Software Requirements Document

Burris Logistics Virtual Warehouse Project

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# 1 Project overview

* Context/Background

Burris Logistics is a frozen goods storage and shipping company. They operate several warehouses, mostly along the Eastern Seaboard, that are responsible for loading and unloading outgoing and incoming shipments, respectively, and storing the received products until such a time as they will be shipped elsewhere. Since Burris specializes in refrigerated and frozen goods, all of their warehouses are refrigerated. Each warehouse has several different temperature zones that must be maintained at a given temperature based on the requirements of the product stored in that section of the warehouse.

This project concerns the internal workings of the Burris warehouse in Elkton, Maryland. Most of the tasks in the warehouse can be grouped into two broad categories: inbound and outbound. All of the goods that are received from incoming shipments must be unloaded, processed, and then moved to the proper storage location. Conversely, whenever a shipment leaves from the warehouse, the correct products must be collected from their storage locations, prepared for shipping, and loaded onto the truck.

Warehouse workers are assigned to the various parts of each process, along with some other tasks that do not fit directly into either category. In particular, there are warehouse workers assigned to unloading incoming good from a truck and processing them. There are also workers assigned to taking these goods and placing them in the correct storage location. Furthermore, there are workers assigned to collecting goods that must be placed on an outbound truck and place these collected goods in the correct loading dock. There are workers assigned to the processing of collected goods, ensuring that the correct goods were collected; and there are workers assigned to preparing and loading the goods onto the truck. There are also workers that are assigned to replenishing the pick-up location of each product that is collected for outgoing shipments.

Initially, this project will mainly concern the job of the workers assigned to picking cases to be placed on the loading dock for outgoing shipments. These workers are called “*pickers*” or “selectors” (see definitions). Burris uses a voice recognition system, called Vocollect, to direct the pickers through their assigned tasks. The Vocollect system gives commands and then waits for the worker to confirm the command and/or give it more information, as required for any given situation. The most common sequence is where the picker is (1) told to go to a certain location in the warehouse, designated by aisle and bin numbers. (2) Once the worker has reached the given location he must relay a series of number, called *check digits*, that are used to double check that the worker has, in fact, reached the correct bin.

(3) Once the picker relays the correct check digits (s)he is told the how much product to pick up. The worker picks up the given amount of products and places them on the pallet or pallets that the goods will eventually be shipped on. (4) The picker then confirms that (s)he picked up the given amount of product. The process then repeats as the worker is directed to a new bin location for the next selection. Steps (1)-(4) are repeated until the picker has completed the *pick job*, at which point the worker places some labels on the product and drops the pallet or pallets off at the loading dock. The worker then tells the Vocollect system that (s)he is ready to begin another pick job, at which point a new pick task is assigned.

The rate at which Burris pays each worker is based, in part, on his or her productivity. This is done using a set of Engineering Labor Standards which specify how much time an average worker takes to complete a given task. Worker pay is partially based on productivity relative to the ELS.

* Application (what will/should it do)

This project will produce a video-game-like application that can be used to help train warehouse workers, specifically the selector, on how to do their jobs. The application should accurately model the Elkton warehouse and relevant equipment used by selectors. The application should interface with the Vocollect technology so that the users can learn how to properly interact with the technology. The application should also be able to train the users in the proper use and operation of the needed equipment.

Initially, the application should simulate the daily tasks of a picker. However, the application should be developed in such a way that will provide the ability to generalize the application for any or all warehouse tasks.

* User(s)

The primary users will consist primarily of two parties: the warehouse trainers and the warehouse trainees. The trainers are well-versed in the inner workings of the warehouse and must become familiar with this application to understand its capabilities and limitations. The trainees may have some knowledge of various warehouse jobs based on previous employment, but will most likely have little to no experience with the Vocollect technology or Burris-specific procedures. Both parties may also have varying computer skills, according to their various backgrounds.

* Purpose (usefulness)

This application will help Burris train new employees for working in the warehouse. In particular, this application will help train those who have little to no experience with either Vocollect or the process of completing tasks in the warehouse.

