WEB-BASED MEDICAL CENTER MANAGEMENT SYSTEM

By

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2020

DECLARATION

I hereby certify that this project and the all the artifacts associated with it is my own work and it has not been submitted before nor is currently being submitted for any other degree programme.

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Further on, I would like to extend my gratitude to Dr. Thilak Perera, the owner of the organization for providing me all the details and giving all the support I needed from the client side.

Last but not the least, I am very much grateful to my family who is there for me in every situation to guide and influence me throughout the difficulties.

ABSTARCT

With the improvement of information technology, the digitization has been able to provide better efficiency over manual operations in most of the cases. Due to this every organization nowadays try to implement some sort of technologies to gain advantages.

The medical center owned by Dr. Thilak Perera also seeking to utilize information technology to improve their day-to-day operations which are carried out manually. These manual operations have led to number of inefficiencies that hinders the performance of the organization.

With the system that is proposed by this project, they will be able to achieve higher efficiencies. This will also allow them to offer a better service for their customers making sure a high retention rates are in place. Furthermore, this proposed system will assist them even during the decision-making process with valuable information.

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CHAPTER 1

1. INTRODUCTION

Chapter overview

1.1. Description about the organization

1.2. Existing business process

1.3. Problems and weaknesses of the current system

1.4. Aims and objectives

1.5. Scope of the project

1.6. Organization of the dissertation

1.7. Chapter summary

1.1. Description about the organization

A medical center owned by Dr.Thilak Perera, is situated in Veyangoda area where all the processes are happening manually, and all the data are held in manual data stores. Patient examining, managing patient records, issuing prescriptions/medicine, inventory keeping are the basic processes happening in this medical center. Some of these activities are given a less focus which has led to overall process to be less efficient and effective. This stands as a barrier to reach customer/patient satisfaction with the occurrence of high time consumption and other issues. A system is required to tackle the above given aspects to integrate and manage the whole entity in a more productive manner.

1.2. Existing business process

The current business process is a total manual process. The patient arrives at the medical center where he/she is given a number with another token of patient details to be examined by the receptionist to initiate the system. The patient wait till his turn comes to be examined by the doctor. Once he is being examined by the doctor, if he is a past patient, his record history will be checked by the doctor. Then the doctor will recommend medication/reports to be taken if needed. If the patient is getting the medication from the medical center itself, he will be led to the dispenser. At the dispenser, the relevant medication will be handed over to the patient with the payment processes. The record of that patient will be updated if he/she is a past patient. If he/she is a new patient, he will be registered in the record books during this time. In addition, the doctor consults the patients through mobile phone and patients can book an appointment through the phone in small operation cases. Moreover, the owner contacts the suppliers himself after roughly assessing the inventory in order get the stock up drugs.

1.3. Problems and weaknesses of the current system

As mentioned above, the manual process has led to number of problems and weaknesses during their day-to-day operations at this medical center.

- All the data are stored and handled manually leading for higher inefficiencies to arise
- Updating past records becomes difficult
- Records takes up a significant space as the organizations has initiated in 1994

- All the employees at the medical center can access these data leading to higher insecurities
- Lack of database with supplier details
- Inventory of drugs is not being managed in a proper way
- No records of invoices are being held
- Activities are exposed to human errors

1.4. Aims and objectives

The proposed system focuses on covering these aims and objectives,

- To reduce physical and manual data stores
- Eliminating data redundancy
- Manage patient records to keep track on the patient history
- Managing employee records
- Managing supplier records
- Managing transaction records and details
- To increase the productivity of the overall process with immediate retrieval of information
- Easily identify the inventory levels
- To place an order to suppliers once low inventory levels are identified
- Analyzing the performance with reports

1.5. Scope of the project

The scope of this project will cover the areas such as,

- Patient Management process such keeping records of patient's personal details, treatment history etc.
- Staff Management process involving adding, updating, and removing employee details.
- Inventory Management process with ability searching inventory levels.
- Transaction Management process for handling and recording payments taking place within the medical center.

1.6. Organization of the dissertation

This section will cover a briefing of the contents of this report.

Chapter 1– Introduction

Chapter 1 provides the introduction to the organization explaining about how the processes are taking place currently. This is where the problems and weaknesses of the current process are identified with the requirement of a system with a scope that is capable of overcoming those issues.

Chapter 2 – System analysis

Chapter 2 analyses the current business process of the organization. In addition to that this chapter focuses on the Requirement Analysis of the System and the Business System Options along with the selected BSO for the System Design stage.

Chapter 3 – System design

Chapter 3 System Design takes on the behavior of the system. Design stage will be carried out taking into account of the outputs of Chapter 2. An overall insights on the interactions and activities take place in the system will be provided using diagrams. The chapter will be concluded with the Database Design.

Chapter 4 – Conclusion

Chapter 4 is the final chapter of the report that provides a summary of the project along with the degree of objectives met. The weaknesses and drawback of the proposed system will be mentioned here as well as the future modifications that the proposed system can go through.

1.7. Chapter summary

This chapter provides the entrant to the report with a description of the organization and with the explanation of the current process. The weaknesses of that current process are identified in this chapter. Finally, the aims and objectives of the proposing system and the scope of the project that can overcome those limitations are mentioned.

CHAPTER 2

2. SYSTEM ANALYSIS

Chapter overview

2.1. Use Case Diagram for the existing business process

2.2. Use case descriptions for the existing business process

2.3. Activity Diagrams for the existing business process

2.4. Software requirement specifications

2.5. Complete business system options

2.6. Chapter summary

2.1. Use Case Diagram for the existing business process

Figure 1 illustrates the use case diagram for the current business process. It includes 5 actors who are the Owner, Doctor, Receptionist, Dispenser, and the Patient. Few of the major use cases would be Provide consultation, Handle payments, Issue drugs, Send out purchase orders.

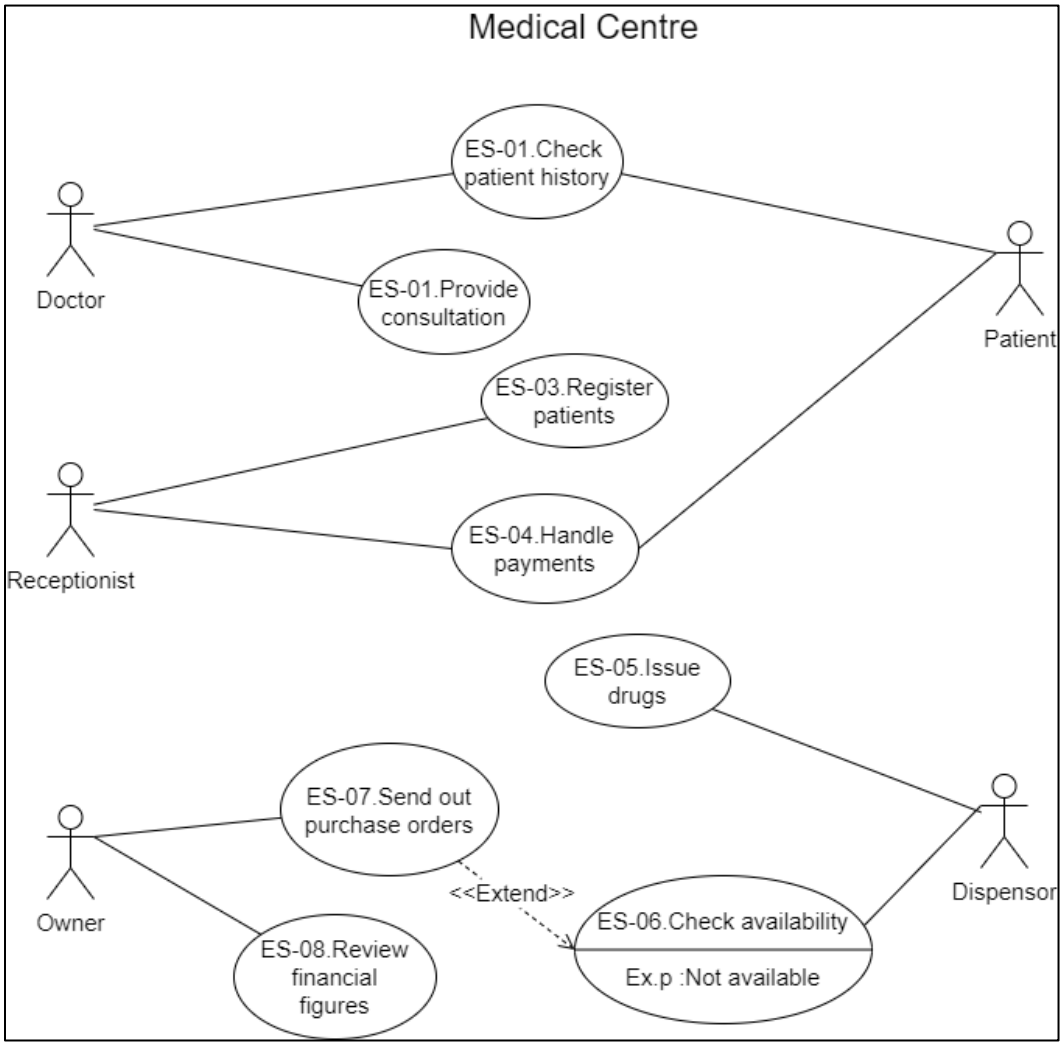

Figure 1 - Use case diagram for the existing business process

2.2. Use case descriptions for the existing business process

The above-mentioned major use cases of the use case diagram are described below using use case descriptions.

2.2.1. Use case description for ES-02. Provide consultation

Use case id	ES - 01
Use case	Provide consultation
Actors	Doctor, Patient
Description	Doctor assessing the patient's condition and provide consultation
Pre-conditions	The patient has a requirement of medical care. Doctor is ready to provide his service.
Normal flow	1. Patient presents his/her complaint 2. Doctor refers the patient history book 3. Doctor records the investigation findings 4. Doctor records the diagnosis 5. Doctor issues treatment
Alternate flow	4b. Doctor recommends reports to be taken.
Exception	No exception
Post-condition	Patient's medical records are updated

Table 1 - Use case description for Provide consultation

2.2.2. Use case description for ES-05. Issue drugs

Use case id	ES - 05
Use case	Issue drugs
Actors	Dispenser
Description	Issuing medicine which are mentioned by the doctor to the patient
Pre-conditions	Doctor issues has issued an internal prescription.

Normal flow	1. Refer the internal prescription issued by the doctor 2. Checks availability 3. Hand out the medicine to the patient
Alternate flow	No alternate flow
Exception	Medicine is not available
Post-condition	Update the patient's payment slip

Table 2 - Use case description for Issue drugs

2.2.3. Use case description for ES-04. Handle payments

Use case id	ES - 04
Use case	Handle payments
Actors	Receptionist, Patient
Description	Handling the payments that the patient needs to be made relevant to the visit.
Pre-conditions	There are payments to be made by the patient
Normal flow	1. Patient hands over the slip to the receptionist 2. Receptionist adds consultation fee to the bill 3. Receptionists add the purchases of drugs to the bill 4. Handle payments
Alternate flow	2a. No consultation charges 3a. No purchases of drugs
Exception	Patient does not have any payment to be made
Post-condition	Patient receives the bill

Table 3 - Use case description for Handle payments

2.2.4. Use case description for ES-07. Send out purchase order

Use case id	ES - 07
Use case	Sending out purchase order
Actors	Owner, Dispenser
Description	Placing orders to purchase necessary inventory items.
Pre-conditions	Dispenser checks the availability of inventory. There are items that are needed to be re-stocked. There is a new item needed to be purchased.
Normal flow	1. Determine the drug items needed 2. Determine the quantity needed 3. Select a supplier 4. Place the order
Alternate flow	1a. Identify a new drug item 3a. Find a new supplier
Exception	Supplier does not have the ordered item/items
Post-condition	Receives stocks

Table 4 - Use case description for Send out purchase order

2.3. Activity diagrams for the existing business process

The activity diagrams that illustrate the flow of the process regarding the major use cases are displayed below.

2.3.1. Activity diagram for ES – 01. Provide consultation

Figure 2 illustrates the activity diagram for the process of providing consultation. It starts from the patient's complaint and the necessary details are recorded regarding the consultation and finally the prescription will be issued.

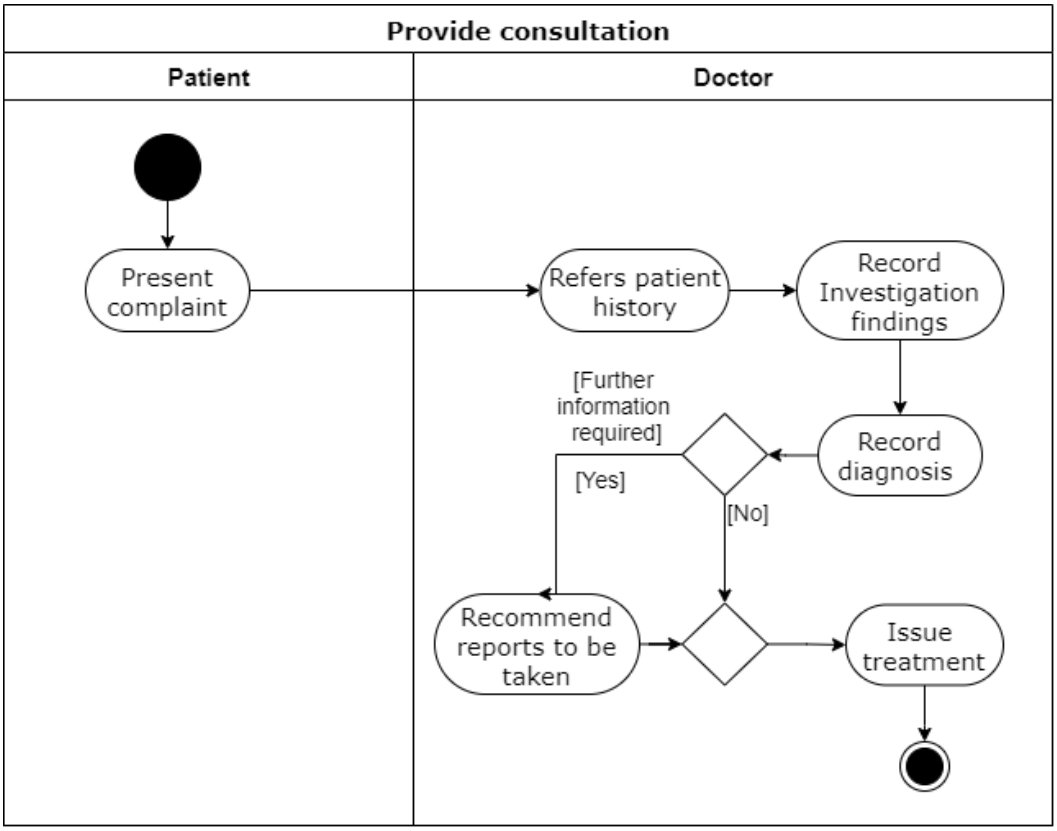

Figure 2 - Activity diagram for Provide consultation

2.3.2. Activity diagram for ES – 05. Issue drugs

Figure 3 illustrates the activity diagram for the process of issuing drugs. The dispenser receives the internal prescription given to the patient by the doctor and issues drugs accordingly. The process comes to a dead end in a case where there are no stocks of an item mentioned in the internal prescription. After issuing the drugs the dispenser records the bill of the issue in a slip and offer it to the patient to hand over at the receptionist.

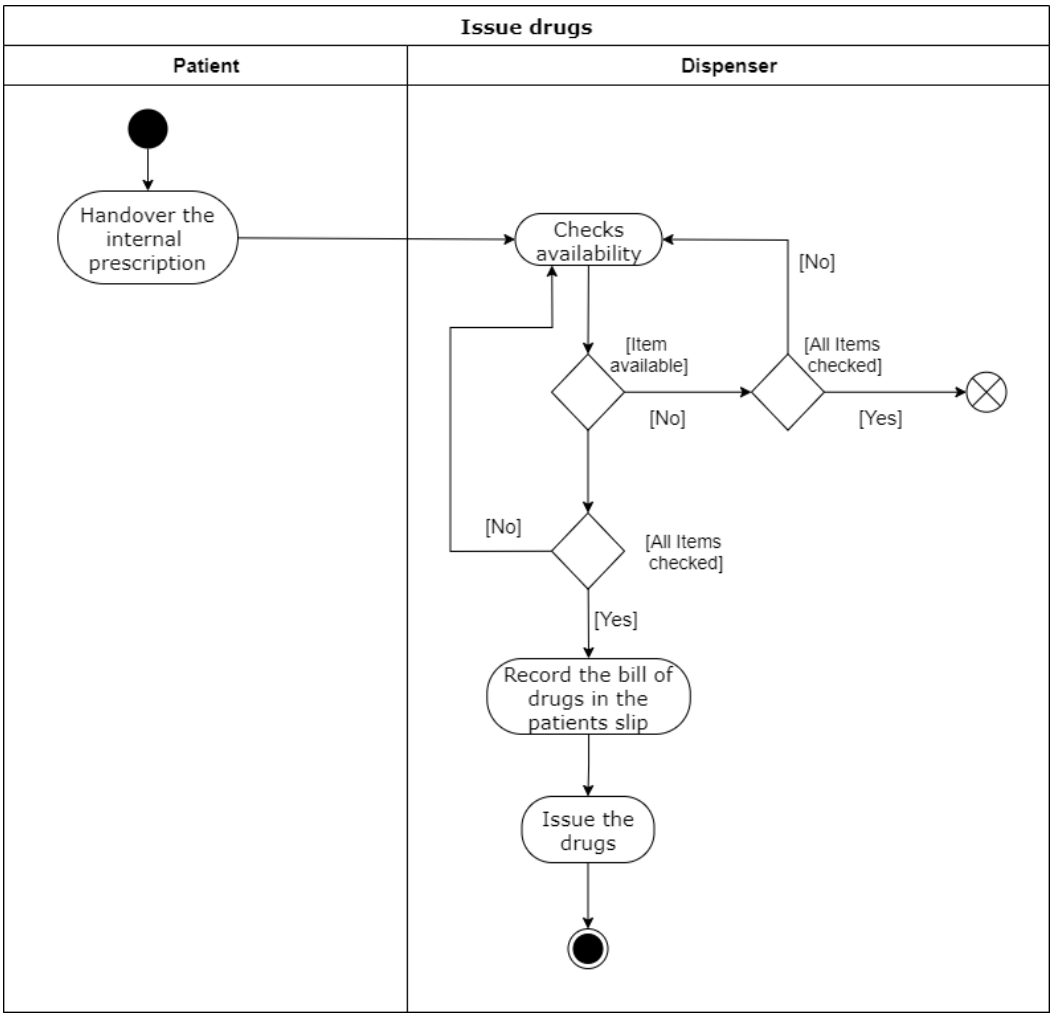

Figure 3 - Activity diagram for Issue drugs

2.3.3. Activity diagram for ES – 04. Handle payments

Figure 2 illustrates the activity diagram for the process of handling payments. Depending on the readiness of consultation fee and purchases of drugs, the final bill will be adjusted and will be issued to the patient after handling the payments.

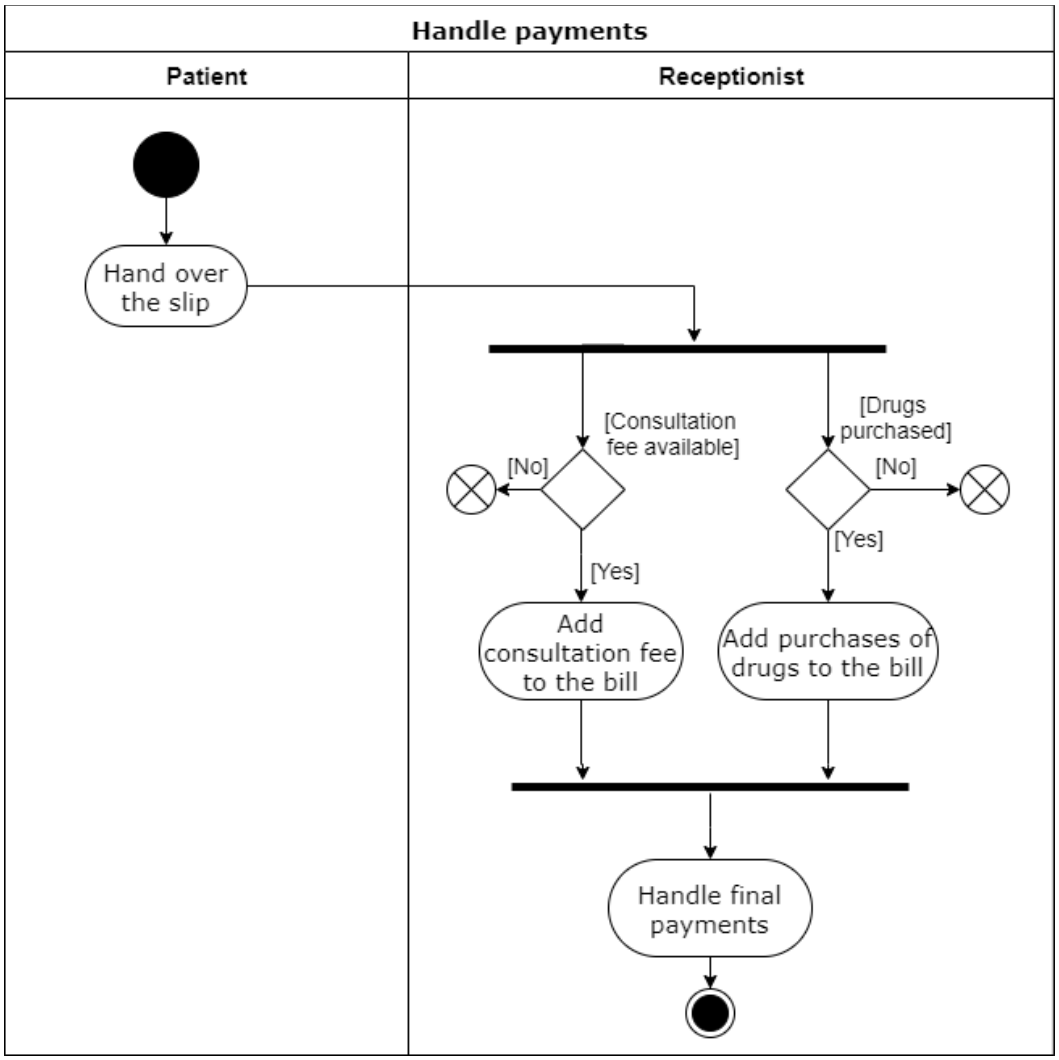

Figure 4 - Activity diagram for Handle payments

2.3.4. Activity diagram for ES – 07. Send out purchase order

Figure 2 illustrates the activity diagram for the process of sending out a purchase order. Low stocks or new items will trigger this activity. If existing suppliers can satisfy the requirement the order will be sent to one of them. If not, a new supplier needs to be found and the order should be placed.

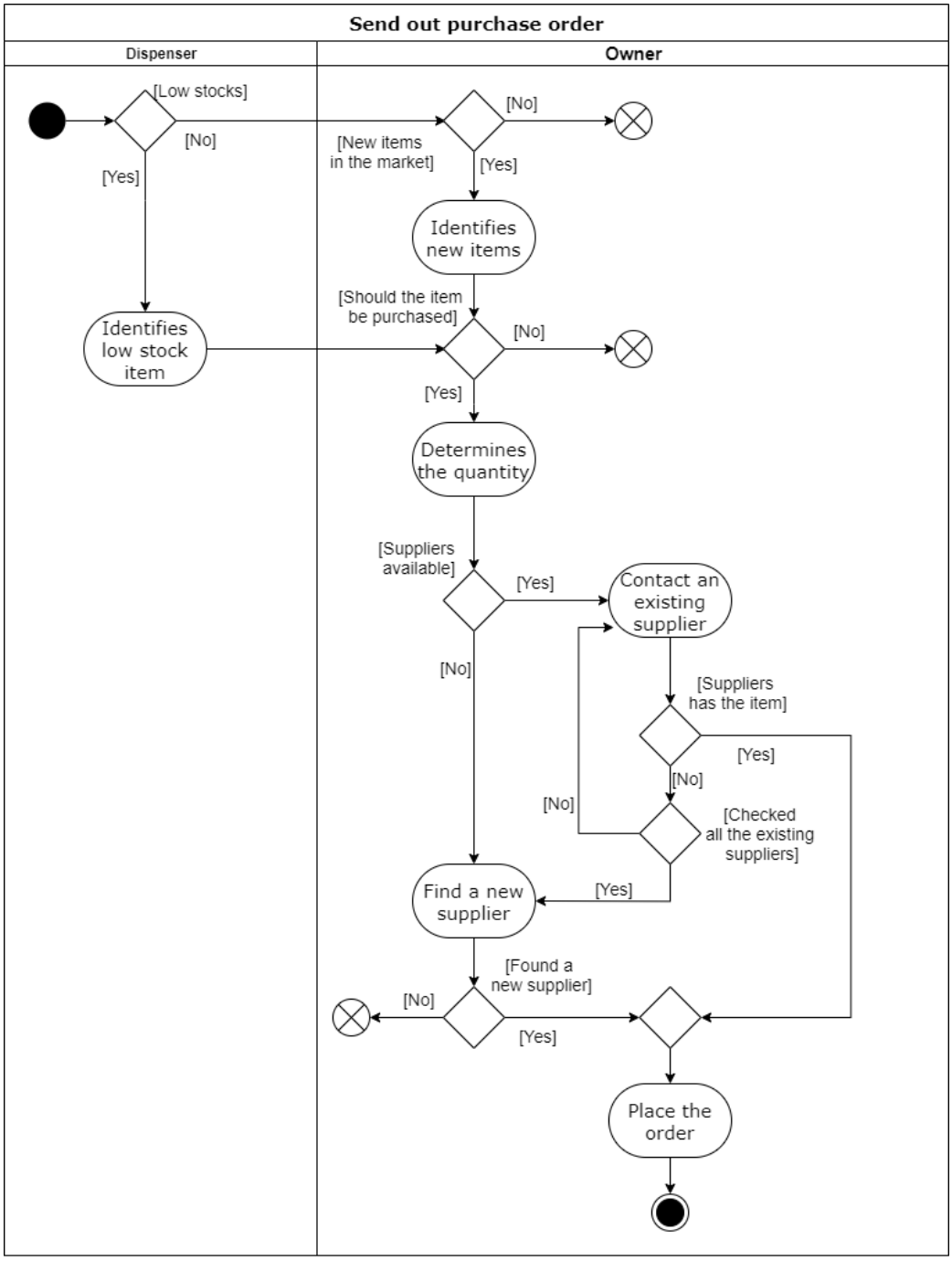

Figure 5 - Activity diagram for Send out purchase order

2.4. Software requirement specifications

Here are the functional and non-functional software requirement specifications according to the client.

2.4.1. Functional requirements

Requirement	Priority H/M/L	M/O	Weight H/M/L
1. Shall be able to log into the system	H	M	M
1.1. Shall be able to verify users through usernames and passwords	H	M	M
1.2. Shall be able to reset password	H	M	M
2. Shall be able to manage inventory	H	M	H
2.1. Shall be able to store all the relevant data of inventory (Item name, brand, quantity, price etc.)	H	M	M
2.2. Shall be able to add new items to the inventory	H	M	M
2.3. Shall be able to update inventory details	H	M	M
2.4. Shall be able to remove items from inventory	H	M	M
2.5. Shall be able to search inventory levels	H	M	H
2.6. Shall be able to filter the viewing of inventory	L	O	M
3. Shall be able to manage patient records	H	M	H
3.1. Shall be able to add a new patient	H	M	M
3.2. Shall be able to add new details to the patient's history	H	M	M
3.3. Shall be able to check the patient visit history	H	M	H
3.4. Shall be able to search patient records	H	M	M

4. Shall be able to send out purchase orders to suppliers through an email		H	M	H
	4.1.Shall be able to select the supplier	H	M	M
	4.2. Shall be able to select the items being ordered	M	M	M
	4.3. Shall be able to select the quantity	M	M	M
5. Shall be able to generate invoices for patients		H	M	H
	5.1. Shall be able to include consultation fees	H	M	H
	5.2. Shall be able to include purchases of drugs	H	M	H
	5.3. Shall be able to search issued invoices	M	M	M
6. Shall be able to manage details of suppliers		H	M	M
	6.1. Shall be able to add new supplier details	H	M	M
	6.2. Shall be able to remove supplier records	H	M	M
	6.3. Shall be able to update supplier details	M	M	M
7. Shall be able to manage employee records		M	M	M
	7.1. Shall be able to add new employee records	M	M	M
	7.2. Shall be able to update employee details	M	M	M
	7.3. Shall be able to remove employee records	M	M	M
	7.4. Shall be able to restrict selected employees from accessing the patient records	M	M	H
8. Should be able to send notifications		M	O	H
	8.1. Should be able to notify critical levels of inventory	M	O	H
	8.2. Should be able to notify inventory levels that are closer to expire	M	O	H
	8.3. Should be able to send reminders to patients when their due examining dates are closer	M	O	H

9. Shall be able to generate income reports	H	M	H

Table 5 - Functional requirements

2.4.2. Non-functional requirements

Requirement	Priority H/M/L	M/O	Weight H/M/L
1. Shall be able to provide a web interface	H	M	H
2. Shall be able to maintain the security of data (passwords, patient records, inventory details, purchase details etc.)	H	M	M
3. Shall be able to provide user friendly GUIs	M	M	H
4. Shall be able to provide information efficiently	M	M	M
5. Shall be able to perform with reliability	M	M	M
6. Shall be able to facilitate 24x7 availability	M	M	L

Table 6 - Non-functional requirements

2.5. Complete business system options

BSO 1 - A web based medical center management system that satisfies all the requirements of the Business.

