ADDIS ABABA UNIVERSITY
SCHOOL OF INFORMATION SCIENCE
AND
SCHOOL OF PUBLIC HEALTH
M.Sc. in Health Informatics Program

Designing a Web-Based Pharmacy Management System for Saint Paul Hospital Millennium Medical College

Tigist W/Mariam

September /2016
Addis Ababa, Ethiopia

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Name and Signature of Members of the Examining Board

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A Project Submitted to the School of Information Science and Public Health of Addis Ababa University in Partial Fulfillment of the Requirement for Degree of Master of Science in Health Informatics.

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ACRONYMS

ART	Anti Retro Viral Therapy
EMM	Electronic Medication Management
FMOH	Federal Ministry of Health
HCMIS	Health Commodity Management Information System
HIS	Health Information System
HIT	Health Information Technology
HIV	Human Immune Deficiency Virus
HTML	Hypertext markup language
ICT	Information Communication Technology
IT	Information Technology
OO	Object Oriented
PFSA	Pharmaceutical Fund and Supply Agency
PMS	Pharmacy Management System
SPHMMC	Saint Paul Hospital Millennium Medical College
UML	Unified Modeling Language
WHO	World Health Organization

Abstract

Background: Today information communication technology plays a great role in different fields of the health care industry; among these medication management is one. With the aid of Information Technology the pharmacy management system process has improved. Computerized pharmacy management system facilitates drug procurement, drug inventory and tracking, drug distribution and its information management. But it is common to observe that these processes are still performed manually in majority of Addis Ababa government hospitals. This manual approach of pharmacy management system has a lot of problem associated with it. The problem can range from problem of handling voluminous file to poor stock management.

Objective: This project attempt to design a web based pharmacy management system that provides accurate and reliable pharmacy management system for Saint Paul Hospital Millennium Medical College by designing cost effective and user friendly application.

Methodology: To build the system on well -formed and verifiable user requirement, a total of 30 participants were selected using a purposive sampling technique. The data was collected through face to face interview using semi-structured open ended questionaries' and by reviewing existing documents. To this end, the necessary data was gathered and system requirements are identified. The project followed waterfall system analysis and design approach. In addition to model the analysis and design of the proposed system UML modeling technique is used. The system prototype is developed using both HTML and Php and the database is designed using MySQL database management system. Microsoft Visio 2013 and Adobe Dreamweaver cc 2015 are used as a tool to model the user interface prototype and to design the UML diagrams.

Result: The system helps the user to easily view available stock and expiry date of drugs. It can also use to request, receive, and issue drugs between the pharmacy departments and store. It also has a feature to generate reliable report for problem solving and better decision making. However, drug procurement process of the hospital is not included in the design because of resource limitation.

Conclusion: These web-based pharmacy management systems facilitate the work of the organization and help to improve patient care. But this project work shows only the system prototype of pharmacy management system. The hospital hardware and internet availability is a good opportunity in the development and implementation of the full system.

CHAPTER ONE

INTRODUCTION

1.1 Background

One of the indispensible departments in hospital is a pharmacy unit. A hospital pharmacy forms an integrated part of patient health care through continuous maintaining and improving the medication management and pharmaceutical care of patients to the highest standards in a hospital setting (1).

A hospital pharmacy play a great role in patient care by ensuring the ordered medication is precisely and timely dispensed to the intended unit and user. It is also responsible in monitoring, evaluating and assurance of the quality drug uses. Under hospital pharmacy the procurement, storing and distribution of all pharmaceuticals used within the facility are the main logistic activities done routinely. Improving the efficiency of this logistic process through appropriate pharmacy management system is the main option for ensuring the accurate and reliable health care service (2).

The set-up of computerized pharmacy management system will ensure availability of sufficient quantity of drugs and consumable materials for the patient at any time needed. Pharmacy management system process the procurement, distribution and control of all pharmaceuticals used within the facility, dissemination of information to the staff and clients, monitoring and assuring of quality of drug (3). Many organizations utilize pharmacy management systems as a means of ensuring accountability over pharmaceuticals inventory and purchasing process. Effective and transparent tracking systems that allow pharmacies to accurately record inventory components, such as medication expiry dates and physical quantities, also have the potential to reduce adverse patient outcomes (4).

1.2 Statement of the Problem

Health is a fundamental human right. Access to health care, which includes access to essential drug, is one of methods to realize this fundamental right (5). Medicines save lives and improve health when they are available, affordable, of assured quality and properly used. This is achieved by using accurate and reliable medication management system in the Pharmaceutical units of hospitals. Within this department drugs are supplied to the needed unit', prescription are filled for inpatient and outpatients', pharmaceuticals are manufactured in bulk, narcotic and other prescribed drug are dispensed', injectable preparation are prepared and sterilized (6).

Drug procurement, inventory, tracking, distribution and its information management are routine activities that are carried out in pharmaceutical unit of various hospitals (7). Study conducted in Ethiopia by Pharmaceutical Fund and Supply Agency (PFSA) in collaboration with USAID/ Delivery project in 2014 G.C shows that it is common to observe this process are still performed manually or are minimally computerized in Ethiopia public center health facilities including large referral hospitals like Saint Paul Hospital Millennium Medical College (8).

On this survey it is indicated that the manual approach of pharmacy management system has a lot of problems associated with it which can lead to inappropriate drug management. Problem of handling voluminous file, incomplete recording and reporting, lack of information system storage are the major ones. Difficulty of retrieving the necessary data from a manual system and incomplete registered data make the data accuracy to be low for efficient decision making (8).

Hence, this project aims to come up with web-based pharmacy management system that ensures effective data storing and manipulating. The system reduce burden and help the pharmacist's easy access of important drug related information. In addition it helps to properly manage stock, determine drug interaction or possible harmful side effects and facilitate the work of the organization and improve patient care.

1.3 Objective of the project

1.3.1 General Objectives

The general objective of this project is to design and develop prototype of a web-based pharmacy management system for Saint Paul Hospital Millennium Medical College so as to ensure good stock management, accurate keeping of records on drug and drug related information.

1.3.2 Specific Objectives

To achieve the general objective, the following specific objectives are attempted

- To assess the existing pharmacy management system;
- To model the proposed system and document user requirement specification;
- To design the user interface prototype and develop a prototype of the pharmacy management system;
- To test user interface prototype model of the system.

1.4 Scope of the project

This Web-Based Pharmacy Management System Project is limited to the design of the system and development of a prototype. That means the project does not include the implementation, testing and deployment of the whole system.

It presents comprehensive design of drug registration, stock management, drug distribution, drug prescription, purchase request and order. In addition, system design document is developed and documented.

The project ends with prototype development of the system followed by user interface testing. However, in this project drug procurement procedure of the hospital is not included due to extended time requirement to collect the necessary data.

1.5 Significance of the Project

This project has a great benefit for the pharmacist, customers and the organization at large. It could benefit the pharmacists by decreasing burden of daily listing of drugs. It also stores data securely, eases data access and helps to monitor drug movement within the department.

The physicians can easily order prescription and can easily trace cause of adverse drug event and drug interaction. In addition, having an automated system will minimize resource like paper, time and manpower.

This web-based pharmacy management system also minimizes human error in medication safety. It helps the hospital to provide reliable health care service, guarantee hospital management and patient of genuine and safe drug. The project ensures efficient and standard drug dispensing system and also possibly it facilitate the work of the health care organization.

1.6 Organization of the Project

Chapter one is the introduction and it covers the statement of problem, objectives of the study, significance of the study and scope of the study. Chapter two is the literature review; it gives related information with this project work. Chapter three is about methodology used to develop this research project. Chapter four is the system analysis and modeling; which talked about the operation of the proposed system. Chapter five is conclusion and recommendation. Finally, a Software Requirement Specification Document is organized.

CHAPTER TWO

LITERATURE REVIEW

2.1 General Literature

2.1.1 Health Information System

The World Health Organization defines Health Information System (HIS) is " A system that integrates data-collection, processing, reporting and using the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services" (9). It also puts designing and developing the information system of hospitals as an important indicator of quality service.

The goal of health information system is to improve staff efficiency, to remove work duplication and unnecessary procedure. Health information system helps to make statistic and data mining technique faster and accurate. It facilitates data communication between hospital and medical center and hence improve the quality of health care service by using information communication as a tool (10).

Information technology allows the health care providers the collection, storing, retrieving and transferring of complex information. Thus, increasing the ability of physicians, nurses, clinical technicians, and others to readily access and use the right information about their patients should improve the health care. Information Technology (IT) has potential to improve the quality, safety and efficiency of health care. The various information technology application in the health care fall mainly in administrative and financial systems that facilitate billing, accounting, and other administrative tasks, clinical systems that facilitate or provide input into the care process, and infrastructure that supports both the administrative and clinical applications (11).

With the use of Information Communication Technology (ICT), the health care delivery environment has benefited and improvement has been witnessed in quality of service provision. Some of the ICT widely used in the health care delivery includes Telemedicine and e-learning.

Telemedicine improves resource coordination, strengthens urban/rural linkages and it connects remote health staff to centralized health expertise and resources. Incorporating already existing technology – such as phone or e-mail – into medical practice and routine consultancies can make a difference (11).

There is strong potential for e-learning in health as demonstrated by a variety of successful small projects around the world. Multiple ICT routes can, and are, being used for e-learning including Internet, radio, in combination with print materials. The potential of ICT in improving communication around the health care study shows that there is growing evidence that ICTs aid health information dissemination, particularly via online routes and that ICTs increase the effectiveness of some communication systems (10). The application of information technology to health and health care, facilitate health information management across computerized system and secure exchange of health information between patient, health care provider, payers and quality monitors (6).

The use of different type of information technology in developed countries in the health care industry has progressed considerably leading to improvement in care given and facilitated information storage and management. The computerization of medical records in the health facilities, the use of the Internet for communication and information exchange, the development of magnetic cards for user identification purpose, using an electronic scheduling systems for appointments, examinations and hospital admissions, and computerized protocols for diagnosis and treatment support are just a few examples (12).

Health Information Technology (HIT) is the area where processes of health information system design, maintenance of the system, health information systems development and use of the system takes place (13). Automated and interoperable healthcare information systems are anticipated to decrease the cost of health services by decreasing both the paper work and idle work time of the health professionals (2). Health care given to a patient is not based on a single transaction rather it includes multiple interactions with a patient over a long period of time. Each time a patient accesses pharmacist care, assessment of individual and previous health care is required. Through the use of Health Information Technology, capturing patient care events and storing them centrally, comprehensive patient care information is made available for health professionals and facilitating improved decision making at multiple point of care (14).World

Health Information System recommends the use of information communication technology as vital to manage patient health information, logistics, and finance of various departments in any hospital.

According to the American Recovery and Reinvestment Act (15), Health Information Technology if implemented and used effectively has tremendous potential to improve patient care. Enhanced use of HIT encompasses a wide variety of clinical and public heath activities that are critical for improving patient care. These applications include quality measurement and reporting, new approaches to provider payment and benefit design based on quality rather than simply the volume or intensity of services provided, and public health surveillance.

2.1.2 Health Information Technology in Medication Management

Medicines and medical supplies account the major portion of hospital expenses. Unless these supplies managed properly it also directly affects the total expense of a country .One of the application and potential benefit of Health Information Technology is in the management of medications in the health care industry(2). The introduction of Health Information Technology (HIT) into medication management process holds the promise of reducing adverse drug events, improve efficiency of care delivery and quality of care, reduce costs, and saves money over the longer term (17).

Medication management is a continuum that covers all aspects of medications such as prescribing and ordering, orders communication between prescribers and pharmacists, dispensing, administering, and monitoring, as well as reconciliation, adherence, and education. Health information technology (HIT) holds great promise to improve the quality of health care and reduce potential and real errors in medication management while at the same time providing cost-effective care (18).

Medicines are special commodities as regards their management. Medicines are also costly and require special handling to ensure their cost effectiveness and quality. Special tools and techniques are therefore necessary for the proper management of medicines. A well-functioning pharmacy information management system is critical to the effective management of medicines so that it enables accurately record the movement of medicines across the supply chain, it enable for rationale prescription and dispensing of pharmaceuticals (19).

Generally, medication management system is a system that consists of data entry, retrieval and stock monitoring, tracking drug dispensing pattern, generation of reports and statistics and others. Pharmacy (medication) Management System focuses on pharmacy store operation and how it manages the inventory flow with suppliers and department dispensary. The system covers operations like receiving medication from suppliers, processing department's medication requests and distribution, returning expired medication to suppliers (10).

For instance, an Electronic Medication Management (EMM) system enables ordering prescriptions, the supply and administration of medicines to be completed electronically. Electronic Medication Management covers the entire hospital medication cycle including drug orders by doctors, review and dispensing of medication orders by pharmacists, and administration of medicines by nurses. Electronic Medication Management reduces medication errors through improved prescription legibility, dose calculation and clinical decision support. It enables best practice information to be more readily available to prescribers and improves linkages between clinical information systems. It can also improve efficiency in the medication management process, such as reducing the time required to locate paper medication charts (11).

2.1.3 Information System Development

An information system development is the process of defining, designing, testing, and implementing a new software application or program. The system developer uses different approach, tools, techniques, procedure, method and philosophy to implement the information system development (20).

There are different system development approach that are used in different organization based on their system type and the way they automate their business procedure. Among these, the two most popular system development approaches are Waterfall and Rapid Application Development approaches.

2.1.3.1 Waterfall approach

Waterfall approach was first Software Development Life Cycle (SDLC) Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases and the outcome of one phase acts as the input for the next phase sequentially. This means that any phase in the development process begins only if the previous phase is complete and so that phases do not overlap (21).

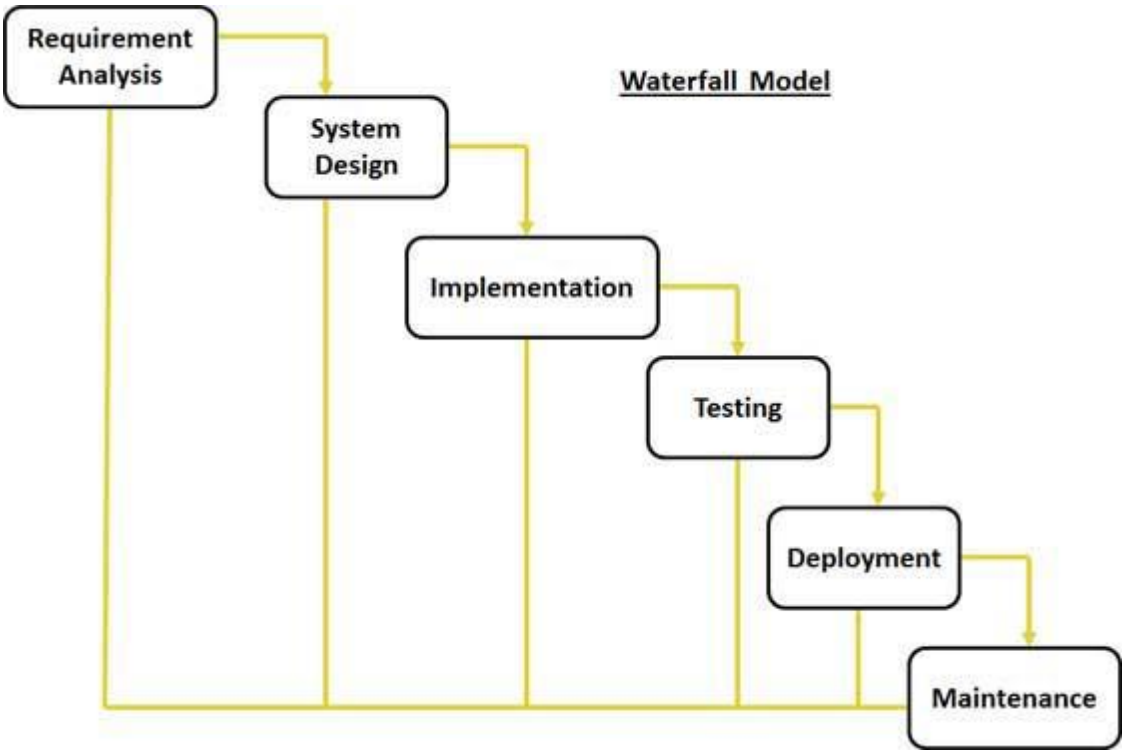

Figure 2.1 Diagrammatic Representations of Different Phases of Waterfall Model

2.1.3.2 Rapid Application Development Approach

Rapid Application Development approach (RAD) refers to a development life cycle designed to give much faster development and higher quality systems than the traditional life cycle. RAD is a people-centered and incremental development approach. Active user involvement, as well as collaboration and co-operation between all stakeholders are imperative. Testing is integrated

throughout the development life cycle so that the system is tested and reviewed by both developers and users incrementally. The RAD approach thus includes developing and refining the data models, process models, and prototype in parallel using an iterative process (22).

2.1.4 System Modeling Approach

Modeling produces a graphical representation of a concept or process that systems developers can analyze, test, and modify (23). A model guides the development process of software and effectiveness of the system. Different modeling approaches such as, structured and object oriented, can be used in information system development.

2.1.4.1 Structured Analysis and Design approach

It is the traditional view of software development. This phase helps developers to plan, analyze, design, implement and support an information system. This view leads developers to focus on issues of control and the decomposition of larger algorithms into smaller ones (23).

2.1.4.2 Object-Oriented (OO) System Analysis and Design Approach

Object-Oriented approach describes the system through a set of business processes by using a set of diagrams or models to represent various view and functionality of a system. Systems developed with the OO approach are more flexible. These systems can be modified and enhanced easily, by changing some types of objects or by adding new types. In object oriented approach their does not exist any function without corresponding data and data base view and application program view grow together (21).

