Information Systems: Prescription Web System

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May God bless all

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Table of Contents

ABSTRACT

The web prescription systems have been for the last decade a large part utilization of health information technology. The lack of knowledge of the existence of this system has led institutions to miscommunication, the dissatisfaction with services from healthcare institutions. This study analyzes the process building a web prescription system and its workflow detailing what composes the systems. It displays the benefits and the number of deaths caused by a medication error. The study will be conducted using an interaction analysis. The goal is to explore the process of how web prescription system works and propose a centralized prescription web system. The purpose of the study was to improve what already exists, which benefits the experience of pharmacies and patients and eradicate deaths caused by medication error from using a paper-based prescription.

Chapter 1

INTRODUCTION

Prescription web system is a computer-based new method of generating medical prescription in replacement of paper prescription and faxed prescription. This system allows physicians to write a medical prescription and to a partnered pharmacy or healthcare providers.

The first exposure of prescription web system was in the United States around 2006 as a proposal by E-Health Standards and Services CMS to the Senate Judiciary Committee on Electronic-Prescribing U.S. Senate. For instance, in 2009 the Congress of US enacted the HITECH Act which stands for Health Information Technology for Economic and Clinical Health Act. This bill was the first milestone that allowed healthcare providers to implement electronic medical prescription [8]. Consequently, states and countries in Europe in Asia and are also migrating to a digital prescription in the result of the medication errors in hospitals and push for the electronic medical record. For example, in the United States, a medication error is responsible for 7000 deaths each year. [2]

So, medication error as one leading cause of many deaths did spark me to explore more about possible solutions to improve the healthcare systems in partnership with hospitals and pharmacies, and an Information Technology student, I decided to connect this issue with some subject that can help find some solutions for this matter. CITA 300 Management Information Systems and CITA 310

Web Server Administration. The combination of this two classes taught me techniques and tools that can help develop a solution the current healthcare problem. For instance, in Management Information Systems, I learned how the organization develops computer-based information systems for business data processing like information reporting and Office automation. In Web Server Administration, I learned how to install and to administer own web server and maintain site security. The need for solving medication error is an immediate demand and to resolve this problem; it is critical that healthcare institutions have a uniformed information system that allowed sharing digital medical data with all sort of responsibility.

This literature review will discuss prescription web system, problems related to paper-based prescription and web prescription workflow. This study will further advance research to incentive healthcare institutions, caregivers and professionals to adhere web prescription system to help reduce prescription medication error and helping them have a less risk system that to prevent any mistake. In today's world, the use of paper-based prescription is putting lives at risk. It is crucial to conduct research that will help further the knowledge on how to improve better a healthcare system. [3]

Chapter 2

PAPER-BASED PRESCRIPTION VS ELETRONIC PRESCRIPTION

A medical prescription or drug prescription consists of a form of instructions that guides the plan of care for an individual patient. Electronic prescription is computer generated prescription transmitted via web from a physician to other healthcare institutions. Prescriptions normally are monitored by a physician or other qualified professional healthcare practitioner. However, paper-based prescription is no longer efficient in regards of its effectiveness, and most important paper-based prescription is putting in risk in numerous lives. [2] For instance, approximately 7000 deaths happens each year because of medication errors. [2] The related problems with prescription paper are;

- Illegibly written prescriptions,
- Errors in drug name and dose
- Inaccurate Formulation,
- Missing prescriber or patient data,
- Repetitive medication treatment
- Ambiguous order number
- Incorrect prescription order.
- Unclear abbreviations and dose designations
- Incompleteness of information on patient medication histories
- Having difficulty obtaining accurate patient-specific formulary information.

Also, another problem in paper prescription is the cycle. The paper prescription runs through a cycle that often creates difficulties in tracking the patient medications merely because of complex workflow the patient has to go through, and this cycle does not contains a patient record system to control the historic aspect of the medication. [4]

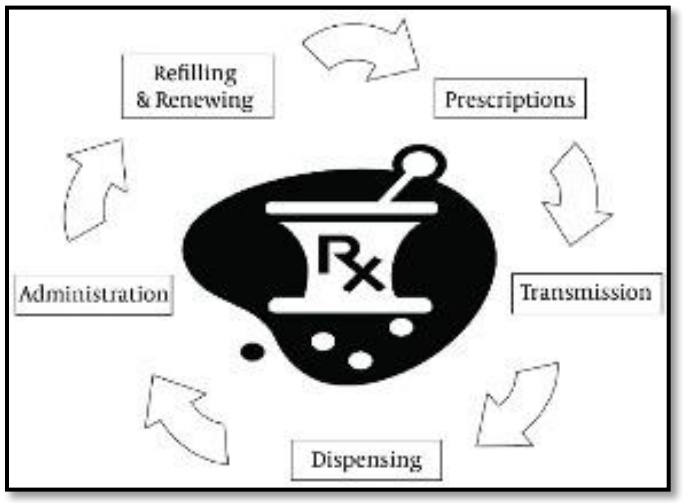


Figure 1. *Paper Prescription Cycle[4]*

This diagram in (Fig.1) describes the paper-based workflow. In this workflow, the Physician issues the prescription, the patient receives written the prescription and take to a pharmacy, and then the patient picks at the pharmacy. From this point the medication is administered to the patient, once it finishes, the patient should refer to the physician to pick up a paper prescription if it needed for refilling or renewal medication.