BSO 2 - A web based medical center management that satisfies all the essential requirements of the business and with the facilitation of a notification system to better manage inventory.

BSO 3 - A web based Medical Centre Management System that satisfies all the essential requirements of the business and with the facilitation of a notification system to better manage inventory along with the provision of a SMS reminder service for the patients via a SMS portal.

2.5.1. Functional requirements vs BSOs

Requirement	BSO 1	BSO 2	BSO 3
1. Shall be able to log into the system	×	×	×
1.1. Shall be able to verify users through usernames and passwords	×	×	×
1.2. Shall be able to reset password	×	×	×
2. Shall be able to manage inventory	×	×	×
2.1. Shall be able to store all the relevant data of inventory (Item name, brand, quantity, price etc.)	×	×	×
2.2. Shall be able to add new items to the inventory	×	×	×
2.3. Shall be able to update inventory details	×	×	×
2.4. Shall be able to remove items from inventory	×	×	×
2.5. Shall be able to search inventory levels	×	×	×
2.6. Shall be able to filter the viewing of inventory	×	×	×
3. Shall be able to manage patient records	×	×	×
3.1. Shall be able to add a new patient	×	×	×
3.2. Shall be able to add new details to the patient's history	×	×	×
3.3. Shall be able to check the patient visit history	×	×	×
3.4. Shall be able to search patient records	×	×	×
4. Shall be able to send out purchase orders to suppliers through an email	×	×	×

	4.1. Shall be able to select the supplier	×	×	×
	4.2. Shall be able to select the items being ordered	×	×	×
	4.3. Shall be able to select the quantity	×	×	×
5. Shall be able to generate invoices for patients		×	×	×
	5.1. Shall be able to include consultation fees	×	×	×
	5.2. Shall be able to include purchases of drugs	×	×	×
	5.3. Shall be able to search issued invoices	×	×	×
6. Shall be able to manage details of suppliers		×	×	×
	6.1. Shall be able to add new supplier details	×	×	×
	6.2. Shall be able to remove supplier records	×	×	×
	6.3. Shall be able to update supplier details	×	×	×
7. Shall be able to manage employee records		×	×	×
	7.1. Shall be able to add new employee records	×	×	×
	7.2. Shall be able to update employee details	×	×	×
	7.3. Shall be able to remove employee records	×	×	×
	7.4. Shall be able to restrict selected employees from accessing the patient records	×	×	×
8. Should be able to send notifications		×	×	×
	4.1. Should be able to notify critical levels of inventory	_	×	×

	4.2. Should be able to notify inventory levels that are closer to expire	–	×	×
	4.3. Should be able to send reminders to patients when their due examining dates are closer	–	–	×
5. Shall be able to generate income reports		×	×	×

Table 7 - Functional requirements vs BSO

2.5.2. Non-functional requirements vs BSOs

Requirements	BSO 1	BSO2	BSO 3
1. Shall be able to provide a web interface	×	×	×
2. Shall be able to maintain the security of data (passwords, patient records, inventory details, purchase details etc.)	×	×	×
3. Shall be able to provide user friendly GUIs	×	×	×
4. Shall be able to provide information efficiently	×	×	×
5. Shall be able to perform with reliability	×	×	×
6. Shall be able to facilitate 24x7 availability	×	×	×

Table 8 - Non-functional requirements vs BSO

2.5.3. BSO explanation

- **BSO 1-** A web based Medical Centre Management System that satisfies all the requirements of the Business.

  Functional description – This Business System Option will cover the basic areas of the business with facilitating Inventory Management and Patient Management being the core aspects. This consists of a POS system to handle payments of patients. Sending out a purchase order to suppliers will be facilitated by this BSO.

- **BSO 2 -** A web based Medical Centre Management System that satisfies all the essential requirements of the Business and allows the user to receive notifications regarding low stocks items and items that are close to expire.

  Functional description – This Business System Option will be able to carry out the inventory management aspect more efficiently as the users can quickly identify what sort of behavior the inventory is showing through notifications. The purchasing drugs will be done in a more productive way due to this. In addition to this all the basic requirements will be covered by this BSO.

- **BSO 3 -** A web based Medical Centre Management System that satisfies all the essential requirements of the business and allows the user to receive notifications regarding low stocks items and items that are close to expire and facilitates SMS reminder services for the patients via a SMS portal.

  Functional description – This is the most advanced BSO which offers more features apart from the basic functionalities. It will facilitate the notification system for the inventory for more efficiency. Apart from that this BSO comes with the ability to send reminders to patients via a SMS to remind them about their upcoming appointments recommended by the doctor.

2.5.4. Cost benefit analysis

Cost	BSO 1	BSO 2	BSO 3
Development cost	-	-	2500.00
Deployment cost			
• Domain purchase cost	3500.00	3500.00	3500.00
• Cloud hosting cost	15000.00	15000.00	15000.00
Maintenance Cost			
• Monthly hosting cost	3500.00	4500.00	5000.00
• Monthly database cost	15000.00	17000.00	18000.00
• SMS portal cost	-	-	0.98 per SMS

Table 9 - Cost benefit analysis

2.5.5. Selected BSO with a sound justification

The BSO 2 is selected for this Web Based Medical Centre Management system as it is able to satisfy the client needs most effectively. This BSO offers the facilitation of all the essential requirements of the client while addressing some of the nice to have features. This BSO is capable of carrying out the basic tasks of the business while providing features that would enhance the efficiency of the processes. At the same time, it stays in the moderate cost regions with higher benefits than the costs assigned to it.

2.6. Chapter summary

This chapter provides the analysis of the current business process. It starts with the use case diagram and then moves on to use case descriptions and activity diagrams to provide the system analysis. Following that is the system requirement specifications and complete business system options to conclude the chapter.

CHAPTER 3

3. SYSTEM DESIGN

Chapter overview

3.1. Use case diagram for the proposed system

3.2. Use case descriptions for the proposed system

3.3. Activity diagrams for the proposed system

3.4. Class diagrams for the proposed system

3.5. Sequence diagrams for the proposed system

3.6. Database models for the proposed system

3.7. Chapter summary

3.1. Use case diagram for the proposed system

Figure 6 illustrates the use case diagram for the proposed system with the different type of users involving and the uses cases that they are carrying out within the system.

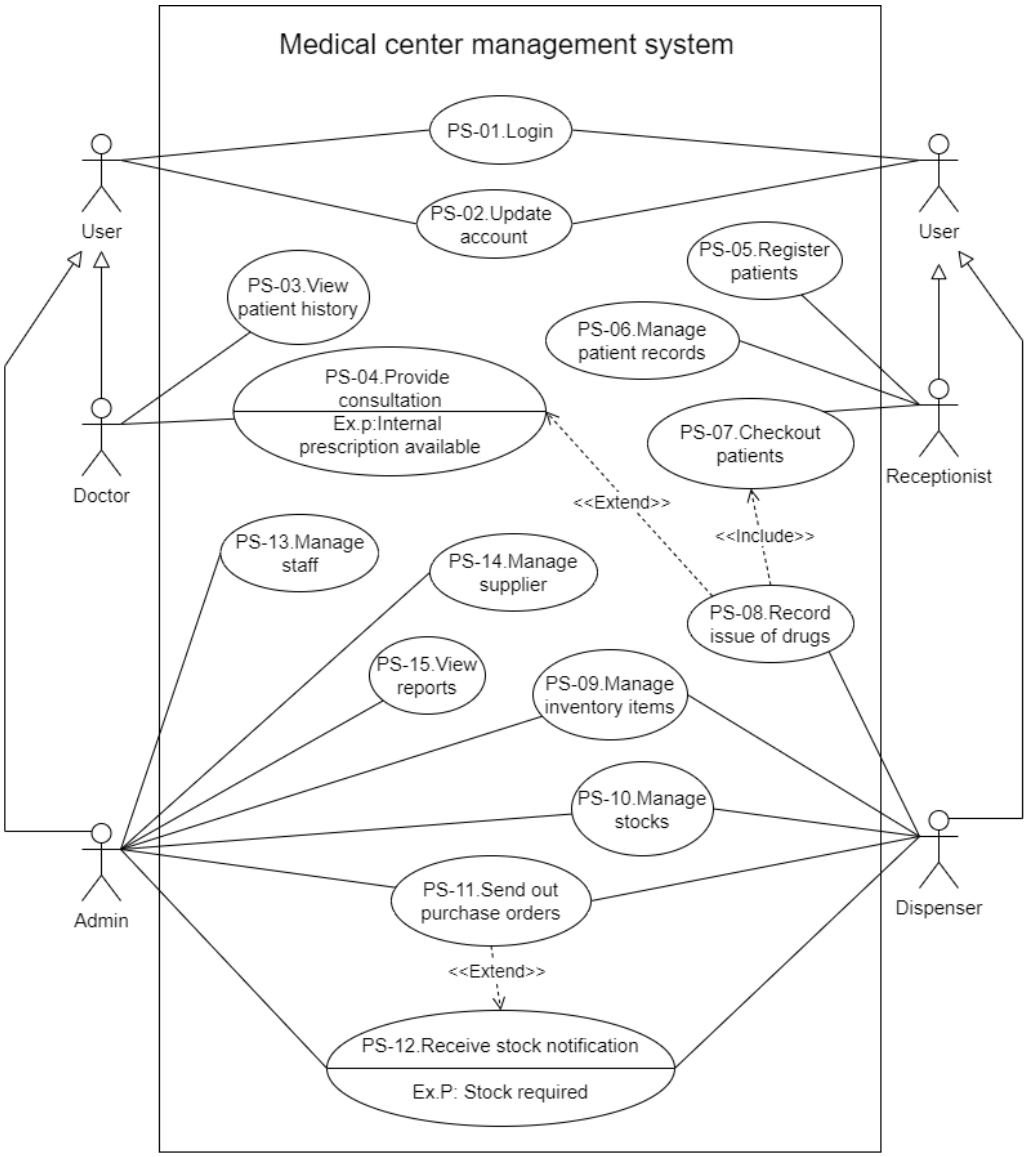

Figure 6 - Use case diagram for the proposed system

3.2. Use case descriptions for the proposed system

All the use cases of the above use case diagram are describes using use case descriptions below.

3.2.1. Use case description for PS-01. Login

Use case id	PS - 01
Use case	Login
Actors	Doctor, Receptionist, Admin, Dispenser
Description	Users login into the system
Pre-conditions	The users have launched the system and the system should be connected to a network The user has a registered account in the system.
Normal flow	1. User elects an account 2. Enter username 3. Enter Password 4. Click login button
Alternate flow	No alternate flow
Exception	4a. Invalid username or password
Post-condition	Login to the system

Table 10 – Use case description for Login

3.2.2. Use case description for PS-02. Update account

Use case id	PS - 02
Use case	Update account
Actors	Doctor, Receptionist, Admin, Dispenser
Description	Users update details of their existing accounts
Pre-conditions	User has logged into their account
Normal flow	1. User selects update account 2. Update user details 3. Set new password 4. Confirm passwords

Alternate flow	2a. user details are kept unchanged 4a. password kept unchanged
Exception	5b. password confirmation is invalid
Post-condition	Login User account has been updates

Table 11 - Use case description for Update account

3.2.3. Use case description for PS-03. View patient history

Use case id	PS - 03
Use case	View Patient history
Actors	Doctor
Description	Doctor goes through the medical history of a particular patient
Pre-conditions	Doctor has logged into his/her account
Normal flow	1. Doctor searches the number of the patient 2. Selects a visit date
Alternate flow	1a. Doctor search a patient
Exception	2a. Patient does not have any medical history
Post-condition	No post condition

Table 12 - Use case description for View patient history

3.2.4. Use case description for PS-04. Provide consultation

Use case id	PS - 04
Use case	Provide consultation
Actors	Doctor
Description	Doctor recoding the treatment for his identified diagnosis regarding a particular patient
Pre-conditions	Doctor has logged into his account
Normal flow	1. Doctor select adding a consultation 2. Record consultation details 3. Add prescription 4. Assign a consultation fee for the patient
Alternate flow	2a. Record recommended investigations

	3a. Add an internal prescription 3b. Add an external prescription 4a. No consultation charge
Exception	No exception
Post-condition	The patient history is updated

Table 13 - Use case description for Provide consultation

3.2.5. Use case description for PS-05. Register patient

Use case id	PS - 05
Use case	Register patient
Actors	Receptionist
Description	Registering a new patient into the system
Pre-conditions	Receptionist has logged into their account
Normal flow	1. Receptionist select add new patient 2. Enter patient's details 3. Register patient
Alternate flow	No alternate flow
Exception	No exception
Post-condition	A new patient is added to the system

Table 14 - Use case description for Register patient

3.2.6. Use case description for PS-06. Manage patient records

Use case id	PS - 06
Use case	Manage patient records
Actors	Receptionist
Description	Adjusting the details of patients that have been changed Assigning a number for the patient to be examined
Pre-conditions	Receptionist has logged into their account Registered patient records are available

Normal flow	1. Receptionist Search patients. 2. a1. Select edit patient a2. Enter new details b1. Assign a number to a patient
Alternate flow	No alternate flow
Exception	1a. No search results
Post-condition	Patients account will be updated, or the patient is assigned for a number valid for a particular day

Table 15 - Use case description for Manage patient record

3.2.7. Use case description for PS-07. Checkout patients

Use case id	PS - 07
Use case	Checkout patients
Actors	Receptionist
Description	Finalizing the process of a treatment with handling of the payments given by patients for the service
Pre-conditions	Receptionist has logged into their account Either the patient has bought medicine from the Medical Centre or the Doctor has assigned a consultation service for the patience.
Normal flow	1. Receptionist search for the patient's number 2. Handle payments 3. System print the treatment sheet
Alternate flow	No alternate flow
Exception	1a. No search results
Post-condition	Issue the printed materials to the patient

Table 16 - Use case description for Checkout patient

3.2.8. Use case description for PS-08. Record issue of drugs

Use case id	PS - 08
Use case	Record issue of drugs
Actors	Dispenser
Description	The drugs that the patients buy from the medical center are recorded
Pre-conditions	Dispenser has logged into his account. The consultation process is finished
Normal flow	1. Dispenser search for the patient's number 2. View the internal prescription 3. Confirm the issue of drugs
Alternate flow	2a. No internal prescription available
Exception	No exception
Post-condition	The sale is recorded Drugs are issued to the patient

Table 17 - Use case description for Record issue of drugs

3.2.9. Use case description for PS-09. Manage inventory items

Use case id	PS - 09
Use case	Manage inventory items
Actors	Dispenser, Admin
Description	Adding, searching, updating, and removing of inventory items
Pre-conditions	User has logged into his account
Normal flow	1. User select add inventory items a1. Enter details 2. Search for the inventory item 3. Modify inventory items
Alternate flow	3a. Update inventory details 3b. Remove inventory item
Exception	No search results.

Post-condition	The inventory item is added, updated, removed, or kept unchanged

Table 18 - Use case description for Manage inventory items

3.2.10. Use case description for PS-10. Manage stocks

Use case id	PS - 10
Use case	Manage stocks
Actors	Dispenser, Admin
Description	Recording the new stocks received
Pre-conditions	User has logged into his account Inventory items of the new stocks are present at the inventory list
Normal flow	1. User select add stocks a1. Enter stock details 2. Search stocks
Alternate flow	No alternate flow
Exception	No exception
Post-condition	The new stocks are recorded, or the stock results are displayed

Table 19 - Use case description for Manage stocks

3.2.11. Use case description for PS-11. Send out purchase order

Use case id	PS - 11
Use case	Send out purchase order
Actors	Dispenser, Admin
Description	Sending out purchase orders to suppliers to receive stocks
Pre-conditions	User has logged into his account and
Normal flow	1. User selects purchase order 2. Select supplier 3. Select items

	4. Set quantities 5. Send the purchase order
Alternate flow	4a. Add a description if necessary
Exception	No exception.
Post-condition	Supplier receives the purchase order through an email

Table 20 - Use case description for Send out purchase order

3.2.12. Use case description for PS-12. Receive stock notifications

Use case id	PS - 12
Use case	Receive stock notifications
Actors	Admin, Dispenser
Description	Users receive notification regarding the stocks on critical levels.
Pre-conditions	User has logged into his account and.
Normal flow	1. User selects notifications 2. System generate notification 3. Display notifications
Alternate flow	3a. Order notified items
Exception	No stocks on critical level
Post-condition	No post condition

Table 21 - Use case description for Receive stock notifications

3.2.13. Use case description for PS-13. Manage staff

Use case id	PS - 13
Use case	Manage staff
Actors	Admin
Description	Adding staff member records along with searching, updating, and removing records
Pre-conditions	Owner has logged into his account and

Normal flow	1. Admin select add staff 2. a1. Enter details 3. Search a staff record 4. Modify staff records
Alternate flow	3a. Update staff details 3b. Remove staff record
Exception	No search results.
Post-condition	Employee record searched, added, updated, or removed

Table 22 - Use case description for Manage staff

3.2.14. Use case description for PS-14. Manage supplier

Use case id	PS - 14
Use case	Manage suppliers
Actors	Admin
Description	Adding supplier records along with searching, updating, and removing records
Pre-conditions	Owner has logged into his account and
Normal flow	1. Admin select add supplier a1. Enter details 2. Search a supplier record 3. Modify supplier records
Alternate flow	4a. Update supplier 4b. Remove supplier
Exception	No search results.
Post-condition	supplier record searched, added, updated, or removed

Table 23 - Use case description for Manage supplier

3.2.15. Use case description for PS-15. View reports

Use case id	PS - 15
Use case	View reports
Actors	Admin

Description	Admin viewing strategic reports
Pre-conditions	Admin has logged into his account and
Normal flow	1. Admin selects reports 2. Filter report type 3. Set report format 4. Set duration
Alternate flow	No alternate flow
Exception	No exception
Post-condition	Strategic reports are displayed to the admin

Table 24 - Use case description for View reports

3.3. Activity diagrams for the proposed system

The activity diagrams that illustrate the flow of activities regarding each use case of the proposed system are displayed below.

3.3.1. Activity diagram for PS – 01: Login

Figure 7 illustrates the activity diagram for the process of a user login into the system.

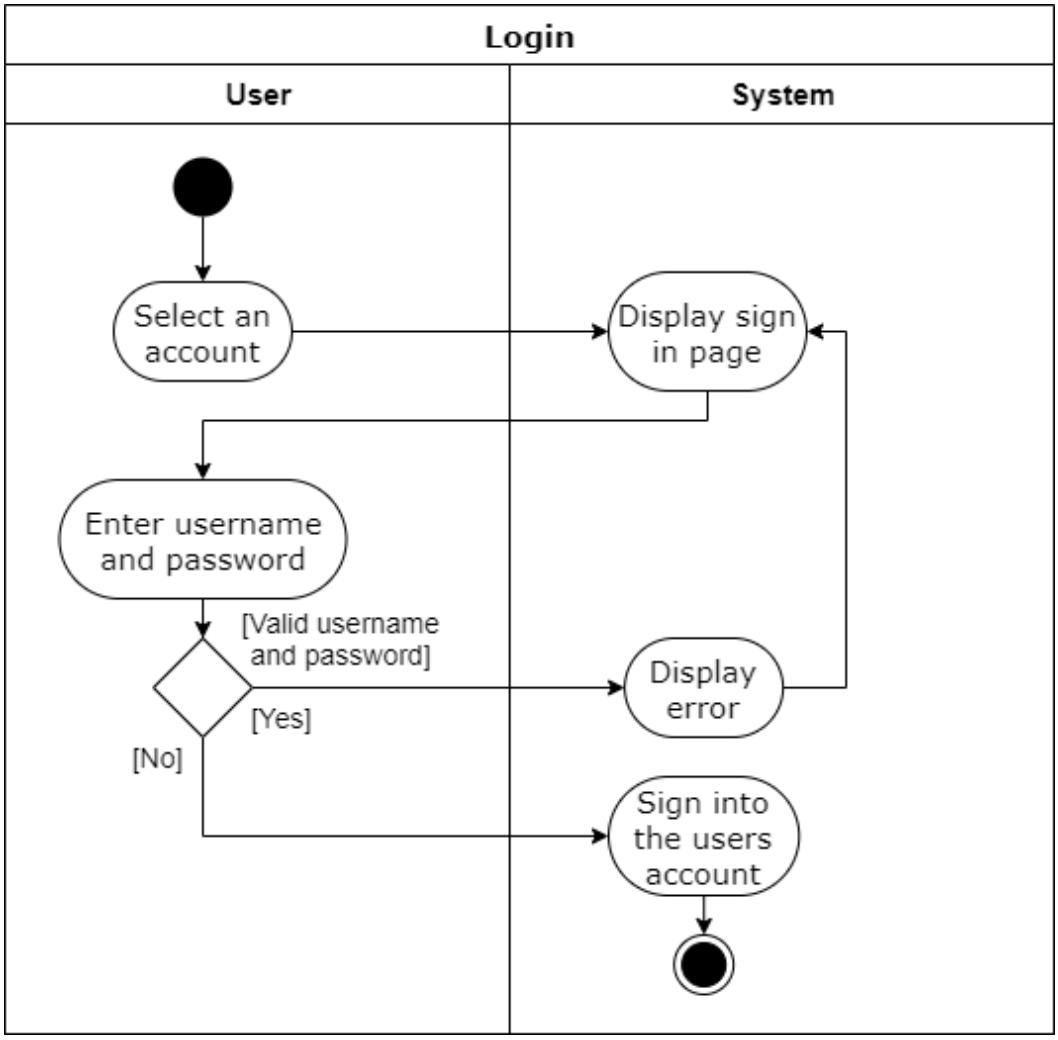

Figure 7 - Activity diagram for Login

3.3.2. Activity diagram for PS – 02: Update account

Figure 8 illustrates the activity diagram for the process of updating an account. The basic user details and the password are considered separately in this use case.

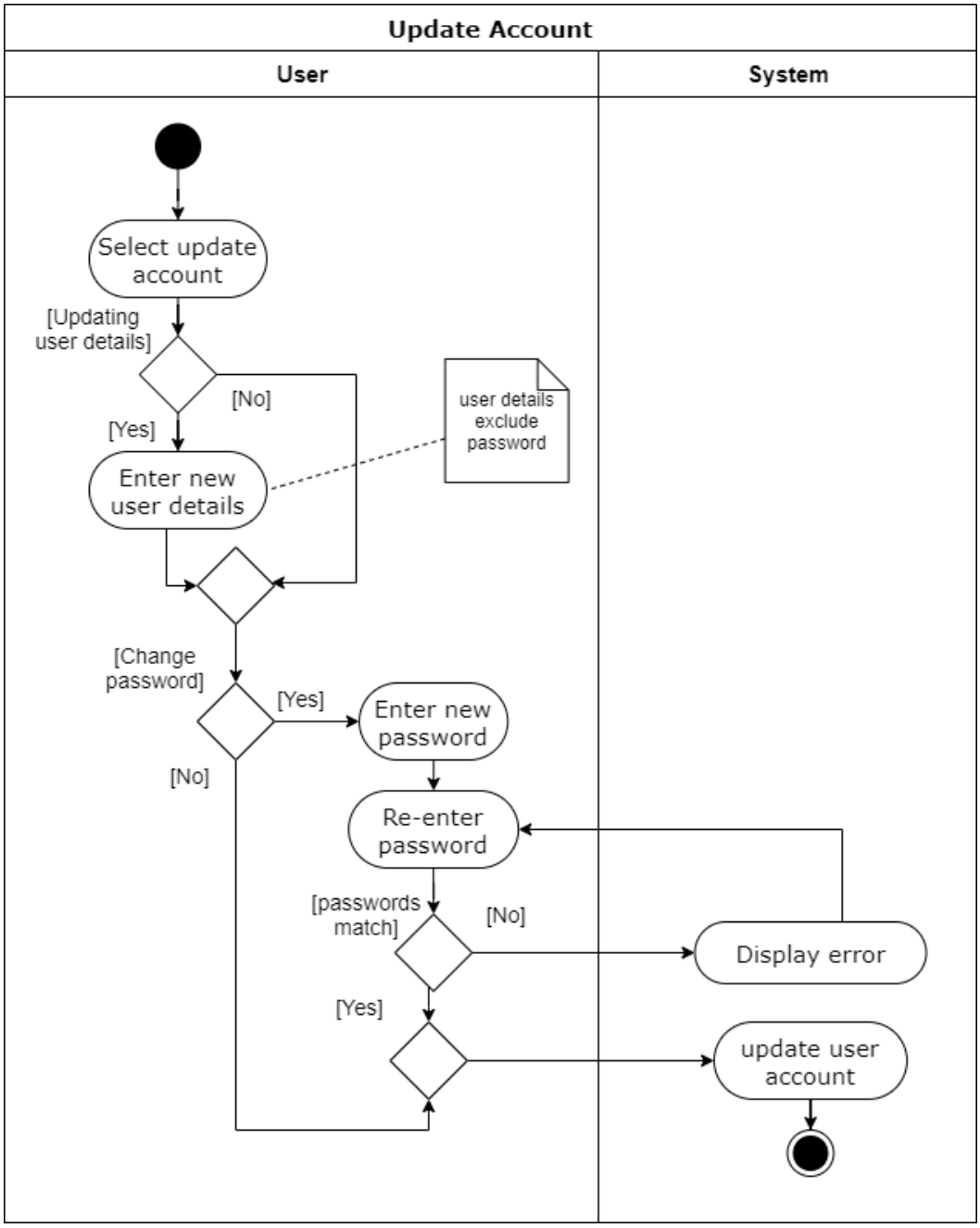

Figure 8 - Activity diagram for Update account

3.3.3. Activity diagram for PS – 03: View patient history

Figure 9 illustrates the activity diagram for the process of viewing the patient history. This use case is carried out by the doctor. The patient's visit history will be displayed first. Then the consultation details of a selected result will be displayed.

