

CLAIMS

What is claimed is:

1. A computerized system for managing product inventory of a plurality of different entities at a plurality of facilities comprising storage structures served by robotic handlers, the computerized system comprising:

at least one storage device storing a database containing product ownership information, the product ownership information comprising information necessary for identification of the different entities;

said computerized inventory management system configured to facilitate a one-to-one (1:1) exchange of storage bins at each of the plurality of facilities and transport vehicles traveling between said plurality of facilities, and thereby enable a continuous and equivalent flow of the storage bins in a forward direction and a reverse direction, such that a forward flow of the storage bins is equivalent to a reverse flow of the storage bins.

2. The computerized system of claim 1, wherein said computerized system includes a processor, said processor communicably coupled to said storage device via a communication network, said processor configured to:

activate a first subset of the robotic handlers at one of the facilities to physically store a first product of a particular product type into a first storage bin located within a first storage structure, said first product being a content of the first storage bin;

assign ownership of said first product to a first entity included among said plurality of different entities identified in said database;

receive, via the communication network, an order for the first product of said particular product type from a second entity included among the plurality of different entities identified in the database;

activate a second subset of the robotic handlers to retrieve the first product from the first storage bin located within the first storage structure to fulfill the first order of said particular product type from the second entity;

update said database to record a transfer of said ownership of said first product from said first entity to said second entity;

activate a third subset of the robotic handlers to physically store a second product of said particular product type into a second storage bin located within a second storage structure, said second storage structure located at a different facility than said first storage structure, and assign ownership of said second product to said second entity, said second product being a content of the second storage bin;

update said database to record a transfer of said ownership of said second product from said second entity to said first entity, whereby said ownership of said first product and said second product is swapped between said first entity and said second entity; and

and wherein the computerized system updates the database to record the transfer of the ownership of the first product from the first entity to the second entity, in response to determining that the second entity has an inventory shortfall of the particular product type and is unable to fulfill the order of the particular product type.

3. The computerized system of claim 2, wherein the processor is further configured to update the database to record the transfer of the ownership of the first product from the first entity to the second entity, by verifying that the second entity is purchasing the first product from the first entity, said processor further configured to update the database to record the second entity as purchasing the first product from the first entity.

4. The computerized system of claim 2, wherein the processor is further configured to:

update the database to record that the second product stored in the second storage structure is owned by the second entity; and

activate a fourth subset of the robotic handlers to retrieve the first storage bin from the first storage structure and thereby fulfill the order of the particular product type for the second entity.

5. The computerized system of claim 2, wherein:

the database is configured to enable assignment of multiple vendor IDs to a multi-compartment storage (MCS) bin at a 1:1 ratio to number of individual compartments in the MCS bin, said database further configured to assign the multiple vendor IDs to a non-compartmentalized storage bin, said database further configured to enable reassignment of only a portion of contents of the non-compartmentalized storage bin or the individual compartments of the MCS bin, without segregating reassigned contents into a second non-compartmentalized storage bin or a second compartment within the MCS bin, thereby denoting inventory reassignment on a product basis instead of bin-wide basis or compartment-wide basis;

and wherein the processor is further configured to:

activate the first subset of the robotic handlers to physically store the first product in the first storage structure within the first storage bin;

activate the third subset of the robotic handlers to physically store the second product in the second storage structure within the second storage bin;

after receiving the order, update the database to record a transfer of ownership of the content of the first storage bin from the first entity to the second entity and ownership of the content of the second storage bin from the second entity to the first entity, whereby the ownership of the content of the first storage bin and the ownership of the content of the second storage bin are swapped between the first entity and the second entity.

6. The computerized system of claim 2, wherein the processor is further configured to execute the transfer of the ownership of the content of the first storage bin from the first entity to the second entity, and the ownership of the content of the second storage bin from the second entity to the first entity at any time after fulfillment of the order of the particular product type for the second entity.

