

# Warehouse Management System

## CSCI 5448 Project: Part 2 (Individual)

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**Title:** Warehouse Management System

### **Requirements:**

For the individual portion of Part 2, I am describing Use Cases 1-4. A basic UC description and mapping to requirement ID's are presented in the following table.

Use Case	Requirements
<b>UC-1: Move Pallet</b> Warehouse Operator directs autonomous forklift to move a pallet from its current location to a specified destination.	U-01 through U-19, U-50, and U-51
<b>UC-2: Cancel a "Move Pallet" Task</b> After giving an autonomous forklift tasking to move a pallet, the Warehouse Operator cancels the move using the UI. AF clears the task from its queue and is now available for further tasking.	U-13, U-14, and U-21
<b>UC-3: Take Robot out of Service</b> In the event of robot malfunction or routine maintenance, the Warehouse Operator deactivates the robot so that the system cannot select it for pallet/product moving tasks.	U-13, U-17, U-22, and U-29
<b>UC-4: Place Robot in Service</b> After robot maintenance, the Warehouse Operator reactivates the robot so that the system can select it for pallet/product moving tasks.	U-13, U-18, U-23, and U-30

### Use Case Documents:

<b>Use Case ID:</b>	UC-1		
<b>Use Case Name:</b>	Move Pallet		
<b>Description:</b>	Warehouse Operator directs autonomous forklift to move a pallet from its current location to a specified destination.		
<b>Actors:</b>	Warehouse Operator (primary), Loading Dock Supervisor, QA Inspector, Autonomous Forklift		
<b>Pre-conditions:</b>	<ul style="list-style-type: none"><li>• Pallet awaiting movement at the loading dock or the QA Inspection Area.</li><li>• System displays current warehouse state (shelves, loading docks, robot status).</li><li>• At least one autonomous forklift (AF) is operational and “available” for tasking.</li></ul>		
<b>Post-conditions:</b>	<ul style="list-style-type: none"><li>• AF is “available” for additional tasking.</li><li>• Products on pallet are added to warehouse inventory when placed on shelves.</li></ul>		
<b>Frequency of Use:</b>	Near continuous (every few minutes)		
<b>Flow of Events:</b>		<b>Actor Action</b>	<b>System Response</b>
	1	Loading Dock Supervisor or QA Inspector scans QR code on pallet.	System displays pallet and relevant information (product ID and quantity) at its current location.
	2	Warehouse Operator (WO) selects pallet to be moved.	
	3	WO selects pallet destination.	<ul style="list-style-type: none"><li>• System sends command to AF to move pallet from its current location to selected destination.</li><li>• System indicates AF is “busy”.</li></ul>
	4	AF moves pallet from its current location to the destination.	<ul style="list-style-type: none"><li>• System indicates that AF is “available”.</li></ul>
<b>Variations:</b>	<p><u>UC-1a (Move Pallet from Truck to Shelf):</u></p> <ol style="list-style-type: none"><li>1. Loading Dock Supervisor scans QR code on pallet.</li><li>3. WO selects an empty shelf as the pallet’s destination.</li><li>4. Actor: AF moves pallet from the truck to the selected shelf.</li></ol> <p>System: In addition to system response listed above...</p> <ul style="list-style-type: none"><li>• System adds products on pallet to warehouse inventory.</li><li>• System displays products on the shelf.</li></ul> <p><u>UC-1b (Move Pallet from Truck to QA Inspection Area):</u></p> <ol style="list-style-type: none"><li>1. Loading Dock Supervisor Inspector scans QR code on pallet.</li><li>3. WO selects the QA Inspection Area as the pallet’s destination.</li><li>4. Actor: AF moves pallet from the truck to the QA Inspection Area.</li></ol>		

	<u>UC-1c (Move Pallet from QA Inspection Area to Shelf):</u> 1. QA Inspector scans QR code on pallet. 3. WO selects an empty shelf as the pallet's destination. 4. Actor: AF moves pallet from the truck to the selected shelf. System: In addition to system response listed above... <ul style="list-style-type: none"> <li>System adds products on pallet to warehouse inventory.</li> <li>System displays products on the shelf.</li> </ul>
<b>Exceptions:</b>	<ul style="list-style-type: none"> <li>WO selects a shelf that is not empty... System response: Error displayed to WO that selected shelf is not empty.</li> <li>AF fails to accomplish the "move pallet" task; AF signals malfunction to the Warehouse Management System and it is displayed on UI. System response: See UC-3 (Take Robot out of Service)</li> </ul>
<b>Developer Notes:</b>	None

