Millhouse Group Inc (Group 9)

Streamlining the Process of Patient Scheduling

Final Report

Version 1.13

Contents

Document History 3

Document History

Version	Date	Author	Changes
v1.00	16-NOV-2016	Muhammad Zubair	Initial Version - Integrated Project Charter and SRS
v1.01	18-NOV-2016	Hannah Xu	Added project charter to introduction
v1.02	18-NOV-2016	Muhammad Zubair	Added backward/forward traceability to Functional requirements

v1.03	22-NOV-2016	Hannah Xu	Glossary
v1.04	23-NOV-2016	Joseph Lee	Gathering information
v1.05	23-NOV-2016	Joseph Lee	Editing
v1.06	23-NOV-2016	Hamid Zamani	Changing use case model image
v1.07	23-NOV-2016	Nicole Ge, Xianhui Chen	User interfaces update
v1.08	23-NOV-2016	Hannah Xu, Nicole Ge, Xianhui Chen, Pennie Wang	Editing Storyboard
V1.09	23-NOV-2016	Hamid Zamani	Adding Sequence Diagrams
V1.10	23-NOV-2016	Muhammad Zubair	ERD updated to reflect changes after client meeting
V1.11	23-NOV-2016	Muhammad Zubair	Solution introduction and fixed functional requirements
V1.12	23-NOV-2016	Muhammad Zubair	Adding interview notes
V1.13	23-NOV-2016	Entire team	Final revisions

1. Introduction

1.1 Executive Summary

The Vancouver Island Centre BC Cancer Agency provides oncology consultations, chemotherapy, and radiotherapy treatment to cancer patients across Vancouver Island. The center is seeking to improve the patient scheduling system, to provide effective and efficient working condition for the radiation therapists (RTs), and to enhance the quality of care they provide to the patients. The current scheduling system is operated primarily by the RTs. This responsibility diverts time and attention from their therapy tasks.

The Oncological Scheduling System Improvement Project (OSSIP) aims to address the objectives of ensuring the RTs are capable of fully utilizing the appointment time for the patient treatment with minimal disruption, and addressing the issues with double booking and need for rescheduling.

1.2 Context

Millhouse Group Inc. is a consulting firm located in Victoria, BC. We specialize in healthcare process analysis and improvement for local healthcare organizations.

The BC Cancer Agency (BCCA) is a group within the BC Provincial Health Service Authority (PHSA) that focuses on the prevention, screening, and treatment of cancer for BC residents. They have perform more than 4.5 million mammograms and detected over 19,600 breast cancers. As such, the BCCA mammography screening program is renowned.

Residents of Vancouver Island and the surrounding area are treated at the Vancouver Island Centre in Victoria, BC which is part of BCCA. In 2013, a 10,000 square foot expansion opened at the Vancouver Island Centre. There are 6 radiation therapy machines, and 24 radiation therapist. Approximately 55% of cancer patients undergo radiation therapy, which results in a high volume of patient visits. The facility sees 40-45 patients each day, and are currently facing difficulties establishing a smooth workflow. The high volume of patients, combined with an inefficient scheduling system, is lowering the quality of service the therapists are able to provide, while increasing their stress levels.

1.3 Needs

Based on the RFP and the client interview, the team at Millhouse Group Inc. has identified three critical problem areas in the BC Cancer Agency’s scheduling process that need to be addressed. The radiation therapists (RTs) are being disrupted by patients, as the seating area is in proximity to where the RTs are conducting their business. Patients are being double-booked as a result of miscommunications between clerks, RTs, and patients. As the schedule is created without input from patients, it does not necessarily work for each patient's personal schedule. Addressing these needs will help streamline the scheduling process and allow therapists to focus on providing quality care.

1.3.1 Reduce Disruptions

The patient seating area is located in proximity to where the therapists walk between the equipment rooms. Patients will try to capture the attention of RTs while in the seating area with questions and/or casual conversation. This diverts the RTs' attention away from the patients they are currently working with, which reduces the quality of care provided. This burden can cause stress for the RTs as they strive to provide a standard of care.

1.3.2 Radiation Therapists Scheduling Visits

When a patient visits the clinic for the first time, the booking clerk schedules his or her appointments for the duration of their entire treatment (typically five to seven weeks). If at any point during the treatment the patient expresses that they are unable to make a future appointment, the RT will reschedule the appointment. This often results in patients being double-booked, as the RT can be unaware of the booking clerk's original schedule.

1.3.3 Double Booking and Rescheduling

The schedule is created without input from the patients. As a result, the clinics schedule does not always work with the patient's personal schedule. Additionally, patients are not informed about their appointment until the day before, despite the schedule being created weeks in advance. This results in an increased number of patient requests to reschedule their appointments, which is difficult to accommodate.

1.3.4 Patient Punctuality

When patients arrive late to their appointment, RTs are forced to shorten the time they spend with other patients. This reduces the quality of care the RTs are able to provide.

1.4 Scope

There are multiple problems that lead to inefficient scheduling and a decreased quality of service at the facility. However, due to time and resource constraints, Millhouse Group will only be addressing the shortcomings of the current scheduling system.

In Scope	Out of Scope
Double booking: Multiple patients booked for same timeslot	Disruptions: RTs are interrupted by patients in the waiting area
RTs spending time scheduling	Patients coming in late due to traffic or unforeseen circumstances
Rescheduling: Patients are rescheduled too often	

1.5 Stakeholders

Project owner -- BC Cancer Agency(BCCA)

BCCA is the owner of the whole project, who can benefit greatly from this project. The success of implementing the project could gain higher patient satisfaction rates for the organization.

Project sponsor -- BCCA Board of Directors
Board of Directors are representatives of the stakeholders to deal with organizational issues. The sponsor would achieve a better quality of care by encouraging RTs and booking clerks to use this project.

Project team -- Millhouse technical team
The Millhouse would select appropriate members to work as a team to address the issues in BCCA. The Millhouse technical team would involve in the designing solutions and completing the project to achieve the needs of client.

Support staff -- BC Cancer Agency technical team, RTs, booking clerks
The technical team in BCCA needs to support the implementation of software and hardware during the process; and the further maintenance would be completed by the BCCA technical team. RT and booking clerks are involved as support stuff to illustrate further needs and preferences would be collected to provide a better solution.

Customers -- patients, patient's family
The project aims to achieve a higher quality of healthcare provided to patients, and to try to provide patient family more convenience. Patients and the family members would experience better scheduling style and longer communication time with RTs after finishing the project.

User -- RTs, booking clerks, patients
RTs and booking clerks are the main roles who are using the system. By booking through the system instead of the current one. Patients might be involved as well.

1.6 User Classes and Characteristics

1.6.1 Booking Clerk

Booking clerks are expected to be the main users of the system. They are assigned a unique username and password to access the system. Booking clerks have a high level of security because they have access to all patients' schedules and information. Booking clerks are able to schedule new appointments, reschedule existing appointments, and delete appointments when necessary. Booking clerks should have minimum Grade 12 education level. They have to understand medical terminology and graduated from a recognized Nursing Unit Clerk Program plus one year of recent related or an equivalent combination of education, training and experience. They should be skillful in use of computer and the booking system. Booking clerks will have interactions with patient, radiation therapists and other specialists, such as oncologists and nutritionists in order to book, change, and delete appointments.

1.6.2 Radiation Therapist

Radiation therapists are able to access the booking system to view their personal schedule. Each RT is assigned unique username and password to access the system. They have patient record access level because they need to view patients' appointments, personal and

medical information to execute treatment plans received from the oncologists. RTs can only view the schedule. RTs do not have access to appointment rescheduling. RTs need to have experience in radiation therapy and they are required to have expert knowledge to make sure the delivery of radiation therapy is accurate and safe. They will interact with patients for the therapy and ask them about their physical conditions and daily lives. They will also contact with both patients and booking clerks for rescheduling.

1.6.3 Patient

Patients only interact with the scheduling system through the booking clerk. While with the booking clerk, they can initiate both the scheduling and rescheduling processes. Whenever a patient's schedule is updated, they are informed by the booking clerk in person, and they receive an email with their updated schedule.

1.7 Objectives

1. Remove Double Booking
   The project aims to remove the possibility of double booking patients

2. RT Scheduling Patient
   The project aims to reduce the amount of interruptions on RT from spending time on scheduling/rescheduling for patients

3. Rescheduling
   The project aims to reduce the overall number of rescheduling

1.8 Project team and Roles

Team Members	**Role**	**Responsibility**
Hamid Zamani	Project Director	Responsible for the progress of the project, the project director makes adjustments as necessary to ensure the project is successful.
Hannah Xu	Outcome Specialist	Assures the quality of our analyst services.
Joseph Lee	Project Manager	Defines and assigns task and ensures that the project is executed in a timely manner.
Huiying (Pennie) Wang	Clinical Informatics Analyst	Gives direction regarding clinical informatics standards.
Muhammad Zubair	Process Improvement Analyst	Identifies and remedies inefficiencies in a process.
Nicole Ge	Benefits Analyst	Assesses the cost-to-benefit ratio of tasks and establishes priorities.

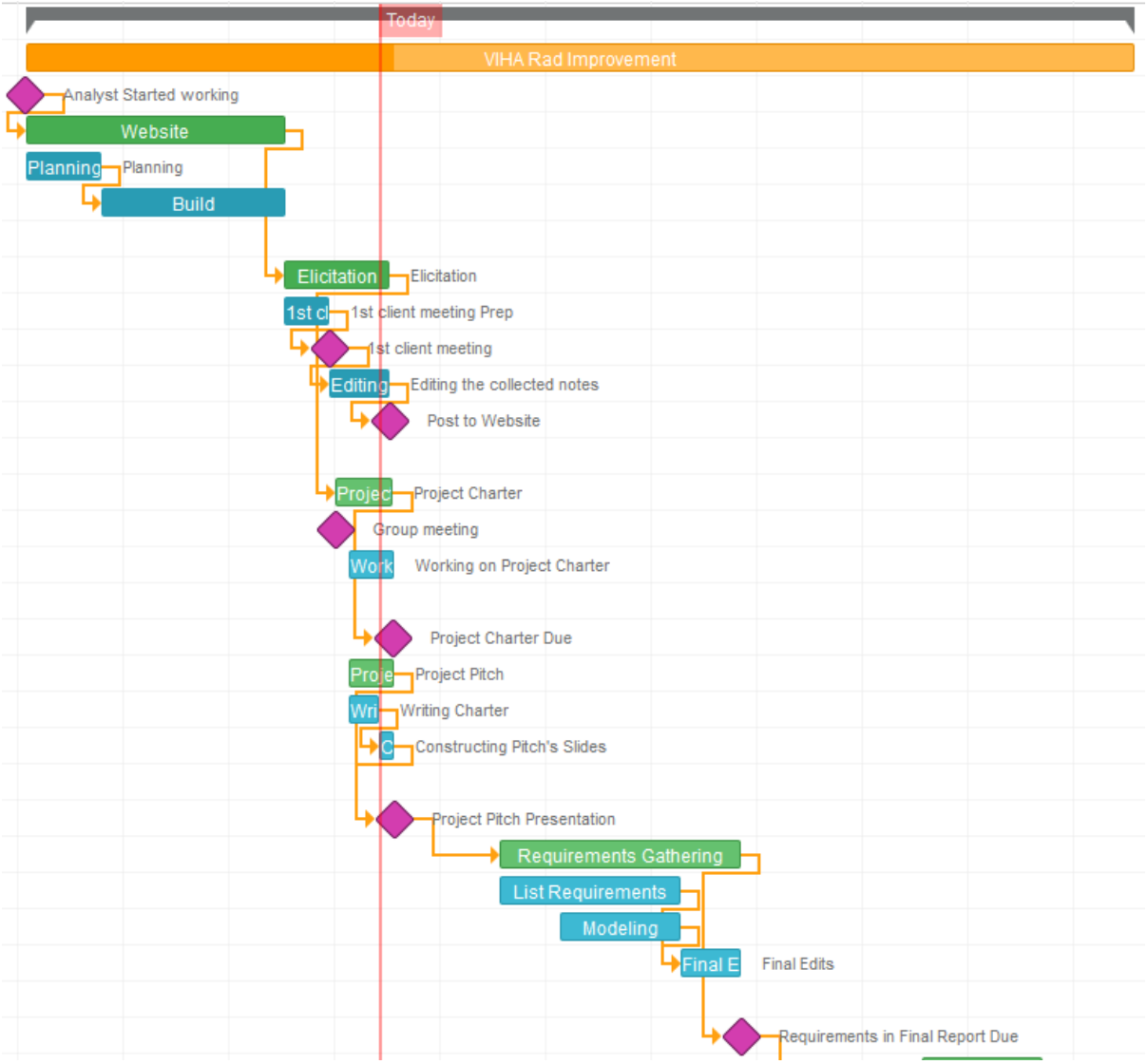
Xianhui Chen	Data Analyst	Identifies patterns using data analysis techniques and makes suggestions based on said patterns.
Madeline Petersen	Technical Lead	Implements technical solutions to systemic problems.

