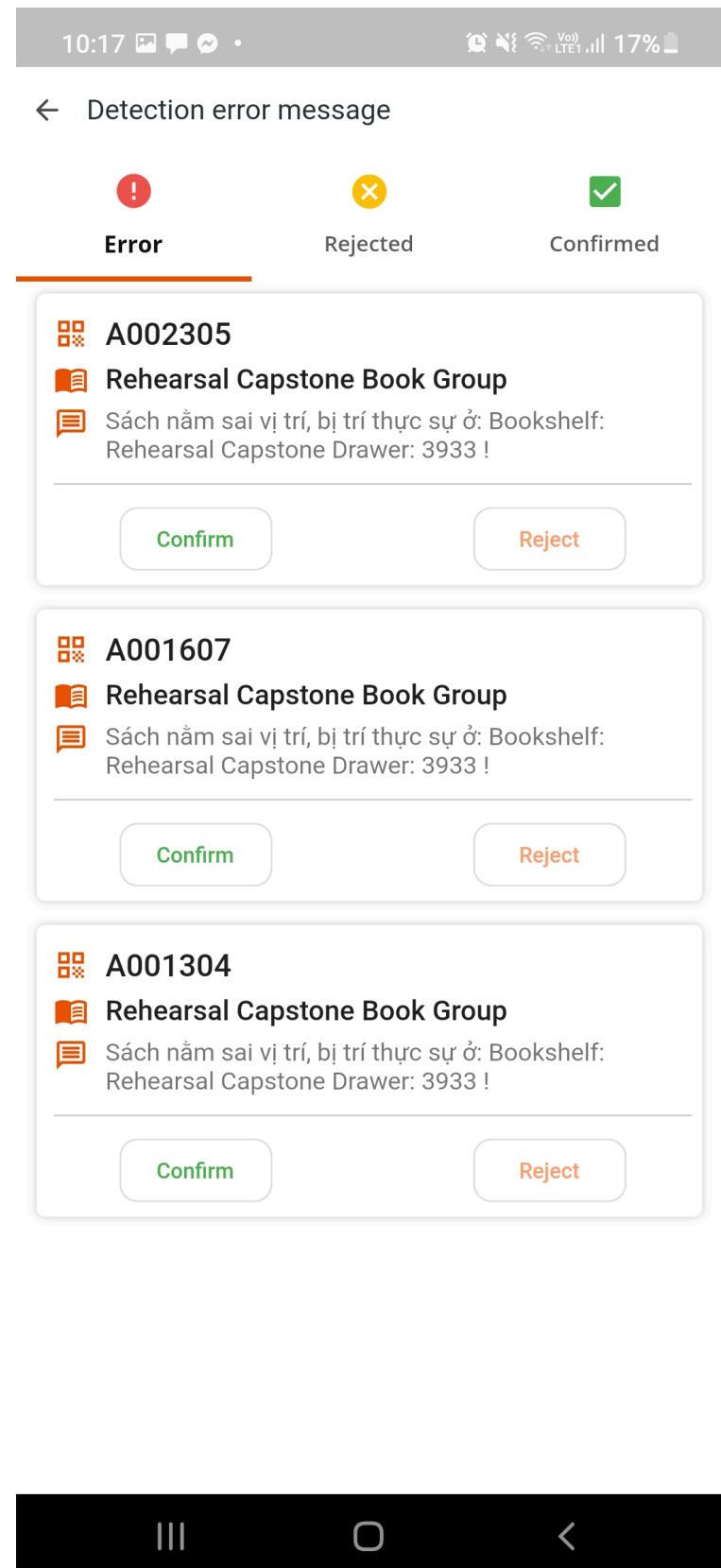


Figure 167 - Detection Error (Step 1)