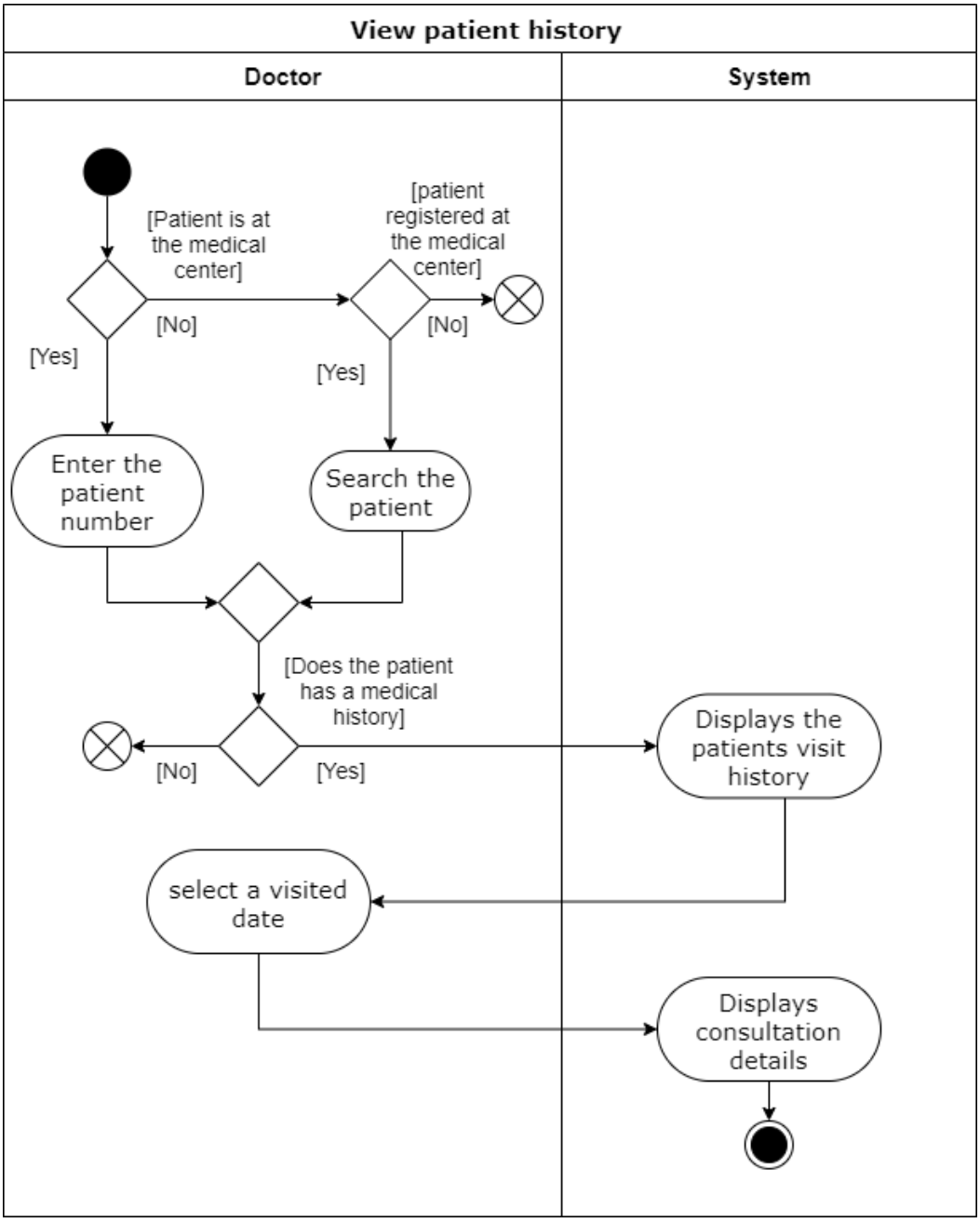

Figure 9 - Activity diagram for View patient history

3.3.4. Activity diagram for PS – 04: Provide consultation

Figure 10 illustrates the activity diagram for the process of providing consultation. The recording of treatment which is the prescriptions are also fall under this use case.

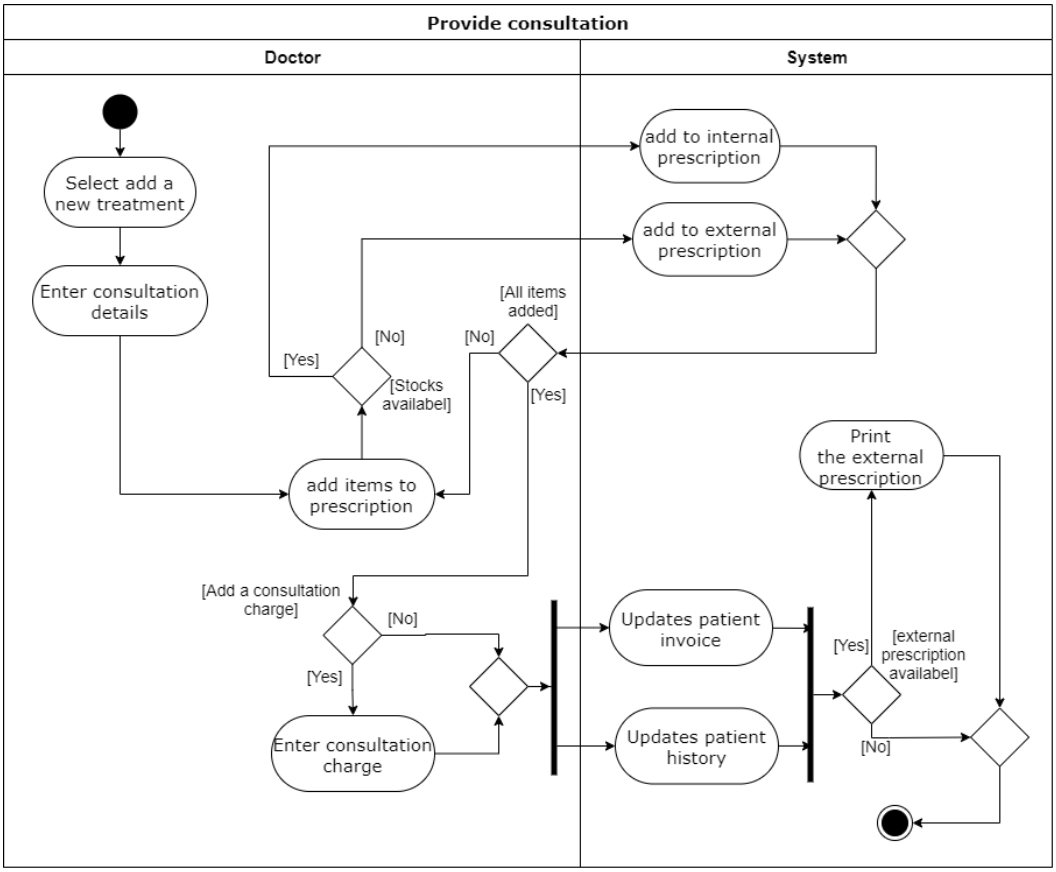

Figure 10 - Activity diagram for Provide consultation

3.3.5. Activity diagram for PS – 05: Register patients

Figure 11 illustrates the activity diagram for the process of registering patients. The relevant use case is handled by the receptionist.

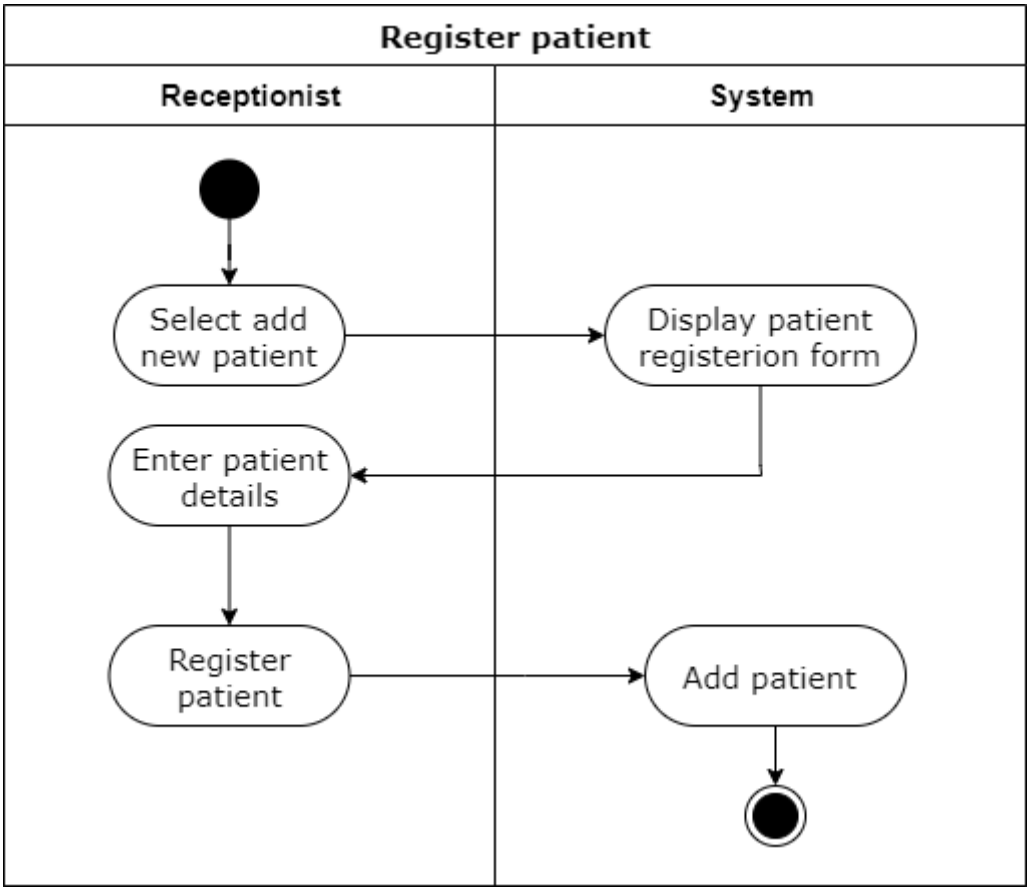

Figure 11 - Activity diagram for Register patient

3.3.6. Activity diagram for PS – 06: Manage patient records

Figure 12 illustrates the activity diagram for the process of managing patient records. The process includes updating patient details and assigning a number to a patient.

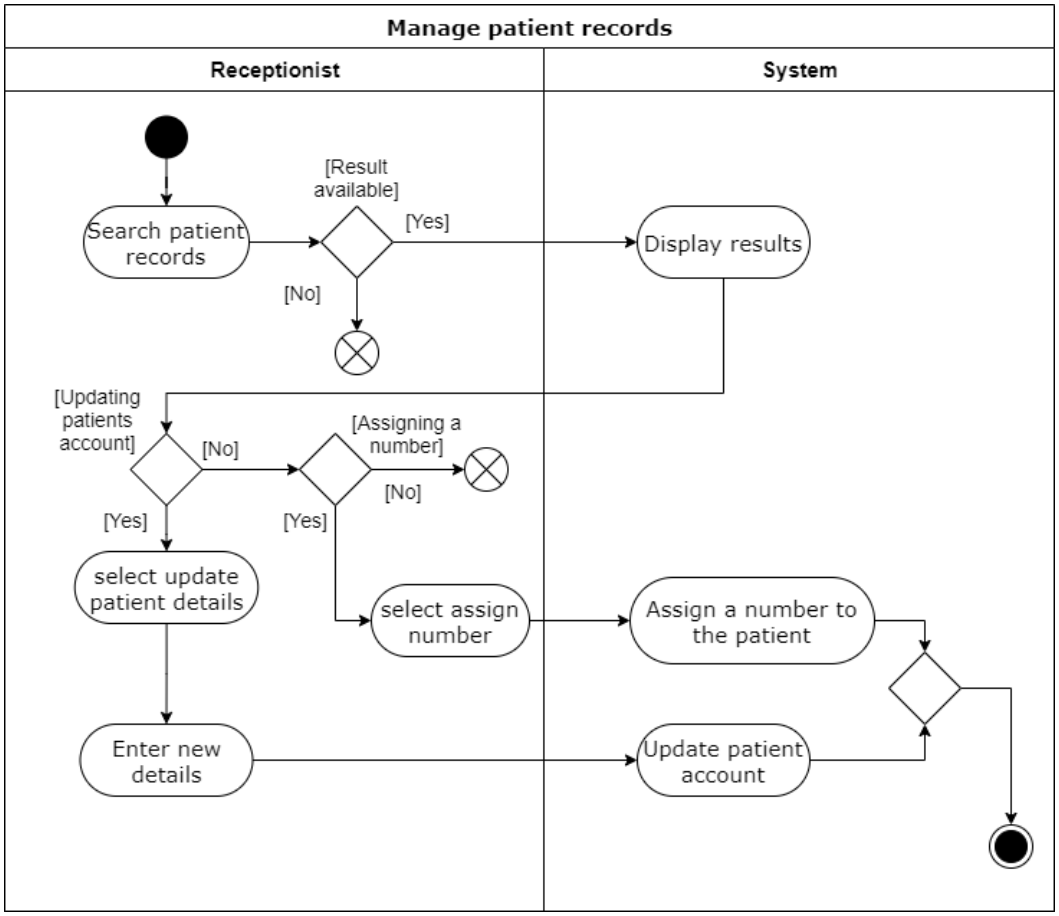

Figure 12 - Activity diagram for Manage patient records

3.3.7. Activity diagram for PS – 07: Checkout patients

Figure 13 illustrates the activity diagram for the process of checking out a patient. The finalizing the payments that a patient must make are handled here.

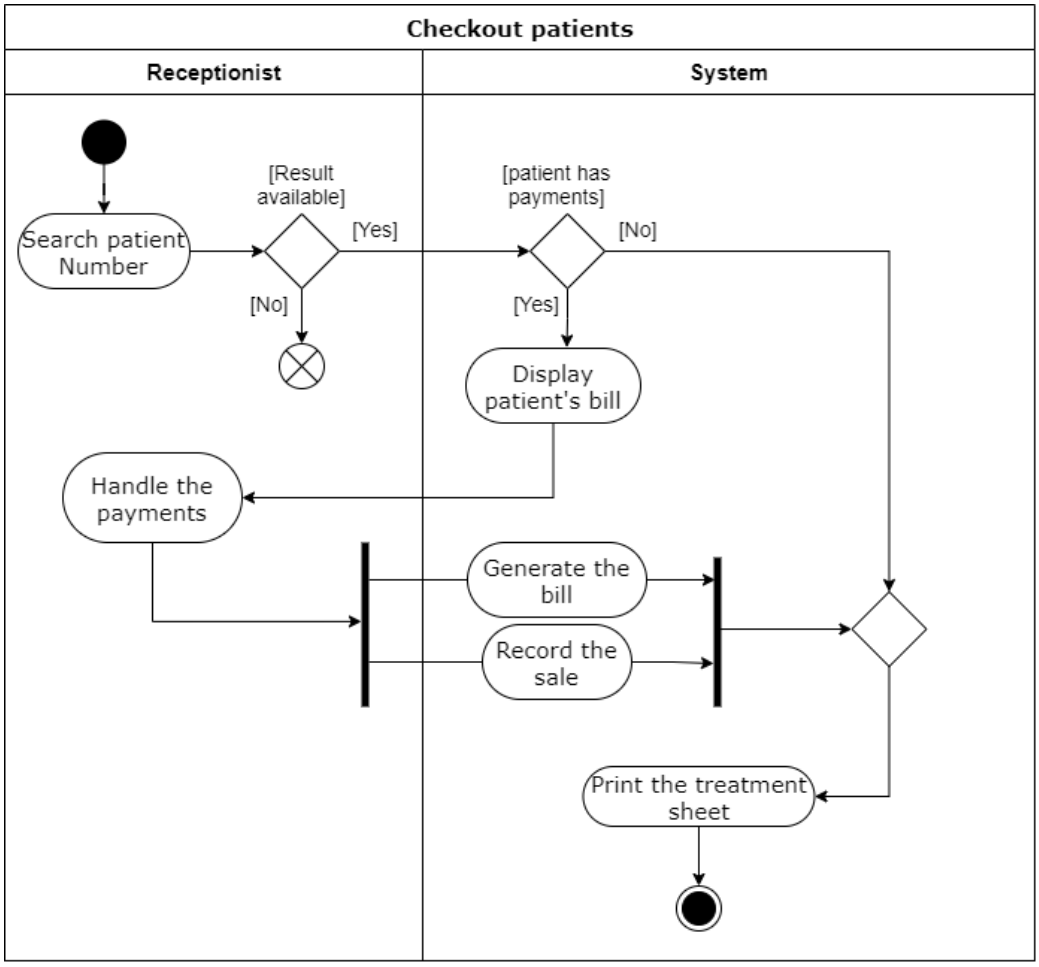

Figure 13 - Activity diagram for Checkout patients

3.3.8. Activity diagram for PS – 08: Record issue of drugs

Figure 14 illustrates the activity diagram for the process of recording issue of drugs. The process is depending on an internal prescription added by the doctor.

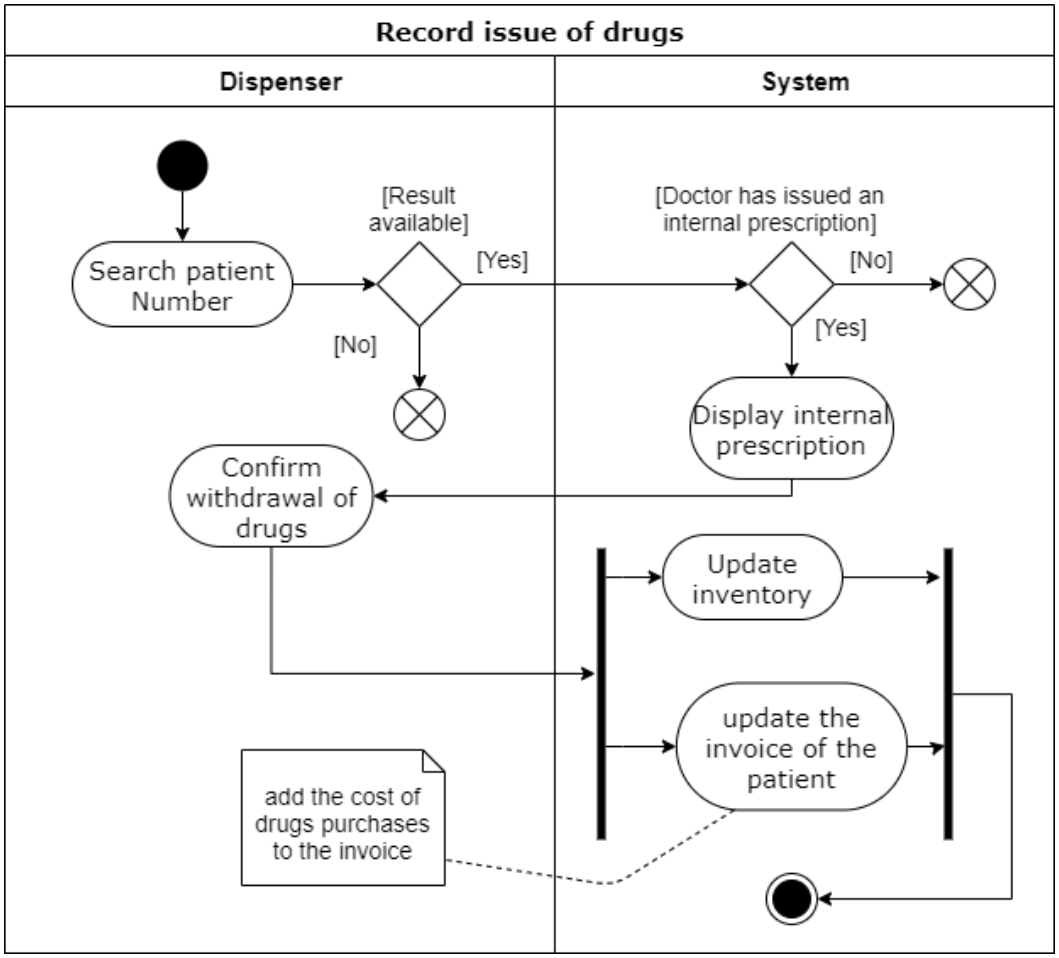

Figure 14 - Activity diagram for Record issue of drugs

3.3.9. Activity diagram for PS – 09: Manage inventory items

Figure 15 illustrates the activity diagram for the process of managing inventory items. Adding, searching, updating, deleting activities are considered here.

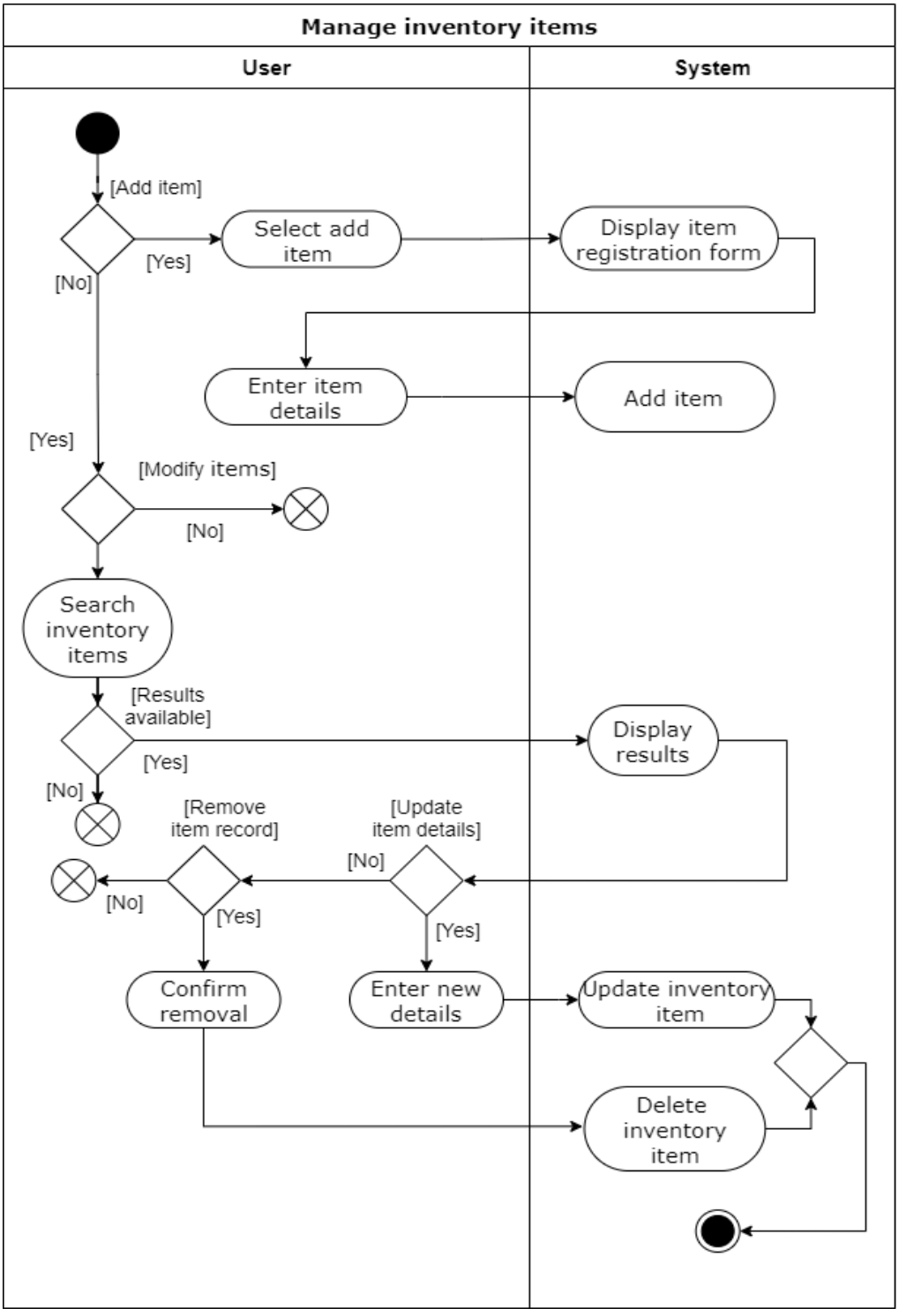

Figure 15 - Activity diagram for Manage inventory items

3.3.10. Activity diagram for PS – 10: Manage stocks

Figure 16 illustrates the activity diagram for the process of managing stocks. It includes only adding and searching activities.

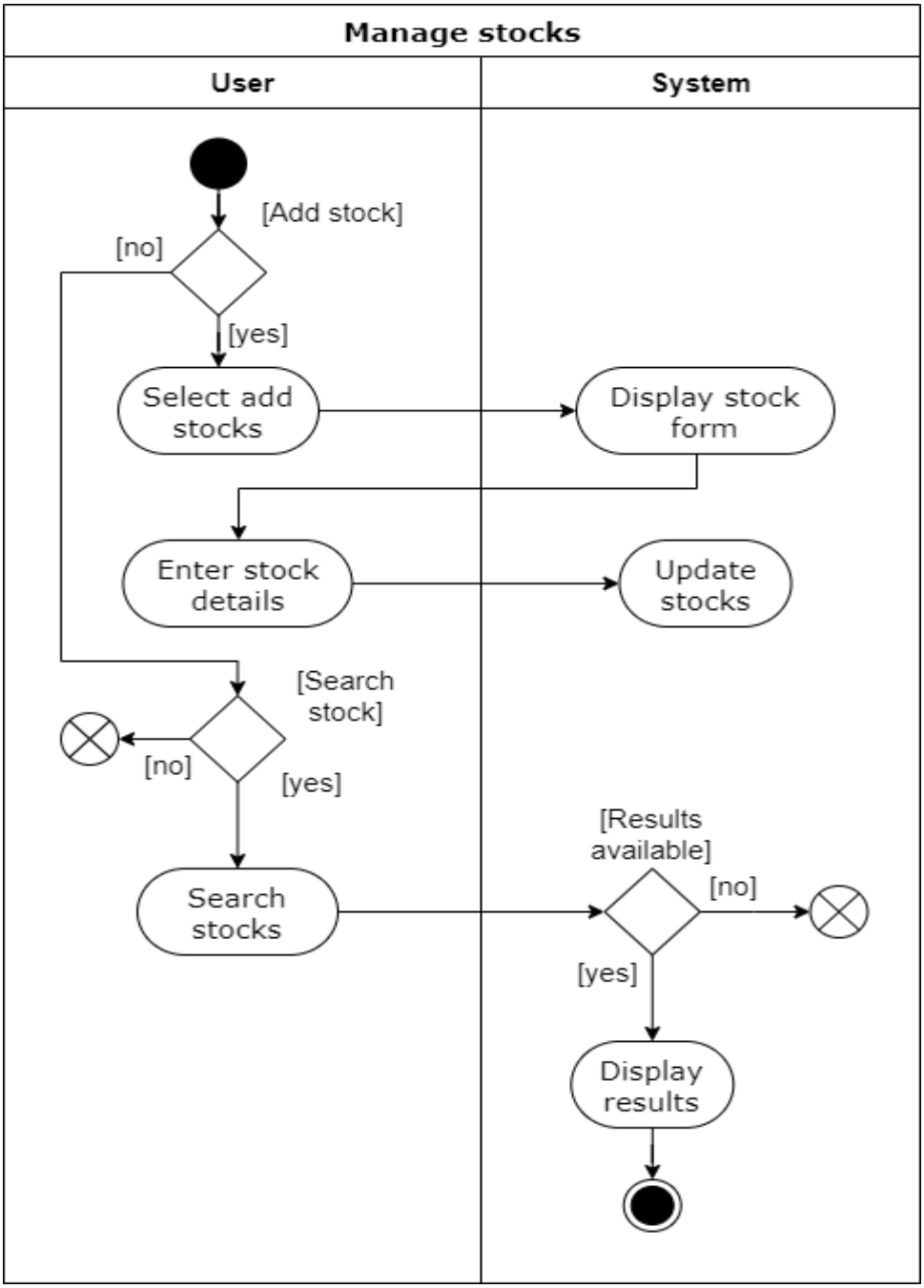

Figure 16 - Activity diagram for Manage stocks

3.3.11. Activity diagram for PS – 11: Send out purchase order

Figure 17 illustrates the activity diagram for the process of sending out a purchase order. Starting with selecting a supplier and then the items, relevant quantities and a note if needed will add up to the purchase order.