Therefore, the disadvantages of paper prescription cannot afford the death of in numerous people because of medical error. So that handwritten prescription should no longer be an option for prescribers. There is no justification to continue using handwritten prescription method if the electronic version can repair the damages paper prescription.

On the other hand, electronic prescription is a system that allows physician deliver directly to the pharmacy. During many decades, the prescription was issued only in a paper-based format. However, with the advent of healthcare technology, the prescription can also be issued and transmitted electronically in some parts of the world. For instance, In March 27, 2016, New York State passed a bill making mandatory all prescriber to electronically prescribe controlled both controlled and non-controlled substance. [12] This action is a result of the number of deaths caused by medication error and drug abuse. The need of adhering prescription web system should become a standard method of issue prescription. Implementing electronic prescription can overcome many problems related to paper prescription process and offer many advantages [4];

- Reducing prescription, medication and transcription errors,
- Providing a safe instrument for electronic access to updated formulary information
- Cost savings and reduced expenses of health care for patients
- Increasing patient convenience and medication compliance
- Establishment of a safe national infrastructure for data communication

- Reform clinical medication management.
- Provide an inter-operate and exchange prescription data

Therefore, prioritizing the implementation of prescription web system will enhance the healthcare sector. With the use of prescription web systems, the professional in healthcare industry will provide the potential to improve the outcome of prescription processes dramatically, reduce medication error, and save health care costs.

Chapter 3

SYSTEM AND DEVELOPMENT TOOLS

The implementation of such system requires few essential components to develop the system. Some of the tools used in this system are open source which are cost-free and other have affordable cost. However, they also have security features that meets the requirement with the most appropriate tools.

The following tools compose the process of development of prescription web systems;

- MySQL
- PHP
- Html
- Dreamweaver
- Apache web server
- VPN

MySQL

MYSQL is an open source, and not-for-profit projects Relational Database Management System. With its proven performance it is the leading DBMS tool used for web platform projects. This tool is used by high profile properties such as Facebook, Google, Twitter, YouTube and many others companies. MySQL is very fast, the implementation of it is even faster than other types of database competitor. For commercial use, developers have to pay a license fee and paid editions for additional functionality.

One of the important features MYSQL provides are the privileges used in MySQL database such as; GRANT and REVOKE. Because Prescriber in

Prescription Web System is only allowed to create a prescription, they cannot delete the records, so to prescriber delete MySQL allows the developer to REVOKE delete privilege. [7]

PHP

PHP: Hypertext Preprocessor. Widely used for open source general purpose. PHP is a scripting language for web development. Because of the nature of the system that needs to build up, an open source such as PHP is the best choice because it is easy to download and associate with a local database such as MySQL. Also more important the system need a strong, secure feature, having PHP is also easier to establish the hash. [11]

HTML

HTML stands for Hyper Text Markup Language. HTML is a tool widely known for creating Web pages and Web applications. Because PHP can be inserted to HTML, it will allow PHP and HTML to generate the homepage once the user access the index page, the server will execute the PHP and send outcomes of implementation to the user. The purpose of a web browser is to read HTML documents and compose them into visible or audible web pages. The browser does not display the HTML tags but uses the tags to interpret the content of the page. [9]

Dreamweaver

Dreamweaver is a web development tool for Adobe systems. It is a tool that allows creating or develop a website more intuitively. This tool also allows to build a PHP

page and configure it with MySQL database. To test the compatibility of PHP with different browsers, Dreamweaver includes features that simulate safari and chrome and preview layout; it can facilitate the resources for testing the layout.

Apache

Apache is a powerful web server tool that contains powerful features that will facilitate to match with needs of this system. Apache is the most used and trusted web server, no need complicated configurations, and it can be modified according to the needs. Furthermore, Apache is compatible with numerous software and hardware. So this is the most suitable web server because it produces frequent updates and the correlation of dealing with sensitive information, in apache the developer can configure to use SSL and TSL encryption for websites that require elevated security. [10]

VPN

Virtual Private Network technology that creates a safe and encrypted connection over a less secure network such as internet. This technology allow remote users and branch offices to access corporate applications and other resources securely. So to ensure safety communication between physician and pharmacy, it is necessary a VPN technology so that the data travels through a secure tunnels which also requires users to use authentication methods such as passwords or other types of identification methods. [13]

Chapter 4

RELATION OF CITA COURSES TO PRESCRIPTION WEB SYSTEM DESIGN

Prescription Web System is an electronic prescription that is transmitted via web from a physician to other healthcare institutions. There two related subjects I took

in the past semesters that inspired me to come up with the topic I choose. For instance, **CITA 300 Management Information Systems, CITA 310 Web Server Administration**, and **CITA 400: Quantitative Approaches to Management**. The combination of these subjects led to select the topic above reference because, in Management Information Systems, I learned how organization develops computer-based information systems for business data processing like information reporting and Office automation (CITA 300). In Web Server Administration, I learned how to install and to administer own web server and maintain site security (CITA 310). In (CITA 400) Quantitative Approaches to Management, taught me find solutions to business problems and analyze solutions developed. Moreover, one important lesson this subject taught me is the study of the decision-making and how quantitative methods are used in business world to find solutions for the business. Therefore, the objective of this research is to facilitate and bring an additional improvement to what already exists. Eliminating the incomprehensiveness of physician's handwriting, medication error, suggest an alternative systems for prescriber to issue prescriptions and meanwhile ensure the safety of data transmitted between prescribers and pharmacies to strength an effective partnership between healthcare institutions through a centralized prescription web system.