# 2 Requirements

## User stories

This section contains a series of narrative-like descriptions of how we envision the user interacting with the application. Although this section is written in a narrative-like fashion is does not follow a strictly linear flow. In places where different options are available to the user the narrative will often split into different “threads”. These threads of narrative are separated into different sections.

## Installation

Edgar, a new Burris selector, is told he will be training this week on Burris’ new selection training application called the Virtual Warehouse (VW). Excited, Edgar sits down at his laptop, navigates to the Burris training website and clicks on the “Download the Virtual Warehouse” link. In about a minute, the VW is downloaded to his laptop. Edgar double clicks on the VW setup icon to install the full application on the laptop. Next, he begins his training by double-clicking on the VW application icon on his desktop that was installed automatically by the setup program.

**(Alternate 1)** The VW setup is copied to the local computer from a network or thumb drive.

**(Alternate 2)** Trainees do not setup the application. The application is set up by a Burris training specialist (in one of the ways specified above) on Burris-owned equipment and trainees access the VW application from a desktop icon or the XP start menu.

**(Alternate 3)** All three of the above options are available. Thus at the warehouse, VW is pre-installed on Burris computers; but the install package is available online or from the network for installation on personal computers if the user so desires.

## Main Menu And Configuration

Upon initiating the Virtual Warehouse, Edgar is directed to a configuration screen where he enters his student information: name, warehouse location (Elkton is initially the only option), default training task (selection is initially the only option), and difficulty level (level one – beginner is the default). Once Edgar’s profile is complete, he is directed to save, save as, or cancel the changes. Edgar chooses to save the changes. He then notices two options: Free Exploration Mode, and Training Mode. He selects the Free Exploration Mode, after which the 3D warehouse scene for the main application begins to load.

**(Alternate 1)** Upon initializing VW, Edgar encounters the normal “Main Menu” screen that allows him to enter free exploration mode or start/continue a training session, and allows him to change game settings such as resolution and controls. He chooses Free Exploration Mode, the game continues (see Exploration Mode).

Another time, however, he chooses to start/continue training sessions. When he does, he encounters a dialog asking him to choose a user profile or create a new profile. He sees many different user profiles available, but since this is the first time that he has attempted a training session, he creates a new profile. The dialog changes and he is asked to enter the information described above. Once he has entered the information he realizes that he can click “Save” or “Cancel”. Correctly assuming that cancel will take him back to the previous screen, he chooses to save his new profile. He then enters the game in training mode.

**(Alternate 2)** *For a pictorial visualization of this interface see Figure 1, below.* Upon initializing VW, Edgar encounters a “Main Menu” screen that contains a number of actions on the left hand side of the screen and a property/option editor on the right hand side of the screen. The actions on the left hand side of the screen are the same as the options in the Main Menu mentioned above. Edgar notices that every time he starts the game the right hand side of the screen displays a section named “Profiles”, where he can edit and create profiles. He quickly scans the options and takes note of the display. He sees a drop-down box with a list of profiles that, by default, says “--Select a Profile--“, and next to this box he sees a button that says “Create”. Below the drop down box he finds a series of profile properties organized in a vertical fashion. The first property consists of a text box labeled “Name”. Below this item is a drop down box labeled location. He clicks on the drop down box and notices that it contains a list of warehouse locations. Next, he finds a “Task” drop down box and, being ever so curious, he clicks on this drop down box as well. Finding that this box contains a list of possible jobs in the warehouse, Edgar moves on to the next property. This property is labeled “Difficulty” and contains three selection boxes labeled, beginner, intermediate, and expert. And finally, below all of these options he finds two buttons, side by side. The first one is labeled “Save Changes” and the second is labeled “Discard Changes”.

Edgar decides not to set up a profile enters Free Exploration Mode. After leaving exploration mode, he wants to try some training tasks. He clicks on the “Start Training” button, but since he forgot to select or create a profile a message pops up reminding him to select or create a profile.

On another computer, Edgar wishes to change a couple of settings and clicks on the “Game Settings” button. Immediately, the options on the right hand side of the screen change. Now, instead of profile options, there are several other options. Edgar changes several options and then hits the back button at the bottom of this screen to return the right hand side to the “Profiles” editor.

