Warehouse Management System
CSCI 5448 Project: Part 1

Team: Max Hollingsworth
Jonathan Magiera
Dan Prendergast

Title: Warehouse Management System

Description: A system that allows warehouse personnel to manage the inventory and operations of an automated warehouse. The warehouse includes the following features:

- 3 truck loading docks for receiving incoming pallets of products
- 1 shipping center for packaging and shipping outgoing products
- 16 storage shelves
- 6 autonomous forklifts for moving pallets from the loading docks to storage shelves
- 8 autonomous robots to move individual products from the shelves to the shipping center

Actors:

- Warehouse Operator – directs the movement of forklifts, robots, and products around the warehouse
- Inventory Manager – responsible for monitoring inventory levels and ordering products from warehouse suppliers
- Customer Service Representative – enters orders that are placed by phone (Stretch Functionality)
- Customer – places orders on the website (Stretch Functionality)

Functionality:

1. Warehouse Operations

- The system shall depict the layout of the warehouse floor, including the locations of the storage shelves, shipping center, and loading docks.
- The system shall show the following information to the Warehouse Operator:
  - total capacity of each storage shelf
  - number of each product currently on each shelf
  - arrival of a truck at the loading dock
  - the next pallet to be offloaded from the truck
  - which product is on the pallet to be offloaded from the truck
  - quantity of the product on each pallet
- The system shall allow the Warehouse Operator to select the shelf on which to store incoming pallets.
- The system shall assign an appropriate autonomous forklift to move each pallet based on pallet specifications and robot capabilities.
- The system shall indicate to the Warehouse Operator the following conditions:

- when an autonomous forklift is "busy"
- when a forklift is carrying a pallet
- when a pallet is placed on the storage shelf

- When a pallet is delivered to a shelf, the system shall update the total number of products on that shelf.
- After delivering a pallet to the shelf, the system will direct the forklift back to its assigned parking spot.

2. *Order Fulfillment*
- Upon receipt of an order, the system shall automatically retrieve the product from the shelf and move it to the warehouse shipping center.
- The system shall show the number of each product ordered.
- The system shall show the number of orders pending shipment.
- The system shall assign an appropriate autonomous robot to retrieve ordered products based on product weight/size and robot capabilities.
- The system shall indicate when an autonomous robot is "busy".
- The system shall indicate when the robot has picked up the product.
- When a product is delivered to the Shipping Center, the system shall update the total number of that product shipped.
- After delivering a product to the Shipping Center, the system shall direct the robot back to its assigned parking spot.

3. *Inventory Management*
- The system shall show product information to the Inventory Manager. Product information to be displayed includes the following:
  - weight
  - supplier
  - supplier's price
  - customer's price
  - location in warehouse
  - quantity on hand
  - quantity on order
  - total number sold
- The system shall allow the Inventory Manager to place orders for new product shipments from the suppliers.
- The system shall allow the Inventory Manager to define the following order specifications:
  - product
  - options as appropriate for the product (e.g., size, color, and style)
  - quantity
  - delivery date

4. *System Test/Demonstration Infrastructure*
   The following requirements are not applicable to the deliverable Warehouse Management System; however, they are necessary for the test and demonstration of system functionality described above.
   - The system shall simulate incoming customer orders.
   - The system shall simulate arriving trucks with pallets of products.

Stretch Functionality:
   - The system shall include a website for customers to place orders.
   - The system shall provide an interface for customer service representatives to place orders received over the phone.
   - The system shall animate the movement of autonomous forklifts/robots in order to show real-time location as they move around the warehouse.