



FURNITURE WAREHOUSE SIMULATION SOFTWARE

User Requirements Specification

Version 2 - 22/03/2018

Members: Denisa Apostol
Amira Cruceru
Emese Engedi
Iana Florea
Bogdan Pavel
Leonard Tudorache

Tutor: Chung Kuah

Table of Contents

Introduction	3
Requirements	4
2.1 Functional	5
2.2 Non-functional	6
Use cases	6
Setup warehouse specification	6
Set orders for simulation	7
Set number of forklifts to be added	8
Set number of forklifts to be removed	8
Remove an order	9
Add an order	9
Change the Map Settings	10
Visualize list of orders	10

Introduction

1.1 Purpose

The purpose of this document is to give an overview of the functional and non-functional requirements of our product “Furniture Warehouse Simulation Software”. Also, use-cases will be present in this report to show to the readers how the software will work in different situations.

1.2 Product overview

The goal of this project is to deliver a warehouse simulation software. Our prototype warehouse will have significant amount of incoming product and two ways of outbound. Automatic forklifts will be present in the warehouse for a better and cheaper way of working. They will be able to pick up new articles that are brought to the outbound and deliver the orders to the customers in the inbound area. The software will read simulation data stream from text files that contain information about the stock and the number of customers that are currently on the website. A 2D model of the warehouse will be available on the screen, showing the objects and the outline of the premises. Also, it will be able to animate the 2D model according to the simulation data stream.

1.3 Scope

1.4 Users

The actors of this system are:

- The customers who interact with the system through the **customer application** which is used to place orders and show the process of delivering on a graphic interface.
- The truck drivers who make use of the **truck delivery application** by inputting a code or selecting the desired products to be brought in the trucks.
- The logistic engineer who will interact with the **graphic simulation application**, which is the main and most complex application.

Requirements

We use the MoSCoW method to prioritize the requirements of the deliverables. This analysis let us use the categories '*Must have*', '*Should have*', '*Could have*' and '*Won't have but would like*'.

Requirement	MOSCOW category
Provides a 2D representation of the warehouse	Must have Iteration 1
Can read order shipment details from a text file (TimeStamp, furniture ID, quantity, inbound/outbound)	Must have Iteration 2
Checks for the length of the product and sends the appropriate forklift picks up the product	Could have
The warehouse has several areas: <ul style="list-style-type: none">- The inbound area, where trucks leave products from outside the warehouse that needs to be arranged in the shelves of the warehouse by the forklifts- The outbound area where the forklifts leave the products from an order- Several sections with products	Should have Iteration 1
Each forklift is assigned to a section	Should have
A forklift only moves within the section that it belongs to, the inbound and outbound areas	Should have
User can set warehouse specification such as: <ul style="list-style-type: none">- Total number of racks- Number of racks per line- Available AVGs- Size of the warehouse (height, weight)	Must have Iteration 2
Before starting the simulation, the user can perform several actions: <ul style="list-style-type: none">- Set the orders in the settings tab (By uploading a file or setting it manually)- Modify the warehouse specifications	Must have

<ul style="list-style-type: none"> - Customize the warehouse map (arrange racks, configure inbound or outbound area) - Arrange products or the racks 	Must have
<p>During simulation, the user can perform several actions:</p> <ul style="list-style-type: none"> - Add or remove orders - Add or remove forklifts 	Must have
During simulation, the changes in the quantity of the already delivered orders are visible	Should have
After the simulation is stopped, it generates an overview page that consists charts and graphs related to data such as average time per order, number of orders, consumed energy etc.	Must have
Compares the previous saved overview with the current one	Could have
The settings of the simulation and the result of it can be stored in a file	Should have

Functional and non-functional requirements

2.1 Functional

1. Provides controls to set the warehouse parameters
2. The incoming and outgoing orders with timestamps and order details (item, quantity) can be set or loaded from a text file
3. Renders a 2D representation of the warehouse according to previous settings
4. The warehouse settings can be stored to a file.
5. The warehouse has some specifications that are set by the users: size of the warehouse, total number of racks, number of racks per line and available AVGs.
6. In the settings tab, the user customizes the map of the warehouse, visualizes the orders list and customizes the dummy data file.
7. Before starting the simulation, the user is able to modify the settings table, warehouse specifications, warehouse map and arrange products on the racks.
8. During the simulation, the user is able to cancel, add or remove orders and forklifts.
9. A forklift only moves within the section that it belongs to, the inbound and outbound areas
10. After the simulation is stopped, it generates an overview file that can be saved.

11. The settings of the simulation and the result of it can be stored in a file.
12. The current overview can be compared with the previous saved overview.