So, based on this centralized prescription web system, patients will only have one time contact with a pharmacist, which will be at the moment that the patient will go pick up his/her order.

Database Tables

According to the system requirements, the fields of tables are as follows;

Table 1. Table of Prescriber

Field Name	Field Type	Description
User ID	INT(11)	Primary key, user's ID autoIncrement
MedID	Tinyint(20)	Prescriber license number
Name	Varchar(20)	Prescriber First Name
Specialty	Varchar(20)	Prescriber specialization
Username	Varchar (15)	Registration name
Password	Varchar(44)	Password encrypted by SHA256 + salt
Country	Varchar(40)	Prescriber country
Zip	Varchar(255)	Zip address

Table 2. Table of Patient

Field Name	Field Type	Description
Id	INT(11)	Patient ID
Name	Varchar(20)	Patient names
DOB	DATE	Patient date birthday
Gender	Varchar(10)	Gender of patient
BMI	Float(	Body Mass index of patient
Country	Varchar(44)	country

Table 3. Table of Medication

Field Name	Field Type	Description
PreID	INT(11)	Prescription number
Drug_Designation	Varchar(20)	Name of drug
Quantity	Varchar(20)	Patient names
Frequency	INT(13)	Patient date birthday
IssueDate	DATE	Gender of patient
MedID	INT(11)	Body Mass index of patient

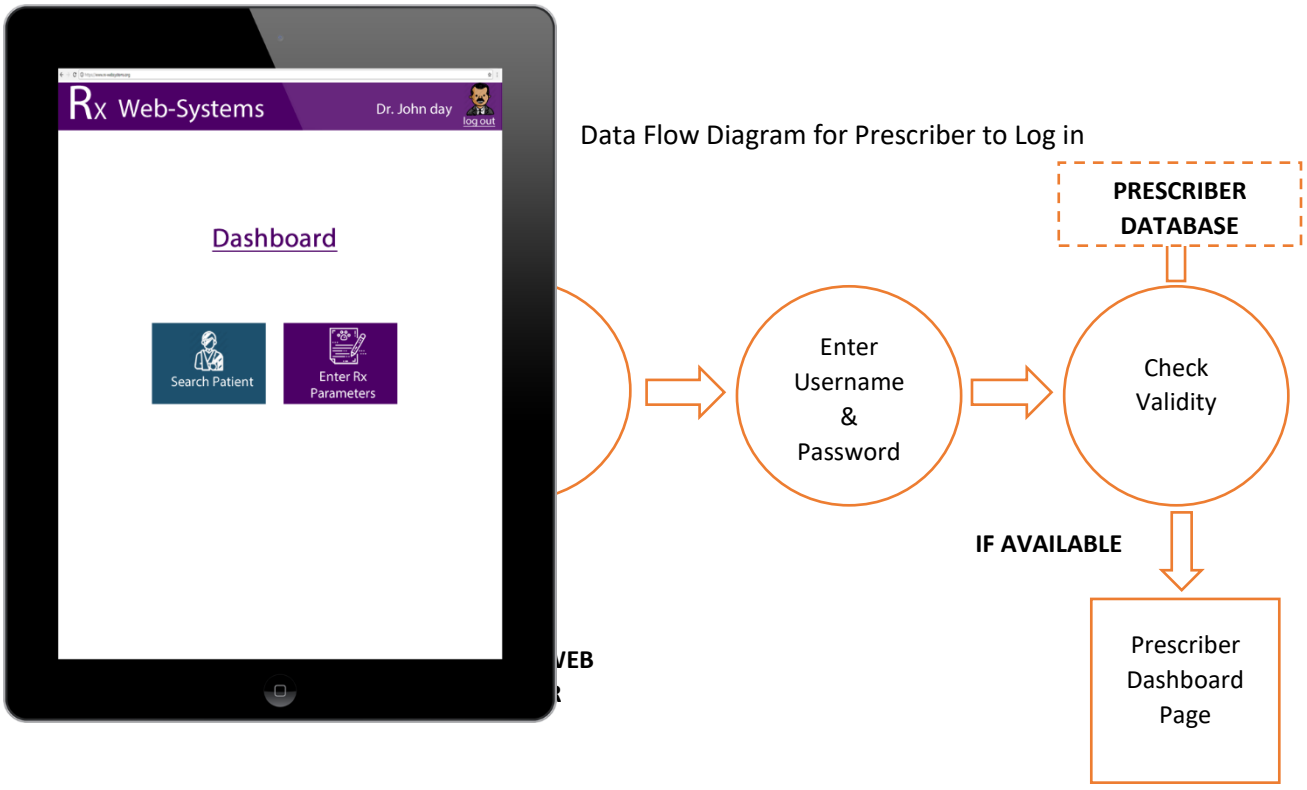


Figure 2. Module 1 -Prescriber accessing Login Page

This module displays the workflow once the prescriber is entering the URL that will land on a home page of the website, the prescriber will have a login screen, where will be asked to **enter username and password**. If the prescriber is a valid user then will grant the prescriber access to **Dashboard Page.**