2.1.5 System Modeling Technique and Tools

Systems analysts use the Unified Modeling Language (UML) to describe object-oriented. UML is a general purposive visual modeling language that is used to specify, visualize, construct and document the deliverables of software system (24). It provides various graphical tools to represent the information system from a user's point of view. There are nine artifacts defined in the UML modeling which are mainly categorized as static (structural) and dynamic (behavioral view).

1) Static view

This view emphasize that any model must be defined from their application, their internal properties and their relationship to each other (25). This static part is represented by use case, class, package, component, and deployment diagram.

- **Use case diagram**

  Use case diagram is a representation of a user`s interaction with the system and depicting the specification of a use case. A use case diagram is helpful in visualizing the context of a system and the boundaries of the system's behavior. Its main purposes are used to gather requirements of system; to get an outside view of a system; to identify external and internal factors influencing the system (26).

- **Class diagram**

  The class diagram represents the static structure of the system. Class diagram show a collection of static model elements such as class and their relationship, connected as graph to each other and to their content, their internal structure and their relationship to other class. In class diagram object in real world are represented by the actual object in the program (26).

- **Package diagram**

  Package diagram shows how the various classes are grouped into packages. Packages are UML constructs that enable to organize model elements into groups. It makes the UML diagrams simpler and easier to understand (27).

- **Component diagram**

  A component diagram provides a physical view of the system. Its purpose is to show the dependencies that the software has on the other software components in the system (24). It is built as part of architectural specification and developed by architects and programmers.

- **Deployment diagram**

  The deployment diagram shows how a system will be physically deployed in the hardware environment. Its purpose is to show where the different components of the system will physically run and how they will communicate with each other (25).

2) Dynamic (behavioral) view

Behavioral diagrams basically capture moving or changing part of the system by showing object collaboration and change to the internal state of the objects (25). The dynamic part is represented by sequence, collaboration, state chart, and activity diagram.

- **Sequence diagram**

  A sequence diagram is an easy and intuitive way of describing the behavior of a system by viewing the interaction between the system and its environment. A sequence diagram shows an interaction arranged in a time sequence (27)

- **Collaboration diagram**

  Collaboration diagram helps to visualize object organization and their interaction by showing message flow between objects in an object-oriented application, and also indicate the basic relationships between classes (26).

- **Activity diagram**

  Activity diagram is used to model consecutive steps in a computational process. This diagram essentially a flow chart that emphasizes the activity that takes place over time (27).

- **State chart**

  The state chart diagram models the different states that a class can be in and how that class transitions from state to state. Every class has a state (which is a situation during the life of an object, which satisfies some condition, performs some activity or waits from some event), but that every class shouldn't have a state chart diagram(26).

2.1.6 System Architecture

The system architecture transforms the logic design of information system in to physical structure. It describes the system's hardware, software, and network support, processing method and security. It is the plan for how the information system components will be distributed across multiple computers. The deliverables include the architecture design and the hardware and software specification (28). Different system developers use different types of architecture in certain situations.

Server-Based Architectures: - server based architecture was the first computing architecture. In this form of architecture the server performs all four application functions (presentation logic, application logic, data access logic and storage). Application software is developed and stored on the server, and all data are on the some computer (29).

Client-Based Architecture: - the client is a micro-computer on local area network, and the server is a computer on the some network. The client computer is responsible for the presentation, application and data access logic, whereas the server simply provides storage for the data (29).

Client-Server Architecture: - this is the most common architecture design used today. The client computer is responsible for the presentation logic. The server is responsible for the data access logic and data storage, but the application logic can be resides on both client and server. This architecture is scalable, support different type of client/server and it also uses an internet standard that helps to clearly separate presentation, application, and the data access logic (28). The two common client-server based architecture tiers are Two-Tiered Architecture and Three-Tiered Architecture.

- **Two-Tiered Architecture:**-In this case, the server is responsible for the data and the client is responsible for the application and presentation.
- **Three-Tiered Architecture:**-In this case, the software on the client computer is responsible for presentation logic, an application server(s) is responsible for the application logic, and a separate database server(s) is responsible for the data access logic and data storage. Typically, the user interface runs on a desktop PC or workstation and uses a standard graphical user interface. The application logic may have one or more separate modules running on a workstation or application server. Finally, a relational Data base management system running on a database server contains the data access logic and data storage (28).

2.1.7 Web-Based Application

In a simple way a web-based application is any application that uses a web browser as a client. The term may also mean a computer software application that is coded in a browser supported programming language (such as php, combined with a browser-rendered markup executable language like HTML) and reliant on a common web browser to render the application. The

World Wide Web provides a new medium for storing, presenting, gathering, sharing, processing, and using information (30). Additionally, the use of existing web browsers and their multimedia capabilities has allowed developers to create more interactive, media-rich user interfaces.

2.2 Related Literature Review

There are various related works regarding the pharmacy management system in different countries, but in this section a few of them is presented as follow.

PCIP Haiti: - Following the earthquake happened in Haiti in 2010, uninterrupted supply chain was essential to manage mass casualties and cholera epidemic at St.Luke Hospital. The hospital medication transaction was only documented on occasion and records were not organized in a manner conducive of retrieving and medication ordering was irrational. After need assessment a pharmacy computerized inventory system (PCIP) was implemented and the PCIP incorporate inventory of medication, drug ordering, filling drug request, distributing and dispensing of medication. The PCIP enabled the hospital staffs to identify and order medication as well as truck usage for future medication need and efficient and significant improvement in medication transaction has improved the care given (31).

HMS pharmacy solution in India: - Hospital Management System's (HMS) integrated pharmacy solution provides online access to all vital pharmacy functions in India such as medication administration records and medication labels, patient profiles and medication charges. The system allows the pharmacy department to input medication orders by mnemonic code, brand or generic description. It supports default values, such as dose, frequency, route of administration and standard comments (32).

The system also includes a flexible tool that can create unlimited reports, including customized monitoring of workload statistics and drug usage. Convenient integration is the last of the pharmacy module. The Pharmacy solution links with Laboratory solution to display key laboratory values that affect a patient's medication profile. It also integrates with Materials Management solution to provide accurate, perpetual inventory control (32).

Rx solution in Namibia:-IHO hospital in Namibia since 2009 G.C implemented Rx solution which is integrated computerized pharmaceutical management system. The software support procurement ,storage ,distribution, dispensing of pharmaceutical and medical supplies and also

manage and track stock transaction and product usage plus has modules for budgeting, procurement, receipts requisition ,dispensing down referral and reporting system(24). Rx solution is used to manage inventory, handle issue to wards, inpatient and outpatient pharmacy and satellite clinics. Post implementation assessment of Rx solution in Namibia hospital showed best improvement in patient queening time, wastage due to expiry of medicine is reduced, stock level accuracy and stock management accuracy is improved (33).

PMS in Abu Dhabi:-The hospital system in Abu Dhabi, UAE has a link between the databases of the hospital with the databases of the pharmacy resulting in an interconnected system between the two databases. This pharmacy system helped the doctors to submit their patient prescription directly to the pharmacist and it also enabled them to check medicines availability in the stock (34).

SILCOM Brazil:-Computerized System for the Control of Drug Logistics (SICLOM) used to deliver ARV treatment for their patients by the Brazilian public health system is used to support prescribing and track medication supplies for more than 100, 000 patients and also believed to be a solution for the challenges of antiretroviral delivery (35).

IPLS in Ethiopia:-With the support of USAID/ Delivery project in Ethiopia, Pharmaceutical Fund and Supply agency has implemented the integrated logistic information system both automated and paper- based in different hospitals and health centers since 2009 G.C. This locally developed automated health commodity management information system is contributing to improve supply chain performance by increasing the visibility of supply and demand data at all level. The routine monitoring report of this integrated pharmaceutical logistic system (IPLS) shows that it improve information recording, reporting, storage and distribution system, as well as availability of essential commodities at service delivery point (8).

CHAPTER THREE

METHODOLOGY

3.1 The case

The project is carried out in Addis Ababa, the capital city of Ethiopia. According to the federal ministry of health (FMOH) health indicator report of 2007, there are 41 hospitals in Addis Ababa city in which 10 of them are public.

This research project is particularly conducted in Saint Paul Hospital Millennium Medical College. SPHMMC is one of the largest public referral hospitals in Addis Ababa which is administrated by Federal ministry of health. SPHMMC was built by Emperor Hailessilase in 1969 G.C. In addition to its medical care service since 2007 G.C it opened a medical school for teaching and research center. Currently there are 544 students that beside their learning and teaching process students and physicians are helping in clinical area (36).

The hospital provides health care through its different clinical departments. These departments are General surgery, Internal Medicine, Obstetrics and Gynecology, Pediatrics, Emergency, Urology, Neurology, Orthopedics, Psychiatry, Ophthalmology, ENT, Dentistry and Maxillofacial surgery, Radiology, Anesthesiology, ICU (Intensive care unit), ART (HIV care), Endoscopy, Physiotherapy, Laboratory, pharmacy and recently it launched a hemodialysis unit. There are a total of 1,300 clinical and non-clinical staffs. It is assumed on regular and emergency bases annually 200,000 patients visit the hospital (36).

3.2 Study population

The study population of this research includes health and pharmacy professional staffs of the Saint Paul Hospital Millennium Medical College and Professionals from Federal Ministry of Health who was involved in the development and implementation of Smart care software. These aforementioned bodies are selected, because there are the major bodies that are directly concerned with pharmacy management system requirement specification.

3.3 Data Source and Method of Data Collection

For the purpose of requirement determination of this project both primary and secondary data collection methods were used.

- **Face-to face interview**

  The primary data was collected by face-to face interview using semi-structured open ended questionnaires. This technique is selected because it helps the investigator to get the information required in detail. Purposive sampling technique was used to select samples. Currently there are a total of 31 pharmacy professionals working in the pharmacy department. The interview was made with 18 pharmacy professionals working in the pharmacy department and pharmaceutical stores. In addition 10 health professional from different department of the hospital and 2 professions from Federal Ministry of Health are included. The interview was undergone with separate guideline for the hospital staffs and professionals from FMOH.

- **Document review**

  The secondary data was conducted by reviewing the existing document, manuals and forms. Here the researcher reviewed patient medication forms, stock cards (bin card), prescriptions, and internal facility report and resupply form.

3.4 Analysis and Design Technique

Waterfall methodology approach is used for the analysis and design of the pharmacy management system. As it is discussed in section 2.1.3.1, this approach is selected because it has an advantage of gathering all requirements from user at the begging of the project development so that system analysis and design is done step by step.

In addition, to model the analysis and design of the system UML modeling technique is used. This includes the use of different unified modeling language. For the analysis part Use Case is used, because it is appropriate to represent user interaction with the system and helps to get an outside view of the system, to clearly identify external and internal factors influencing the system

and interaction of actors with the system. To model the design part of the system, Class diagram is used in order to describe the structure of the system by showing the system class, attribute and relationship among objects. In addition Sequence diagram was used to model the logic of usage action for each functionality process flow.

3.5 Prototype Implementation Tools

For the development of pharmacy management system for the Saint Paul Hospital Medical Millennium College, Microsoft Visio 2013 and Adobe Dreamweaver cc 2015 are used as a tool to model the user interface prototype and to design the UML diagrams.

For the implementation of the system prototype, System implementation tools for the front end (to design the web-page), middleware (to connect web-page with web-server) and back end (to design web-server) is selected as follow based on their availability and the researcher experience on using this tools.

- Html (hypertext makeup language) enables the construction of easy and intuitive user interface as front end for accessing the database (37).
- PHP is selected as a connector between the front end the database since it works nearly in all platforms and it is a general purpose scripting language. It can be embedded into HTML and contains many server interfaces. It plays a basic role in the functioning different services that are provided by the system (38).
- The back end is implemented using MySQL which is easy to use, inexpensive data base language it can run on a variety of operating systems such as Window, Linux, UNIX. To manage MySQL database through the internet phpMyAdmin is used and some of its features include create databases, add/edit/delete tables, run SQL queries, manage user authorization and manage field keys (37).

3.6 Evaluation of the Prototype

Prototype is a software development process which allows developers to greater portions of the solution to demonstrate functionality and make needed refinements before development the final solution. Prototyping is an excellent way for the development term to confirm understanding of the requirements and ensure that the proposed solution is consistent with expectation of the gathered requirements (39).

After designing the system prototype user interface acceptance test was done to evaluate the usability of the system. The goal of this evaluation is to determine the usability of a web-based PMS system by the end-system users. Usability often refers as the question of how well users can use system functionality and to evaluate this prototype the researcher used Heuristic evaluation method.

3.7 Ethical Clearance

Ethical clearance was obtained from the school of public health ethical clearance committee in order to obtaining permission for requirement collection from respective respondent. The objective of the project work is clearly stated on the information sheet prior the interview guides. Key informants were also asked about their consent for sincere participation in the interview through a consent letter in addition to oral agreement.

3.8 Method of Result Dissemination

The result of the project will be distributed to Federal Ministry of Health, Saint Paul Hospital Millennium College, Addis Ababa University School of Information Science and School of Public Health.

3.9 Operational Definitions

Drug: drug or medicine means any substance or mixture of substances or medical equipment's or supplies, used for human health care including narcotics & psychotropic substance, chemicals, blood and blood products, vaccines, supplementary foods, pharmaceutical cosmetics and sanitary products.

Sell: is processing of the ordered prescription through the pharmacy management system.

Users: are stalk holders who has the right to use the built pharmacy management system.

User-friendly: Is the way that the built system is not ambiguous which is clear for using the created software interface for manipulating actions or tasks.

Pharmacy management system: is a system that consists of receiving medication from supplier, processing department medication and purchase requests, issuing medication to departments, ordering and processing prescription by using information communication technology as a tool.

Departments: are hospital units that provide different services and request pharmaceuticals from the stores.

Stores: are pharmaceutical warehouses that receive and distribute drugs or medicines to departments

Physician: is a health professional that has the right to order medication/drug to patients.

CHAPTER FOUR

SYSTEM ANALYSIS AND MODELLING

4.1 Analysis of the Existing System

System analysis is a process of investigating, analyzing, design, installation, and evaluation of information system for change or modernization (21). It is also a process of collecting factual data, understanding the process involved, identifying problems in order to improve the system functionality. To clearly understand the existing system, it is analyzed based on the key information system component.

A) Process

The pharmacy departments of the Saint Paul Hospital Millennium Medical College act as essential medical support service. Pharmaceuticals are stored in three main stores before distribution. The store manager controls appropriate drug procurement, inventory and distribution system in the hospital. These processes take place under the supervision of drug supply management team. DSM team approves quantity to be issued, the right dispensing schedule and tracking and then registration and documentation take place. It also ensures the availability of sufficient quantity of drug and pharmaceutical materials for patients and for efficient hospital work.

Those pharmaceuticals are mainly distributed to the six pharmacy units of the hospital. These are, Special or retail pharmacy provide service for patients who are treated in the hospital or elsewhere but only if they can afford payment for the prescribed medication. The inpatient pharmacy give service for patients admitted temporarily in the hospital and the outpatient pharmacy serve for those not admitted but treated at outpatient department and return to their home. For Patients under emergency condition in the emergency room the emergency pharmacy is responsible. HIV positive individuals who has follow up can get their drug from ART pharmacy. Finally, for the new launched kidney transplant and dialysis center the kidney transplant pharmacy provide service. This pharmacy is unique in Ethiopia and only serves for patient who undergone kidney transplant and candidate for kidney transplant.

A process which describes the tasks or functions that are undertaken day- to-day in order to achieve the desired result of the organization mainly addresses the following.

I. Drug procurement system

The drug procurement process which is concerned with purchasing activities of drugs by the hospital pharmacy department is done by the pharmacy head. Those drugs that are under stock will be registered and request is filled to the first and permanent government supplier agency that is the Pharmaceutical Fund and Supply Agency (PFSA) and incase for unavailable medicines at these agency the chief pharmacist report to the pharmacy head and to the medical vice provost and the hospital management team decide the drug should be purchased from private wholesaler or importer either through Performa or tender.

II. Drug tracking and inventory system

Physical inventory which is a process of manual counting is done quarterly (every three months) in order to ensure the actual inventory is consistent with the number recorded in stock card. If situation like under stocking or over stocking happened, overstocks pharmaceuticals will be either dispensed to departments as much as possible before expiry or may be transfer to other governmental health institution. On the other hand, for under-stocked vital medicines it will be bought urgently or supplied from other government institutions

.

III. Drug distribution system

Drug distribution is concerned the distribution of pharmaceuticals within different medical units in the hospital. The store manager and drug supply management team are responsible for the distribution process. Medicines prescribed by the physician for admitted patient in wards, the nurse in charge of this duty collect all ordered medication daily by type and quantity, and fill the Internal Facility Report and Resupply form and based on the request the store manager issue, but for pharmaceutical materials that cannot be consumed by one patient, like alcohol, cottons, bandage, plaster each department present request based on schedule every two week or a weak.

IV. Inpatient and Outpatient drug management system

For patients that are admitted in the hospital the nurse in charge collect the prescribed medication from admission chart and fill the request for the main store and this process is done daily. For those treated and return to home the physician prescribe in prescription form that they can get the service by showing this form to the pharmacy.