1.9 Work Breakdown Structure

VIHA Radiology Improvement

a. Website
b. First Client Elicitation
c. Project Charter
d. Project Pitch
e. Requirements Gathering
f. Second Client Elicitation
g. Designing a Solution
h. Final Report
i. Final Presentation

1.10 Gantt Chart



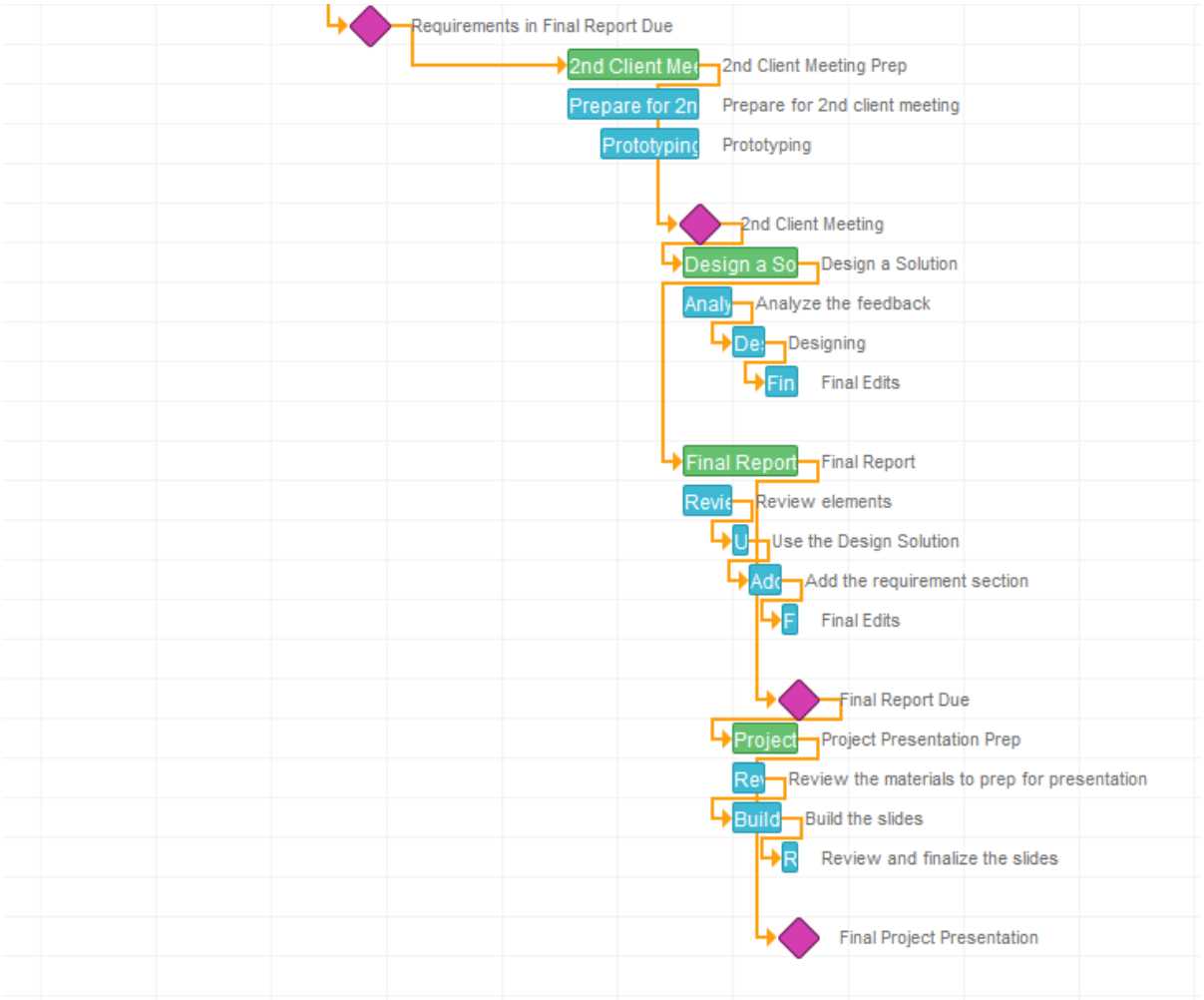


Fig 1. Gantt Chart

1.11 Milestones

Items	Description	Delivery Date
Group Formed	The group was formed	Sept 12, 2016
First Client Meeting	After reviewing the RFP, the analysts interviewed the clients to write the project charter	Sept 29, 2016
Project Charter	The analyst group used the information in RFP and the interview answers to write the project charter	Oct 6, 2016
Project Pitch	The analysts prepared the Pitch using the information from RFP, client interview and the project charter	Oct 6, 2016
Requirements Analysis	The analysts started working on the Requirements gathering for the solution system	Oct 29, 2016
Second Client Meeting	The analysts did the second interview with the client group and did the prototype demonstration	Nov 14, 2016
Final Project Report	The analysts wrote the project report	Nov 24, 2016
Group Presentation	The analysts group did the presentation on the best solution to the client's problem	Dec 1, 2016

1.12 Deliverables

Items	Description	Delivery Date
Elicitation	The analysts' meeting notes through interviewing the client in the 1st client meeting	Oct 3, 2016
Analysts' Website	Online medium to show project status, the analysts involved and the work done	Sept 29, 2016
Project Charter	Detailed document showing project goals, roles and responsibilities, identifies the main stakeholders by analysts	Oct 6, 2016
Project Pitch	Demonstrating the major clients' problems in the form of a presentation by the analysts	Oct 6, 2016
Requirements Section in Final Report	Gathering requirements of the solution system for the final report	Oct 29, 2016
Final Report	Final Report by project team (clients and analysts)	Nov 24, 2016
Project Presentation	Final presentation by project team (clients and analysts)	Dec 1, 2016

1.13 Risks

Risks	Probability	Impact	Contingency Plan
Project Resource Constraint	Medium	Medium	As financial resource is limited, we would plan ahead and ensure stable relationship with projects sponsors
Radiation Therapists are resistant to adopting a new system	Medium	High	Communicate with the RTs early and periodically to ensure their needs are understood and addressed
Data available is insufficient to accurately evaluate the problem	Medium	Medium	Include extra slack and funding to collect data required for analysis
Interruption to patients during implementation	High	Low	Communicate to patients ahead of time before any change in the workflow and provides answers to their questions

2. Requirements

2.1 Product Perspective

The system described in the following sections is intended to replace the existing scheduling system at the Vancouver Island Centre. The system will consider the patient's availability, as well as the Centre's existing calendar, to create appropriate appointments for the patient. Patients are able to initiate the process of scheduling and reschedule appointments.

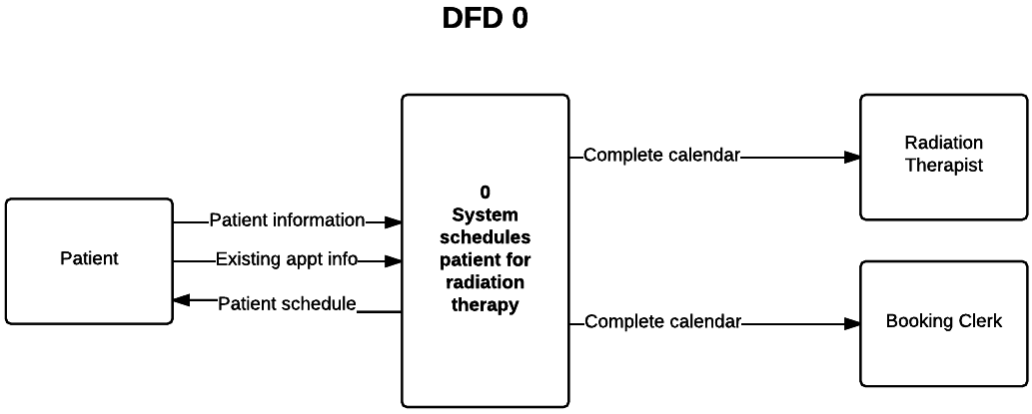


Fig. 2 Data Flow Diagram Level 0

2.2 Product Features

Each user type is limited to a certain set of features. The system's primary user is the booking clerk, who is able to register patients, and create appointments for patients to visit the facility for their treatment. Booking clerks are able to view the centre's schedule in its entirety. Radiation therapists are able to view the patient's schedules. The patient is emailed their schedule on initial scheduling, and each time their schedule is updated.