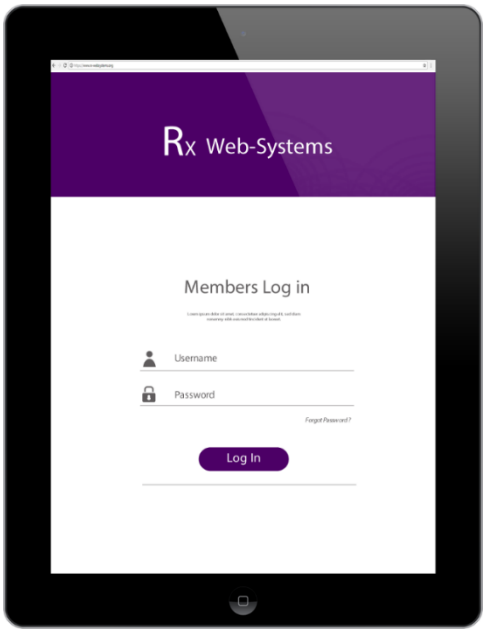


Figure 3. Login Page Interface

Figure 4. Dashboard Page Interface

User authentication

The major features of User login:

- PHP detects the initial login information entered by the user in the login form interface.
- The login module checks the user inputs if matches with information located in the database server
- If the inputs are correct, the user will be notified of successful login and set to login state. Session page
- If the inputs are wrong, the user will be notified of login failure.