B) Software

Ethiopian determine to replace the paper based record system with Electronic record system by implementing the smart Care system and this software was adopted in SPHMMC in 2009G.C by Tulane University Technical Assistance Program to Ethiopia (TUTAPE's) in collaboration with Federal Ministry of Health. The software has Pharmacy modules that enable the pharmacy department to handle under and over stock medicine and to detect expire data of drugs. It also supports prescription which enables the physicians to order medicine for their patients. The system does not support drug distribution and department request. Despite this, the main challenge to use the system was, it need frequently feeding of issued drugs to the system manually which create high work load and time constrain for the pharmacist. In general despite the adoption of the smart Care after a year the system failed to operate fully and retuned back to paper based approach. Currently the hospital has no software to manipulate the pharmacy management system.

C) Hardware

There are different computer related hardware devices in various departments of the Saint Paul Hospital Medical Millennium Collage. In each unit there is at least one idle desktop computer which is functional. In addition there are four MCU-M8900 servers and three of which are MC80 server. The DHCP server is responsible for centralized management of network addresses and network access control. The lists of servers, aggregate; core and Access switch found currently in the hospital is summarized in Annex II.

D) Network

The hospital and the corresponding departments are interconnected by the network. Moreover almost all departments have a broadband internet connection within the organization. SPHMMC has 8MB/S internet connection and the National Kidney Transplant department has alone 6MB. This internet availability can be a valid opportunity in the implementation of web based pharmacy management system.

E) People

Saint Paul Hospital Millennium Medical College Board is organized in three major provosts. Administrative and development vice Provost, Medical service vice Provost and Academic and research vice provost. The pharmacy department is under the Medical service vice Provost. According to the 2016 human resource profile of the SPHMMC there are 27 pharmacy professionals, 2 druggist and 2 clinical pharmacist that works in pharmaceutical store and pharmacy department. These professionals are categorized as expert, chief, senior and junior based on their educational status and service year.

The overall responsibilities (activities) of these professionals is summarized as

- ✓ Dispensing drugs
- ✓ Store (ware house) managing
- ✓ Clinical service (patient orientation)
- ✓ Purchasing medical supplies
- ✓ Counseling for special patients (patient on ART)
- ✓ Recording and reporting of drug related documents

4.1.1 Limitations of the Existing System

Currently, almost all works in the hospital pharmacy department is accomplished by paper. Daily request and issuing of medicines for departments, manual tracking of medicines on the shelf, ineligible hand writing on request and prescription form makes the pharmacist work tedious situation. Difficulty of retrieving the necessary data from manual base system and incomplete registered data make inefficient decision making. On the other hand, demand estimation is impossible in the current pharmacy management system since there is no mechanism to know type and quantity of dispensed medicines daily for patients. The other one is irrational ordering of medicine; anyone who has access to prescription can order medication even without privilege.

In general the following limitations and challenges are identified with the current paper-based medication management system.

- daily issuing of medication to different departments and recording of those overwhelming information
- limited communication of the pharmacy department with the rest of hospital units
- difficulty of retrieving patient data in organized manner
- difficulty of getting complete report
- incomplete patient and medication data documentation
- inability to easily track inventory, under or over stocking
- weak control of medicine transaction in the hospital
- un-streamed lined work flow in the pharmacy unit
- furthermore the other constraint of this paper based medication management is the accuracy of information gained for decision making

4.2 System Requirements

Information obtained through system analysis is synthesized with related knowledge and experience in order to achieve the desired objectives of the project. Based on the user requirement and detailed analysis of the existing system, the new system focus on how to create a pharmacy management system and efforts was made to present a design that will meet the researcher goal and user expectation.

Hence, the design of the new pharmacy management system helps the user to:-

i. manage stock appropriately
ii. create a modular programming interface for users
iii. design a system that will be relatively fast than the existing approach

In general, from the requirement gathered and analyzed the new designed pharmacy management system easy up the problem and challenge of manual recording of drug, inpatient and outpatient drug management, drug distribution and tracking system. The system helps to minimizing error in medication safety, facilitate accessibility of drug related information and information management among employee. It also provides optimal drug movement in the pharmacy unit and hospital departments. In addition, it also minimizes irrational ordering of drug in the hospital and create responsibility among employee. Based on this requirements are identified that the system should fulfill the need of the organization.

4.2.1 Functional Requirements

Functional requirement defines a function of a system or its component and specify particular results of the system and describe the relationship between the input and output of the system. These requirements mainly address what has to be performed by the system. It involves identifying the basic functionalities that the system should provide to user and a task that must be done by the system. The functional requirements of the proposed pharmacy management system are listed as follows:

Table 4.1 Functional Requirement List

No	Requirement Description	Requirement Source	Remark	
			Mandatory	Optional
1	The system should enable the administrator to create, delete, and update system user privilege and setup.	UC-Manage User	✓	
2	The system should enable authenticated user to login.	UC-Login	✓	
3	The system should generate purchase order of under stock pharmaceuticals.	UC-Re Order	✓	
4	The system should enable the pharmacist and departments to request, receive and view available stock.	UC-Request Drug	✓	
5	The system should enable the pharmacist to send purchase request.	UC-Purchase Request	✓	
6	The system should enable the physician to order drug for patients.	UC-Prescribe Drug	✓	
7	The system should enable the pharmacist to view and issue requested drugs.	UC-Issue Dug	✓	
8	The system should enable to generate user requested report.	UC-Generate Report		✓
9	The system should generate standard reports.	UC- Generate Report	✓	
10	The system should show alert for under stocked and near expire drugs.	Interview	✓	
11	The system should enable to search and view saved data.	Interview	✓	
12	The system should enable the user to register drug detail.	Document review	✓	

4.2.2 Non-functional Requirements

A non-functional requirement defines system properties and constraints or it is a requirement that specifies criteria that can be used to judge the operation of a system rather than specific behaviors. The following are the non-functional requirements of the proposed system:

Table 4.2 Non-Functional requirement list

No	Requirement description	Requirement source	Remark	
			Mandatory	Optional
1	The system should have frequent and full back up mechanism to avoid any data loss.	Interview	✓	
2	The system should support any version of Window operating system such as Window 7, Window 8, Linux, and any latest version.	Interview	✓	
3	The system should have a very simple and user friendly interfaces for system users to understand the functionalities easily.		✓	
4	The system should be available for 24 hours a day and 7 days a week.	Interview	✓	
5	The system should be protected from unauthorized user and the administrator page ought not to be accessed by any other system users.		✓	

4.3 System Analysis Models

Based on the requirement identified the system process is modeled. From the different type of the UML designing tools majorly the investigator identified the use case diagram which describe the major scenarios and actors of the system and use case narration which represent textually the course of event when an actor interact with use case is used.

4.3.1 Use Case Diagram

Use case diagram is a representation of a user`s interaction with the system and depicting the specification of a use case. Its main purposes are used to gather requirements of system; to get an outside view of a system; to identify external and internal factors influencing the system. To model the system using use case diagram, the following actors and use cases are identified (40).

Actors: an actor is idealization of an external person, process, or thing interacting with the system and each actor can participate in one or more use cases. The researcher identified seven actors in which each of them have their respective identified tasks.

Table 4.3: List of Actors and Their Goal

Actors	Description	Goal
Administrator	Is a person responsible in controlling overall the pharmacy management system and assign privilege to the hospital staffs, create user count	Create user account, register hospital staffs with their privilege
Physician	A health professional in charge of diagnosing and treating a patient	Write prescription (order medications) for the patients
Department	The hospital units that provide different service for patients and need pharmaceuticals from the store	Request pharmaceuticals from the store
Supplier	Is an organization that supply pharmaceuticals for the store	Supply pharmaceuticals to the hospital
Pharmacist	The pharmacy professional who is responsible in the pharmacy unit	Request drugs for the pharmacy store and sell medicines for the patient
Store	Is pharmacy professional in controlling the main store	Register drug on the data base, receive drug from supplier, issue medicines to departments
Patient/customer	A person who visit a physician and come with prescription	Purchase drug as per the prescription

Use case: use case represent functionality provided by a system unit and expressed by sequence of message exchange by the system unit and one or more actors of the system. The recognized use cases of the system are the following:-

Table 4.4: List of Use Cases

No	Use Case	Description
1	login	Describes how the user is authenticated by the system
2	Manage user	Describes the process of registering and creating user account
3	Re order	Describes how to manage stock and purchase order of pharmaceuticals
4	Purchase request	Describes how to request purchase of under stoke or new pharmaceuticals
5	Register drug	Describes the process of registering new drugs on the system
6	Receive drug	Describes how to validate and receive the registered drugs
7	Request drug	Describes how to request drug from store
8	Issue drug	Describes how to issue the requested drugs to departments
9	Prescribe drug	Describes how to prescribe (order) drugs for customers
10	Generate report	Describes how to generate reports
11	Sell drug	Describes how to sell drugs

Ones actors and use cases are identified, use case diagram is constructed, as depicted in figure 4.1. Use case diagram shows relationship among actors and use case with in the system.

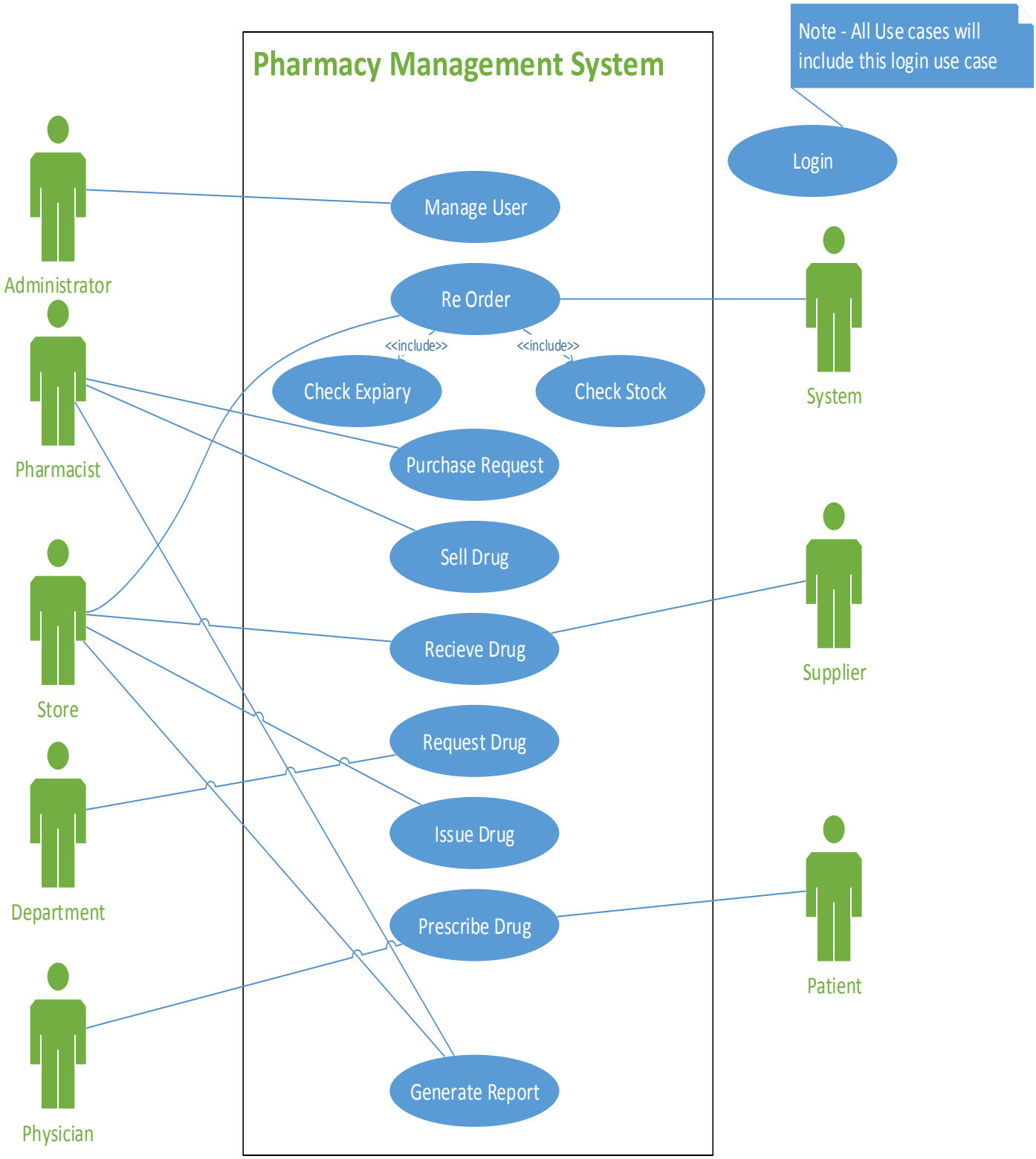

Figure 4.1: System Use Case Diagram

4.3.2 Use Case Narration

Use case narration is a textual representation of the course of events encountered when an actor is interacting with the system. It describes each use case in detail as path transverse through the system to meet a requirement. The description of each use case are listed below

Table 4.5: Description of Use Case login

Use Case ID	PMS-1
Use Case Name	Login
Use case Description	Describes how the user is authenticated by the system.
Primary Actor(s)	Administrator, Pharmacist, Physicians, Department, Store.
Pre-condition	The user must have authorized username and password.
Post-condition	The system displays the main page based on the user assigned privilege.
Basic Scenario	1) The user initiate(opens) the PMS; 2) The PMS responds by presenting the home page along with the login form; 3) The user enters username and password in the login form 4) The user clicks login button; 5) The system displays the main page based on the user privilege. The use case ends
Alternative Scenario	3 A) If the user enters wrong username or password the system display an error message “invalid username or bad password” B) Prompt for the correct username and password C) If the user tries three times continuously the system Locks the user
Special Condition	None

4.4 System Design Models

4.4.1 System Class Diagram

Class diagram is a type of static structure diagram that describes the structure of a system by showing the system`s classes, their attributes, and the relationships among objects. Class diagram show a collection of static model elements such as class and their relationship, connected as graph to each other and to their content, their internal structure and their relationship to other class. In class diagram object in real world are represented by the actual object in the program (41). So a well-developed class diagram helps to effectively develop a model of the system and create ease of understanding. Figure 4.2 shows the structure of pharmacy management system.

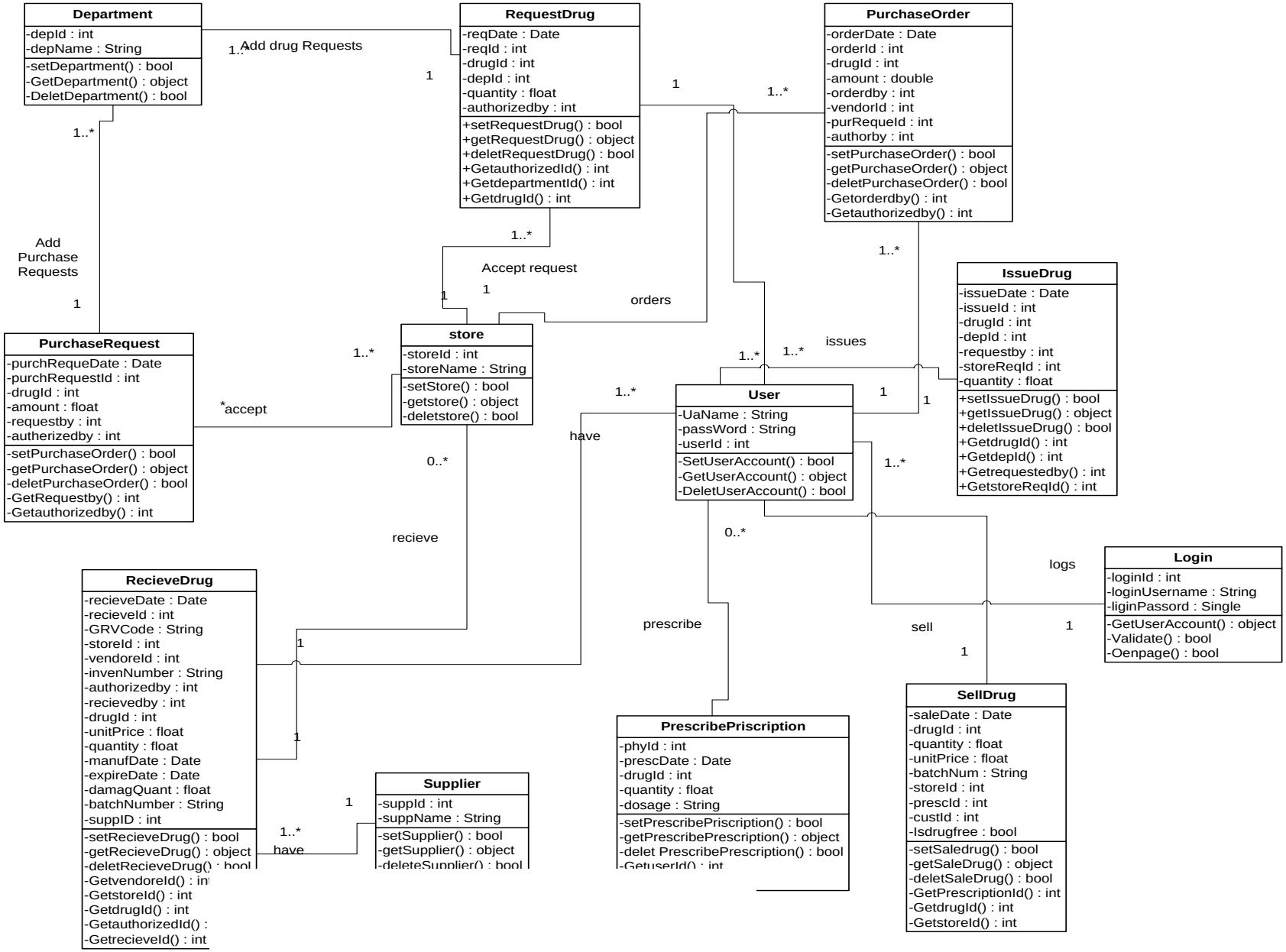

Figure 4. 2: System Class Diagram

4.4.2 Sequence Diagram

Sequence diagram are used to model the logic of usage action. A usage scenario is exactly what its name indicate, the description of a potential way that the system is used. A sequence diagram is an easy and intuitive way of describing the behavior of a system by viewing the interaction between the system and its environment. A sequence diagram shows an interaction arranged in a time sequence. It shows the objects participating in the interaction by their lifelines and the messages they exchange, arranged in a time sequence (42).

