

VACCINE INVENTORY AND PATIENT'S ELECTRONIC RECORD KEEPING WITH
SALES MONITORING SYSTEM FOR UNITED SPECIALTY CLINIC (PEDIATRIC
DEPARTMENT)

An IT Project Proposal
Presented to the
Faculty of the School of Computing and Information Sciences
Saint Louis University

In Partial Fulfillment
of the Requirements for the Course
IT 421

By:
Cerezo, Kyrie Jericho G.
Custodio, Danica Shiene D.
Daclison, John Brian Z.
Dela Cruz, Ojoj Ynel C.
Derije, Franchesca Bernadette C.
Mendoza, Renendez Jon C.
Mercado, Kimberly Shane T.
Salazar, Von Karlos D.
Valdez, Drizzle Joy M.

Ms. Beverly Estephany Ferrer
Project Adviser
January 2019

TABLE OF CONTENTS

Title	Page
Chapter 1 Introduction	
1.1 Context of the Study	1
1.2 Background of the Study	2
1.2.1 Company Profile	2
1.2.2 Basic Operations	2
1.2.2.1 Current Business Process of Pediatric Department	2
1.2.2.2 Manual Inventory Process	2
1.2.2.3 Returning of Supplies	3
1.2.2.4 Manual Record Keeping and Scheduling Process	7
1.2.2.5 Manual Sales Monitoring	7
1.2.3 Problems Encountered on the Current System	11
1.2.4 Rationale for the Project Development	12
1.3 Statements of Objectives	12
1.4 Scope of the Project	12
1.5 Significance of the Study	13
Chapter 2 Methodology	
2.1 Identifying the Functional and Non Functional Requirements	14
2.2 Identifying the Different Modules and Features of the System	15
2.3 System Design	16
2.3.1 System Architecture	16
2.3.2 Development Architecture	16
2.4 Implementing the System	16
2.5 Deploying the System	17
2.5.1 User Manual	18
Chapter 3 Outcomes and Results	
3.1 Functional and Non Functional Requirements	19
3.1.1 Functional Requirements	19
3.1.2 Non Functional Requirements	20
3.2 Modules and Features of the System	22
3.3 System Design	23
Data Dictionary	33
Relational Database Scheme	37
3.4 System Implementation	40
3.4.1 Development Tools	40

3.4.2 System Testing	42
3.4.3 Architecture of the System	43
3.4.3.1 System Architecture	43
3.4.3.2 Development Architecture	45
3.5 System Deployment	43
3.5.1 User Manual	44
User Interfaces	45
Chapter 4 Conclusions and Recommendations	
4.1 Conclusion	54
4.2 Recommendations	59
Appendices	69
References	71

LIST OF FIGURES

Title	Page
Figure 1 Work Flow Diagram of Current Manual Inventory Process	4
Figure 2 Work Flow Diagram of Returning of Vaccines	5
Figure 3 Work Flow Diagram of Reordering of Vaccines	6
Figure 4 Work Flow Diagram of Current Manual Record Keeping Process	8
Figure 5 Work Flow Diagram of Current Manual Scheduling Process	9
Figure 6 Work Flow Diagram of Current Sales Monitoring	10
Figure 7 Iterative Model	14
Figure 8 Doctor Module	22
Figure 9 Assistant Module	22
Figure 10 Admin Module	23
Figure 11 Use Case Diagram of United Specialty Clinic	25
Figure 12 Work Flow Diagram of the Proposed Inventory Management for Pediatric Department of United Specialty Clinic	26
Figure 13 Work Flow Diagram of the Proposed Record Keeping for Pediatric Department of United Specialty Clinic	28
Figure 14 Work Flow Diagram of the Proposed Scheduling Process for Pediatric Department of United Specialty Clinic	29
Figure 15 Work Flow Diagram of the Proposed Sales Monitoring for Pediatric Department of United Specialty Clinic	30
Figure 16 Data Flow Diagram (Context Level)	31
Figure 17 Data Flow Diagram (Level 0)	32
Figure 18 Entity Relationship Diagram	37
Figure 19 System Architecture	43
Figure 20 Development Architecture	44
Figure 21 Dashboard Interface of United Specialty Clinic	45
Figure 22 Inventory Interface of United Specialty Clinic	45
Figure 23 Add New Vaccine Type Interface of United Specialty Clinic	46
Figure 24 VaccineType Interface of United Specialty Clinic	46
Figure 25 Edit Vaccine Interface of United Specialty Clinic	47
Figure 26 Adjust Vaccine Interface of United Specialty Clinic	47
Figure 27 Adjust Vaccine Interface of United Specialty Clinic	48
Figure 28 Inventory Adjustment Record Interface of United Specialty Clinic	48
Figure 29 Register New Patient Record Interface of United Specialty Clinic	49
Figure 30 Register New Patient Record Interface of United Specialty Clinic	49
Figure 31 List of Patient Records Interface of United Specialty Clinic	50
Figure 32 Patient Profile Interface of United Specialty Clinic	50

Figure 33 Add Patient Vital Signs Interface of United Specialty Clinic	51
Figure 34 Edit Patient Record Interface of United Specialty Clinic	51
Figure 35 Archive Patient Record List Interface of United Specialty Clinic	52
Figure 36 Archive Patient Profile Interface of United Specialty Clinic	52
Figure 37 List of Expiring Vaccine Interface of United Specialty Clinic	53
Figure 38 List of Scheduled Patient Interface of United Specialty Clinic	53
Figure 39 List of Edit Patient's Schedule Interface of United Specialty Clinic	54
Figure 40 List of Done Patient's Schedule Interface of United Specialty Clinic	54
Figure 41 Inventory Interface of the Doctor of United Specialty Clinic	55
Figure 42 Inventory Interface of the Doctor of United Specialty Clinic	55
Figure 43 Check Up Interface of the Doctor of United Specialty Clinic	56
Figure 44 Growth and Development Interface of the Doctor of United Specialty Clinic	56
Figure 45 Growth and Development Interface of the Doctor of United Specialty Clinic	57
Figure 46 Childhood Immunization Interface of the Doctor of United Specialty Clinic	57

LIST OF TABLES

Title	Page
Table 1 Functional Requirements of Inventory Management	19
Table 2 Functional Requirements of Record Keeping Management	20
Table 3 Functional Requirements of User Management	21
Table 4 Non Functional Requirements	21
Table 5 Web Technologies	24
Table 6 Programming Environment	40
Table 7 Test Cases	59

Chapter 1

INTRODUCTION

1.1 Context of the Study

Business organizations that use manual system often experience difficulties in monitoring records and generating reports. Paper-based forms that are prone to damage and illegible handwriting are some of the issues encountered in manual inventory management and record keeping.

Inventory refers to the list of stocks and items needed for the services. It is also the process of tracking supplies where it involves monitoring, reordering and delivering of goods in the company (Kiisler, 2014). Manual inventory management updates the inventory by means of monitoring the stocks on a daily basis. The owner and the employees might lose count on the stocks and forget to record the transaction. (Arshad & Muhammad, 2000).

When it comes to medical care, inventory management of medicines and surgical supplies are some of the most important tasks a clinic administration should consider since these supplies are the commonly used products and items in the clinic (Kritchanchai & Meesamut, 2015).

Another strategy that the clinic should consider is the efficient way of recording the patient's information. Medical record is defined as the "collection of data of a patient including history, statement of current problem, diagnosis and the treatment procedures" (Raza, 2012). Record also contains all the statements and the evidences of a service (Tough & Lihoma, 2017).

In relation to medical care, using an electronic record keeping system will help the clinic personnel in updating and monitoring patient records and generating reports. Archives and Records Management Section (ARMS) states that an electronic record keeping system will decrease clinic's demand for additional employees who have to deal with the paper works (Newton, 2006).

An electronic record keeping system will improve the patient's care and contentment, in a way that the employees will have more time for their patient's needs in exchange for patient satisfaction (Odit, 2008). Electronic record keeping system will also provide security and would allow them to backup the patient records (Hutter, 2016).

Using a computerized inventory management and record keeping system would positively. One good example is the project implementation and evaluation of a web-based stock management system for the nine pharmacies in rural Haiti.

The system helped by providing a communications link between the nine pharmacies including the recording of local stock levels. The system allowed the organization to manage the stocks of more than 450 drugs across 9 sites as one unit (Berger, 2007).

The system of Jigar Medical Store is also a good example of using a computerized inventory management since it helped the store lessen the time for the completion of any work. Other benefits from using the system were also mentioned such as the store can now easily search

record, all the stock of medicine is updated automatically and the system also provide security against unauthorized users (Gaurav & Hitarth, 2014).

An additional instance of electronic record keeping is the system used by Life Support Eye Clinic which results to faster retrieval of information and bill tracking and elimination of problems encountered from illegible handwriting. The security of the patient's information was also ensured with the use of secure computer code that can only be accessed by an authorized staff members (Ogundipe, 2011).

The development of CloudeMR which is a Cloud Based Electronic Medical Record System, had helped a healthcare in Nigeria by speeding up the accessing of the medication administration record system which includes the monitoring of the patient's vital signs, collaboration in patient care and multi-site review of patient records (Boyinbode & Toriola, 2015).

1.2 Background of the Study

1.2.1 Company Profile

The United Specialty Clinic was founded by four doctors in the year 1996. The clinic is located at the second floor of Laperal Bldg., Session Road, Baguio City and has a branch at Pines Hospital, Magsaysay Avenue. The United Specialty Clinic is a Pediatric and Obstetrics and Gynecology clinic that specializes in medical care for infants, toddlers, adolescents, young adults and women.

The Obstetrics and Gynecology department offers medical check-up for pregnant women and female patients and serves an average of 120 patients per week. The Pediatric department offers medical check-up and vaccination for infants to young adults. The Pediatric department serves an average of 150 patients per week in which a minimum of 60 patients are for vaccination and the rest are for check-up.

There are three pediatricians on call whenever the main pediatrician is not present. The assistant is the one who manually records and updates the patient's information and the clinic's inventory.

1.2.2 Basic Operations

1.2.2.1 Current Business Process of Pediatric Department

Monitoring the inventory and managing the patient's records are the main business processes of the Pediatric department of the United Specialty Clinic. The processes involved to accomplish these processes are discussed in the following sections.

1.2.2.2 Manual Inventory Process

The Pediatric department has fifteen types of vaccines and maintains fifteen stocks for each type. Once the stock has reached the minimum number of two, the assistant will order the number of vaccines that are needed from one local hospital. The ordered vaccines are usually

being delivered after 1 - 2 hours. The assistant orders from a hospital in La Trinidad whenever there are no available vaccines from the local hospital.

For every transaction, the assistant logs on a logbook the date and the number of vaccines that has been ordered. Checking and updating the available number of vaccines and generating inventory reports through inputs from a logbook are the daily responsibilities of the assistant as shown in Figure 1.

1.2.2.3 Returning of Supplies

Some of the few cases when the Pediatric department has experienced product returns are the following:

1. Mismatched Vaccines and Syringe

The assistant will notify the supplier when incorrect vaccines and syringe were delivered in the clinic. The supplier will immediately collect and replace with the correct supplies.

2. Expired Vaccines

The assistant usually returns the vaccine three months before its expiration date. The assistant will then call the supplier for the replacement of vaccines.

3. Damaged Vaccines

Upon the delivery of the vaccines, the assistant will check the orders for any damage. Damaged vaccines will be kept until the supplier will be able to replace it.