**RESOLVED ISSUE**: Are there parameters other than name, warehouse location, default training task, and difficulty level that we need to capture in order to control variations in the game? None at this time.

**OPEN ISSUE**: Should we offer the option to control where profiles are saved, or err on the side of simplicity and automatically save to a default location? Not addressed in discussion.

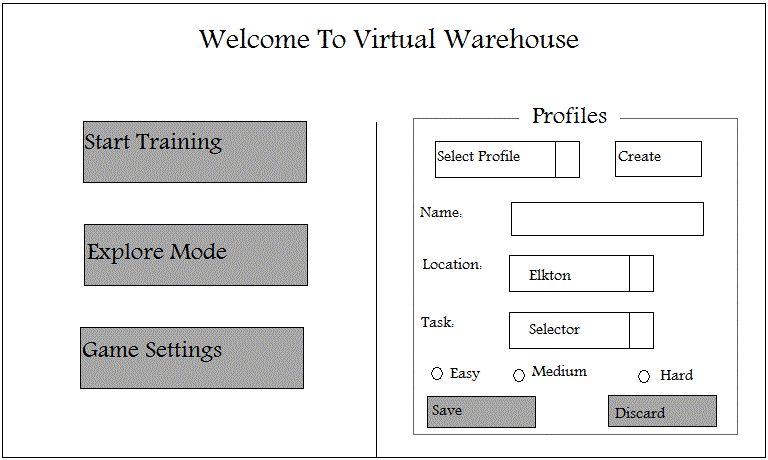


Figure : Example Menu System

## Game Play: User Interface

Once the warehouse is loaded, Edgar finds his game player inside the warehouse just outside the break room. On the outer border of the scene, he notices some information hovering before the 3D scene, like an aircraft’s heads-up display (HUD), telling him which keyboard and/or mouse movements he needs to make to move about and how to access additional help. There is also a small map in the lower right corner of the screen that he recognizes as an overhead view of the entire warehouse with a small yellow marker indicating his current position. Edgar does not know it yet, but these helps are all configurable options. Last of all, he notices a scrollable message at the bottom of the screen welcoming him to the Virtual Warehouse and giving him instructions for his first training task.

## Game Play: Exploration Mode

Edgar now sees that he is free to move about the warehouse without any constraints. He is glad that he can begin to explore the warehouse and get a feel for its layout without having to worry about completing any tasks. A message at the bottom of the screen notifies him that he can move forward with the “w” key (alternative: up arrow key), steer his player with the mouse, and use the “a”, “d”, and “s” keys to strafe left, strafe right, and move backwards (alternatives: left arrow key, right arrow key, and down arrow key). After walking around for a few minutes, Edgar begins to feel more comfortable with the setup of the warehouse. He notices that the dairy section is very detailed (**RESOLVED ISSUE:** Burris considers it important that all areas of the warehouse be modeled accurately. “Accurate modeling” means that the bin locations, numbering and product type for the given room be accurate (i.e., juice, yogurt, etc. in diary room), but the specific individual products and their appearance need not be accurate. Rather, a “representative sample of products” for the given area is sufficient. The different areas in the warehouse are (in order of importance in training), meat, produce, dairy, frozen (subdivided into consigned and bakery), deli and cheese. **Note:** not all warehouses will have the same area, in developing the application, care should be taken to parameterize the virtual information to allow flexibility in customizing the application after delivery to the user. **Note:** In exploratory mode, the user wants to be able to portray various types of information, e.g., “info keys,” at user-specified locations in the warehouse. . Examples include: info keys for room type, product information, case weights, room temperatures, or stack-ability of cases. Info keys could be either be text-based, audio (e.g., vocalized text), or video with the text keys having various appearances: signage, icons, slide shows, messages. Other “helps” in exploratory mode include indicating traffic patterns restricting vehicular travel (mandatory) or pick paths (suggested). **Note:** Users suggested an “auto-pilot” mode for exploration to ensure common orientation to warehouse floor. Auto-pilot would need a pause mode to accommodate narrative dialog during the playback. **Note:** In keeping with the notion for parameterizing the application auto-pilot content would need to be customizable by the end-user.). Remembering what he was told when he first entered Free Exploration Mode, he presses escape, taking him back to the main menu. After making sure that his profile is selected, he chooses to click on the Training Mode option. The warehouse is loaded once again, and he again finds himself just outside the break room.