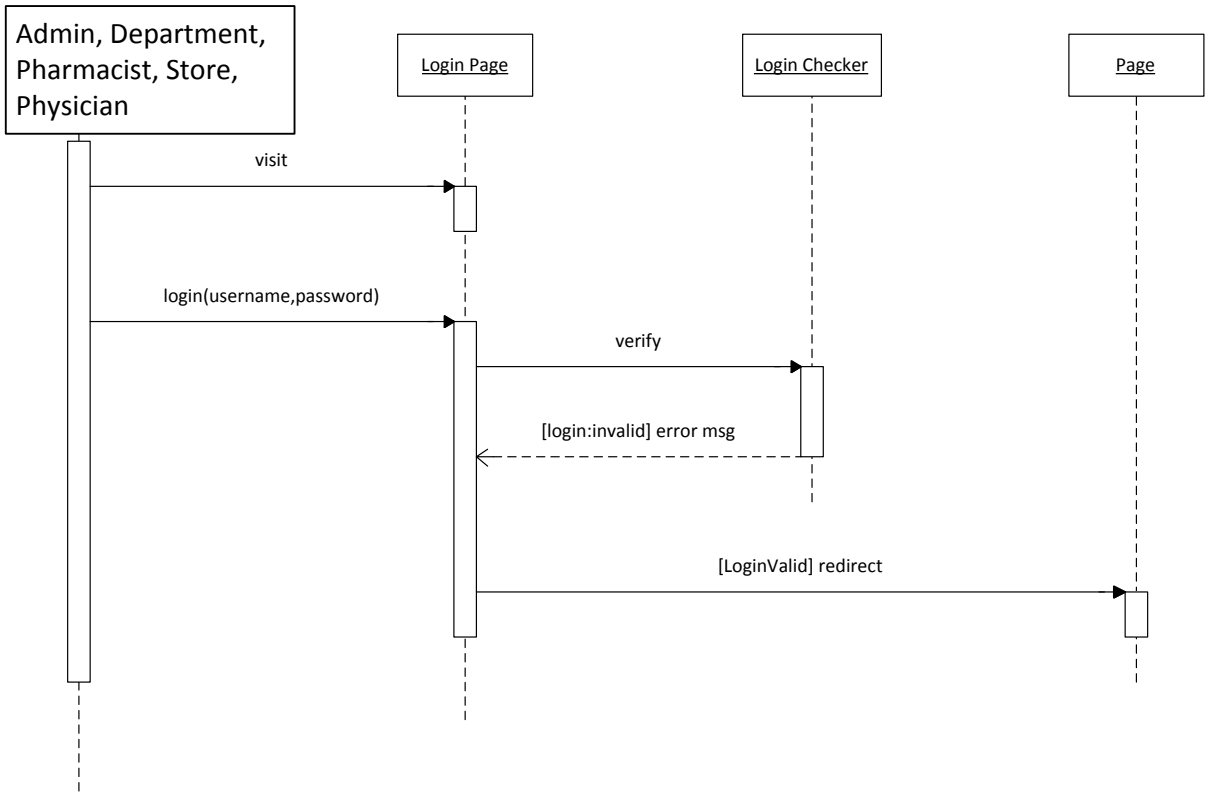

Figure 4.3 Login Sequence Diagram

4.5 System Architecture

The SPHMMC pharmacy management system is designed to have three-tier client server architecture. As discussed in section 2.1.6, in three-tiered architecture the software on the client computer is responsible for presentation logic, an application server(s) is responsible for the application logic, and a separate database server(s) is responsible for the data access logic and data storage. Having this architectural design can help to support many different client and servers and also they are scalable.

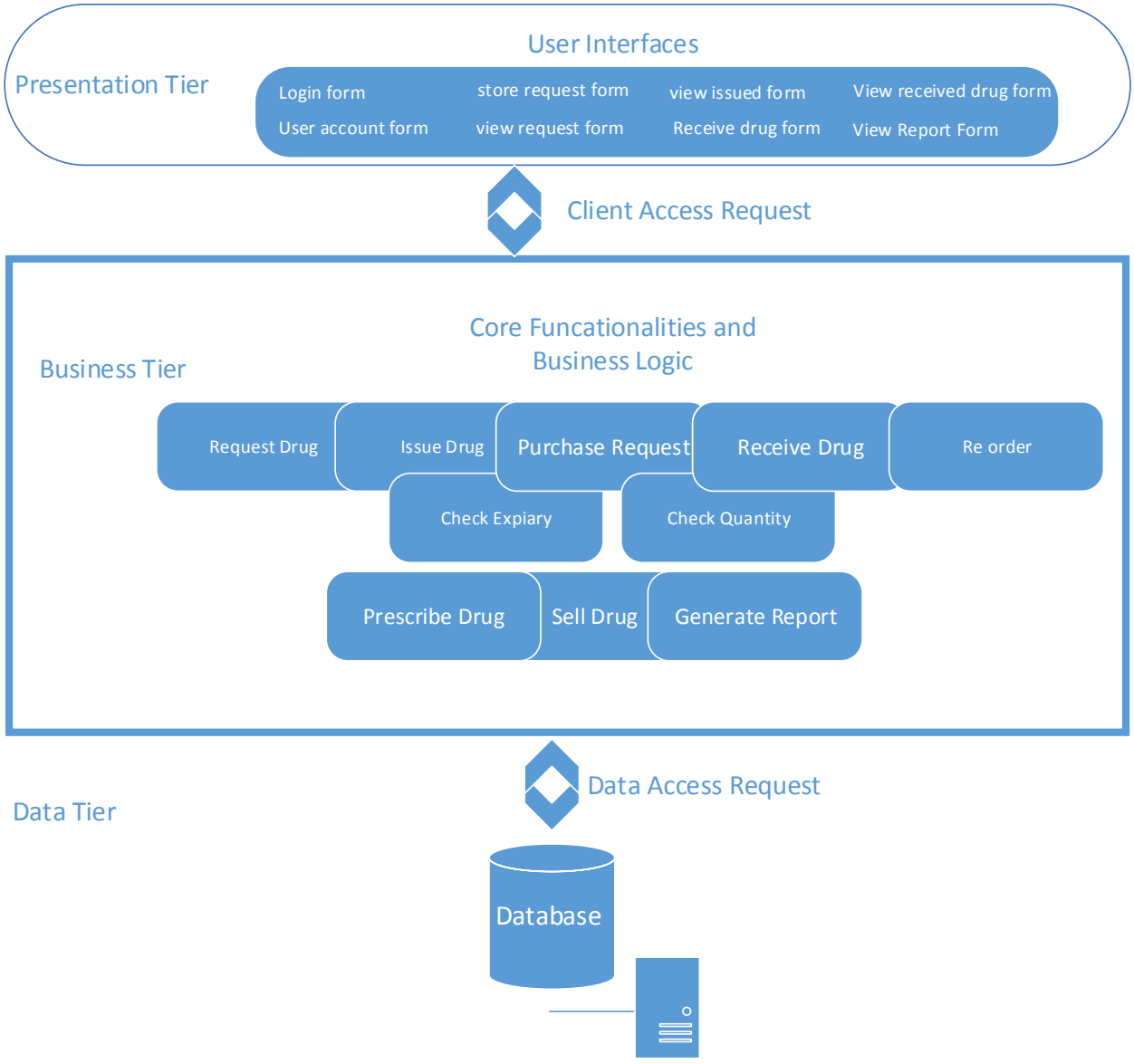

Figure 4.4: SPHMMC Pharmacy management system architecture

4.6 Prototype Implementation

Prototyping is an excellent way for the development term to confirm understanding of the requirements and ensure that the proposed solution is consistent with expectation of the gathered requirements. In prototype implementation phase, the user interface is developed using HTML and CSS. The MySQL database management system is used to develop the database and php code is used to construct the middle ware that connects the user interface and the database.

4.6.1 **Presentation layer**

Store Request:-the store request form enables departments to request drug from the store. This page automatically generates request code. Date of request, department which generates the request and employee should be filled appropriately. The user should click on **"detail"** part of the form to select drugs and amount to be requested.

Figure 4.5: Store Request Form

4.6.2 Data base layer

The data storage is created using tables in the database. All fields in the tables are identified and the corresponding primary keys, which are used to identify each instance in the table uniquely, are assigned. Figure 4.6 shows sample table created from MySQL database management system.

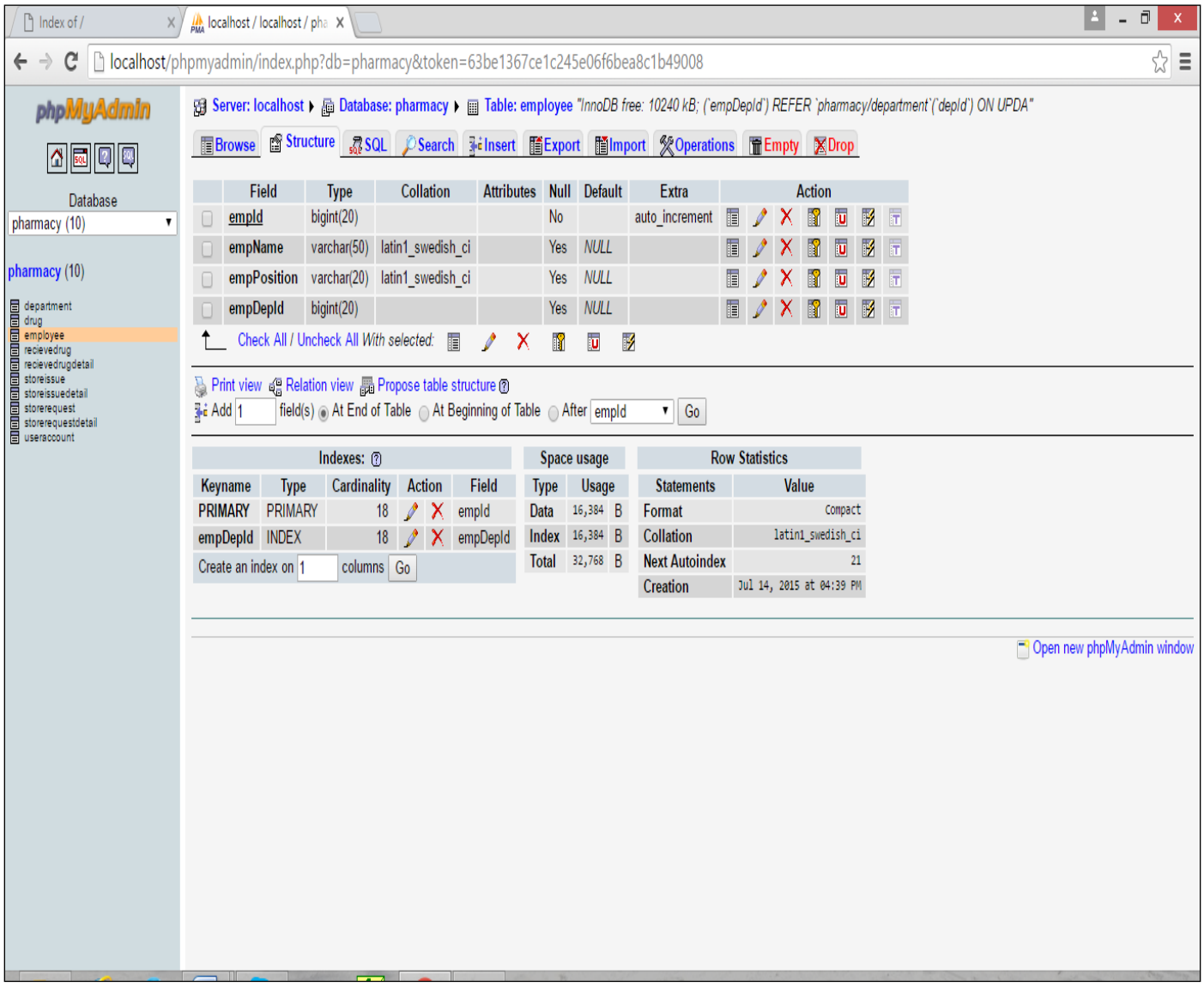

Figure 4.6 Employee table on the system database

4.6.3 Middle Layer

Php codes are used as a middleware to connect the user interface and database. The following sample php code is developed to check a user account.

```
<?php
        session_start();
          include_once('Class/UserAccount.php');
          include_once('Class/StoreRequest.php');
          include_once('Class/StoreIssue.php');
          include_once('Class/RecieveDrug.php');
          include_once('Class/Employee.php');
          include_once('Class/Drug.php');
          include_once('Class/Department.php');
          include_once('Class/Connection.php');
          $lid = $_GET['lid'];
          $ua = new UserAccount;
          $ua->setLID($lid);
          if($ua->CheckLogin() == false)
          {
                    $_SESSION["loginMsg"] = "Please login first";
                    header("location:index.php",true);
          }
          $username = $_SESSION[$lid];
          $ua->setUsername($username);
          $ua->GetUserAccount();
?>
```

4.7 Usability Evaluation of Prototype

Usability is the degree to which software is used by specified user to achieve quantified objectives of the project. The evaluation of the system usability is an important aspect of a software design and development process. In order to measure the success of the system the designer must evaluate the system (43). Heuristic evaluation method is one of the usability testing method that asks system users to evaluate system based on a set of principles. For the evaluation of web based pharmacy management system prototype, the researcher used a method of questionnaires with 8 major usability criteria.

Table 4.6: User Interface Evaluation

No	Criteria	Fully agree	Agree	Undecided	Disagree	Fully disagree
1	All the font on the system are readable	9	1			
2	The interface is pleasing and easy to use	8	2			
3	All the system input field button location are consistence	10				
4	All important content addressed well	8	2			
5	I like the color of the interfaces	9			1	
6	The system is easy to open and access	8	2			
7	The system saves entered data properly	10				
8	The system views saved data accurately	10				
	Average result	90 %	8.75%		1.25%	

As shown on the above table questioners were given for a total of five respondents. The value of the response is taken based on the Likers scale. The attributes are fixed as Fully Agree=5, Agree=4, Undecided =3, Disagree=2, and Fully Disagree=1.The above questions help us to capture the opinion of the respondent and individual interest towards the system interface. According to the result of user interface evaluation most of the respondents that is 90 % fully agreed that the system prototype has easy to use and attractive interface however it still need some revision to address the concern and suggestion given by the few.

CHAPTER FIVE

Conclusions and Recommendations

5.1 Summary and Conclusion

Summary

A web based pharmacy management system enables to control and handle the overall activities performed efficiently and effectively in the pharmacy department of Saint Paul Hospital Millennium Medical College.

In this system development process requirements were acquired by using interview and document review. The existing system was analyzed and based on findings proposed system was modeled and designed using UML.

The project come up with a pharmacy management system that offers a number of benefits for the users. The system can capture and store data centrally and those stored data can be retrieved easily and interactively. The system increases the speed and accuracy of drug distribution and tracking in pharmacy department of the hospital. It also handles medication transaction and account and hence save time and paper wastage. The system generates report which will help in demand forecasting and better decision making. The other important and use full feature of the system is it has minimum stock and expiry data alert which enable to manage stock properly.

Conclusion

System usability testing was done to capture the opinion of the respondent and individual interest towards the system. The prototype user interface evaluation result showed that the system is easy to use and requirements are well addressed. Generally, this project developed only the prototype of the pharmacy management system. The hospital internet availability can be a good opportunity in the full system development and implementation of web based pharmacy management system.

5.2 Recommendations

This pharmacy management system, in order to remain relevant to the hospital the full system must be developed and implemented and so the hospital should allocate budget for resource required to do this. In addition the hospital should work with Federal Ministry of Health and with other concerned organization like Tulane University for the implementation of the system.

The Pharmaceutical Fund and Supply Agency (PFSA) should be networked with the PMS to facilitate the drug procurement system of the hospital.

I recommend for other researcher to integrate this Pharmacy Management system with electronic medical record (EMR) of the hospital that will replace the paper based approach in the hospital. And also the system can be enriched with other additional functionalities by integrating with Barcode Reader system and Drug Information System.