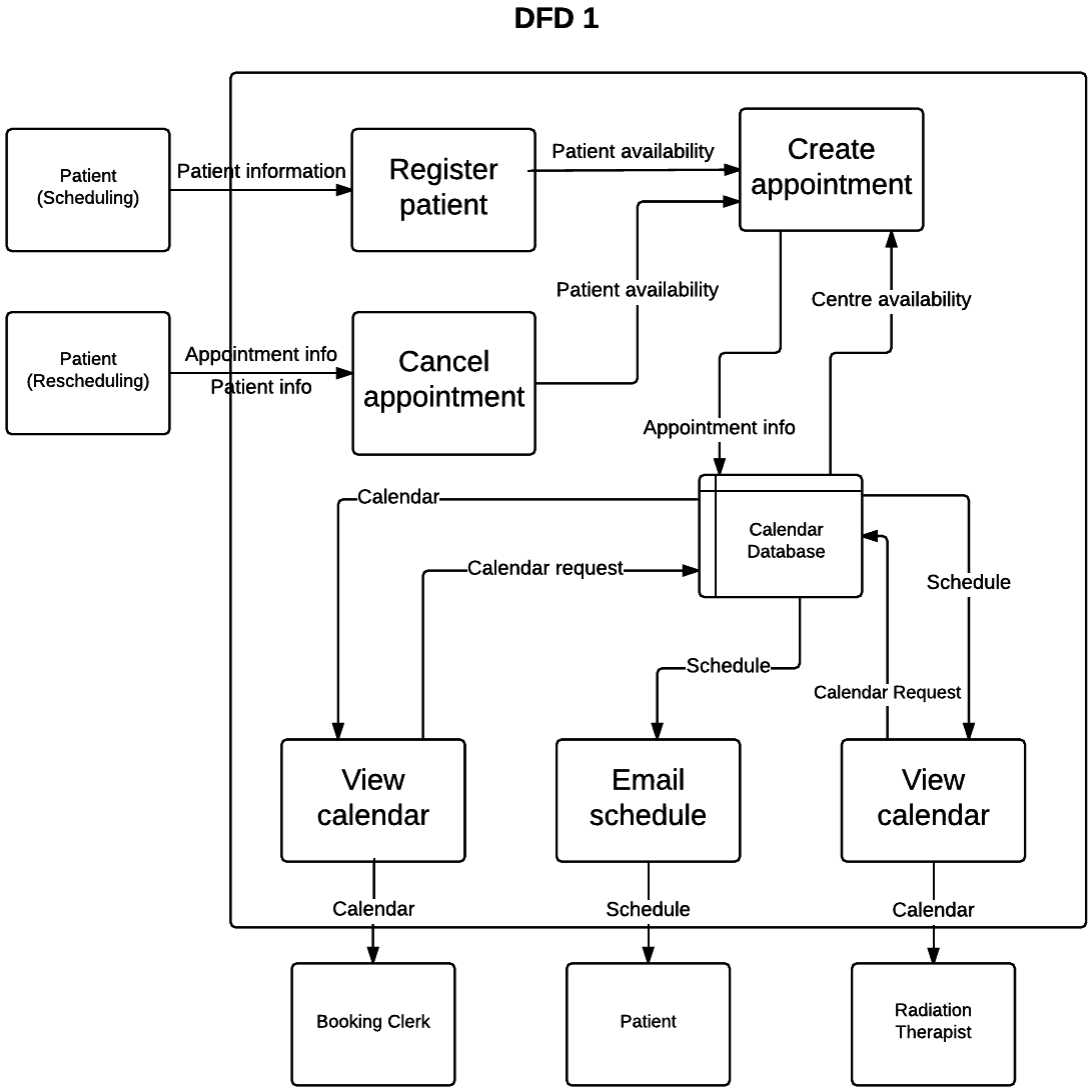


Fig. 3 Data Flow Diagram Level 1

2.3 Use Case Relations

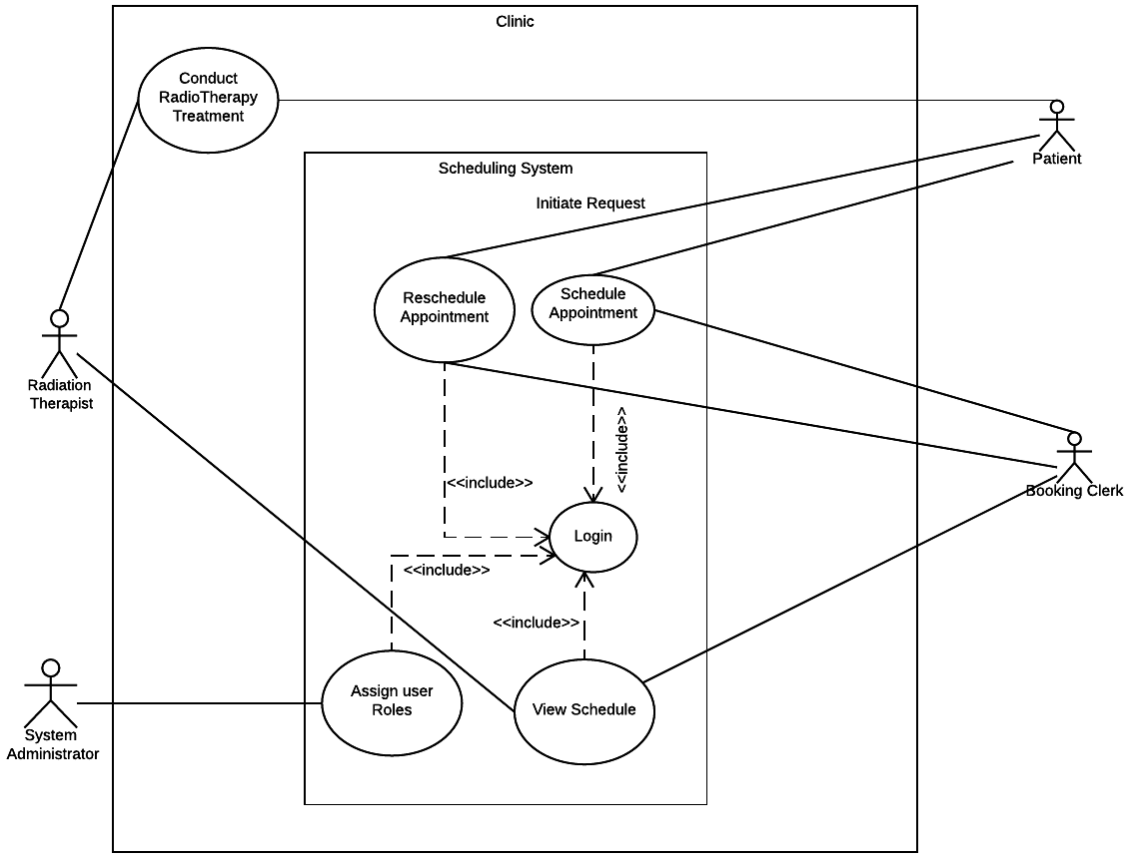


Fig.4 Use Case Model

The system contains four roles which are booking clerk, patient,system administrator and Radiation Therapist.For the first appointment, Patients initiate booking request to booking clerk and they meet in person. Booking clerk will schedule the appointment for the patients. When a patient shows up for their appointment an RT will conduct the treatment. The permissions to access system is different between different roles. The only duty for System administration is to assign roles to users. For Radiation Therapist are only allowed to retrieve the information in the system. Booking clerk is the role who has the permission to schedule, retrieve and reschedule the appointment.

2.4 Use Cases

2.4.1 Use Case 1: Schedule Appointment

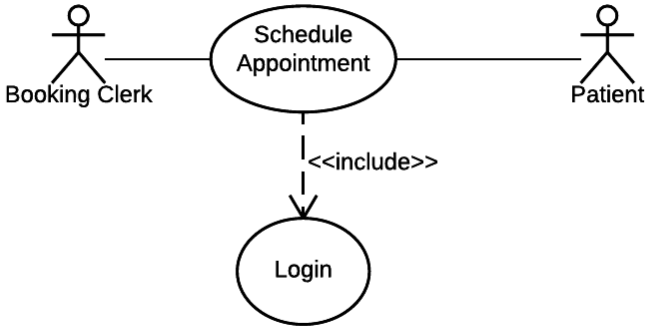


Fig. 5 Use Case Model for Schedule Appointment

In this use case, a patient requests an appointment with the clinic for the duration of their treatment.

Preconditions	The patient has been referred to the clinic by their doctor.
Success Steps	- Patient informs the booking clerk that they are referred and require treatment - Clerk verifies patient information - Clerk presents patient with times available - Patient picks the times that work for them from the available times offered - Clerk books the patient for the duration of their treatment (5-7 weeks) using patient's preferred times - Clerk provides a printout of the schedule to the patient - An email with the schedule is sent to the Patient
Success Postcondition	Patient is booked for the duration of their treatment in the system, and has been provided with a copy of their schedule.
Alternate Paths:	In cases where the centre is already at full capacity, patient would be put onto the waiting list.

2.4.1.1 Functional Requirement For Use Case 1

FQ01. The system shall add new patients to the system when a patient is not already in the system.
Backward Traceability: RFP.
Forward Traceability: The clerk is able to add new patients to the system when they visit during clinic's open hours.

FQ02. The system shall produce all available appointment times when booking new patients.
Backward Traceability: RFP, and the change of process being introduced to ensure patient's preferences are considered.
Forward Traceability: A patient is presented with options when selecting their schedule.

FQ03. The system shall prompt the clerk to input patient preferences when booking patient's schedule.
Backward Traceability: Project charter.
Forward Traceability: Patient has a say in determining their schedule.

FQ04. The system shall send an email to the patient with their schedule.
Backward Traceability: Client meeting #2.
Forward Traceability: An email is sent to the patient with their schedule.

2.4.2 Use Case 2: Reschedule Appointment

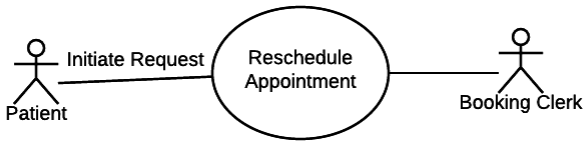


Fig. 6 Use Case Model for Reschedule Appointment

In this use case, a reschedule is requested by the patient.

Preconditions	The patient has at least one scheduled appointment in the future, and the patient would like to reschedule the appointment.
Success Steps	- Patient contacts clerk in person or through phone - Patient and clerk together work out a new agreeable time for the appointment
Success Postcondition	Patient has rescheduled their appointment and has been given a new appointment time. Their updated schedule incorporates the patient's preference, and does not conflict with other existing schedules from other patients. Patient is sent an email with their new schedule.

Alternate Paths:	If there does not exist a time slot that agrees with the patient's preference, a time that the patient can attend reliably for the best outcome of the treatment would be selected.

2.4.2.1 Functional Requirement For Use Case 2

FQ05. The system shall display all currently free time slots to the clerk for the patient to choose from.
Backward Traceability: RFP
Forward Traceability: Booking clerk can see a list of time slots that are not at full capacity (six patients for six machine at the same time slot).

FQ07. The system shall store the new appointment and remove the older one from patient's overall schedule.
Backward Traceability:RFP.
Forward Traceability: Updated schedules are stored in the database that reflect the patient's appointments.

2.4.3 Use Case 3: View Schedule

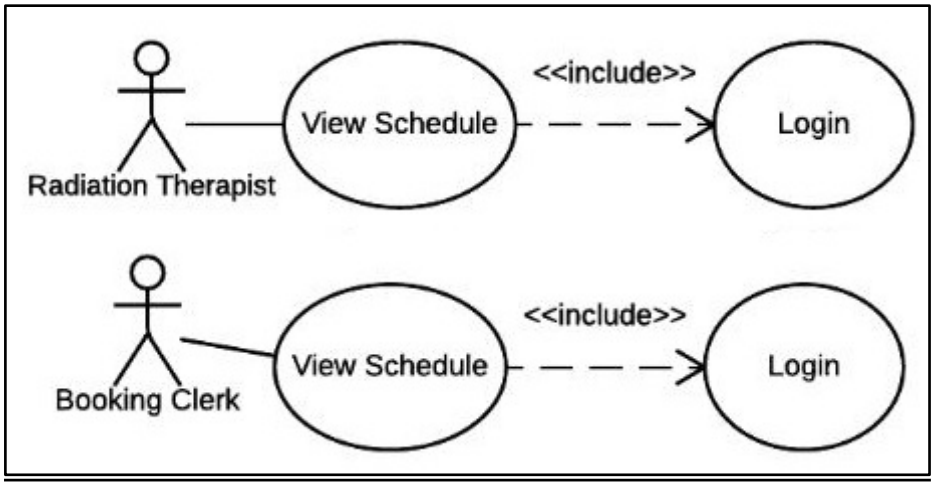


Fig. 7 Use Case Model for View Schedule

In this case, booking clerks and RTs would have multiple options to view the scheduled appointments existing in the centre, including multiple patients over multiple days.

Preconditions	Users have authorized access to log in to the scheduling system. There are scheduled appointments exist in the day.
Success Steps	- Users log in to the scheduling system - Users are brought to the scheduling system's main view - Users pick the specific date range (one week) - Users are brought to the view of the schedules for the specific date range - User could search one specific patient by entering the name and PHN - Users click on "View Schedule button" to view one specific patient's schedules.
Success Postcondition	Users have the ability to view the schedule.
Alternate Paths:	If users cannot see the real-time schedules, there would be a pre-printed schedule sheet, which contains all the appointments for the day. The sheet includes all the basic information, such as time slot and patient's name.