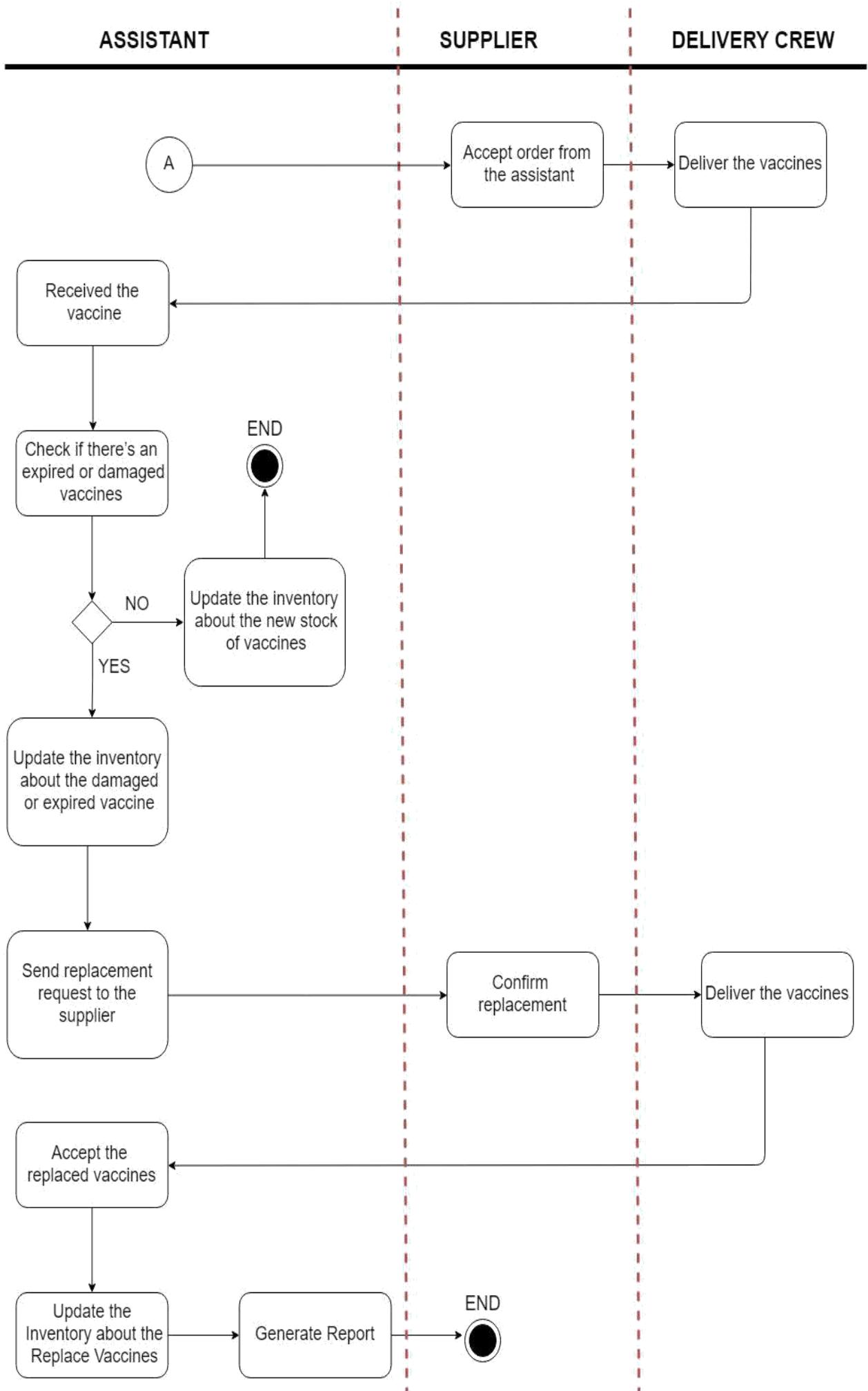


Figure 1 Work Flow Diagram of Current Manual Inventory Process

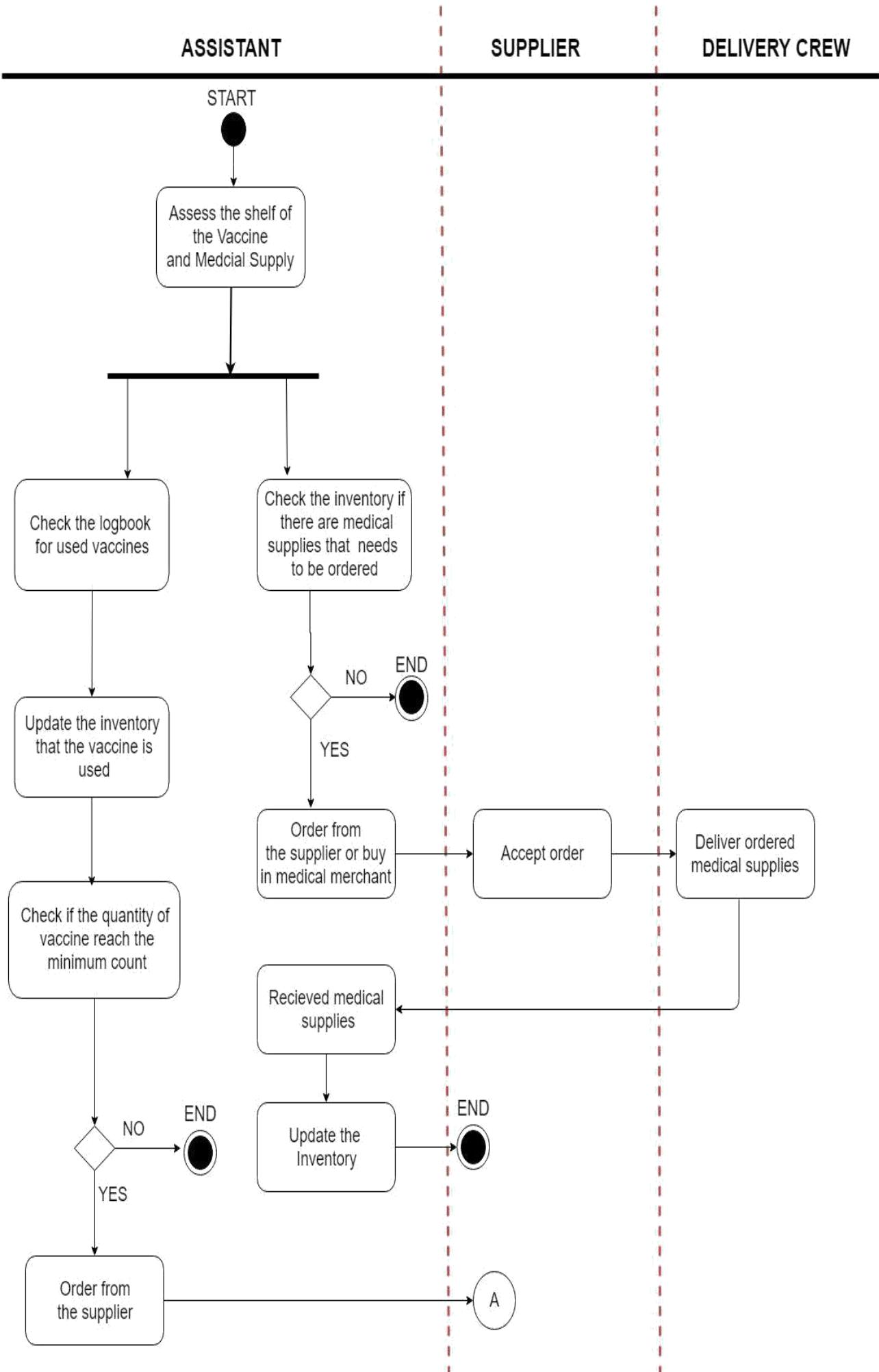


Figure 2 Work Flow Diagram of Returning of Vaccines

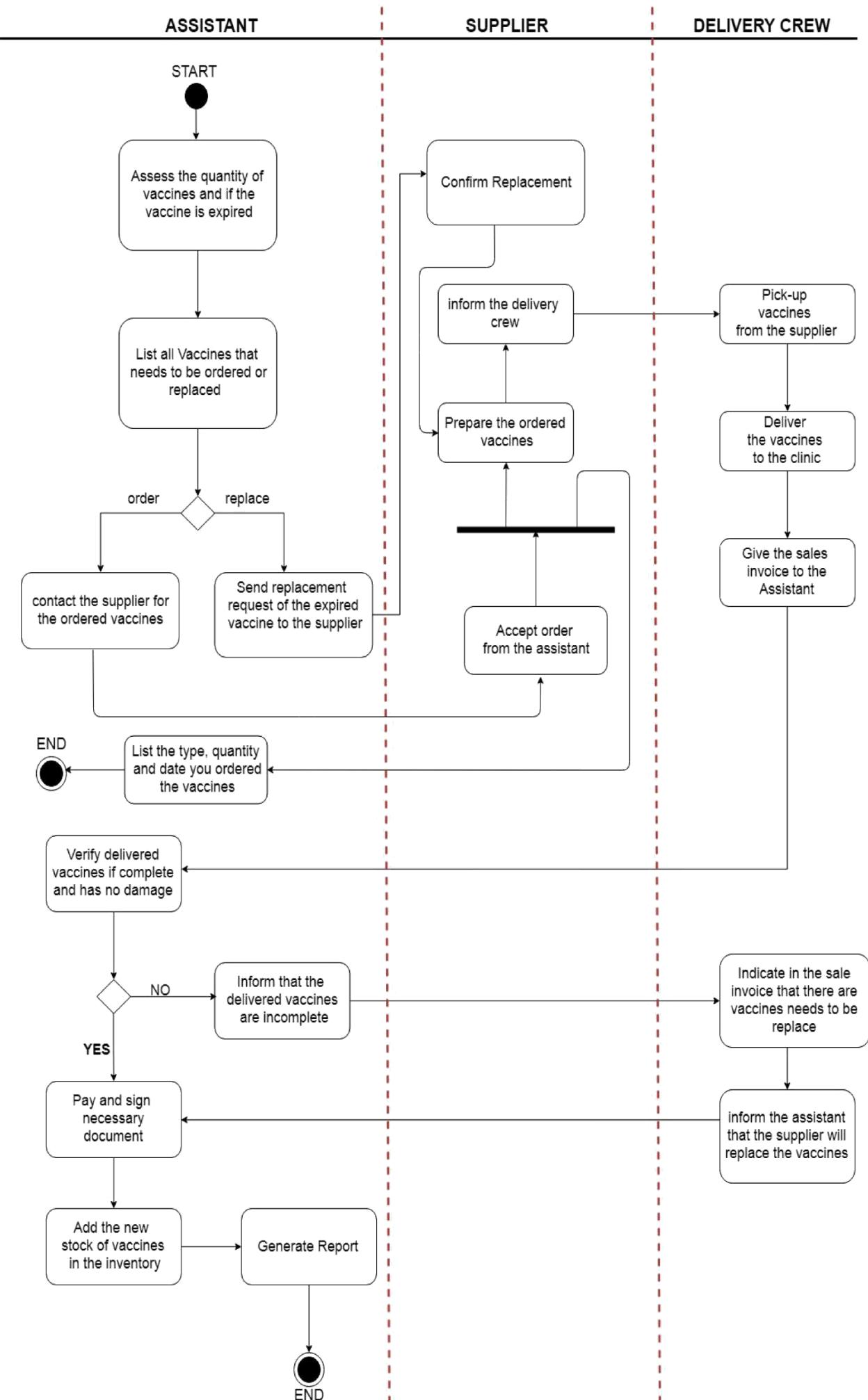


Figure 3 Work Flow Diagram of Reordering of Vaccine

1.2.2.4 Manual Record Keeping and Scheduling Process

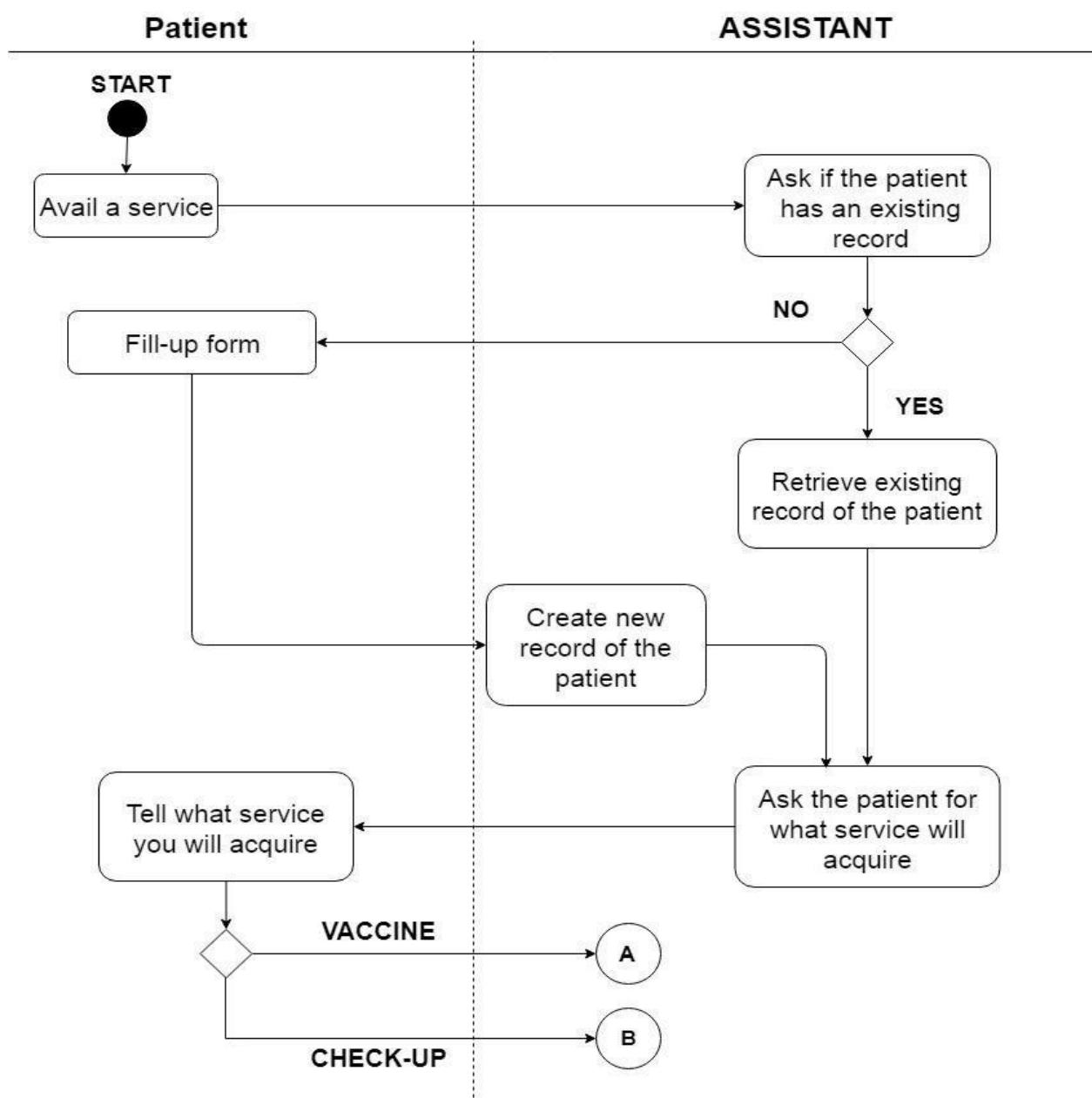
Figure 4 and Figure 5 present the current manual record keeping and scheduling process of the pediatric department of United Specialty Clinic wherein the doctor deals with examining the patient and writing the diagnosis and prescription for the patient.

The doctor will then log the patient's name, date and service rendered on a logbook. The assistant handles the paper works involved in creating and updating the patient's record that includes the schedule for the next appointment.

The patient normally pays to the assistant right after the service. The assistant will then log the transaction on the logbook.

1.2.2.5 Manual Sales Monitoring

The patient pays the amount due after the service had been rendered. The assistant records the sales details on the same log book the assistant logs the name and the service rendered. At the end of the day, the assistant will compute for the total income of the clinic.



Continuation

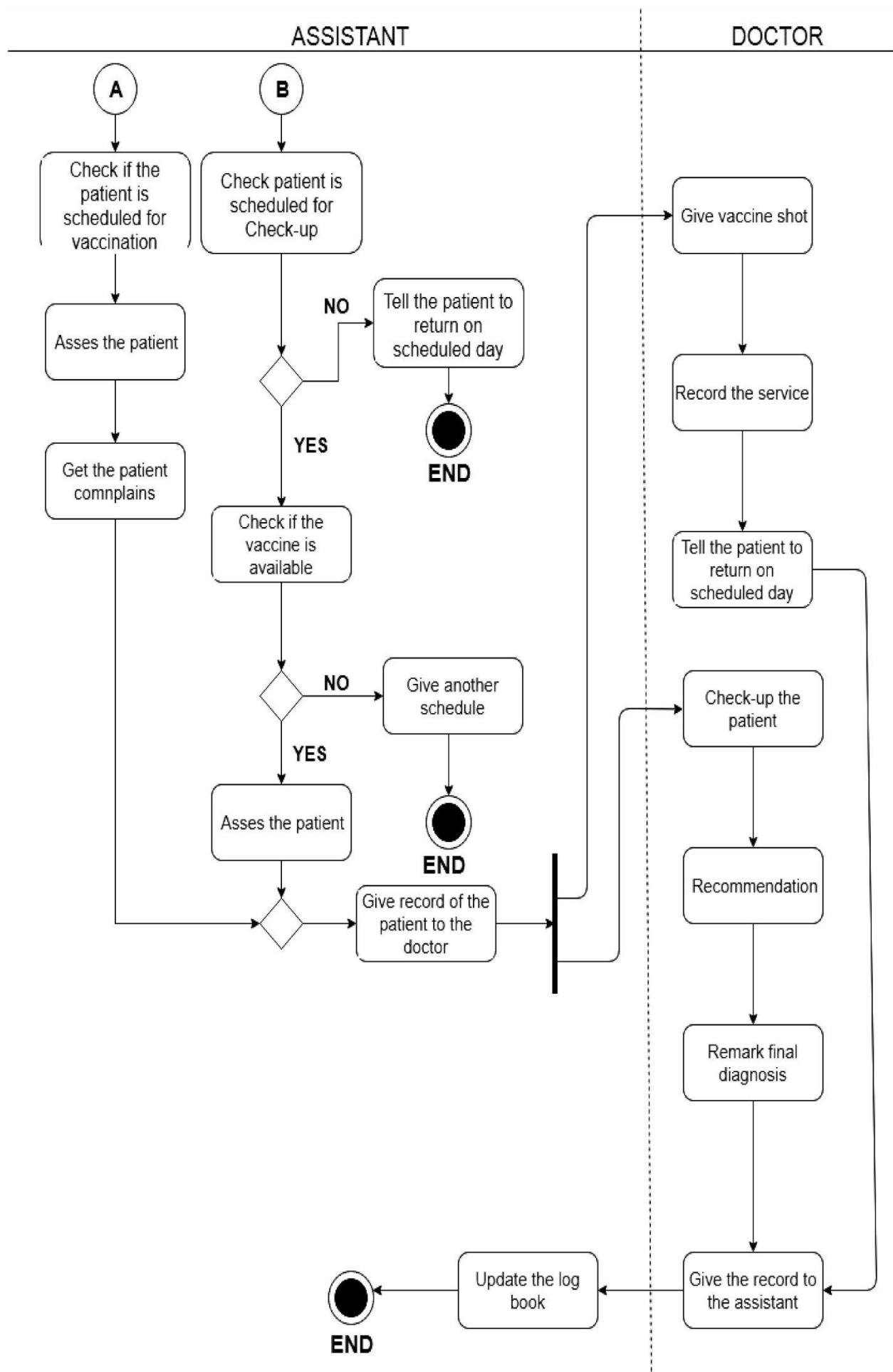


Figure 4 Work Flow Diagram of Current Manual Record Keeping Process

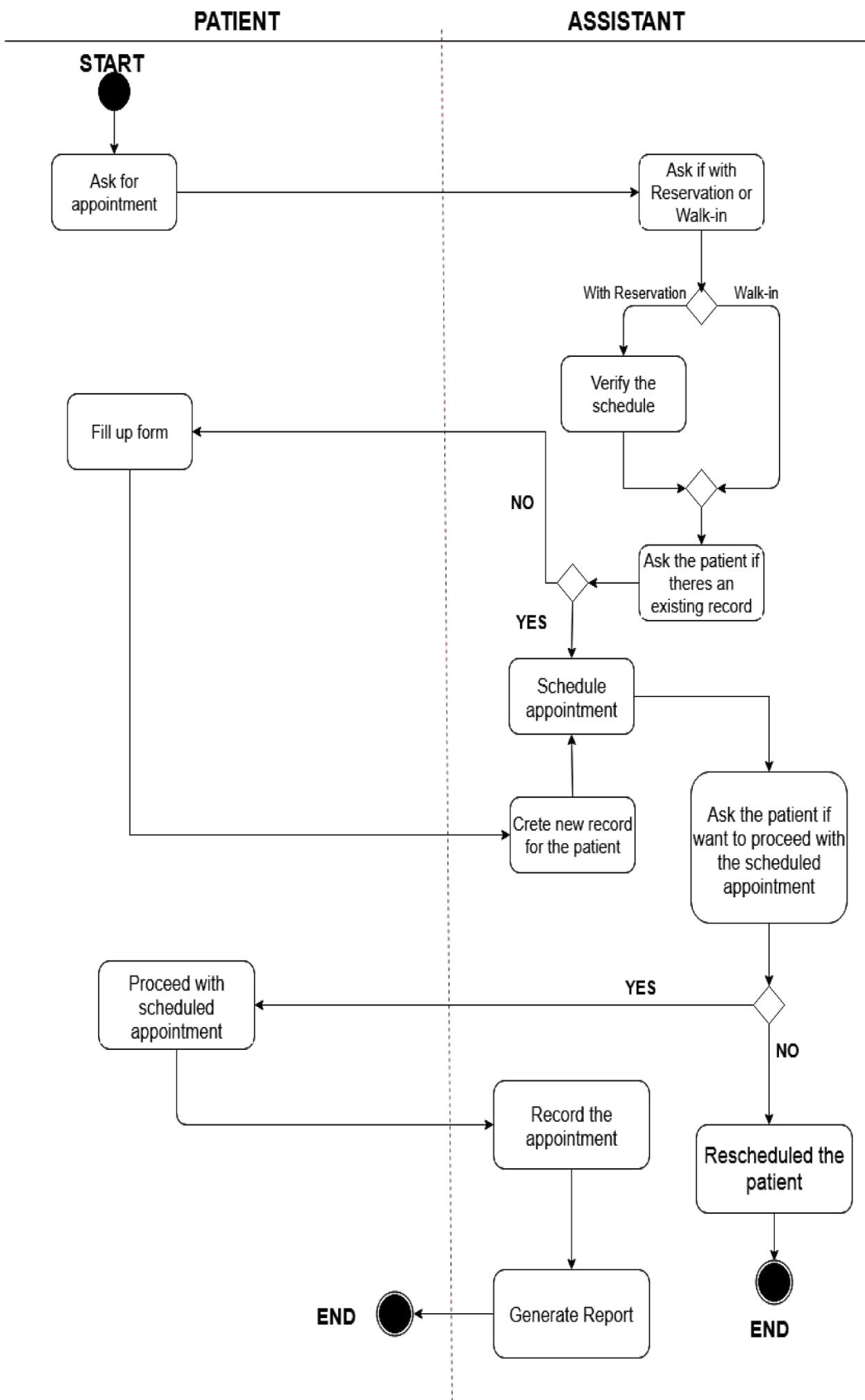


Figure 5 Work Flow Diagram of Current Manual Scheduling Process

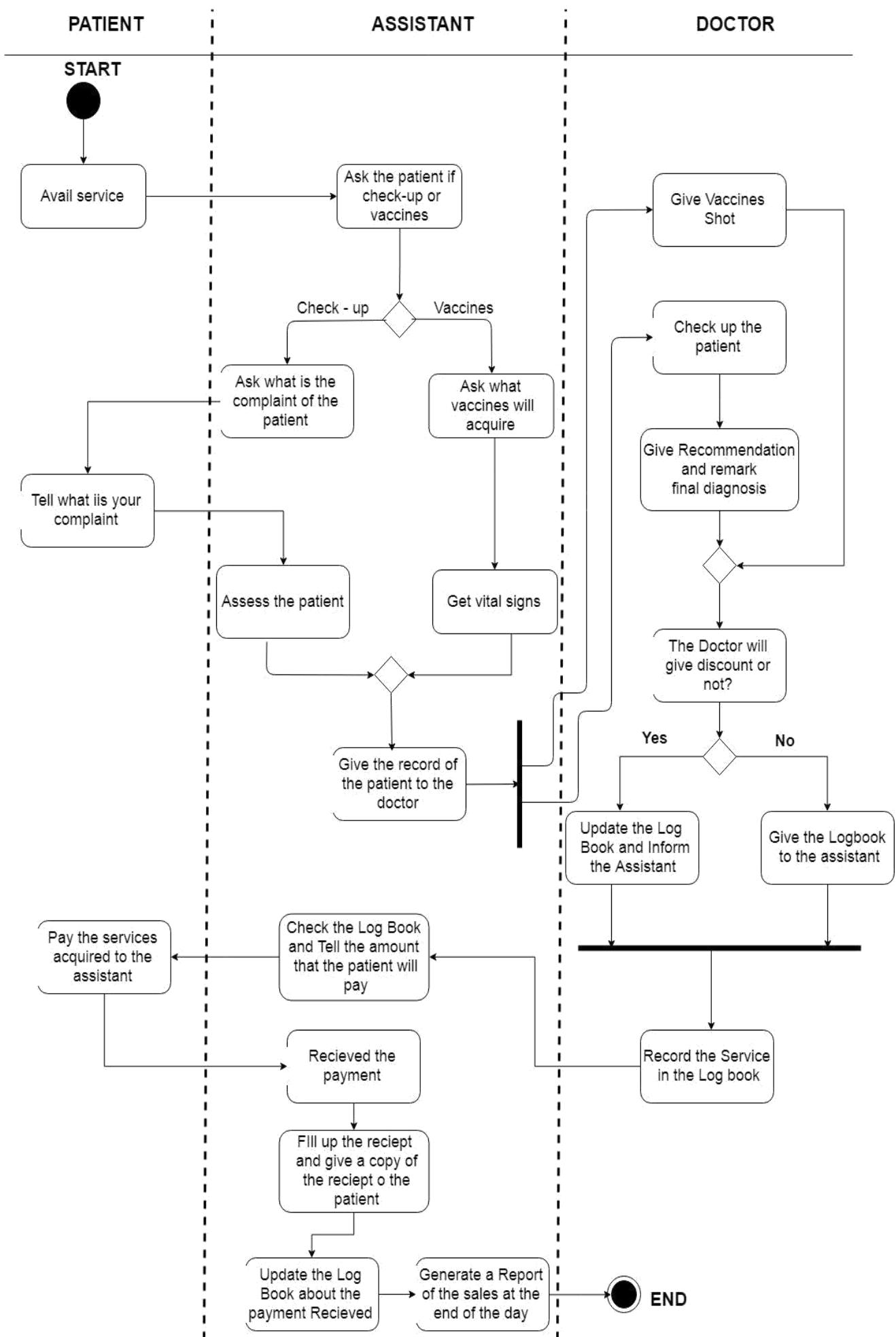


Figure 6 Work Flow Diagram of the Current Sales Monitoring for Pediatric Department of United Specialty Clinic

1.2.3 Problems Encountered on the Current System

Using manual inventory management and record keeping system, the Pediatric department encounters problems on monitoring the supplies and patient records.

- **Inventory**

1. Lack of Monitoring

The manual inventory of the clinic results to shortage of supplies because it does not automatically provide the total number of stocks available or needed.

2. Time Consuming

The assistant manually checks and updates the inventory at the end of the day. The assistant needs to review the patient's record and count from the log book all the listed vaccines that were used.

The daily process of checking and updating the inventory consumes a lot of time from the assistant.

- **Record Keeping**

1. Data Redundancy

In case that the assistant cannot find the existing patient's record, the assistant will then require the patient to fill out a new form which leads to data redundancy. Also, the doctor and the assistant log the same data on two separate log books which also leads to multiple records.

2. Time Consuming

The assistant takes a lot of time searching for the patient's record from the cabinet with the current record keeping system.

Generating report manually may also be difficult since the current manual system of the pediatric department does not automatically provide the summary report. The assistant needs to generate report daily and recheck data by comparing the patient records with the data from the logbook.

3. Lack of Centralized Data Management

Lack of centralized data management often result to redundancy of activities of the assistant and the doctor. The doctor needs to update a log book then the assistant will again update another log book in which the two log books contain the same data.

4. Lost and Damaged Records

Paper records have the tendency to be damaged overtime or be lost. This will result to the patient filling out another form which is inconvenient for the patient and the assistant will have to make another record for the patient.

1.2.4 Rationale for the Project Development

The group proposed a computerized inventory management and electronic patient record keeping system that will help facilitate the inventory of vaccines and patient's record keeping of the pediatric department of United Specialty Clinic.

By the implementation of the different features of the system, such as the computerized inventory and patient's record, the system will help minimize the issues in the pediatric department. Compared to manually monitoring the inventory of supplies and patient's record, the system will lessen the problems encountered from being damaged and misplaced.

1.3 Statement of Objectives

The main objective of the project is to help facilitate the inventory management and patient's record keeping system of the pediatric department of the United Specialty Clinic.

Sub objectives are as follows:

1. To identify the functional and nonfunctional requirements for the pediatric department of the United Specialty Clinic inventory management and record keeping system.
2. To identify the different modules and features needed for the implementation of the system.
3. To design the system based on the requirements of the clinic.
4. To implement the design of the system.
5. To deploy the computerized inventory management and record keeping system for the pediatric department of United Specialty Clinic.

1.4 Scope of the Project

In order to meet the different requirements of the system, the group conducted an interview with the doctor and the assistant to gather information that were used to develop the system. The group also performed an observation to visually understand how the current business process works for a healthcare business.

The different modules and features of the system were determined through requirements analysis and the creation of the prototype of the system and a use case that helped the group in developing the system.

Several diagrams were also created such as Data Flow Diagram and Entity Relationship Diagram that served as guides to the group in designing the system including the different tools and technologies that will be used.

The project covered the installation of the system to put it into work as well as the configuration of the network and the hardware infrastructure of the clinic. The group added an additional feature which is patient appointment scheduling.

A user manual was provided by the group to guide the doctor and assistant in using the system. The user manual includes the step by step tutorial on how the system will be used.

1.5 Significance of the Study

The system was intended to facilitate the inventory management and record keeping of the pediatric department of the clinic that helped the assistant and the doctor monitor their inventory of supplies and patient's record electronically. Furthermore, with the help of the system, the assistant and the doctor save time by reducing series of activities in manually managing the overall operations of the business.

The pediatric department also benefited from having a computerized record keeping system that resulted to faster record monitoring and report generation. Though paper records and forms were not eliminated completely, it served as backup in case the electronic record gets lost.