Bibliography

1. Gouveia AM. Hospital and clinical pharmacist present and future role. EAHP.Portugal; 2000.
2. Romero A. Managing medicine in hospital pharmacy :Logestic Inefficiences USA: world congress in engeenering and computer science; 2013.
3. https://www.scribd.com/doc [cited 1/20/2016].
4. Manuel D. Rossetti. Inventory Management Issues in Healthcare Supply Chains. University of Arkansas, USA: Departmen of Engeenering; 2008.
5. Rmerio G. Evaluating hospital pharmacy inventory management and revenue cycle process. 2nd edition. Canada; 2008.
6. McConnell R. The Role of ICT In The Health Sector of Developing countries :infoDev; 2006.
7. Chaowalit Monton. Purchasing and inventory management by pharmacist of a private hospital. International Journal of Pharmacy and Pharmaceutical Sciences, volum6,Issue 5;April,2014 .
8. Snow J. National survery of integrated pharmacutical Logestic system. Ethiopia: PFSA; 2015.
9. McMaster, Evidence-based Practice Center ;Enabling medication management through health information technology: Hamilton, ON Canada ; AHRQ Publication: 2011.
10. Sima Ajami, Aazieh Arab-Chadegani. Barriers to implement electronic health records (EHRs); mater Sociomed[Internet]. 2013[cited1/2/2016
11. MedPac:Information technology in the health care. Report to the Congress: New Approaches in Medicare : June 2004.
12. Elaine Tomasi . Health information technology in primary health care in developing country; 2011.

13. Using Information Technology to support better health care . one infrastructure with many use. Engelberg Center for Health Care Reform.The Brookings Institution. Washington, 2010
14. National Association of Pharmacy Regulatory Authorities. Pharmacy management system requirment to support NAPRA. Ottawa; 2009.
15. Sana Z. Khan Z. Hope and fear in implementation of electronics health record. Journal of information system indeveloping countries. 2012.
16. ACSQHC ,Electronics medication management :A Guide to Safe Implementation. 2nd ed. , Sydney,; 2012.
17. Daria O'Reilly JETRGCL. The economy of health information technology in medication management. review of economic revolution. 2012.
18. Hamish SF Fraser. Implemennting electronic medical record system in developing country. British Computer Society. England ; 2005.
19. Hare Ram Bhattarai. Logistics management information system software used in the antiretroviral therapy program in Karnataka state, India: Recommendations for improvement; 2011
20. Anders G. Nilsson, Information Systems Development, A Frame Of Reference and Classifications, the Institute for Development of Activities in Organizations, Sweden.
21. Mohammad A. Rob, Dilemma between the structured and Object-Oriented Approaches to system analysis and Design. Houston: Texas: 2008
22. Office of the Chief Government Information officer: An Introduction to Rapid Application Development (RAD). The Government of the Hong Kong Special Administration Region, 2009.
23. The Unified Modeling Language User Guide, by Grady Booch, James Rumbaugh and Ivar Jacobson. Addison Wesley First Edition October 20, 1998.
24. Garry B.Shelly, Harry J.Rossenblatt. System analysis and design, 9th edition; Course Technology, USA: 2012.
25. Padmanabhan Bharath; Principles of Software Engineering; 2012.
26. Joseph S. Valacich, Joey F. George, Jeffrey A. Hoffer, Essentials of systems analysis and design;5th edition.
27. Donald Bell, IBM Global Services, UML basics: An introduction to the Unified Modeling Language, 2003.

28. Dennis, Wixom, Roth: Systems Analysis and Design, 5th edition, 2012.
29. Nick Rozaski, Software system architecture; working with stakeholders using view points and perspective; 2005
30. Daniel .N:What is a Web Application? Available from: http://www.About.com/guide.
31. www.globalhealth action .net[cited on 1/18/2016].
32. Btmohdrazali F. pharmacy stock inventory system. partial fulfilment of the requirment for the award of degree of bachelor of computer science. Malaysia:, software Engineering; 2005.
33. Enhancing efficiency in pharmacy and patient management: The Resolution experience at the Intermediate Hospital Shakti, Namibia. survey. Namibia :. Republic of Namibia , Ministry of health; 2012.
34. A.Khelifi . Hospital pharmacy management system UAE. International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:7, No:11, 2013.
35. http://himtalks.blogspot.co[cited on 3/18/2016].
36. https:// en.wikepedia.org/wiki/[cited on 1/18/2016]
37. Nixon R. Learning Php,MysQl,JavaScript,CSS& HTML. 3rd ed. United state of America: O'Reilly Media Inc; 2014
38. Scott Ambler.. The Object Primer, agile model Third Edition. 3rd ed .Ronin International. Inc.Cambrige University press; USA; 2004.
39. V.Scott Gordon James M. Bieman: Rapid Prototyping: Department of Computer Science Colorado State . IEEE Software;1996
40. Donald Bell:UML basics: An introduction to the Unified Modeling Language ,IBM Global Services, Rational Software; 2003
41. Addison Welly. The Unified Modeling Language Reference Manual, 2nd edition,2004.
42. Laurie Williams: An Introduction to the Unified Modeling Language;2004
43. Wilson C. User Interface Inspection Method. A User-Centered Design Method Elsevier;2014

Annex I: Software Requirement Specification Document

Software Requirement Specification Document

For

Web- Based Pharmacy Management System of SPHMMC.

CHAPTER ONE

1.1 Introduction

One of the indispensible departments in hospital is a pharmacy unit. A hospital pharmacy forms an integrated part of patient health care through continuous maintaining and improving the medication management and pharmaceutical care of patients to the highest standards in a hospital setting (1).

A hospital pharmacy play a great role in patient care by ensuring the ordered medication is precisely and timely dispensed to the intended unit and user. It is also responsible in monitoring, evaluating and assurance of the quality drug uses. Under hospital pharmacy the procurement, storing and distribution of all pharmaceuticals used within the facility are the main logistic activities done routinely. Improving the efficiency of this logistic process through appropriate pharmacy management system is the main option for ensuring the accurate and reliable health care service (2).

The set-up of computerized pharmacy management system will ensure availability of sufficient quantity of drugs and consumable materials for the patient at any time needed. Pharmacy management system process the procurement, distribution and control of all pharmaceuticals used within the facility, dissemination of information to the staff and clients, monitoring and assuring of quality of drug (3). Many organizations utilize pharmacy management systems as a means of ensuring accountability over pharmaceuticals inventory and purchasing process. Effective and transparent tracking systems that allow pharmacies to accurately record inventory components, such as medication expiry dates and physical quantities, also have the potential to reduce adverse patient outcomes (4).

1.2 Objectives

The general objective of this project is to design and develop prototype of a web-based pharmacy management system for Saint Paul Hospital Millennium Medical College so as to ensure good stock management, accurate keeping of records on drug and drug related information.

1.3 Significance

This project has a great benefit for the pharmacist, customers and the organization at large. It could benefit the pharmacists by decreasing burden of daily listing of drugs. It also stores data securely, eases data access and helps to monitor drug movement within the department.

The physicians can easily order prescription and can easily trace cause of adverse drug event and drug interaction. In addition, having an automated system will minimize resource like paper, time and manpower.

This web-based pharmacy management system also minimizes human error in medication safety. It helps the hospital to provide reliable health care service, guarantee hospital management and patient of genuine and safe drug. The project ensures efficient and standard drug dispensing system and also possibly it facilitate the work of the health care organization.

1.4 Scope

This Web-Based pharmacy management system Project is limited to the design of the system and development of a prototype. That means the project does not include to the implementation, testing and deployment of the whole system.

It presents comprehensive design of drug registration, stock management, drug distribution, drug prescription, purchase request and order. In addition, system design document is developed and documented.

The project ends with prototype development of system followed by user interface testing. However, in this project drug procurement procedure of the hospital is not included due to extended time requirement to collect the necessary data.

CHAPTER TWO

2. Functional Requirements

Functional requirement defines a function of a system or its component and specify particular results of the system and describe the relationship between the input and output of the system. These requirements mainly address what has to be performed by the system. It involves identifying the basic functionalities that the system should provide to user and a task that must be done by the system. The functional requirements of the proposed pharmacy information management system are listed as follows:

Table 2.1 Functional requirement list

No	Requirement Description	Requirement Source	Remark	
			Mandatory	Optional
1	The system should enable the administrator to create, delete, and update system user privilege and setup.	UC-Manage User	✓	
2	The system should enable authenticated user to login.	UC-Login	✓	
3	The system should generate purchase order of under stock pharmaceuticals.	UC-Re Order	✓	
4	The system should enable the pharmacist and departments to request, receive and view available stock.	UC-Request Drug	✓	
5	The system should enable the pharmacist to send purchase request.	UC-Purchase Request	✓	
6	The system should enable the physician to order drug for patients.	UC-Prescribe Drug	✓	
7	The system should enable the store to view		✓	

	and issue requested drugs.	UC-Issue Dug		
8	The system should enable to generate user requested report.	UC- Generate Report		✓
9	The system should generate standard reports.	UC- Generate Report	✓	
10	The system should show alert for under stocked and near expire drugs.	Interview	✓	
11	The system should enable to search and view saved data.	Interview	✓	
12	The system should enable the user to register drug detail.	Document review	✓	

CHAPTER THREE

3. Non-functional Requirements

A non-functional requirement defines system properties and constraints or it is a requirement that specifies criteria that can be used to judge the operation of a system rather than specific behaviors. The following are the non-functional requirements of the proposed system:

Table 3.1 Non-Functional requirement list

No	Requirement description	Requirement source	Remark	
			Mandatory	Optional
1	The system should have frequent and full back up mechanism to avoid any data loss.	Interview	✓	
2	The system should support any version of Window operating system such as Window 7, Window 8, Linux, and any latest version.	Interview	✓	
3	The system should have a very simple and user friendly interfaces for system users to understand the functionalities easily.		✓	
4	The system should be available for 24 hours a day and 7 days a week.	Interview	✓	
5	The system should be protected from unauthorized user and the administrator page ought not to be accessed by any other system users.		✓	

CHAPTER FOUR

4. SYSTEM MODELING

4.1 Analysis Models

4.1.1 Use Case Diagram Presentation

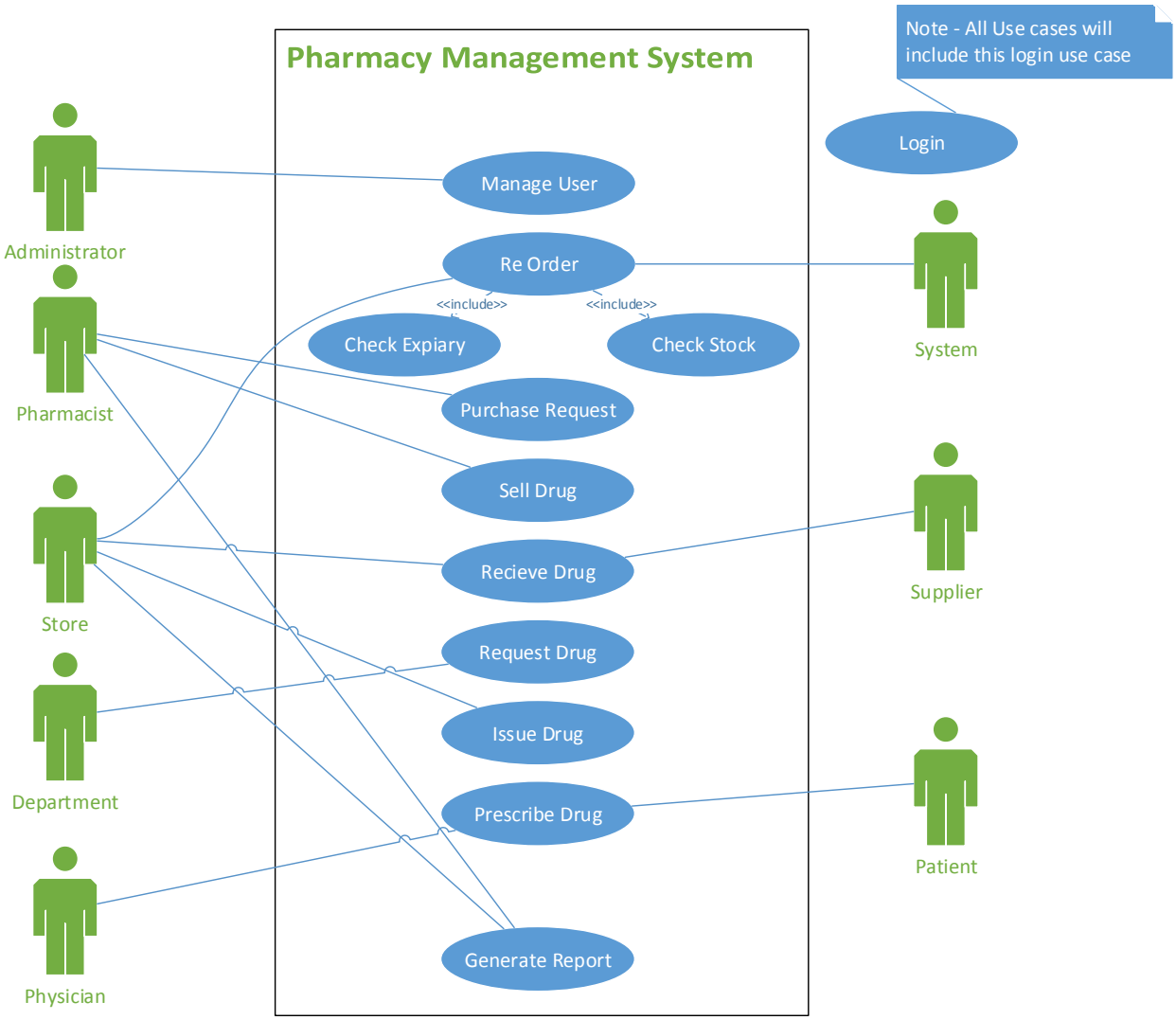

Figure 4.1 System Use Case Diagram of SPHMMC Pharmacy Management System.

4.1.2 Use Case Narration

Use case narration is a textual representation of the course of events encountered when an actor is interacting with the system. It describes each use case in detail as path transverse through the system to meet a requirement. The description of each use case are listed below

Table 4.1: Description of Use Case login

Use Case ID	PMS-1
Use Case Name	Login
Use case Description	Describes how the user is authenticated by the system.
Primary Actor(s)	Administrator, Pharmacist, Physicians, Department, Store.
Pre-condition	The user must have authorized username and password.
Post-condition	The system validate the username and password
Basic Scenario	1) The user initiate(opens) the PMS; 2) The PMS responds by presenting the home page along with the login form; 3) The user enters username and password in the login form and press the login button; 4) The system displays the main page based on the user privileges. The use case ends
Alternative Scenario	4 A) If the username or password is incorrect the system display an error message “invalid username or bad password” B) Prompt for the correct username and password C) If the user tries three times continuously the system Locks the user
Special Condition	None

Table 4.2: Description of Use Case Manage user

Use Case ID	PMS-2
Use Case Name	Manage user
Use Case Description	Describes the process of registering and creating user account
Primary Actor(s)	Administrator
Pre-condition	The administrator is logged into the system using administrator account
Post-condition	The system updated User status
Basic Scenario	1) The system displays the administrator screen; 2) The system displays input field to create new user at the top and the list of already existed user accounted along with their status 3) If the administrator wants to create new account should enter into appropriate field and submit 4) The system checks the information provided 5) The system saves the user account to the database 6) The system display the newly created account in the account list 7) The use case ends
Alternative Scenario	3 a) If the administrator wants to update status of already existing user b) The administrator select the user c) The system display the user d) The administrator change the status and add e) The system update the database f) The use case end 4 a) If user account form is not completely filled or is not correct, error message displayed “please fill out this page” b) Prompt correct form again
Special Condition	None

Table 4.3: Description of use case Re Order

Use Case ID	PMS-3
Use Case Name	Re Order
Use Case Description	Describes how to manage stock and purchase order of pharmaceuticals
Primary Actor(s)	Store
Pre-condition	a) The system checks expiry date of drugs b) The system checks all under stock drugs
Post-condition	The system process purchase order
Basic Scenario	1) The user is logged in to the system; 2) The user select Re order button; 3) The system displays lists of near expiry and under stocked drugs; 4) The user clicks print button; The use case ends.
Alternative Scenario	None
Special Condition	None

Table 4.4: Description of Use Case Purchase Request

Use Case ID	PMS-4
Use Case Name	Purchase Request
Use Case Description	Describes how to request purchase of under stoke or new pharmaceuticals
Primary Actor(s)	Departments
Pre-condition	There must be registered medicines in the system
Post-condition	None
Basic Scenario	1) The user logged in to the system; 2) The user opens purchase request form; 3) The user selects medicines to be requested and fill the purchase request form with all appropriate information; 4) The user clicks on request button; 5) The system validate the form; 6) Purchase request processed.
Alternative Scenario	5 a) If the purchase request form is not completely filled or is not correct, error message displayed b) Prompt correct form again
Special Condition	None

Table 4.5: Description of Use Case Register Drug

Use Case ID	PMS-5
Use Case Name	Register drug
Use Case Description	Describes the process of registering new drugs on the system
Primary Actor(s)	Stores
Pre-condition	The user is logged into the system
Post-condition	Drugs information is registered in the system data base
Basic Scenario	1) The user logged into the system; 2) The user select drug register form; 3) The user fill the register form with all appropriate information; 4) The user clicks save button; 5) The system saves drug detail on the database.
Alternative Scenario	5 a) If the drug register form is not completely filled or is not correct, error message displayed b) Prompt correct form again
Special Condition	None

Table 4.6: Description of Use Case Receive Drug

Use Case ID	PMS-6
Use Case Name	Receive drug
Use Case Description	Describes how to validate and receive the registered drugs
Primary Actor(s)	Store
Pre-condition	Medicines should be registered on the system
Post-condition	The system increases the store balance of medicine
Basic Scenario	1) The user logged in to the system; 2) The user select receive drug form; 3) The system displays receive drug form; 4) The user fills the receive drugs form with all appropriate information 4) The user clicks save button; 5) The system validates the form.
Alternative Scenario	5 a) If the receive drug form is not completely filled or is not correct, error message displayed; b) Prompt correct form again.
Special Condition	None

