CS 475 - Senior Project

Secure Electronic Medical Record System (SEMRS)

Ryan Kane & Ricky Orndorff

Software Specifications Document

Version 1.1 **Date: 02/26/12**

Table of Contents

1. Introduction

1.1. Purpose

The purpose of this Software Specification Document is to present a detailed description of the software requirements for a secure electronic medical records system that will help to eliminate the displacement and damage to patients' files. This document aims to outline the system's features and specifications, including its functionality, interface, performance requirements, and constraints. This document is intended for the members of Team U1, who will be representative of the designers, developers, and testers of this software project; for our faculty advisers Dr. Aijuan Dong and Dr. George Dimitoglou, our reader William Pierce, and for any future developers who may have an interest in expanding this project's scope. It has been written by the members of this team for the 2012 Senior Project at Hood College.

1.2. Scope

The Secure Electronic Medical Records System (SEMRS) is an intranet application that allows for the retrieval and manipulation of patient data by medical staff such as administrator, physicians, clinician, counselors, pharmacy, and receptionists.

1.3. Definitions, Acronyms, and Abbreviations

AES - Advanced Encryption Standard
LAN - Local Area Network
MySQL - a relational database management system.
OpenEMR – an open source electronic medical records software application
PHP - server-side scripting

1.4. References

IEEE. *IEEE Std 830-1993 Recommended Practice for Software Requirements Specifications*. IEEE Computer Society, 1993.

MySQL 5.1 Reference Manual. (2008, November 27).Sun Microsystems, 27 Nov. 2008. <http://dev.mysql.com/doc/refman/5.1/en/>.

1.5. Overview

The remainder of this document is broken down into two sections. Section 2 provides an informal description of the requirements of the electronic medical records system. This section contains more general information, including the product's perspective, functions, and constraints, and is most relevant to potential users. Conversely, Section 3 provides the specific requirements most relevant to developers of the system, including performance requirements, design constraints, and software system attributes.

2. Overall Description

2.1. Product Perspective

The electronic medical records system is dependent on a web browser that can view PHP scripts and access a MySQL database in the background. The system will not be hosted online, but on an intranet that can only be accessed by LAN. The applications user interface design will be modeled after OpenEMR, but the underlying functions and database will be very different.

2.1.1. System Interfaces

The application will not have any system interfaces.

2.1.2. Interfaces

The application will have a log in screen at launch. The user will type in their unique user name and password. Depending on the type of user, they will be redirected to their appropriate home screen after successful authentication.

2.1.2.1. Users

(a) Administrator
(b) Physician
(c) Receptionist
(d) Pharmacist

2.1.2.2. Log-ins

(a) Administrator log-in
(b) Physician log-in
(c) Receptionist log-in
(d) Pharmacist log-in

2.1.3. Hardware Interfaces

The system will require a server to store that data to be accessed.

2.1.4. Software Interfaces

The system will require an up to date web browser to view the web pages.

Operating Systems: 32-bit Microsoft Windows (95/98/NT/2000/XP/Vista/7)
Web Browser Support:

(a) Google Chrome (current stable version)
(b) Mozilla Firefox 3.6 or higher
(c) Microsoft Internet Explorer 8.0 or higher
(d) Apple Safari 4.0 or higher

2.1.5. Communications Interfaces

The system will require an active connection to the company's intranet in order to access the server.

2.1.6. Memory Constraints

There will be minimal memory constraints on the host computer, but the data will be stored on a server that will be able to handle all data storage. The server must have at least 4GB of RAM, but with higher queries 8GB is recommended.

2.1.7. Site Adaptation Requirements

Refer to section 2.1.4. Software Interfaces.

2.2. Product Features

2.2.1. Authentication

Each user must have a unique user name and a password that will be authenticated on the server upon log in. After the server responds that the user name and password match, the user will be directed to their respective user class specific home page.

2.2.2. Search

Any user shall be able to search by either birth year or last name.

2.2.3. Send Message

Any physician can send a message to another physician.

2.3. User Classes and Characteristics

(a) **Administrator:** user has control over user account management. There is no user interface for administrators. They would not need to know any patient information.

(b) **Physician:** user can view, add, and edit patient medical history.