2.4.3.1 Functional Requirement For Use Case 3

FQ08. **The system shall show the patient's entire schedule when an RT or clerk use the view functionality.**
Backward Traceability: RFP
Forward Traceability: RT or the Clerk is shown the patient's schedule.

FQ09. **The system shall show all booked appointments when the clerk uses the view functionality.**
Backward Traceability: RFP
Forward Traceability: System shows all booked schedules in the system.

FQ10. **The system shall show the latest schedule if a patient has rescheduled.**
Backward Traceability: RFP
Forward Traceability: The latest schedule is shown by the system.

2.4.4 Use Case 4: Conduct Radiotherapy Treatment

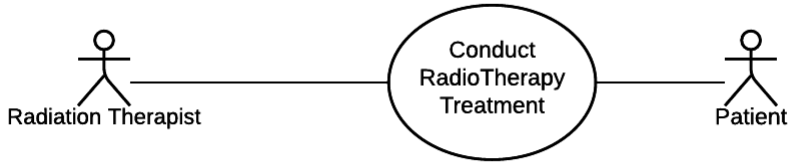


Fig. 8 Use Case Model for Conduct Radiotherapy Treatment

In this case, RT would perform planned radiotherapy treatment to scheduled patient in the scheduled room.

Preconditions	Scheduled Patient is in waiting room.
Success Steps	- RT brings patient into treatment room. - RT perform planned treatment on patient - RT assess patient condition through conversation and vital signs measure - RT confirm patient's next appointment time
Success Postcondition	Patient finishes treatment, and if treatment plan is not yet finished, patient obtain next appointment time card from clerk.
Alternate Paths:	If patient treatment plan needs to be altered, physician will be notified and a new plan will be issued by the physician.

2.4.4.1 Functional Requirement For Use Case 4

FQ11. **The system shall show patient's schedule when an RT opens patient's file.**
Backward Traceability: RFP
Forward Traceability: When conducting the radiotherapy, RT is able to see patient's schedule.

2.4.5 Use Case 5: Assign Roles

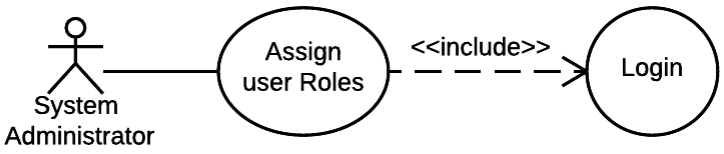


Fig. 9 Use Case Model for Assign User Roles

In this use case a system administrator assigns roles to users. Possible roles are "Radiation Therapist" who can view schedules of all patients, and initiate rescheduling requests, and "Clerk" who are able to see schedules of all patients, add new patients, book new schedules, and reschedule existing appointments.

Preconditions	A user with system administration role exists in the system.
Success Steps	- System Administrator signs into the administration portal of scheduling system - System Administrator assigns a role to a user (Either, RT or Clerk) - System Administrator submits the change
Success Postcondition	The user's role is changed to what the system administrator picked (RT, Clerk or Patient)
Alternate Paths:	a) The system administrator submits the wrong credentials and is presented with an error message. b) The system administrator tries to assign the wrong type of role to a user (I.E tries to give the RT role of rescheduling) and is presented with an error message.

2.4.5.1 Functional Requirement For Use Case 5

FQ12. The system shall show all users in system when a system administrator is searching the database.
Backward Traceability: Client Meeting.
Forward Traceability: A system administrator is able to see list of users to assign roles.

2.5 Non-Functional Requirements

NFQ01. The scheduling system should take less than a minute to load patient's existing schedules.
Backward Traceability: Project Charter.
Forward Traceability: Patient file is loaded within a minute.

NFQ02. The system should allow user to reschedule as many times as needed.
Backward Traceability: RFP, Project Charter, Client meetings 1 and 2.
Forward Traceability: There are no limits on rescheduling.

NFQ03. The system should accommodate scheduling and rescheduling of all patients that visit the facility.
Backward Traceability: RFP.
Forward Traceability: A patient is able to start the scheduling or rescheduling process.

NFQ04. The scheduling system ensures security by requesting and validating credentials (username/password).
Backward Traceability: Security concerns presented by the clients in client meeting 1 and 2.
Forward Traceability: User credentials are validated are only correct credentials are accepted.

NFQ05. The system should store the correct schedules for patients.
Backward Traceability: RFP
Forward Traceability: A correct schedule is produced by the system.

NFQ06. The system shall ensure that only one patient per machine is booked at any given time.
Backward Traceability: RFP mentions there are multiple machines available at any given time.
Forward Traceability: Up to 5 patients are booked at any given time slot.

NFQ07. The system should not allow booking patients on time slots that are full.
Backward Traceability: RFP.
Forward Traceability: Double booking is not allowed to occur.

NFQ08. The system should validate that only booking clerk is able to schedule new patients.
Backward Traceability: RFP mentions that booking is not RT's job.
Forward Traceability: A clerk must be signed in to perform the booking task.

NFQ09. The Schedule features shall remain available during clinic's operating hours.
Backward Traceability: RFP, Client meetings.
Forward Traceability: The system is accessible during operating hours.

NFQ10. The system shall allow rescheduling when the clerk talks to the patient in person or by phone.
Backward Traceability: Client Meeting #2
Forward Traceability: A patient can reschedule via phone or in person.

2.6 Operating Environment

The system operates in a healthcare-based fast paced environment with all the past platforms in place. The system users will be viewing or editing the appointments using the current scheduling system software running on windows platform. BCCA has a scheduling system that is part of the EHR system. The BCCA's EHR system has a complete scheduling system; it is built on relational databases. All documents are stored either as Word documents and pdf files because they scan reports, and receive faxed referrals from oncologists. The BCCA's health records system interfaces with all health authorities and lab reports. Microsoft software is used for any other purpose that is not mentioned here.

2.7 Design and Implementation Constraints

First, the radiation machine to staff ratio causes limitation. There is a maximum of four RTs working at each station. The arrival desk is manned by a maximum of two RTs, and two RTs work with the radiation machine. The radiation machines cannot support more than two RTs. The project is also limited by the centre's staff capacity. The treatment centre has already reached its maximum capacity of radiation therapists, and increasing the number of radiation therapists will result in disorganization that will potentially reduce the quality of care.

The length of the workday is another constraint. The normal workday starts at 8:00 am and runs to 4:00pm; it cannot be extended. The machines cannot tolerate any longer workday as this may harm the life of the equipment significantly. However, in exceptional circumstances, and with the discretion of the RT staff, 30 minutes can be added to the centre's hours of operation.

Finally, the project is constrained by the workload capacity of the RTs. RTs are assigned specific tasks related to providing radiation treatment for patients and collecting critical clinical data. Any additional duties will result in more stress for the RT staff, and potentially reduce the quality of care.

2.8 Assumptions and Dependencies

We have assumed the the scheduling information can be shared between the booking clerk and the RT through a single database. We assumed the clerk has the capacity to handle the increased workload. We assumed the patients have valid needs for rescheduling, thus it cannot be avoided, but we also assumed that by making the whole schedule for the treatment transparent, and rescheduling more accessible, instances of last minute rescheduling can be decreased. We assume that RTs are assigned to a patient appointment as they become available, and thus the assigning of RTs to a particular patient is not a function of interest in our system. We assume the centre has two monitors for each booking clerk station on which they can display the schedule availability to the patient.

2.9 Hardware Interfaces

There are several hardware interfaces of this system. The system requires a computer for users to interact with the booking software. Users are able to view, book, change, and delete patients' schedules. They will get the output and feedback through the computer monitor. The system requires a keyboard to input information to the booking system. The users need

to have a mouse to control the system and navigate as an input hardware. A printer is also required to print out schedules for patients.

2.10 Software Interfaces

The system would use an internal database to save information. The patients' and RTs' schedules and permissions to use the system are saved and are accessible in the backend database. All the information related to the patient's history would be stored as well. The system can run on any current web browser, defined as:

- Internet Explorer 8+
- Firefox 5+
- Chrome 13+
- Safari 5+
- Opera 11+

The system will require a calendar interface, which allows clerks to pick out date, time, and available RTs, so that clerks could book accurate appointments within the system.

2.11 Communications Interfaces

Vancouver Island centre uses several communication tools, including telephone, Email and face-to-face communication. Detailed information is as follows.

2.11.1 Telephone

When patients need to reschedule their appointment, they might call the clerk to complete the rescheduling process.

2.11.2 Email

After new patients complete the scheduling process with clerk, and patients successfully rescheduling the appointment, an Email containing the schedule information would sent from clerk to patients. Notifications of the creation, and update of the patient schedule can be sent as a reminder and confirmation for his or her appointment.

2.11.3 Face-to-face Communication

The original booking process between patients and clerks are completed through the face-to-face communication. For rescheduling an appointment, patient could communicate with clerk face-to-face to complete the process.

2.12 Entity-Relationship Diagram

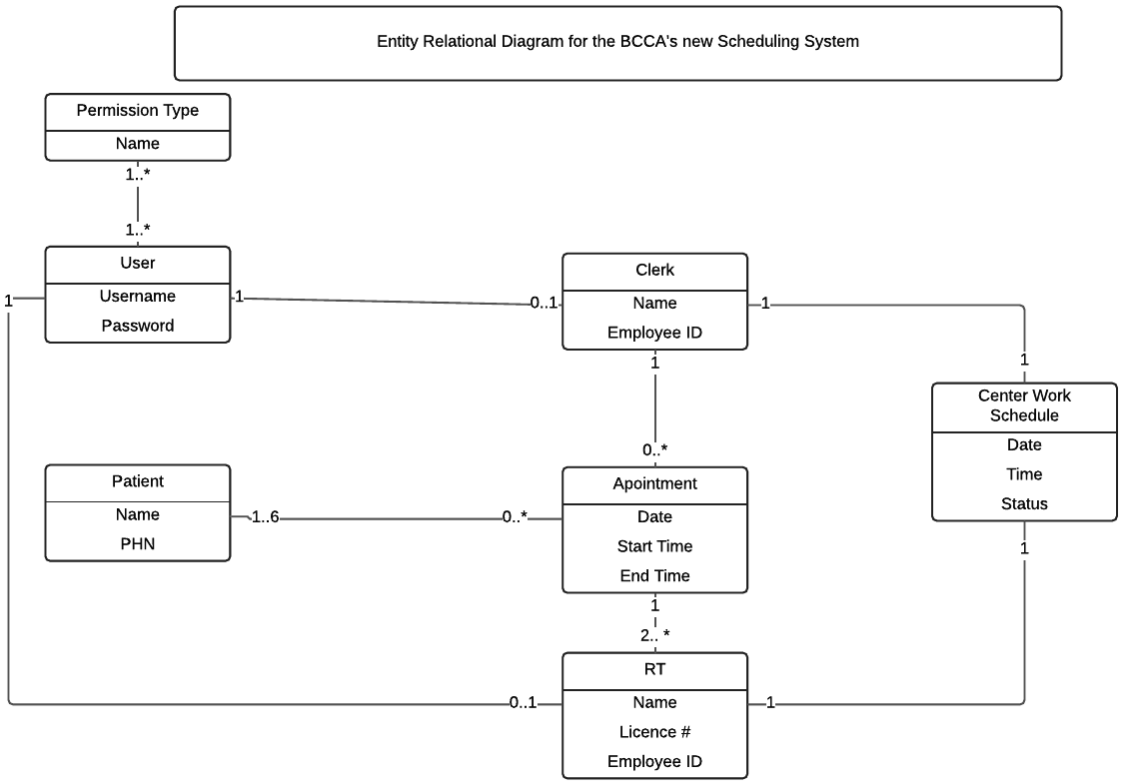


Fig. 10. Entity-Relationship Diagram For New Scheduling System

This entity relational diagram shows all required tables that are needed to make the new scheduling system work more effectively. RTs and clerks have access to the system using their usernames and passwords. The permission type allows the users to be able to view only or view and edit the appointments. The Centre Work Schedule allows the employees' (Clerk and RT) work schedules to be taken into account when scheduling appointments.