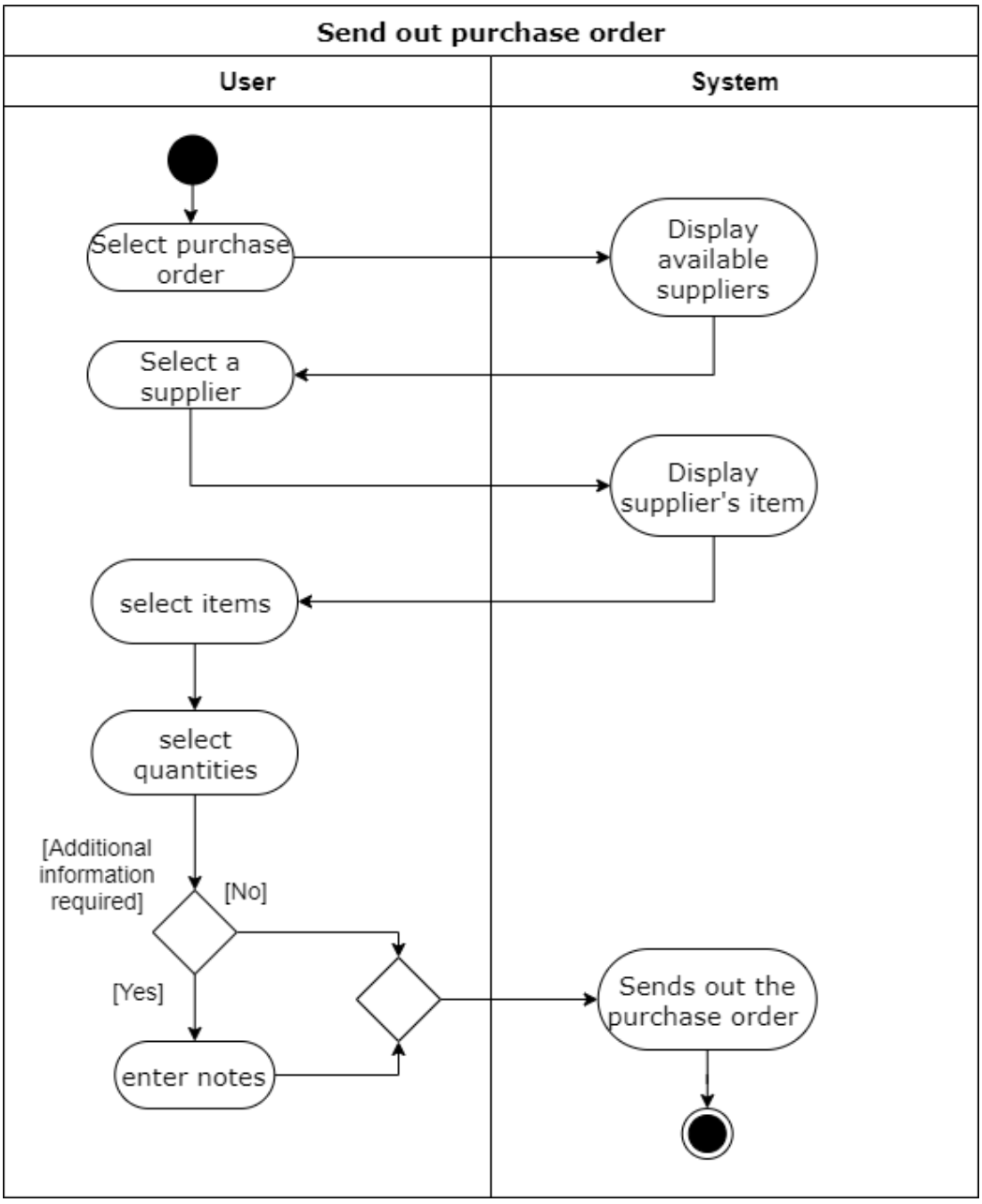

Figure 17 - Activity diagram for Send out purchase order

3.3.12. Activity diagram for PS – 12: Receive stock notifications

Figure 18 illustrates the activity diagram for the process of receiving stock notifications. Low stock levels and stocks that are closer to expire will be notified to the user. Depending on the need to order notified items there will be a reference to the send out purchase order activity diagram.

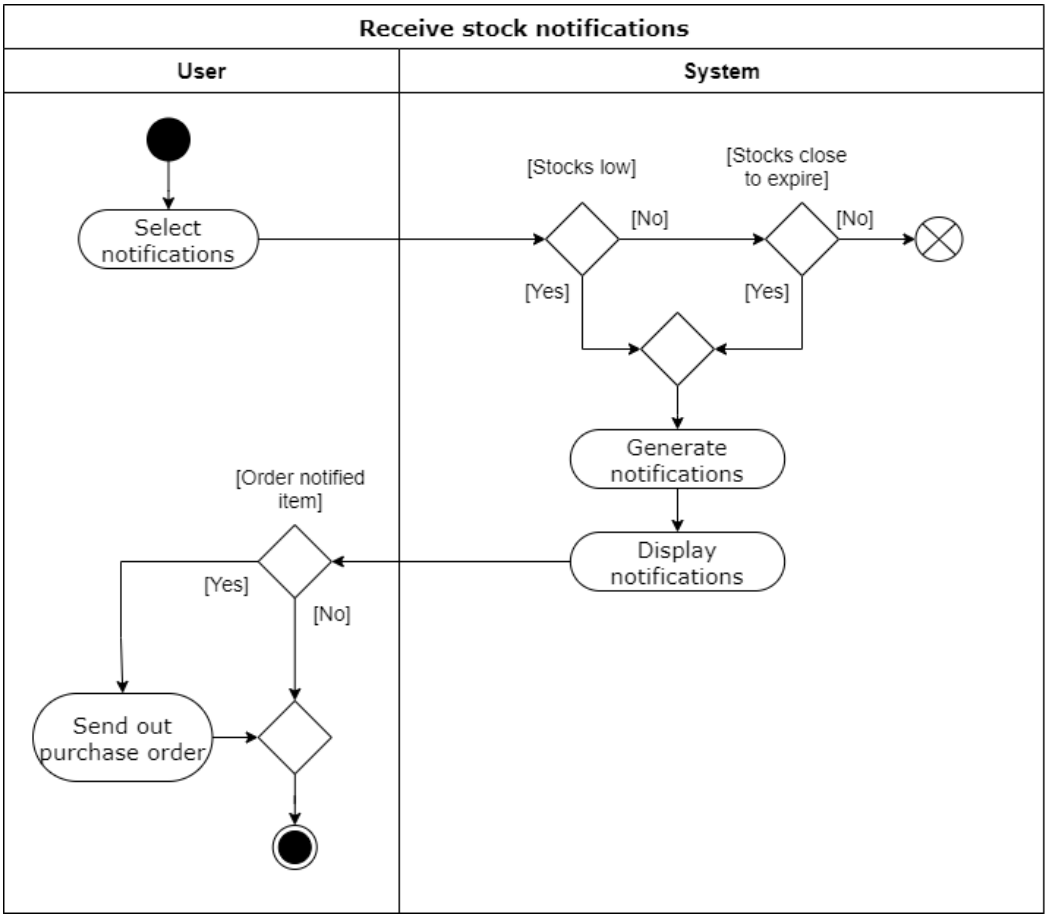

Figure 18 - Activity diagram for Receive stock notifications

3.3.13. Activity diagram for PS – 13: Manage staff

Figure 19 illustrates the activity diagram for the process of managing staff. Adding a new staff member, searching a staff record updating a staff record, and removing a staff member activities and their flows are included.

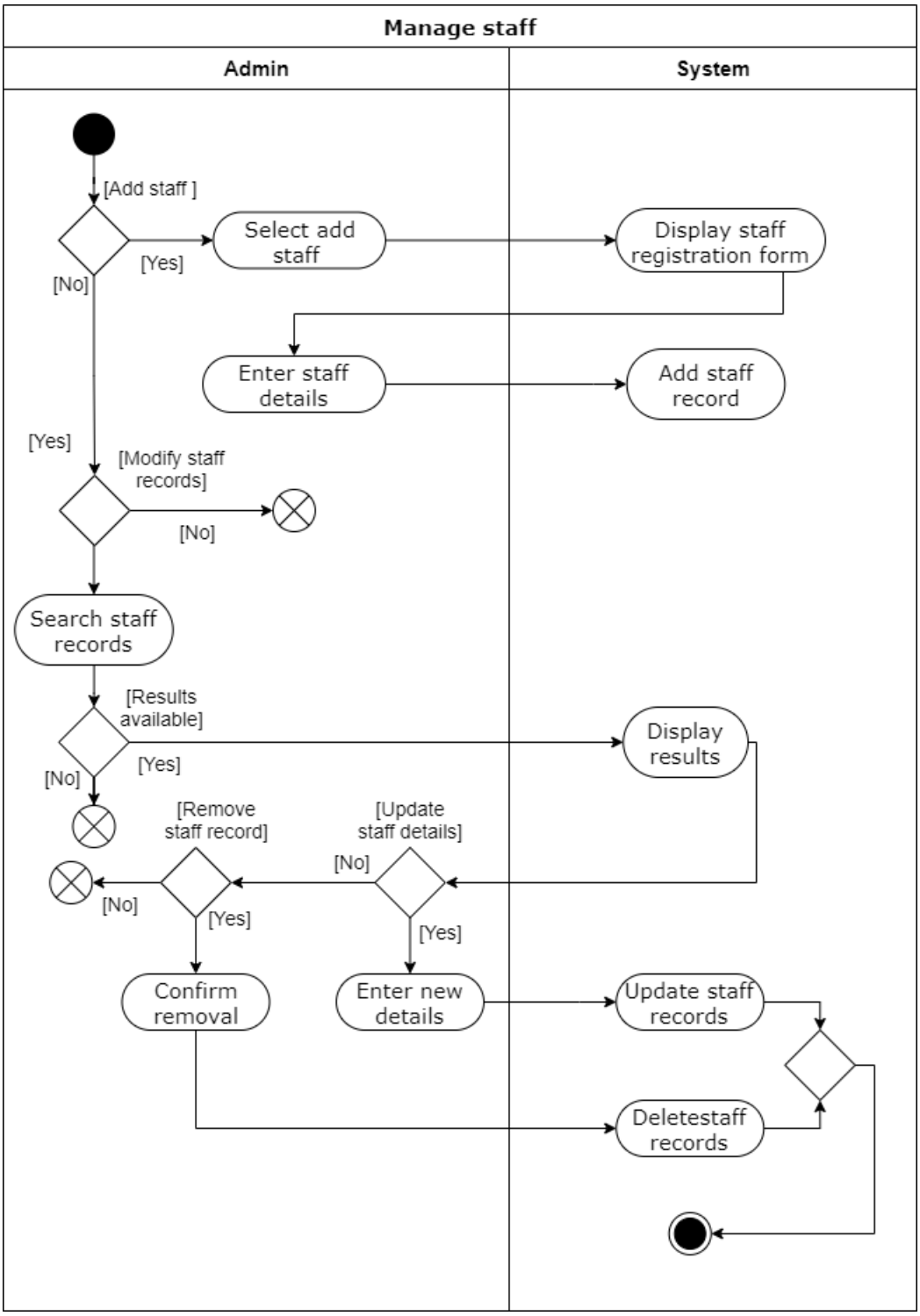

Figure 19 - Activity diagram for Manage staff

3.3.14. Activity diagram for PS – 14: Manage supplier

Figure 20 illustrates the activity diagram for the process of managing suppliers. It consists of adding, searching, updating, or removing supplier records.

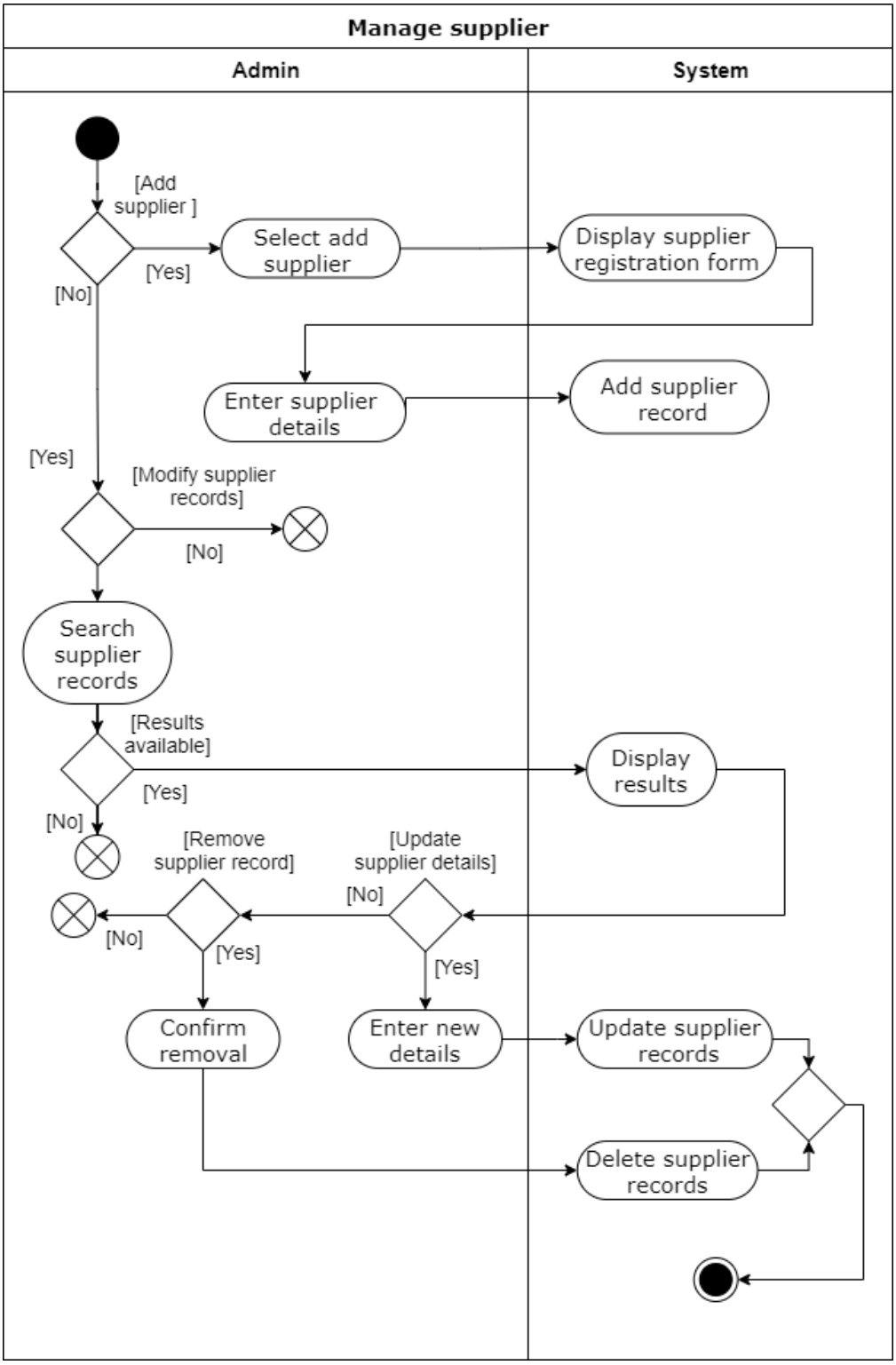

Figure 20 - Activity diagram for Manage supplier

3.3.15. Activity diagram for PS – 15: View reports

Figure 21 illustrates the activity diagram for the process of viewing reports. The admin starts by applying relevant filters to get the report he prefers. Then the system will generate the report and will display it to the admin.

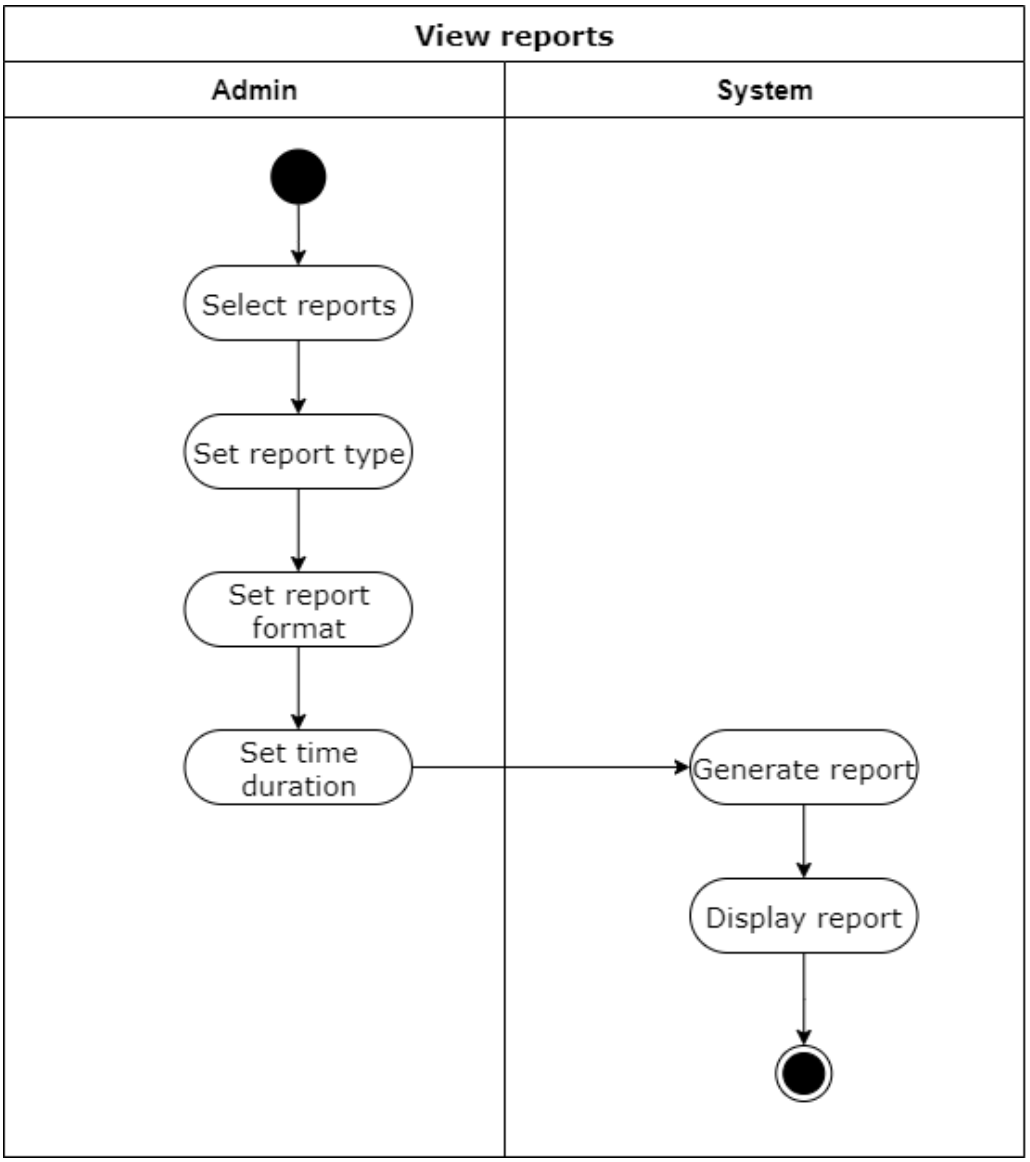

Figure 21 - Activity diagram for View reports

3.4. Class diagram for the proposed system

The class diagrams for the proposed system are completed according to the MVC architecture which includes 3 class diagrams.

3.4.1. Model class diagram for the proposed system

Figure 22 illustrates the model class diagram for the proposed system. It shows the relationships between different classes and their attributes along with the methods that interacts with the database.

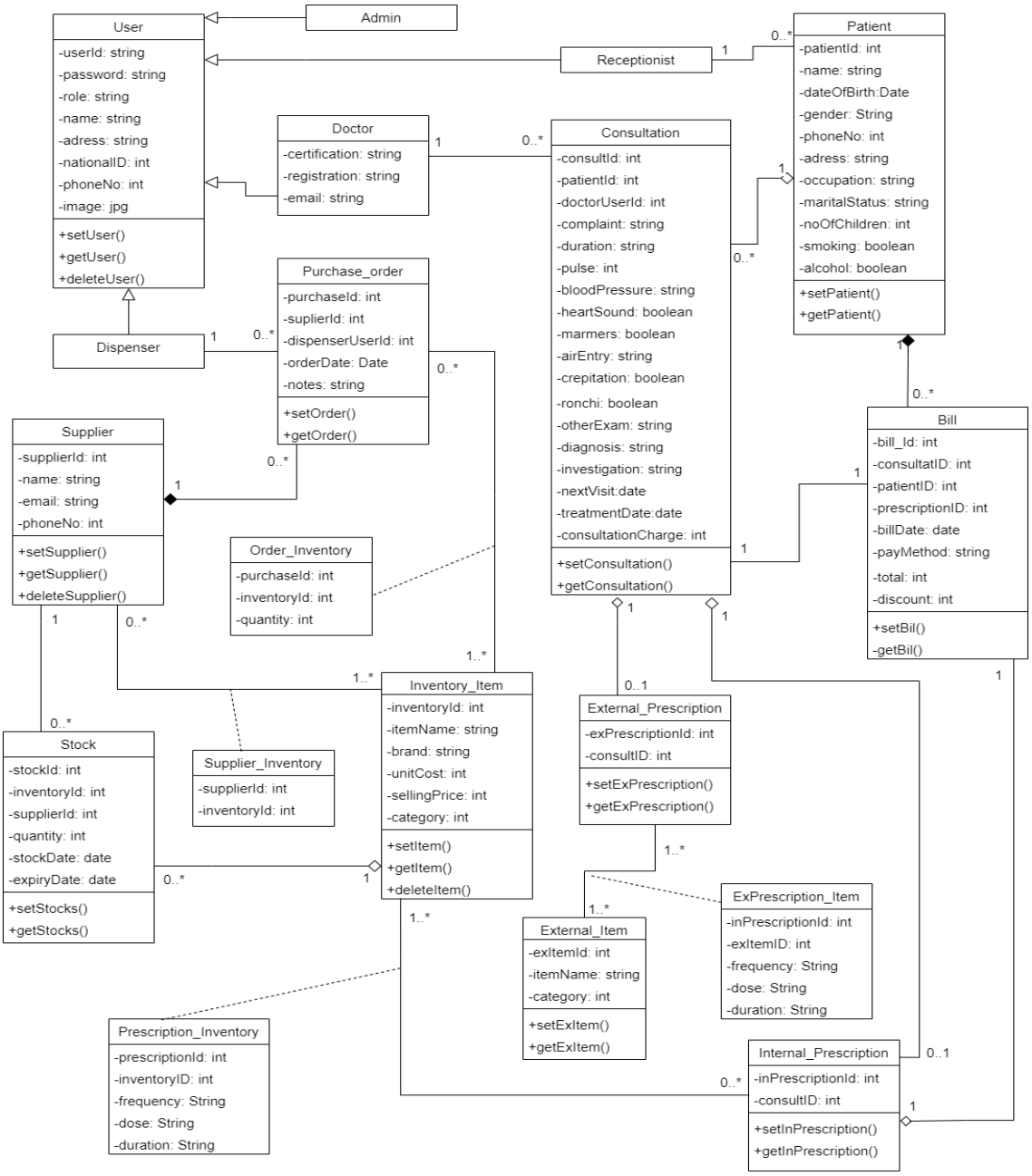

Figure 22 - Model class diagram

3.4.2. View class diagram for the proposed system

Figure 23 illustrates the view class diagram for the proposed system. It consists of interface classes and the different methods used to communicate with the controller class.

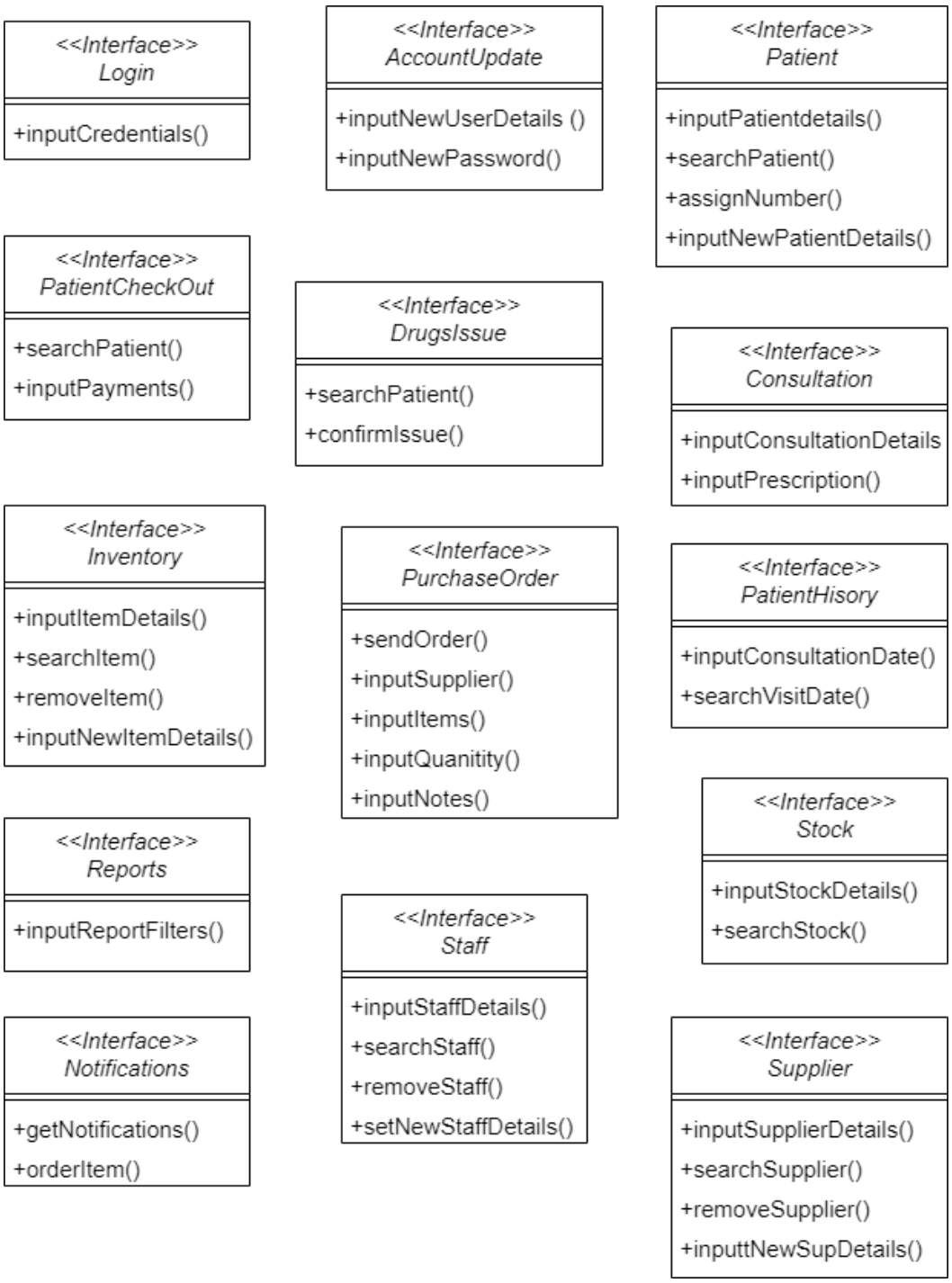

Figure 23 - View class diagram

3.4.3. Controller class diagram for the proposed system

Figure 24 illustrates the model class diagram for the proposed system. It demonstrates the different methods used to communicate with both the view and model classes along with the link between the Database controller.

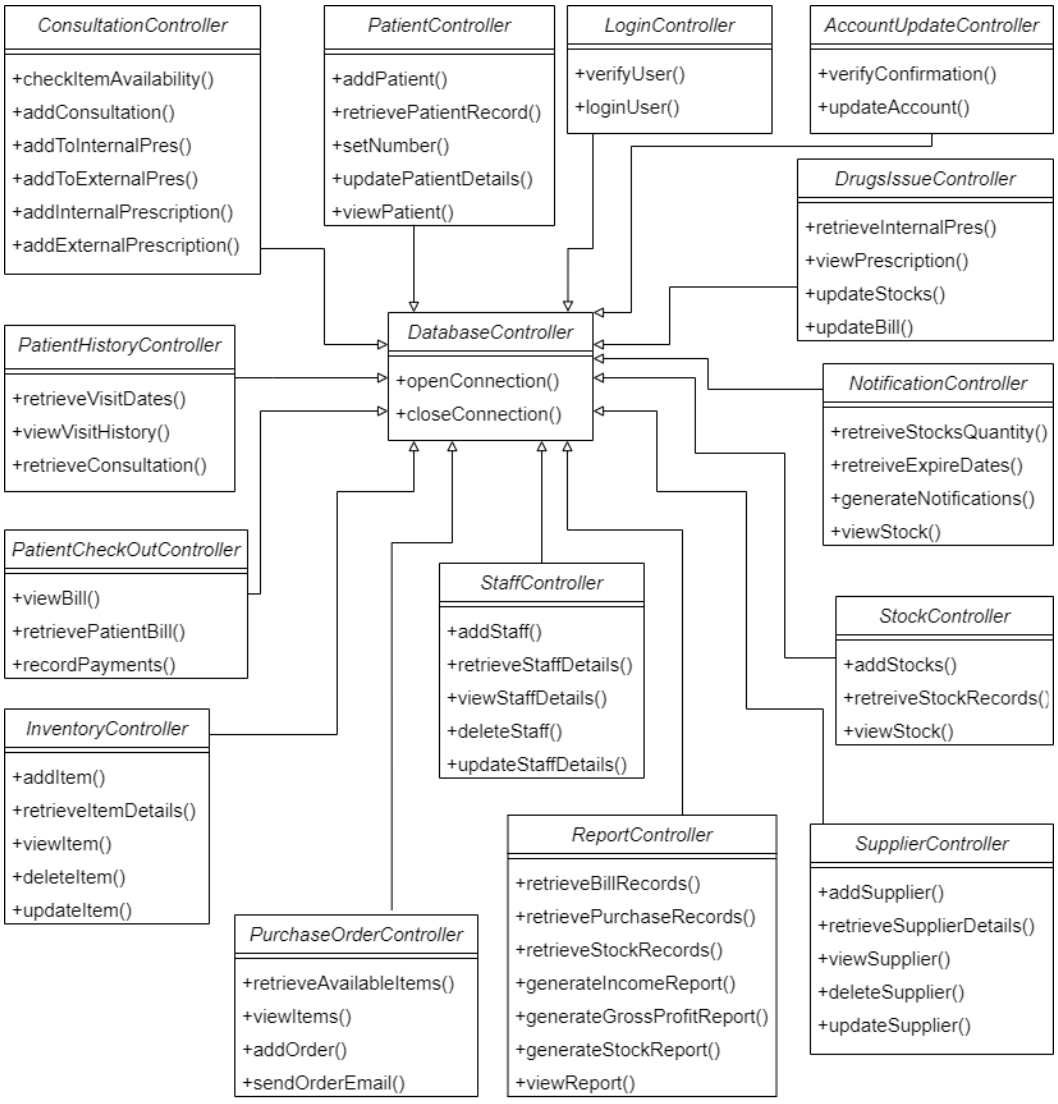

Figure 24 - Controller class diagram

3.5. Sequence diagrams for the proposed system

Sequence diagrams further explains the transaction of data within a use cases. Horizontal lifelines are used to represent actors and other objects which are in line with the MVC class diagrams.

