System and Software Architecture Description (SSAD)

Surgery Assist

Team 11

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Version History

Date	Author	Version	Changes made	Rationale
09/26/13	Y.Z.	1.0	• All details known as of 09/26/13	• Initial Draft
10/03/13	Y.Z	1.1	• Finish all of Section 1 and part of Section 2	• Update System Context diagram and Artifacts & Information diagram
10/11/13	Y.Z.	1.2	• Finnish all of Section 2	• Update use case diagram and description
10/16/13	Y.Z.	1.3	• Modify Section 2.1.3	• Make modification according to ARB Feedback
11/02/13	Y.Z.	2.0	• Add Section 3	• Initial draft of NDI/NCS analysis
11/10/13	H.L.	2.1	• Add Section 4.1.2	• Initial draft of Class Design Diagram
11/12/13	Y.Z.	2.2	• Add Section 4.1.1 and 4.1.3	• Initial draft of component class diagram and sequence diagram
11/22/13	H.L	2.3	• Update Section 4.1.2	• Modify Class Design Diagram
11/25/13	Y.Z	2.4	• Update Section 4.1.3	• Modify sequence diagram
12/01/13	Y.Z	3.0	• Finish Draft Version of SSAD	• Organize diagrams and tables
12/06/13	Y.Z	3.2	• Made modification and fix	• Modify according to the ARB feedback

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1. Introduction

1.1 Purpose of the SSAD

The purpose of this SSAD is to record the results of the design and analysis of our Surgery Assistant Web System. Developers can use this SSAD as reference to the architecture of the system when writing implementation code in the development phase.

1.2 Status of the SSAD

The current version of this SSAD is 3.2. In this version, we do all necessary modification and fix for this documentation according to the feedback from Professors and Client in the ARB presentation. This will be the final version of SSAD document for our team.

2. System Analysis

2.1 System Analysis Overview

The main purpose of Surgery Assistant is to provide a platform for surgery centers to post available surgical slot to our system, then doctors are able to find surgical slot more efficiently using the search function of our system and make reservation to the surgical slots.

In a word, Surgery Assistant builds a provider and consumer relationship between surgery centers and doctors so they can communicate more directly about the usage of surgical slot. This will help both sides work more efficiently.
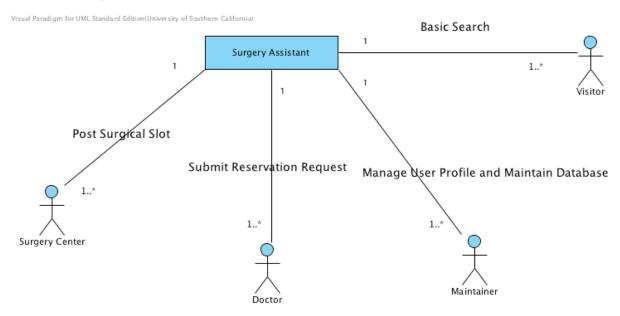
2.1.1 System Context

Figure 1: System Context Diagram

Table 1: Actors Summary

| Actor	Description	Responsibilities
Surgery Center	Users who provide surgical slot	Provide Surgical Slot Information Approve/Decline reservation request from doctors
Doctor	Users who reserve surgical slot	Make surgical slot reservation
Maintainer	System administrator	Monitor system running situation and conduct maintenance and user management job
Visitor	Users who don't register as a formal user	Do some basic search

