MCMASTER UNIVERSITY

CAS 4ZP6 CAPSTONE PROJECT 2013/2014

PORTER SIMULATION

Requirements Documentation Revision 1

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1 Revision History

Revision #	Author	Date	Comment
1	Vitaliy Kondratiev, Nathan Johrendt, Tyler Lyn, Mark Gammie	October 28	Info Missing
2	Vitaliy Kondratiev, Nathan Johrendt, Tyler Lyn, Mark Gammie	October 29	Info Missing
3	Vitaliy Kondratiev, Nathan Johrendt, Tyler Lyn, Mark Gammie	October 29	Info Missing
4	Vitaliy Kondratiev, Nathan Johrendt, Tyler Lyn, Mark Gammie	October 30	Info Missing
5	Nathan Johrendt	January 13	Info Update
6	Vitaliy Kondratiev	February 2	Update and Corrections
7	Vitaliy Kondratiev	April 11	Update and Corrections
8	Nathan Johrendt	April 15	Update and Corrections

2 Purpose of the Project

2.1 Template

This requirements document is based on the Volere template, formatted using LaTex.

2.2 Background

Hamilton Health Sciences have become aware of several inefficiencies in their porter services at their Juravinski Hospital location. Porter services, in this context, are defined as the movement of hospital equipment and patient transfers from one area to another. Porters are a key piece of overall patient experience and satisfaction; the flow of day to day operations in a hospital depends on their efficiency. Some of the particular issues they identified relate to porters complying with operational policies, as well as finding ways to better handle spikes in work volume on busy days. Hamilton Health Sciences have gathered substantial operational data on porter activity, but are lacking the tools to interpret it.

2.3 Goals

Our goal is to provide HHS with the tools to simulate their porter services so that they can test their own solutions, methods and make calculated decisions based on the results.

3 The Stakeholders-Clients-Customers

Hamilton Health Sciences (HHS) operational management team is the main stakeholder/client/customer for this project.
Names and position are:
Corey Stark (CSS - Sodexo Systems and Performance Manager)
Kym Kempf (Business and Program Manager - Corporate Services)
David DiSimoni (Site Manager - Customer Support Services)
Anita Lamond (Director - Corporate Services)
Steve Metham (Manager - Quality)

Mohammad Majedi (Quality Specialist)
Talha Hussain (Quality Specialist)

3.1 Other Stakeholders

Patients and Hospital Staff are the secondary stakeholders for this project. Any benefits that arise from the successful completion of this project will affect these stakeholders.

3.2 Hands on Users

Operational Management Staff will be the primary hands on users of the finished product. Names and positions are:
Talha Hussain (Quality Specialist)
Corey Stark (CSS - Sodexo Systems and Performance Manager)

4 Mandated Constraints

4.1 Solution Constraints

Given that this software is an imitation of real-world events at an HHS hospital, and that real historical data is used by the simulation, the results produced must be accurate and consistent.

4.2 Schedule Constraints

Simulation Software must be completed and requirements met by the end of April 2014.

5 Naming Conventions and Technology

5.1 Definitions of All Terms, Including Acronyms, Used by Stakeholders involved in the Project

(a) **HHS:** Hamilton Health Sciences

(b) **IVR:** Interactive Voice Request - phone system for requesting porter services

(c) **Porter:** Staff member responsible for movement of equipment such as beds, wheelchairs, other medical instruments and patient transfers from one location to another

  (i) **Off-System Porter:** Porters that follow a strict scheduled and a predetermined set of activities

  (ii) **On-System Porter:** Porters that respond to ad-hoc and pre-booked requests

(d) **Dispatching System:** An automated software system responsible for receiving and assigning requests to Porters

(e) **Standard Equipment:** Non-powered stretchers, beds, wheelchairs

(f) **Priority of Requests:** Requests placed by Hospital Staff can be prioritized on a scale from 0 - 9 with 0 being the most urgent. Porters can place an Assist Call that has a higher priority than 0.

(g) **Event State:** A state of the porter service event as dictated by the Dispatching System

  (i) **Pending:** Job has been placed in the system queue

  (ii) **Dispatched:** Job has been matched to an available porter

  (iii) **In-Progress:** Job is being executed by the porter

  (iv) **Complete:** Job has been completed

  (v) **Dispatch Delay:** Porter states that he/she is delayed during a Dispatched event

  (vi) **In-Progress Delay:** Porter states that he/she is delayed during a In-Progress

(h) **Transaction Time:** the time from Event State (Pending) to Event State (Complete)

(i) **Proactive Page:** A porter pages the request location to inform the requester of his/her impending arrival

(j) **Age of Request:** How long a job has been pending in the dispatch system do not receive any calls from the dispatch system

(k) **CSV file:** Comma Separated Values file, stores tabular data in plain text form.