Data Flow Diagram for Prescriber to Issue a Prescription

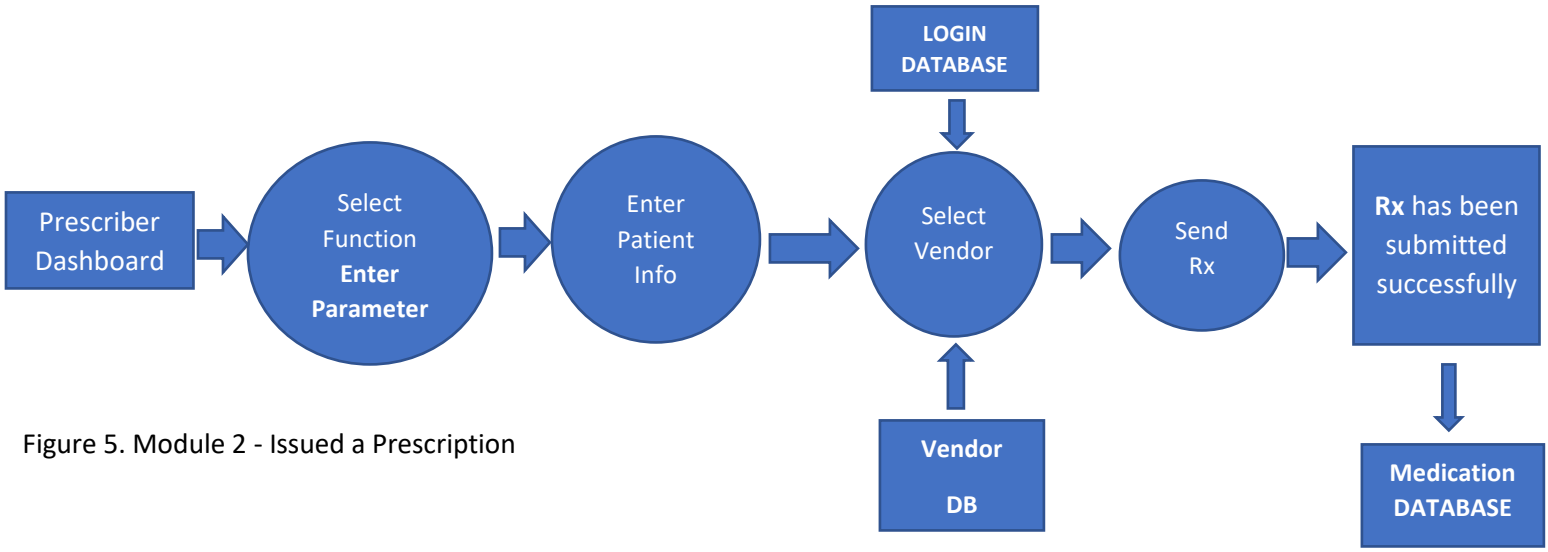


Figure 5. Module 2 - Issued a Prescription

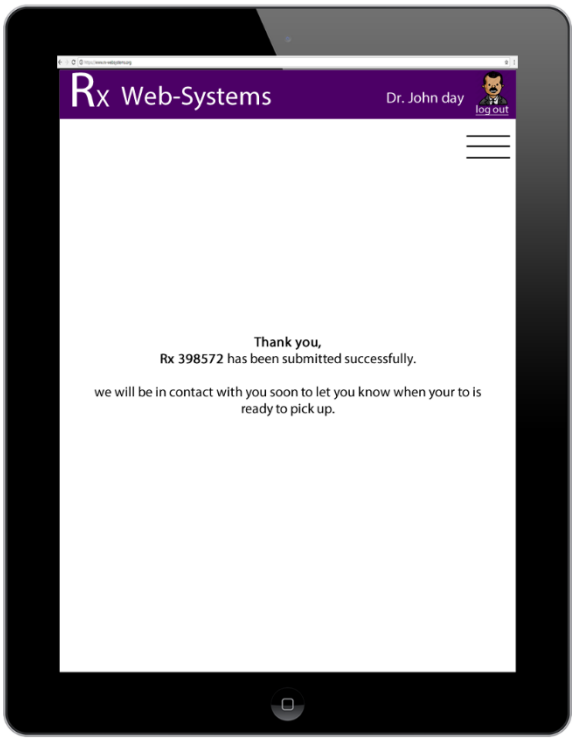


Figure 6. Interface of Issued Prescription

In this model, after the prescriber access to **Login Page**, the prescriber can **Select Function** option, and then select **Enter Rx Parameters**. After entering the patient information, the prescriber can **select the vendor/ pharmacy**; then the request will be sent to the vendor who will notify back that "***the prescription has been submitted successfully.***"

Data Flow Diagram for Refilling Patient Prescription

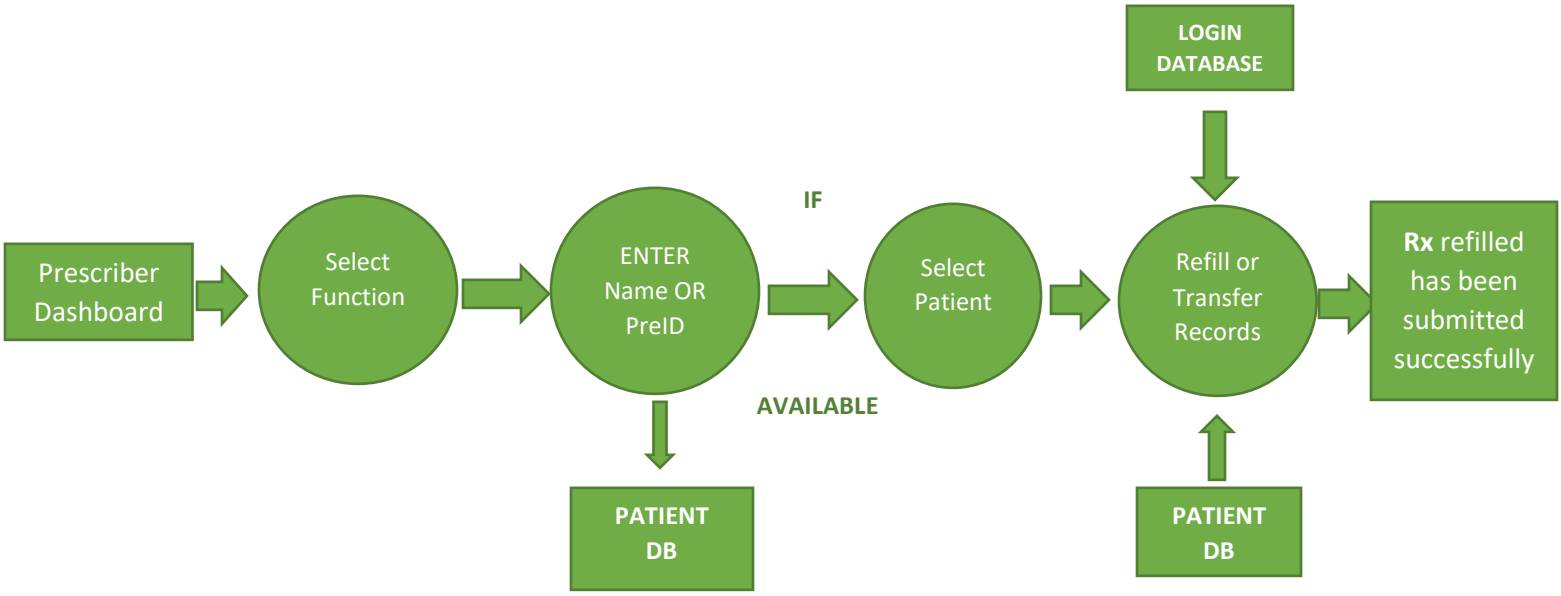
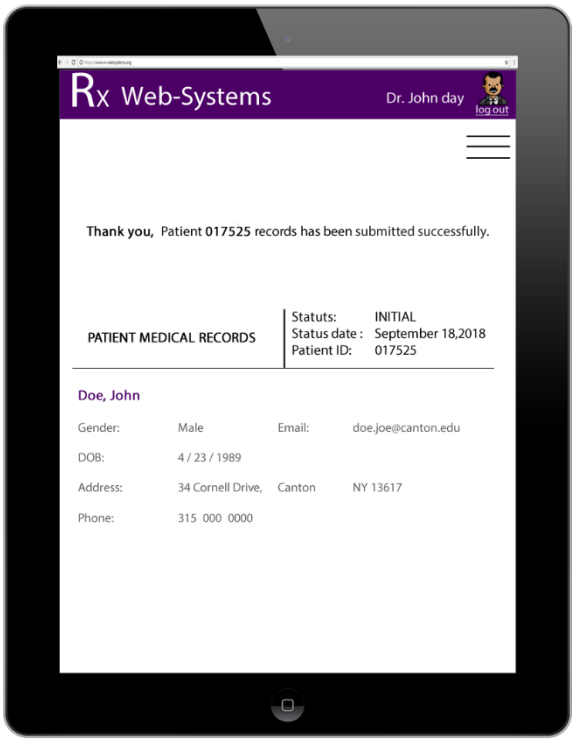


