# Design and Implementation of a Clinical Pharmacy Management and Electronic Prescription System

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***ABSTRACT:*** *A pharmacy is viewed as a physical store contained either in a hospital or as a small venture primarily saddled with the responsibility of dispensing medication to various individuals. While various individuals choose voluntarily to bypass the need for professional medical advice in the area of drug prescription by engaging in self-medication, either as a result of lack of funds or ignorance of what should be done, quality pharmaceutical services could mean the difference between life and death. Problems such as handwriting misinterpretation, cost incurred from frequent calls from pharmacists to physicians, data inconsistency and long waiting lines exist in traditional, manual pharmacy management methods. The goal of this paper therefore is to review the traditional approach to pharmacy management and prescription handling with the view of developing an electronic version. The solution was implemented using the Java programming language due to its platform independence and object-oriented nature. The proposed system addresses the aforementioned problems.*

**Keywords:** Electronic prescription, Pharmacy, Pharmacy management

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## 1. Introduction

As a result of the growing interest in patient safety by the health care industry, the automation of pharmacy management services cannot be ignored. A clinical pharmacy is one that is mostly found within the hospital and is usually concerned with providing medications for patients visiting the hospital [5] [6]. The clinical pharmacy and the associated hospital jointly form an integrated hospital-pharmacy system [3]. Within the conventional model of corporate organizations, pharmacists managed all of the business dealings like small-scale independent entrepreneurs. The pharmacists operated with few employees usually managing the administrative aspects by themselves which includes the ordering and sale of pharmaceutical goods as well as inventory management. In some of the cases, there were cash points joined to these systems or the purchases were supported by Electronic Data Interchange (EDI), but in majority of the pharmacies, information technology consisted mainly of standard, stand-alone applications for the processing of data, archiving and transaction [1] [7].

The purpose of an integrated hospital-pharmacy system is to ensure that quality healthcare services are given to the patients

while ensuring that the whole organization operates under a unified structure. Hospital-Pharmacy Management System (HPMS) is a system used by hospitals and their associated pharmacies to improve both the working environment of the pharmacists and to ensure their patients' satisfaction by synchronizing the databases of a hospital and a pharmacy together for a better flow of work [3]. It is expedient that every hospital pharmacy develops a clinical information management strategy. The existing systems should be examined to determine which functions are not relevant anymore and which could be enhanced without the software needing major modifications. Such enhancements might include regular entry of drug allergy information so that all orders can be screened and the use of networks and interfaces to provide medication profiles to hospital personnel [2].

The goal of this paper is to review existing systems and the traditional approach to pharmacy management and prescription with the intent to design and develop an electronic version [13]. The rest of this paper is structured as follows: Section 2 discusses related works while Section 3 presents the design of the proposed system. In Section 4, the proposed system is implemented as a web application. Section 5 discusses the results obtained while Section 6 concludes the paper.

## 2. Related Work

In line with the recommendation by the Institute of Medicine that all prescriptions be routed electronically by the year 2010, a number of systems have been developed.

Pharma Space [10] allows patients to fill prescriptions prepared by a pharmacist at the patient's local pharmacy from their homes. It is designed for patients with busy schedules as prescriptions can be shipped directly to the patient's home. MediEaz [12] was produced to serve as a brand range for MediEaz Hospital management system and their other arms. It is web enabled and has modular applications which supports distributed center transactions. It also provides mobile access and cloud support.

Miracle PIS [9] on the other hand integrates the pharmacy with computerized physician order entry and drug charting. It allows for flexible automation of the regular workflow associated with pharmacists through many inpatient and ambulatory pharmacy functionality. CGM PIS [15] provides a solution for daily pharmacy operations for CompuGroup medical pharmacy. VeraSuite PIS [16] is customized for VeraSuite is a fully integrated solution that enables prescription management from the time of order placement to administration or dispensation of medication to patients. It is observed that the works above are customized for the operations of specific hospitals, hence, this study focuses on providing a pharmacy management system with a focus on e-prescription [4] using Covenant University health center as a case study.