(l) **GUI:** Graphical User Interface - interaction with electronic devices through graphical icons and visual indicators

(m) **Dashboard:** Visualization of the data formatted to serve a purpose in critical decision making

6 Relevant Facts and Assumptions

6.1 Relevant Facts

(a) HHS will provide the project team with available non critical data

(b) HHS currently uses a Dispatching System to route its porters to desired locations

(c) On certain route segments, two porters are required to transport the patient

(d) HHS will provide personnel and hours for testing of the application

(e) HHS will be available to answer any queries as well as give feedback on the ongoing project milestones

6.2 Business Rules

(a) Each request has six event states (Pending, Dispatch, In-Progress, Complete, Dispatch Delay, In-Progress Delay)

(b) Requests are prioritized on a 0 - 9 scale

(c) There are two types of porters (On-System, Off-System)

(d) Every completed event has an associated transaction time, unless cancelled

(e) Dispatch System determines the assignment of requests by using these parameters (Priority, Proximity, Pre-Scheduled Appointment Use, Age of Request)

(f) Industry standard for patient transport transaction time is 30 minutes

(g) Porter service requests can be made using any hospital computer or phone (IVR)

(h) Porters can be "zoned" into system item requests by the dispatching system

6.3 Assumptions

(a) Every porter is equally capable of performing every task as every other porter

(b) Some of the porters use proactive paging

(c) The majority of service requests are made through hospital computers

(d) Data is 100 percent accurate but may not represent the each situation exactly, as porters do not always follow operational policies

7 Scope of the Work

7.1 Current Situation

Hamilton Health Sciences are experiencing inefficiencies when synchronizing their porter services throughout each of their locations and are lacking the tools to solve this problem. The biggest problem comes from the lack of compliance and coordination of the many separate entities of the hospital body. The porters are currently being scheduled by an online dispatching system, which also tracks their progress. Although the system is very efficient at how it completes it's dispatching, it has no insight or analysis capabilities to review past recorded data.

7.2 Context of the Work

HHS requires a tool to support their daily operations and decision making. The tool is to provide the stakeholders with the data and insight to complete their objectives.

7.3 Business Use Case

The simulation tool will be used by members of the operational management staff to trial new scheduling, compliance and overflow handling techniques in a no cost environment. Any results can then be used to reinforce arguments for making changes around the hospital.

8 Scope of the Product

8.1 Product Boundary

(a) The simulation tool will not model the 100% full hospital environment

(b) The simulation will only consider the On-System Porters

(c) Not all porter activities will be simulated. Simulation will concentrate on the 6 event states tracked by the dispatching system (Pending, Dispatch, In-Progress, Complete, Dispatch Delay, In-Progress Delay).

(d) Simulation will be limited to seven days of modelling

(e) Main focus of output analysis will be porter wait times, transaction time, numbers of completed and cancelled jobs

8.2 Product Use Cases

(a) Operational Manager has a new initiative they want to implement into everyday operation. He/She uses the simulation by changing the adjustable variables with his/her own values and executing it. He/She analyses the output of the simulation and determines if the new initiative should be implemented.

(b) Operational Manager has to determine how to modify the schedule for the porter service staff. He/She uses the simulation by changing the adjustable variables with his/her own values, importing a test version of the schedule and executing it. He/She uses the output to design/refine the new schedule.

(c) Operational Manager wants to increase operational compliance of some particular policy. He/She uses the simulation by changing the adjustable variables related to a certain level of compliance with his/her own values and executing it. Once positive results have been verified he/she shows the results to all the parties involved in the compliance policy to effectively increase compliance.

(d) Operational Manager wants to experiment with theoretical scenarios. He/She uses the simulation by changing the adjustable variables with his/her own values and executing it. He/She analyses the output data and either creates a new initiative based on result or archives the data.