## Game Play: Beginner Mode

*See Advanced Mode for an alternate path through the game.*

**Getting Started**: After receiving a reminder that his actual shift would begin after he clocks in, Edgar is directed to proceed to the Battery/Equipment room for his next instructions. As he pauses, wondering where the “Battery/Equipment Room” may be, he is surprised to see a translucent arrow appear pointing to his left with the phrase, “This Way to the Battery/Equipment Room.” Relieved that he doesn’t have to find it on his own, Edgar follows the arrow by moving forward and steering his player with the mouse until he passes through a doorway with a sign hovering over it with the words “Equipment Room.” Inside the room, he sees a row of double palette jacks (DPJ) and many boxy objects along the left side of the room (he figures that these must be the batteries). A new message confirms his thoughts about the boxy objects and explains that this is the room where he’ll obtain the DPJ he needs for his shift. The message also proceeds to give him instructions regarding a safety inspection for the DPJ, including what to do if anything is not in proper order. Finally, he is reminded that an actual shift would include a pre-shift meeting and a short period (OPEN: how long?) of stretching before beginning his selection tasks.

**Obtaining the Vocollect**: Edgar is now directed with a message to proceed to “Grand Central” as a new arrow appears showing him the way. This time Edgar takes the visual cues in stride and proceeds to the middle of the dock floor, where he sees a blue cabinet. Upon reaching the cabinet, a new message appears at the bottom of the screen explaining the function of Grand Central and the offices directly across from it. The instructions also explain the Vocollect equipment used by selectors and point out the cabinet where Edgar can find a headset and the T5 module. Edgar is then directed to put on his actual headset (this was provided to him at the beginning of his training with the instructions that the VW program would “let him know when to use it”) (OPEN: should there be captions on the screen to match the audio output from the Vocollect? Will the software allow us to do this?).

**Voice Training (optional)**: Edgar is directed through voice training with the Vocollect.

**Selection Tasks:** Although he feels like he’s learned a lot already, Edgar realizes that his training is just beginning, because a new task set pops up on his HUD listing the general procedures in a selection task: obtain pick job from the printer, obtain palettes, make selections, deposit the job at the designated dock location, and repeat the process. Edgar presses the enter key as directed to dismiss the general procedures where upon he sees the familiar direction arrow and messages walking him through each step of the selection task. After this, Edgar is directed to board the pallet jack he had seen earlier. Since he is a beginner, a new message appears on the screen, telling him to press “spacebar” to enter the vehicle. He does so, and is notified that he can press “spacebar” again to exit the vehicle. He is also told that “w” and “s” will move the pallet jack forward and backward, while “a” and “d” will steer it to the left and right. Finally, he learns that the “h” key will sound the horn, and pressing the “e” key will move the forks up and down (this makes sense to him, as he notes that the “e” key is the main action key in many of the computer games that he plays).

**RESOLVED ISSUES:** What other action keys are needed? None noted.

As Edgar begins the selections task, he hears and learns to respond to the Vocollect commands in the same manner that a selector would interact with Vocollect on the job. He is told by the Vocollect device to go to a given aisle and upon reaching this aisle he confirms that he has reached it. He is then told to go a certain bin location. He reaches the location and reads the check code. The Vocollect device then tells him to select several units of a product. (**RESOLVED ISSUES**: *see Pallet Building notes at the bottom of this document*). He exits the DPJ and selects the product, as commanded, and confirms the number of items that he selected. He is then commanded to go to another pick bin location and the selection process repeats.