<b>Use Case ID:</b>	UC-2		
<b>Use Case Name:</b>	Cancel a "Move Pallet" Task		
<b>Description:</b>	After giving an autonomous forklift tasking to move a pallet, the Warehouse Operator cancels the move using the UI. AF clears the task from its queue and is now available for further tasking.		
<b>Actors:</b>	Warehouse Operator (primary), Autonomous Forklift (AF)		
<b>Pre-conditions:</b>	<ul style="list-style-type: none"> <li>AF is executing a "move pallet" task.</li> <li>AF has not yet picked up the pallet to be moved.</li> </ul>		
<b>Post-conditions:</b>	<ul style="list-style-type: none"> <li>Autonomous forklift is "available" for additional tasking.</li> <li>Pallet remains in original location.</li> </ul>		
<b>Frequency of Use:</b>	Frequently (about once an hour)		
<b>Flow of Events:</b>		<b>Actor Action</b>	<b>System Response</b>
	1	AF receives command from the system to move pallet from its current location to some destination. AF signals to the system that it is "busy".	System shows "busy" indicator on the UI.
	2	WO cancels the "move pallet" task for that robot.	<ul style="list-style-type: none"> <li>System verifies that the AF is not already carrying the pallet.</li> <li>System sends "cancel" command to AF.</li> </ul>

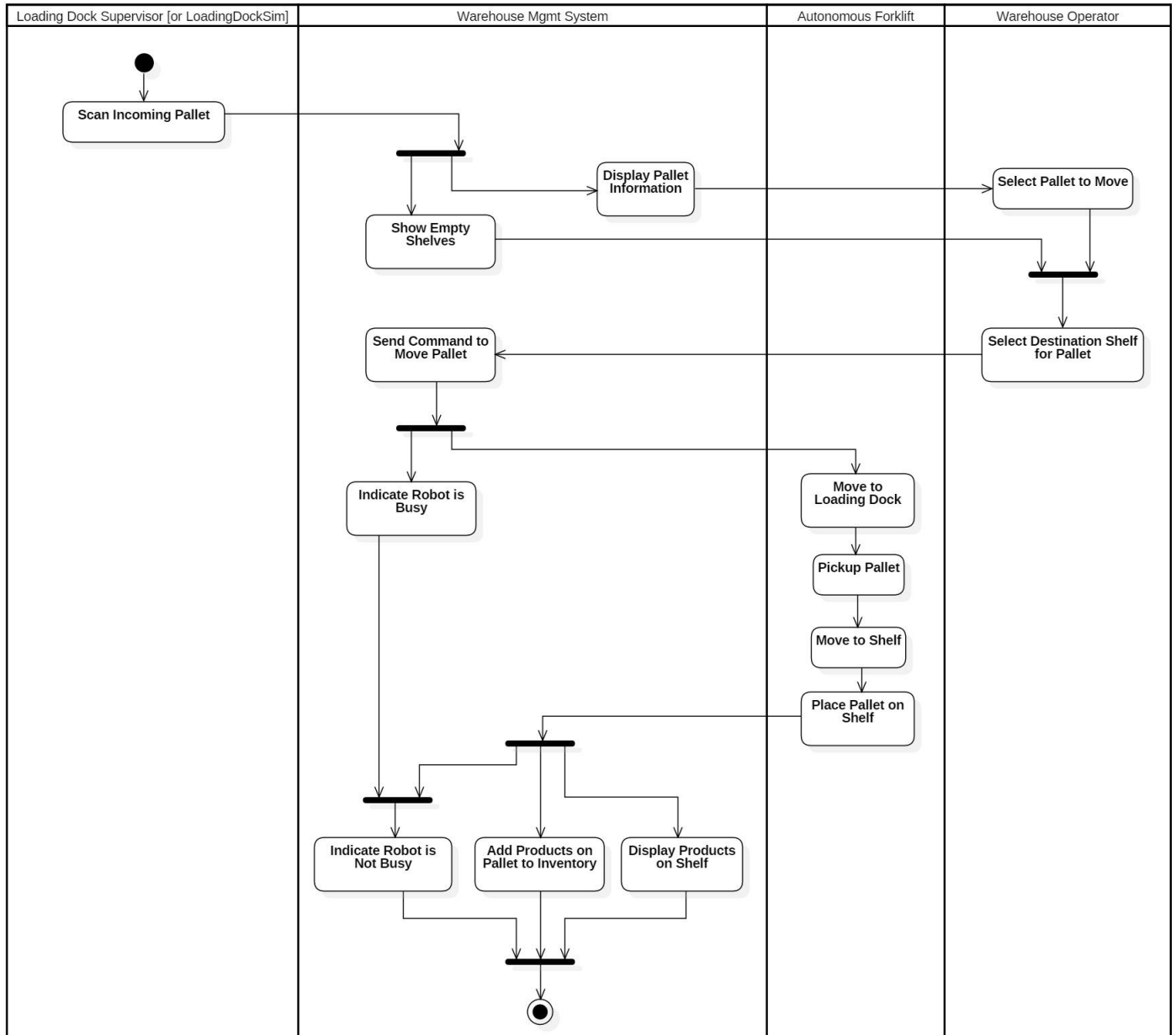
	3	AF aborts the task and signals to the system that it is “available”.	System shows “available” indicator on the UI.
<b>Variations:</b>	None		
<b>Exceptions:</b>	<ul style="list-style-type: none"> <li>WO attempts to cancel the “move pallet” task after the AF has picked up the pallet. System response: No response. Task is not canceled and the AF continues to move the pallet to the selected destination.</li> </ul>		
<b>Developer Notes:</b>	None		