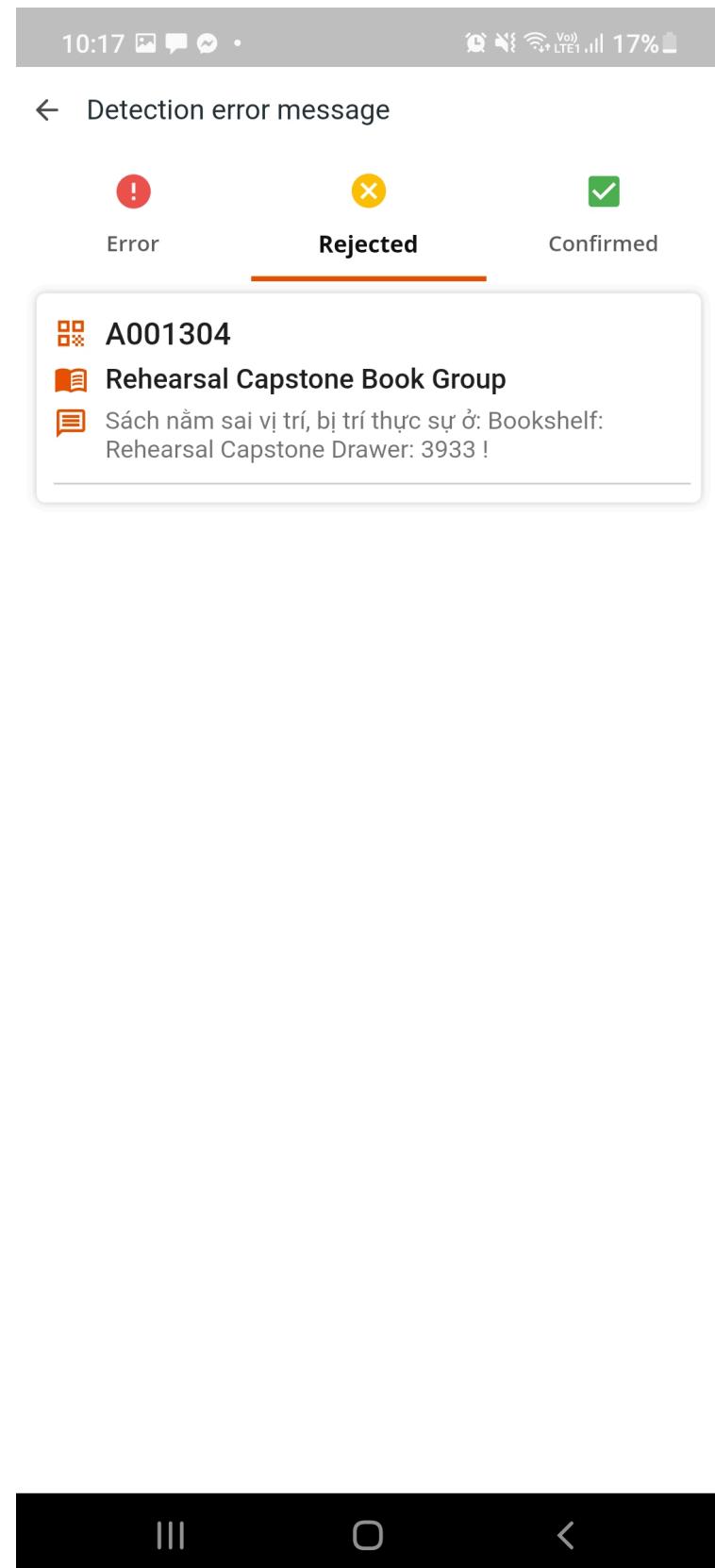


Figure 1680 - Detect Error (Step 2)



← Detection error message



Error



Rejected



Confirmed

A001607

Rehearsal Capstone Book Group

Sách nằm sai vị trí, bị trí thực sự ở: Bookshelf:
Rehearsal Capstone Drawer: 3933 !



Figure 169 - Detect Error (Step 3)

3.4 Troubleshooting

3.4.1 Notification

Notification about return book may not reach to the patron due Firebase failed.

- **First occurrence:**
 - During testing time.
- **Problem:**
 - Patron cannot receive notification at that time.
- **Solution:**
 - Patron login in PAPV mobile app.
 - Patron click notification icon to get notification and see detail.

3.4.2 Camera Permission

- **First occurrence:**
 - During testing time.
- **Problem:**
 - Librarian cannot scan QR code or barcode.
- **Solution:**
 - Open Setting -> Application -> user_library -> Privacy -> Access Camera.

VII. Appendix

1. Glossary [Optional]

Acronym	Definition
BR	Business Rule
ERD	Entity Relationship Diagram
GUI	Graphical User Interface
UC	Use Case
API	Application Programming Interface
FE	Feature
LI	Limitation
EX	Exclusion
WBS	Work Breakdown Structure
JSON	JavaScript Object Notation
QR	Quick Response

CUDA	Compute Unified Device Architecture
IIS	Internet Information Services
PAPV	Book Library Management With Flycam And Barcode System

Table 152 - Glossary

2. References [Optional]

1. **Signal R:**
 - <https://dotnet.microsoft.com/apps/aspnet/signalr>
2. **Entity Framework Core:**
 - <https://www.entityframeworktutorial.net/efcore/entity-framework-core.aspx>
3. **ReactJS:**
 - <https://reactjs.org/docs/getting-started.html>
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 - <https://pro.ant.design/docs/getting-started>
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6. **Flask:**
 - <https://flask.palletsprojects.com/en/1.1.x/>
 - <https://www.tutorialspoint.com/flask/index.htm>
7. **AI paper:**
 - <https://github.com/ultralytics/yolov5>
 - <https://phamdinhhanh.github.io/2020/03/09/DarknetAlgorithm.html>
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8. **Flutter:**
 - <https://flutter.dev/docs>
9. **BLOC:**
 - <https://viblo.asia/p/hoc-bloc-pattern-theo-cach-de-hieu-nhat-maGK7JY05j2>