Table 4.7: Description of Use Case Request Drug

Use Case ID	PMS-7
Use Case Name	Request drug
Use Case Description	Describes how to request drug from store
Primary Actor(s)	Department
Pre-condition	1. There must be registered drug on the system; 2. Drugs must be sufficient in the store.
Post-condition	The system saves drug request on the database.
Basic Scenario	1) The user logged in to the system; 2) The user select request drug form; 3) The system displays drug request form; 4) The user select medicines to be requested and fill the request order form with all appropriate information 5) The user clicks request button; 6) The system process requested drug.
Alternative Scenario	5 a) if the requested form is not completely filled or the requested amount is greater than the stocks, error message displayed “insufficient balance” b) Prompt correct form again
Special Condition	None

Table 4.8: Description of Use Case Issue Drugs

Use Case ID	PMS-8
Use Case Name	Issue drug
Use Case Description	Describes how to issue the requested drugs to departments
Primary Actor(s)	Stores
Pre-condition	Drug must be registered on the database.
Post-condition	1. The system displays issued drugs; 2. The system deducts Issued drugs from the database.
Basic Scenario	1) The user logged in to the system; 2) The system displays all requests; 3) The user clicks on request to be issued; 4) The user clicks check balance button; 5) The system displays amount on stocks and request; 4) The user clicks on issue button.
Alternative Scenario	3 a) If the requested drug amount is greater than the store balance, display an error message "insufficient balance" b) Issue the appropriate balance
Special Condition	None

Table 4.9: Description of Use Case Prescribe Prescription

Use Case ID	PMS-9
Use Case Name	Order Prescription
Use Case Description	Describes how to prescribe (order) drugs for customers
Primary Actor(s)	Physicians
Pre-condition	1. There must be registered drug in the system 2. Patient must be registered on the database
Post-condition	Prescription is issued to the pharmacy department.
Basic Scenario	1) The user logged in to the system; 2) The user select the prescription form; 3) The user fills all the necessary information on the prescription form; 4) The user click on save button
Alternative Scenario	3 a) If the prescription form is not completely filled or is not correct, error message displayed b) Prompt correct form again
Special Condition	None

Table 4.10: Description of Use Case Generate Report

Use Case ID	PMS-10
Use Case Name	Generate Report
Use Case Description	Describes how to generate reports
Primary Actor(s)	Pharmacist, Physicians, Department, Stores
Pre-condition	The user is logged into the system
Post-condition	The System generate reports
Basic Scenario	1) The user select report menu; 2) The system displays report option; 3) The user select generate report button; 4) The system generates report from the database.
Alternative Scenario	None
Special Condition	None

Table 4.11: Description of Use Case Sell Drug

Use Case ID	PMS-11
Use Case Name	Sell drug
Use Case Description	Describes how to sell drugs
Primary Actor(s)	Pharmacist
Pre-condition	The Pharmacist is logged into the system using his/her account.
Post-condition	Sell detail is recorded in the system database.
Basic Scenario	1) The pharmacist open the PMS; 2) Open sale drug form, select medicines to be sold with its quantity and unit price; 3) The Pharmacist clicks **"sell"** button; 4) The system displays deducted balance from stock; 5) The system generate sale invoice.
Alternative Scenario	2 a) If the sell is for internal ordered prescription, open prescription form; b) The Pharmacist view all prescription lists; c) The pharmacist clicks on the appropriate patient prescription; d) The pharmacist add prescription to the sales screen; e) The pharmacist clicks "**sell**" button; f) The system generates sale invoice. 2 (e)(a) If balance is not sufficient or patient reject to buy; (b) The system print prescription
Special Condition	None

4.2 Design Models

4.2.1 Class Diagram

Class diagram is a type of static structure diagram that describes the structure of a system by showing the system`s classes, their attributes, and the relationships among objects. Class diagram show a collection of static model elements such as class and their relationship, connected as graph to each other and to their content, their internal structure and their relationship to other class. In class diagram object in real world are represented by the actual object in the program (32). So a well-developed class diagram helps to effectively develop a model of the system and create ease of understanding. Figure 4.2 shows the structure of pharmacy management system.

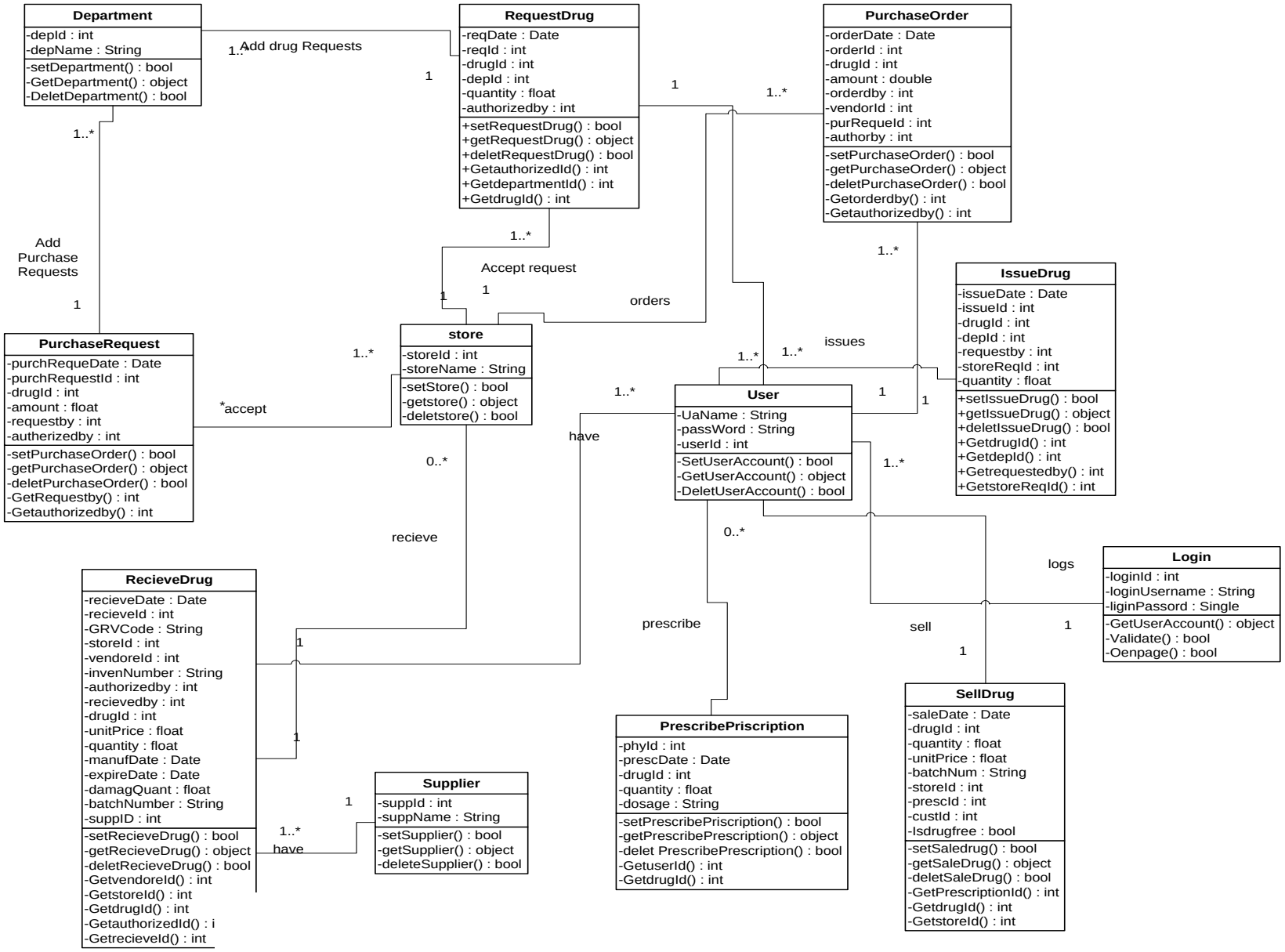

Figure 4. 2: system class diagram

4.2.2 Sequence diagram

Sequence diagram are used to model the logic of usage action. A usage scenario is exactly what its name indicate, the description of a potential way that the system is used. A sequence diagram is an easy and intuitive way of describing the behavior of a system by viewing the interaction between the system and its environment. A sequence diagram shows an interaction arranged in a time sequence. It shows the objects participating in the interaction by their lifelines and the messages they exchange, arranged in a time sequence (33).