It also included an additional feature of patient appointment scheduling which is used to keep track of their patient's schedule without the need of searching and browsing manually. Another feature is the sales monitoring which helped the assistant and the doctor keep track of the clinic's sales which includes the payments of the patients.

Chapter 2

METHODOLOGY

To guide the group in the development of the web-based system and to meet the requirements for Pediatric department of United Specialty Clinic, the iterative model was used as shown in Figure 7. The model is a sequential design process wherein the software development of a large system is broken down into smaller chunks where the system is designed, developed and tested in repeated cycles.

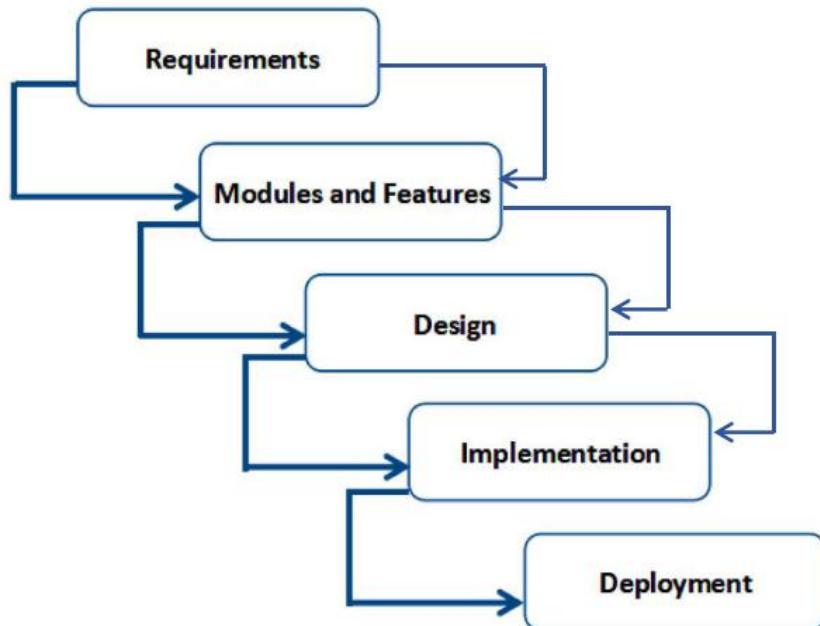


Figure 7 Iterative Model

The group will follow the iterative development method based from the model of Amir Ghahrai but there will be several modifications that will be done in developing the system such that the group will only perform requirements analysis, define the modules and features of the system as well as the designing, implementing and deploying the system where the process can be repeated, producing a new version of the system for every cycle of the method.

In iterative model, each phase would assist the group answer the objective of the system where every phase must be accomplished one after the other before moving, only when its preceding phase is completely done.

2.1 Identifying the Functional and Non-Functional Requirements

In the first phase of the iterative model which is requirements analysis, the group had followed various requirements elicitation techniques which are composed of interviews, forms analysis and observations in order to identify the functional and non-functional requirements of the system.

Interviews

The group had conducted series of interviews with the assistant and doctor of Pediatric department in order to gather the needed information about the business. The interviews were conducted once a week depending on the availability of the interviewee.

The current business process and other business operations were the main topics in the interviews as well as the issues the clinic has been encountering with their current manual inventory and record keeping system.

Follow up interviews were also performed in gathering additional information needed in order to meet the requirements of the project.

Forms Analysis

During the interviews, the assistant and the doctor presented sample forms that the clinic has been using to record the information of the patient as well as the log book in monitoring and updating the clinic's paper based inventory as shown in Appendix A, B, C and D.

The group had analyzed the forms that were presented to have an idea on what particular information the clinic needs from their patients.

Observations

To completely understand the clinic's business process and to visibly experience how the clinic operates, the group had also performed an observation during interviews. The observation lasted for 4-5 hours within a time span of 4 days, where the group had seen the actual business process that are being performed in the clinic.

Additionally, observation were conducted to distinguish some other information and important processes that were not mentioned in the interview. Through observations, the group collected the information needed in order to meet the requirements of the system.

2.2 Identifying the Different Modules and Features of the System

The modules and features of the system to be created and implemented is included in the second phase of the iterative model.

In identifying the different modules and features of the system, requirements analysis were conducted by the group as well as the creation of the prototype and use case diagram that is needed in the development of the system.

Requirements Analysis

With the interviews, forms analysis and observations that the group had conducted, the group had come up with the different modules and features of the system based on the identified functional and non-functional requirements.

The group had determined the different modules that the system needs by classifying and grouping the functional and non-functional requirements together.

Prototype

To have a better view and a sample walkthrough of the inventory management and record keeping system of the clinic, a high-fidelity prototype was created by the group that will be based on the user's requirements.

Use Case

A use case diagram is a graphical model created by the group to organize and understand the functional and non-functional requirements and to be able to map the respective roles and privileges of the users in the system.

2.3 System Design

In iterative model, the third phase would guide the group in determining the design of the system based on the requirements of the clinic.

There were various design tools that were used by the group in designing the system mainly, the Use Case Diagram, Data Flow Diagram (DFD) and Entity Relationship Diagram (ERD).

The group also constructed a DFD to completely illustrate the overview of the system in connection on how the business process sends and receive data.

Moreover, an ERD is another graphical model which consists of different symbols that represents the entities, relationships and attributes. With the use of ERD, the group had identified the design that fits the clinic's business rule. A Relational Database Schema was also created to distinguish the required tables that will be used in creating the database.

2.4 Implementing the System

The implementation phase would assist the group on how will the vaccine inventory management and patient's record keeping system for the pediatric department of the clinic be developed.

When it comes to implementing the system, the group studied various related articles and systems as basis in identifying the different tools and technologies that will be used in

creating the system as well as the different types of testing that are suitable in developing the system and its architecture.

Identifying the Tools and Technologies

The familiarity and the knowledge of the group were considered to narrow down the appropriate tools in developing the system for pediatric department of United Specialty Clinic.

In identifying the different tools and technologies needed in creating the system, the group had also conducted a brainstorming activity in order to determine the appropriate tools. However, if there is a need for the group to use a new certain tool which is most appropriate, new technologies will be considered.

Identifying the Types of Testing

In identifying the types of testing, related literature were gathered and read to guide the group. Additionally, with the group's knowledge about software testing, the different testing types were determined.

The appropriate testing type will be used in checking the functionality of the system as well as verifying that the system had met the business requirements.

2.4.1 Architecture of the System

2.4.1.1 System Architecture

The system architecture was created to show the interactions of the different components within the system along with the flow of the system between the users.

The system architecture also presents how the system will work on an architectural level from the users through the browsers to the system itself.

2.4.1.2 Development Architecture

The group proposed a web-based application for the pediatric department of the clinic. The development architecture was created by the group to present an outline on how will the proposed system be developed. Additionally, the development architecture was used to show the different tools and technologies that will be used in developing the system.

2.5 Deploying the System

The deployment of the system which is the last phase of the iterative model is the last activity that the group would conduct to make the system available for use.

Several factors will be considered such as the different hardware, software and network in deploying the system including the creation of user manual for the users of the system.

With the related literature that will be gathered and read, the group will be able to identify the possible setup of the database application.

The most appropriate minimum computer specification requirements needed for the system will also be identified by considering the type and scope of the project. The deployment of the system will also include the configuration of the system and the installation of the needed softwares in order for the system to work.

In addition, the group also consulted the assistant and the doctor about the placement of the hardware that will be used.

2.5.1 User Manual

A user manual will be created to guide the assistant and the doctor in using the system. The user manual will contain the step by step instruction on how to use the different functionalities of the system. Additionally, the user manual will also include the description of the different functions of the system along with its capabilities and use.

Chapter 3

OUTCOMES AND RESULTS

The group had undergone requirements analysis, design phase and prototyping in order to obtain the results from the objectives of the project.

3.1 Functional and Non-Functional Requirements

The functional and non functional requirements were determined after gathering all the needed requirements through the different elicitation techniques.

3.1.1 Functional Requirements

The table below shows the identified functional requirements of the system.

Table 1 Functional Requirements of Inventory Management

Functional Requirements	Description
Monitoring	<ul style="list-style-type: none">● The assistant should be able to view the number of supplies available in the clinic.● The assistant should be able to view the complete information of a particular vaccine.● The assistant should be able to search a specific name of vaccines.● The assistant should see the expiration date of a particular vaccine.● The assistant should view the summary report of the status of the vaccines.
Inventory Management	<ul style="list-style-type: none">● The assistant should be able to add new stock of supplies in the inventory.● The assistant should be able to change the status of a certain vaccine if it is damaged, expired or returned and would automatically reflect to the number of vaccine stocks.● The system should be able to provide a daily report specifically the total number of supplies used and its type.
Login	<ul style="list-style-type: none">● The user should be able to enter their credentials (username and password) in order to log-in.
Supply Status Notification	<ul style="list-style-type: none">● The system will automatically notify the user when the stocks of supplies are insufficient.

	<ul style="list-style-type: none"> The system will automatically notify the user 3 months before when the stocks reached the expiration date.
Report Generation	<ul style="list-style-type: none"> The system must be able to allow the user to print the report.

Table 2 Functional Requirements of Record Keeping Management

Functional Requirements	Description
Login	<ul style="list-style-type: none"> The assistant and the doctor should be able to enter credentials (username and password) in order to log-in.
Adding New Patient's Records	<ul style="list-style-type: none"> The assistant should be able to create a new patient record for a non-existing patient.
Managing Patient's Record	<ul style="list-style-type: none"> The assistant and doctor should be able to search a particular patient. The assistant and the doctor should be able to view the lists of the patient's record. The system should be able to filter the list of all patients' record. The assistant and the doctor should be able to view the scheduled patient. The assistant and the doctor should be able to view the updated record of a particular patient. The assistant and the doctor should be able to view the complete information of a particular patient. The assistant should be able to edit and update patient records when needed. The system must be able to track the payments of the patients.
Patient's Record Status	<ul style="list-style-type: none"> The assistant should be able to change the status of the scheduled patient into "cancelled" or "rescheduled".

Table 3 Functional Requirements of User Management

Functional Requirements	Description
Login	<ul style="list-style-type: none"> The admin should be able to enter his credentials (username and password) in order to log-in.
Adding New User	<ul style="list-style-type: none"> The admin must be able to add new user account
Reset Password	<ul style="list-style-type: none"> The user must be able to reset the password of the user. The system must be able to provide an auto-generated password.
Activate/Deactivate User Account	<ul style="list-style-type: none"> The admin must be able to activate or deactivate user account.

3.1.2 Non-Functional Requirements

The non-functional requirements of the system were identified to ensure stability and efficiency when using the system.

Table 4 Non-Functional Requirements

Non-Functional Requirements	Description
Availability	<ul style="list-style-type: none"> The system will always be available during the working hours of the United Specialty Clinic.
Reliability	<ul style="list-style-type: none"> The system should be able to notify the user such that it will display a message when an error occurs. The system must be able to validate the user's input.
Available	<ul style="list-style-type: none"> The system must be able to produce accurate results .
Usability	<ul style="list-style-type: none"> The system should be user friendly for the assistant and doctor for easier understanding on how to use the system.
Responsiveness	<ul style="list-style-type: none"> The system's interface must be responsive regardless of the web browser that has been used.
Security	<ul style="list-style-type: none"> The system shall deny unauthorized users and shall only be accessed by the legitimate users.

3.2 Modules and Features of the System

The modules and features of the pediatric department of the clinic were identified using the functional and non functional requirements of the system and through interviews and observations. The different modules of the system include the admin, doctor and assistant module.

The admin module includes account management and has an access to all the modules. The doctor module will only cover the viewing of the inventory, monitoring, adding diagnosis and immunization to the patient record. The assistant module includes the management of the inventory such as editing, adding, updating and removing a vaccine from the list along with monitoring the patient's record.

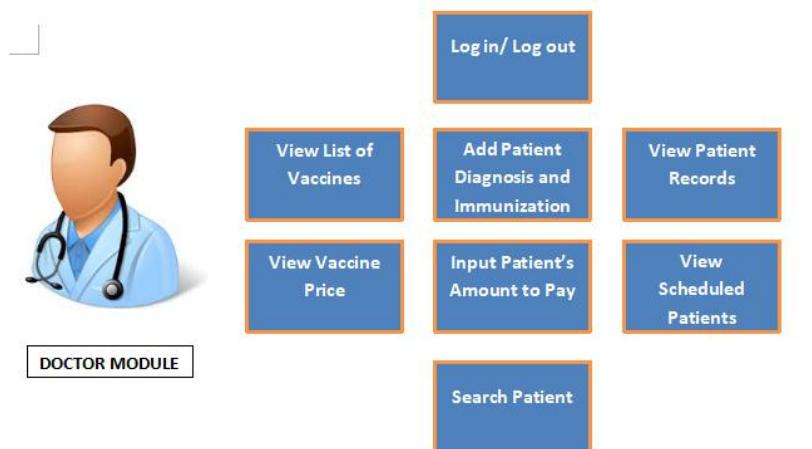


Figure 8 Doctor Module

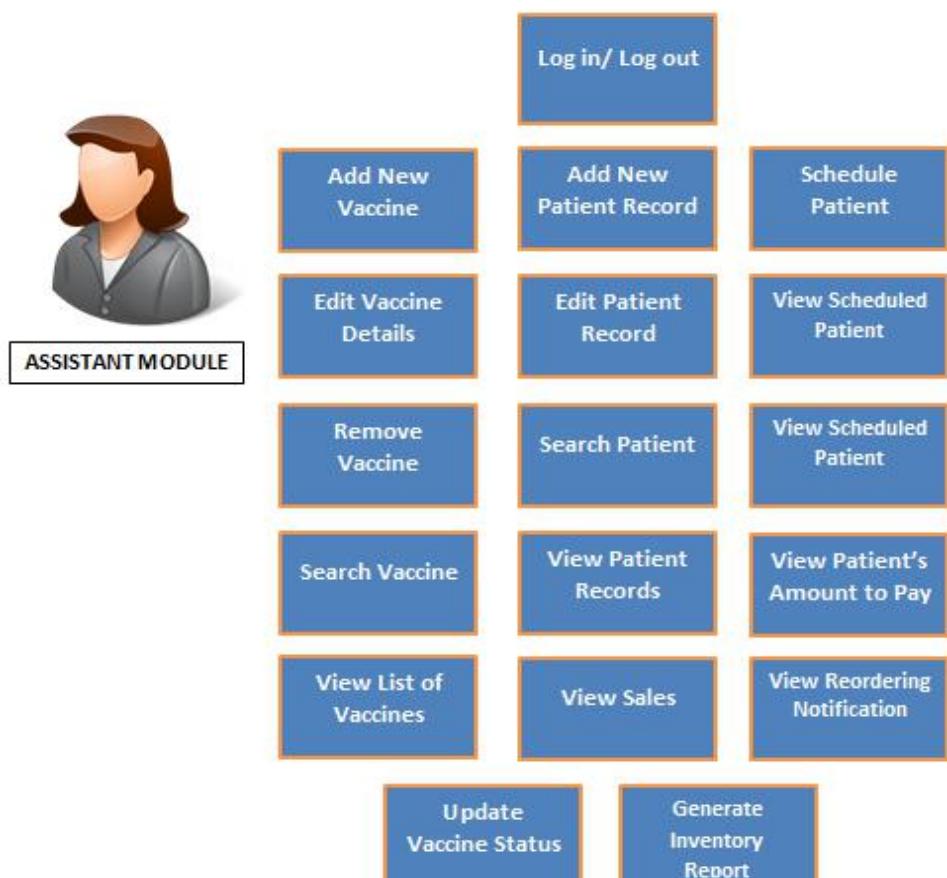


Figure 9 Assistant Module

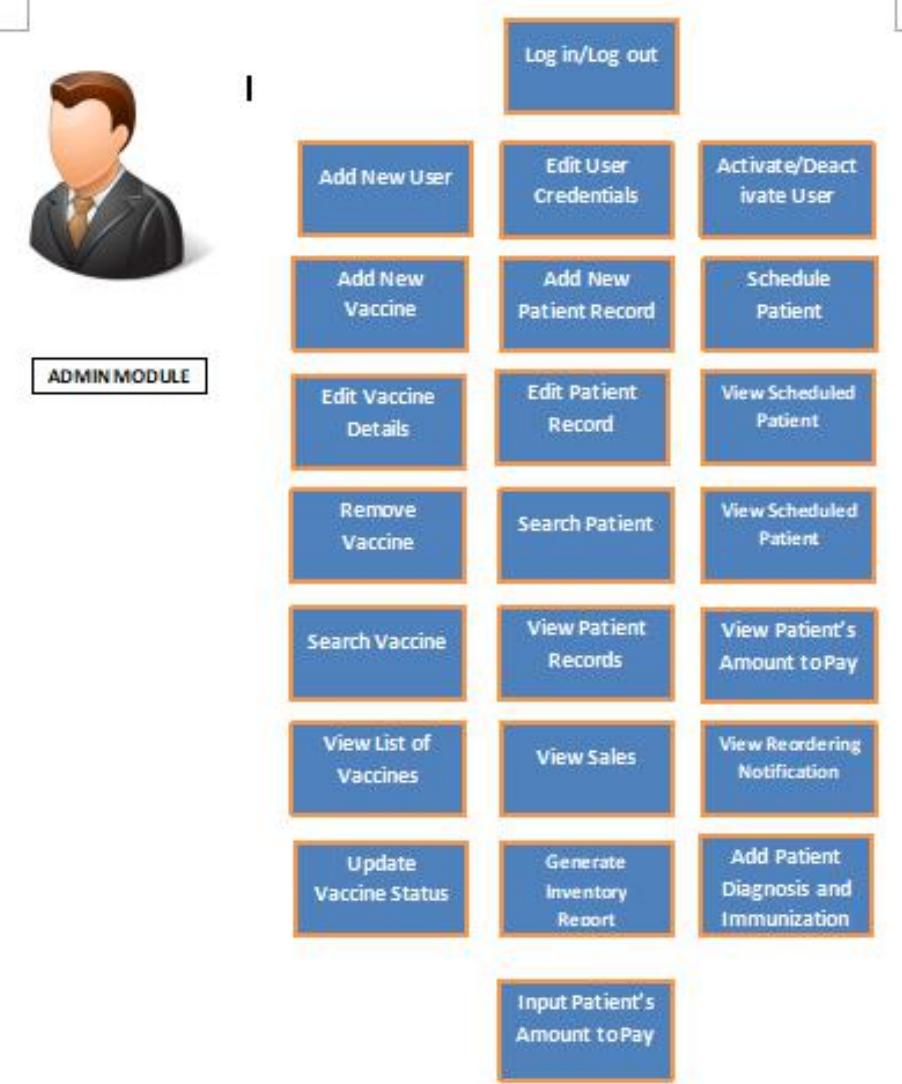


Figure 10 Admin Module

3.3 System Design

Design Specification

The group used several graphical tools, diagrams and analysis tools such as use case diagrams, data flow diagram, data dictionary, entity relationship diagram and relational database schema in creating the design of the system.

The use case diagram as shown in Figure 8 presents the roles of the users to the system such as the doctor, assistant and the patient. The roles of the users were determined using the identified functional requirements along with the different modules and features of the system.