2.1.2 Artifacts & Information
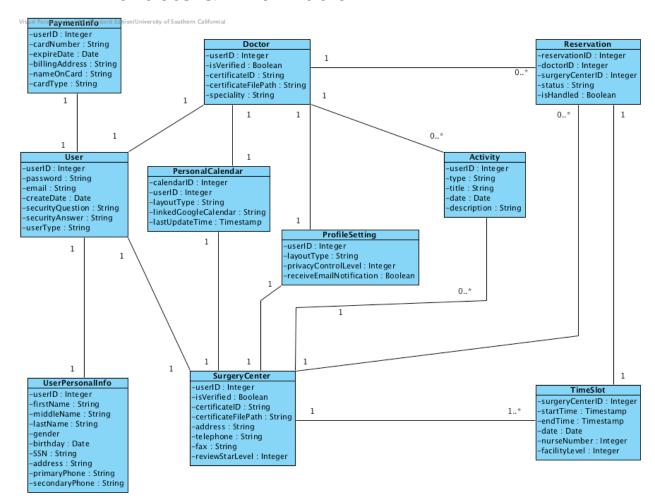
Figure 2: Artifacts and Information Diagram

Table 2: Artifacts and Information Summary

Artifact	Purpose
User	Store User account information including ID, password, email
UserPersonalInfo	Store User personal information such as name and birthday
PaymentInfo	Store payment credit card information of a user
Doctor	Store all specific information for Doctor users
SurgeryCenter	Store all specific information for Surgery Center users
PersonalCalendar	Store a user's Google calendar information used to synchronize user's schedule information
ProfileSetting	Store settings information of a user's profile and account
Activity	Store activity history of a user
TimeSlot	Store information of posted time slot

2.1.3 Behavior

Figure 3 Process Diagram

2.1.3.1 Use Case Description

🔵 Login

Main	
Identifier	UC-01: Login
Purpose	Authorize a user to log into the system and determine the user's role and access privileges.
Requirements	WC_2753: As a doctor / SC, I can log in/off the system.
Development Risk	None
Preconditions	System database is properly initialized
Post-conditions	1. If the user login successfully, the user is able to access system with the access privileges of the user role 2. If the user log in information is not valid, the system informs the user that she/he has entered an invalid username and password

Flow of Events		Actor Input	System Response
	1	Enter a username and password	
	2	Click the "Login" button	
	3		Validate username and password
	4		Redirect the user to their personal home page

Alternate		Actor Input	System Response
	1	Enter a username and password	
	2	Click the "Login" button	
	3		Validate username and password
	4		Redirect the user to the login page and informs the user that he/she has entered an invalid username or password.

Exceptional		Actor Input	System Response
	1	Unsuccessfully attempt to log in to the system four consecutive times	

	2		Disable the user's privilege to login.
	3		Notify the user that he/she will have to contact the administrator.

● **View Profile**

Extension Points

Update Profile

Identifier	UC-04: View profile
Purpose	Allow the system users to view their profiles
Requirements	WC_2754: As a doctor / SC, I can create/update my profile. WC_2426: As a doctor / SC I can view doctor/ SC profiles
Development Risk	None
Preconditions	User is logged into the system.
Post-conditions	User profile is displayed to the user.
Flow of Events		**Actor Input**	**System Response**
	1	Click "View Profile"	
	2		The user profile is displayed to the user.

⬤ Update Profile

Identifier	UC-05: update profile
Purpose	Enable users to edit their profiles.
Requirements	WC_2754: As a doctor / SC, I can create/update my profile.
Development Risk	None
Preconditions	User logs into the system
Post-conditions	User updated profile successfully

Flow of Events		Actor Input	System Response
	1	Click "Profile".	
	2		Display the profile information.
	3	Click "Edit".	
	4	Filled in all required fields	
	5		Validate that if the user has filled all the required fields.
	6		Notify the user that profile has been updated in the system

⬤ Make Payment

Identifier	UC26: Make payment
Purpose	Allow the user to make payment online
Requirements	WC_2425: As a doctor / SC I can make a payment
Development Risk	None
Preconditions	User is logged into the system
Post-conditions	The payment has been made successfully

Flow of Events		**Actor Input**	**System Response**
	1	Click "Make a payment"	
	2	Input credit card information	
	3		Displaying a message showing that the payment has been made successfully

Exceptional		**Actor Input**	**System Response**
	1	Click "Make a payment"	
	2	Input credit card information	
	3		Displaying a message showing that transaction has been denied and ask user to check credit card information