7. The computerized system of claim 2, wherein the processor is further configured to:

before receiving the order, update the database to record that the content of the first storage bin is owned by the first entity; and

before receiving the order, update the database to record that the content of the

second storage bin is owned by the second entity.

8. The computerized system of claim 2, wherein the processor is further configured to:

query the database to determine whether the content of the first storage bin is equal to the content of the second storage bin; and

after receiving the order, update the database to record swapping of the ownership of the content of the first storage bin and the content of the second storage bin between the first entity and the second entity, in response to determining that the content of the first storage bin is equal to the content of the second storage bin;

in response to a determination that the content of the first storage bin and the content of the second storage bin are not equal, perform at least one of the following:

(a) activate a robotic worker at the one of the facilities to equalize the content of the first storage bin relative to the content of the second storage bin;

(b) activate, at the one of the facilities:

(i) a fifth subset of the robotic handlers to deliver the first storage bin to a human-attended workstation; and

(ii) a human-machine interface to instruct a human worker of the human-attended workstation to equalize the content of the first storage bin relative to the content of the second storage bin;

(c) activate a robotic worker at the different facility to equalize the content of the second storage bin relative to the content of the first storage bin; and

(d) activate, at the different facility:

(i) a sixth subset of the robotic handlers to deliver the second storage bin to a human-attended workstation; and

(ii) a human-machine interface of the human-attended workstation to instruct a human worker of the human-attended workstation to equalize the content of the second storage bin relative to the content of the first storage bin.

9. The computerized system of claim 2, wherein the processor is further configured to activate another subset of the robotic handlers to retrieve the second product from the second storage structure for relocation of the second product to the one of the facilities, after updating the database to record the transfer of the ownership of the second product from the second entity to the first entity.
10. The computerized system of claim 2, wherein the processor is further configured to:
- receive a reservation message from the second entity requesting that the particular product type be reserved prior to receiving the order for the particular product type from the second entity;
 - query the database to confirm that the first product is available for reservation;
 - reserve the first product for the second entity by recording in the database an indication that the first product is reserved for the second entity after confirming that the first product is available; and
 - start a reservation period during which the first product is exclusively held for the second entity, such that the first product is unavailable for reservations by other entities;
 - update the database by reversing the indication that the first product is reserved and making the first product available for reservation by the other of the different entities, when no order corresponding to the first product is received from the second entity within the reservation period.
11. The computerized system of claim 2, wherein the processor is further configured to:
- receive a product availability request for the particular product type from the second entity;
 - parse the product availability request for requirements associated with the product availability request;
 - search the database for products that match the requirements associated with the product availability request, and wherein a result from the search at least shows an availability of the first product owned by the first entity; and

to a requestor from which the product availability request was received, send information about the first product.

12. The computerized system of claim 11, wherein the processor is further configured to:

restrict the search for the products to only include available products owned by entities identified in a whitelist associated with the second entity;

restrict the search for the products to not include in-stock products owned by the entities identified in a blacklist associated with the second entity;

restrict the search for the products to only include available products with a selling price that is less than or equal to a preferred maximum purchase price defined by the second entity in the product availability request;

restrict the search for the products to only include available products that are within a predetermined radius of a preferred destination defined in the product availability request; and

restrict the search for the products to only include available products that are deliverable within a preferred delivery timeline specified in the product availability request.

13. A computer-implemented method for managing product inventory of a plurality of different entities at a plurality of facilities comprising storage structures served by robotic handlers, the computer-implemented method employing an inventory management system comprising at least one storage device and at least one processor operably coupled to the storage device, the method comprising:

storing, in the storage device, a database containing product ownership information, the product ownership information comprising information necessary for identification of the different entities;

facilitating, by said inventory management system, a one-to-one (1:1) exchange of storage bins at each of the plurality of facilities and transport vehicles traveling between said plurality of facilities, thereby enabling a continuous and equivalent flow of the storage bins in a forward direction and a reverse direction through the inventory management system, such that a forward flow of the storage bins through the inventory management system is

equivalent to a reverse flow of the storage bins through the inventory management system.