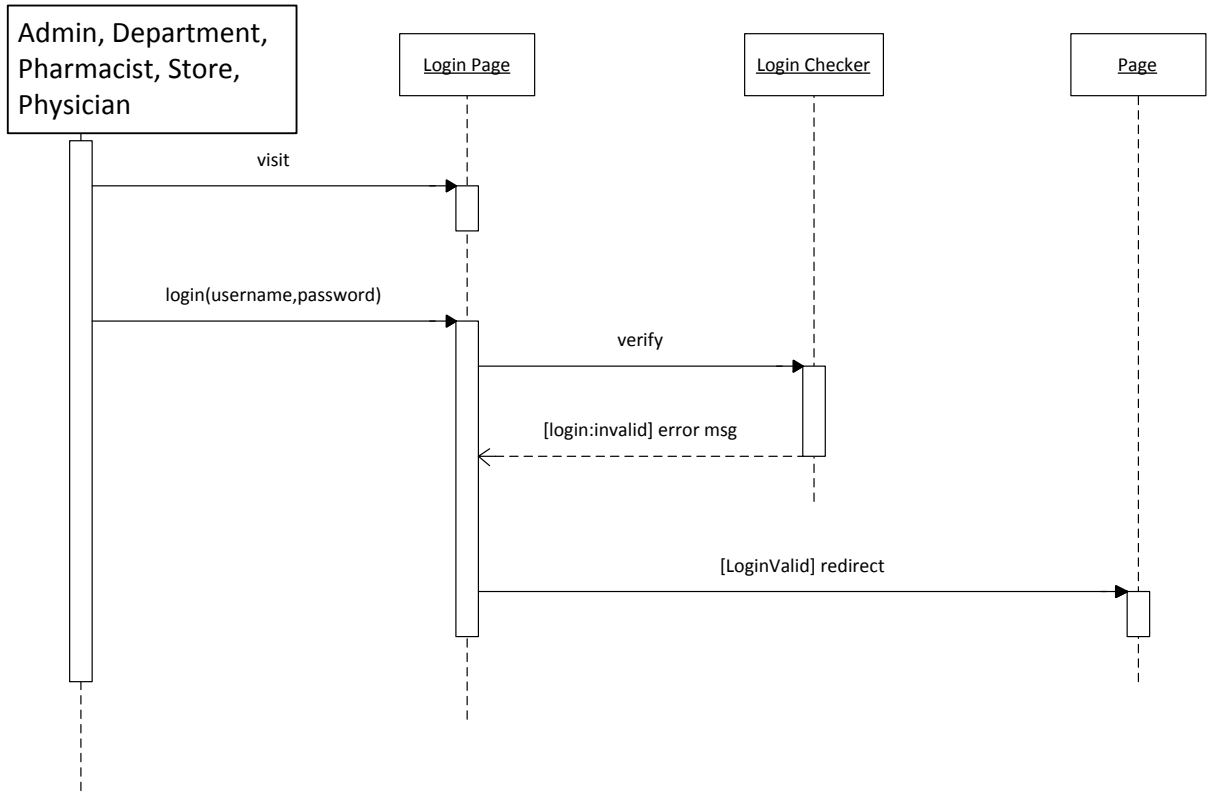

Figure 4.3 Login Use Case Sequence Diagram

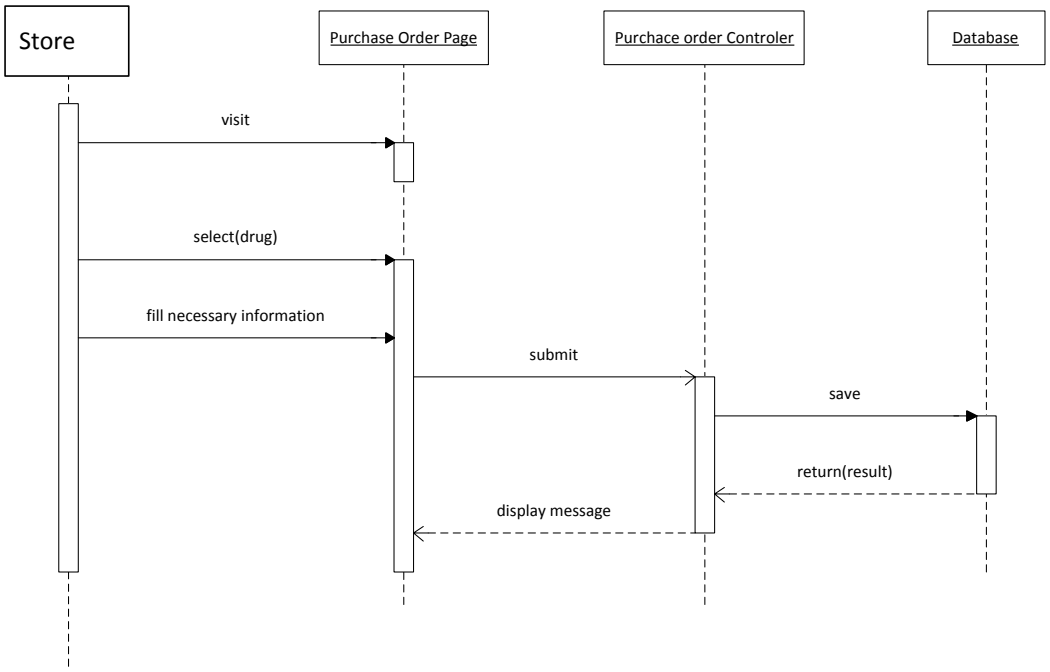

Figure 4.4 Purchase Order Sequence Diagram

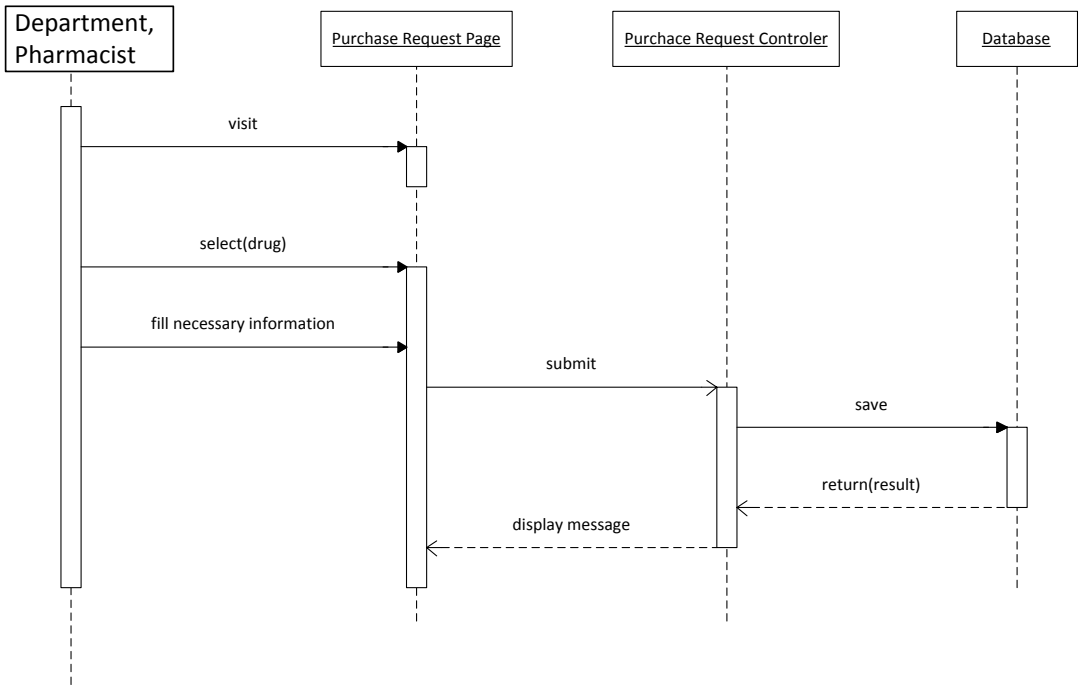

Figure 4.5 Purchase Request Sequence Diagram

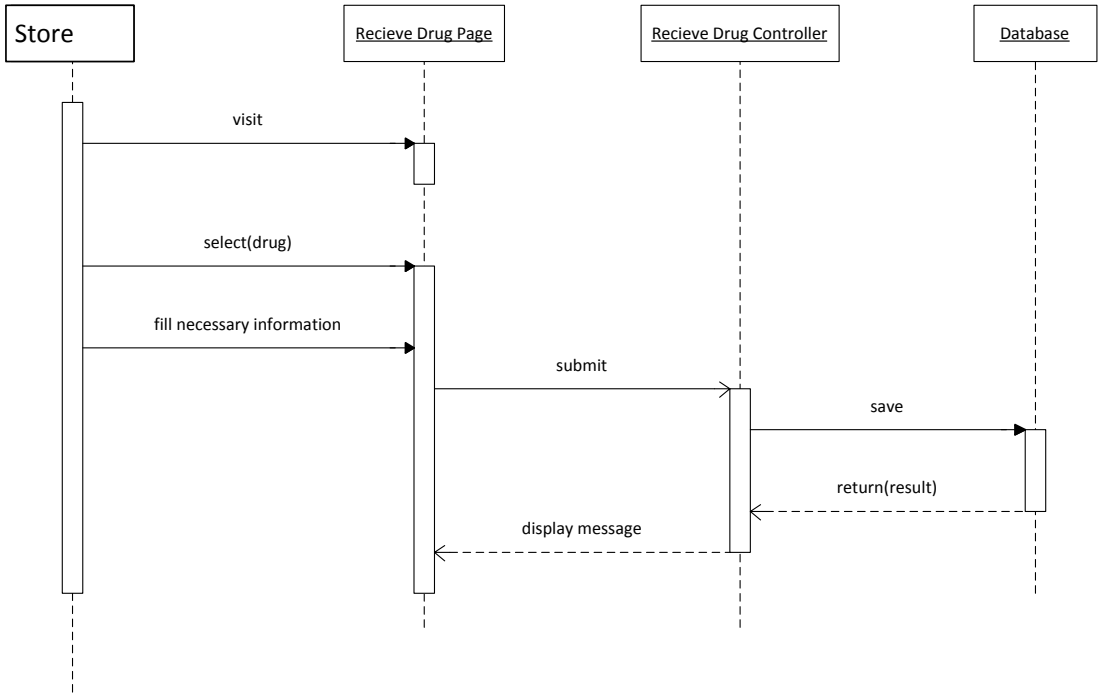

Figure 4.7 Receive Drug Use Case Sequence Diagram

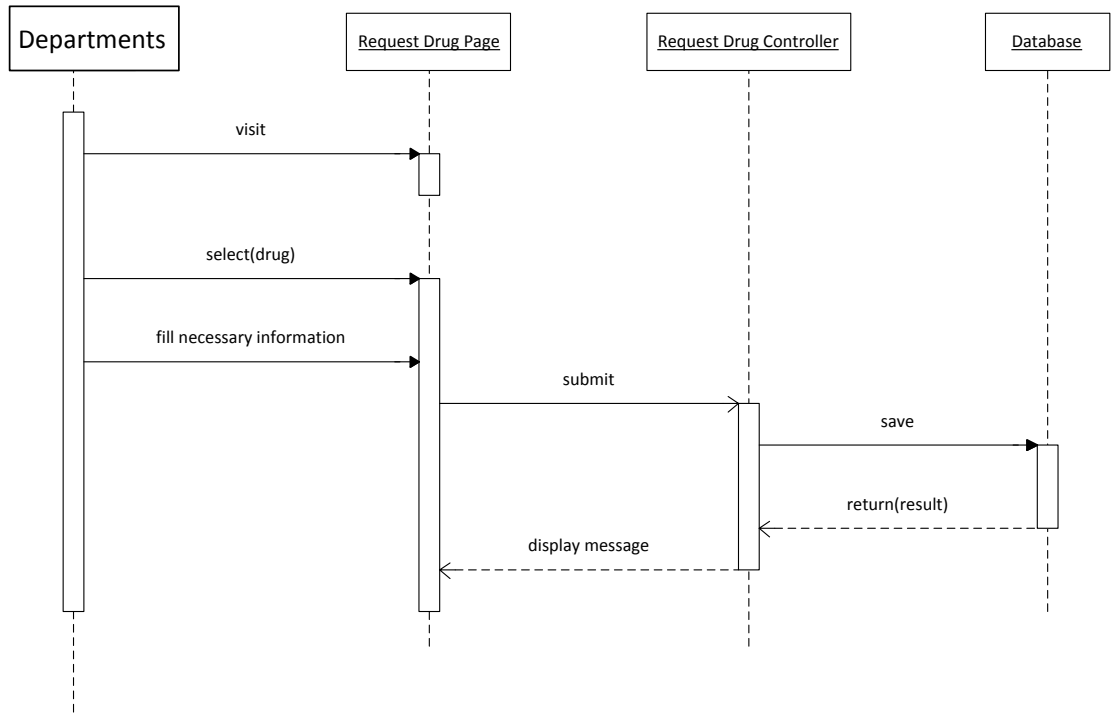

Figure 4.8 Request Drug Use Case Sequence Diagram

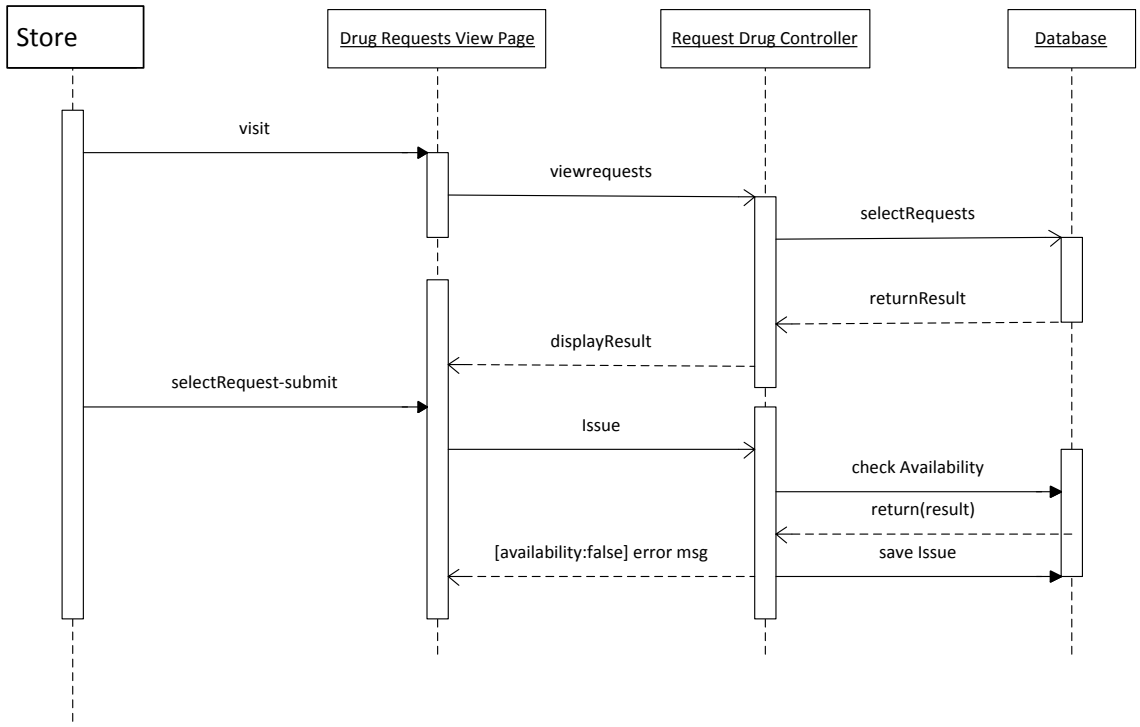

Figure 4.9 Drug Request View sequence diagram

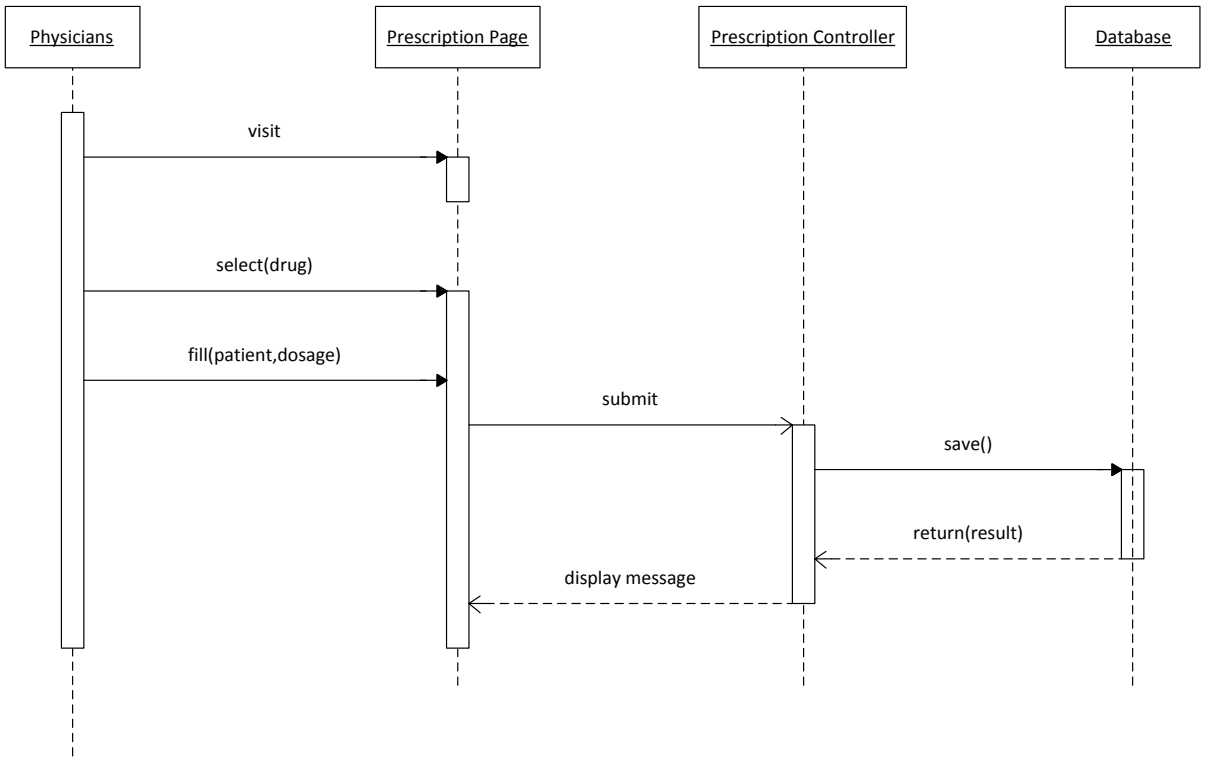

Figure 4.10 Drug Prescription Sequence Diagram

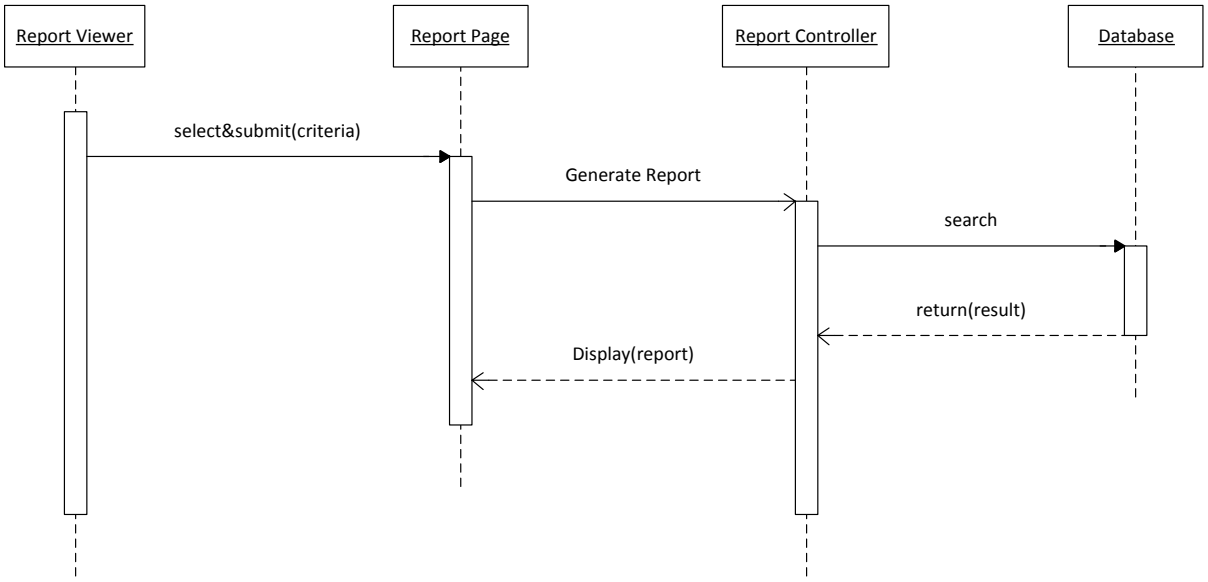

Figure 4.11 Generate Report Sequence Diagram

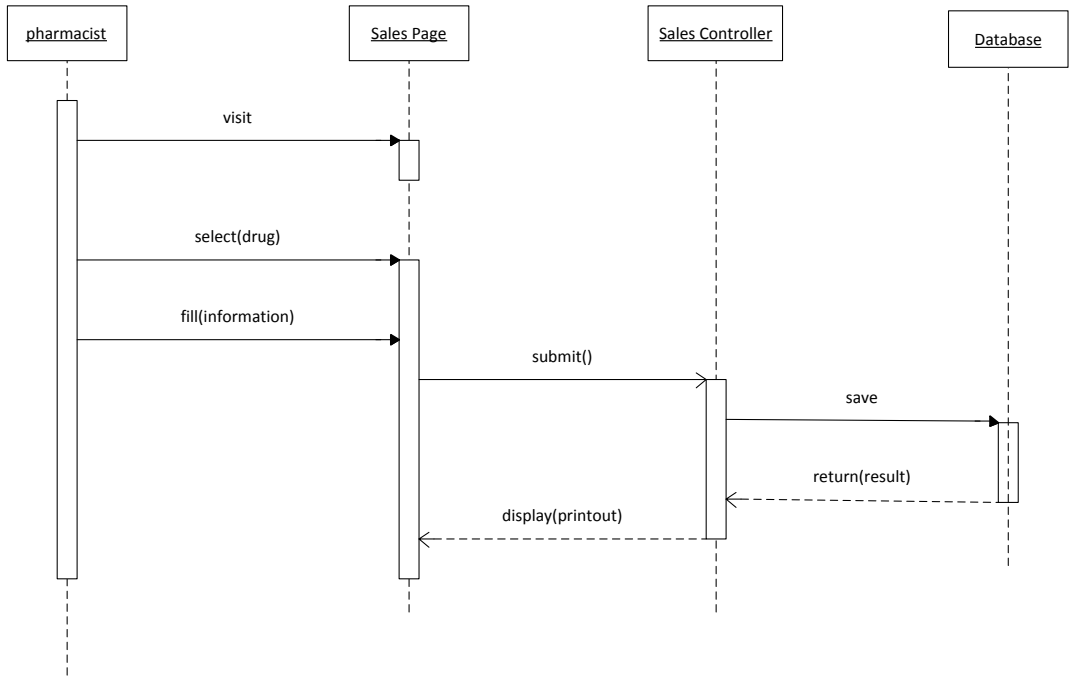

Figure 4.12 Sell Drug Sequence Diagram

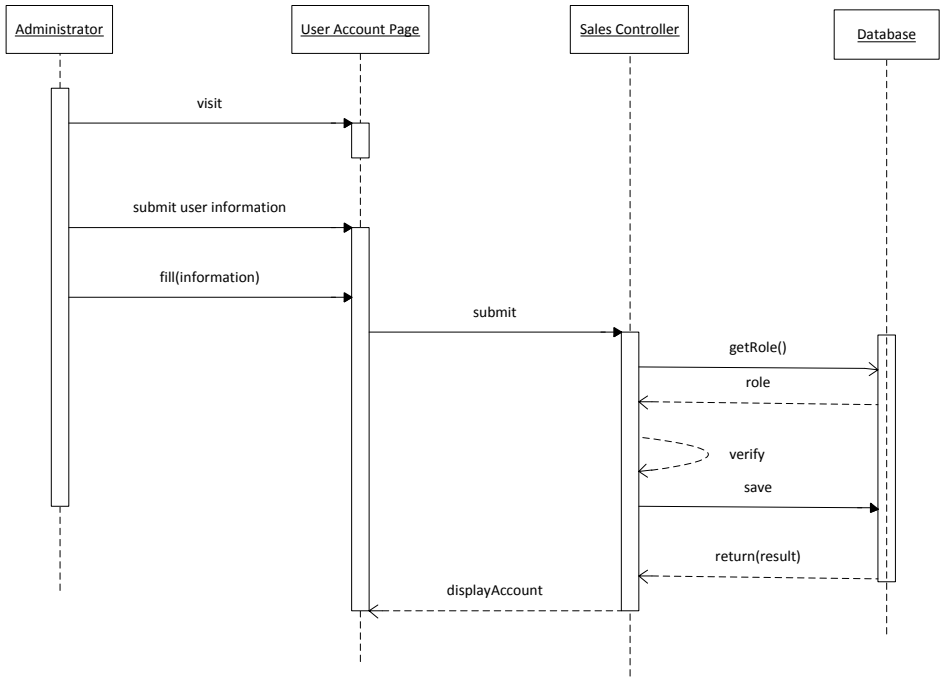

Figure 4.13 User Account Sequence Diagram

4.2.3 system prototype presentation

Login form:-this form is used to login into the system. It enables to insert valid user name and password in field. After valid input the system displays the page based on his/her privilege to access the service the system provides.

Figure 4.14: The home page along with Login form

The user account form:- this form is accessed only by administrator body in order to create user account and assign privilege for system users. The administrator select employee from the data base, create user name, assign privilege based on the position, and user password is filled, and then confirm in order to add to the system. The status should be active in order to use the system. Edit and delete menus can be used to correct this form incase if correction is needed.