**RESOLVED ISSUES**: Should we have non-player characters (other pickers/workers, moving equipment, moving obstacles to avoid)? The presence of non-player characters is desirable. However, this is not a critical feature of the application. To simplify the control of these players, they may be driven by randomly selected pre-set paths. Could this perhaps be tied in to level difficulty? Should there be shorts and other problematic situations that occur depending on the difficulty level? There was limited enthusiasm for “advanced” pick features. Most customers expressed opinions that the value of the application was the orientation of the selectors to the warehouse layout and the nature of the pick tasks. Most agreed that selectors would quickly move from the virtual training to actual task training with real equipment. Trainees might only be expected to use the application 2-4 times. Therefore, variations, special circumstances and degree of difficulty in tasks were seen as less important to the training exercise.

Upon completing the selection task he goes through the normal post-selection procedures and is then presented with the option to exit training mode, to continue selecting at the current difficulty or to continue selecting at a different difficulty.

## Game Play: Advance Mode

This time, after initializing the program, Edgar chooses the advanced difficulty level, rather than beginner, before starting the Training Mode. He quickly notices that there are no arrows to help guide him around the warehouse this time. He is on his own to remember the picking process that he learned from playing on the beginning difficulty level.

**RESOLVED ISSUES**: Should anything else make “advanced” mode more advanced? If so, should there be an intermediate/medium difficulty level in between the beginner and advanced modes? Also see discussion on pallet building below. Advanced mode is shelved until after first operational prototype.

## Requirements Sythesis

This section is intended to be a summary or list of requirements and open issues pulled from the narrative above, plus other issues or points of discussion.

* What needs to be modeled? We need a 3D model of the Elkton Warehouse. All areas (as possible) should exhibit good detail in modeling. Warehouse-specific information such as pick paths, room identification, product location, and safety reminders needs to be data driven and user customizable.
* Vocollect integration: should there be captions on the screen? Captioning is a useful feature, specifically in the auto-pilot mode. Of less utility in the training mode.
* Do we need a database for storing user profiles, game configurations, training progress, and product training data? Absolutely.
* Do we need a main menu for accessing profiles and choosing which mode to play? Yes, there will be at least three modes: auto-pilot, free exploration, and training.
* Are the character controls using the keyboard and mouse: “w”, “a”, “s”, “d” to control the character (alternate keys: arrow keys), or the pallet jack if in the pallet jack, “spacebar” to enter and exit the pallet jack, “h” to honk the horn and “e” to move the forks up and down acceptable? Yes.
* Should HUD messages be displayed to the player? Yes.
* Are the sound effects which are appropriate for a warehouse setting? The initial response to this question was no. However, after some discussion, it was determined that the user should visit the warehouse floor with the intent to listen to events on the warehouse that may be desirable in the application. Of specific interest are those sounds that help promote safe operation.
* Must the selection area be specified (e.g., dairy)? No. Selectors train for all areas of the warehouse—most notably, in the meat, produce and dairy areas—therefore, it is desirable that the application support training in multiple areas.
* Should/must training occur in the presence of other selectors? Other non-player characters? There is little expectation that the application needs to support a multi-player mode. There is interest in non-player activity. These players should be kept simple.
* Is voice training necessary or desirable with VW? Can voice information be imported from WMS? **Not resolved. Need to address question to Josh Krupka.**
* **Game scoring needs to be resolved.** There was general agreement that scoring should it be connected with pay. However, the customer requested time to consider whether scoring should emphasize safety or correct procedure or some other training goal. No resolution on whether or not we need a high-score table.
* **Should a player avatar be part of the game, or just operate as a first-person viewer?**  Our customers did not appear to understand this question. We may need to demonstrate the application to make the question clearer. However, after the discussion, Dr Shomper was left with the impression that a first-person view was most appropriate.
* How many difficulty levels should be included and what are the differences between them? Difficulty levels were of little interest to the customer.
* How should the palettes be built? Little interest from the customer on this point.
* Should profiles just be saved to a default location or should we give the user the chance to specify the location to save the profile? Save profiles in DB.
* What game settings options need to be available? Develop as most appropriate and discuss after prototype.
* When setting up a profile, are there parameters other than name, warehouse location, default training task, and difficulty level that we need to capture in order to control variations in the game? None at this time.