## 3. System Design

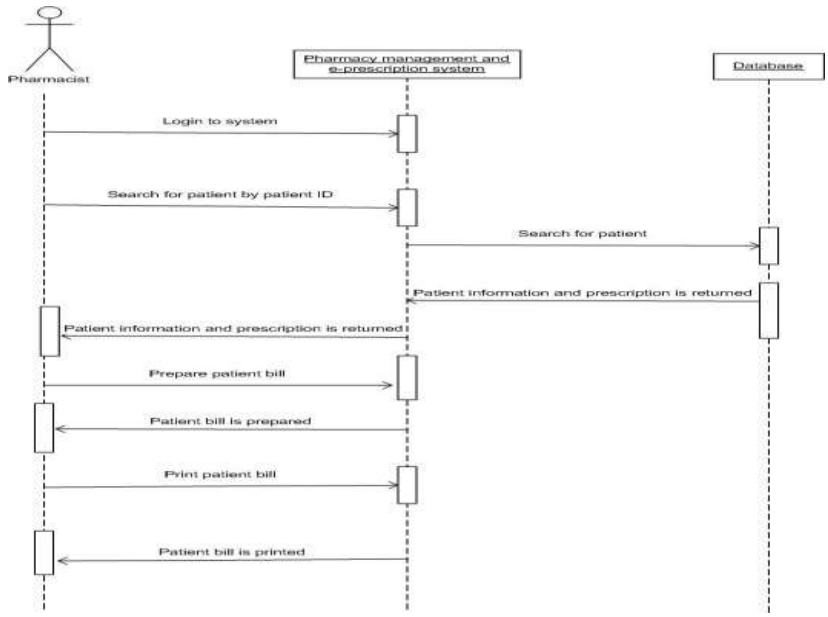


Figure 1. Sequence Diagram showing how prescriptions are retrieved and how patients are billed

The HPMS uses the evolutionary prototyping method where the prototype is not discarded but forms a part of the final system as opposed to throwaway prototyping [8]. The evolutionary prototyping approach is used in this project due to the need for an aesthetically pleasing user interface, which can only be achieved by constant user feedback. Also due to the fact that it is software, which will be used for medical purposes, it is necessary that medical personnel such as the pharmacists evaluate the system and give feedback so changes [11]. UML diagrams were used to model the key players of the system.

Figure 1 is a sequence diagram that describes how the prescription and bill preparation for a patient takes place using the proposed system. The hospital first sends out the prescriptions for a given patient to the hospital pharmacy. At this point, the pharmacist is then able to log into the system and see the prescription sent by querying the system using the patient's ID. The patient's information and prescriptions are then displayed so that the pharmacist can administer the drugs and bill the patient accordingly.

Figure 2 presents the various classes and their interactions within the proposed system. From this figure we observe that there are five crucial entities interacting. For instance, a doctor is able to make multiple prescriptions. Also, a pharmacist can receive prescriptions from multiple doctors as seen in Figure 2. In addition, a procurement staff is responsible for stocking the pharmacy inventory with requisite drugs.