3.5.1. Sequence diagrams for user login

Figure 25 illustrates the sequence diagram for the login process.

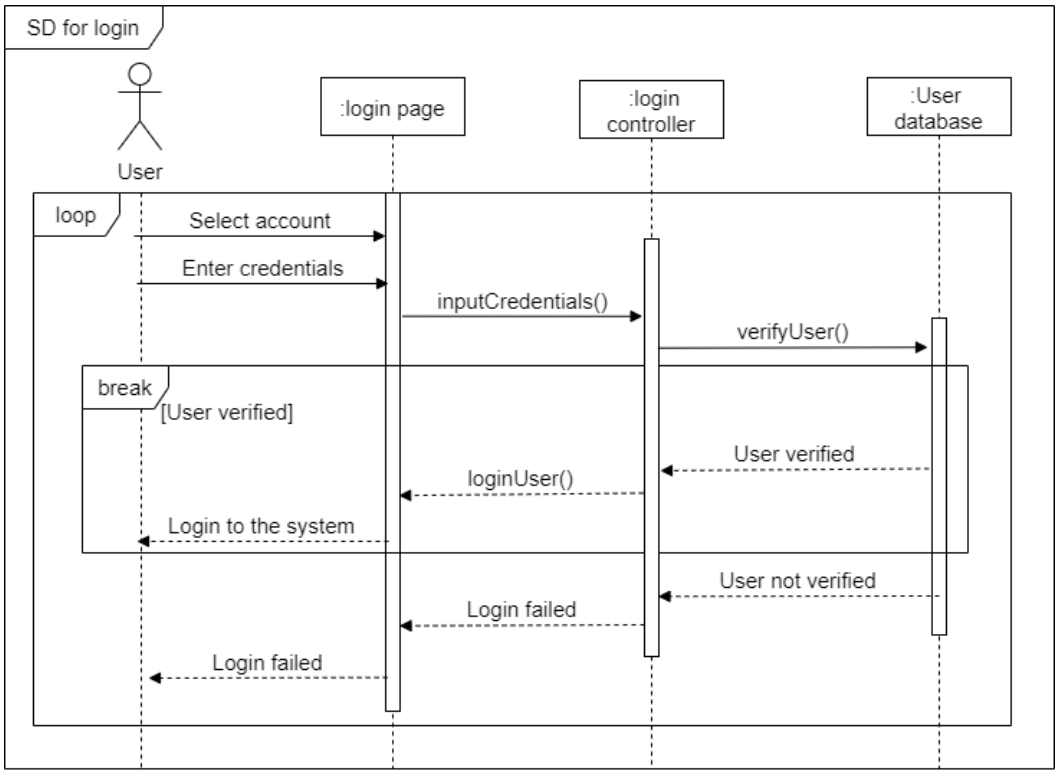

Figure 25 - Sequence diagram for user login

3.5.2. Sequence diagrams for updating user account

Figure 26 illustrates the sequence diagram for the account updating process. This includes updating basic details or resetting the password. The password needs to be confirmed to be reset.

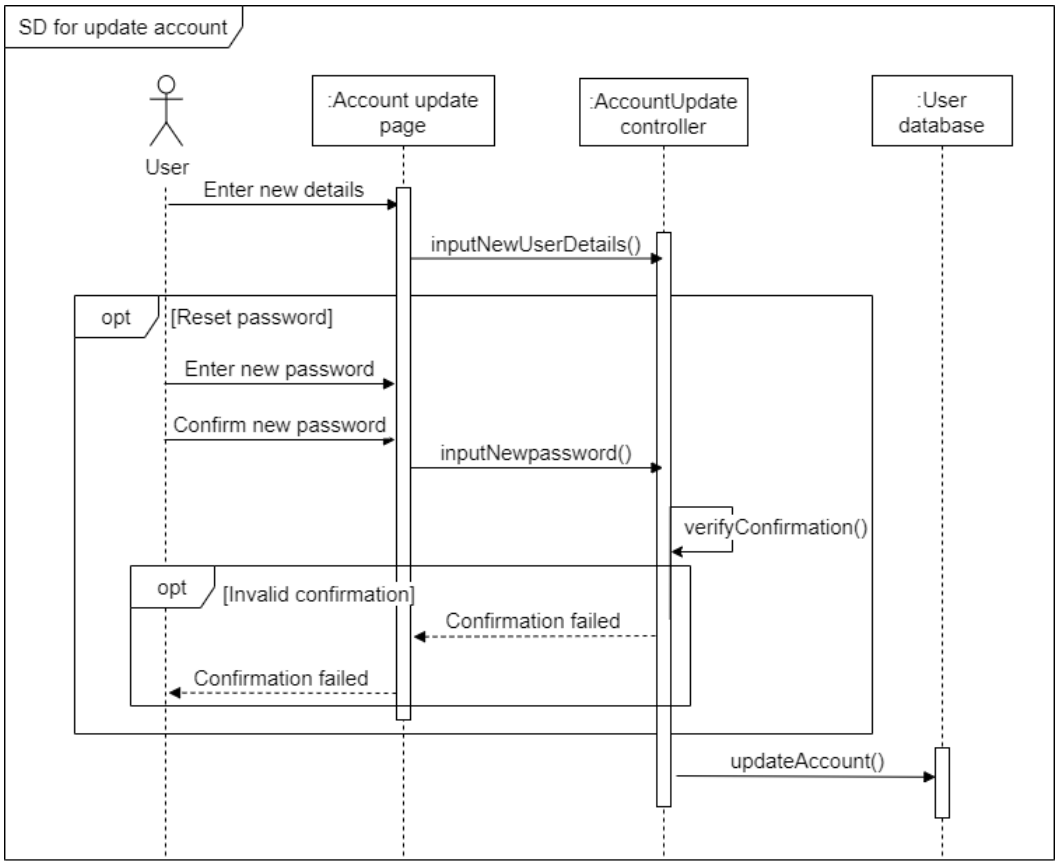

Figure 26 - Sequence diagram for updating user account

3.5.3. Sequence diagrams for viewing patient history

Figure 27 illustrates the sequence diagram for the viewing patient history process.

The doctor searches for patient to get the visit history of the patient. After selecting a particular visited date, the consultation data relevant to that visit will be communicated the user to provide as the patient history.

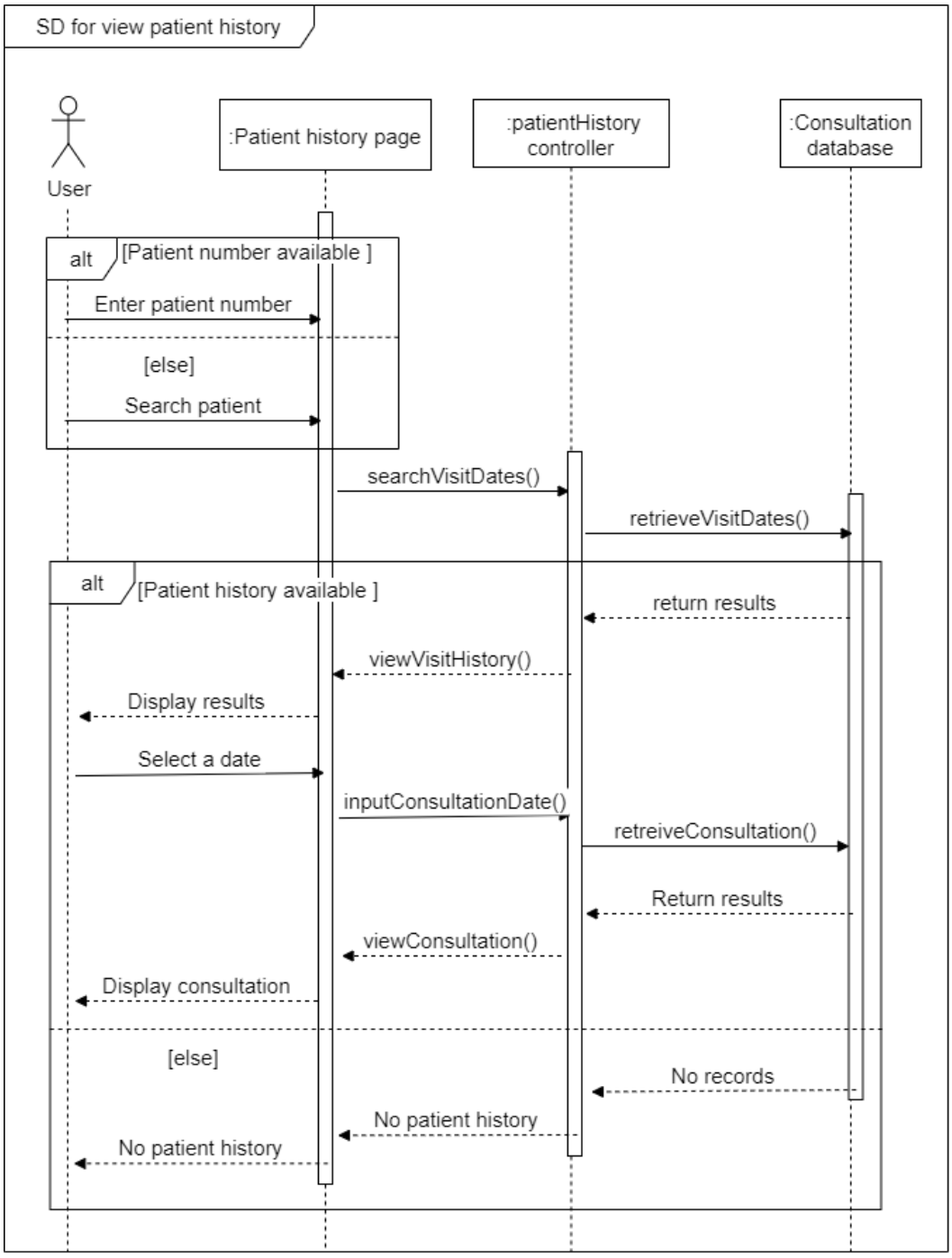

Figure 27 - Sequence diagram for viewing patient history

3.5.4. Sequence diagrams for providing consultation

Figure 28 illustrates the sequence diagram for the providing consultation process. Recording of consultation details and the issuing of prescription are the major sections. There will be two types of prescription as internal and external depending on the availability of stocks.

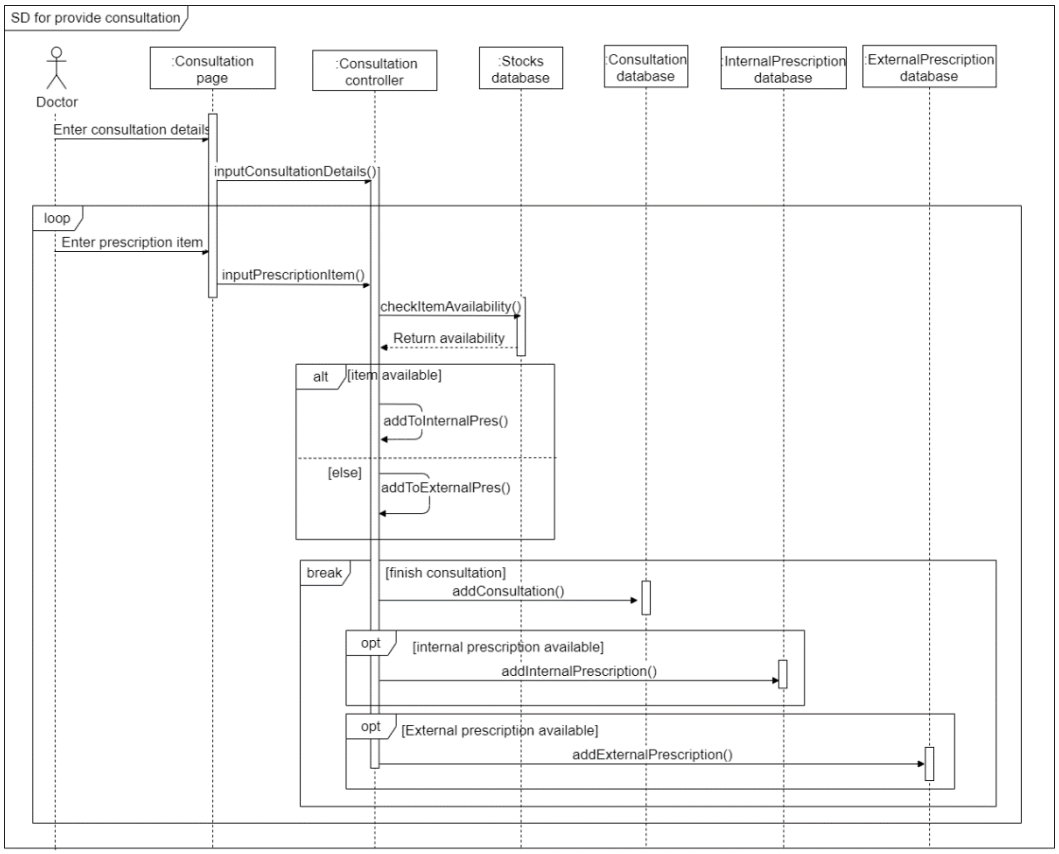

Figure 28 - Sequence diagram for providing consultation

3.5.5. Sequence diagrams for registering patients

Figure 29 illustrates the sequence diagram for the registering patient process. When a new patient visits the medical center, he/she will be registered.

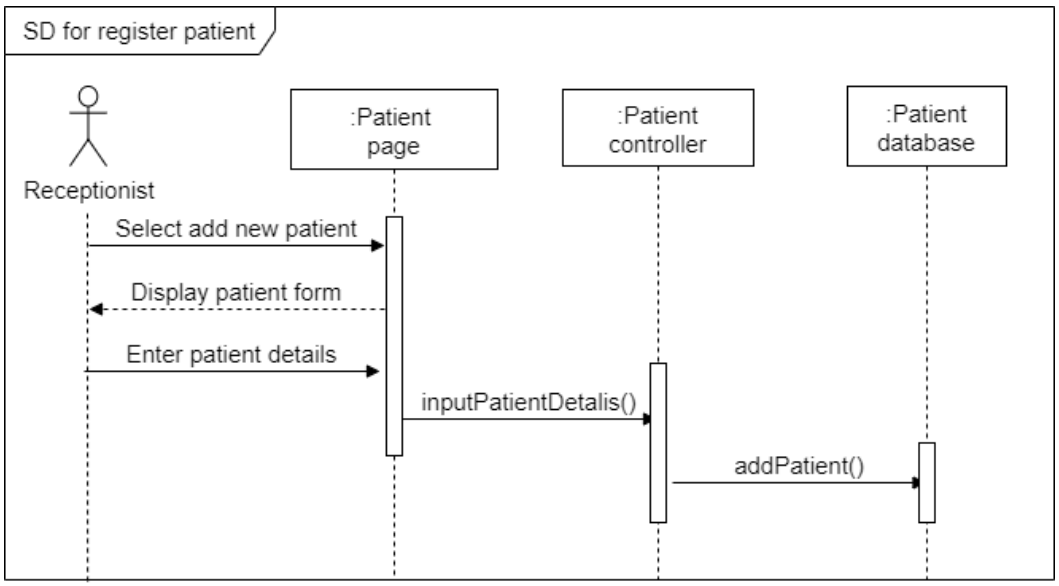

Figure 29 - Sequence diagram for registering patients

3.5.6. Sequence diagrams for managing patients

Figure 30 illustrates the sequence diagram for the process of managing patients. The registered patients can be searched and updated. Also, he/she can be assigned a number to be examined. That number will link to the patient record till he/she checks out from the medical center.

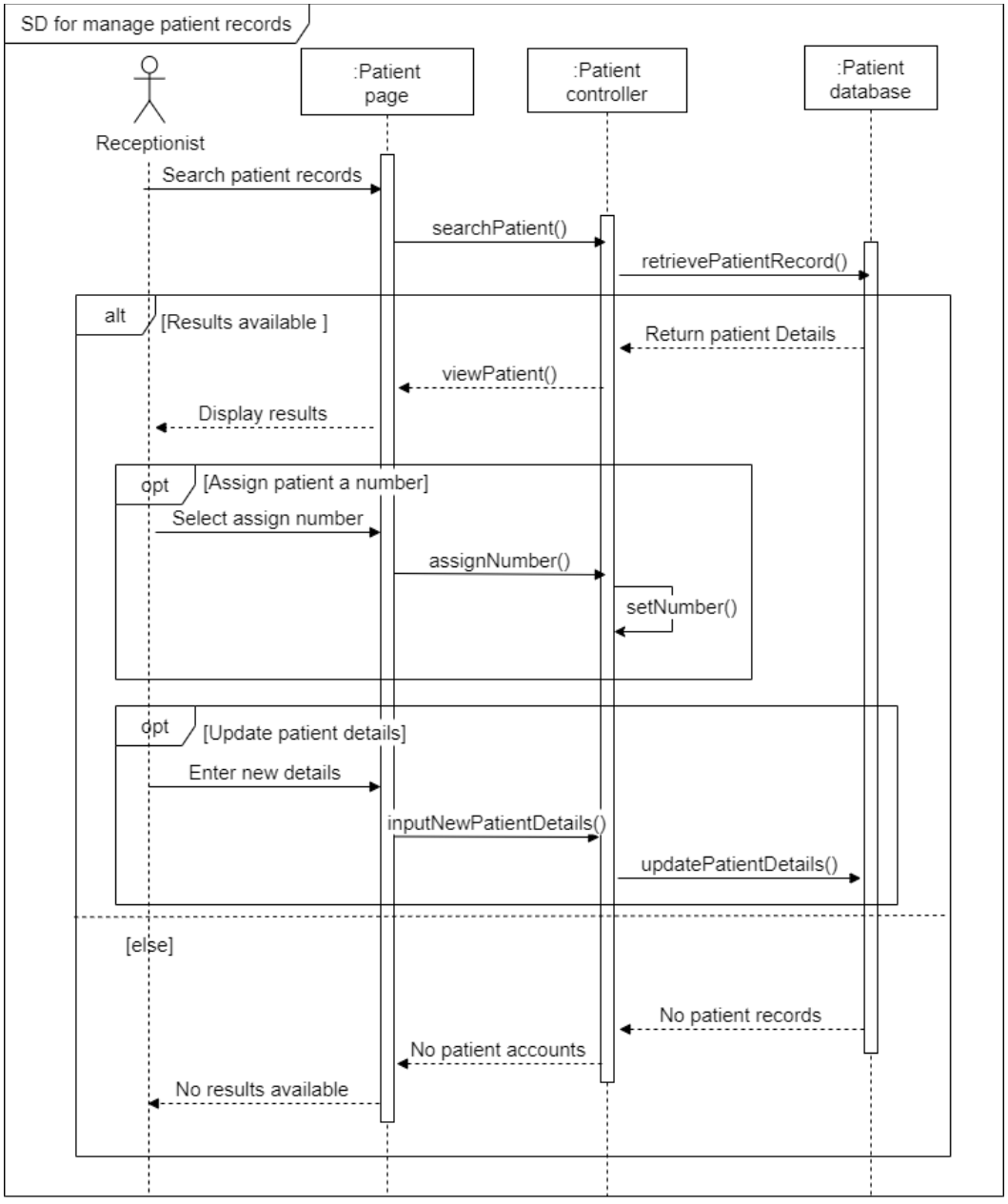

Figure 30 - Sequence diagram for managing patients

3.5.7. Sequence diagrams for checkout of patients

Figure 31 illustrates the sequence diagram for the checking out patient process. The handling of the patient bill that got updated from consultation and issuing of drugs takes place in this scenario.

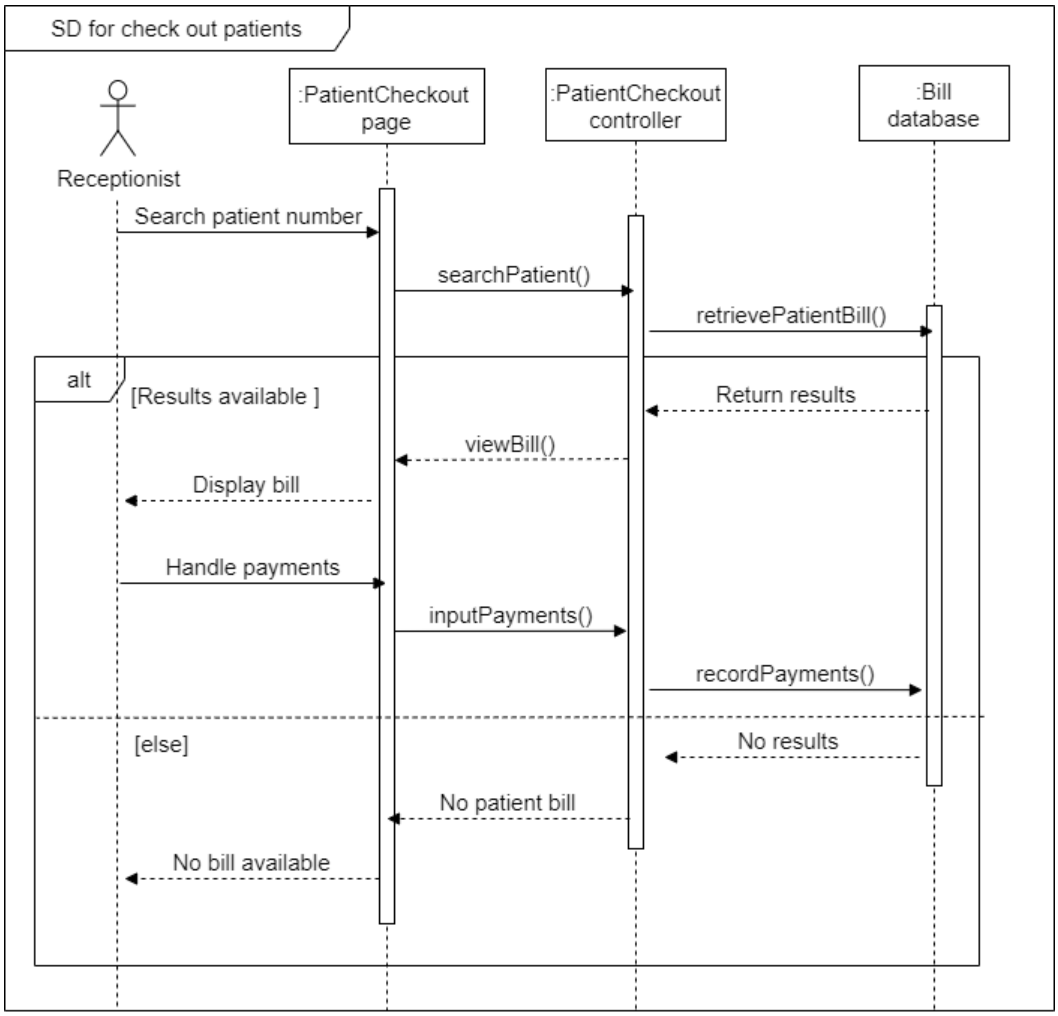

Figure 31 - Sequence diagram for checking out patients

3.5.8. Sequence diagrams for recording issue of drugs

Figure 32 illustrates the sequence diagram for the recording issue of drugs process.

The internal prescription issued to the patient will be displayed to the dispenser where he can issue the drugs and confirm the withdrawal. With that confirmation the patient bill and the stocks will be updated.

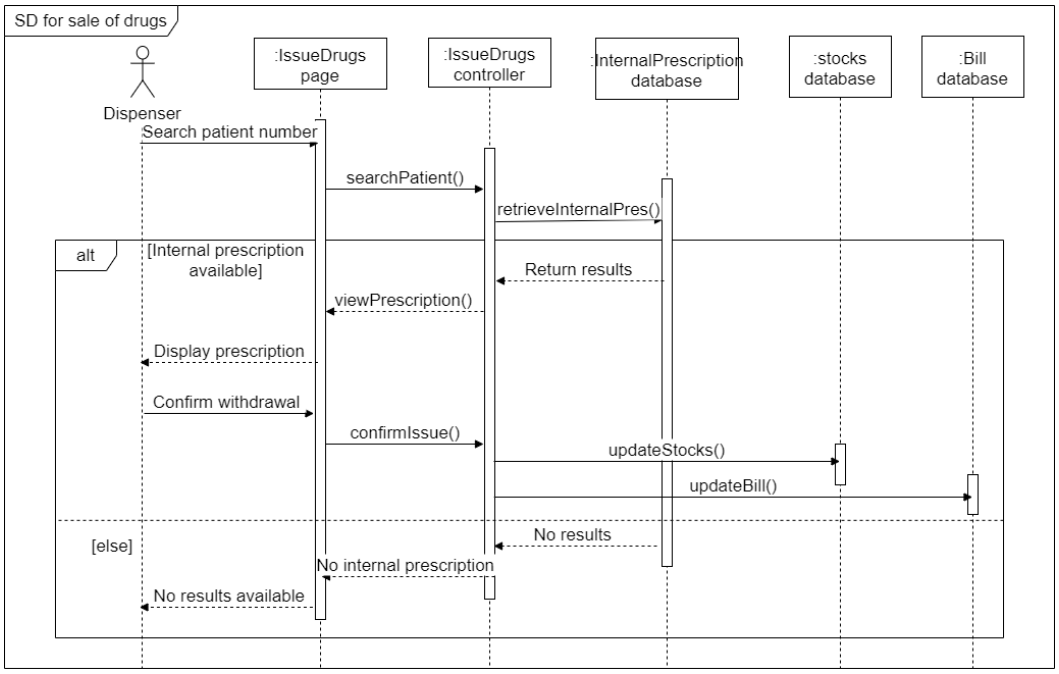

Figure 32 - Sequence diagram for recording issue of drugs

3.5.9. Sequence diagrams for managing inventory

Figure 33 illustrates the sequence diagram for the managing process. It shows the communication between different objects in a case of adding, searching, updating, or removing an inventory item.