⬭ Manage Users

Extension Points

Modify User Role

Identifier	UC-20: Manage users
Purpose	Allow the maintainer to view details of all current users
Requirements	WC_2766: As a maintainer I can view/create/update/delete profiles of every doctor/SC.
Development Risk	
Preconditions	User is logged into the system as maintainer
Post-conditions	A list of current users is displayed
Flow of Events	

		Actor Input	**System Response**
	1	Click "View Current Users"	
	2		Display a list of current users

⬭ Modify User Role

Identifier	UC-21: Modify user role
Purpose	Maintainer is able to modify user role
Requirements	WC_2767: As a maintainer I can modify the role of a doctor/SC
Development Risk	
Preconditions	A list of current users is displayed
Post-conditions	user's role is modified and saved in the database

Flow of Events		**Actor Input**	**System Response**
	1	Select one user	
	2	Choose "Option"	
	3	Click on "Change role"	
	4	Choose the new role	
	5		System modifies the specified use's roles.
	6		Display a message showing that the role has been updated

⬤ Verify User Identification

Identifier	UC-19: Verify user identification
Purpose	Allow the maintainer to verify the user's valid identification
Requirements	WC_2765: As a maintainer I can verify the validity of a doctor/SC's identification.
Development Risk	
Preconditions	User is logged into system as Maintainer
Post-conditions	1. If the user identification is valid, the new user account is created 2. If the user identification is not valid, registration request is declined In both cases, an notification email will be sent to the user

Flow of Events		Actor Input	System Response
	1	Click "View registration request"	
	2		A list of registration request is displayed
	3	Select one request and click "approve"	
	4		Displaying a message showing that the new user account is created

Alternate		Actor Input	System Response
	1	Click "View registration request"	
	2		A list of registration request is displayed
	3	Select one request and click "decline"	
	4		Displaying a message showing that the registration request is declined

⬤ View Activity Report

Identifier	UC-18: View activity report
Purpose	Allow the Project Owner to view an activity report
Requirements	WC_2764: As a maintainer, I can view/generate an activity report.
Development Risk	
Preconditions	User is logged into the system as Project Owner.
Post-conditions	Reservation activity reports of selected time periods are displayed to the user

Flow of Events		**Actor Input**	**System Response**
	1	Click "View Report"	
	2	Select time periods	
	3		A reservation report of selected time period is displayed to the Project Owner

⬤ Post Surgical Slot

Identifier	UC-11: Post Surgical Slot
Purpose	Allow the Surgery Center users to post Surgical slot to the Online System
Requirements	WC_2775: As a surgery center, I can post a surgical slot.
Development Risk	
Preconditions	User is logged into the system as Surgery Center user
Post-conditions	Surgical Slot information is available from the online system

Flow of Events		**Actor Input**	**System Response**
	1	Attempt to create a surgical slot posting	
	2		Check web page for completeness
	3		Display a message to indicate the surgical slot posting is updated

Exceptional		**Actor Input**	**System Response**
	1	Attempt to create a surgical slot post	
	2		Check web page for completeness
	3		Reload the web page and indicate which required information was not completed

🔵 View Posted Surgical Slot

Extension Points

Update Surgical Slot Posting

Identifier	UC-12: View posted surgical slot post
Purpose	Allow the Surgery Center users to view surgical slot post
Requirements	WC_2761: As a surgery center, I can view/update my surgical slot post.
Development Risk	
Preconditions	User is logged into the system as Surgery Center user
Post-conditions	Surgical slot post is displayed to the Surgery Center user

Flow of Events		**Actor Input**	**System Response**
	1	Click "View Surgical slot Post"	
	2	Choose "by time" or "by status"	
	3		Surgical slot posting is displayed to the Surgery Center user

Exceptional		**Actor Input**	**System Response**
	1	Click "View Surgical slot Post"	
	2	Choose "by time" or "by status"	
	3		Display a message saying that "there is no existing surgical slot post" and redirect to the Profile page