Table 5 Web Technologies

Tools and Technologies		
Web Platform	Xampp Server	Provides the apache web server and MySQL database
Framework	Bootstrap and Laravel	Bootstrap and Laravel is an open source used for front-end in developing web application
Template	Admin Lite LTE	The template that will be used for the system
IDE	Visual Studio Code	Environment editing tool used in modifying the contents of the template
Data Storage	SQL	Language used for storing, manipulating and retrieving data for the database
Web Page Structure	HTML	Markup language in constructing the webpage
Web Page Presentation	CSS3	Describes and provides the styles for HTML
Browser	Google Chrome and Internet Explorer	Opens the output for the system created
Scripting Languages	PHP, JavaScript, JQuery	Scripting languages used for the server-side and client-side on developing the webpage
Database Management Tools	MySQL and PHPMyAdmin	Open source software that is used in creating and modifying the contents of the database

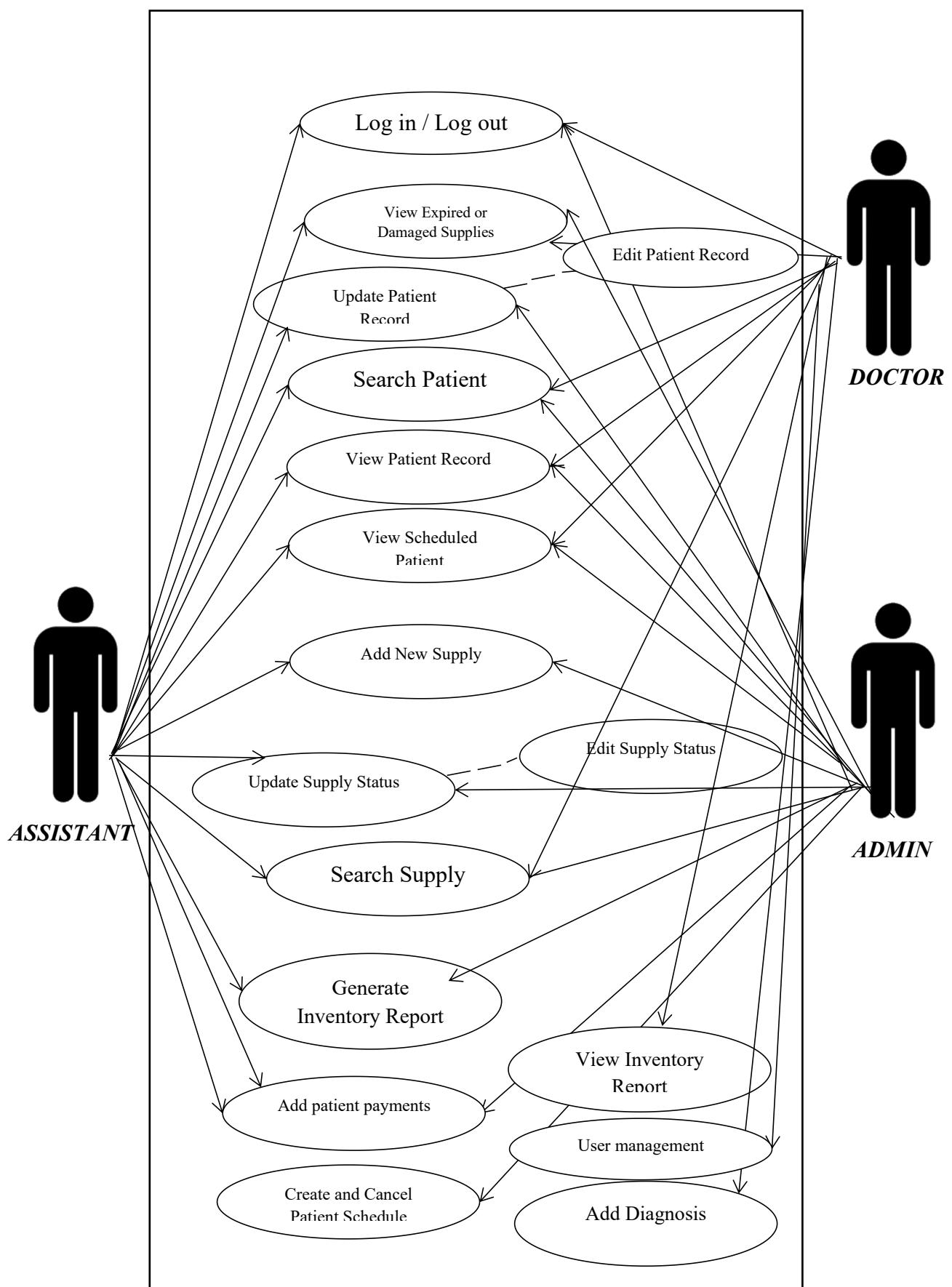


Figure 11 Use Case Diagram of United Specialty Clinic

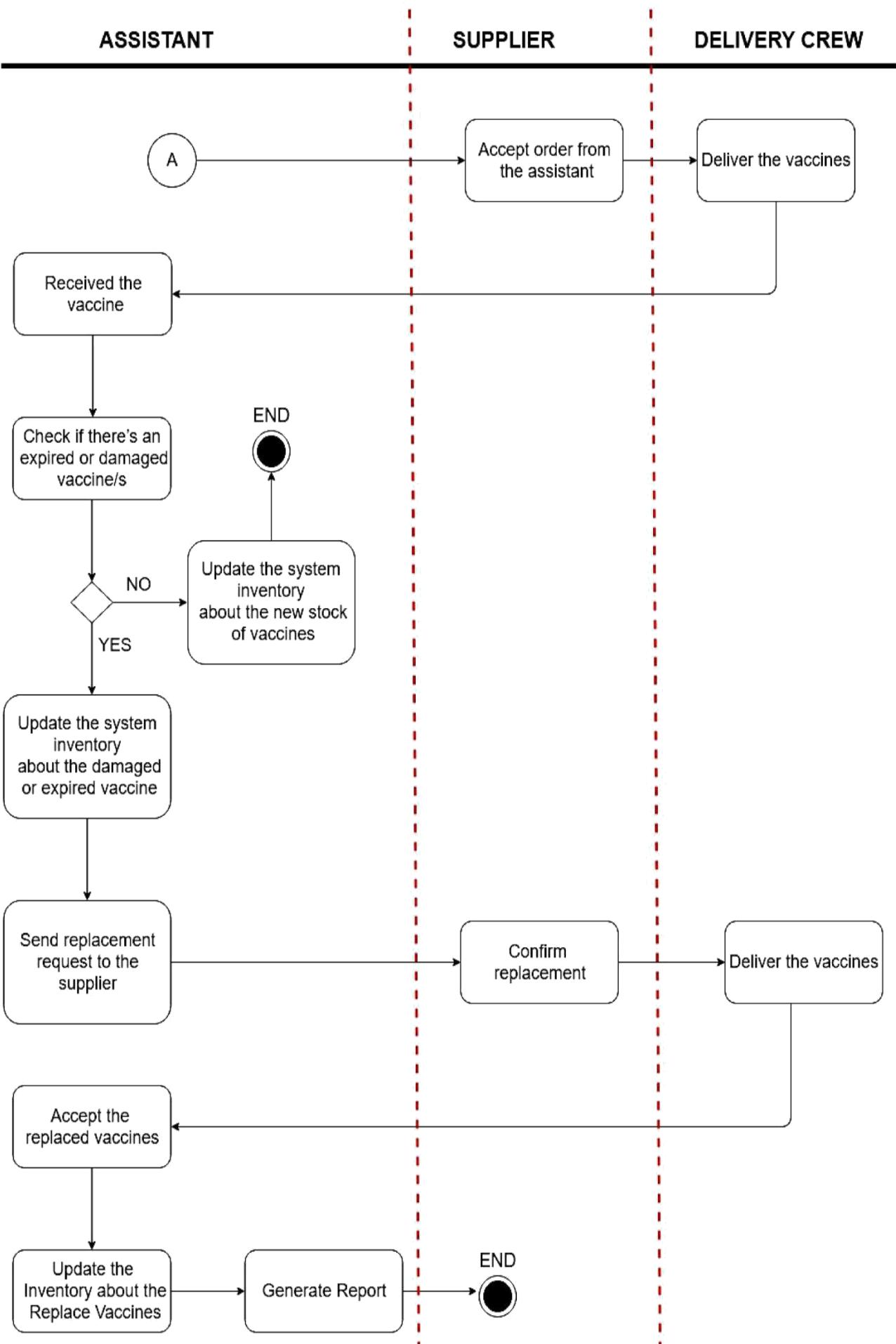
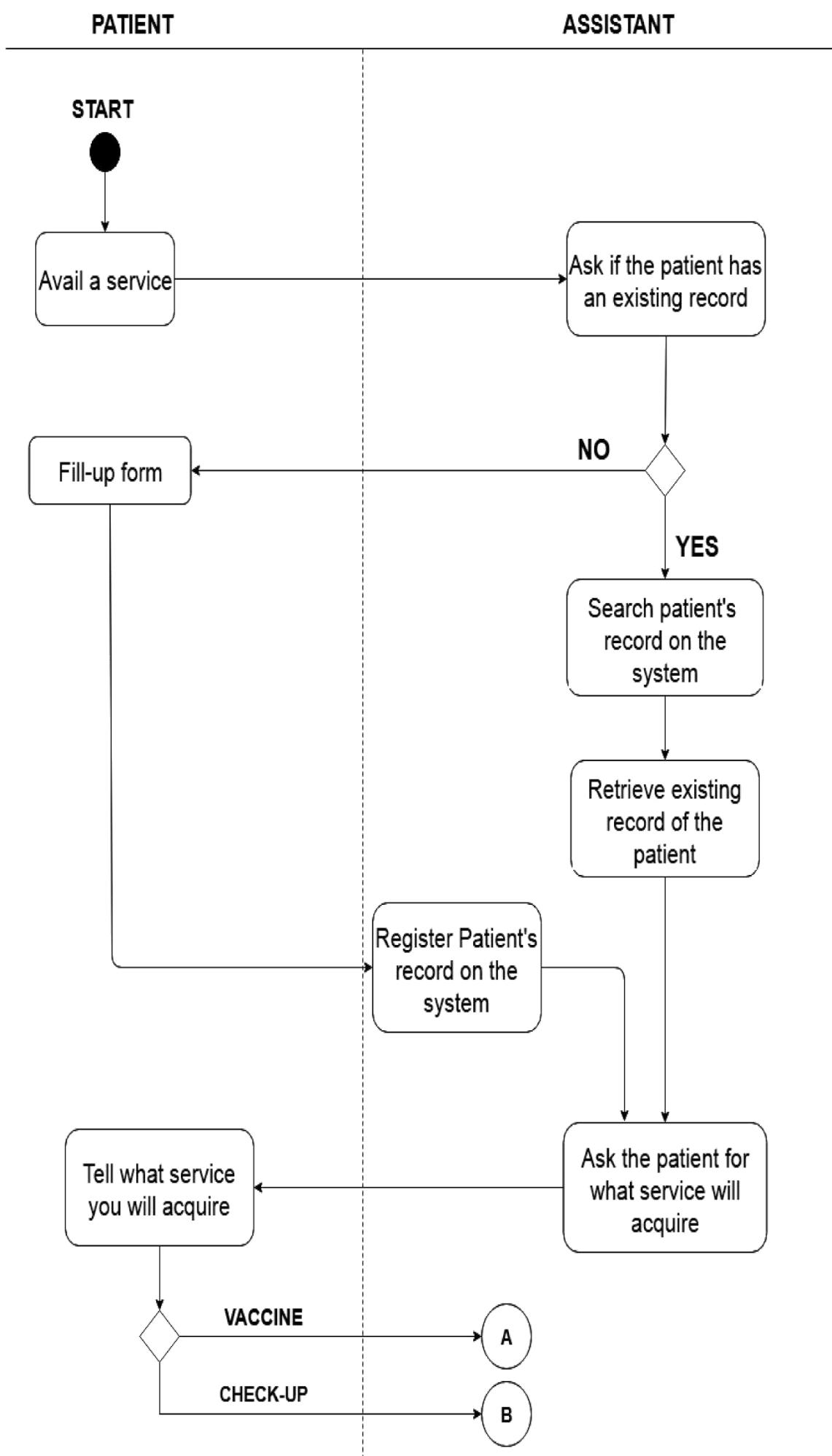


Figure 12 Work Flow Diagram of the Proposed Inventory Management for Pediatric Department of United Specialty Clinic



Continuation

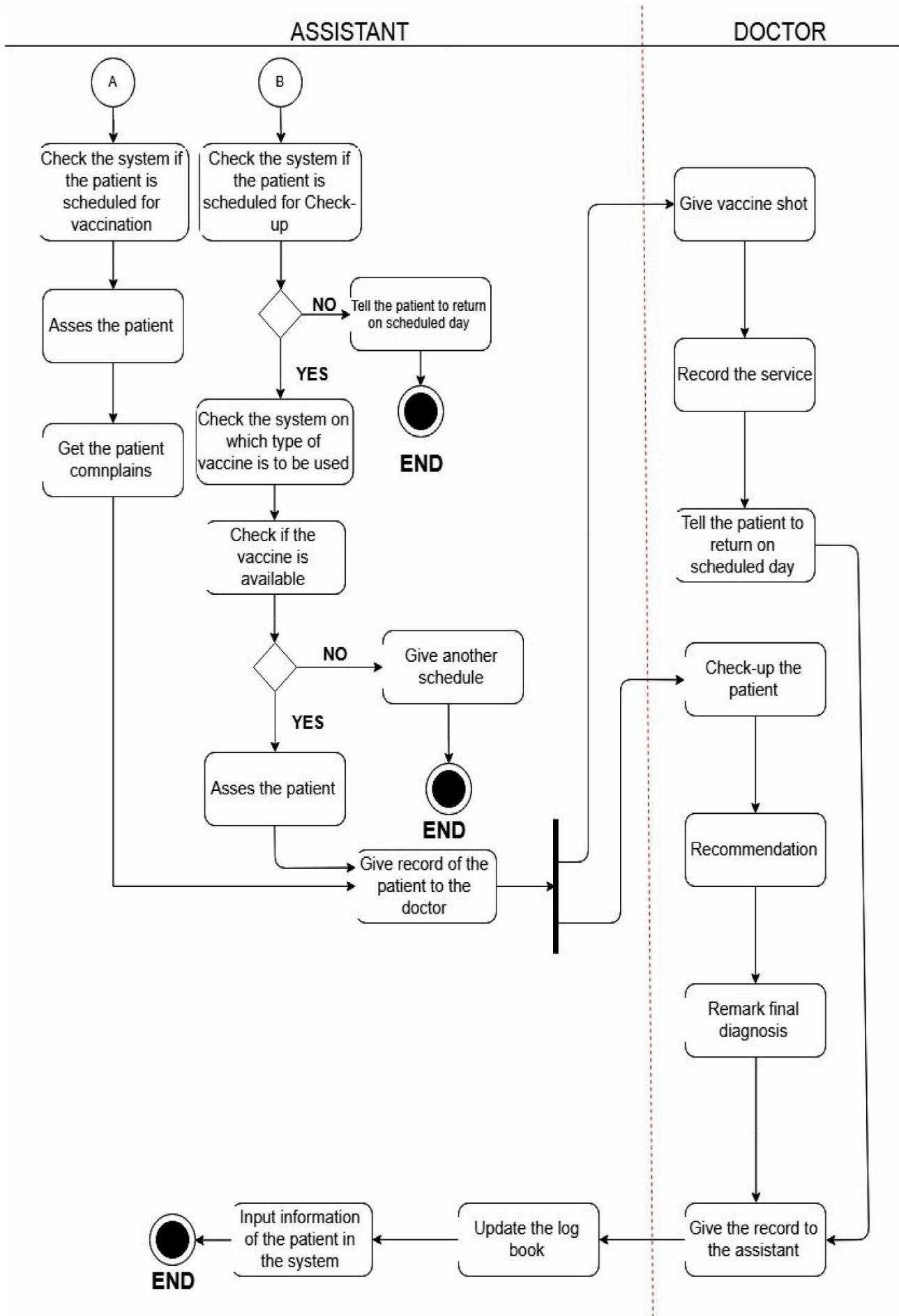


Figure 13 Activity Flow Diagram of the Proposed Record Keeping for Pediatric Department of United Specialty Clinic

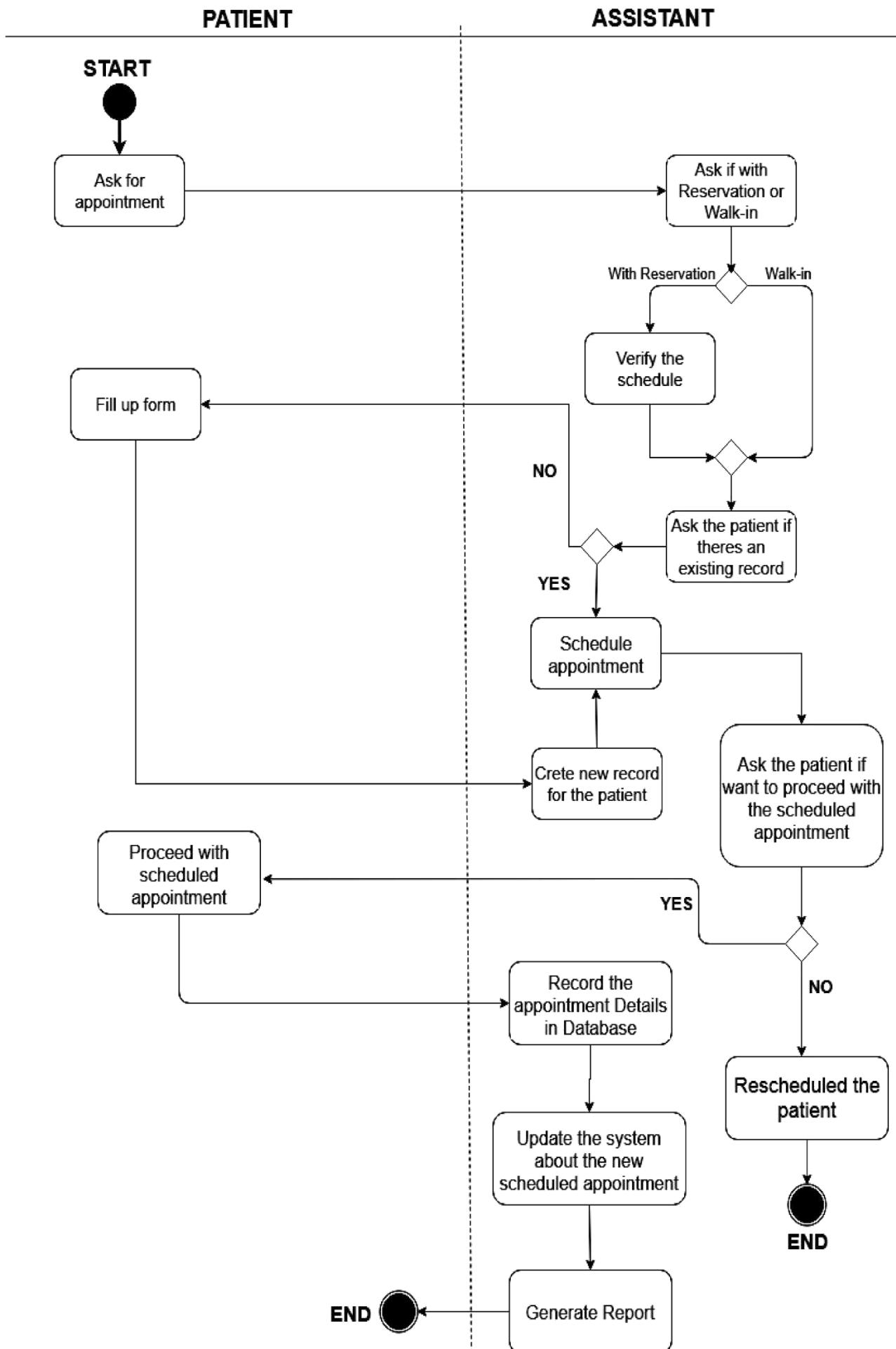


Figure 14 Activity Flow Diagram of the Proposed Scheduling Process for Pediatric Department of United Specialty Clinic

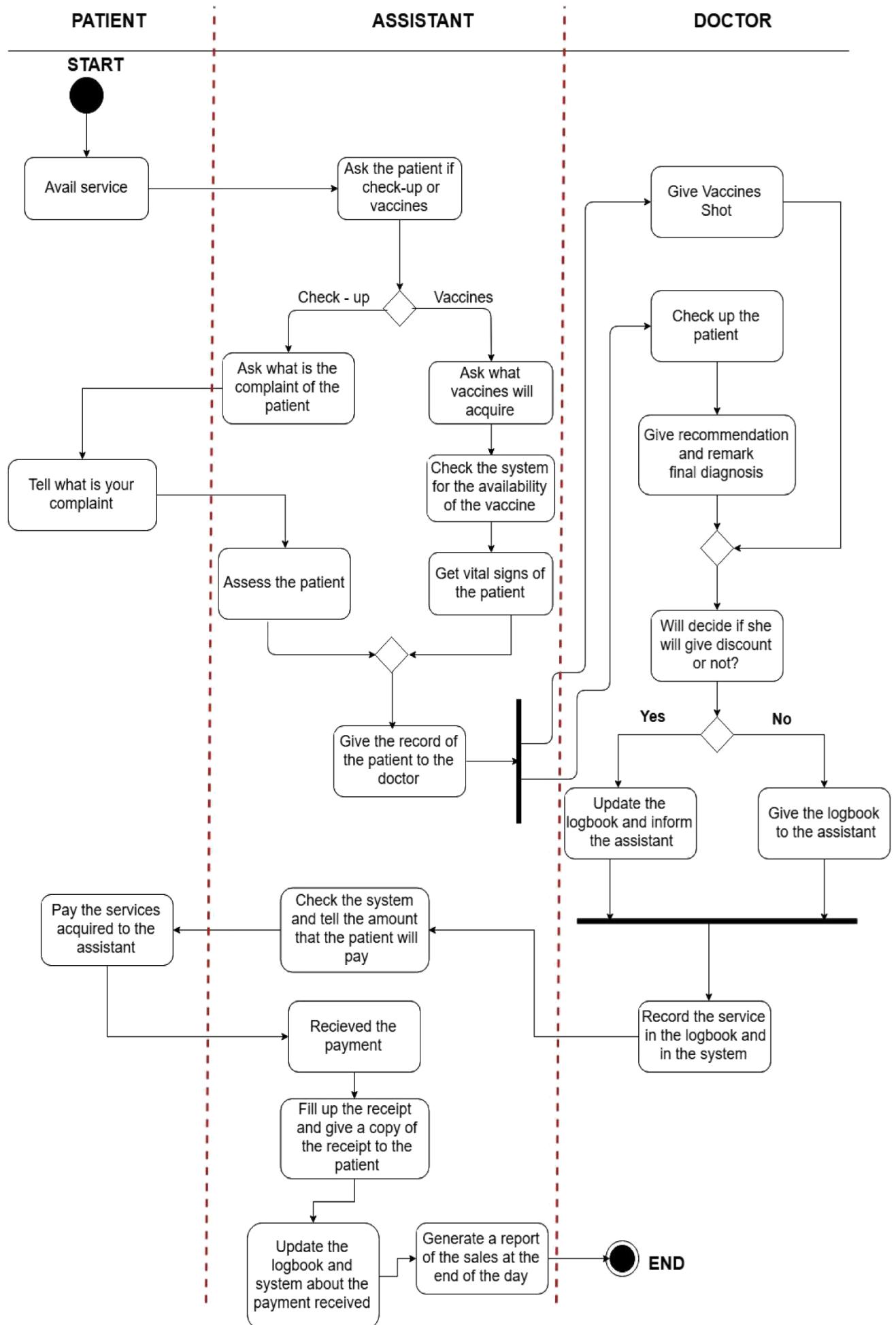


Figure 15 Activity Flow Diagram of the Proposed Sales Monitoring for Pediatric Department of United Specialty Clinic