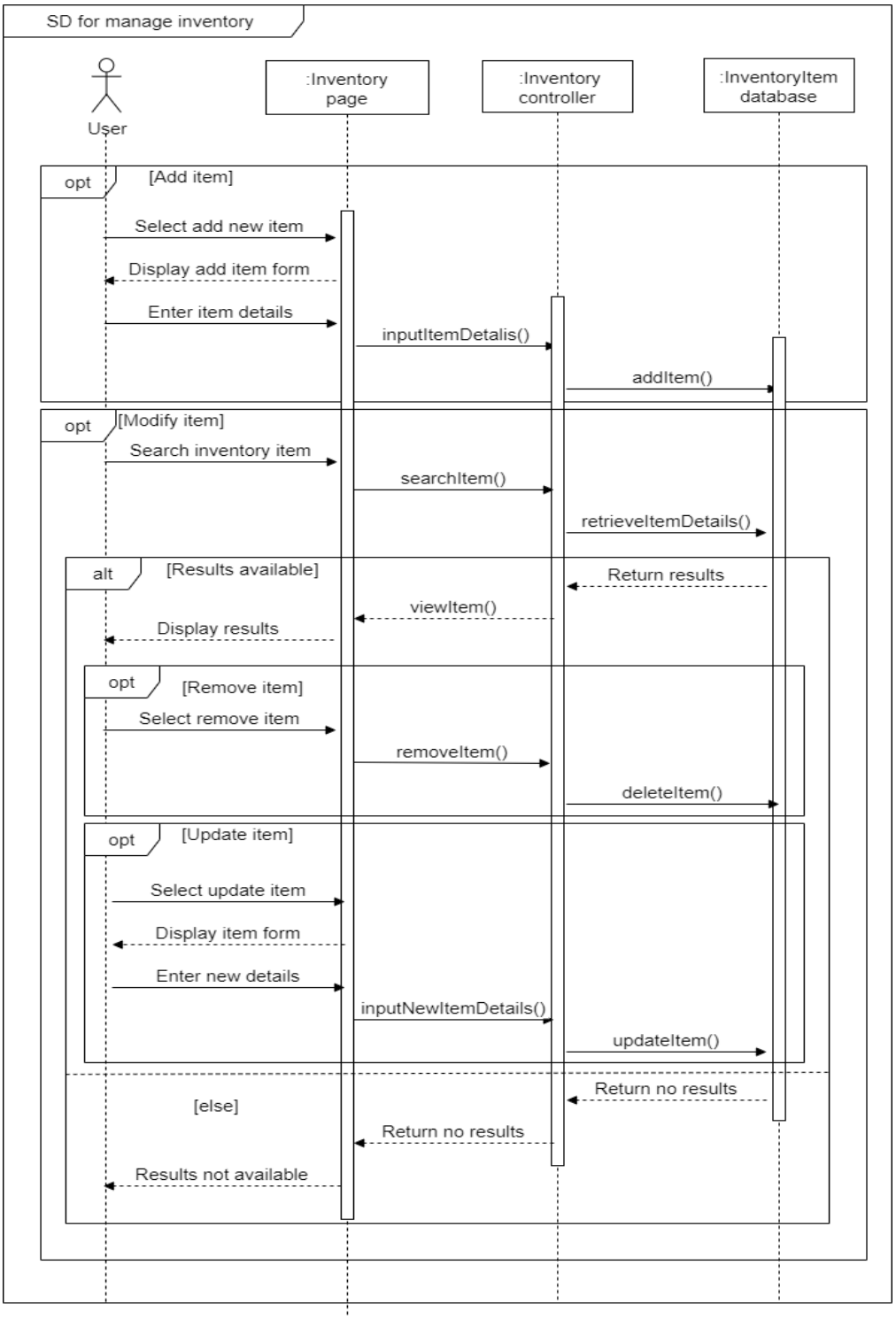

Figure 33 - Sequence diagram for managing inventory item

3.5.10. Sequence diagrams for managing stocks

Figure 34 illustrates the sequence diagram for the managing stocks process. It only includes adding stocks and searching stocks. Updating and removal of stocks are not something that can be done as such data should not be manipulated.

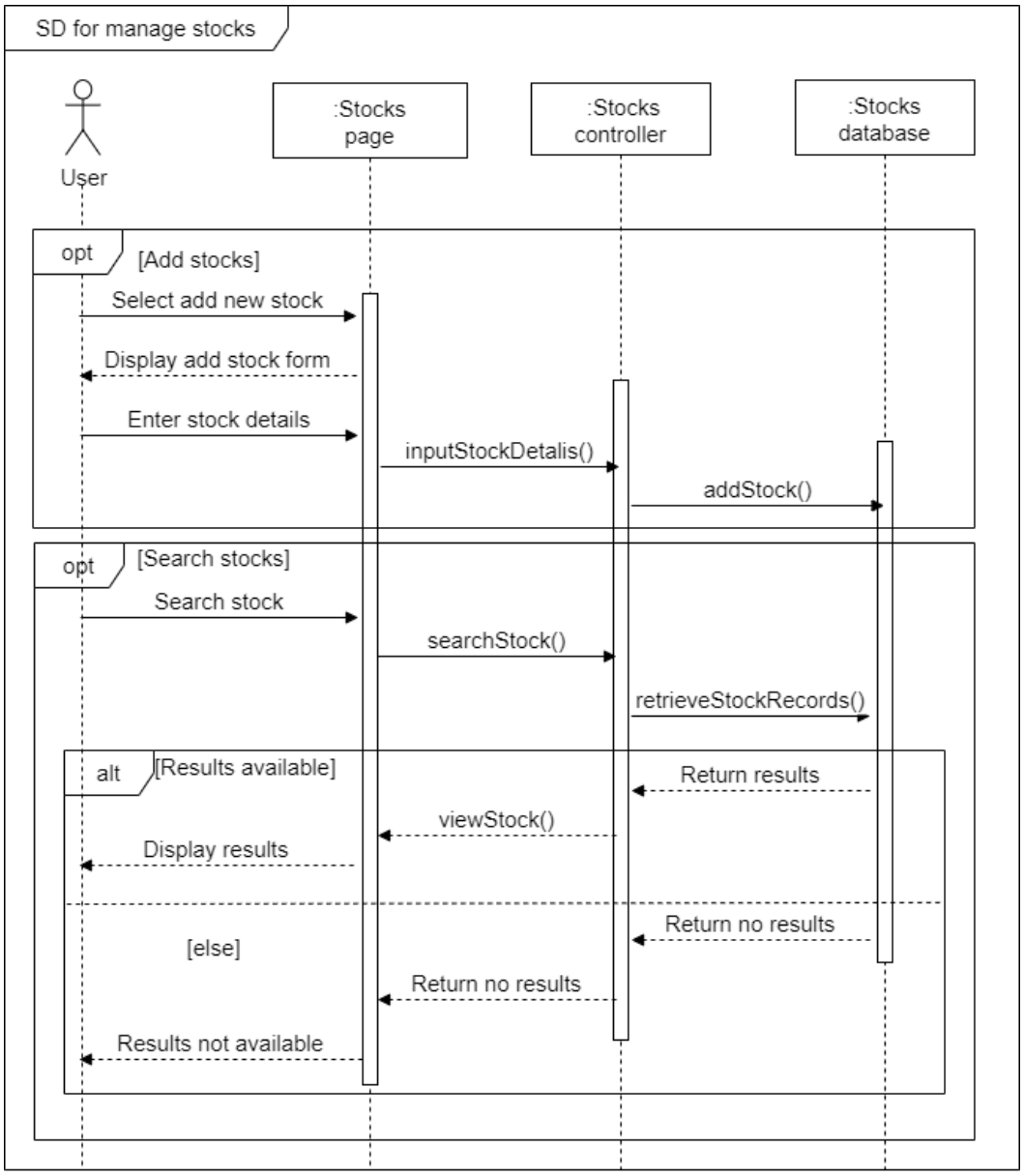

Figure 34 - Sequence diagram for managing stocks

3.5.11. Sequence diagrams for sending out purchase order

Figure 35 illustrates the sequence diagram for the sending out purchase order process. It starts with selecting a supplier. The items that the supplier has will be displayed after retrieving it from the database. Then the items and the quantities can be set along with a note if needed. Finally, the purchase order will be sent to the supplier through an email.

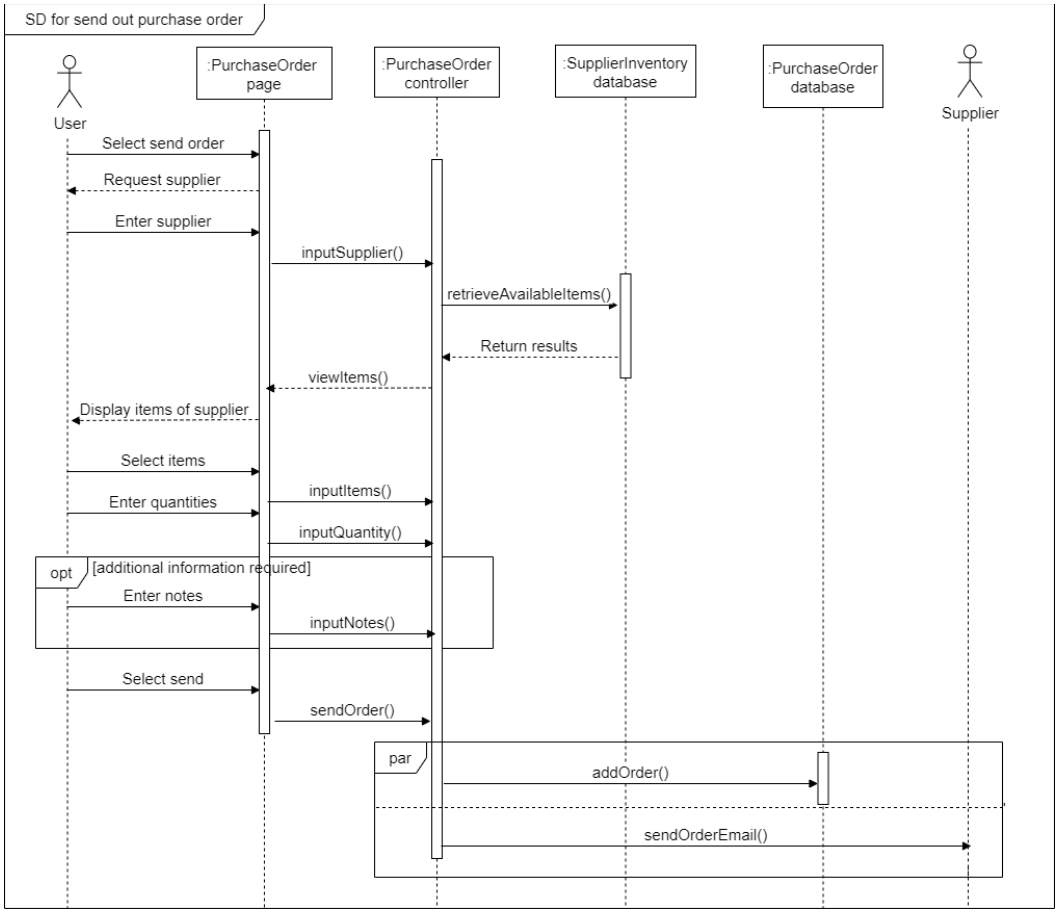

Figure 35 - Sequence diagram for sending out purchase order

3.5.12. Sequence diagrams for receiving stock notifications

Figure 36 illustrates the sequence diagram for the receiving stock notification process. The stocks that are closer to expire and are low in stocks will be retrieved from the stocks database. After retrieving relevant data, the notification controller class generates the notification and displays them to the user. user can order the notified items which will refer to sending out a purchase order.

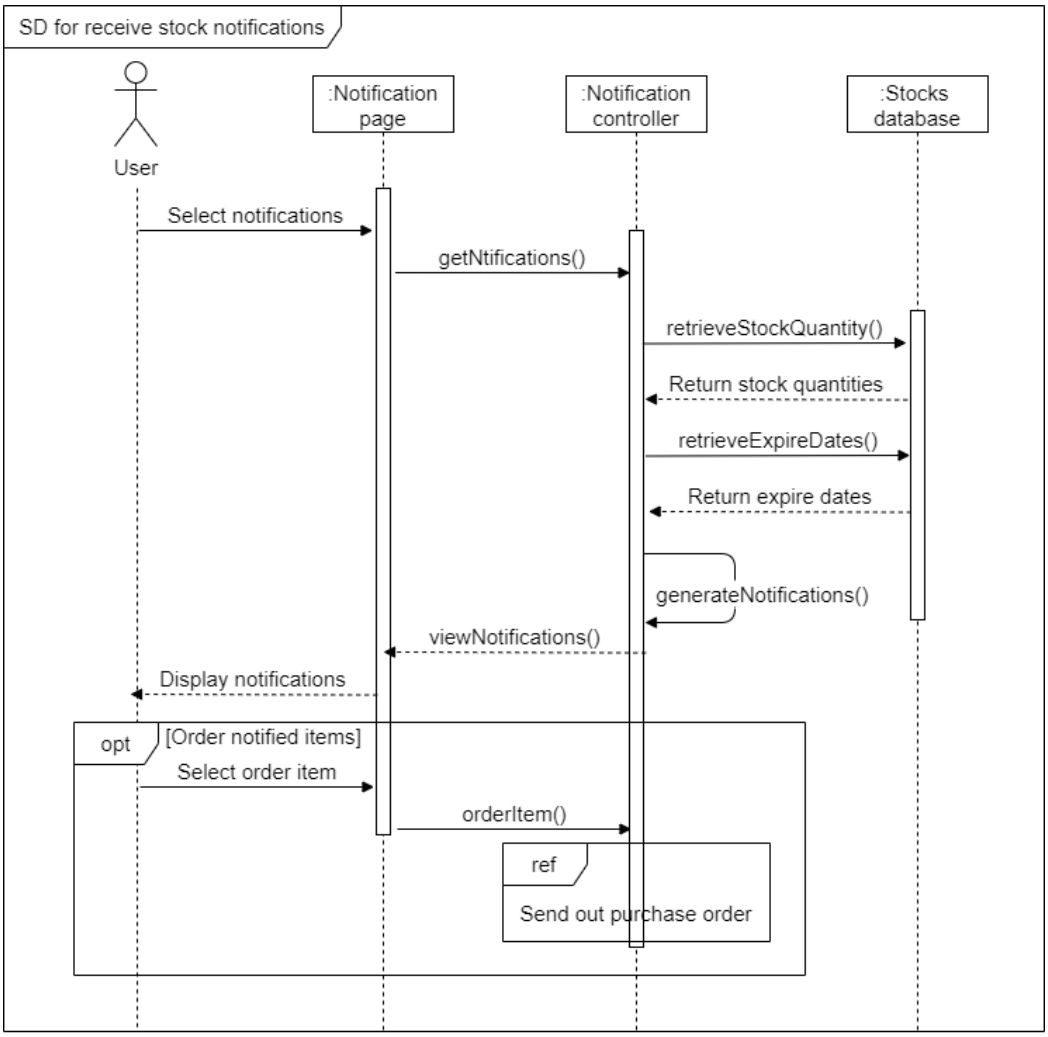

Figure 36 - Sequence diagram for receiving stock notifications

3.5.13. Sequence diagrams for managing staff

Figure 37 illustrates the sequence diagram for the managing staff process. It consists of adding, searching, updating, or removing staff records.

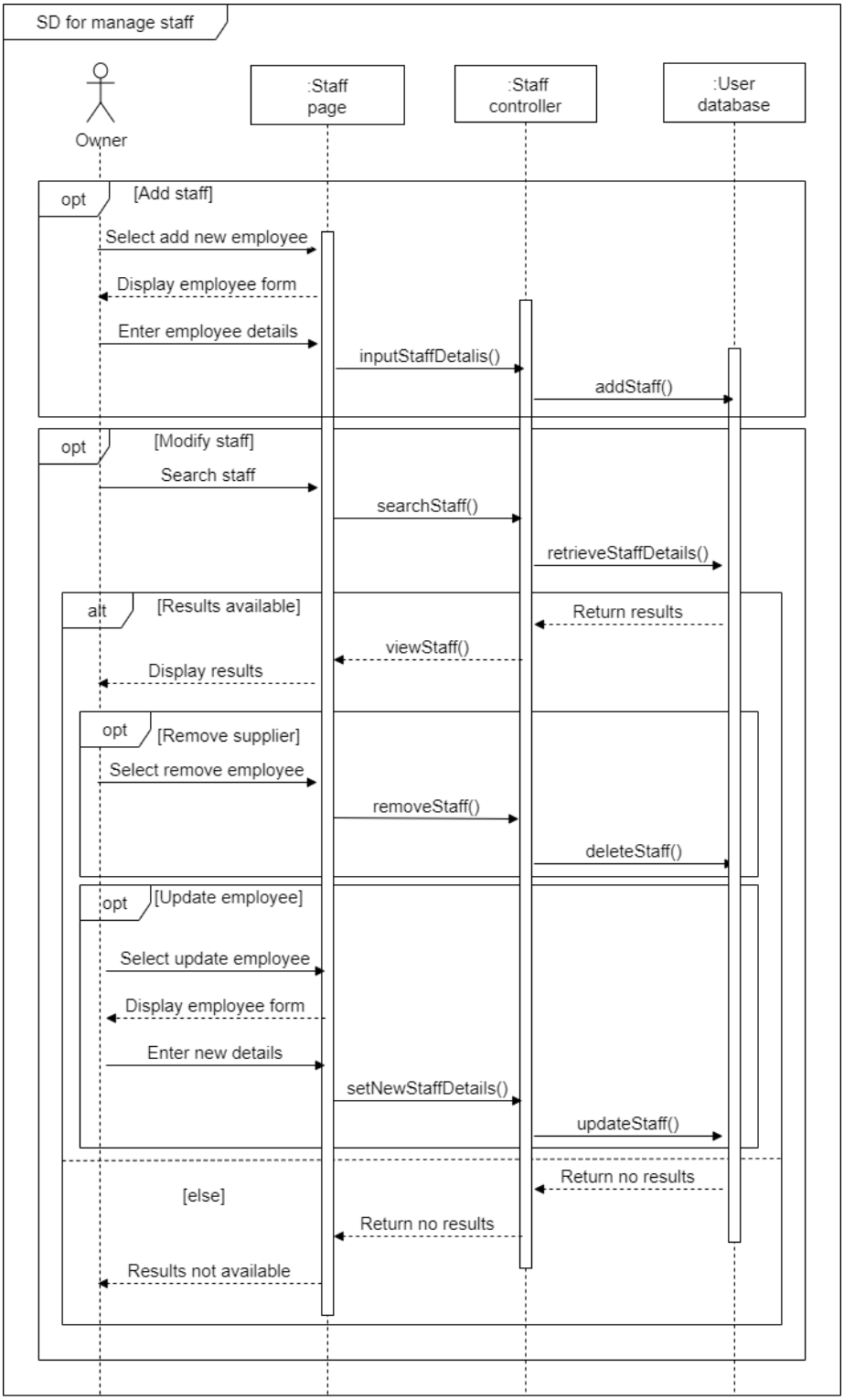

Figure 37 - Sequence diagram for managing staff

3.5.14. Sequence diagrams for managing suppliers

Figure 38 illustrates the sequence diagram for the managing supplier process. It consists of adding, searching, updating, or removing supplier records.

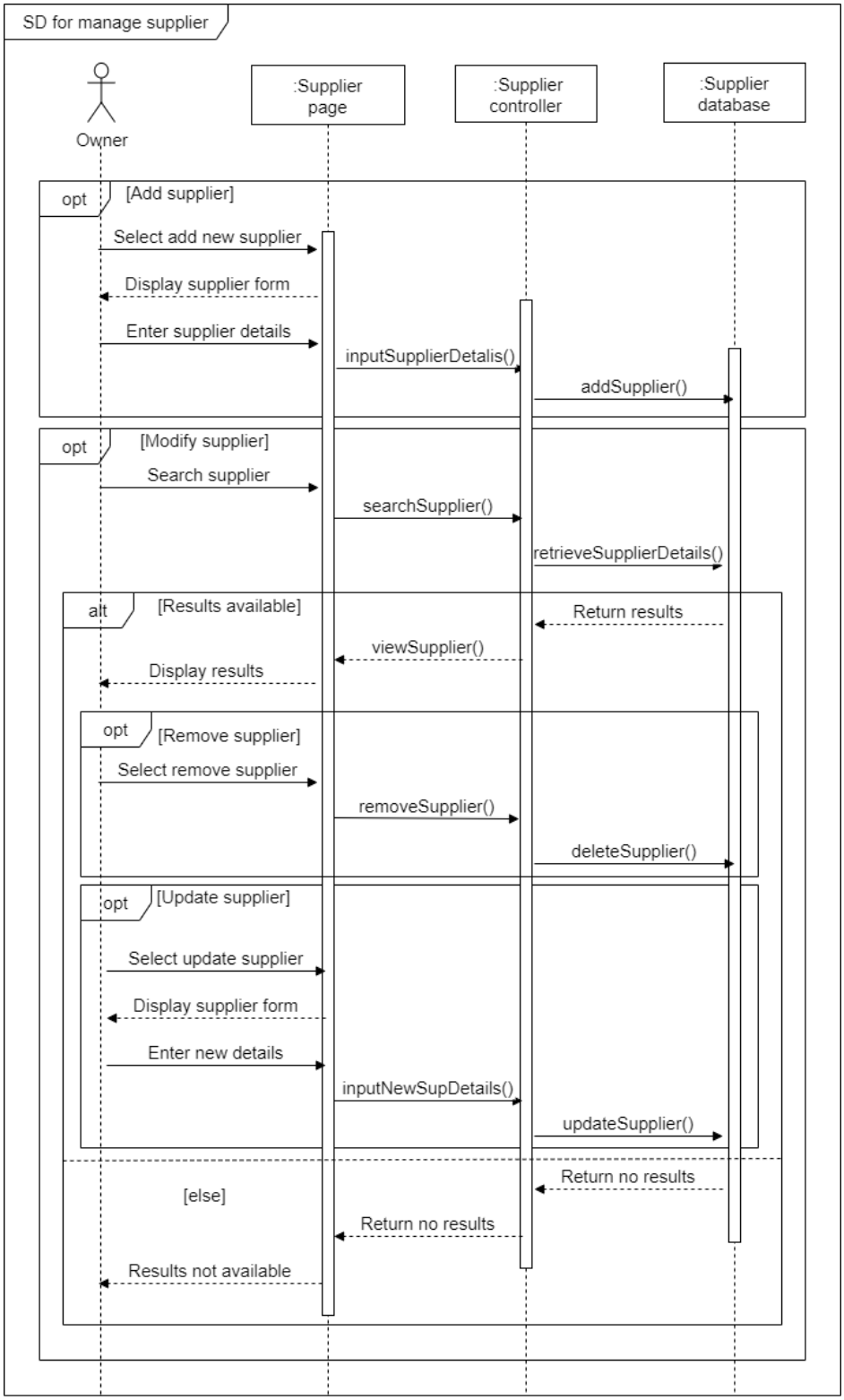

Figure 38 - Sequence diagram for managing suppliers

3.5.15. Sequence diagrams for viewing reports

Figure 39 illustrates the sequence diagram for the viewing report process. Depending on the report type, data will be retrieved through different sections. Then the report controller will generate the report and display it to the admin.

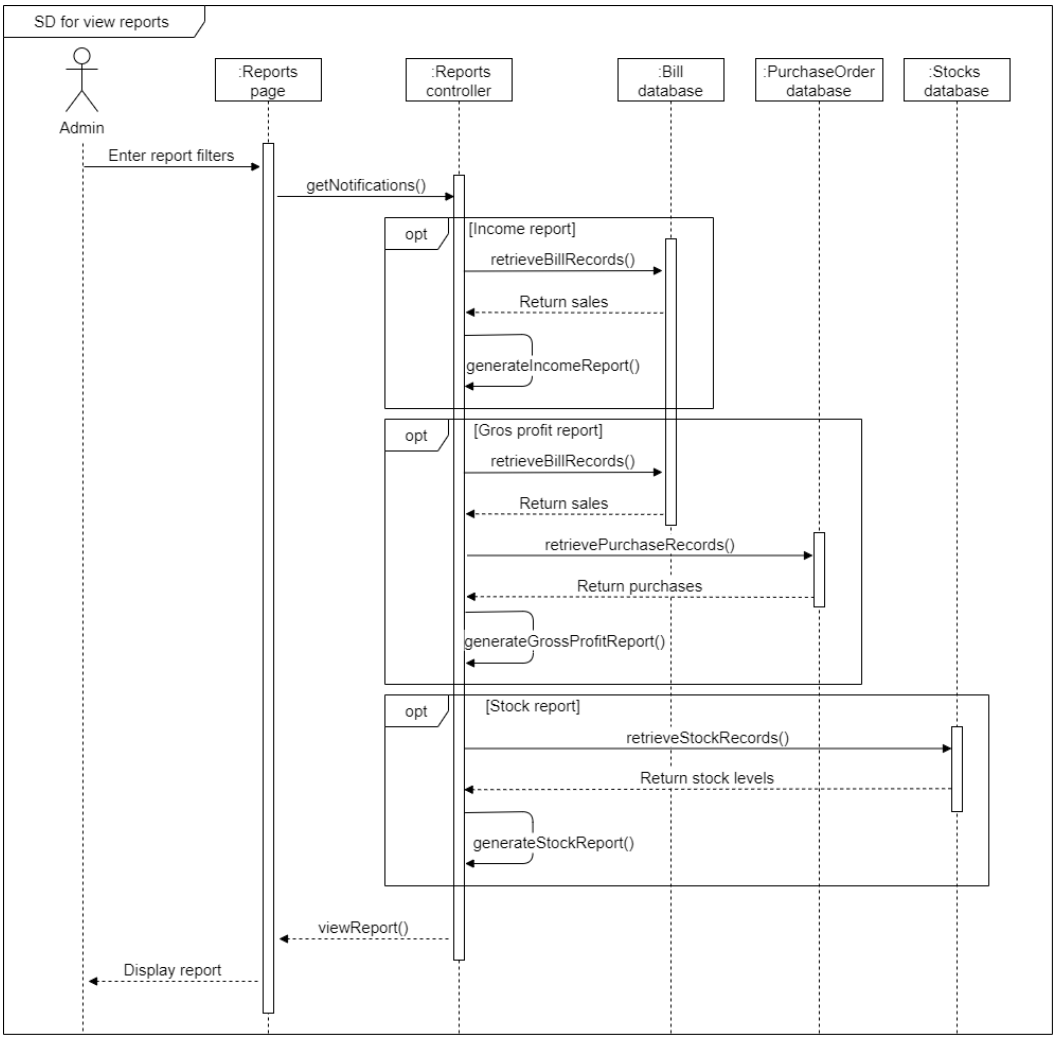

Figure 39 - Sequence diagram for viewing reports

3.6. Database models for the proposed system

The database design includes the entity relationship diagram, and the normalized database design.

3.6.1. Entity relationship diagrams

Figure 40 illustrates entity relationship diagram for the proposed system. It explains the structure of a database with different entities and relationship. The following ER diagram is done with the crow's foot notation.

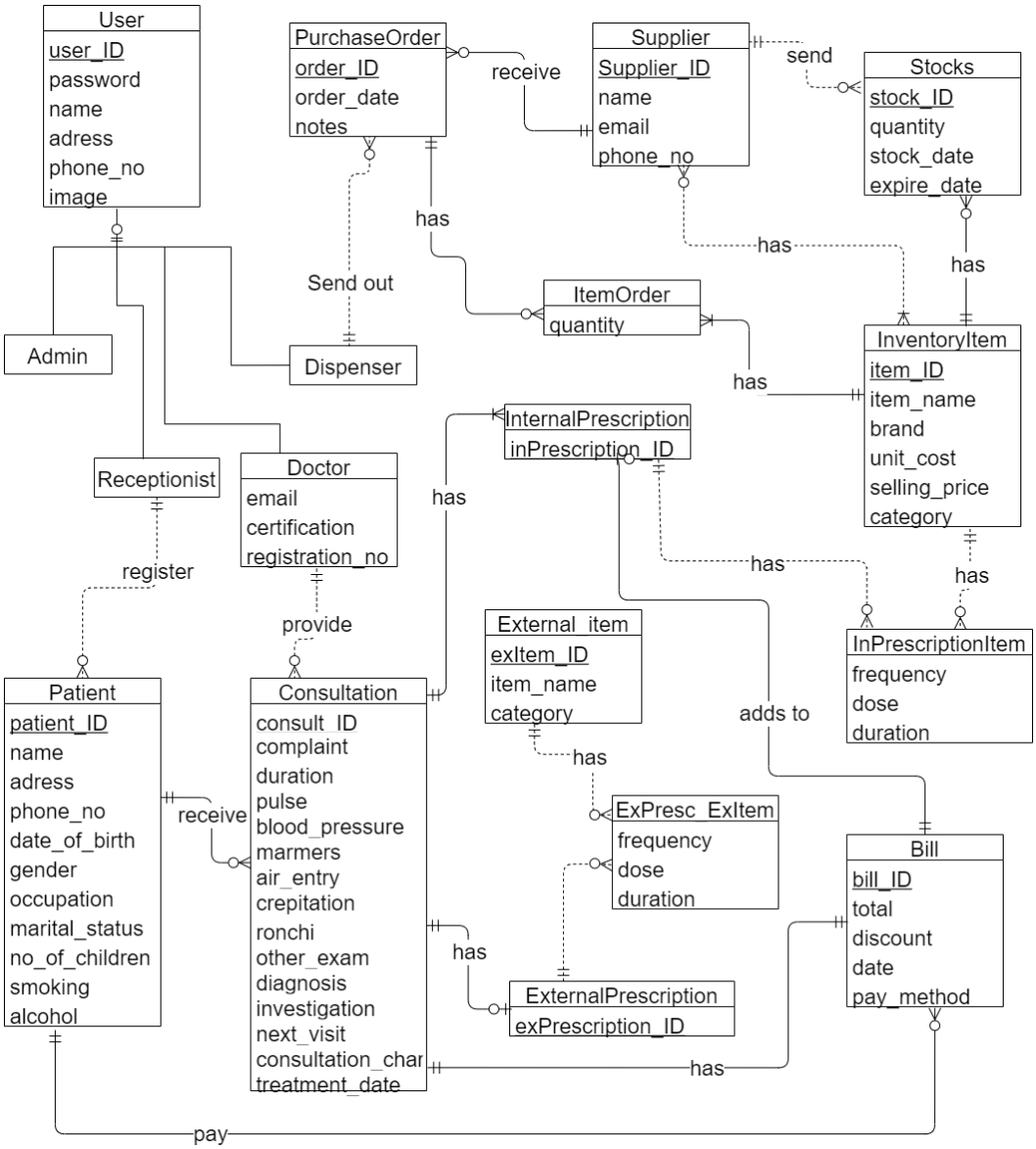

Figure 40 - Entity relationship diagram

3.6.2. Normalized database design

Figure 41 illustrates the normalized database design. It is obtained using the figure 40 -ER diagram. It provides an improved structure from a relational database with more clarity.