3. Solution

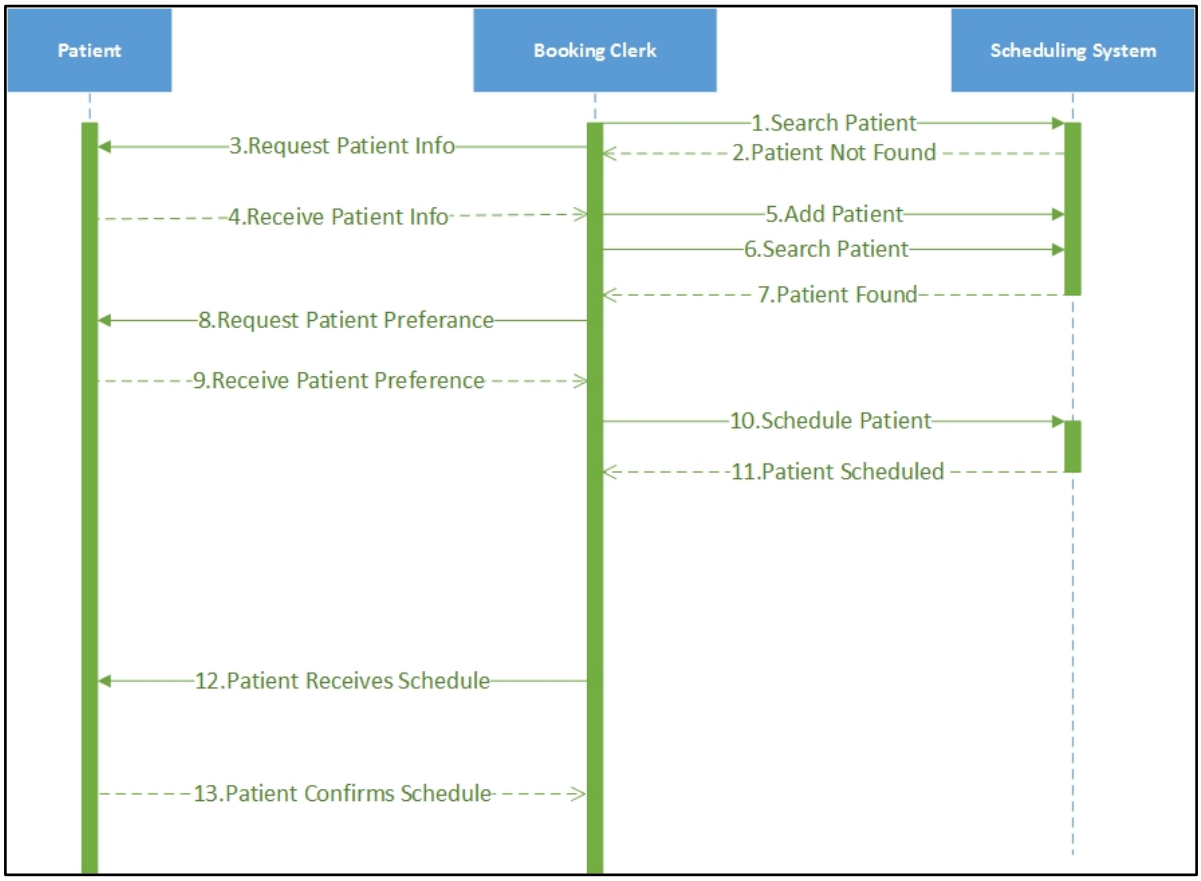
3.1 Overview

Millhouse Group Inc has devised a solution to address the problems described in the client's RFP. The solution described below address the concerns regarding double booking, quality of care due to RT spending time rescheduling, and the inability to consider user preferences when scheduling appointments. The solution is the result of careful analysis of the current practices at the client's facility, in-person meetings with the client, and email communication.

The proposed solution addresses the concern over double booking by assigning the responsibility of rescheduling to the booking clerks and removing the functionality from the RTs. This change also addresses the problem of RT spending time performing rescheduling tasks, and improves the quality of care they can provide to the patient. Finally, the solution allows the clerk to incorporate user preferences when booking schedules by allowing the patient to look at available time slots and pick the ones that work best for them.

3.2 Storyboard

3.2.1 Scheduling



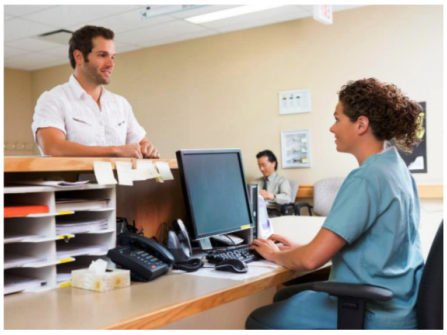
Step 1:

- The patient Jason Watson has Skin Cancer and he's referred to the radiotherapy in BCCA.

BC Cancer Agency
CARE + RESEARCH
An agency of the Provincial Health Services Authority

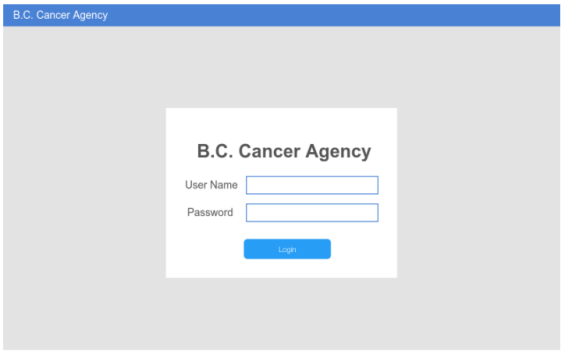
Step 2:

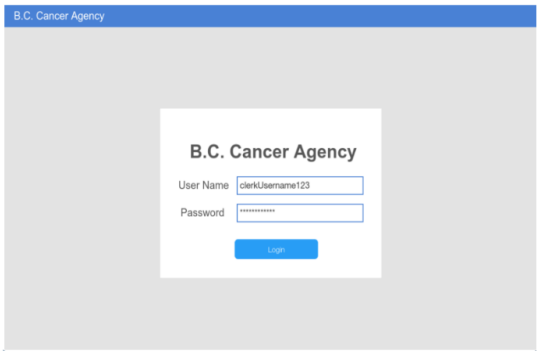
- The patient Jason Watson meets with booking clerk and makes entire schedule for his therapy treatment.



(Retrieved from http://images.wisegeek.com/woman-in-scrubs-working-at-computer-near-counter-and-man.jpg)

Step 3:

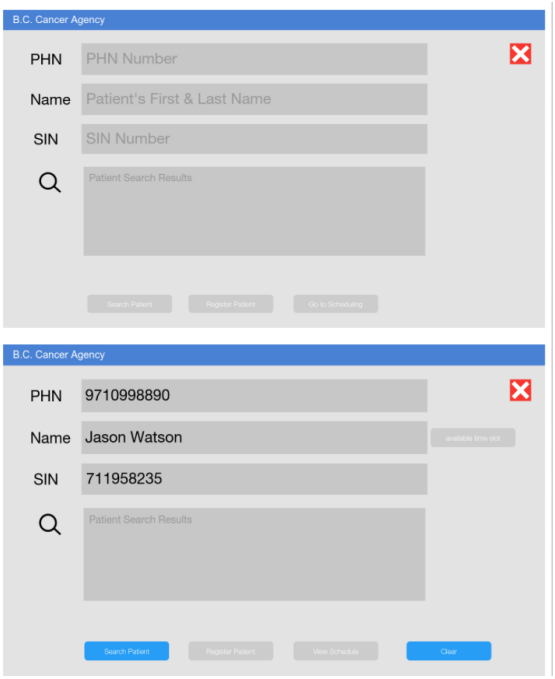




- The booking clerk logs in to the system with assigned username and password.

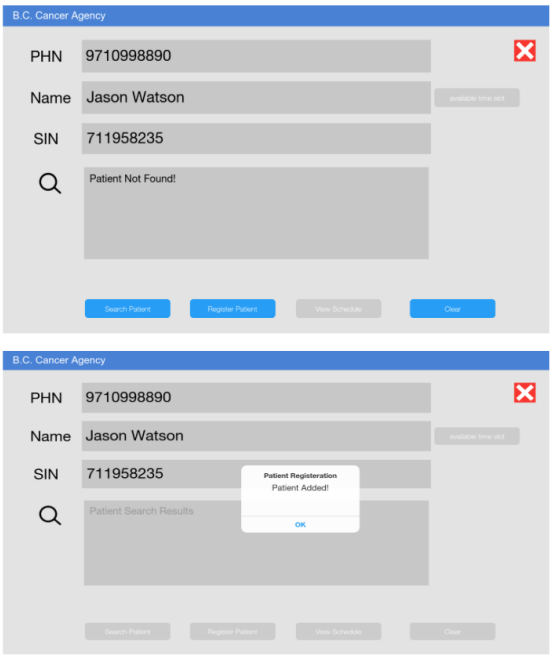
Step 4:

The booking clerk asks the patient for name, PHN number or SIN. Jason Watson provides the information and then, the booking clerk searches in the system to check whether the patient is already in the system.



Step 5:

The system shows the patient Jason Watson is not in the system. The booking clerk clicks on the “Register Patient” button. A pop-up box shows on the screen and informs the clerk that the patient is now registered in the system. The booking clerk clicks OK button.



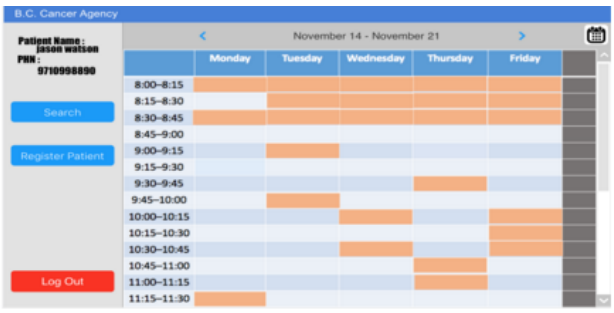
Step 6:

The booking clerk clicks the “available time slot” button, the page switches to a patient view, with the specific patient name and available time slots. Jason tells the clerk the preferred time slots.

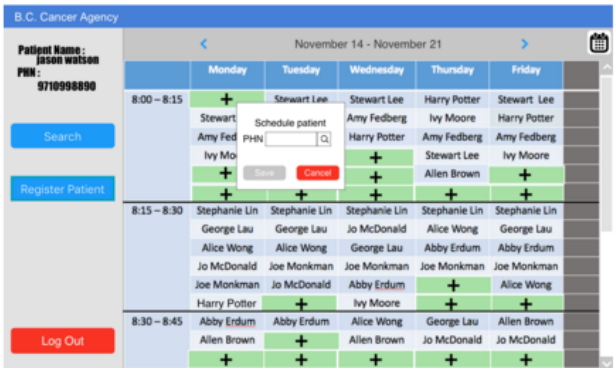
Step 7:

Jason Watson sees the orange colored slots which means there’s at least one machine left as empty time slots and chooses the time spots which are available for him.