14. The computer-implemented method of claim 13, wherein the method includes the following steps:

activating, by said inventory management system, a first subset of the robotic handlers at one of the facilities to physically store a first product of a particular product type into a first storage bin located in a first storage structure, said first product being a content of the first storage bin;

responsive to activating the first subset of the robotic handlers, updating the database, by the inventory management system, to record that the first product is owned by a first entity included among the plurality of different entities identified in the database;

receiving, by the inventory management system via a communication network, an order of the particular product type from a second entity included among the plurality of different entities identified in the database, the second entity being different than the first entity;

updating the database, by the inventory management system, to record a transfer of ownership of the first product stored at the first storage bin located in the first storage structure from the first entity to the second entity;

activating a second subset of the robotic handlers, by the inventory management system, to retrieve the first product from the first storage bin located in the first storage structure, for use in fulfilling the first order of the particular product type for the second entity;

activating, by said inventory management system, a third subset of said robotic handlers to physically store a second product of said particular product type into a second storage bin located within a second storage structure, said second storage structure located at a different facility than the first storage structure, and wherein ownership of said second product is assigned, by said inventory management system, to said second entity, said second product being a content of the second storage bin; and

updating said database, by said inventory management system, to record a

transfer of said ownership of said second product from said second entity to said first entity, whereby said ownership of said first product and said second product is swapped between said first entity and said second entity;

updating, by the inventory management system, the database to record the transfer of the ownership of the first product from the first entity to the second entity, in response to determining that the second entity has an inventory shortfall of the particular product type and is unable to fulfill the order of the particular product type.

15. The computer-implemented method of claim 14, wherein the updating of the database to record the transfer of the ownership of the first product from the first entity to the second entity is performed by the inventory management system by verifying that the second entity is purchasing the first product from the first entity and by updating the database to record the second entity as purchasing the first product from the first entity.

16. The computer-implemented method of claim 13, further comprising the following steps:

configuring said database to enable assignment of multiple vendor IDs to a multi-compartment storage (MCS) bin at a 1:1 ratio to number of individual compartments in the MCS bin, and configuring said database to assign the multiple vendor IDs to a non-compartmentalized storage bin; and

configuring said database to enable reassignment of only a portion of contents of the non-compartmentalized storage bin or the individual compartments of the MCS bin, without segregating reassigned contents into a second non-compartmentalized storage bin or a second compartment within the MCS bin, thereby denoting inventory reassignment on a product basis instead of bin-wide basis or compartment-wide basis.

17. The computer-implemented method of claim 14, further comprising the following steps:

activating the first subset of the robotic handlers by the inventory management system to physically store the first product in the first storage structure within the first storage bin;

activating the third subset of the robotic handlers by the inventory management system to physically store the second product in the second storage structure within the second storage bin;

after receiving the order, updating the database to record a transfer of ownership of the content of the first storage bin from the first entity to the second entity and ownership of the content of the second storage bin from the second entity to the first entity, whereby the ownership of the content of the first storage bin and the ownership of the content of the second storage bin are swapped between the first entity and the second entity; and

activating a fourth subset of the robotic handlers, by the inventory management system, to retrieve the first storage bin from the first storage structure and thereby fulfill the order of the particular product type for the second entity.

18. The computer-implemented method of claim 14, further comprising:

before receiving the order, updating the database in the storage device, by the inventory management system, to record that the content of the first storage bin is owned by the first entity; and

before receiving the order, updating the database in the storage device, by the inventory management system, to record that the content of the second storage bin is owned by the second entity.

