

Project #33

Warehouse Manager

Dan Prendergast
Jon Magiera
Max Hollingsworth

CSCI 5448

Object-Oriented Analysis & Design



University of Colorado **Boulder**

Warehouse Management System Overview

- System allows warehouse personnel to manage warehouse inventory and operations
- Manage the movement of products in a warehouse using automated forklifts/robots
- Track inventory as pallets arrive and product orders are fulfilled
- Database back-end keeps track of inventory

The screenshot displays a complex interface for a Warehouse Management System. It includes several functional areas:

- QA Inspection Area:** Located at the top right, it contains buttons for "Select Pallet", "QA", and "QA Dropoff".
- Shipping Center:** A button located below the QA area.
- Incoming Order:** A section with a text input field and a "Select Pallet" button.
- Robot/Forklift Control Panel:** On the left side, there are three rows of controls. Each row includes an "Enable" radio button, a robot icon, status indicators for "Functional" (green) and "Available" (green), and a "Cancel Move" button (red).
- Inventory Grid:** The central area features a grid of pallet slots. The left column has slots A1 through A4, with A3 containing the text "MIC-13 12". The right column has slots B1 through B4. Below these, there are columns C1 through C4 and D1 through D4. Slot D1 contains the text "COF-06 23".
- Loading Dock Interface:** At the bottom, there are three sections for "Loading Dock 1", "Loading Dock 2", and "Loading Dock 3". Each section includes a text input field, a "Select Pallet" button, and a status display showing a pallet ID and a count (e.g., "BLE-21 24" for Dock 2 and "MIC-13 20" for Dock 3).







Warehouse Details

Shipping Center

Retrieval robots

QA Inspection Area

Shipping Center Incoming Order

Enable <input type="radio"/>		<input checked="" type="radio"/> Functional	<input type="button" value="Cancel Move"/>
		<input checked="" type="radio"/> Available	
Enable <input type="radio"/>		<input checked="" type="radio"/> Functional	<input type="button" value="Cancel Move"/>
		<input checked="" type="radio"/> Available	
Enable <input type="radio"/>		<input checked="" type="radio"/> Functional	<input type="button" value="Cancel Move"/>
		<input checked="" type="radio"/> Available	
Enable <input type="radio"/>		<input checked="" type="radio"/> Functional	<input type="button" value="Cancel Move"/>
		<input checked="" type="radio"/> Available	
Enable <input type="radio"/>		<input checked="" type="radio"/> Functional	<input type="button" value="Cancel Move"/>
		<input checked="" type="radio"/> Available	
Enable <input type="radio"/>		<input checked="" type="radio"/> Functional	<input type="button" value="Cancel Move"/>
		<input checked="" type="radio"/> Available	

Storage Shelves

A1	<input type="text"/>	B1	<input type="text"/>
A2	<input type="text"/>	B2	<input type="text"/>
A3	MIC-13 12	B3	<input type="text"/>
A4	<input type="text"/>	B4	<input type="text"/>
C1	<input type="text"/>	D1	COF-06 23
C2	<input type="text"/>	D2	<input type="text"/>
C3	<input type="text"/>	D3	<input type="text"/>
C4	<input type="text"/>	D4	<input type="text"/>