(c) **Receptionist:** user can add and remove patients, along with editing their contact, and insurance information.

(d) **Pharmacist:** user can view patient prescription information.

2.4. Constraints

2.4.1 Criticality of Application

Provide a general description of any other items that will limit the developer's options. These may include:

(a) Parallel operation: The processed modification request should be reflected in the tracking software as well as the client's database simultaneously.
(b) Audit functions: Double entry and data redundancy should be taken care of.
(c) Security Considerations: Every user is required to enter a password to prevent unauthorized access.

2.5. Assumptions and Dependencies

(a) We are assuming that the person who fills out a form at the institution will be immediately entered into the database.
(b) We assume that patient information will be correctly filled out by personnel.
(c) Verification of forms are done as quickly as possible.
(d) This software is dependent on the existing database.

2.6. Apportioning of Requirements

All listed users shall be able to operate the application.

3. Specific requirements

3.1. External interface requirements

3.1.1. User Interfaces

There will be a different user interface for each user type, i.e. administrator, physician, receptionist, and pharmacist.

3.1.2. Hardware Interfaces

There are no hardware interfaces, because this is a web application.

3.1.3. Software Interfaces

Windows XP or later and an up to date web browser.

3.1.4. Communications Interfaces

There are no other specific communication interfaces for this system.

3.2. Functional Requirements

3.2.1. User class 1 - Administrator

3.2.1.1. Feature 1 - Add User Accounts

3.2.1.1.1. Introduction/Purpose of feature

When creating a user account, the new user is given a user name, a blank password (this should be changed as soon as possible), and a user access type. The types will include: administrators, physicians, receptionists, and pharmacists.

3.2.1.1.2. Stimulus/Response sequence

3.2.1.1.2.1. Basic Data Flow

1. Click “Add New User” button
2. Enter a user name
3. Select the appropriate user access type.
4. Alert will pop up listing the new user’s information
5. Click submit

3.2.1.1.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 15

3.2.1.2. Feature 2 - Inactivate User Accounts

3.2.1.2.1. Introduction/Purpose of feature

When an employee leaves the company, the admin will have to inactivate them from the list of authorized users to maintain confidentiality of patient information.

3.2.1.2.2. Stimulus/Response sequence

3.2.1.2.2.1. Basic Data Flow

1. User click button to inactivate selected user.
2. A notification that will ask the administrator to confirm to proceed with the action.
3. User click OK
4. User is inactivated

3.2.1.2.2.2. Alternative Data Flow

1. User clicks “Inactivate” for selected user.
2. A notification that will ask the administrator to confirm to proceed with the action.
3. User click CANCEL
4. User is not inactivated

3.2.1.2.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 15

3.2.1.3. Feature 3 - Edit User Accounts

3.2.1.3.1. Introduction/Purpose of feature

The administrator reserves the right to modify user access control settings.

3.2.1.3.2. Stimulus/Response sequence

3.2.1.3.2.1. Basic Data Flow

1. Select a user
2. Choose change user access type
3. Press submit

3.2.1.3.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 15

3.2.2. User class 2 - Physician

3.2.2.1. Feature 1 - Add Patient Information

3.2.2.1.1. Introduction/Purpose of feature

To add patient medical history, allergies, medications, immunizations

3.2.2.1.2. Stimulus/Response sequence

3.2.2.1.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 14

3.2.2.2. Feature 2 - Add Prescriptions

3.2.2.2.1. Introduction/Purpose of feature

To add prescription information to the patient so that the pharmacy can later view and fill them for the patient.

3.2.2.2.2. Stimulus/Response sequence

3.2.2.2.2.1. Basic Data Flow

1. Select add prescription
2. Enter the prescription name
3. Enter the dosage
4. Enter the count
5. Enter refill count
6. Enter any notes
7. Submit prescription for pharmacy to view

3.2.2.2.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 14

3.2.2.3. Feature 3 - Add Notes

3.2.2.3.1. Introduction/Purpose of feature

To keep a record of each visit, to see how the patient is progressing through treatment.