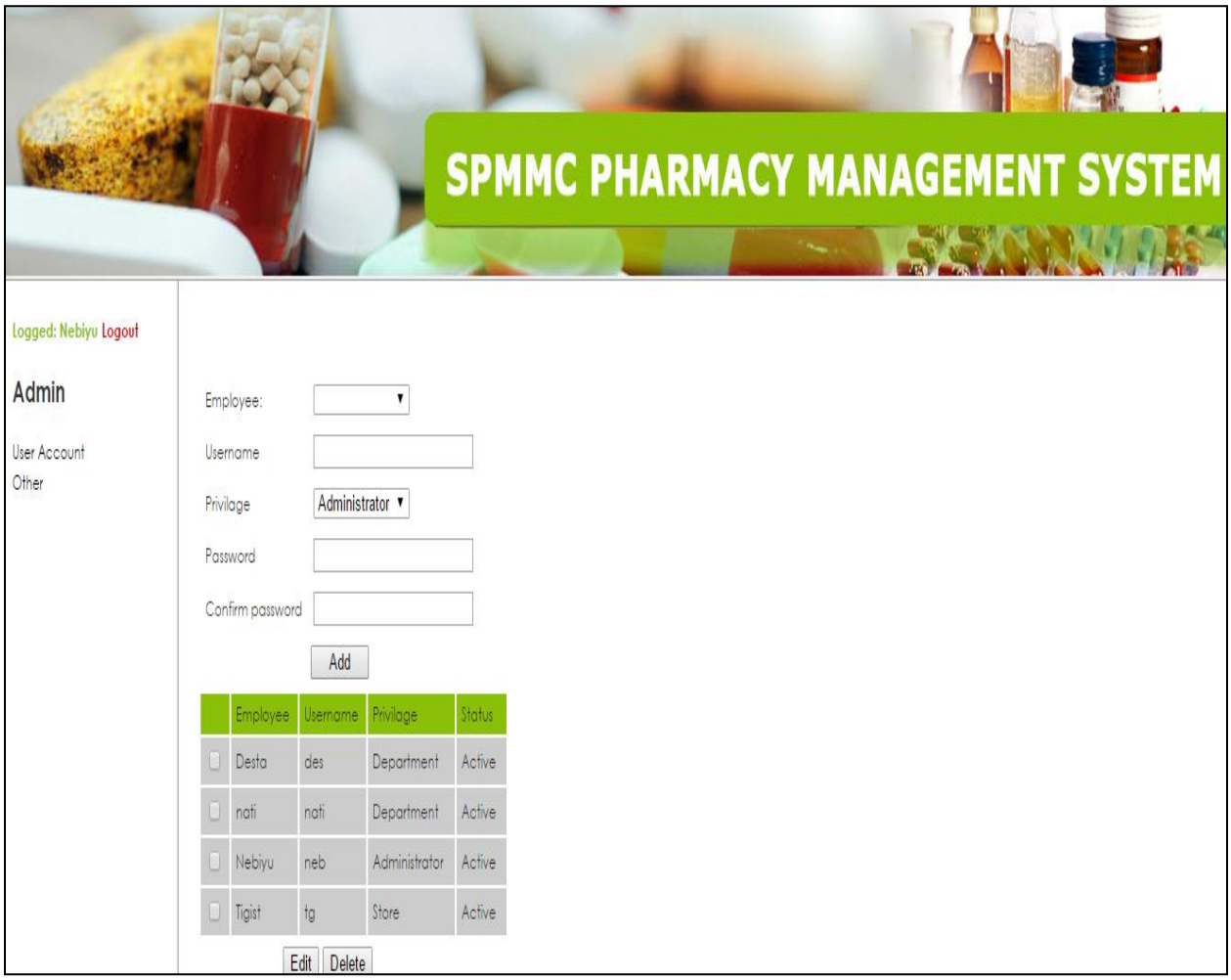

Figure 4.15: User account form

New employee and department registration form:- this is also administrator form which is used to registered new employee with his/her position and the department he/she is working. In addition departments can be registered in this form in order to be saved on the data base.

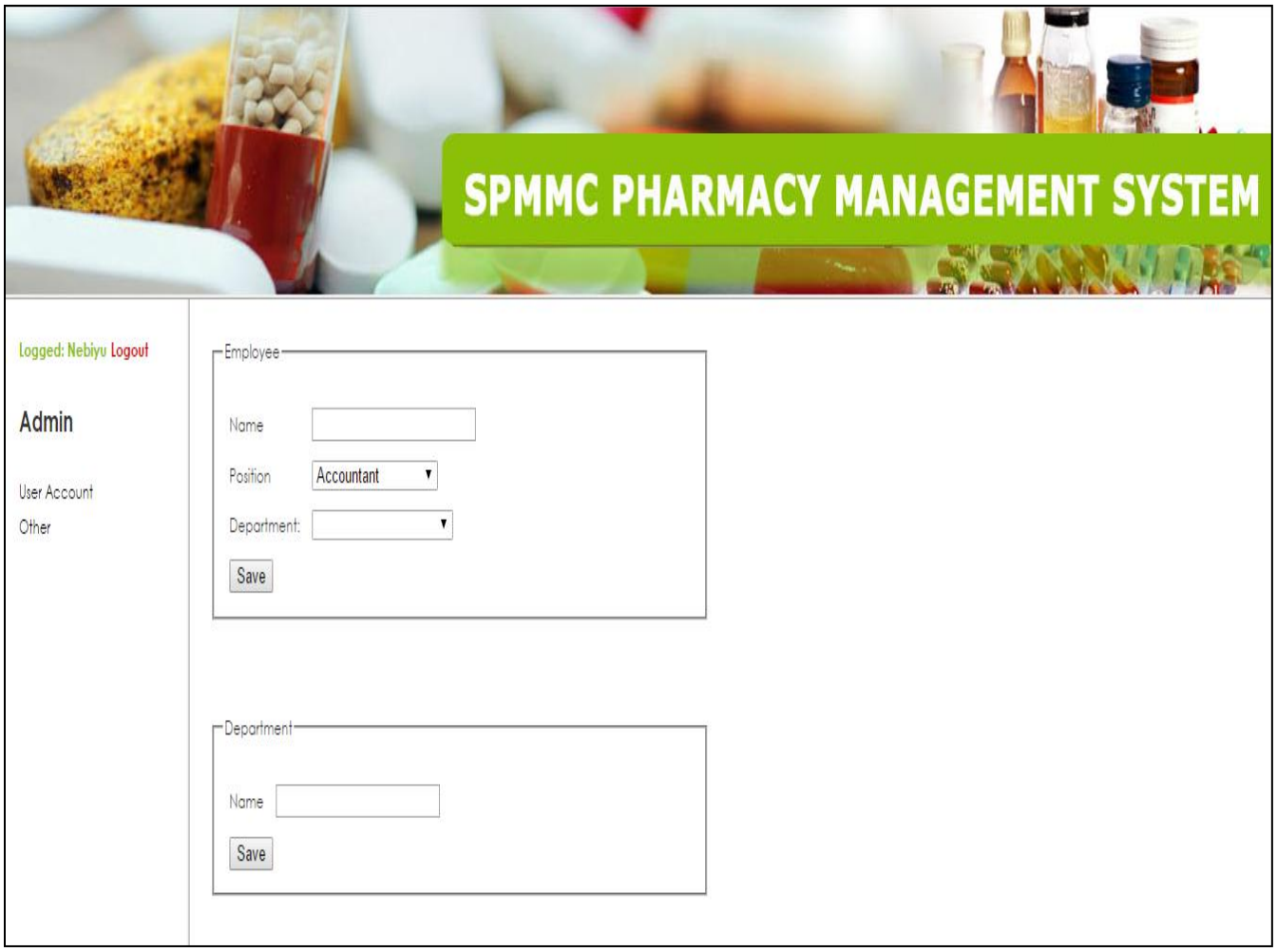

Figure 4.16: New employee and department registration form

Store request form:-the store request form enables departments to request drug from the store. This page automatically generates request code and the rest fields like request date, department from which the request generated and employee should be filled appropriately. The detail part of the form enables to select drugs and quantity to be requested.

Figure 4.17: Store request form

View request:-this form has all details of the department requested at any date. It enhances to search requested drug either by code or by date of request.

Figure 4.18: View request form

View Issued form:- this form helps departments to view drugs issued from store based on their request.

Figure 4.19: view issued form

Store view request form :- this page contains information such as request code, request date, by whom and from which department is requested. In addition request detail part show the requested drug name, store balance of the drug and the requested amount/quantity. By clicking on the issue drug button the drug is issued and the store balance deduct.

Figure 4.20: Store View request form

View issued form:-this form contains all issued drug with all the necessary information including by whom it is issued, date of issue, type and quantity of issued drugs. In addition it enable the store man to search drugs by using date of issued or by issued code.

Figure 4.21 Store view issued form

Receive drug form:- with this form the store man receive drug from the supplier. The form must be appropriately filled with in the appropriate information listed in the field.

Figure 4.22: Receive drug form

Register drug:-in order to register drugs on the system and to save on the data base register drug form is used. With this form drugs can be saved both with trade or generic name, drug code, and its measurements. Unless this form is properly saved on the data base drugs cannot be received.

Figure 4.23 New drug registration form

View received drug form:-this window enables the store man to view received drugs in any time.

Figure 4.24 :View received drug form

Report form:-is used to know store balance of all registered drugs with their code. The system helps to easily monitor under -stoke drugs by using this form because under stocked medicines will be red if there are not in sufficient balance.

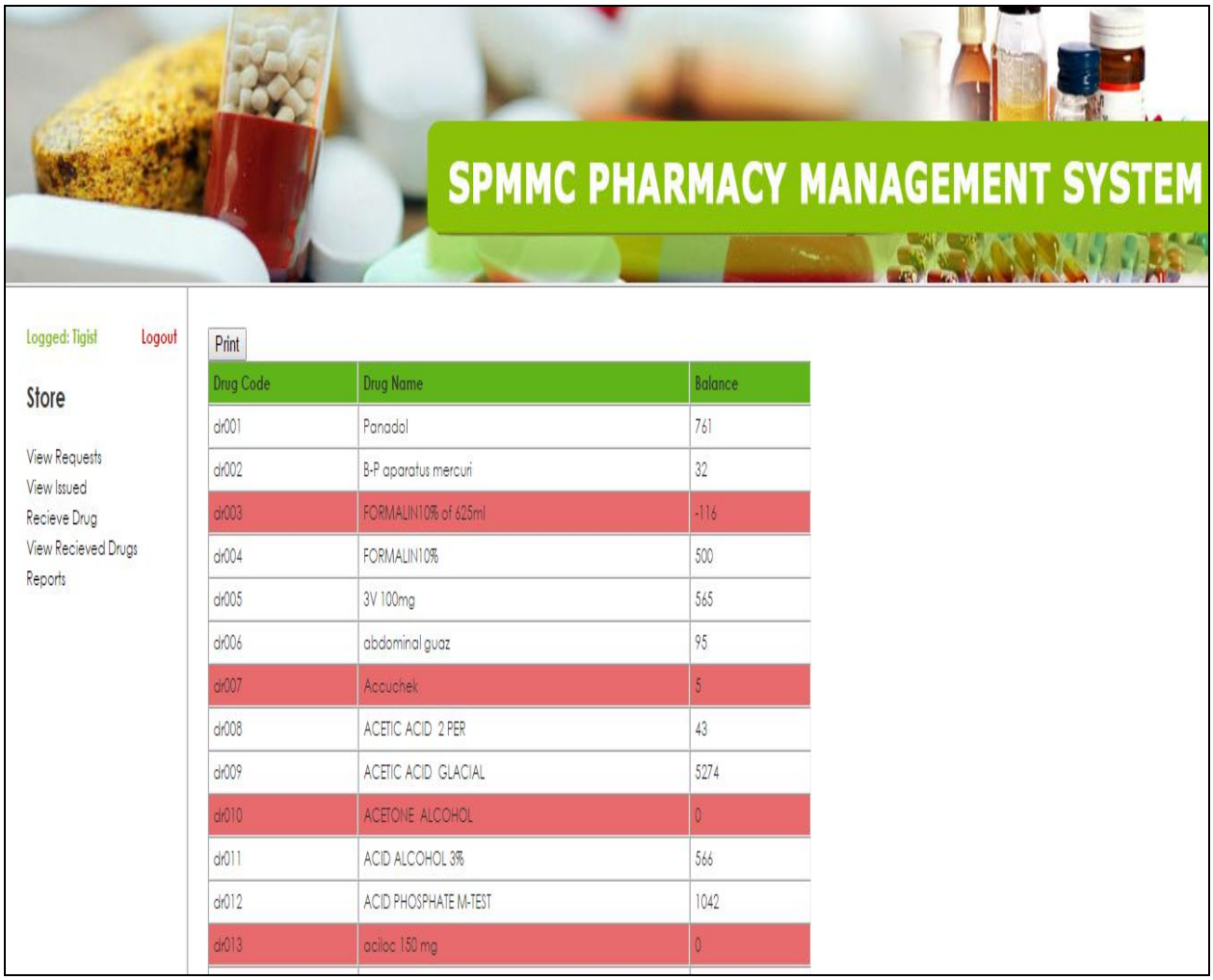

Figure 4.25 Report form

Annex II: Hardware Inventory

- **Device Quantity**

Type	Model	Quantity
Firewall	ZXSEC US1612	1
Router	Cisco 3925	1
Core Switch	ZXR10 5928E	2
AGG Switch	ZXR10 5928E	2
Access Switch	ZXR10 2928E	5
IBM Server	IBM X3650 M3	5
Tape Library	Dell TL2000	1

Naming rule: A-BC-D-FG

A = Site Name

B = Building / Branch Office Name

C = Model Number

D = Equipment Type

E = Equipment Count

Location	Device Name
SPH Datacenter	SPH-DC01-US1612-FW01
SPH Datacenter	SPH-DC01-C3900-GR01
SPH Datacenter	SPH-DC01-S5952-CS01
SPH Datacenter	SPH-DC01-S5952-CS01
SPH Datacenter	SPH-DC01-S5952-AS01
SPH Datacenter	SPH-DC01-S5952-AS02
SPH Datacenter	SPH-DC01-S2928-ACS01
SPH Datacenter	SPH-DC01-S2928-ACS02
SPH Datacenter	SPH-DC01-S2928-ACS03
SPH Datacenter	SPH-DC01-S2928-ACS04
SPH Datacenter	SPH-DC01-S2928-ACS05
SPH Datacenter	SPH-DC01-X3850-SR01
SPH Datacenter	SPH-DC01-X3850-SR02
SPH Datacenter	SPH-DC01-X3850-SR03
SPH Datacenter	SPH-DC01-X3850-SR04
SPH Datacenter	SPH-DC01-X3850-SR05
SPH Building 01	SPH-BD01-S2928-ACS01
SPH Building 01	SPH-BD01-S2928-ACS02
SPH Building 01	SPH-BD01-S2928-ACS03
SPH Building 01	SPH- BD01-S2928-ACS04
SPH Building 01	SPH- BD01-S2928-ACS05
SPH Building 01	SPH- BD01-S2928-ACS06
SPH Building 01	SPH- BD01-S2928-ACS07
SPH Building 01	SPH- BD01-S2928-ACS08
SPH Building 01	SPH- BD01-S2928-ACS09
SPH Building 02	SPH- BD02-S2928-ACS01
SPH Building 02	SPH- BD02-S2928-ACS02
SPH Building 02	SPH- BD02-S2928-ACS03

Annex III: Requirement Collection Checklist

Addis Ababa University
School of Information Science and School of

Public Health MSc.in Health Informatics Program

I, the undersigned, am here to gather requirement for my project work entitled as **"Designing a web-based pharmacy management system for Saint Paul Hospital Millennium Medical College"**

The objective of the interview is to gather basic requirement that will be input for proposed pharmacy management system development and I assure that the information you are going to respond is entirely confidential and only will be used for analysis and design purpose.

By considering your permission, I would like to appreciate your participation in the interview.

Name of the interviewee ----------signature----------date----------.

Addis Ababa University

School of Information Science and School of

Public Health MSc.in Health Informatics Program

Interview guide questions for professionals from Federal Ministry of Health

1. Name
2. Job title
3. Who are involved during development of the system?
4. When was the system piloted?
5. What was the challenges encounter during development and implementation of the system?
6. Will you support the product or will others support it?
7. What about maintenance and service access?
8. What are the functionalities of the system?
9. What is the status of the project now a day?

Addis Ababa University
School of Information Science and School of

Public Health MSc.in Health Informatics Program

Interview guide questions for professionals from Saint Paul hospital Millennium Medical College.

1. Name
2. Job title
3. What is your main responsibilities
4. How would do you do it
5. Which problem interface on your day to day activity and its impact on your success
6. Why do you think this problem exist
7. How do you solve it
8. What will be the possible solution
9. what would you expect if my system is applicable
10. can you think any other requirement in your mind
11. would you be willing to participate in requirement review and evaluation of the system

Annex V: Prototype Evaluation Check List

1. All of the fonts on the system are readable
   - Fully agree
   - Agree
   - Undecided
   - Disagree
   - Fully disagree
2. The interface is pleasing and easy to use
   - Fully agree
   - Agree
   - Undecided
   - Disagree
   - Fully disagree
3. All the system input field button location are consistence
   - Fully agree
   - Agree
   - Undecided
   - Disagree
   - Fully disagree
4. All important content addressed well
   - Fully agree
   - Agree
   - Undecided
   - Disagree
   - Fully disagree
5. The system is easy to open and access
   - Fully agree
   - Agree
   - Undecided
   - Disagree
   - Fully disagree
6. I like the color of the interfaces
   - Fully agree
   - Agree
   - Undecided
   - Disagree

Declaration

I, the under signed, declare that this project is my original work and has not been presented for a degree in any other university, and all source of materials used for the project have been fully acknowledged.

Tigist W/Mariam

This project has been submitted for examination with our approval as university advisors,

_____	_____
Dr. Million Meshesha	Dr. Demeke Assefa

Place and date of submission

_____

Addis Ababa, November 2016.