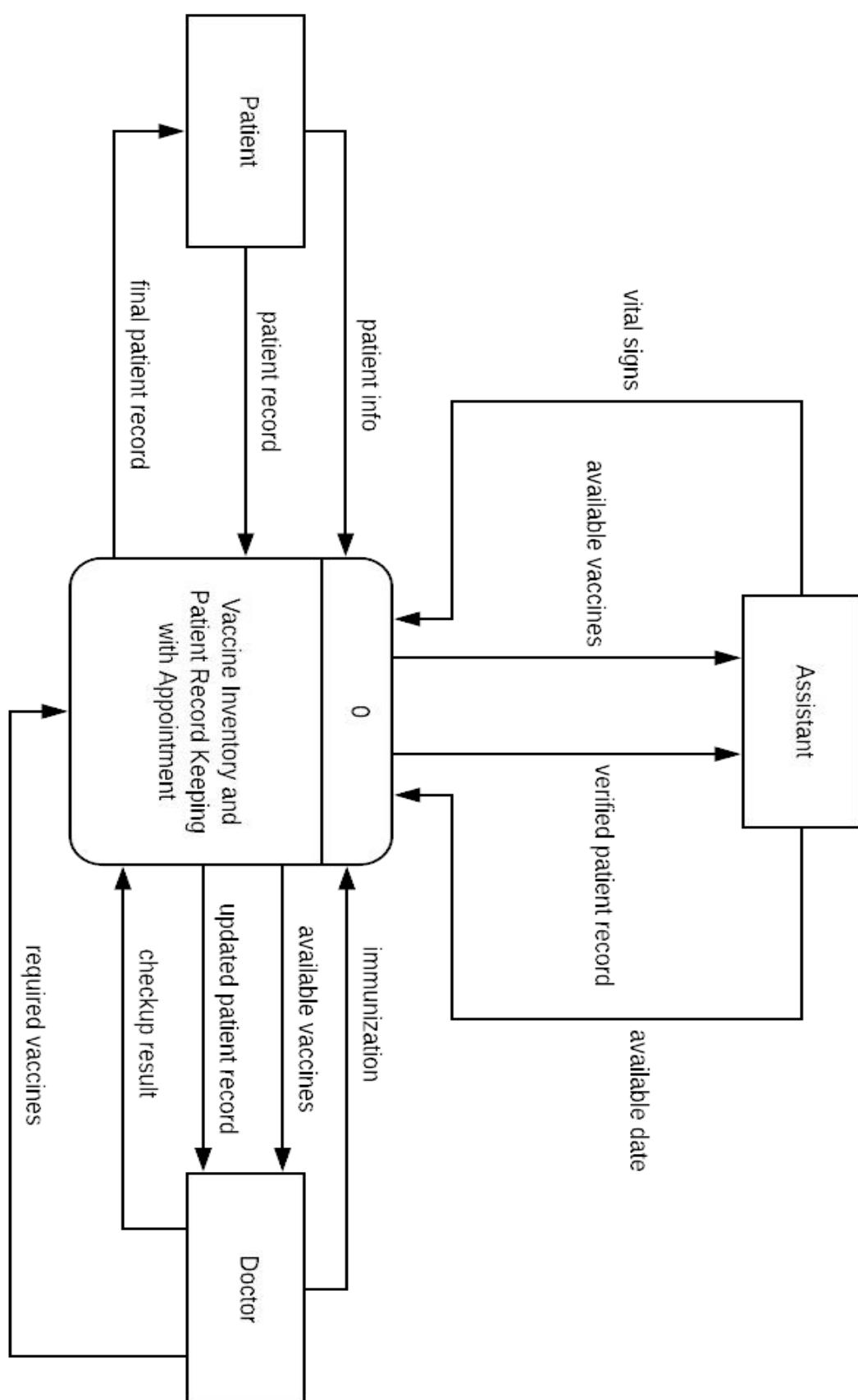


Figure 16 Data Flow Diagram (Context Level)

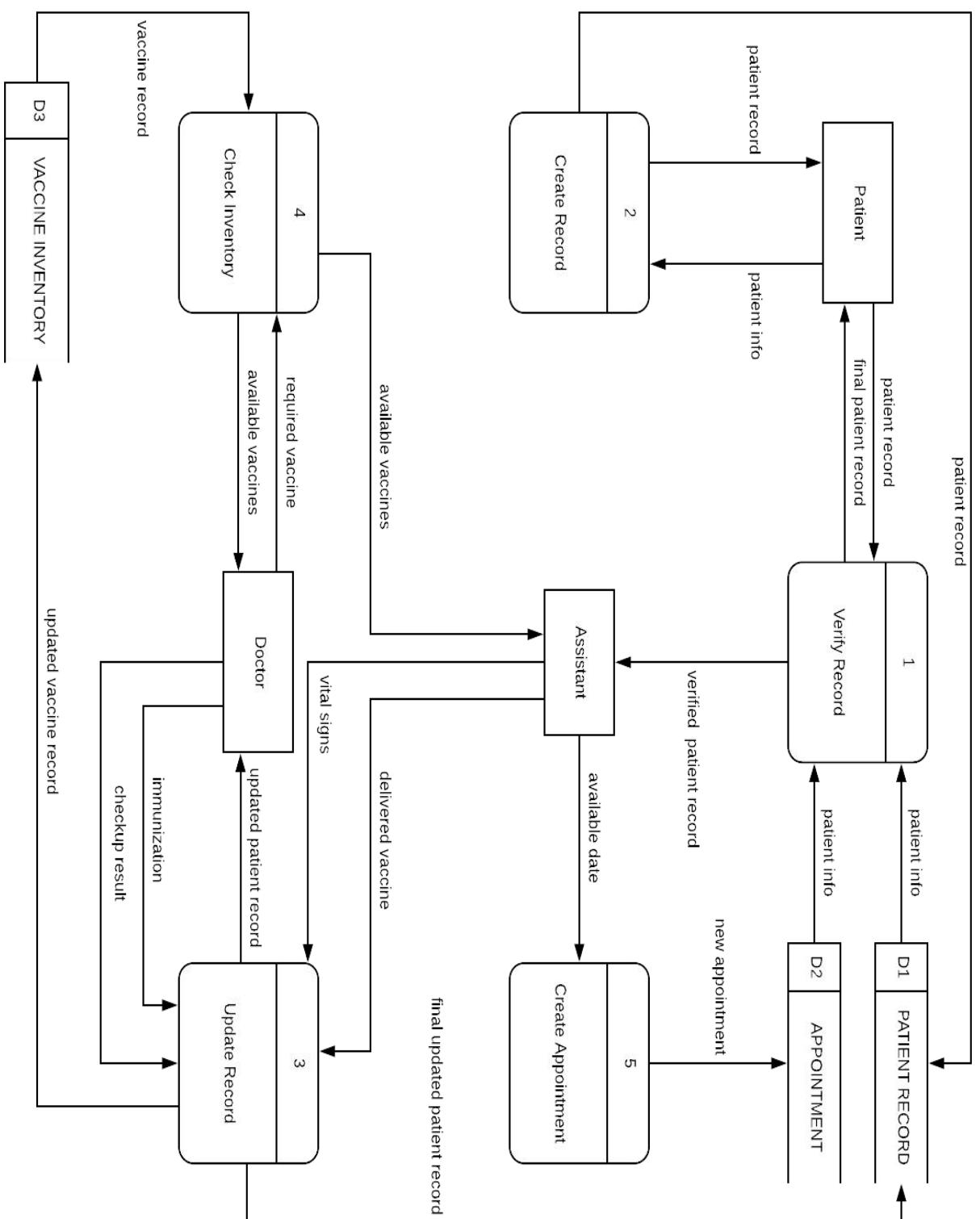


Figure I7 Data Flow Diagram (Level 0)

Data Dictionary

A

Abdominal circumference	= number
Address	= string
age	= number
Allergies	= string
Appointment	= date + total amount + appointment status
Appointment status	= [Paid Scheduled]
Available date	= date
Available vaccines	= vaccine type + quantity

B

Birthday	= date
Birth history	= blood type + birth length + birth height + head circumference + chest circumference + abdominal circumference
Birth length	= number
Blood type	= [A B O AB A+ B+ AB+ A- B- AB-]

C

Checkup result	= prescription + diagnosis
Chest circumference	= number
Contact number	= number

D

Date	= month + day + year
Date administered	= date
Date received	= date
Day	= [1...31]
Delivered vaccine	= date received + vaccine list + total amount + quantity
Diagnosis	= vital signs + allergies
Dose	= number

E

Expiration date	= date
-----------------	--------

F

Father's name	= string
Father's occupation	= string
Final patient record	= final updated patient record + new appointment
Final updated patient record	= updated patient record + immunization + checkup result
First name	= string

G

Gender	= [Male Female]
H	
Head circumference	= number
height	= number
I	
Immunization	= vaccine acquired + dose
L	
	= string
Last name	= text
Lot number	
M	
Month	= [Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec]
Mother's name	= string
Mother's occupation	= string
N	
New Appointment	= date
Number	= [0...9]
P	
Patient info	= last name + middle name + first name + birthday + address + gender + father's name + mother's name + mother's occupation + father's occupation + contact number + type of delivery + age + birth history
Patient record	= patient info + appointment
Prescription	= text
Pulse rate	= number
Q	
quantity	= number
R	
Required vaccine	= vaccine type + dose
respiration	= number
S	
string	= {a...z A...Z @,.}
T	
Text	= string + number
Total amount	= number
Type of delivery	= [Vaginal Delivery Natural Delivery Vacuum Assisted Delivery or Vacuum Extraction Forceps Delivery C-Section

	Vaginal Birth After Ceasarian]
temperature	= number
U	
Updated patient record	= patient record + vital signs
Updated Vaccine Record	= delivered vaccine + vaccine record
V	
Vaccine acquired	= vaccine list + date administered
Vaccine description	= text
Vaccine list	= vaccine type + vaccine name + lot number + date received + expiration date + vaccine status
Vaccine name	= text
Vaccine record	= vaccine list + dose + vaccine description
VACCINE INVENTORY	= updated vaccine record
Vaccine status	= [Available Damaged Expired Returned] = [BCG Hep. B DTwP IPV/OPV PCV RV Influenza Measles JE Vaccine MMR Varicella Hep. A HPV Dengue]
Vaccine type	= patient record + appointment
Verified patient record	= date + height + weight + pulse rate + respiration + temperature
Vital signs	
W	
weight	= number
Y	
Year	= number

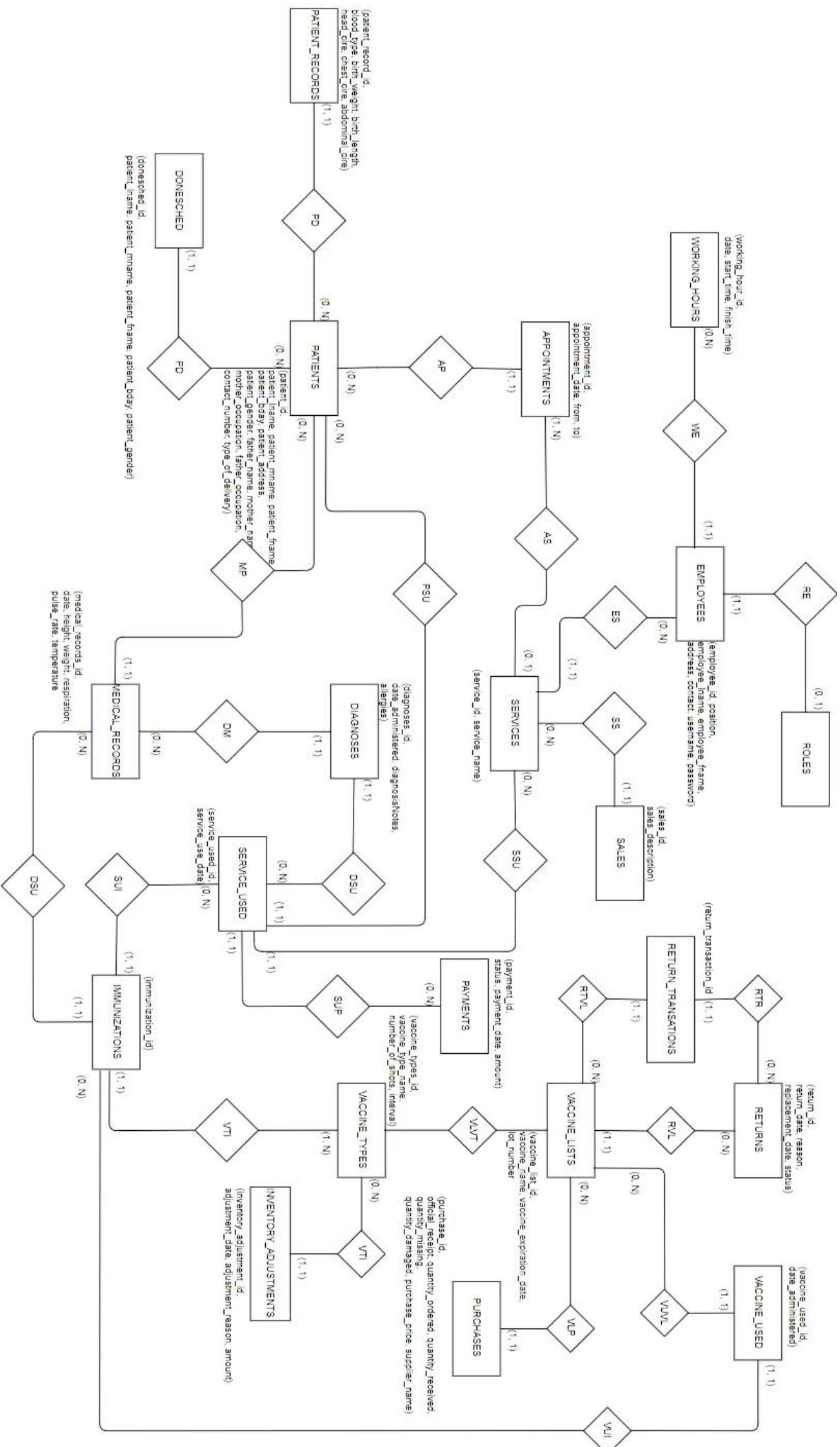


Figure 18 Entity Relationship Diagram

Relational Database Schema

APPOINTMENTS (appointment_id, appointment_date, from, to, patient_id, service_id)

FK patient_id REFERENCES PATIENTS Nulls Not Allowed

Delete Restrict, Update Cascade

service_id REFERENCES SERVICES Nulls Not Allowed

Delete Restrict, Update Cascade

DIAGNOSES (diagnoses_id, date_administered, diagnosisNotes, allergies, medical_records_id, service_used_id)

FK medical_records_id REFERENCES MEDICAL_RECORDS Nulls Not Allowed

Delete Restrict, Update Cascade

service_used_id REFERENCES SERVICES Nulls Not Allowed

Delete Restrict, Update Cascade

DONESCHED (donesched_id, patient_lname, patient_mname, patient_fname, patient_bday, patient_gender, patient_id)

FK patient_id REFERENCES PATIENTS Nulls Not Allowed

Delete Restrict, Update Cascade

EMPLOYEES (employee_id, position, employee_lname, employee_fname, address, contact, username, password)

IMMUNIZATIONS (immunization_id, medical_records_id, vaccine_type_id, service_used_id)

FK medical_records_id REFERENCES MEDICAL_RECORDS Nulls Not Allowed

Delete Restrict, Update Cascade

vaccine_type_id REFERENCES VACCINE_TYPES Nulls Not Allowed

Delete Restrict, Update Cascade

service_used_id REFERENCES SERVICE_USED Nulls Not Allowed

Delete Restrict, Update Cascade

INVENTORY_ADJUSTMENTS (inventory_adjustment_id, adjustment_date, adjustment_reason, amount, vaccine_list_id)

FK vaccine_list_id REFERENCES VACCINE_LISTS Nulls Not Allowed

Delete Restrict, Update Cascade

MEDICAL_RECORDS (medical_records_id, date, height, weight, respiration, pulse_rate, temperature, patient_id)

FK patient_id REFERENCES PATIENTS Nulls Not Allowed

Delete Restrict, Update Cascade

PATIENTS (patient_id, patient_lname, patient_mname, patient_fname, patient_bday, patient_address, patient_gender, father_name, mother_name, mother_occupation, father_occupation, contact_number, type_of_delivery)

PATIENT_RECORDS (patient_record_id, blood_type, birth_weight, birth_length, head_circumference, chest_circumference, abdominal_circumference, patient_id)

FK patient_id REFERENCES PATIENTS Nulls Not Allowed

Delete Restrict, Update Cascade

PAYMENTS (payment_id, status, payment_date, amount, service_used_id)

FK service_used_id REFERENCES SERVICE_USED Nulls Not Allowed

Delete Restrict, Update Cascade

PURCHASES (purchase_id, official_receipt, quantity_ordered, quantity_received, quantity_missing, quantity_damaged, purchase_price, supplier_name, vaccine_list_id)

FK vaccine_list_id REFERENCES VACCINE_LISTS Nulls Not Allowed

Delete Restrict, Update Cascade

RETURNS (return_id, return_date, reason, replacement_date, status, vaccine_list_id)

FK vaccine_list_id REFERENCES VACCINE_LISTS Nulls Not Allowed

Delete Restrict, Update Cascade

RETURN_TRANSACTIONS (return_transaction_id, vaccine_list_id, return_id)

FK vaccine_list_id REFERENCES VACCINE_LISTS Nulls Not Allowed

Delete Restrict, Update Cascade

return_id REFERENCES RETURNS Nulls Not Allowed

Delete Restrict, Update Cascade

ROLES (role_id, title, employee_id)

FK employee_id REFERENCES EMPLOYEES Nulls Not Allowed

Delete Restrict, Update Cascade

SALES (sales_id, sales_description, service_id)

FK service_id REFERENCES SERVICES Nulls Not Allowed

Delete Restrict, Update Cascade

SERVICES (service_id, service_name)

SERVICE_USED (service_used_id, service_use_date, service_id, patient_id)

FK service_id REFERENCES SERVICES Nulls Not Allowed

Delete Restrict, Update Cascade

patient_id REFERENCES PATIENTS Nulls Not Allowed

Delete Restrict, Update Cascade

VACCINE_LISTS (vaccine_list_id, vaccine_name, vaccine_expiration_date, lot_number, vaccine_type_id)

FK vaccine_type_id REFERENCES VACCINE_TYPES Nulls Not Allowed

Delete Restrict, Update Cascade

VACCINE_TYPES (vaccine_types_id, vaccine_type_name, number_of_shots, interval)

VACCINE_USED (vaccine_used_id, date_administered, vaccine_list_id, immunization_id)

FK vaccine_list_id REFERENCES VACCINE_LISTS Nulls Not Allowed

Delete Restrict, Update Cascade
 immunization_id REFERENCES IMMUNIZATIONS Nulls Not Allowed
 Delete Restrict, Update Cascade

WORKING_HOURS (working_hour_id, employee_id, date, start_time, finish_time)
 FK employee_id REFERENCES EMPLOYEES Nulls Not Allowed
 Delete Restrict, Update Cascade

3.4 System Implementation

With the various related literature and systems that the group had examined, the different tools and technologies were identified as well as the different types of testing that will be used in implementing the system.

3.4.1 Development Tools

The different development tools that will be used in creating the system as well as the tools to be used in database management were determined with the groups familiarity and knowledge. Related articles and journals were also considered by the group in identifying the different tools and technologies.

The different technologies such as frameworks, front-end and back-end tools that will be used in developing the system are presented below.

Table 6 Programming Environment

Web Technologies	
Name of Technology	Description
HTML 	Standard markup language used in editing and developing a website
CSS 	Style sheet language used for the development of web design

	<p>Server-side scripting language to fetch and store data from and to the database</p>
	<p>A cross-platform JavaScript library used for creating interactive User Interface</p>
Bootstrap 	<p>A free and open-source front-end library with a pre-designed interface that is used for front-end developers</p>
	<p>An open-source PHP web framework, intended for the development of web applications</p>
	<p>A programming language used to enhance the interaction between end-users and the website</p>
Text Editors	
Visual Studio Code 	<p>Visual Studio Code is a code editor redefined and optimized for building and debugging modern web and cloud applications.</p>
Data Management	
	<p>An open-source relational database management system that can run in all platforms. It is based on SQL.</p>

	A tool written in PHP, intended to handle the administration of MySQL over the Server.
 Apache HTTP Server	An open-source HTTP server that can run on windows and unix
	Tool to fetch and store data from and to the database

3.4.2 System Testing

There are four different testing types that the group will conduct such as unit testing, integration testing, functional testing and performance testing.