Figure 7. Module 3 - Prescription Record



In this module after the prescriber land to **Dashboard Page**, there will be an option of **Select Function.** After a click on, it will prompt a search page asking to **Enter Name or Prescription ID** then select if find the **selected Patient** and then choose refill or transfer record to the physician which will be displayed "***Prescription refilled has been submitted successfully.***"

Figure 8. Prescription Record Interface

Search Patient

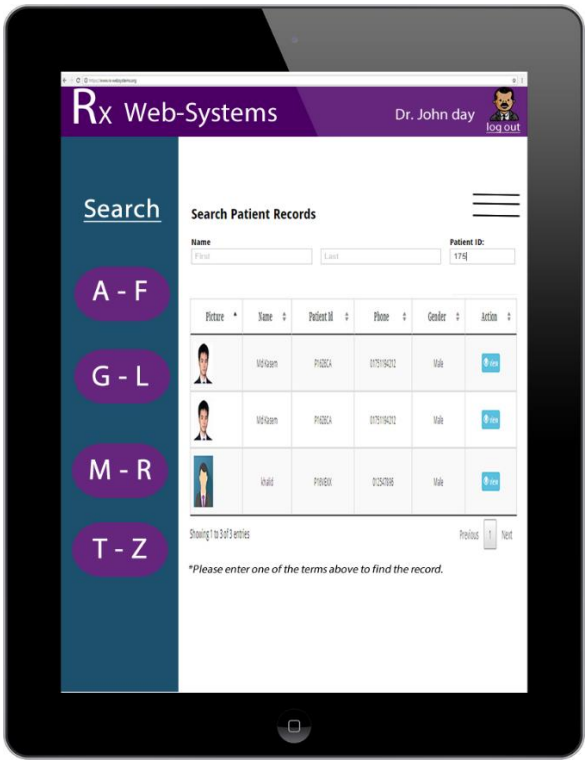


Figure 9. The Search page interface

This search form module provided a search function; the prescriber could search patient based on two conditions. The Prescriber should fill out one of the two conditions so that the system could process searching function. The system will search based on either "and" or "or" to match the exact value in MySQL database.

Structure of Prescription web system

As the widespread application of Web prescription systems continues, the need to address the workflow of it has never been more effective. Figure 3 shows the whole structure of prescription web system. After prescriber access the web page, the user interface will be shown unless web server detected server error. Once the prescriber login successfully, the prescriber will be able to select one of the main functions; *Search patient* or *Enter parameters*. In search patient prescription the prescriber has two option either *search patient records* or *refill a prescription.* While on the other side Enter parameters, the prescriber will have the prescription see a form to fill out, then the two options available will be sent a prescription to a selected pharmacy or print RX.