2.2 Non-functional

1. The system is secure
2. The system is responsive
3. The warehouse has several areas:
 - a. The inbound area, where trucks leave products from outside the warehouse that needs to be arranged in the shelves of the warehouse by the forklifts
 - b. The outbound area where the forklifts leave the products from an order
 - c. Several sections with products

Use cases

Setup warehouse specification

Use Case ID: 1

Use Case Name: **Warehouse specification setup**

Goal: Setting up the dimensions, the number of racks, number of racks per line and the available AVGs

Actors: Warehouse employee

MSS:

1. The user clicks the 'Change' button in the 'Warehouse specifications' section on the main screen
2. The user sets the size of the warehouse using the NumericUpDown control next to it
3. The user sets up the number of racks using the NumericUpDown control next to it
4. The user sets up the number of racks per line using the NumericUpDown control next to it
5. The user sets up the number of available AVGs using the NumericUpDown control next to it
6. The user clicks the button "Save changes"
7. The system processes the information and shows the main screen

Extensions:

- 5a. System is not able to process the information
 1. System displays an error message
 2. The use case returns to step 1

Set orders for simulation

Use Case ID: 2

Use Case Name: **Simulation orders setup**

Goal: Create an order list to be used for starting the simulation

Actors: User

Pre-conditions:

The system is currently at the main interface of the application

MSS:

1. The user clicks the 'Set Orders' button
2. The system displays a list of empty orders in a new panel
3. The user checks the 'Outbound' radio button in one of the orders
4. The user inputs the date and time of start on the same order
5. The user selects which products (and its quantities) he wants to add to the order
6. The user repeats 3-5 ten times
7. The user clicks 'Save orders' button
8. The system saves the information provided
9. The system returns to the main interface

Extensions:

- 6a. The user does not fill in a field
 1. User selects the products without setting the time
 2. The user clicks 'Save orders' button
 3. The system shows a red warning label under the critical DateTimePicker
 4. The user chooses a time
 5. Use case returns to step 7
- 6a. The user sets the quantities too high
 1. User sets the 'Norrebo' chair quantity to 20000
 2. The user clicks 'Save orders' button
 3. The system shows a red warning label under the critical text box
 4. The user reduces the quantity to 200
 5. The use case returns to step 7

Run the simulation

Use Case ID: 3

Use Case Name: **Run the simulation**

Goal: Run the simulation

Actors: User

Pre-conditions:

Warehouse specifications and order data are properly set, main form is displayed

MSS:

1. The user clicks the 'Start Simulation' button
2. The system plays the simulation
3. The system exits the simulation, displays the overview tab

Extensions:

2a: The simulation fails to succeed:

1. The simulation stops and a message is shown containing the reason for failure.
2. The user can choose to retry the simulation by adjusting the order or start a new simulation.
3. System returns to step 1.

2a: The user modifies the orders during the simulation

1. See use cases 4,5,6,7
-

Set number of forklifts to be added

Use Case ID: 4

Use Case Name: **Add forklifts**

Goal: Increasing the number of forklifts during the simulation

Actors: User

Pre-conditions:

The system is running the simulation

MSS:

1. The user chooses add option using the radio buttons
 2. The user sets up the number of forklifts using the numeric up down button next to it
 3. The user clicks the button "Save changes"
 4. The system processes the information and adds the forklifts and continues the process
-

Set number of forklifts to be removed

Use Case ID: 5

Use Case Name: **Remove forklifts**

Goal: Removing a number of forklifts during the simulation

Actors: User

Pre-conditions:

The system is running the simulation

MSS:

1. The user chooses remove option using the radio buttons
2. The user sets up the number of forklifts using the numeric up down button next to it
3. The user clicks the button "Save changes"

4. The system processes the information and removes the forklifts and continues the process

Extensions:

- 2a. The selected number is bigger than the number of forklifts in the system
 - 1. System displays an error message
 - 2. The use case returns to step 2
 - 2b. The selected number is equal to the number of forklifts in the system
 - 1. System displays an error message "There will be no forklifts left"
 - 2. The use case returns to step 2
-

Remove an order

Use Case ID: 6
Use Case Name: **Remove Order**
Goal: Removing an order while it's being processed
Actors: User
Pre-conditions:

The system is running the simulation

MSS:

- 1. The user chooses an order
 - 2. The user chooses "Remove order" button
 - 3. The system displays warning message
 - 4. The user clicks the button "Save changes"
 - 5. The system processes the information and the forklifts place back the order
-

Add an order

Use Case ID: 7
Use Case Name: **Add Order**
Goal: Adding an order to be processed
Actors: User
Pre-conditions:

The system is running the simulation

MSS:

- 1. The user chooses "Add order" button
- 2. The system displays the products
- 3. The user selects which products he wants to add
- 4. The user sets the time for the products to be delivered
- 5. The system provides for each product a tracking ID
- 6. The user confirms the selected products

7. The system saves the information provided

Extensions:

- 4a. User selects the products without setting the time
 1. System shows error message
 2. User presses 'OK' button
 3. The use case returns to step 4

Change the Map Settings

Use Case ID: 8

Use Case Name: **Customize map**

Goal: Create a customized map

Actors: User

Pre-conditions:

The system is at the main interface of the application

MSS:

1. The user chooses 'Change' button in the 'Warehouse Specifications' section
2. The system displays a new popup window
3. The user sets the warehouse specifications
4. The system renders the map according to the settings
5. User positions the racks, inbound and outbound area by drag and drop
6. System displays the customized map on the main application

Extensions:

6a. The map doesn't contain any inbound/outbound/racks

1. System shows error message
2. User presses 'OK' button
3. Use case returns to step 4

Visualize list of orders

Use Case ID: 9

Use Case Name: **Display orders**

Goal: Visualization of the list of orders

Actors: User

Pre-conditions:

The system displays the main form, orders are set

MSS:

1. The user clicks 'Set Orders' button
2. The system displays the settings tab filled with the order data