Loading Dock 1 BLE-21 24 Loading Dock 2 MIC-13 20 Loading Dock 3

Autonomous Forklifts

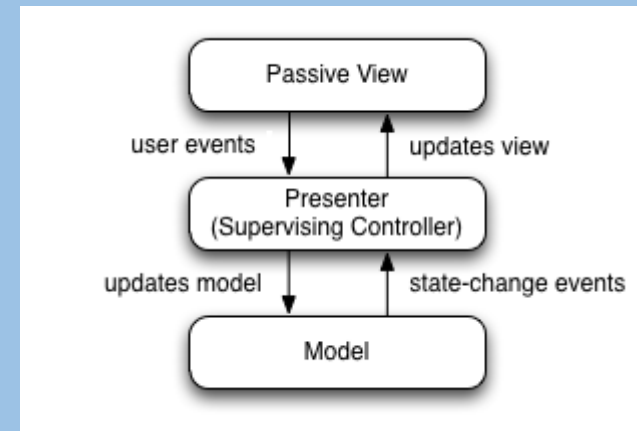
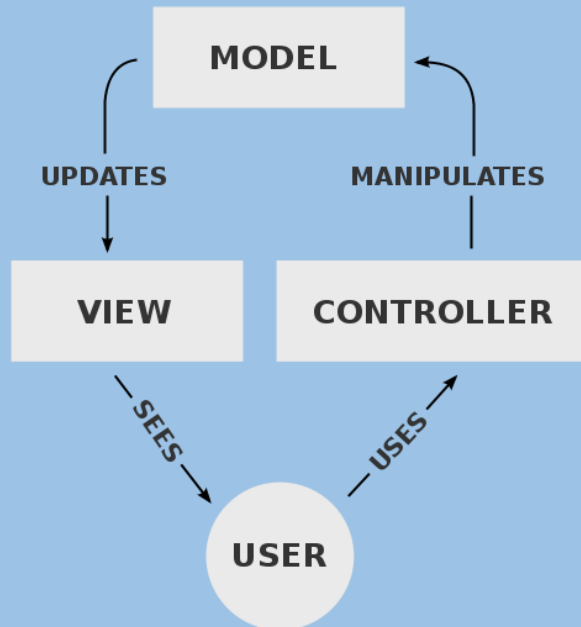
Loading Docks

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

Use Case ID:	UC-08
Use Case Name:	Fetch Product from Shelves
Description:	The Management System is notified of an order and a Retrieval Robot is sent to move the product from the shelf to the Packing Center.

Actors:	Packing Center, Retrieval Robot, Order System		
Pre-conditions:	An order is placed in the Order System. Order System divides orders into products and quantities. Product must be in stock. At least one Retrieval Robot must be idle.		
Post-conditions:	The correct quantity of the product is in the Packing Center awaiting shipment.		
Frequency of Use:	Potentially non-stop.		
Flow of Events:		Actor Action	System Response
	1	Order System notifies Management System of product and quantity to move.	System alerts the RetBot of the product and quantity. System updates UI to show RetBot is Busy.
	2	RetBot notifies System and Packing Center that product has been moved.	System updates the UI to show that RetBot is idle. System updates model and database with new inventory count.
	3	Packing Center makes product ready for shipment, then ships product.	

Model View Presenter vs. Model View Controller



Observer Design Pattern

Uses many-to-one dependency between objects so that if one object is modified, all of its dependents are updated automatically.

-Gang of Four

```
public class ModelObserver implements Observer
{
    private WarehouseController warehouseController;

    public ModelObserver(WarehouseController warehouseController){}
    public WarehouseController getWarehouseController(){
    public void setWarehouseController(WarehouseController warehouseController){
    public void addObserver()
    {
        ArrayList<Pallet> pallets = warehouseController.getWarehouse().getPallets();
        for (Pallet pallet : pallets)
        {
            pallet.addObserver(this);
            pallet.indicateChange();
            System.out.println("pallet observed");
        }
        ArrayList<Forklift> forklifts = warehouseController.getWarehouse().getForklifts();
        for (Forklift forklift : forklifts)
        {
            forklift.addObserver(this);
            forklift.indicateChange();
            System.out.println("forklift observed");
        }
        ArrayList<RetBot> retbots = warehouseController.getWarehouse().getRetBots();
        for (RetBot retbot : retbots)
        {
            retbot.addObserver(this);
            retbot.indicateChange();
            System.out.println("retbot observed");
        }
    }
}
```



U
E

er.

Link To Demo

[Warehouse manager demo video](#)