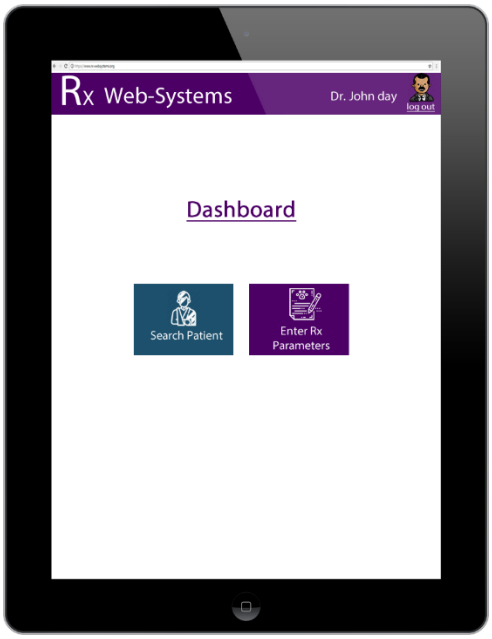


Figure 10. Dashboard Page

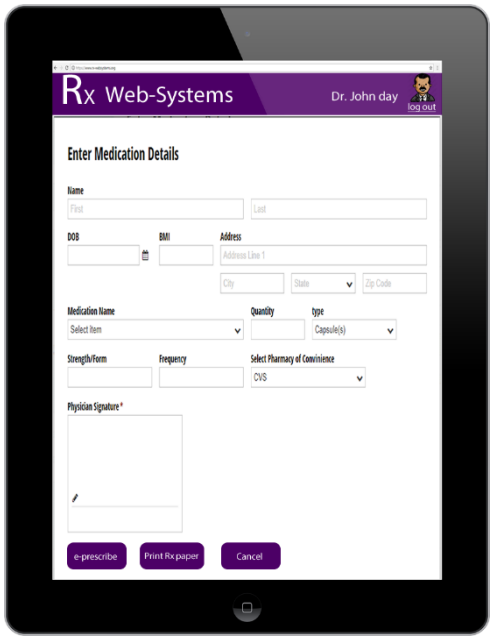


Figure 11. Enter Parameter Page

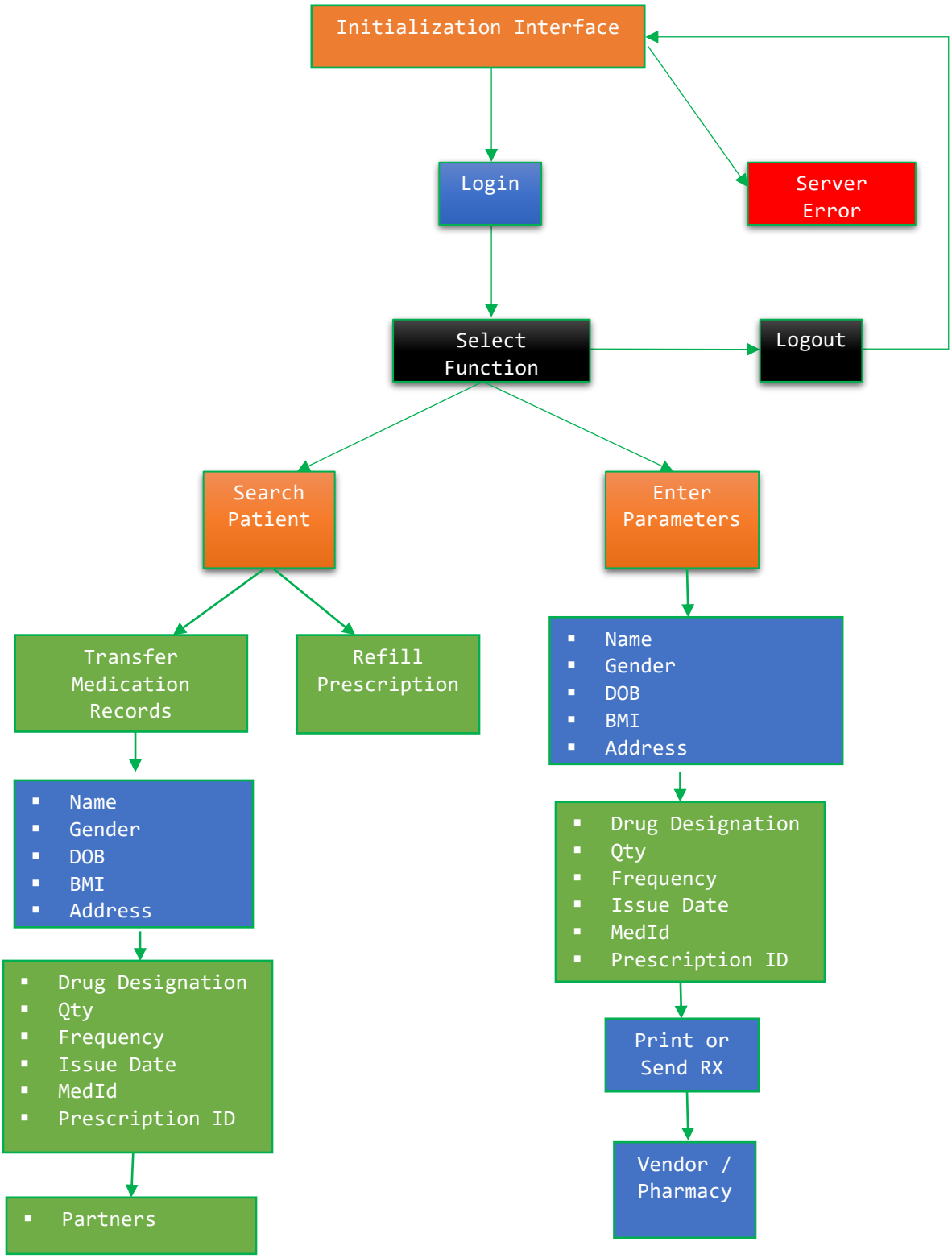


Figure 11. Admin Module

The prescription sample represents a result data flow diagram from above figures. The sample prescription in the figure.8 aggregated in one page. The electronic sample prescription contains various data like prescriber ID, patient information, medical information like prescription ID, drugs designation and number of refills.