The appropriate testing type will be used to verify if the functional requirements of the system are working properly and to confirm that the non functional requirements are met. The different testing type will be performed to validate the requirements and to look for bugs and errors within the system.

Unit Testing

The purpose of unit testing is to validate that each unit of the software performs as designed. Several unit testing tasks include the reviewing of the system before performing the actual test.

Integration Testing

The purpose of this level of testing is to detect errors in the interaction between integrated units. Integration testing is performed to expose defects in the interfaces and interactions within the system.

Functional Testing

The purpose of functional testing is to verify the process of the software development by which the system will be tested to check if all functional requirements are met.

Performance testing

Performance testing is used to determine the system parameters in the flexibility and security of the workload. Several tasks are considered such as load testing to conduct the behavior of the system in a specific load.

3.4.3 Architecture of the System

3.4.3.1 System Architecture

The group used a client-server architecture where the server acts as producer since most of the task are done by the server such as hosting and managing the resources of the system where all the data are stored and retrieved through the server where the database is located.

For the client to have an access to the web application, the client would first need to start a connection to the server through the network and wait for the server's response until a stable connection to the server is established.

Some instances like data lost can be recovered immediately and conveniently by using a client-server architecture where creating a backup of all the files are easier considering that the files will be stored on the server.

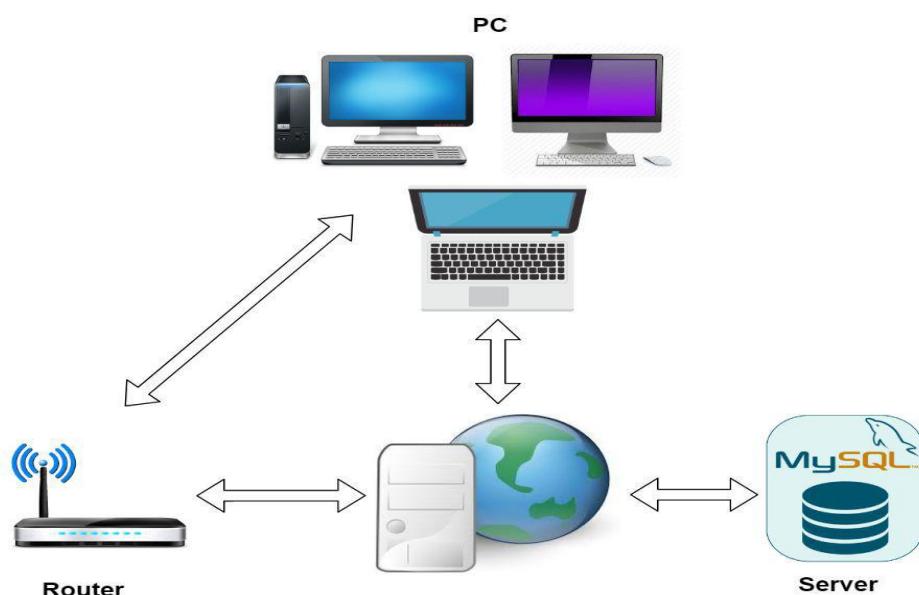


Figure 19 System Architecture for Pediatric Department of United Specialty Clinic

3.4.3.2 Development Architecture

In the development of the system, the group make use of a repository tool specifically GitHub which will allow the group to collaborate and work orderly and to keep track of the various changes made to the project and to quickly check the revisions that has been made.

For the functionality of the system, the group will be using several scripting languages such as JavaScript, HTML, CSS and PHP. The group will also use frameworks specifically Bootstrap and Laravel for the frontend and backend development of the web application.

For the database management, different servers and applications like MySQL Workbench and PhpMyAdmin will also be used for creating and populating databases.

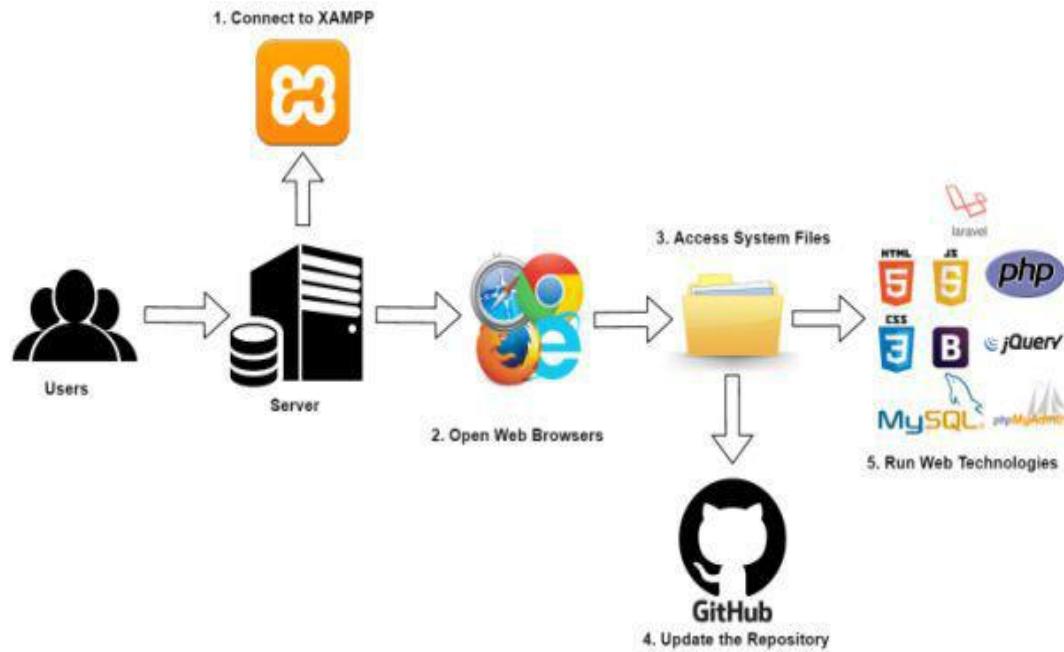


Figure 20 Development Architecture for Pediatric Department of United Specialty Clinic

3.5 System Deployment

In deploying the system, the minimum computer requirements for the hardware, software and network were identified by searching and analyzing the minimum requirements needed for the web technologies to run as well as the configuration and installation of the needed softwares for the system to work.

An additional interview will also be conducted with the doctor and assistant of the pediatric department of United Specialty Clinic in relation to the placement of the hardware. After the installation, testing the system will follow as well as demonstrating to the doctor and assistant how the system will be used.

3.5.1 User Manual

The group will create a user manual that will contain the different steps on how to use the different modules and features of the system. The user manual will also contain the step by step training on the different functions of the system as well as its capabilities and use.

User Interface

The figures below presents the high fidelity prototype created by the group to have a better view on the system.

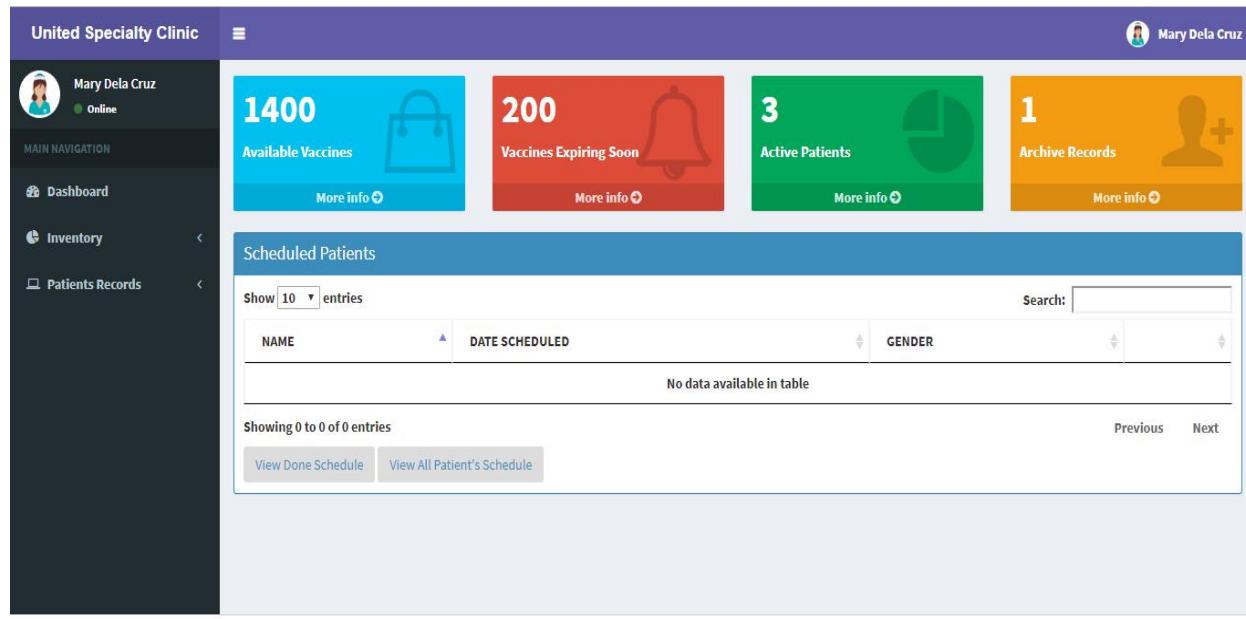


Figure 21 Dashboard Interface of United Specialty Clinic

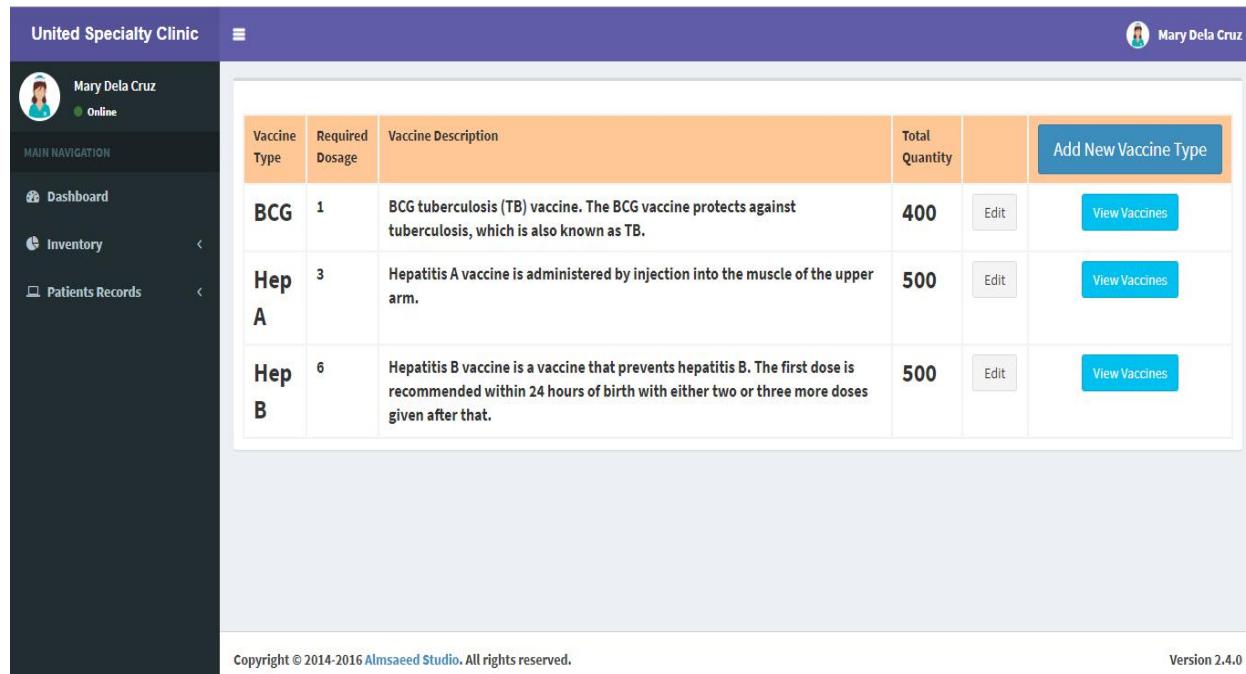


Figure 22 Inventory Interface of United Specialty Clinic

United Specialty Clinic

Mary Dela Cruz Online

MAIN NAVIGATION

- Dashboard
- Inventory
- Patients Records

Vaccine Type Name
BCG

Vaccine Dose
1

Vaccine Type Description
Bacillus Calmette Guérin vaccine is a vaccine primarily used against tuberculosis.

Add Type

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 23 Add New Vaccine Type Interface of United Specialty Clinic

United Specialty Clinic

Mary Dela Cruz

MAIN NAVIGATION

- Dashboard
- Inventory
- Patients Records

BCG

Show 10 entries Search:

Vaccine Name	Lot No.	Expiration Date	Date Received	Quantity	Price	Edit	Adjust
Bacille Calmette-Guerin BCG	1127G	2019-05-16	2019-01-15	200	1550	<input type="checkbox"/>	<input type="button" value="Adjust Here"/>
Bacillus Calmette-Guerin	1115F	2019-04-17	2019-01-16	200	1550	<input type="checkbox"/>	<input type="button" value="Adjust Here"/>

Showing 1 to 2 of 2 entries Previous 1 Next

Add New Vaccine

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 24 VaccineType Interface of United Specialty Clinic

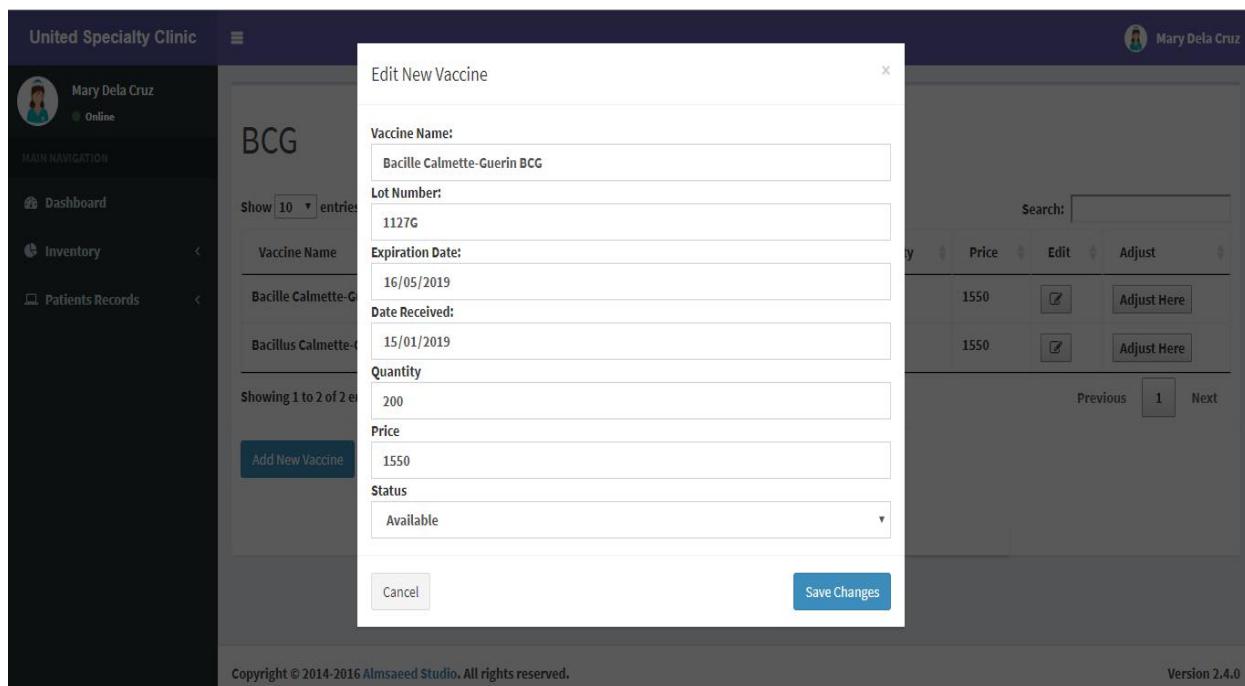


Figure 25 Edit Vaccine Interface of United Specialty Clinic

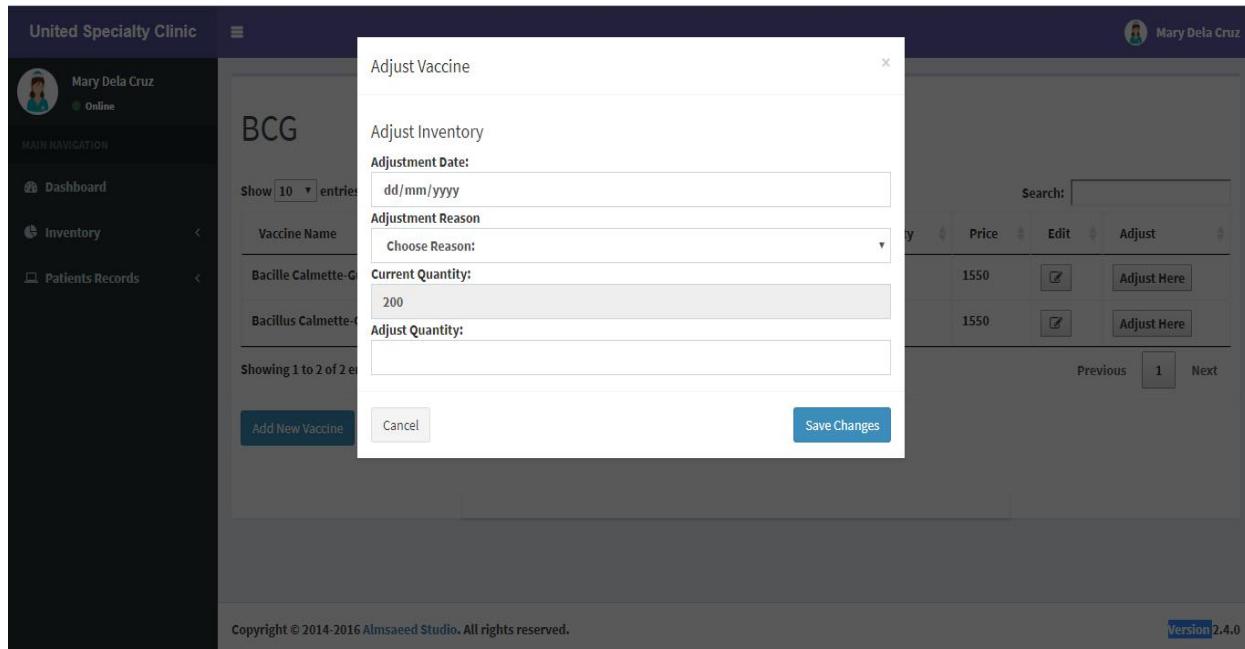


Figure 26 Adjust Vaccine Interface of United Specialty Clinic

Inventory Report

Show 10 entries

Vaccine Name	Available Quantity
BCG	400
Hep A	500
Hep B	500

Showing 1 to 3 of 3 entries

Previous 1 Next

Print

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 27 Adjust Vaccine Interface of United Specialty Clinic

Inventory Adjustment Record

Show 10 entries

VACCINE NAME	LOT NUMBER	QUANTITY	ADJUSTMENT DATE	ADJUSTMENT REASON
--------------	------------	----------	-----------------	-------------------

No data available in table

Showing 0 to 0 of 0 entries

Previous Next

Print Report

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 28 Inventory Adjustment Record Interface of United Specialty Clinic

PATIENT FORM

PERSONAL DETAILS

First Name	Middle Name	Last Name	
First Name	Middle Name	Last Name	
Gender	Date of Birth	Age	Contact No:
Choose...	Date of Birth	Age	09*****
Address			
Mother's Name		Occupation	
Mother's Name		Occupation	
Father's Name		Occupation	
Father's Name		Occupation	

Figure 29 Register New Patient Record Interface of United Specialty Clinic

BIRTH HISTORY

Mother's Name	Occupation				
Father's Name	Occupation				
Father's Name	Occupation				
Type of Delivery:					
Choose...	Blood Type:				
Choose...	Choose...				
Birth Weight:	Birth Length:				
Birth Weight	kg	Birth Length	cm		
Head Circumference:	Chest Circumference:	Abdominal Circumference:			
Head Circumference	cm	Chest Circumference	cm	Abdominal Circumference	cm

Reset Add Patient

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 30 Register New Patient Record Interface of United Specialty Clinic

The screenshot shows the 'List of Patients' page of the United Specialty Clinic software. At the top, there's a header bar with the clinic's name and a user profile for 'Mary Dela Cruz'. On the left, a dark sidebar titled 'MAIN NAVIGATION' includes links for 'Dashboard', 'Inventory', and 'Patients Records'. The main content area is titled 'List of Patients' and displays a table with three entries:

PATIENT'S NAME	DATE OF BIRTH	GENDER	
Drizzle Valdez	2014-01-07	Female	<button>Appoint Here</button>
Franchesca Derije	2009-01-20	Female	<button>Appoint Here</button>
Niall Horan	2015-01-13	Male	<button>Appoint Here</button>

Below the table, it says 'Showing 1 to 3 of 3 entries'. At the bottom right, there are navigation buttons for 'Previous', '1', and 'Next'.

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 31 List of Patient Records Interface of United Specialty Clinic

The screenshot shows the 'Personal Information' page for patient 'Drizzle Valdez' in the United Specialty Clinic software. The top navigation bar and sidebar are identical to Figure 31. The main content area is titled 'Personal Information' and contains two sections: 'General Information' and 'Birth History'.