--------> patient’s screen

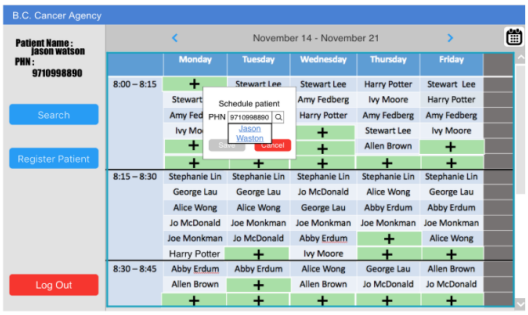


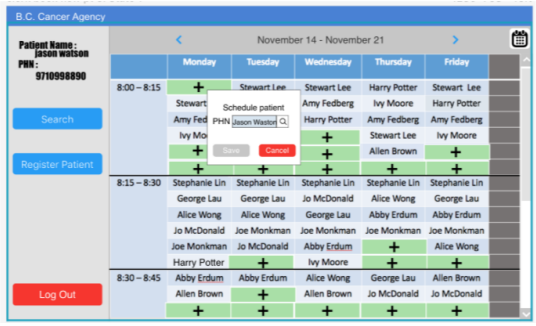
--------> clerk’s screen



Step 8:

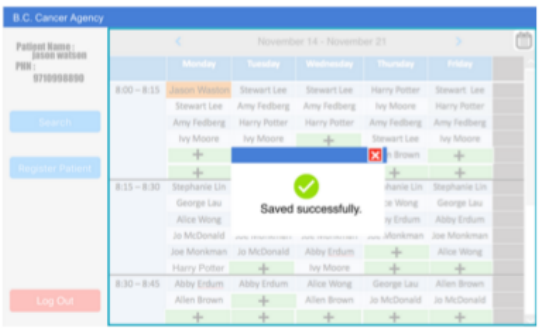
The booking clerk clicks the empty spots which is available for Jason Watson. The booking clerk enters Jason's PHN and clicks his name.

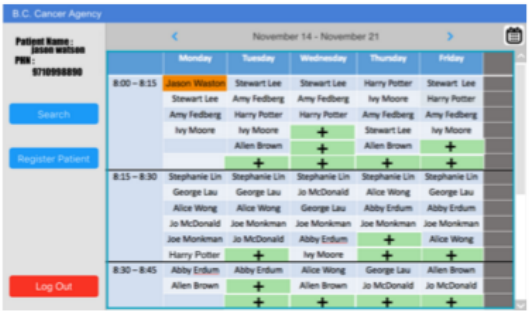




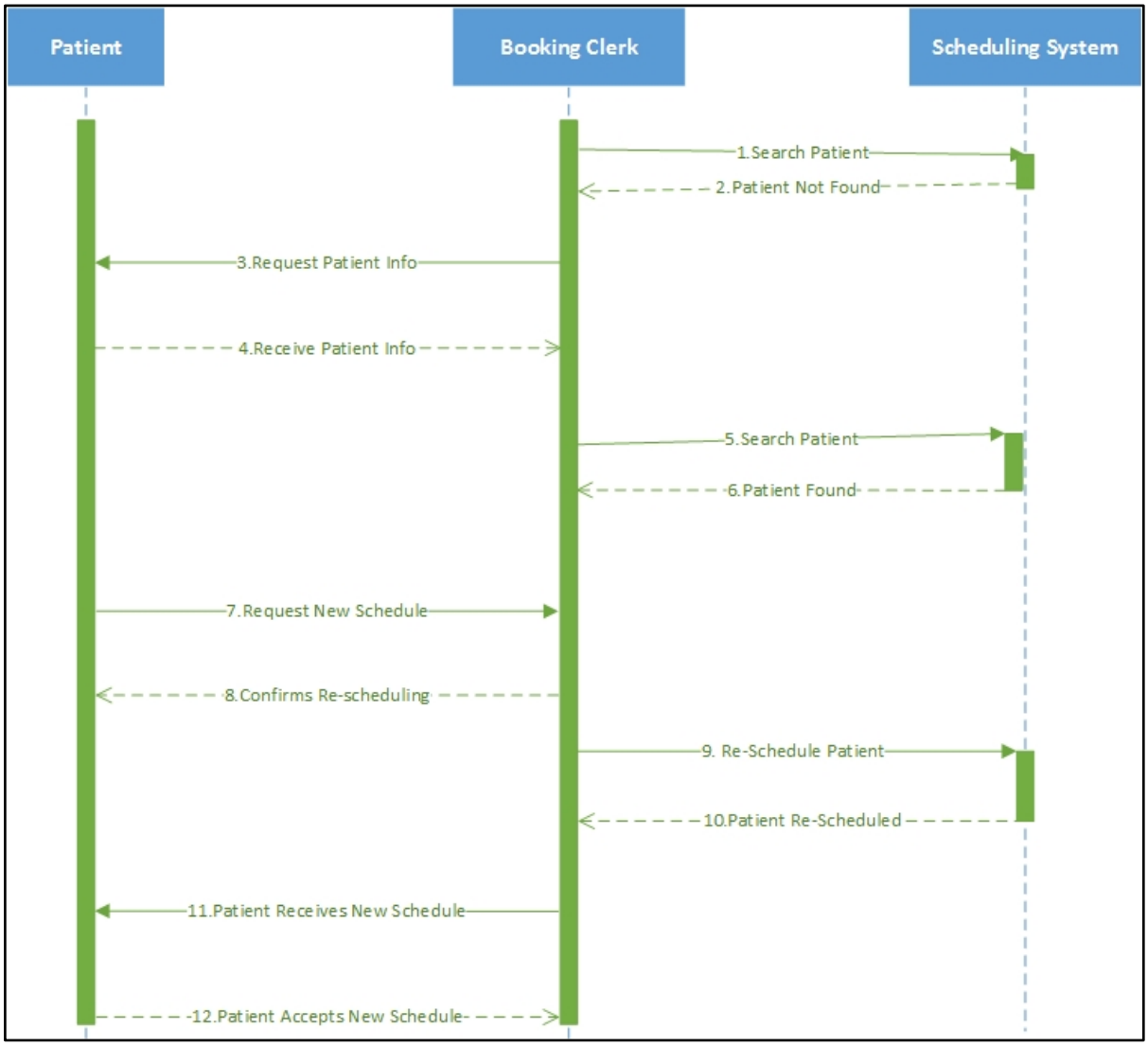
Step 9:

The booking clerk clicks "save" button and a pop-up box shows "saved successfully" appears on the screen. The system has been updated with Jason's name in the time slot. After Jason books his schedule on Monday, there's no "add" button for Monday's all free time slots in order to prevent double booking. An email about all the Jason's appointments will be sent.





3.2.2 Rescheduling



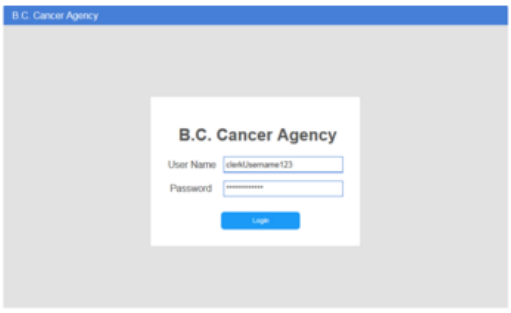
Step 1:

A patient called Harry Potter needs to reschedule his appointment on the following Monday. He walks into BCCA and requests rescheduling to booking clerk.

(Retrieved from http://images.wisegeek.com/woman-in-scrubs-working-at-computer-near-counter-and-man.jpg)

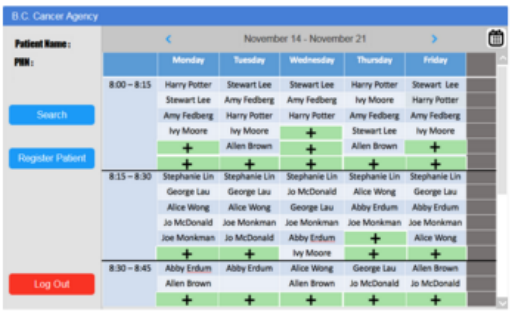
Step 2:

The clerk logs in the system with assigned username and password.



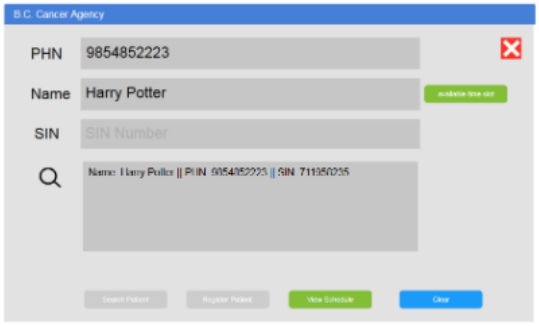
Step 3:

The clerk is brought to the main view of the system. Clerk clicks on the “Search” button.



Step 4:

After confirming he is in the system, the booking clerk clicks on “view schedule” to see highlighted schedules of this Harry Potter.

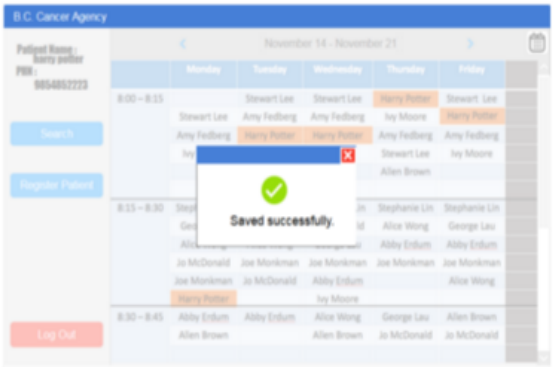


Step 5:

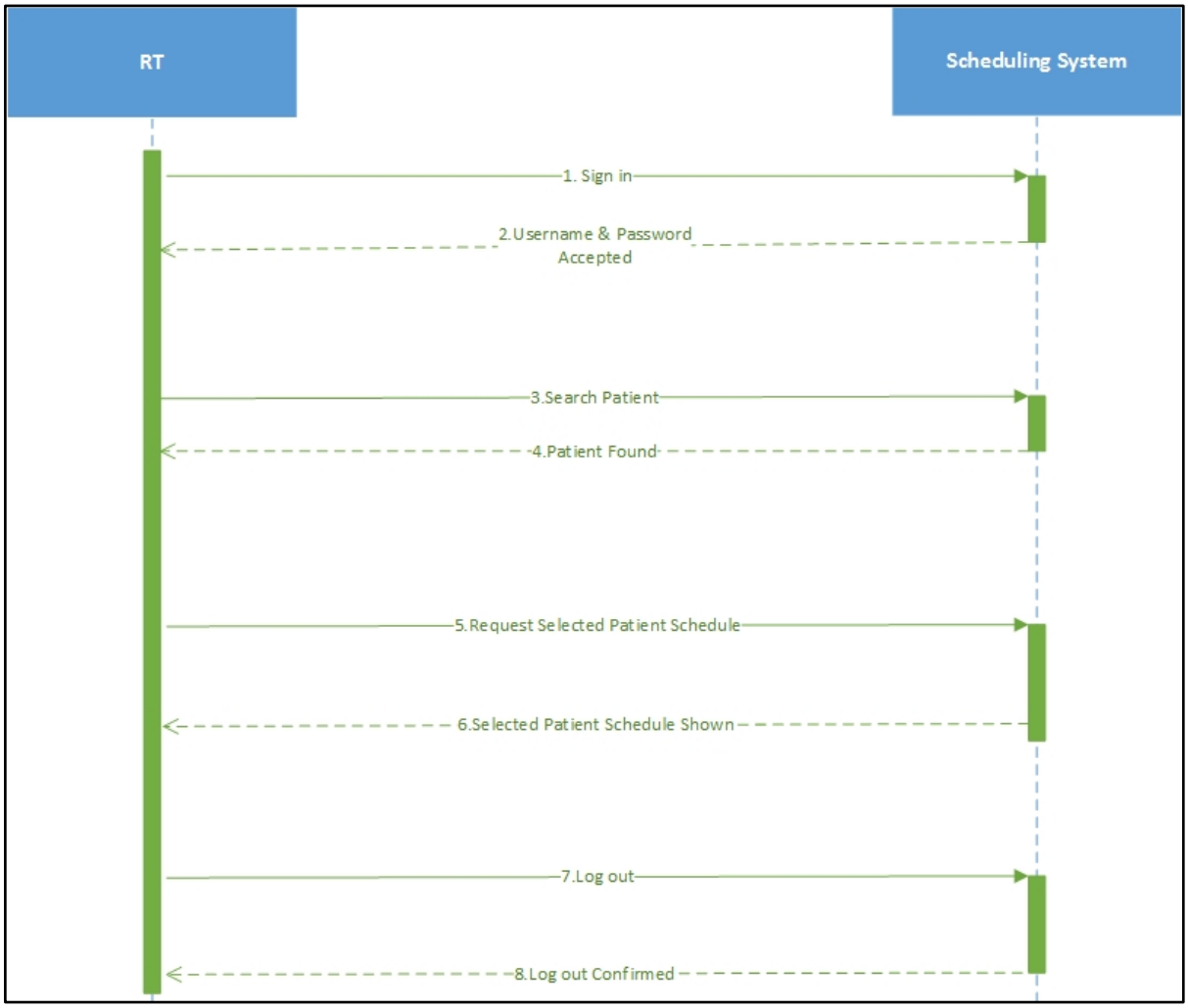
The booking clerk clicks on the “edit” button to reschedule. Only available time slots in the system shows up. The booking clerk asks Harry’s preference for existing time slot, and saves the result.

Step 6:

After saving, Harry Potter’s appointment on Monday is successfully switched to 8:15 - 8:30. An email about the change will be sent to patient automatically.



3.2.3 RT View Schedule



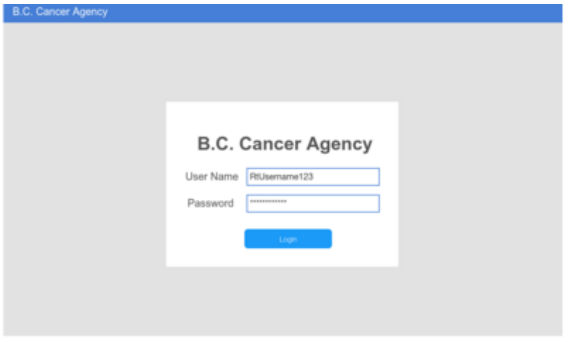
Step 1:

The patient Harry Potter comes for treatment with the RT. After they finish the treatment, RT wants to check Harry Potter's next appointment time.

retrieved from
http://www.healthitoutcomes.com/doc/the-importance-of-patient-engagement-and-technology-0001

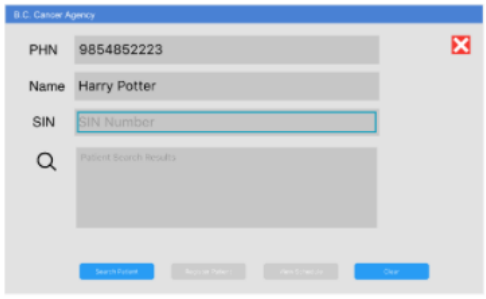
Step 2:

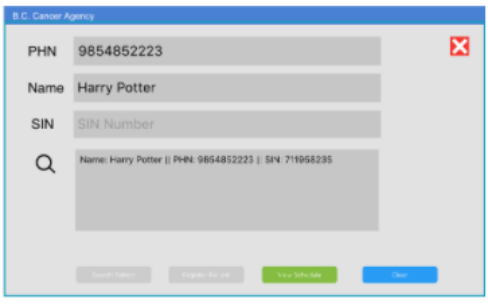
RT logs in the system and views the entire schedule for all the patients in the week.



Step 3:

The RT clicks on the “Search” button to find Harry Potter and clicks on “View Schedule” button.

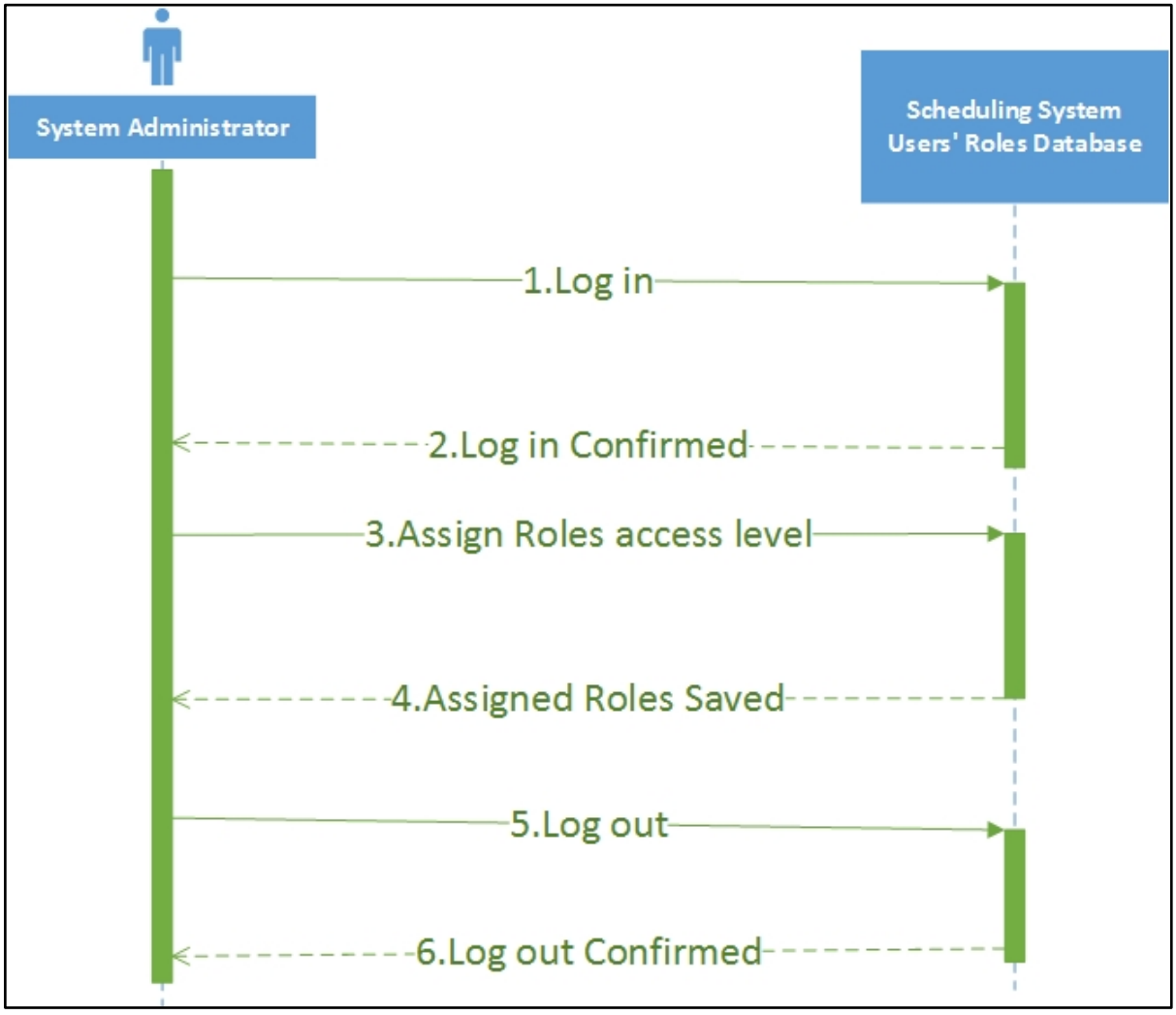




Step 4:

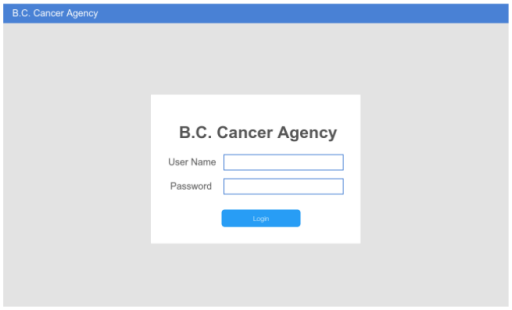
The time slots with Harry Potter's name in are highlighted. The RT refreshes the screen to check whether there's any change to the schedule by booking clerk when RT is viewing it.

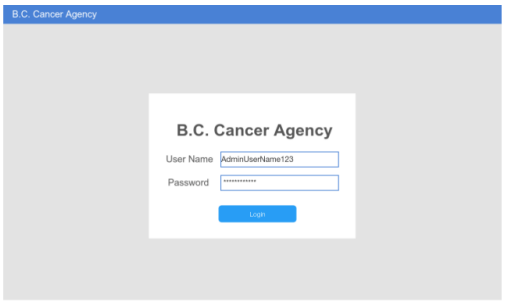
3.2.4 System Administrator Assign Role



Step 1:

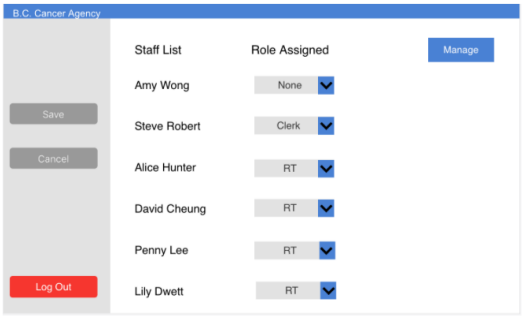
The administrator wants to add the role for a new clerk Amy Wong. The administrator logs in the system. A list of staffs shows on the screen with Amy Wong's name on it.

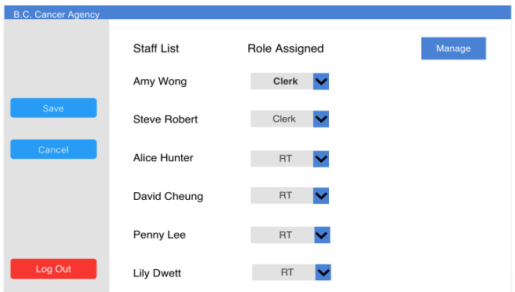




Step 2

The administrator selects "clerk" as Amy Wong's role.





4. Conclusions and Recommendations

Over the course of the semester, The Millhouse Group has grown from a group of strangers to an effective and professional team. We have learned to dissect a need for improvement into granular pieces before considering a solution. We have adapted to working with a large group and learned to delegate effectively to take full advantage of our team's manpower. Through dedication and hardwork we have learned how to craft and present a professional solution to real-world problems.