9 Functional Requirements

9.1 Functional Requirements

1. **Description:** Simulation must take a file as input. This file contains data logs from the dispatching system concerning past porter events
   Rationale: Operational Management staff has indicated that using a file as input is the preferred method
   Fit Criterion: Simulation must accept the file without error 100% of the time

2. **Description:** A series of simulation variables that affect the simulation output must be editable by the user
   Rationale: Operational Management staff must be able to modify the simulation
   Fit Criterion: Simulation must include the following variables
   (i) Simulation Duration
   (ii) Porter Wait Times
   (iii) Job Flow
   (iv) Start Day
   (v) Appointment Factor
   (vi) Automatic Job Priority Values
   (vii) Weighted Job List
   (viii) Random Seed

3. **Description:** Simulation Tool must be able to run a pre-designed model incorporating the given input variables and terminate correctly
   Rationale: Operational Staff must be able to run the simulation
   Fit Criterion: The simulation will terminate to produce output results

4. **Description** The output of the simulation must be relevant data
   Rationale: Data must be relevant for the Operational Management's business process
   Fit Criterion: The output must be 100% relevant in the scope of the problem

5. **Description** The output of the simulation must contain a visual dashboard
   Rationale: The data needs to be aggregated and presented to the user
   Fit Criterion: The output dashboard must be have 0% errors

6. **Description** The simulation must have a GUI
   Rationale: The user must be able to use the simulation tool intuitively
   Fit Criterion: The user will know how to use the tool with minimal training

10 Look and Feel Requirements

10.1 Appearance Requirements

1. The simulation is required to contain output graphs in an excel dashboard. The specific metrics and design of each graph have been refined by stakeholders and are open to modification at their preference.

10.2 Style Requirements

1. Software must contain elements of basic human/computer interface design as expected by a casual user of personal computers and popular software/operating systems.

11 Usability and Humanity Requirements

11.1 Ease of Use Requirements

1. **Content:** Software must have a GUI
   Motivation: Users of this software are not assumed to be advanced computer users. Users are not expected to know how to use command line or similar advanced interfaces.
   Fit Criterion: All simulation variables of the software are accessible through a GUI
   Considerations: This Ease of Use requirement considers all of the Product Use Cases

2. **Content:** The GUI must have checks in place to prevent the user from using invalid inputs
   Motivation: All inputs must comply with the arguments of the execution program
   Fit Criterion: GUI restricts the user to a predetermined set of inputs
   Considerations: This Ease of Use requirement considers all of the Product Use Cases

3. **Content:** Software must be easy to navigate
   Motivation: Users should be able to easily move between different screens
   Fit Criterion: Each screen is linked to each other with an easily accessible interface feature
   Considerations: This Ease of Use requirement considers all of the Product Use Cases

4. **Content:** User must clearly understand all the functions with minimal training
   Motivation: User should be able to pick up the functionality based on the context material
   Fit Criterion: All elements of GUI will be easy to understand under context of the usability
   Consideration: This Ease of Use requirement considers all of the Product Use Cases

11.2 Learning Requirements

1. **Content:** Software must be easy to learn with some hands-on training and documentation by a casual user of personal computers
   Motivation: Users are not required to have any knowledge of simulation software to operate the product
   Fit Criterion: Users will be able to use the software after two or three training sessions of less than sixty minutes
   Consideration: This Learning requirement considers all of the Product Use Cases

11.3 Understandability and Politeness Requirements

1. **Content:** Users should be able to quickly understand how the software will benefit them in their business process
   Motivation: Users are not expected to understand aspects that do not directly relate to their purpose
   Fit Criterion: All of the simulated aspects will be related to the user's business problems unless the case considered is far out of the problem scope stated in these requirements
   Consideration: This Understandability requirement considers all of the Product Use Cases

12 Performance Requirements

12.1 Speed and Latency Requirements

1. **Content:** Software must be able to complete the simulation as set up by the user within a reasonable time
   Motivation: As per request by the stakeholders
   Fit Criterion: A single simulation should not take more than five minutes to complete
   Considerations: This speed requirement considers all of the Product Use Cases

12.2 Precision or Accuracy Requirements

1. **Content:** Simulation must be 100% precise to the data source being sampled, even if the supplied data is not 100% precise
   Motivation: Software cannot ensure that every data entry recorded is valid, but can filter out issues through parsing

Fit Criterion: Only valid jobs with complete data entries will be processed by the simulation
Considerations: This precision requirement considers all of the Product Use Cases

12.3 Reliability and Availability Requirements

1. **Content:** Software must output relevant data to the user without error
   Motivation: Users should expect the output to be useful in their business process
   Fit Criterion: Output will be in correct format as per Functional Requirement # 4
   Considerations: This reliability requirement considers all of the Product Use Cases