General Information

Gender:	Female	Birthday:	2014-01-07
Mother:	Salina Valdez	Occupation:	Housewife
Father:	Hugo Valdez	Occupation:	Engineer
Address:	Baguio City, Baguio City	Contact Number:	09225441789

Birth History

Type of Delivery:	Natural Delivery	Head Circumference:	10 cm
Blood Type:	Type B	Chest Circumference:	15 cm
Birth Length:	25 cm	Abdominal Circumference:	16 cm
Birth Weight:	4 kg		

Figure 32 Patient Profile Interface of United Specialty Clinic

United Specialty Clinic

Mary Dela Cruz Online

MAIN NAVIGATION

- Dashboard
- Inventory
- Patients Records

Drizzle Valdez

PERSONAL INFORMATION

CHECK UP

IMMUNIZATION

MEDICAL RECORD

Vital Signs

Date:	dd/mm/yyyy
Height:	Height cm
Weight:	Weight kg
Pulse Rate:	Pulse Rate beats per minute
Respiration:	Respiration breaths per minute
Temperature:	Temperature °C

Submit

Figure 33 Add Patient Vital Signs Interface of United Specialty Clinic

MAIN NAVIGATION

- Dashboard
- Inventory
- Patients Records

General Information

First Name:	Middle Name:	Last Name:
Drizzle	Joy	Valdez
Gender:	Birthday:	
Female	07/01/2014	

Mother:	Mother Occupation:
Salina Valdez	Housewife
Father:	Father Occupation:
Hugo Valdez	Engineer
Address:	Contact Number:
Baguio City, Baguio City	9225441789

Birth History

Type of Delivery:	Blood Type
Vaginal Delivery	Type B
Birth Weight:	Birth Length:
4 kg	25 cm
Head Circumference:	Chest Circumference:
	Abdominal Circumference:

2014-01-07
Housewife
Engineer
09225441789

10 cm
15 cm
16 cm

Edit

Version 2.4.0

Figure 34 Edit Patient Record Interface of United Specialty Clinic

The screenshot shows the 'Archive Patient List' interface of the United Specialty Clinic system. At the top, there's a header bar with the clinic's name and a user profile for 'Mary Dela Cruz'. On the left, a dark sidebar lists 'MAIN NAVIGATION' items: Dashboard, Inventory, and Patients Records. The main content area has a blue header 'Archive Patient List'. Below it, a table displays patient information: 'PATIENT'S NAME' (Harry Styles), 'DATE OF BIRTH' (2000-02-23), and 'GENDER' (Male). A search bar and a page navigation section ('Showing 1 to 1 of 1 entries', 'Previous', '1', 'Next') are also present. At the bottom, copyright and version information are displayed.

Copyright © 2014-2016 Almsaeed Studio. All rights reserved. Version 2.4.0

Figure 35 Archive Patient Record List Interface of United Specialty Clinic

The screenshot shows the 'Archive Patient Profile' interface for patient 'Harry Styles'. The layout is similar to Figure 35, with a sidebar and a main content area. The main content includes a title 'Archive Patient Profile' and 'Harry Styles'. Under 'General Information', there's a table with four rows: Gender (Male), Birthday (2000-02-23), Mother (Anne Styles), Occupation (Housewife); Father (Gem Styles), Occupation (Engineer); Address (Aurora Hill, Baguio City), Contact Number (9998844552). Below this is a section titled 'Birth History' with a table containing birth details: Type of Delivery (Vaginal Delivery), Head Circumference (10 cm), Blood Type (Type A), Chest Circumference (15 cm); Birth Length (24 cm), Abdominal Circumference (16 cm); Birth Weight (3 kg).

Figure 36 Archive Patient Profile Interface of United Specialty Clinic

The screenshot shows the 'Vaccines Expiring Soon' interface. At the top, there's a header with the clinic name and a user profile. Below it, a large blue box displays '1400 Available Vaccines'. A central modal window titled 'Vaccines Expiring Soon' lists one entry:

VACCINE NAME	LOT NUMBER	QUANTITY	EXPIRATION DATE
Bacillus Calmette-Guerin	1115F	200	2019-04-17

Below the modal, there are two sections: 'Scheduled Patients' and 'Patients Records', both showing 0 entries. The bottom of the screen includes copyright and version information.

Figure 37 List of Expiring Vaccine Interface of United Specialty Clinic

The screenshot shows the 'Scheduled Patients' interface. At the top, there's a header with the clinic name and a user profile. Below it, a large blue box displays 'Scheduled Patients'. A central modal window titled 'Scheduled Patients' lists two entries:

PATIENT'S NAME	GENDER	DATE OF SCHEDULE	MODIFY
Drizzle Valdez	Female	2019-01-17	<button>Edit Schedule</button>
Niall Horan	Male	2019-01-17	<button>Edit Schedule</button>

Below the modal, there are two sections: 'Dashboard' and 'Inventory', both showing 0 entries. The bottom of the screen includes copyright and version information.

Figure 38 List of Scheduled Patient Interface of United Specialty Clinic

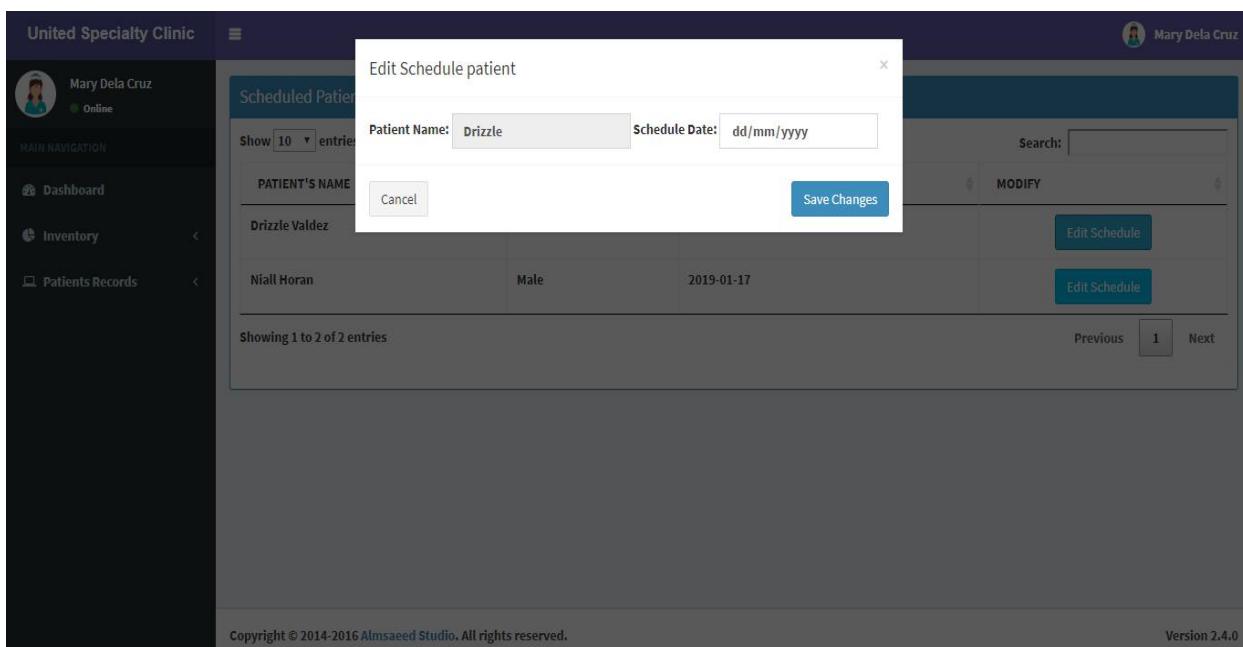


Figure 39 List of Edit Patient's Schedule Interface of United Specialty Clinic

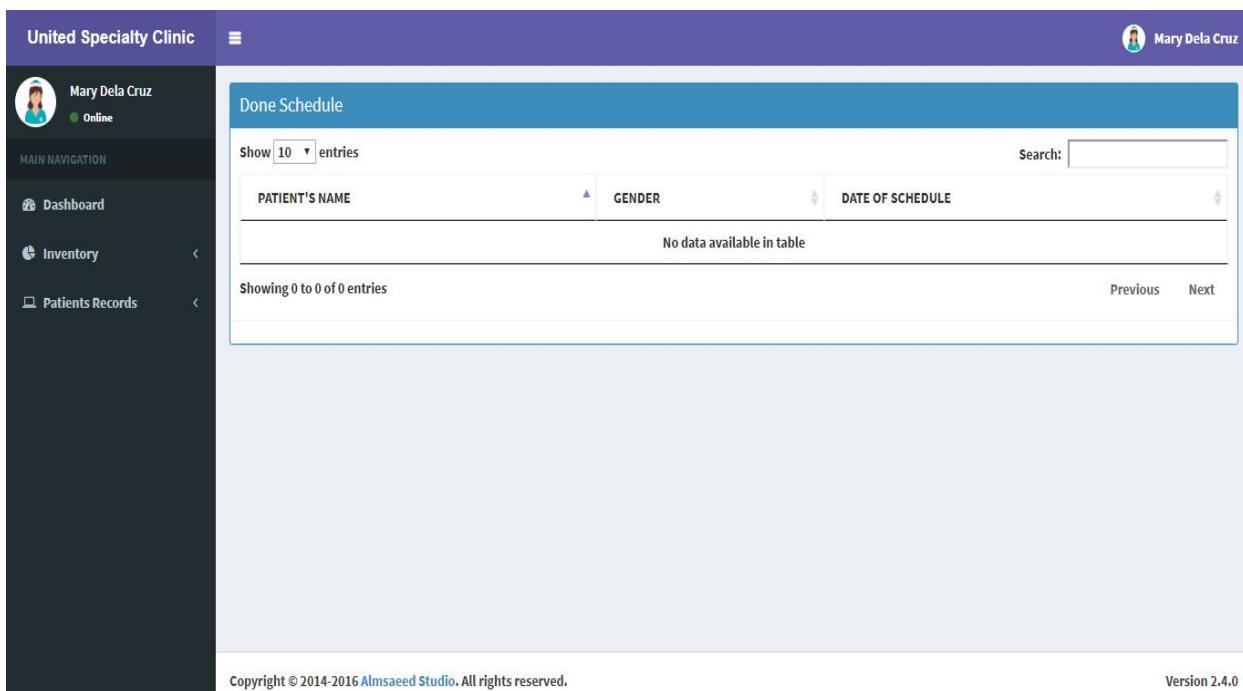


Figure 40 List of Done Patient's Schedule Interface of United Specialty Clinic

The screenshot shows the inventory interface for United Specialty Clinic. At the top, there's a header bar with the clinic's name and a user profile for 'Jane Doe'. On the left, a dark sidebar contains navigation links: 'Dashboard', 'Inventory' (which is currently selected), and 'Patients Records'. The main content area displays a table of vaccines:

Vaccine Type	Required Dosage	Vaccine Description	Total Quantity	Action
BCG	1	BCG tuberculosis (TB) vaccine. The BCG vaccine protects against tuberculosis, which is also known as TB.	400	View Vaccines
Hep A	3	Hepatitis A vaccine is administered by injection into the muscle of the upper arm.	500	View Vaccines
Hep B	6	Hepatitis B vaccine is a vaccine that prevents hepatitis B. The first dose is recommended within 24 hours of birth with either two or three more doses given after that.	500	View Vaccines

At the bottom of the page, there are copyright and version information: 'Copyright © 2014-2016 Almsaeed Studio. All rights reserved.' and 'Version 2.4.0'.

Figure 41 Inventory Interface of the Doctor of United Specialty Clinic

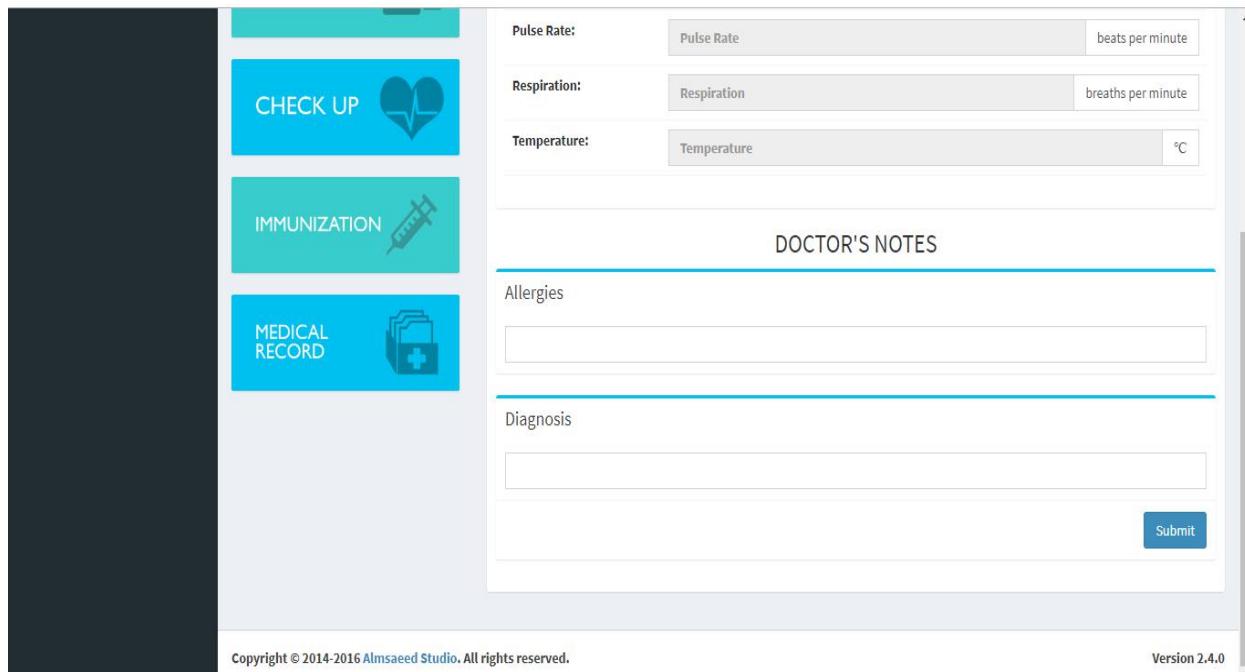
This screenshot shows a detailed view of the BCG vaccine inventory. The top navigation bar and sidebar are identical to Figure 41. The main content area has a title 'BCG' and includes a search bar and a table with the following data:

Vaccine Name	Lot No.	Expiration Date	Date Received	Quantity	Price
Bacille Calmette-Guerin BCG	1127G	2019-05-16	2019-01-15	200	1550
Bacillus Calmette-Guerin	1115F	2019-04-17	2019-01-16	200	1550

Below the table, it says 'Showing 1 to 2 of 2 entries' and includes navigation buttons for 'Previous', '1', and 'Next'.

At the bottom of the page, there are copyright and version information: 'Copyright © 2014-2016 Almsaeed Studio. All rights reserved.' and 'Version 2.4.0'.

Figure 42 Inventory Interface of the Doctor of United Specialty Clinic



The interface is a medical form titled 'CHECK UP' with a heart icon. It includes sections for 'IMMUNIZATION' (with a syringe icon) and 'MEDICAL RECORD' (with a folder icon). On the right, there are input fields for 'Pulse Rate', 'Respiration', and 'Temperature', each with a unit indicator ('beats per minute' and '°C'). Below these is a section titled 'DOCTOR'S NOTES' with fields for 'Allergies' and 'Diagnosis'. A 'Submit' button is located at the bottom right. The footer contains copyright information and 'Version 2.4.0'.

Pulse Rate: Pulse Rate beats per minute

Respiration: Respiration breaths per minute

Temperature: Temperature °C

DOCTOR'S NOTES

Allergies

Diagnosis

Submit

Copyright © 2014-2016 Almsaeed Studio. All rights reserved.

Version 2.4.0

Figure 43 Check Up Interface of the Doctor of United Specialty Clinic

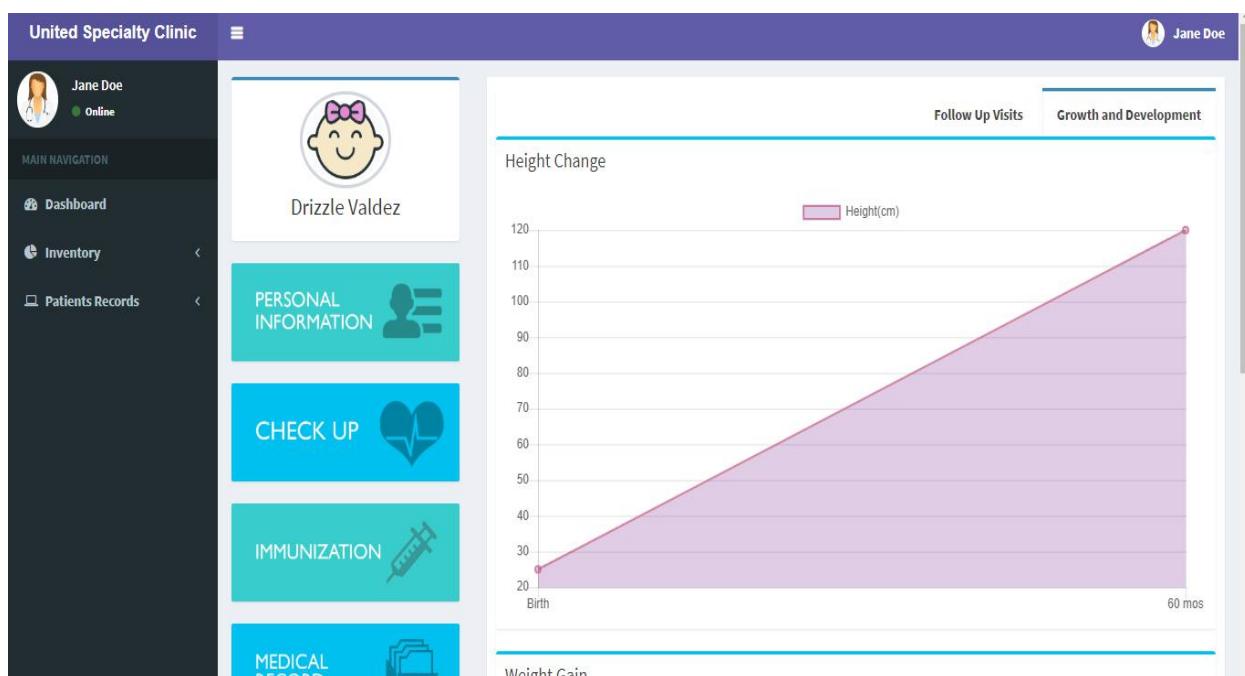


Figure 44 Growth and Development Interface of the Doctor of United Specialty Clinic



Figure 45 Growth and Development Interface of the Doctor of United Specialty Clinic

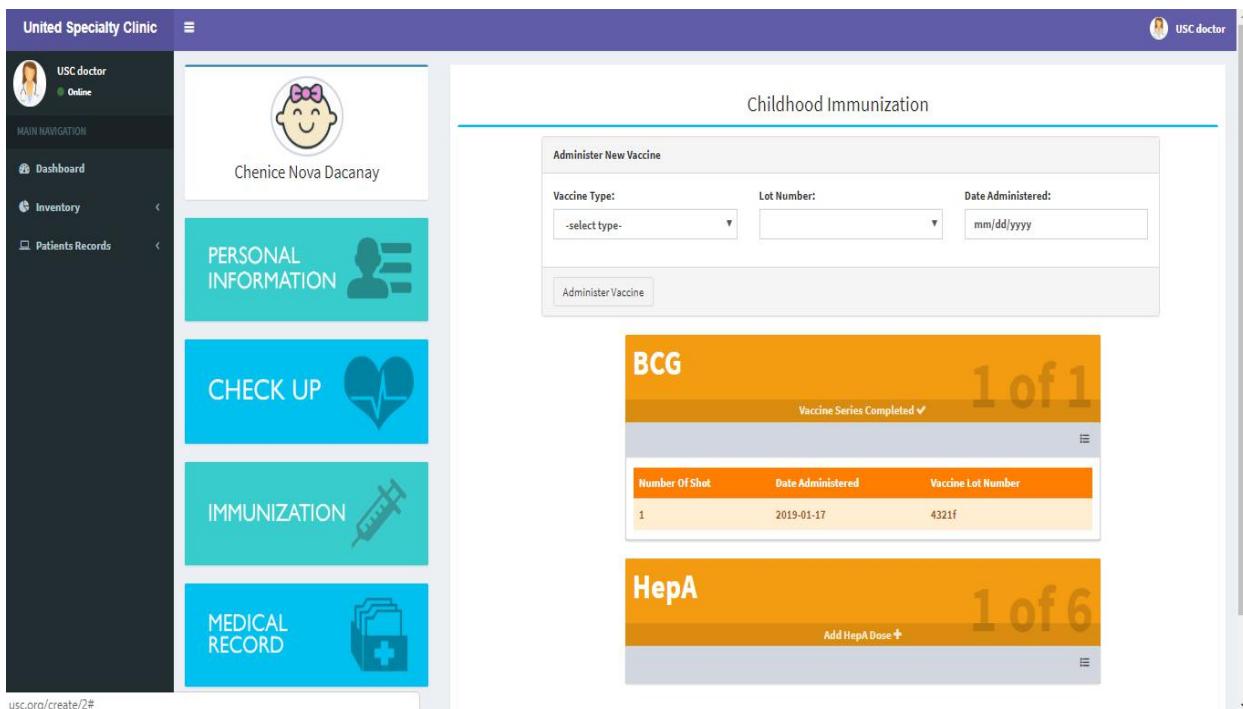


Figure 46 Childhood Immunization Interface of the Doctor of United Specialty Clinic

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of the project are presented below.