🔵 Update Surgical Slot Posting

Identifier	UC-13: Update Surgical Slot Post	
Purpose	Allow the Surgery Center users to update the surgical slot post	
Requirements	WC_2761: As a surgery center, I can view/update my surgical slot post	
Development Risk		
Preconditions	Surgical slot post is displayed to the Surgery Center user	
Post-conditions	Surgical slot post is updated in the database.	
Flow of Events		**Actor Input**	**System Response**
	1	Click "Update"	
	2	Fill in all required fields	
	3	Click "Submit"	
	4		Check fields for completeness
	5		Display a message to indicate that the surgical slot post is updated successfully
Exceptional		**Actor Input**	**System Response**
	1	Click "Update"	
	2		Reload the form page and indicate that confirmed post cannot be updated
Exceptional		**Actor Input**	**System Response**
	1	Click "Update"	
	2	Fill all required fields	
	3	Click "Submit"	
	4		Check for completeness
	5		Reload the form page and indicate which fields are not complete

🔵 View Reservation Request

Extension Points

Confirm Reservation Request

Decline Reservation Request

Identifier	UC-14: View reservation request
Purpose	Allow Surgery Centers to view received reservation request
Requirements	WC_2763: As a surgery center, I can view/confirm/decline a reservation request.
Developmentl Risk	
Preconditions	User is logged into the system as Surgery Center user
Post-conditions	All received reservation requests are displayed to the Surgery Center user.

Flow of Events		**Actor Input**	**System Response**
	1	Click "View Reservation Requests"	
	2	Select time period	
	3		The reservation requests are displayed to the Surgery Center user.

Alternate		**Actor Input**	**System Response**
	1	Click "View Reservation requests"	
	2	Select time period	
	3		Display a message indicating that "You have no received reservation request".

⬤ Confirm Reservation Request

Identifier	UC-15: Confirm reservation request
Purpose	Allow Surgery Center user to confirm reservation request sent from Doctors
Requirements	WC_2763: As a surgery center, I can view/confirm/decline a reservation request.
Development Risk	
Preconditions	All received reservation requests are displayed to the Surgery Center user.
Post-conditions	1. The reservation request is marked as confirmed in the database 2. A notification will be sent to the Doctor who made this request

Flow of Events		**Actor Input**	**System Response**
	1	Click "View Unconfirmed Reservation Requests"	
	2		A list of unconfirmed reservation is displayed to the user
	3	Click "confirm" button next to a reservation request	
	4		A message displays showing that the reservation request has been confirmed

Alternate		**Actor Input**	**System Response**
	1	Click "View Unconfirmed Reservation Requests"	
	2		Display a message showing that "You don't have any unconfirmed Reservation Requests"

⬤ Decline Reservation Request

Identifier	UC-16: Decline reservation request
Purpose	Allow Surgery Center user to decline reservation request sent from Doctors
Requirements	WC_2763: As a surgery center, I can view/confirm/decline a reservation request.
Development Risk	
Preconditions	All received reservation requests are displayed to the Surgery Center user.
Post-conditions	1. The reservation request is marked as declined in the database 2. An email notification will be sent to the Doctor who made this request

Flow of Events		**Actor Input**	**System Response**
	1	Click "View Unconfirmed Reservation Requests"	
	2		A list of unconfirmed reservation is displayed to the user
	3	Click "decline" button next to a reservation request	
	4		Prompt for decline reason input
	5	Enter the decline reason and click "Send"	
	6		A message displays showing that the reservation request has been declined

Alternate		**Actor Input**	**System Response**
	1	Click "View Unconfirmed Reservation Requests"	
	2		Display a message showing that "You don't have any unconfirmed Reservation Requests"

🔵 Search Surgical Slot

Extension Points

Submit Reservation Request

Identifier	UC-07: Search surgical slot
Purpose	Allow a doctor to search for available surgical slot online
Requirements	WC_2739: As a doctor, I can search for the surgery center by name/location WC_2432: As a doctor I can pick the top five SC according to my preference
Development Risk	
Preconditions	User is logged into the system as Doctor
Post-conditions	Available surgical slots are displayed to Doctor