Upon reflection of the course, The Millhouse Group has curated a list of recommendations for future students. Foremostly, we recommend establishing a consistent weekly meeting time and place, to ensure that the course work does not get neglected as the semester becomes more demanding. Decisions and establishment of common concepts are very important before splitting the work, and these can be done most effectively during meetings that allow face to face communication. We also recommend keeping a dictionary of terms. This will help groups to have a common and accurate understanding of the document requirements. For each deliverable, we recommend creating a shared document that contains each task and who it is assigned to. This will impose accountability and ensure that all team members are on the same page. We found it really helpful to use a collaborative tool when working on the documents.

Overall, the biggest challenges revolved around organizing the group to meet and collaboratively work on documents. We found that using online tools to find best meeting times, and a communication tool like slack helped with keeping the team aware of what was happening. We used Google documents to collaboratively write and edit the documents, using the “comment” and revisioning features to track progress.

5. Contributions

Hamid Zamani

Hamid stimulated discussions by engaging other group members and challenging our assumptions. Hamid has also been very encouraging to others during meetings and always patiently listen to the opinions from those who are usually more quiet. Hamid was organized and worked well with the team and independently when working on assigned tasks. He produced high quality work and took suggestions and feedback from other members into consideration when doing revisions. His willingness to give others a ride after late meetings significantly reduced the stress that we could have had from having to go home late alone.

Hannah Xu

Hannah's knowledge of the current system and the client's needs helped our group discussions to be highly productive. Hannah helps keeping track of the documents' consistency from the higher perspective. She helps picking out layout inconsistencies, which help organizing the overall document much easier. Hannah works well in a group environment and she is always willing to help others finish their parts. Her positive energy throughout group meeting made the meetings a lot more fun than they could be.

Joseph Lee

Joseph came prepared to facilitate our group meetings with an agenda. He delegated tasks to ensure nothing was neglected and the worked was divided evenly. Joseph helps with structuring of the assignment and is able to manage all his assigned tasks exceptionally. Joseph took charge of the meetings, ensuring all group members felt included and had their voices heard. He encouraged discussions and provided good feedback on artifacts produced by other members of the team.

Madeline Petersen

Madeline's understanding of the course content allowed her to help her teammates meet the course expectations and create accurate diagrams. She was able to build a complete website with little or no direction providing our group with exceptionally fine looking website. Madeline has been very thorough for the technical perspectives of the project, from possible system designs, to the DFD diagrams. Her eagerness to have a fully functional solution for the centre is out of the scope of the course, but this generates energy and motivation for us to dive deeper into the problem, and come out with more understanding of the course material.

Huiying (Pennie) Wang

Pennie's dedication and hard work helped the team to complete assigned work and meet deadlines in a timely manner. Pennie works well in a team environment and produces good quality work on the parts she was assigned to do. Pennie has been very open to the feedback provided by the team and consistently tries to improve her work. She is a very responsible team member. Her attempt of ownership of the lower presentation grade became a catalyst that brought the team together.

Muhammad Zubair

Muhammad kept the team mobilized throughout the term by preparing the documents, folder structure, and notification to each one of us the next incoming deadline. His preparation made the meetings effective. He has a strong sense of being efficient and that also kept our

meeting moving from objective to objective. His in-depth understanding of the course content from previous courses allowed him to produce high-quality work and guide other team members to do the same. Muhammad's keen eye for details helped the team to find inconsistencies ahead of time and deliver high quality artifacts.

Nicole Ge

Nicole’s thoughtfulness and attention to detail helped her to identify problems and present solutions. Nicole’s personal experience and knowledge with the Vancouver Island Centre through her volunteering work has provided insight to the group on decision and information gathering. She worked extensively on the UI prototypes and performed admirably under pressure. Frequently she asked critical questions that points the group to details that led to a change in course of action.

Xianhui Chen

Xianhui was responsible for the UI and took great pride in his work. This converted to motivation and security to all of us that the UI design was handled carefully and responsibly. This was very critical as a number of us were more technical and conceptual focus. His desire for good desire eased the overall workload on each one of us. He brought important points to the team and adapted to feedback to create a high-quality storyboard.

6. Appendices

6.1 Glossary of Terms

PHSA - Provincial Health Service Agency

Provincial Health Service Agency is an authority to ensure that BC residents have access to a coordinated provincial network of high-quality specialized health-care services.

RT - Radiation Therapist

Radiation therapist is a role in the treatment process who provide treatment involving the use of high-energy radiation.

EHR - Electronic Health Record

Electronic Health Record is a digital version of a patient’s paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users.

BCCA - BC Cancer Agency

The organization that provides a comprehensive provincial program of cancer control and health care delivery in British Columbia. Research ranges from basic molecular and genetic studies to epidemiological and clinical research on cancer prevention, early diagnosis, molecular characteristics of the cancer process and new treatments for cancer using drugs and radiotherapy.

OSSIP - Oncological Scheduling System Improvement Project

The name of the project that tackles the problems outlined in the client's RFP.

6.2 References

1. B.C. Cancer Agency - Radiation Therapy, Streamlining the process of patient scheduling, Request for Proposal V4.0, September 24, 2016.

2. Notes taken during interview with the clients group (Group 7), September 29, 2016, Available on analyst website: <http://csc375group09.wixsite.com/millhousegroupinc/client-notes>.

3. Email Correspondence with Group 7, Extra Questions and Answer, October 1, 2016.

4. External correspondence with the B.C. Cancer Agency's Health Informatics Director, October 25, 2016.

5. Notes taken during the second meeting with client group. Available on analyst website: <http://csc375group09.wixsite.com/millhousegroupinc/client-notes>.

6.3 Issues List

Clerk's Workload

The clerk's workload is not clarified, so we cannot make sure if it is reasonable to assign all the rescheduling tasks to clerks.

Office Relocation

The communication between RTs and clerks is significant, because the RTs would like to inform clerks about the patient's rescheduling information, frequently. The location between RTs and clerks is not clear, which leads to lower possibility of the face-to-face communication.

Appointment Time Card Drop Off

The appointment time card usage is unclear. We know that the patient is given the time card during the time that clerk makes the appointments, and the patient drops them off at the radiation station during their first appointment. After that the appointment time cards are discarded. It seems that the appointment card are useless but we are not sure.

6.4 Interview Notes

6.4.1 First Client Meeting Notes

The first meeting with the client group (Group 7) took place during class time on September 29th 2016. The client interview was conducted by Hamid and Muhammad. From the Client's team the following members were present: Alyssa Koniuk, Cindy Li, Billy Li, Dian Zhang, Judy Yu and Leon Li.

Question	Response
Please verify and prioritize the current objectives are: A. Allow therapist to have time with patient B. Reduce therapist scheduling workload C. Result in high quality/ comprehensive care	Reducing therapist scheduling workload is the highest priority. The other two objectives will be fulfilled if b is resolved.
How late, or late in time of day, does the patient have to be to not allow for same day rescheduling. (I.E if the patient is 3 hours late, are they no longer able to see the radiologist that day?)	Depends, but unsure. The team will try to see the patient regardless of how late they come. The closing time is 4:30 so must be before then.
What is the average time for patients being late?	5-10 minutes usually
Can you describe your patients demographic (Age ranges)	Adults only (19+). Most patients are retired and in their 60s. Older patients usually have a support member who comes with them.
How do patients get to the clinic? (Bus, car) Does the clinic provide transportation?	Most patients have their own transportation. The clinic runs 2 volunteer shuttles. Patients have to arrange the pickups. About 10% of patients rely on this service.
Do most patients have access to smartphones?	Most people will have smartphones, but not everyone. The ones that don't will probably have a support member with them that has a smartphone.
Has there been survey data about reasons for patient's late appointment? If yes, what is it?	Unforeseen circumstances: Emergency, Traffic.
Can you describe the "appointment card"? What do they look like, are they issued daily, what information is on it? Are they the size of business cards?	Paper, just has patient's name and appointment time.
How is the 10-15min time distributed for different process during the appointment?	5 minutes for delivering the treatment. Rest talking to the patient and getting them ready for the treatment and talking to the patient after the treatment.

Other Information Gathered During the Meeting:

- 5-7 weeks of schedule is booked at a time by the clerk, but the patient only gets the time of their next appointment, daily.
- The group likes the idea of improving the booking schedule to take patient preferences into account when booking the appointment.
- Another clinic has preference system, and it has improved the scheduling problem.
- Biggest problem is Double Scheduling.
- Client group prefers Restricting therapists' access to booking system.
- The seating area for patients is undesirable. They see therapists walking around, and can interrupt their schedule by asking them questions. Prefer a separate seating area where they don't see therapists until it's their turn.
- A better scheduling system should be able to hold people who double book accountable.

6.4.2 Second Client Meeting Notes

The second meeting with the client group (Group 7) took place during class time on November 14th 2016. The client interview was conducted by Xian and Hannah. From the Client's team, the following members were present: Alyssa Koniuk, Linden Querengesser, Cindy Li, Billy Li, Dian Zhang, Judy Yu and Leon Li.

1. The client suggested that patients should have ability to view all free times slots.

2. We need to consider that the centre has five machines, and as such can accommodate up to five appointments at one time.(We later verified through RFP that the centre has six machines, and six appointments at one time.)
3. The client suggested that the patient should have the option to reschedule via email contact with the booking clerk, or some other option if the patient is not able to meet with the booking clerk in person.

4. The client would like clarification on how we plan to mitigate security issues. They would like to see more concrete artifacts of our implementation and a clear explanation of how our process improves the current system.

5. The client clarified that radiation therapists are not authorized to change a patient's treatment plan.

6. The client would like to know how we handle the case when a patient is late for or absent from an appointment.

7. The client clarified that there is no need for a patient to be assigned to a specific machine, they only require that there are not more patients scheduled than there are machines (i.e. six).

6.5 Revision History

Based on client meeting on November 14th, 2016, we have made a number of changes to the design of the solution to better represent the client's feedback and address the client's concern.

6.5.1 Solution Modification

1. In correspondence to point 1 of the second meeting notes, we extended our design of the interface to include a patient view option that would show the free slots to the patient during scheduling.

2. In correspondence to point 2 and 7 of the second meeting notes, we modified our UI design to allow the clerk to see all 6 patients scheduled for each time slot, as well as added highlighting function to make the free slots more visible.

3. In correspondence to point 3 and 4 of the second meeting notes, we have eliminated the ability for patient to view their schedule through any patient portal, or other online tools, to ensure patient data remain secure. This also allow us to focus on providing a more concrete, precise solution to our scope stated in the project charter. Patient can only view their schedule when a booking clerk displays it on screen for the patient.

4. In correspondence to point 5 of the second meeting notes, we have eliminated Use Case 3.2.2.2 on the SRS document as RT cannot initiate request for rescheduling.

5. In correspondence to point 6 of the second meeting notes, our system is capable of handling the concern through the flexibility of the system and the decision made by the professional staff at the centre, i.e. RT and booking clerk.

6.5.2 Changes to SRS

1. Removed all clauses, and sections of diagrams, involving allowing patient to login to the system.
    a. Modified Use case Relations 3.1
    b. Modified Use Case 3.2.3

2. Removed all clauses, and sections of diagrams, involving allowing RT to initiate rescheduling.
    a. Modified Use case Relations 3.1
    b. Modified Use Case 3.2.2
    c. Eliminated Use Case 3.2.2.2
    d. Modified Use Case 3.2.5
    e. Removed communication through notes 6.4.3

3. Redesigned DFD 0 and DFD 1 with full detail that accurately represent the updated design.
    a. Modified section 2.1 Product Perspective
    b. Modified section 2.2 Product Features

4. Consolidated multiple sections of the non-functional requirements and other requirements into one single non-functional requirement section.

5. Replaced User Interface Requirement section with Storyboard to better represent the purpose and use of the solution.

6. Added traceability to each of the functional requirements.