4.1 Conclusion

1. Functional and Non-functional Requirements

In order to come up with the system, the group used several elicitation techniques such as interviews, forms analysis and observations in order to gather information. The functional requirements which are composed of management patient records, inventory and users were identified. The non functional requirements were also determined such as the usability, reliability, responsiveness, availability and security.

2. Modules and Features of the System

The group made use of the information using the different elicitation techniques together with the creation of prototype to identify the modules and features of the system. The several modules that were identified are the record keeping, inventory and user management. The features of these modules are consists of add, search, edit, filter, sort and view functions.

3. System Design

To come up with the system design, the group used certain graphical tools like Use Case diagram, Data Flow Diagram (DFD) and Entity Relationship Diagram (ERD). Use Case Diagram were used to depict the how the different modules of the system will interact with the end users. The DFD was also used to design the flow of the data within the system. Additionally, the ERD was used to design the system based on the business process of the clinic. The group successfully made use of the different tools and came up with the system design.

4. Implementation of the System

In implementing the system, various development technologies were used to assist the group in the actual development of the system. The PHP Scripting Language along with the web application framework, Laravel, in implementing the modules and features of the system. Moreover, in managing the database, MySQL was used. To validate the system in the actual working environment, the group conducted four testing types like unit, integration, functional

and performance testing. With the use of the different tools and technologies, the group was able to develop the functional and non functional requirements of the system.

5. Deployment of the System

The deployment of the system is the last activity that the group would conduct to make the system available for use. The different hardware, software and network including the creation of user manual for the users of the system will also be considered. Additionally, the installation of the needed software in order for the system to work is also included in the deployment of the system.

4.2 Recommendations

Though the system will already be helpful for the Pediatric clinic in monitoring their inventory and patient records, the developers recommend additional feature such that the user will be able to record and see the total expenses of the clinic in a given period of time. Since the system includes appointment and scheduling of patients, an additional feature that would automatically send a text message to remind the patients of their scheduled appointment may also be added.

TEST CASES

TEST #	TITLE	EXPECTED RESULT	ACTUAL RESULT	STATUS	DATE
1	Login	The user must be able to login	The user was able to login.	PASSED	January 5, 2018
INVENTORY					
2	Add new type of vaccine	The user must be able to add new type of vaccine		PASSED	January 5, 2018
3	Vaccine Type Name	The user must be able to add vaccine type name which may consists of alphabet and	The user was able to add vaccine type name that consists of alphabet and	PASSED	January 5, 2018

		characters	characters.		
4		The system must require a vaccine type name.	The user was not able to add new vaccine type.	PASSED	January 5, 2018
5		The user must not be able to add vaccine type name that already exists.	The user was not able to add vaccine type name that already exists.		
6	Vaccine Dose	The system must only accept positive whole numbers.	The system accepted a zero and negative input value.	PASSED	January 5, 2018
7		The system must require vaccine dose.	The user was not able to add vaccine type without vaccine dose.	PASSED	January 5, 2018
8	Vaccine Type Description	The user must still be able to add new vaccine type without vaccine type description.	The user was still able to add new vaccine type name without vaccine type description.	PASSED	January 5, 2018
9	Edit vaccine type	The user must be able to edit details of the vaccine.	The user was not able to update the details of the vaccine if the vaccine type	PASSED	January 5, 2018

			name is not changed.		
10	View Vaccine	The user must be able to see the list of vaccines	The user was able to view the list of vaccines.	PASSED	January 5, 2018
11	Add New Vaccine	The user must be able to add new vaccine	The user was able to add but redirected to the wrong page.	PASSED	January 5, 2018
12	Vaccine Name	The system must accept vaccine name which includes alphabet, number and characters	The system was able to accept vaccine name which includes alphabet, number and characters	PASSED	January 5, 2018
13	Lot No.	The system must require lot. no input	The system does not add new vaccine without lot no. but does not show error messages.	PASSED	January 5, 2018
14		The user must be able to input lot no. which consist of alphabet, numbers and characters.	The system does not allow character input for lot no.	PASSED	January 5, 2018

15	Expiration Date	The user must not be able to input date before the receiving date.	The system accepts expiration date earlier than the receiving date.	PASSED	January 5, 2018
16	Date Received	The system must not accept date later than the present date.	The system accepts date received later than the present date	PASSED	January 5, 2018
17	Edit Vaccine	The user must be able to edit the details of the vaccine.	The user can edit but redirected to the wrong page.	PASSED	January 5, 2018
18	Notify User	The system must be able to notify the assistant and the doctor the vaccines that will be expiring 3 months later.	The system was able to notify the user.	PASSED	January 5, 2018
	Inventory Adjustments	The assistant must be able to input number of vaccines and reason for readjustments	The assistant must was able to input number of vaccines and reason for readjustments	PASSED	
	Inventory Quantity	The system must be able	The system was not able	FAILED	

	Adjustments	to validate if the input number for readjustments is valid	to validate input number for readjustments		
--	-------------	--	--	--	--

INVENTORY REPORT

21	Inventory Report	The user must be able to view vaccine inventory report	The user was able to view vaccine inventory report	PASSED	January 5, 2018
----	------------------	--	--	--------	-----------------

PATIENTS RECORDS

22	Records	The user must be able to view the list of patients.	The user was able to view the list of patients.	PASSED	January 5, 2018
23	Viewing of Individual Patient Record	The user must be able to view the individual patient record	The user was able to view the individual patient record	PASSED	January 5, 2018
25	Adding of Patient	The user must be able to add new patient	The user was able to add new patient	PASSED	January 5, 2018
26		The system must be able to validate if the user is entering an existing patient record and shows an error message	The system allows the user to add an existing patient record and did not show an error message	PASSED	January 5, 2018

27		All fields in adding patient record are required	The system will not add patient record if the information on the form is incomplete	PASSED	January 5, 2018
28	Last Name, First Name, Middle Name	The first name should only include letters and characters	The system only accepts letters	PASSED	January 5, 2018
29	Age	The system must automatically compute the age of the patient from his birthday to the current date	The system automatically computes the age of the patient	PASSED	January 5, 2018
30	Mother's Name	Mother's name should only include letters and characters	The system only accepts letters and characters	PASSED	January 5, 2018
31	Father's Name	Father's name should only include letters and characters	The system only accepts letters and characters	PASSED	January 5, 2018
32	Contact No	Contact number should only include	The system only accepts numbers	PASSED	January 5, 2018

		numbers			
33	Birth Length	The system should only accept input greater than zero and should accept input with decimals	The system does not accept negative input and accepts decimal input	PASSED	January 5, 2018
34	Head, Chest, Abdominal (Circumference)	The system should only accept input greater than zero and should accept input with decimals	The system does not accept negative input and accepts decimal input	PASSED	January 5, 2018
35	Edit Patient Information	The user must be able to edit the patient information	The user was able to edit the patient information	PASSED	January 5, 2018

VITAL SIGNS

37	Adding of Vital Signs	The user must be able to add vital signs	The user was able to add vital signs	PASSED	January 5, 2018
38		The system must require all fields in adding vital signs form	The system will not allow the user to submit vital sign if the form is incomplete	PASSED	January 5, 2018
39		All fields must only	The system accepts	PASSED	January 5, 2018

		accept input greater than zero and should accept input with decimals	negative input and accepts decimal input		
--	--	--	--	--	--

IMMUNIZATION

40	Adding of immunization	The user must be able to add available vaccine from the inventory	The user was able to add vaccine to the immunization record	PASSED	January 5, 2018
----	------------------------	---	---	--------	-----------------

MEDICAL RECORD

41	Adding of Diagnosis	The user must be able to add diagnosis to the record of a patient	The user was able to add diagnosis to the record	PASSED	January 5, 2018
----	---------------------	---	--	--------	-----------------

42	Height and Weight Graph	The user must be able to see a graph showing the changes in weight and height of a patient according to his age	The user was able able to see the graph that shows the changes in weight and height of a aptient	PASSED	January 5, 2018
----	-------------------------	---	--	--------	-----------------

USER MANAGEMENT

43	Adding of Users	The admin must be able to add another user	The admin was able to add a new user	PASSED	January 5, 2018
----	-----------------	--	--------------------------------------	--------	-----------------

SCEDULING					
45		The assistant must be able to schedule a patient	The assistant was able to schedule a patient	PASSED	January 10, 2019
46		The scheduled patients of the day must be shown on the dashboard	The scheduled patients was shown on the dashboard	PASSED	January 10, 2019
DASHBOARD					
47		The assistant and the doctor must be able to see scheduled patients	The assistant and the doctor was able to see scheduled patients	PASSED	January 10, 2019
48		The assistant and the doctor must be able to see the vaccines that will be expiring in 3 months, total number of available vaccines and total number of active students	The assistant and the doctor was able to see the vaccines that will be expiring in 3 months, total number of available vaccines and total number of active students	PASSED	January 10, 2019
19	Amount Due	The doctor must be able to enter the	The doctor was able to enter the	PASSED	January 5, 2018

		total amount that patient needs to pay.	amount.		
50		The assistant must be able to see the total amount due the patient needs to pay	The total amount due by the patient was seen by the assistant	PASSED	January 20, 2019
20	Amount Paid	When the assistant clicked the paid button, the patient name should be moved to done scheduled list	The patient's name was move to the done scheduled list	PASSED	January 5, 2018

Appendices

PERSONAL DETAILS

Name:	Gender:	Age:	Birthday:
Address:		Tel. No.:	
Father's Name:	Age:	Occupation:	
Mother's Name:	Age:	Occupation:	

BIRTH HISTORY

Delivery:	Birth Weight:	Birth Length:
Head Circ.:	Chest Circ.:	Abdominal Circ.:

VACCINE

	1st	2nd	3rd	BOOSTER	BOOSTER	BOOSTER
BCG						
Hep. B						
(DTaP + Hib + Hep B) and other DTap combinations						
IPV / OPV						
PCV						
RV						
Influenza						
Measles						
JE Vaccine						
MMR						
Varicella						
Hep A						
HPV						
Dengue Vaccine						
Others	1	2	3	4	5	6

Appendix A Patient Record of Pediatric Department of the United Specialty Clinic

NAME: _____

SEX: _____ **AGE:** _____ **DATE OF BIRTH:** _____

MOTHER'S NAME: _____ **FATHER'S NAME:** _____

ADDRESS: _____

CONTACT NUMBER(S): _____

NEONATAL SCREENING: _____

NEONATAL HEARING TEST: _____

Type of Delivery: _____

Birthweight: _____ g

Birthlength: _____ cm

Blood Type: _____

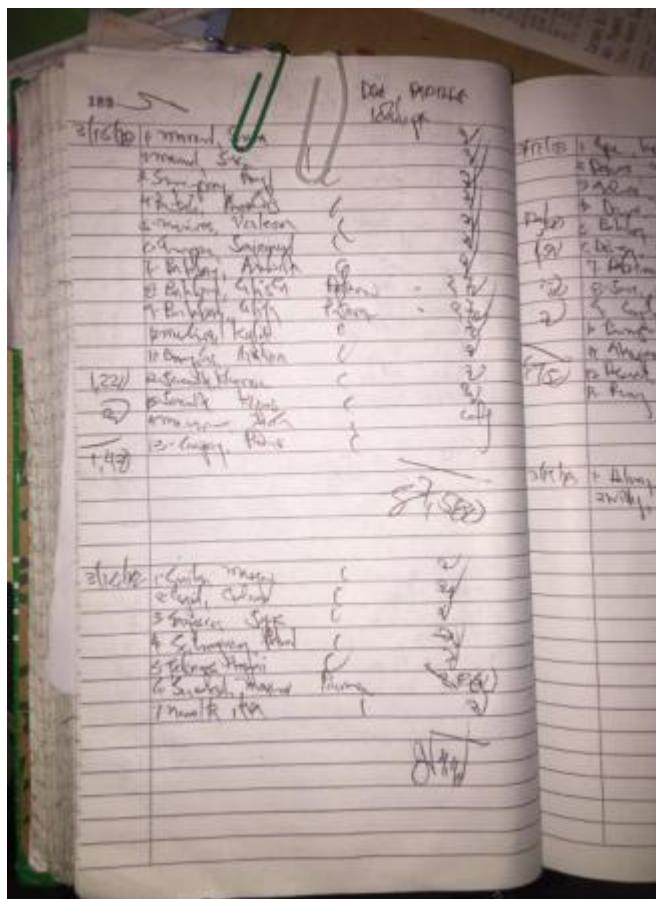
Childhood Immunization Record

Vaccine	Date	Date Administered	Signature	Vaccine	Date	Date Administered	Signature
BCG	1			Influenza	1		
DTaP + Hib + Hep B	2				2		
and others	3				3		
DTaP combinations	4				4		
	5				5		
	6				6		
	7				7		
	8				8		
	9				9		
	10				10		
	11				11		
	12				12		
	13				13		
	14				14		
	15				15		
	16				16		
	17				17		
	18				18		
	19				19		
	20				20		
	21				21		
	22				22		
	23				23		
	24				24		
	25				25		
	26				26		
	27				27		
	28				28		
	29				29		
	30				30		
	31				31		
	32				32		
	33				33		
	34				34		
	35				35		
	36				36		
	37				37		
	38				38		
	39				39		
	40				40		
	41				41		
	42				42		
	43				43		
	44				44		
	45				45		
	46				46		
	47				47		
	48				48		
	49				49		
	50				50		
	51				51		
	52				52		
	53				53		
	54				54		
	55				55		
	56				56		
	57				57		
	58				58		
	59				59		
	60				60		
	61				61		
	62				62		
	63				63		
	64				64		
	65				65		
	66				66		
	67				67		
	68				68		
	69				69		
	70				70		
	71				71		
	72				72		
	73				73		
	74				74		
	75				75		
	76				76		
	77				77		
	78				78		
	79				79		
	80				80		
	81				81		
	82				82		
	83				83		
	84				84		
	85				85		
	86				86		
	87				87		
	88				88		
	89				89		
	90				90		
	91				91		
	92				92		
	93				93		
	94				94		
	95				95		
	96				96		
	97				97		
	98				98		
	99				99		
	100				100		

Childhood Immunization Record

Vaccine	Date	Date Administered	Signature	Vaccine	Date	Date Administered	Signature
BCG	1			Influenza	1		
DTaP + Hib + Hep B	2				2		
and others	3				3		
DTaP combinations	4				4		
	5				5		
	6				6		
	7				7		
	8				8		
	9				9		
	10				10		
	11				11		
	12				12		
	13				13		
	14				14		
	15				15		
	16				16		
	17				17		
	18				18		
	19				19		
	20				20		
	21				21		
	22				22		
	23				23		
	24				24		
	25				25		
	26				26		
	27				27		
	28				28		
	29				29		
	30				30		
	31				31		
	32				32		
	33				33		
	34				34		
	35				35		
	36				36		
	37				37		
	38				38		
	39				39		
	40				40		
	41				41		
	42				42		
	43				43		
	44				44		
	45				45		
	46				46		
	47				47		
	48				48		
	49				49		
	50				50		
	51				51		
	52				52		
	53				53		
	54				54		
	55				55		
	56				56		
	57				57		
	58				58		
	59				59		
	60				60		
	61				61		
	62				62		
	63				63		
	64				64		
	65				65		
	66				66		
	67				67		
	68				68		
	69				69		
	70				70		
	71				71		
	72				72		
	73				73		
	74				74		
	75				75		
	76				76		
	77				77		
	78				78		
	79				79		
	80				80		
	81				81		
	82				82		
	83				83		
	84				84		
	85				85		
	86				86		
	87				87		
	88				88		
	89				89		
	90				90		
	91				91		
	92				92		
	93				93		
	94				94		
	95				95		
	96				96		
	97				97		
	98				98		
	99				99		
	100				100		

Appendix B Patient Record of Pediatric Department of the United Specialty Clinic



Appendix C Inventory Log Book of Pediatric Department of the United Specialty Clinic

Appendix C Inventory Log Book of Pediatric Department of the United Specialty Clinic

References:

- Ain Kiisler. L-Consult OÜ. 2014 Inventory Management - Basic Concepts. (April 7, 2014). Retrieved March 6, 2018 from <https://www.vkok.ee/logontrain/wp-content/uploads/2014/03/Riga-3-july-2014.pdf>
- Shazia Arshad & Muhammad. Department of Computer Sciences. University of Agriculture. (2000). Development of a Computerized Inventory System. Retrieved March 3, 2018 from <https://www.pakjas.com.pk/papers/668.pdf>
- Duangpun, Kritchanchai. Watcharaphong, Meesamut. 2015. Developing Inventory Management in Hospital. (June 2015). Retrieved February 18, 2018 from <http://www.loghealth.mahidol.ac.th/file/file-11-16-2015-2-43-15-PM.pdf>
- Alistair G Tough. Paul Lihoma. 2017. Health Information Systems and Medical Record Keeping in Malawi: A Report on Preliminary Field Research with Recommendations. Retrieved February 26, 2018 from https://www.gla.ac.uk/media/media_541720_en.pdf
- Newton, T. (June 2006). Manual for the Design and Implementation of Recordkeeping Systems (DIRKS). United Nations Headquarters, New York. Retrieved March 3, 2018 from https://archives.un.org/sites/archives.un.org/files/files/French%20files/Manual_for_the_Design_and_Implementation_of_Recordkeeping_Systems.pdf
- Nicolle da Silva Panzuto. Universidade do Sagrado Coração (USC). Analysis of Inventory Management in a Small Business. Retrieved March 3, 2018 from <https://www.pomsmeetings.org/confpapers/015/015-0032.pdf>
- Acheng Doris Odit. 2008. Records Management System for MBarara Hospital. A Case Study of the Maternal and Child Health Section (MCH). (April 2011). Retrieved February 18, 2018 from <https://www.slideshare.net/dorisacheng/hospital-records-management-system>
- David Hutter. (2016). Physical Security and Why It Is Important. June 10, 2016. Retrieved March 6, 2018 from <https://www.sans.org/reading-room/whitepapers/physical/physical-security-important-37120>

Jonick, B. Anthony, V. Mary Kris, O. Elma, J. 2014. Computerized Inventory System and POS of Brothers Burger. (March 2014). Retrieved February 18, 2018 from https://www.slideshare.net/JONICK_BOGUAT09/full-docu-it-thesis-project-in-computerized-inventory-system-in-brother-burger-visual-basic-60-back-end-ms-access

Dihn, T. Vu Van, T. Nguyen Duc, D. 2010. Inventory Management System. (August 2010). Retrieved February 18, 2018 from <https://www.slideshare.net/copo7475/inventory-management-system-16598132>

Berger, E.J., et.al (2007). Implementation and evaluation of a web based for pharmacy stock management in rural Haiti. Retrieved March 18, 2018 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2655915/>

Raza, M.(2012). International Journal of Collaborative Research on Internal Medicine & Public Health. Central Manchester University Hospitals Foundation Trust – England. Retrieved March 25, 2018 from <http://internalmedicine.imedpub.com/good-medical-record-keeping.pdf>

Ogundipe, O. (2011). Electronic Medical Record Keeping: Eleven Years Experience at Life Support Eye Clinic, Lagos, Nigeria. Retrieved April 21, 2018 from <https://www.ajol.info/index.php/njo/article/viewFile/70771/59430>.

Zuva, B., Choga, F. (April 2016). Inventory Management System and Business Performance: Case of Zimbabwean Mining Sector. Retrieved April 21, 2018 from <http://www.iosrjournals.org/iosr-jbm/papers/Vol18-issue4/Version-2/R180402120122.pdf>

Caluza, L.J.(2017). Development of Electronic Document Archive Management System (EDAMS): A Case Study of a University Registrar in the Philippines. Retrieved April 21, 2018 from http://www.lnu.edu.ph/ljbcaluza/IJDIWC_edams.pdf.

Bassil, Y. (2012). A Simulation Model for the Waterfall Software Development Life Cycle. Retrieved April 21, 2018 from <https://arxiv.org/ftp/arxiv/papers/1205/1205.6904.pdf>

Schein, H. Web-based Medical Inventory Software System. Retrieved April 21, 2018 from <https://www.henryschein.com/medical-inventory-management.aspx>.

Boyinbode, O., Toriola, G. (2015). CloudeMR: A Cloude Based Electronic Medical Record System. Federal University of Technology, Akure, Nigeria. Retrieved April 22, 2018 from <https://pdfs.semanticscholar.org/abd3/9300e8397178c40e0bfe38223b1fec33bd6c.pdf>.

Patel, G., Patel, H.(2013-2014). Medical Store Management System. Acharya Motibhai Patel Institute of Computer Studies Ganpat Vidhyanagar, Kherva-384012. Retrieved April 22, 2018 from

<http://gnu.inflibnet.ac.in:8080/jspui/bitstream/123456789/2616/17/Medical%20Store%20Management%20System%20%20Patel%20Gaurav%20R.Patel%20Hitarth%20S..pdf>