Flow of Events		**Actor Input**	**System Response**
	1	Choose to search for a Surgery Center by "location, by "name"or by "preference"	
	2		A list of Surgery Centers is displayed
	3	Select a Surgery Center	
	4		All available up to date surgical slot for the selected surgery center is displayed in the calendar format

Exceptional		**Actor Input**	**System Response**
	1	Choose to search for a Surgery Center by "location",by "name"or by "preference"	
	2		Display a message showing "there is no such a surgery center exists, please input another name or choose another area"

● Submit Reservation Request

Identifier	UC-09: Submit Reservation Request
Purpose	Allow Doctors to submit a surgical slot reservation request form
Requirements	WC_2774: As a doctor I can make a surgical slot reservation request.
Development Risk	
Preconditions	Available surgical slots are displayed to Doctor
Post-conditions	A surgical slot reservation form is submitted

Flow of Events		Actor Input	System Response
	1	Select a surgical slot to reserve	
	2	Fill in all required fields	
	3	Click "Submit"	
	4		Check form for completeness
	5		Display a message to indicate that the form has been submitted

Exceptional		Actor Input	System Response
	1	Select a surgical slot to reserve	
	2	Fill in all required fields	
	3	Click "Submit"	
	4		Check form for completeness
	5		Display a error message showing which required fields are missing

⬤ View Submitted Reservation

Extension Points

Cancel Submitted Reservation

Identifier	UC-08: view submitted reservation
Purpose	Allow the Doctors to view their submitted reservation
Requirements	WC_2734: As a doctor I can view/cancel a submitted surgical slot reservation request.
Development Risk	
Preconditions	User is logged into the system as a Doctor
Post-conditions	A list of submitted reservation is shown to the Doctor

Flow of Events		**Actor Input**	**System Response**
	1	Click "View Submitted Reservation"	
	2		Display list of all submitted reservation
Exceptional		**Actor Input**	**System Response**
	1	Click "View Submitted Reservation"	
	2		Display a message showing "You do not have any submitted reservation"

⬭ Cancel Submitted Reservation

Identifier	UC-10: Cancel submitted reservation
Purpose	Allow Doctors to cancel submitted reservations
Requirements	WC_2734: As a doctor I can view/cancel a submitted surgical slot reservation request.
Development Risk	
Preconditions	A list of submitted reservation is shown to the Doctor
Post-conditions	1. An alert regarding the canceled reservation is sent to the corresponding surgery center 2. The corresponding reservation form is deleted from database

Flow of Events		Actor Input	System Response
	1	Click "Cancel"	
	2		Display a message to indicate that the reservation has been canceled

🔵 Sync schedule

Extension Points

Set up reminder

Identifier	UC31: Sync schedule
Purpose	Allow the user to sync reservation schedule with google calendar
Requirements	WC_2429: As a doctor / SC I can sync reservations with my Google calendar.
Development Risk	None
Preconditions	User is logged into the system
Post-conditions	Reservation schedule is synced with user's google calendar
Flow of Events	<table><tr><th></th><th>Actor Input</th><th>System Response</th></tr><tr><td>1</td><td>Click "View reservation schedule"</td><td></td></tr><tr><td>2</td><td>Click "Sync with my google calendar"</td><td></td></tr><tr><td>3</td><td></td><td>Display a message showing that the schedule information has been synced with google calendar</td></tr></table>

⬤ Set up reminder

Identifier	UC32: Set up reminder
Purpose	Allow the user to set up a reminder for their reservation schedule
Requirements	WC_2434: As a doctor / SC I can set up a reminder for surgery schedule.
Development Risk	None
Preconditions	Reservation schedule is synced with google calendar
Post-conditions	A reminder is set successfully for the schedule

Flow of Events		**Actor Input**	**System Response**
	1	Click "Set up a reminder"	
	2	Input a time	
	3		Display a message showing that the reminder has been set up successfully