3.2.2.3.2. Stimulus/Response sequence

3.2.2.3.2.1. Basic Data Flow

1. Select the current visit
2. Retrieve the notes
3. Add/edit notes
4. Update notes

3.2.2.3.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 13

3.2.2.4. Feature 4 - Send Messages

3.2.2.4.1. Introduction/Purpose of feature

To send message to other physicians about a patient. Physician ID and a TIMESTAMP will be recorded after the physician sends the message.

3.2.2.4.2. Stimulus/Response sequence

3.2.2.4.2.1. Basic Data Flow

1. Select “Send Message”
2. Select physician from the list of physicians
3. Compose message
4. Submit message

3.2.2.4.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 13

3.2.3. User class 3 - Receptionist

3.2.3.1. Feature 1 - Add Patients

3.2.3.1.1. Introduction/Purpose of feature

To add new patients to the office records. A patient ID will be automatically generated when the receptionist creates a new patient in the system. The date and time when the patient was created will also be automatically set.

3.2.3.1.2. Stimulus/Response sequence

3.2.3.1.2.1. Basic Data Flow

1. Select “Add New Patient” button
2. Enter General Information: name (title. last middle, first) of patient, birth year of the patient, gender, SSN, license, marital status.
3. Enter Contact Information: address, city, state, postal code, country, mother’s name, guardian’s name, emergency contact, emergency phone, home phone, cell phone, contact email.
4. Enter Employer Information: occupation, employer name, employer address, city, state, postal code, country
5. Enter Primary Insurance Information: Insurer, plan name, effective date, policy number, group number, subscriber, relationship, DOB, SSN, gender, subscriber phone, subscriber address, city, state, postal code, country, subscriber employer, employer address, city, state, postal code, country
6. Enter Secondary Insurance Information: (Same as above)
7. Submit

3.2.3.1.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 14

3.2.3.2. Feature 2 - Edit Patients

3.2.3.2.1. Introduction/Purpose of feature

To change patient information because it needs to be updated.

3.2.3.2.2. Stimulus/Response sequence

3.2.1.2.2.1 Basic Data Flow

1. Select “Edit Patient Information” button
2. Update any of the fields as necessary
3. Submit

3.2.3.2.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 14

3.2.3.3. Feature 3 - Inactivate Patients

3.2.3.3.1. Introduction/Purpose of feature

To inactivate a past patient from the system.

3.2.3.3.2. Stimulus/Response sequence

3.2.3.3.2.1. Basic Data Flow

1. Select “Inactivate Patient” button
2. Alert verifying your action
3. Click yes
4. User is inactive

3.2.3.3.2.2. Alternative Data Flow

1. Select “Inactivate Patient” button
2. Alert verifying your action
3. Click no
4. User is not inactive

3.2.3.3.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 10

3.2.3.4. Feature 4 - Add Visit

3.2.3.4.1. Introduction/Purpose of feature

To add information to track patient visit history.

3.2.3.4.2. Stimulus/Response sequence

3.2.3.4.2.1. Basic Data Flow

1. Select “Add Visit” button
2. Enter brief description, visit type (established patient, new patient, office visit, reserved), facility, date of service, onset date, issues (injury, medical, allergy)
3. Select submit

3.2.3.4.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 10

3.2.4. User class 4 - Pharmacist

3.2.4.1. Feature 1 - View and Fill Prescriptions

3.2.4.1.1. Introduction/Purpose of feature

To view patient prescriptions that were created by the physician.

3.2.4.1.2. Stimulus/Response sequence

3.2.4.1.2.1. Basic Data Flow

1. Select a prescription with a fill count > 0
2. View the prescription information
3. The rest is handled at the pharmacy
4. After the pharmacy has filled the prescription they will check off that the prescription was filled and add the date. The prescription refill could will be decremented.

3.2.4.1.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 14

3.2.4.2. Feature 2 - View Contact Information

3.2.4.2.1. Introduction/Purpose of feature

To view patient contact information to attach to prescription.

3.2.4.2.2. Stimulus/Response sequence

3.2.4.2.2.1. Basic Data Flow

1. User click view contact
2. Contact information is displayed

3.2.4.2.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 14

3.2.4.3. Feature 3 - View Insurance Information

3.2.4.3.1. Introduction/Purpose of feature

To view insurance information to adjust the price of the medication.