19. The computer-implemented method of claim 14, further comprising:

querying the database, by the inventory management system, to determine whether the content of the first storage bin is equal to the content of the second storage bin; and

after receiving the order, updating the database, by the inventory management system, to record the ownership of the content of the first storage bin and the second storage bin as being swapped between the first entity and the second entity, in response to determining that the content of the first storage bin is equal to the content of the second storage bin;

in response to a determination that the content of the first storage bin and the content of the second storage bin are not equal, performing at least one of the following:

- (a) activating a robotic worker at the one of the facilities, by the inventory management system, to equalize the content of the first storage bin relative to the content of the second storage bin;
 - (b) activating, by the inventory management system, at the one of the facilities:
 - (i) a fifth subset of the robotic handlers to deliver the first storage bin to a human-attended workstation; and
 - (ii) a human-machine interface to instruct a human worker of the human-attended workstation to equalize the content of the first storage bin relative to the content of the second storage bin;
 - (c) activating a robotic worker at the different facility, by the inventory management system, to equalize the content of the second storage bin relative to the content of the first storage bin; and
 - (d) activating, by the inventory management system, at the different facility:
 - (i) a sixth subset of the robotic handlers to deliver the second storage bin to a human-attended workstation; and
 - (ii) a human-machine interface of the human-attended workstation to instruct a human worker of the human-attended workstation to equalize the content of the second storage bin relative to the content of the first storage bin.
20. The computer-implemented method of claim 14, further comprising activating another subset of the robotic handlers, by the inventory management system, to retrieve the second product from the second storage structure for relocation of the second product to the one of the facilities after updating the database to record the transfer of the ownership of the second product from the second entity to the first entity.
21. The computer-implemented method of claim 14, further comprising:
- receiving a reservation message from the second entity, by the inventory management system, requesting that the particular product type be reserved, prior to receiving the order for the particular product type from the second entity;

querying the database, by the inventory management system, to confirm that the first product is available for reservation;

reserving the first product for the second entity by the inventory management system, by recording in the database an indication that the first product is reserved for the second entity after confirming that the first product is available; and

starting a reservation period by the inventory management system during which the first product is exclusively held for the second entity, such that the first product is unavailable for reservations by other different entities; and

updating the database, by the inventory management system, by reversing the indication that the first product is reserved, and making the first product available for reservation by the other of the different entities, when no order corresponding to the first product is received from the second entity within the reservation period.

22. The computer-implemented method of claim 14, further comprising:

receiving a product availability request, by the inventory management system, for the particular product type from the second entity;

parsing the product availability request, by the inventory management system, for requirements associated with the product availability request;

searching the database, by the inventory management system, for products that match the requirements associated with the product availability request, wherein a result from the search at least shows an availability of the first product owned by the first entity; and

to a requestor from which the product availability request was received, sending information about the first product, by the inventory management system.

23. The computer-implemented method of claim 22, further comprising:

restricting the search, by the inventory management system, for the products to only include available products owned by entities identified in a whitelist associated with the second entity;

restricting the search, by the inventory management system, for the products

to not include in-stock products owned by the entities identified in a blacklist associated with the second entity;

restricting the search, by the inventory management system, for the products to only include available products with a selling price that is less than or equal to a preferred maximum purchase price defined by the second entity in the product availability request;

restricting the search, by the inventory management system, for the products to only include available products that are within a predetermined radius of a preferred destination defined in the product availability request; and

restricting the search, by the inventory management system, for the one or more products to only include available products that are deliverable within a preferred delivery timeline specified in the product availability request.

24. A non-transitory, computer-readable storage medium having embodied thereon, computer program instructions executable by at least one processor for managing product inventory of different entities at a plurality of facilities comprising storage structures served by robotic handlers, the computer program instructions, when executed by the processor, cause the processor to:

store, in a storage device, a database containing product ownership information, the product ownership information comprising information necessary for identification of the different entities;

facilitate a one-to-one (1:1) exchange of storage bins at each of the plurality of facilities and transport vehicles traveling between said plurality of facilities, and thereby enable a continuous and equivalent flow of the storage bins in a forward direction and a reverse direction, such that a forward flow of the storage bins is equivalent to a reverse flow of the storage bins.