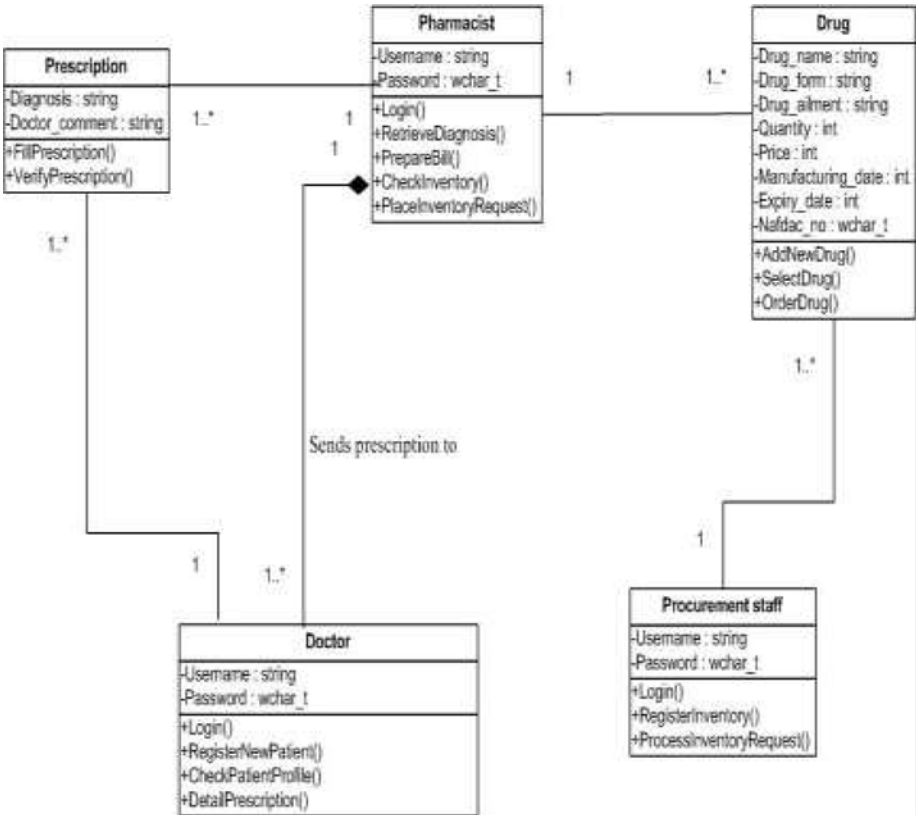


Figure 2. Class Diagram showing the interactions between the various entities in the proposed system

**4. System Implementation**

This section describes the implementation of the HPMS, which was developed using Java programming language. The proposed system was implemented as a desktop application with MySQL being used as the database.

The interface shown in Figure 3 describes the doctor's portal, which comes up after a doctor has successfully logged into the system. The doctor can check patient profile, register a patient and make prescriptions based on the patient's complaint.

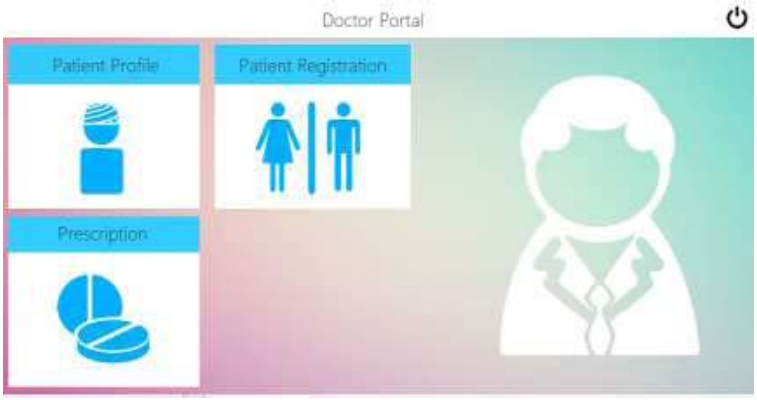


Figure 3. Doctor's portal

The interface shown in Figure 4 represents the prescription interface where the doctor gives his/ her prescription for the patient after consultation and submits it to the pharmacy for further processing.


Figure 4. Prescription Interface

The interface in Figure 5 represents the pharmacy portal, which comes up after logging in as a pharmacist. The portal allows the pharmacist to retrieve diagnosis from doctor, administer drugs, prepare bill, take inventory of drugs and re-order for more drugs when the one in stock is being depleted.


Figure 5. Pharmacy Portal

## 5. Discussion

This paper has presented pharmacy management and drug prescription in an automated way as opposed to the manual method still in use in many hospital pharmacies in developing countries. The project places emphasis on clinical pharmacies and how the inclusion of technology in this process can help boost productivity of the pharmacy staff. Existing systems have mostly been built for specific hospital set-ups and so looking at their basic features, this system adapts and applies the features to the proposed system for a University Medical Centre in sub-Saharan Africa. This work also goes a step further by including electronic prescription and procurement processing to the system in an attempt to ensure a seamless flow of operations from the patients' first visit to the hospital to their departure from the pharmacy [4].

## 6. Conclusion

The ultimate purpose of healthcare is to ensure that the best possible care is given to the patients. To this end, the role of automated clinical pharmacy management cannot be over-emphasized [5][14]. However, the integration of electronic prescription systems helps to improve the prescription process by reducing medical errors, eliminating handwriting interpretation errors, decreasing pharmacy costs, reducing phone calls between pharmacists and physicians, reducing data entry and expediting prescription refill requests thereby cutting down on long waiting lines in pharmacies. This study reviewed the traditional approach to pharmacy management and prescription handling and went on to develop an electronic version that is platform independent. The system is built specifically for a University Medical Centre.

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