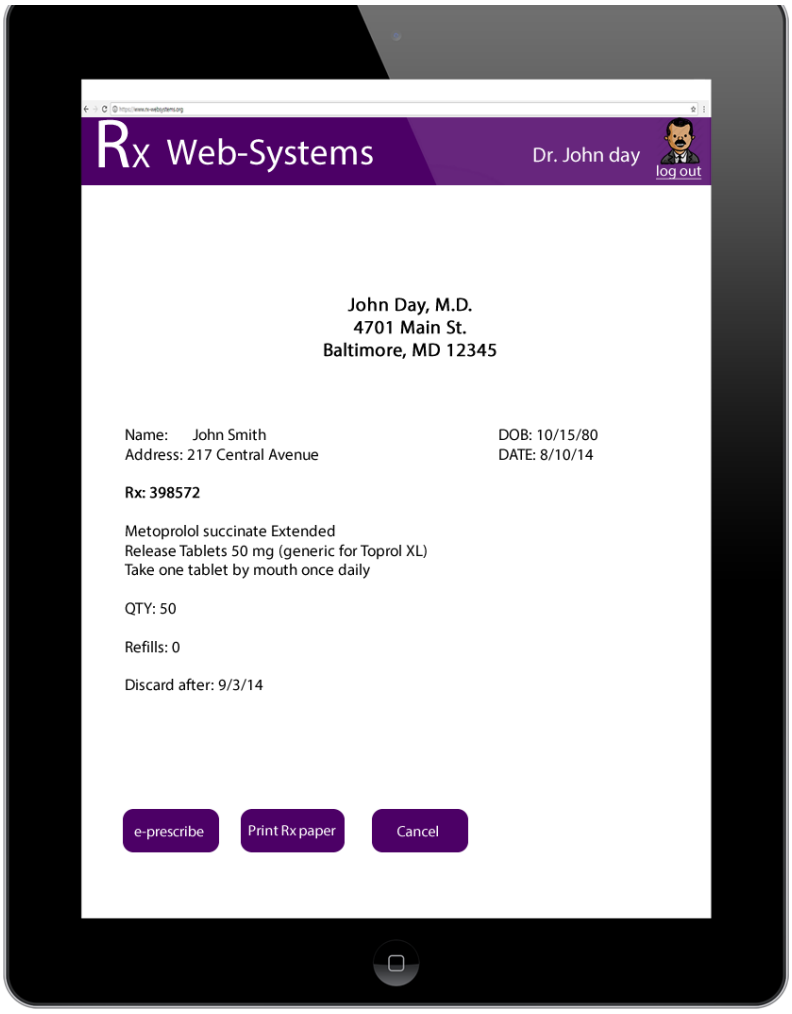


Figure 12. Sample Prescription Interface

Chapter 5

PROJECT RELEVANCE

The main area of inquiry under this topic focused on the relevance of finding solutions by using the basics learned from various subjects and approach in practice. Overall, most upper-level courses learned at SUNY Canton added a value in this research, although some of the subjects were more precise than others because of the nature of the topic which is related to technology, development, and management. For instance, CITA 400: Approach Quantitative to Management, CITA 300: Management Information Systems, SOET: Project Management, CITA 310: Web Server Administration and others have contributed to the selection of the topic and its results.

These subjects I learned at SUNY Canton, some from School Engineering Technology and others from School of Business and Liberal Arts were relevant to identify the issues and compose a solution to the problems identified.

Chapter 6

ANALYSIS

The prescription web system contains essential information such as patient identification, medical record, and healthcare plan. If the system does not have an adequate security mechanism, then the system will be vulnerable to invasion. Therefore, the prescription web system must use double web authentication to prevent any hack attack such as cross-site scripting and SQL injection. SQL injection is a type of attack that can obtain confidential information in the databases, which is critical to have a double security measure that protects against SQL injection. While cross-site scripting attack, the hacker can get still session ID of a prescriber and use it. Another security concern is that some deliver information wirelessly. For this concern, the system needs have a properly limited user time login, anti-intrusion systems to protect any attempt of system intrusion.

This research study could be limited search security strategy for this type of system. However, some studies suggest that increase of adherence to prescription web system has resulted in improving patient safety, and reduce medication error. Prescription web system has shown the reduce medication error by preventing more than 2 million patients a year. Therefore, this is a technology that helps remove mistakes, cost savings and reduce the amount of time pharmacist and providers spend on the phone.

Chapter 7

CONCLUSIONS

The goal of this research was to explore the process of how web prescription system works, what benefits and why paper-based prescription no longer is used. The purpose of the study was to improve what already exists and eradicate deaths caused by medication error from using paper-based prescription and forgery.

Web prescription system is one of the components of healthcare development program in the current century. This study provided additional improvement in the health care services by promoting efficiency. As the system expands, more and more healthcare institutions will consider adhering to this system. The financial benefit from the system will be much higher than the operation and maintenance costs. In the latter part of this system development process, the developer would focus on security improvement. The simplification and optimization of security aspects of web prescription system will reinforce the trustiness of the system and bring more partners to the business.

Chapter 8

FUTURE PERSPECTIVES

Web prescription system is already a trend in most of the world, although it is standardize in most places. It is fair to acknowledge that web prescription system is not yet a mature technology, but the opportunities and challenges of this technology is becoming the trend in the healthcare sector. The future of prescription web system is promising because of the advantages it brings for the healthcare professionals, many states in the United States are adhering to electronic prescription because It is considered a public health matter. The challenges that this technology represents are less than the advantages. While healthcare institutions concerns increase for the safety of patient information, HIPAA (Health Insurance Portability and Accountability Act of 1996) providing a guide series for protecting patient information. In addition to this matter, research has been done in the area to identify the impact of these issues on pharmacists or patients.[1].

Therefore, despite security concerns of prescription web systems, it will be hard for reverting to paper-based prescription for those institutions that have already adhered to Prescription web systems because of the advantages is greater than the issues.

List of Figures

List of Tables

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