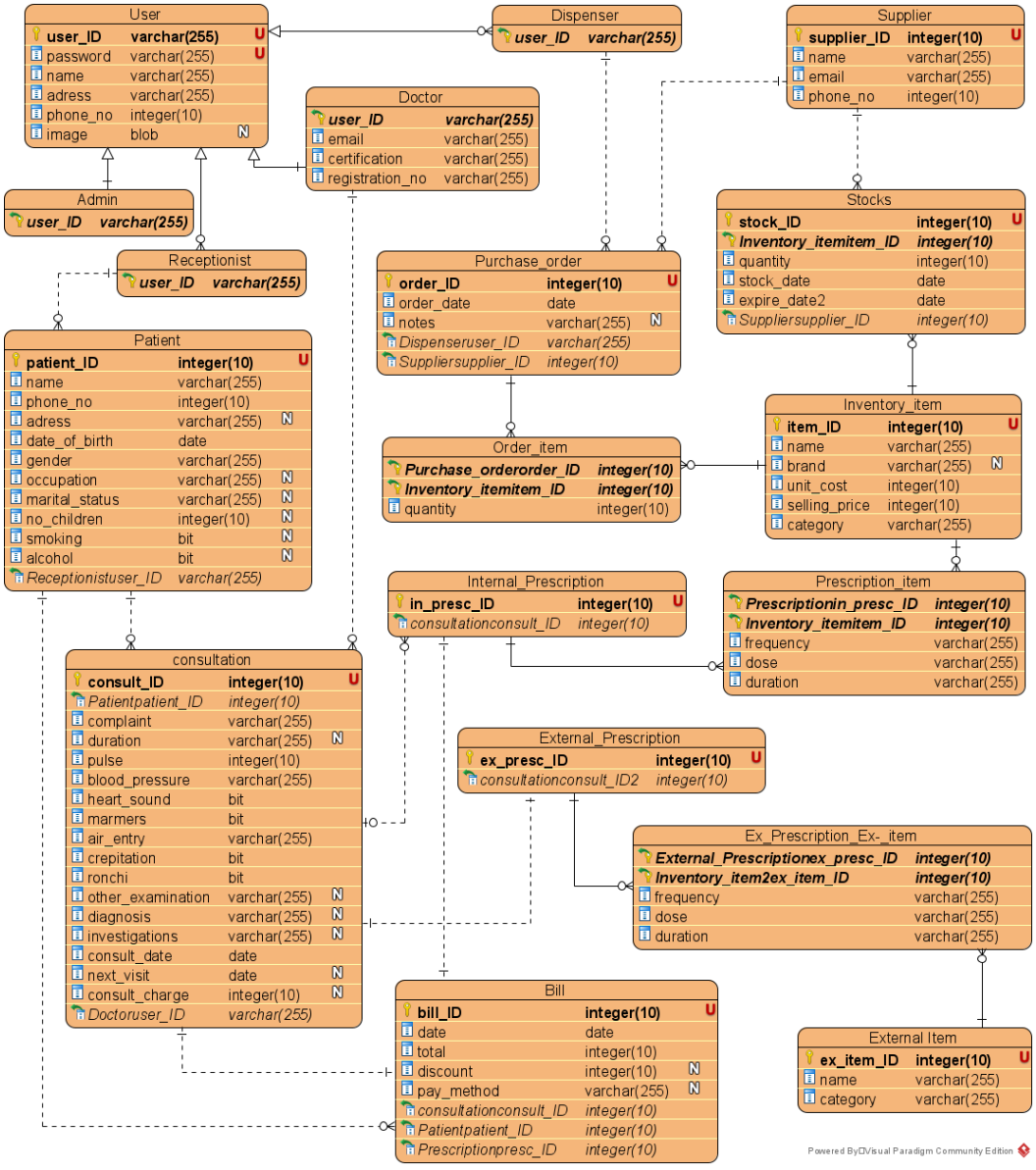

Figure 41 - Normalized database design

3.7. Chapter summary

This chapter explains the design of the proposed system. Use case diagram, use case descriptions, activity diagrams, class diagrams, sequence diagrams and database models are used for the system design. The chapter is concluded with the design of data capturing interfaces and report layouts.

CHAPTER 4

4. SYSTEM DEVELOPMENT

Chapter overview

4.1. Programming languages and frameworks

4.2. Development tools and technologies

4.3. Third party components and libraries

4.4.Chapter summary

4.1.Programming languages and frameworks

4.1.1. JavaScript (JS)

JavaScript is a programming language which is use widely for dynamic web development applications. It offers object oriented capabilities. Since there needs to be the ability to manage user interactions from the frontend application, JavaScript becomes much more useful.

4.1.2. Hyper Text Markup Language (HTML)

Hyper Text Markup Language is used for creating web pages and web applications. HTML turn text into images, tables, links and many other forms that are present in a web application frontend. Incorporating JavaScript with HTML allows the preparation of a interactive web application that different users will interact with.

4.1.3. Cascading Styles Sheet (CSS)

Cascading Style Sheet is a language based for designing which offers the functionality of making the HTML web pages more attractive and user friendly. It gives control of colors, font sizes, alignments, spacing and many other aspects of a web page.

4.1.4. ReactJs

React is a front-end library used for handling the viewing layer of a web page and can. It is a widely used JavaScript library and allows the reusability of UI components. React components implement a render() method that takes input data and returns what to display.

4.1.5. NodeJs

Node.js is an open source server environment and it is utilized as the main components that handles the interactions with the database.Node.js eliminates the waiting time when handling requests as it simply continues with the request. Node.js runs single-threaded, non-blocking, asynchronously programming, which is very memory efficient.

4.1.6. Express

Express is web framework, written in JavaScript and hosted within the Node.js runtime environment. Express sets up middleware's to respond to HTTP requests which are used for Handling different database interactions withing the NodeJS environment.

4.1.7. MongoDB

MongoDB is a NoSQL database which uses JSON documents with optional schemas to store data.

4.2.Development Tools and Technologies

Technology	Use
Visual Studio Code	Visual Studio Code was the main tool used for coding purposes. Both the backend and the frontend coding were done with the Visual Studio Code application.
MongoDB compass	The database was hosted locally, and MongoDB compass was used as the interaction point of accessing data.
Insomnia	Insomnia was used to test the functionality of different HTTP requests coded while developing.
Power Bi	Power Bi was used to generate reports which is a main functional requirement of the client.
GitHub	GitHub offered securing the developments done along the way as it was backed up in the cloud.

4.3.Third Party Components and Libraries

Libraries Used	Functionality
Multer	Multer was used for saving different file types withing the server.
NodeMailer	Nodemailer allows to send emails to different users from a single email account. The email body consists of an HTML code.
Mongoose	Mongoose is used for defining different schemas that will be entered into the MongoDB database.
Axios	Axios allows the connection between the fronend and the backend as it can call the HTTP requests defined in the backend.
Bootstrap	Bootstrap provides JavaScript-based design templates that can be used for the UI development.
Sweetalters	Sweetalerts were used to communicate different processes for the users in an attractive manner.
Moment	the current time, calculate time durations and convert time formats are enabled with Moment
JsPDF	JsPDF was used to convert different HTML elements in the front end to PDF formats.

4.4.Chapter summary

In this chapter, the development aspects of the system have been elaborated under the areas of technologies, constraints, third party support etc. The factors such as availability, cost, performance, functionality, etc. have been considered in order to decide the technologies described above.

CHAPTER 5

5. SYSTEM TESTING

Chapter overview

5.1. Test Plan and Test Strategy

5.2. Test Cases

5.3. Test Report

5.4.Chapter summary

5.1. Test plan and test strategy

Test planning is a vital part in the development process as it makes sure that the project is keeping up with the milestones set and their functionality. It defines the different activities to be tested and their expected outcome. Then the test cases are developed relevant to the use case descriptions. They were executed manually, and results were recorded. If any desired outcomes were not present, relevant correction actions were performed till the desired outcome is achieved.

5.1.1. Testing approach

Testing approach: Black box testing

Black Box testing methods refers to where the focus is given for the inputs and outputs of data without giving any consideration to the internal mechanisms. It is entirely based on software requirements and specifications. To further elaborate, known inputs are entered into the system while expecting a known outcome. Yet the process of transforming the known input into a known output is unknown which is referred to as the Blackbox.

5.2. Test case

The testing environment consists of MS-Windows 10: version 20H2 as the operating system and Google Chrome, Microsoft Edge as web browsers

5.2.1. Test case for PS-01. Login

ID	Test	Input	Expected output	Status
1.1	Login to the system	Correct username and correct password	User will be redirected to the page relevant to his/her role	Passed
1.2	Login to the system	Incorrect username or incorrect password	User will be notified about the false entry of data	Passed

Table 25-Test case for Login

5.2.2. Test case for PS-02. Update account

ID	Test	Input	Expected output	Status
2.1	Updating account details	Correctly formatted data for all attributes	User will be notified about the successful account update.	Passed
2.2	Updating account details	Falsely formatted data for at least one attributes	User will be notified about the false entry of data	Passed
2.3	Resetting password	Enter correct current password and new password matching with the confirm password	User will be notified about the successful password reset.	Passed
2.4	Resetting password	Enter correct current password but new password mismatching with the confirm password	User will be notified about the mismatch of new passwords.	Passed
2.5	Resetting password	Enter false current password.	User will be notified about the invalid current password	Passed

Table 26-Test case for Update account

5.2.3. Test case for PS-03. View patient history

ID	Test	Input	Expected output	Status
3.1	Viewing the patient visit history	A currently available patient assigned number is entered and searched	Users visit history will appear	Passed
3.2	Viewing a particular past consultation	Click on an available single visit history record	Relevant consultation and the treatments will appear.	Passed

Table 27-Test case for View patient history

5.2.4. Test case for PS-04. Provide consultation

ID	Test	Input	Expected output	Status
4.1	Entering item to the prescription	Enter an item recorded in the allergic history of the current patient	The item will not be allowed to be entered with the drug allergy alert	Passed
4.2	Entering item to the prescription	Enter an item that has sufficient sock for the relevant treatment item	Item will be added to the internal prescription	Passed
4.3	Entering item to the prescription	Enter an item that has insufficient sock for the relevant treatment item	Item will be added to the external prescription	Passed
4.4	Adding the consultation	Enter all required details.	Added consultation will be displayed in the patient history list.	Passed
4.5	Adding the consultation	Not enter at least one required detail.	User will be notified about the absence of inputs.	Passed

Table 28-Test case for Provide consultation

5.2.5. Test case for PS-05. Register patient

ID	Test	Input	Expected output	Status
5.1	Adding a new patient	Enter all required details.	Added patient will be displayed in the patient list	Passed
5.2	Adding a new patient	Not enter at least one required detail.	User will be notified about the absence of inputs.	Passed

Table 29-Test case for Register patients

5.2.6. Test case for PS-06. Manage patient records

ID	Test	Input	Expected output	Status
6.1	Assigning a number	Selecting a patient that has not being assigned a number	Number assigning form will appear.	Passed
6.2	Assigning a number	Selecting a patient that has already being assigned a number	User will be asked whether the number wants to be changed through an alert.	Passed
6.3	Adding an appointment	A doctor and a date is selected for the needed appointment	The appointment schedule of the selected doctor displays the newly added appointment.	Passed
6.4	Editing a patient's profile	Correctly formatted data for all attributes	User will be notified about the successful update.	Passed
6.5	Editing a patient's profile	Falsely formatted data for at least one attributes	User will be notified about the false entry of data	Passed

Table 30-Test case for Manage patient records

5.2.7. Test case for PS-07. Checkout patients

ID	Test	Input	Expected output	Status
7.1	Retrieving the invoice of a patient's visit	A currently available and consultation concluded patient assigned number is entered and searched	The invoice relevant for the patient's visit will be generated and displayed	Passed
7.2	Retrieving the invoice of a patient's visit	A currently available and consultation not concluded patient	The consultation is in progress note will appear	Passed

		assigned number is entered and searched		
7.3	Retrieving the invoice of a patient's visit	A currently not patient assigned number is entered and searched	Invalid number alert will appear	Passed
7.4	Adding a discount	Entering an amount to the discount section	Total value will alter accordingly	Passed
7.5	Completing checkout	Click on checkout	Checkout completion will be notified, the invoice pdf will be converted, and the next patient's(number) invoice will appear	Passed

Table 31-Test case for Checkout patients

5.2.8. Test case for PS-08. Record issue of drugs

ID	Test	Input	Expected output	Status
8.1	Retrieving the prescriptions relevant for a patient's visit	A currently available and consultation concluded patient assigned number is entered and searched	The prescripts set at the consultation will be displayed	Passed
8.2	Retrieving the prescriptions relevant for a patient's visit	A currently available and consultation not concluded patient assigned number is entered and searched	The consultation is in progress note will appear	Passed
8.3	Retrieving the prescriptions relevant for a patient's visit	A currently not patient assigned number is entered and searched	Invalid number alert will appear	Passed

8.4	Switching an item to the external prescription	Switch button on an internal prescription item is pressed	Item will be switched to the external prescription section	Passed
8.5	Switching an item to the internal prescription	Switch button on an external prescription item which was there in the original external prescription is pressed	Not sufficient stocks note will appear	Passed
8.6	Switching an item to the internal prescription	Switch button on an external prescription item which was switched from the internal prescription is pressed	Item will be switched to the internal prescription section	Passed

Table 32-Test case for Record issue of drugs

5.2.9. Test case for PS-09. Manage inventory items

ID	Test	Input	Expected output	Status
9.1	Adding a new inventory item	Correctly formatted data for all attributes	Added item will be displayed in the item list.	Passed
9.2	Adding a new inventory item	Falsely formatted data for at least one attributes	User will be notified about the false entry of data	Passed
9.3	Updating item details	Correctly formatted data for all attributes	User will be notified about the successful update	Passed
9.4	Updating item details	Falsely formatted data for at least one attributes	User will be notified about the false entry of data	Passed

9.5	Removing an inventory item	Press on the delete button	Confirmation alert will appear	Passed
9.6	Removing an inventory item	Press on the delete button and confirming	Item delete note will appear and will be removed from the list.	Passed

Table 33-Test case for Manage inventory items

5.2.10. Test case for PS-10. Manage stocks

ID	Test	Input	Expected output	Status
10.1	Confirming items of a purchase order	All the required inputs are set and confirmed.	The stocks will get updated with the newly added stock record.	Passed
10.2	Confirming items of a purchase order	Not setting at least one required input	User will be notified about the absence of data	Passed
10.3	Returning an item of a purchase order	Pressing on the return button and confirming	A return email will be sent to the supplier	Passed

Table 34-Test case for Mange stocks

5.2.11. Test case for PS-11. Send out purchase order

ID	Test	Input	Expected output	Status
11.1	Selecting a supplier and supplier items	Supplier is selected	Only the items that the supplier will be able to provide will be suggested for the purchase order	Passed
11.2	Sending a purchase order	Input all the required fields	Email sent for the supplier	Passed

Table 35-Test case for Send out purchase order

5.2.12. Test case for PS-12. Receive stock notifications

ID	Test	Input	Expected output	Status

12.1	Removing an expire notice stock	Click on remove stock button	Notification will be removed, and stock will be removed	Passed
12.2	Ordering low stock items	Click on order button	Sending out purchase order form will appear	Passed

Table 36-Test case for Receive stock notifications

5.2.13. Test case for PS-13. Manage staff

ID	Test	Input	Expected output	Status
13.1	Adding a new staff member	Select a role	Relevant form for the staff role appears	Passed
13.2	Adding a new staff member	All the required inputs are set and confirmed.	The staff list will get updated with the newly added staff record.	Passed
13.3	Adding a new staff member	Not setting at least one required input	User will be notified about the absence of data	Passed
13.4	Paying a staff member	Press on pay button	Staff payment form will appear	Passed
13.5	Paying a staff member	Entering the payment amount and confirm	Confirmation alert will appear	Passed

Table 37-Test case for Manage staff

5.2.14. Test case for PS-14. Manage supplier

ID	Test	Input	Expected output	Status
14.1	Adding a supplier	All the required inputs are set and confirmed.	The staff list will get updated with the newly added staff record.	Passed
14.2	Adding a supplier	Not setting at least one required input	User will be notified about the absence of data	Passed

Table 38-Test case for Manage supplier

5.2.15. Test case for PS-15. View reports

ID	Test	Input	Expected output	Status
15.1	Viewing reports	Selecting the necessary report type	Relevant report will appear	Passed

Table 39-Test case for View reports

5.3. Test report

The testing was done for all the use cases to ensure the system was function properly as a whole. With this it was able to make sure that,

- There were no any syntax errors occurred in the coding process,
- All the external libraries imported are supported and working properly,
- The database connections are stable at all points,
- Frontend applications are outputting all the necessary elements for a considered point,
- Reports are generating properly,
- Etc.

Testing of each function along with the development was crucial as the integration of activities depends on successful execution at each stage. Testing as done till any errors were completely fixed. However, with the updates happened along the way, initially developed functions were needed to be recoded slightly and retested with the intention of maintaining the integration. Concept testing, Unit Testing, Integrated testing, Functional testing were also incorporated to the testing procedures. Apart from that, UI testing was also used to improve the usability and visual appeal of the overall system.

5.4. Chapter summary

In this chapter, the test types are elaborated, followed when implementing the testing procedure and test cases of the system. Apart from that, the test strategies used, test plan and the report of the overall test phase are mentioned.

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CHAPTER 6

6. SYSTEM IMPLEMENTATION

Chapter overview

6.1.Installation guide

6.2.User guide

6.3.Chapter summary

6.1. Installation guide

This section describes the hardware and software requirements of the developed system.

6.1.1. Hardware Requirements

Intel Core i5 or above with 2.4 GHz or above

RAM - 4 GB or above

Router with firewall to be always connected to the internet

100 GB or above hard disk

6.1.2. Software Requirements

Operating system - Windows 8 or above version

Web browser (Chrome, Firefox or Edge)

Any sort of a reliable Anti-Virus Software

6.2. User guide

6.2.1.Login

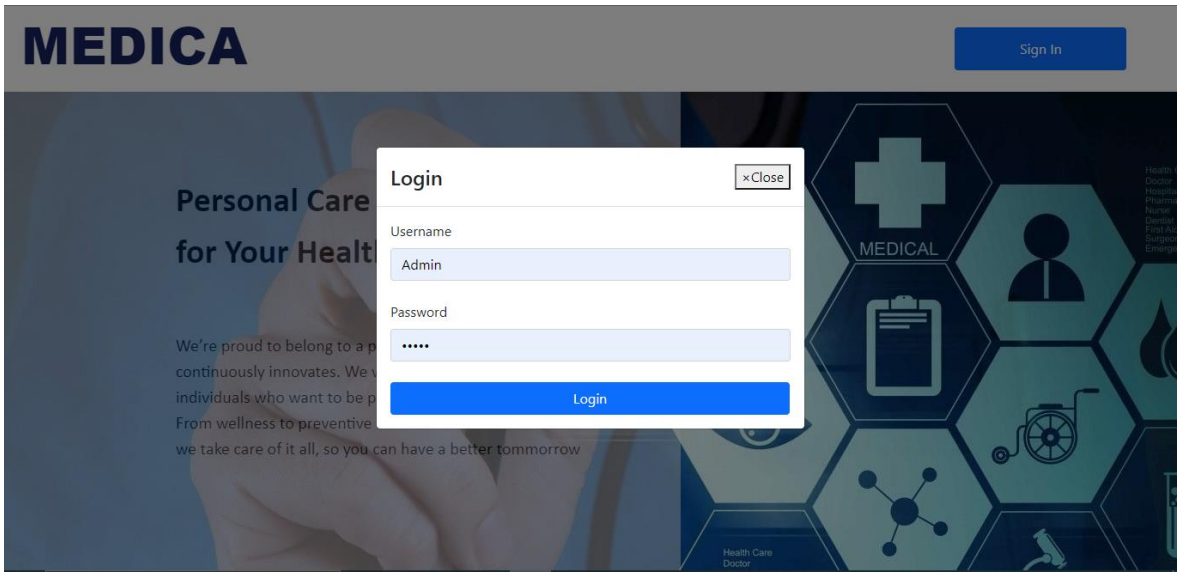

Figure 42 – Login interface

Procedure:

1. Enter credentials and login,
2. False credentials will be indicated and re attempt should be made,
3. Successful logins will redirect the user to relevant page.

6.2.2.Manage Inventory

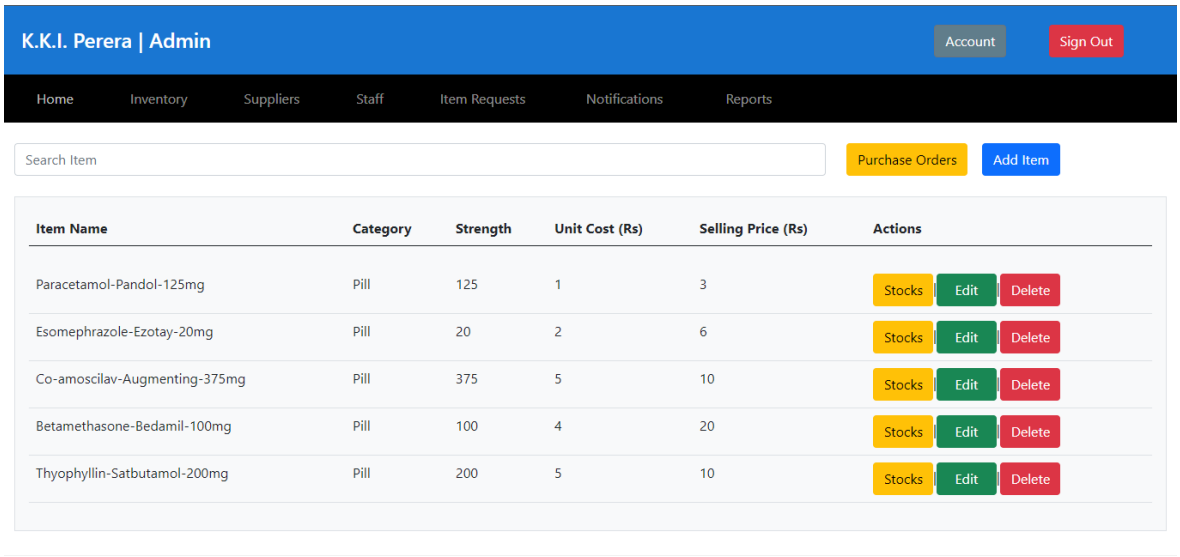

Figure 43-Manage inventory interface

Procedure:

1. All the inventory items can be viewed
2. New item can be added by the Add Item button and filling the form
3. A current item can be edited, deleted, or viewong stocks from the relevant buttons.
4. Sent purchase orders can be viewed from purchase orders button

6.2.3.Managing suppliers

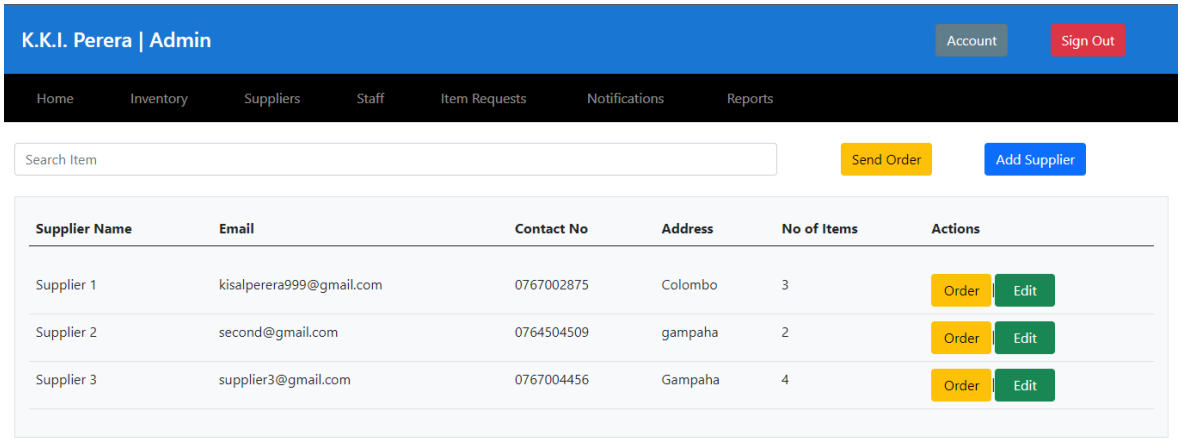

Figure 44-Manage suppliers interface

Procedure:

1. All the suppliers can be viewed,
2. Each supplier can be edited through each dedicated button
3. A new supplier can be added
4.

6.2.4.Sending out purchase order

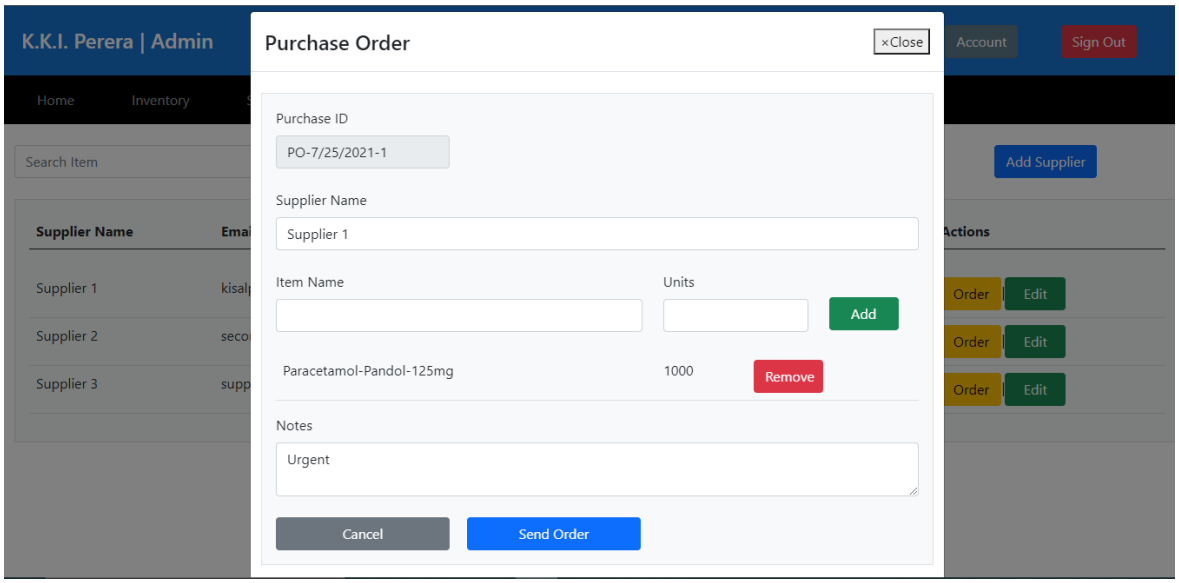

Figure 45-Sending out purchase order interface

Procedure:

1. A supplier can be selected
2. Each item,quantity can be set
3. Notes can be set and the purchase order will be sent as an email.