3.2.4.3.2. Stimulus/Response sequence

3.2.4.3.2.1 Basic Data Flow

1. User click view insurance
2. Insurance information is displayed
3. The user will then have the option to edit insurance information, or adjust price of the medication.

3.2.4.3.3. Associated functional requirements

See Requirements Document, Sec. 5 REQ 10

3.3. Performance Requirements

3.3.1. Capacity

This server can allow up to 500 users access to our database at one time. This information was pulled from section C.5.2.7. of the MySQL 5.5 Manual.

3.3.2. Encryption

The speed of the encryption and decryption of patient data should not hinder performance, because the AES_ENCRYPT() and AES_DECRYPT() are built-in functions for MySQL 5.5 and later.

3.4. Logical Database Requirements

The system will have a MySQL database running in the background while the user is accessing the data through client-side web pages. Any sensitive information will be encrypted client-side before being pushed to the server. In order to view patient data client-side, the user, depending on their access privileges, must have the associated SALT. Patient contact information will be able to be viewed by all users, so the data will be encrypted using the same SALT. In the case of sensitive and confidential medical history that is to be entered only by physicians, this information will be salted with a differently. This way, only the physician's interface will be able to encrypt/decrypt the data.

3.5. Design Constraints

3.5.1. Database

The system shall use the MySQL database, which is open source and free.

3.5.2. Operating System

The environment we will be operating Windows XP and Windows 7.

3.5.3. Web-Based

The system shall be a web-based application.

3.6. Software System Attributes

3.6.1. Usability

(a) The system's interface shall be user-friendly and easy to get familiar with.
(b) It is recommended that all users read the product's manual before using the software to fully understand all features of the system.
(c) In regards to training, any user with familiarity with a personal computer shall be able to use the system with a maximum training of one hour.

3.6.2. Reliability

The reliability of the application is dependent upon the server it is hosted on.

3.6.3. Availability

(a) The system shall be available at a rate of 99.99%.
(b) The system shall be available at all times except for system updates and maintenance because it will be running on a secure server.
(c) If the system crashes, the user will have to log in again.

3.6.4. Security

The following are security requirements that indicate how the system shall protect itself and its sensitive data and communications from accidental, malicious, or unauthorized access, use, modification, or destruction.

(a) All users that access the system must have a valid unique log-in identification, as well as an encrypted password. While on the server, only port 443 for https will be opened. A firewall that only allows port 443, for https traffic, will be applied to the server. The MySQL root password must be set to something unique.

(b) The MySQL AES encryption/decryption will be used in conjunction with a SALT to encrypt information entered client side, and store the information in encrypted text in the database. Each type of information will have an associated SALT that can be used among particular user classes.

3.6.5. Maintainability

The database will be maintained by an administrator.

3.6.5.1. Back Up

We shall use the Database Backup Methods that are listed in section 6.2 of the MySQL 5.1 manual.

3.6.5.2. Errors

We shall use the Error Log that is listed in section 5.2.2 of the MySQL 5.1 manual

4. Change Management Process

All changes to the project's scope and requirements will be recorded in subsequent versions of this Software Specifications document. Any future versions of this document shall contain a change log that clearly documents all revisions made to the project's requirements and when these changes were made. Any and all changes made to this document or any future project documentation shall be agreed upon equally by all members of the team.

All interaction with the client shall be conducted through the specified liaison, either by email or in person. It is the liaison's responsibility to act as the go-between contact between the client and the rest of the development team.

Change Log

Version	Date	Changes/Revisions
v1.0	**February 23, 2012**	***(First version)*** **Basic outline of document**
v1.1	**February 26, 2012**	**[Ryan] : Added the Purpose, Scope, and Overview. Added features for the Administrator, Physician, Receptionist, and Pharmacist.** **[Ricky] : Added Section 3(Specific Requirements), 3.6, Other minor edits/corrections**
v1.2	**March 22, 2012**	**[Ryan] : Elaborated on sections 3.3.1 and 3.5.2.** **[Ricky] : Addressed spelling errors and provided enumerated lists in place of bullets.**

5. Document Approvals

x Aijuan Dong

Aijuan Dong, Ph.D.
Faculty advisor