Exceptional		**Actor Input**	**System Response**
	1	Click "Set up a reminder"	
	2	Input a time	
	3		Display an error message showing that the time format is not valid

3. NDI/NCS Interoperability Analysis

3.1 Introduction

In our Surgery Assist Project, Java Spring Framework will be used as the main development platform. JDBC will be used to connect with Microsoft SQL Server to implement the data query. Some network services, such as Google Map, Google Calendar, PayPal, will be embedded to the main platform

3.1.1 COTS / GOTS / ROTS / Open Source / NCS

Table 3: NDI Products Listing

NDI/NCS Products	Purposes
Java Spring Framework	To provide web application framework.
Microsoft SQL Server	Used as the database management system.
Apache Tomcat Server	To provide web server to support Spring framework.
JDBC	To provide database connection between database server and Java Spring Framework.
Google Calendar	Used for calendar view interface
Google Map	Used for location base service
PayPal	Used as the payment process platform
jQuery	To implement front-end interactive functionality
Bootstrap.css /Bootstrap.js	To make front-end development more efficient
Spring JavaMail	To provide email notification functionality
GoDaddy host	To provide running domain service.

3.1.2 Connectors

1. JDBC connector is used to connect Microsoft SQL Server.
2. Google Calendar API v3 is used to connect Google Calendar service.
3. Google Map API v3 is used to connect Google Map service.
4. PayPal API is used to connect PayPal service, which helps process payment activity.
5. Bootstrap.css, Bootstrap.js and other style/script files will be imported into Spring framework by modifying the configurations in web.xml
6. jQuery library will be included in the JavaScript file
7.JavaMail API will be invoked in our source code, and will send auto request to Oracle Java.net.

3.1.3 Legacy System

The current system is a web application developed in last semester and now running on the AWS server. It uses Java Spring Framework on Apache Tomcat Server as the development framework and uses Microsoft SQL Server as the database.

It has a well-built back-end implementation, however, very few front-end implementation thus almost no page flow implementation. We use the back-end implementation provided by the current system and develop the front-end and page flow functionality.

3.2 System Structure
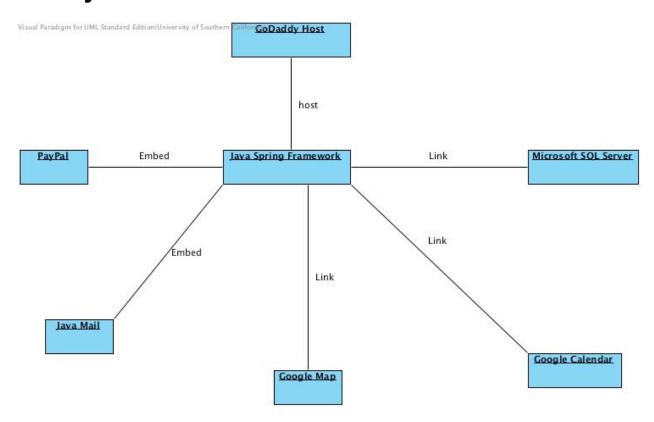
Figure 4 System Structure Diagram

3.3 Evaluation Summary

Table 4: NDI Evaluation

NDI	Usages	Comments
Java Spring Framework	Development framework providing back-end MVC architecture, and the port to connect database server.	Positive Points: 1. Currently used 2. Widely used 3. More testable Negative Points:

		1. Too many code to maintain
Microsoft SQL Server	Provide the database to store and manage the information about doctors and surgery centers.	Positive Points: 1. Current Used 2. Better secure and scalable, famous in enterprise Negative Points: 1. Bad consistency of distributed transactions across databases 2. Not open source
Apache Tomcat Server	To provide web server to support Spring framework.	Positive Points: 1. No extra expense on software 2. Perfectly support Spring framework Negative Points: 1. Less optimal performance 2. Low concurrency
JDBC	To provide database connection between database server and Java Spring Framework.	Positive Points: 1. Perfectly support Spring Framework 2. Widely used. Negative Points: 1. Hard to maintain.
Google Calendar	Provide a friendly user interface to display the reservation schedule of a doctor, and the posted surgical slots timetable of a surgery center.	Positive Points: 1. Widely used thus can be, better for synchronizing with user's personal calendar 2. Inter component compatibility 3. Easy to use Negative Points: 1. Less Optimized in categorize and search
Google Map	Provide a friendly user interface to display the location information of searched Surgery Centers	Positive Points: 1. Widely used 2. Accurate and up-to-date Negative Points: 1. N/A based on our requirement.
PayPal	Provide a financial platform to process the payments activity	Positive Points: 1. Widely Used 2. Highest security Negative Points: 1. High transaction fee on every single purchase
jQuery	Provide front-end interactive implementation library	Positive Points: 1. Excellent interactive and animation

		2. Widely Used 3. Free Negative Points: 1. Decrease performance

Bootstrap	Provide front-end layout implementation development framework	Positive Points:
		    1. Provides a clean and elegant GUI
		    2. Free
		Negative Points:
		    1. Likely to have namespace bugs

JavaMail	Provide the email implementation for notification feature of our system	Positive Points:
		    1. Compatible with most of email protocol
		    2. Build within Java EE platform
		Negative Points:
		    1. Less fault tolerate

4. Technology-Specific System Design

4.1 Design Overview

4.1.1 System Structure
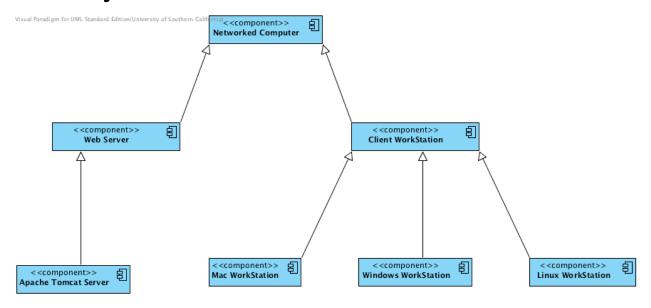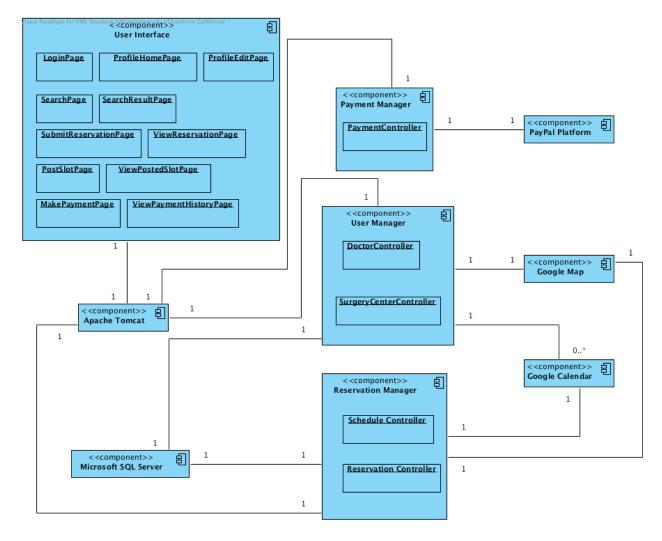

Figure 5 Hardware Component Class Diagram
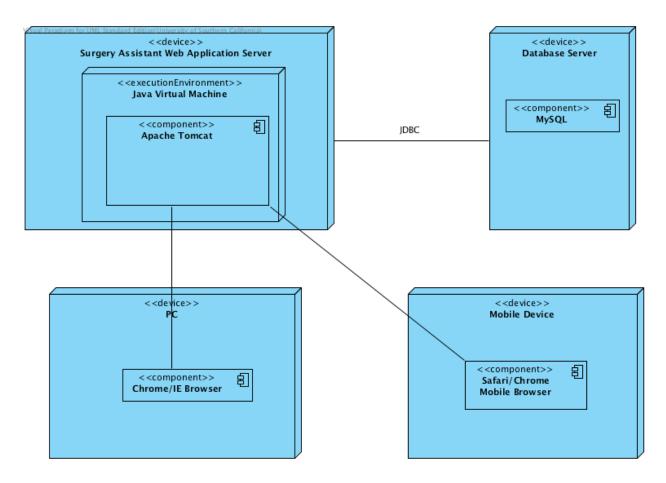
Figure 6 Software Component Class Diagram