6.2.5.Managig staff

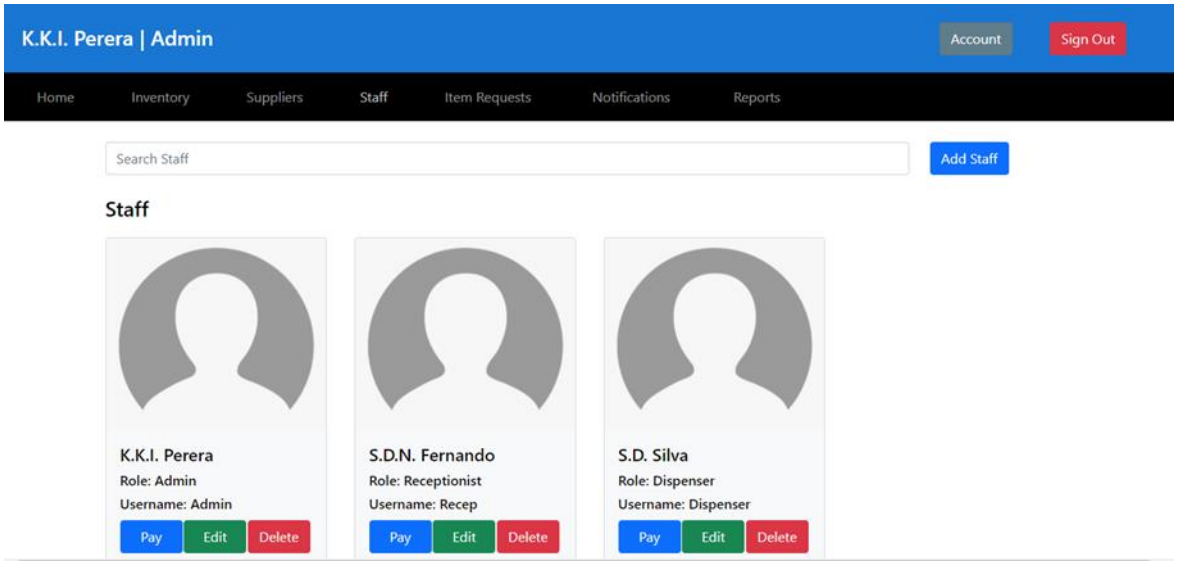

Figure 46-Manage staff interface

Procedure:

1. All staff and doctors list can be viewed separately
2. Each record can be edited and deleted by each dedicated button
3. A new staff member can be added through the Add Staff button,
4. A payment can be set for each staff member except for doctors

6.2.6.Receiving item requests

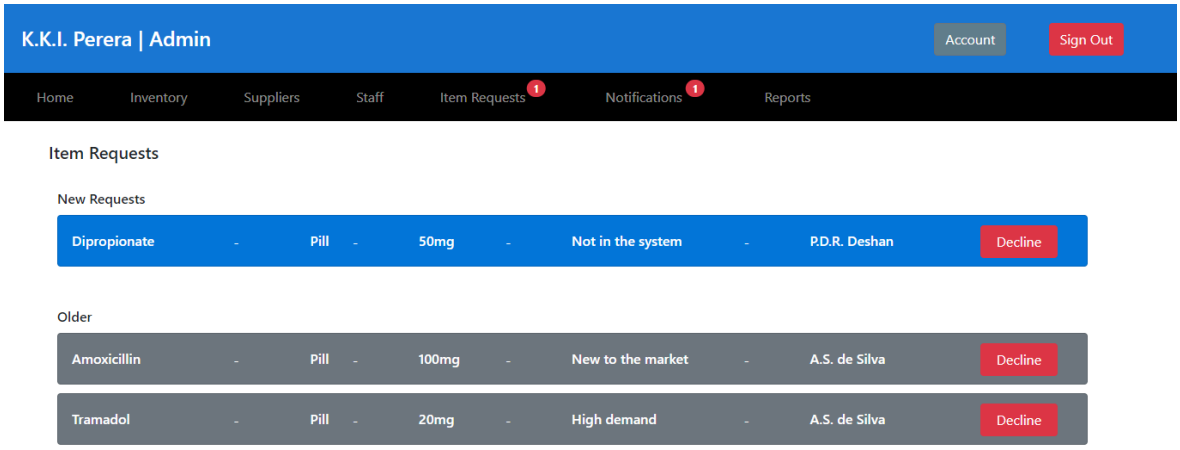

Figure 47-View item requests interface

Procedure:

1. Each new item requests and previously viewed item requests can be seen here
2. A request can be declined

6.2.7.Receiving notifications

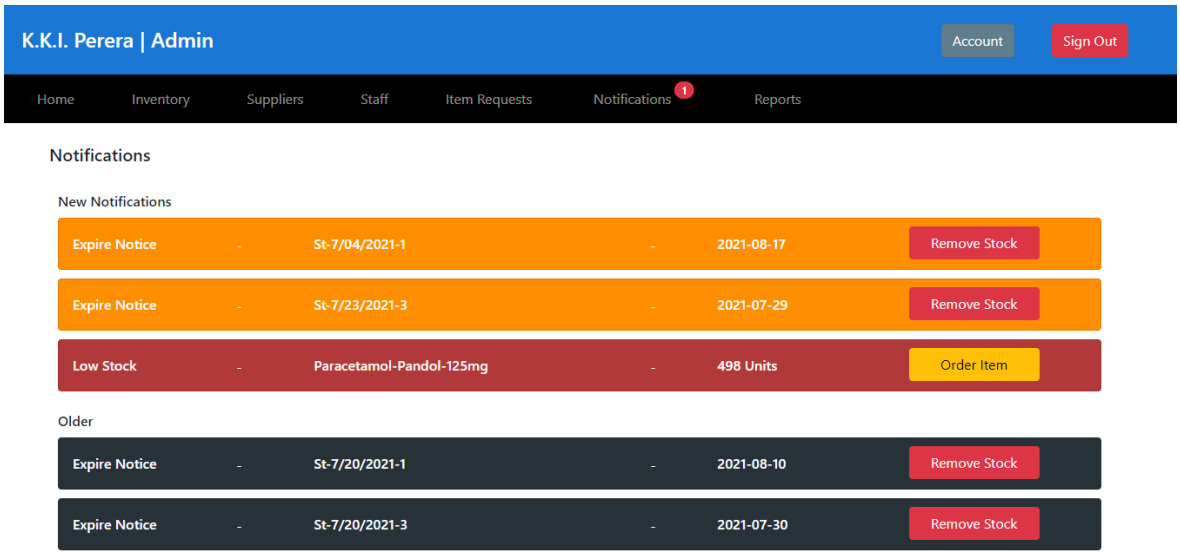

Figure 48-View notifications interface

Procedure:

1. All the new and old low stock and expire notices can be viewed
2. Each expiry noticed stocks can be removed from stocks

3. Low stocks items can be ordered

6.2.8.Viewing reports

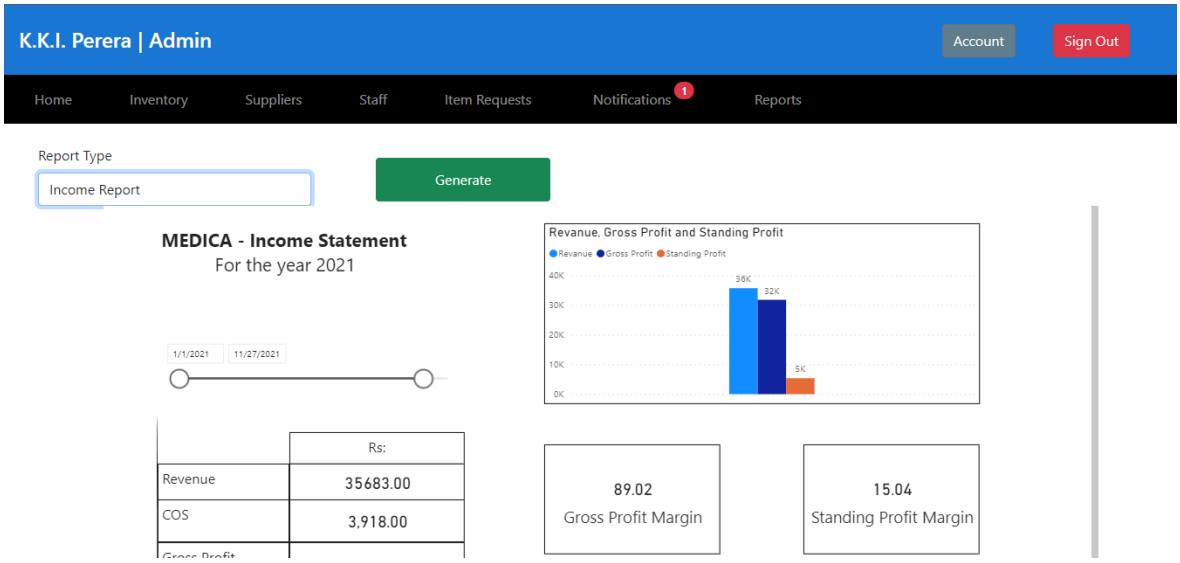

Figure 49-Viewing reports interface

Procedure:

1. Report type can be selected and viewed
2. A report PDF can be generated

6.2.9.Patient Management

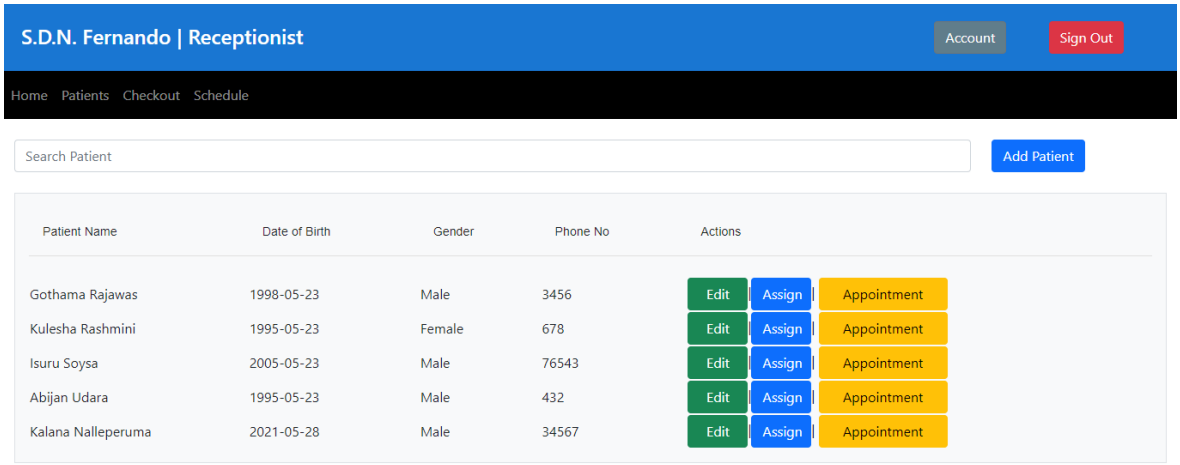

Figure 50-Manage patients interface

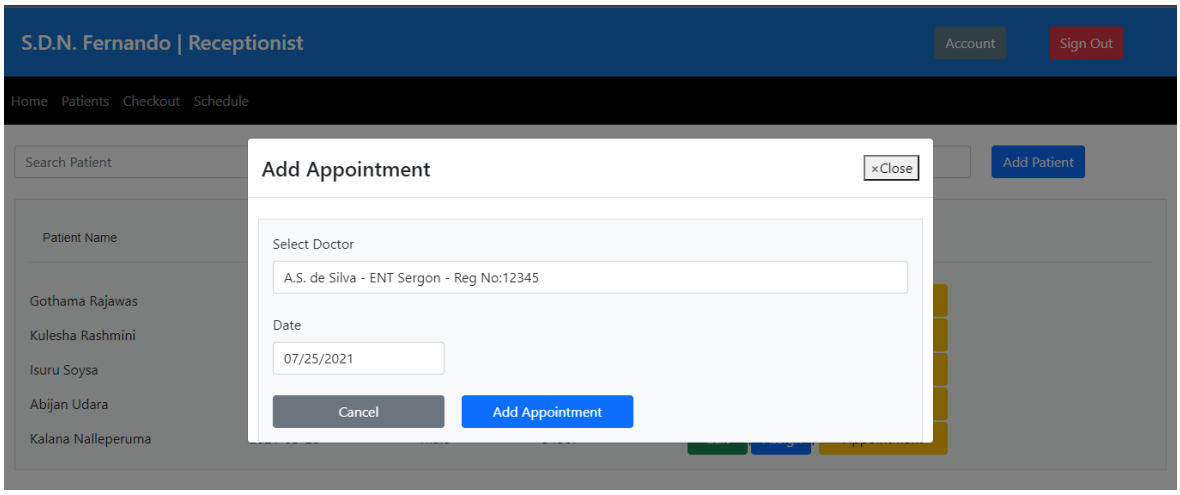

Figure 51-Add appointment interface

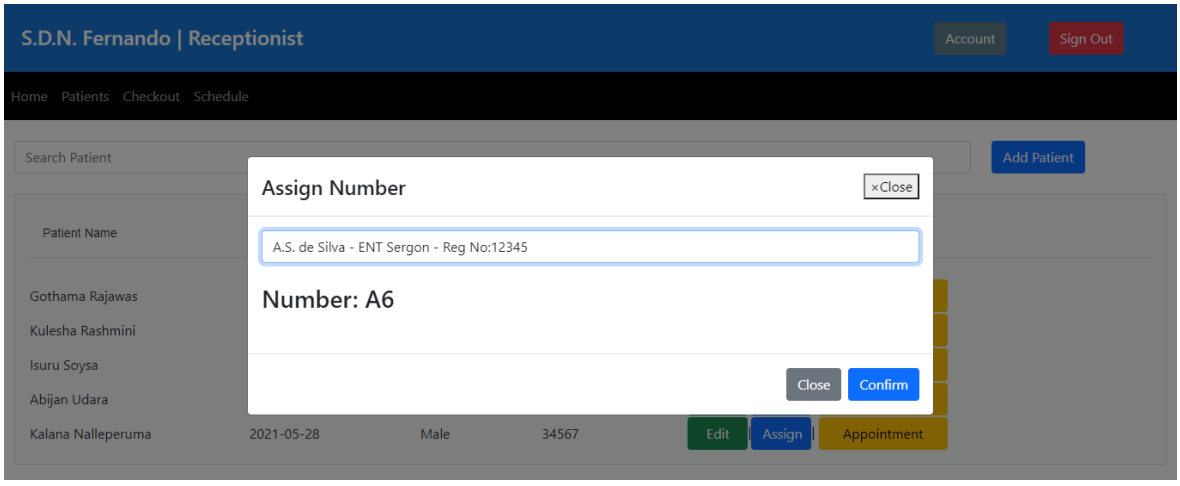

Figure 52-Assign number interface

Procedure:

1. All registered patients can be viewed
2. A patient record can be edited by each dedicated button.
3. An appointment and a number can also be set for each patient
4. New patients can be registered.

6.2.10. Viewing appointment schedule

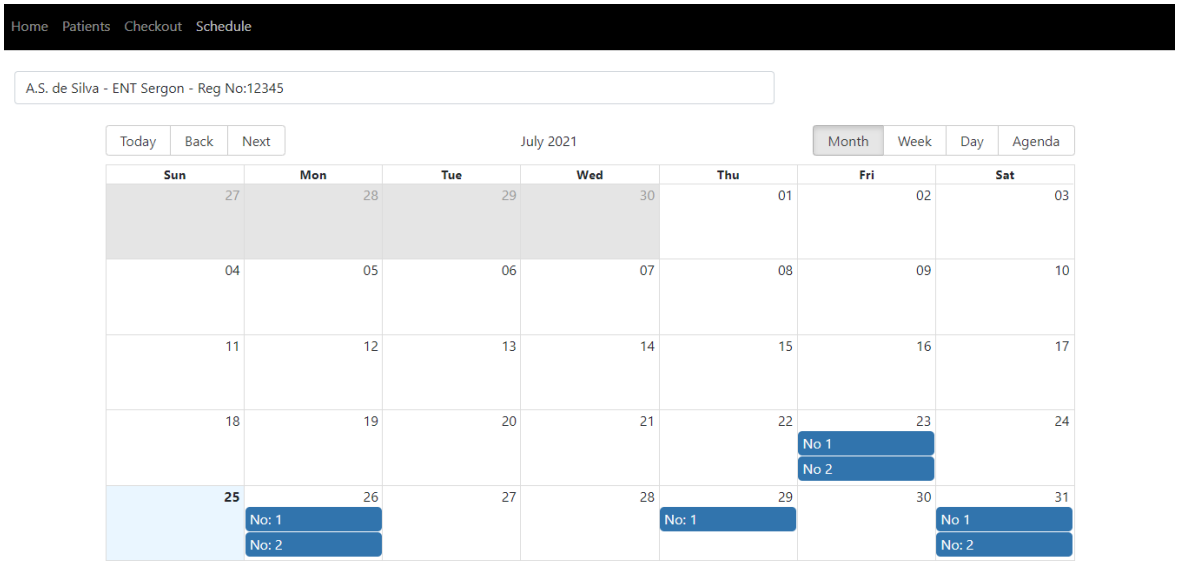

Figure 53-View appointment schedule interface

Procedure:

1. All the appointments and assigned numbers can be viewed for each doctor

6.2.11. Managing patient history

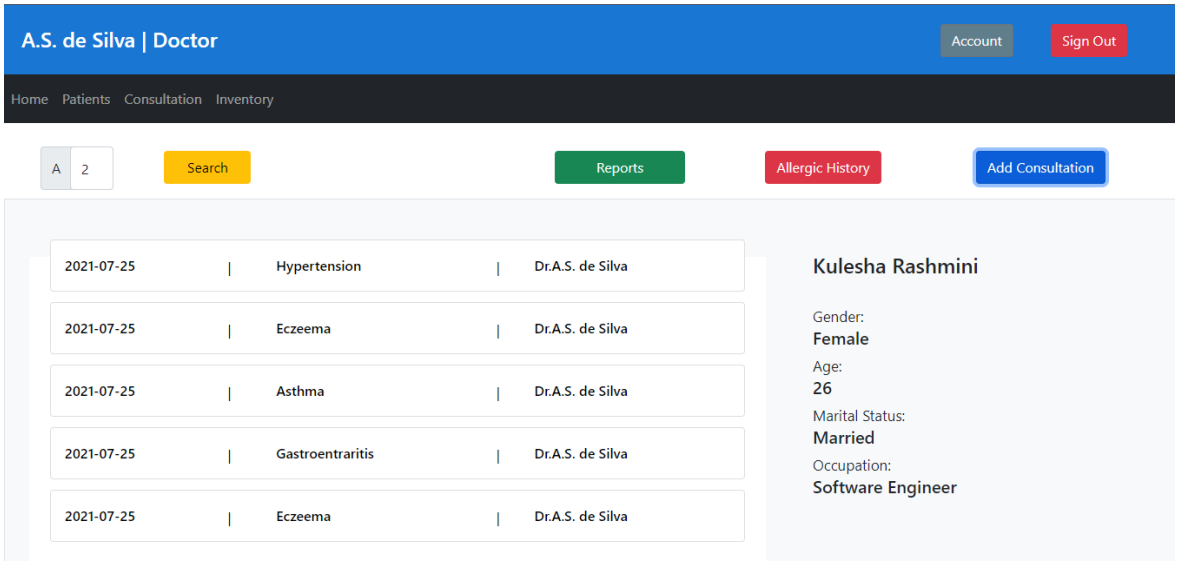

Figure 54- Manage patient history interface

Prcedure:

1. Patients assigned number can be searched to view the patient history
2. Each past consultation can be viewed seperately
3. Patients past reports and allergies recorded can be viewed from relavant buttons
4. Patients reports and allergic hisotory can be updated
5. A new consultation can be added by the add consultation button

6.2.12. Issue of drugs

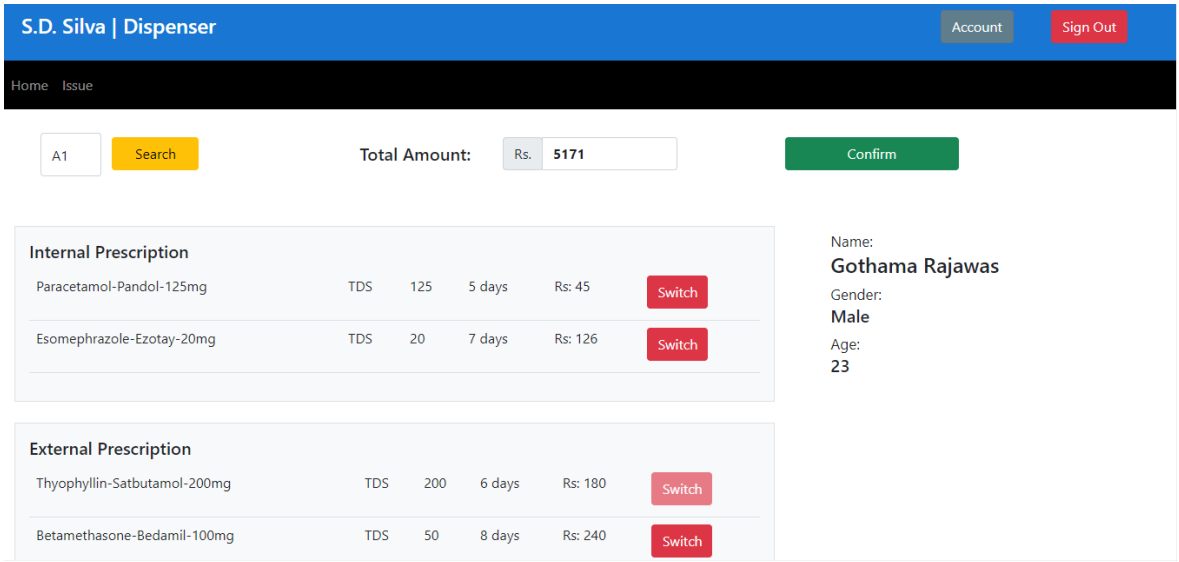

Figure 55-Issue of drugs interface

Procedure:

1. Patient number can be searched to view prescriptions
2. Items from the internal prescription can be switched to the external prescription
3. Items originally set for the external prescription cannot be switched to the internal prescription
4. Final setup with patient's preference can be confirmed

6.2.13. Checkout

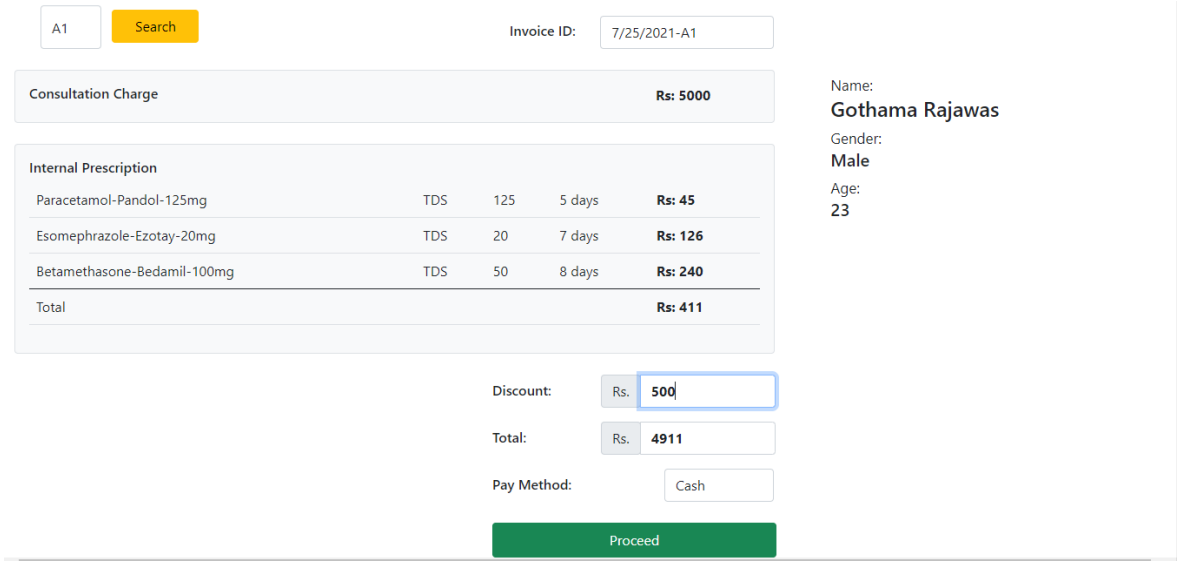

Figure 56-Checkout interface

Procedure:

1. Patient's number can be searched to get the invoice of the visit
2. A discount can be set
3. The final setup can be confirmed with proceed

6.2.14. Account update

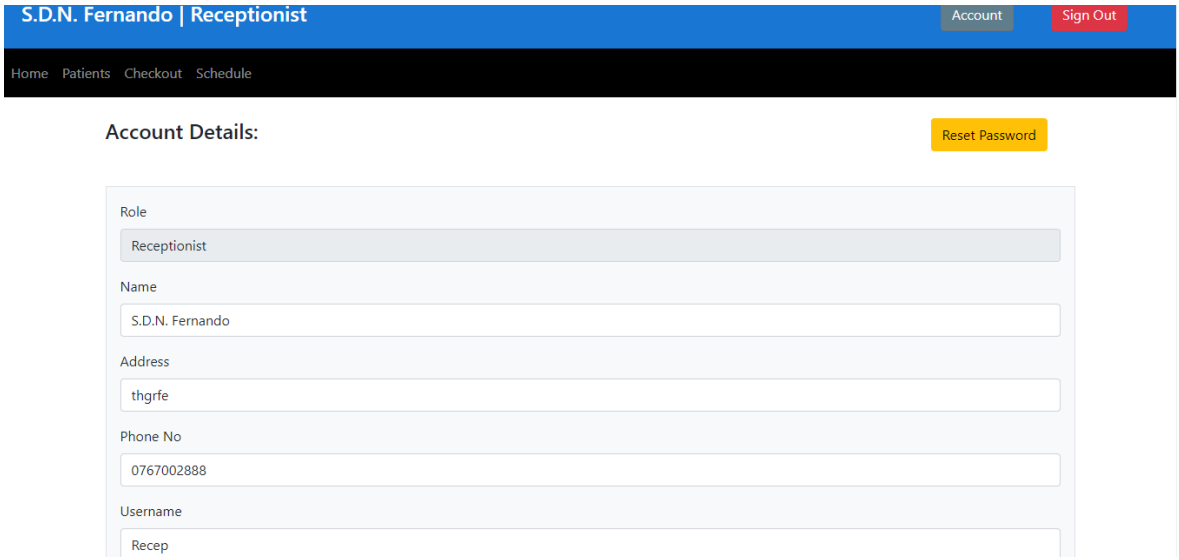

Figure 57-Update account interface

Procedure:

1. The logged in users account can be viewed
2. Account details can be updated
3. The password can be reset from the Reset Password button

6.3. Chapter summary

This chapter included the installation guide and the user guide which will be referred by the user when training to use the system. Any confusions appearing when using the system can be overcome using the provided guidelines.

CHAPTER 7

7. CONCLUSION

Chapter overview

7.1. Degree of objectives met

7.2. Usability, accessibility, reliability, and friendliness

7.3. Limitations and drawbacks

7.4. Future modifications, improvements, and extensions possible

7.5. Chapter summary

7.1. Degree of objectives met

All the essential functional and non-functional requirements identified by the system requirement specification are satisfied by the developed system. Apart from that few nice to have features are fed into the proposed system after a cost benefit analysis. Few more functionalities have been added for better utilization of the system that were not identified in the initial design. The components like patient management and inventory management are given a main focus. In addition, employee management, supplier management, and transaction management are facilitated by the proposed system meeting the objectives that was set initially.

7.2. Usability, accessibility, reliability, and friendliness

The graphical user interfaces provide an ease of doing a task. Users can easily navigate through the system. The learnability, memorability, efficiency, and satisfaction come together to provide a better usability for the user.

The accessibility is kept at an adequate level to allow all types of users to interact with the system with minimum confusions. Users can perceive, understand, and contribute to the system with ease.

The system reliability is ensured by the restriction of access. Only the authorized parties can enter into the system. Furthermore, the admin user has the ability to decide which role should be assign to which party. This allows accessing certain components of the system to a specific user increasing the reliability of the system.

The graphical user interfaces enable the user friendliness keeping the system within a minimalist design. Icons, fonts, colors, and objects come together to guide users easily allowing them to carry out their tasks in an efficient and effective manner.

7.3. Limitations and drawbacks

The system comes with the internet facility limitations as it is a web site. These are inevitable factors that should be tolerated by the users. Apart from that, being unable to provide access for patients becomes a drawback due to resource constraints. This can be solved by the future modifications.

7.4. Future modifications, improvements, and extensions possible

Future modifications can be done to the system allowing patients to take a significant part of the system. A portal for patients to register themselves and receive minor online consultations can be implemented in the future. An online appointment booking facility can be implemented in the future which need to be carried out considering the social factors affecting the organization.

7.5.Chapter summary

This chapter concludes the report with the degree of objectives met, usability aspects, limitations, and future modifications.