2. **Content:** Software must be available to the user at all times except when a simulation is running
   Motivation: Users should be able to access and use the software at any point in time
   Fit Criterion: Software is available to use 100% of the time other than when the simulation is executing
   Considerations: This availability requirement considers all of the Product Use Cases

12.4 Robustness or Fault-Tolerance Requirements

1. **Content:** Software must not crash during the simulation process if the simulation is running within the scope of the project
   Motivation: Users should expect most simulations to complete without error
   Fit Criterion: The simulation should not fail 99% of the time
   Considerations: This robustness requirement considers all of the Product Use Cases

2. **Content:** In the event of failure the user will be made aware the failure event and reason
   Motivation: Users should expect feedback on failure
   Fit Criterion: Simulation gives feedback on failure 100% of the time unless a failure event has crashed the software as a whole
   Considerations: This robustness requirement considers all of the Product Use Cases

12.5 Capacity Requirements

1. **Content:** Software must be capable of simulating a large number of porters
   Motivation: Users should expect to schedule as many porters as they would like to test theories, any more than
   Fit Criterion: Users are not met with any bounds, beyond system memory limits, when specifying porter numbers
   Considerations: This reliability requirement considers all of the Product Use Cases

2. **Content:** Software must be able to read very large quantities of input data
   Motivation: Users should not be bounded by how much input data can be fed into the simulation
   Fit Criterion: Users are not met with any bounds when specifying input data, beyond system memory limits
   Considerations: This reliability requirement considers all of the Product Use Cases

13 Operational and Environmental Requirements

13.1 Expected Physical Environment

Software on a computer station or terminal in an HHS employee's office.

13.2 Release Requirements

Final version of simulation software should be made available by April 20th 2014.

14 Maintainability and Support Requirements

14.1 Maintenance Requirements

1. The Project Team will provide maintenance to the software up to the projected project finish date (April 29th 2014)

14.2 Supportability Requirements

1. The Project Team will provide support for the software up to the projected project finish date (April 29th 2014)

14.3 Adaptability Requirements

1. The simulation is being modelled after existing data provided by stakeholders, with the possibility of modifying the software later to accommodate new hospital locations or additional

15 Security Requirements

15.1 Access Requirements

1. Software will be accessible to any user who has access to the system the Porter Simulation is stored on

15.2 Privacy Requirements

1. Confidentiality waivers are required for project members to participate in on-site visits to HHS locations during simulation development.

16 Off-the-Shelf Solutions

16.1 Ready-Made Products

Visual8 produces visual process modelling simulations and have worked with HHS on past projects.

16.2 Reusable Components

Simulation model should be adaptable to other HHS locations utilizing on-system porter monitoring and logging services.

16.3 Products That Can Be Copied

None found that are applicable and freely available to duplicate.

17 New Problems

17.1 Effects on the Current Environment

Only when the product simulates positive beneficial results consistently will stakeholders consider implementing modifications to the existing HHS environment.

17.2 Effects on the Installed Systems

The product will have 0% effect on installed systems or other software.

17.3 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

The simulation software should only be executed on systems that meet the previously stated Performance Requirements.

17.4 Follow-Up Problems

Should major changes in HHS operational protocol occur in the future, aspects of the simulation will likely require modification to continue producing accurate results.

18 Tasks

18.1 Stakeholder Milestones

(a) **Deliver first demo to HHS representatives** - due by February 4th, 2014

(b) **Deliver second demo of the product to HHS staff** - due by March 21st, 2014

(c) **Lead usability tests with users of the product** - due by March 28th, 2014

(d) **Provide final project report + design documentation + user manual + Final Demonstration** - due by April 16th, 2014

(e) **Install final version of software on department computers** - due by April 16th, 2014

19 Risks

(a) Simulation gives false data leading to wrong decisions by the Operational Management Team

(b) Simulation is used as not intended/ out of scope leading to wrong decisions by the Operational Management Team

(c) Simulation does not help with decision making process of the Operational Management Team

20 Costs

There are currently no financial costs associated with this project.

21 User Documentation and Training

21.1 User Documentation Requirements

The users of this software will be provided with detailed documentation outlining the framework, functionality, and usability

21.2 Training Requirements

The users will be provided with hands-on training and training material by the project team.

22 Open Issues

1. Output graphs need further refinement for consistency
2. Further validation and verification of simulated results would provide additional opportunity for refinement

23 WAITING ROOM

1. Further development into a flexible web application
2. Remove dependency on excel by graphing through python libraries

24 LIST OF TABLES

(a) Revision History Table - Section 1 contains a table detailing the revision history of the document.