<b>Use Case ID:</b>	UC-3		
<b>Use Case Name:</b>	Take Robot out of Service		
<b>Description:</b>	In the event of robot malfunction or routine maintenance, the Warehouse Operator deactivates the robot so that the system cannot select it for pallet/product moving tasks.		
<b>Actors:</b>	Warehouse Operator (primary), Autonomous Forklift (AF) or Retrieval Robot (RetBot)		
<b>Pre-conditions:</b>	<ul style="list-style-type: none"> <li>Robot is powered on.</li> <li>Robot is currently in service.</li> </ul>		
<b>Post-conditions:</b>	<ul style="list-style-type: none"> <li>Robot cannot be tasked to perform pallet/product move operations.</li> <li>Robot is powered down.</li> </ul>		
<b>Frequency of Use:</b>	Occasionally (about once a week)		
<b>Flow of Events:</b>		<b>Actor Action</b>	<b>System Response</b>
	1	Robot signals to the system that it is experiencing a malfunction	System shows “malfunction” indicator on the UI.
	2	WO presses button to take the robot out of service	<ul style="list-style-type: none"> <li>System sends a command to the robot to shutdown.</li> <li>System removes that robot from pool of in-service robots.</li> <li>UI indicates that robot is out of service.</li> </ul>
	3	Robot performs shutdown procedure.	
<b>Variations:</b>	None		
<b>Exceptions:</b>	None		
<b>Developer Notes:</b>	None		

<b>Use Case ID:</b>	UC-4		
<b>Use Case Name:</b>	Place Robot in Service		
<b>Description:</b>	After robot maintenance, the Warehouse Operator reactivates the robot so that the system can select it for pallet/product moving tasks.		
<b>Actors:</b>	Warehouse Operator (primary), Autonomous Forklift (AF) or Retrieval Robot (RetBot)		
<b>Pre-conditions:</b>	<ul style="list-style-type: none"> <li>Robot is powered on.</li> <li>AF is currently out of service.</li> </ul>		
<b>Post-conditions:</b>	<ul style="list-style-type: none"> <li>Robot can be tasked to perform pallet/product move operations.</li> </ul>		
<b>Frequency of Use:</b>	Occasionally (about once a week)		
<b>Flow of Events:</b>		<b>Actor Action</b>	<b>System Response</b>
	1	After booting up, robot signals to the system that it is operational	System shows “operational” indicator on the UI.
	2	WO presses button to place the robot in service	<ul style="list-style-type: none"> <li>System adds that robot to the pool of in-service robots.</li> <li>UI indicates that robot is in service.</li> </ul>
<b>Variations:</b>	None		
<b>Exceptions:</b>	None		
<b>Developer Notes:</b>	None		

## Activity Diagram

### UC-1a: Move Pallet from Truck to Shelf (Req ID: U-01 through U-19, U-50, and U-51) Created by Daniel Prendergast



## User Interactions

### UC-1a: Move Pallet from Truck to Shelf (Req ID: U-01 through U-19, U-50, and U-51)