Figure 7 Deployment Diagram

4.1.2 Design Classes

Figure 8 Design Class Diagram

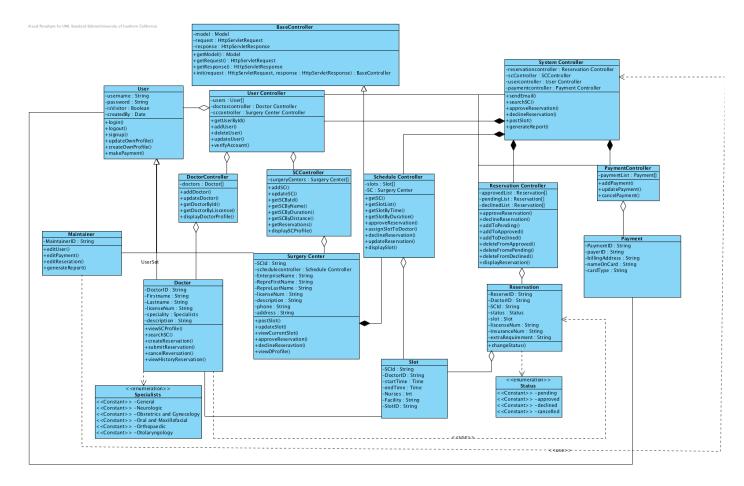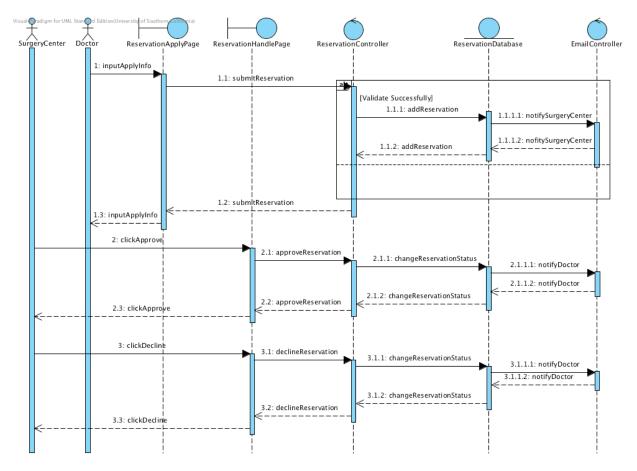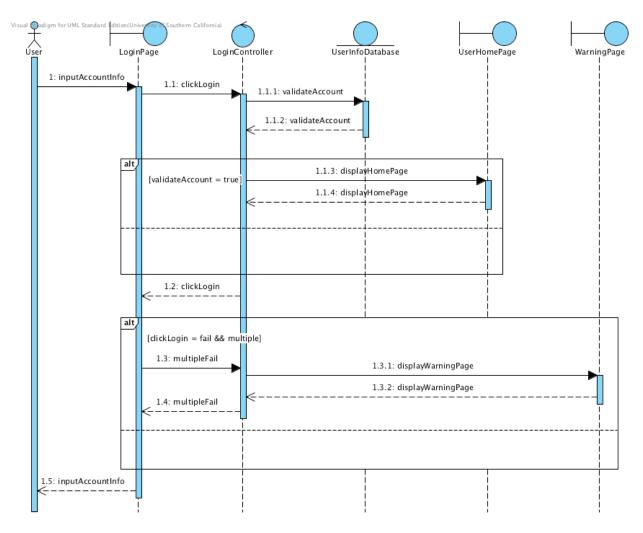## 4.1.3 Process Realization

Figure 9 Reservation Sequence Diagram

Figure 10 Login Sequence Diagram