

COMPUTERIZED SYSTEMS AND METHODS FOR MANAGING INVENTORY BY DETERMINING PRODUCT PRICES BASED ON PRODUCT CHARACTERISTICSTechnical Field

[001] The present disclosure generally relates to computerized systems and methods for managing inventory by determining product prices based on product characteristics. In particular, embodiments of the present disclosure relate to inventive and unconventional systems that may automatically calculate and apply discounts to product prices by automatically identifying relationships between the age of the product and the condition or the inventory rate of the product.

Background

[002] The sale of returned products may be as important as the sale of new products for many organizations. The sale of any product may be difficult or impossible if it is listed at a price that is inconsistent with the true value of the product. Return processing is costly to organizations in two ways. The first type of cost relates to shipping and handling costs. The process of reversing an online order has many steps and includes the cost of the delivery as well as the many touches, each of which comes with a labor cost, to move a return item back into inventory stored in fulfillment centers. It is inevitable that the expense will reduce profit margins. The second type of cost is more difficult to quantify, but the longer a return item stays out of circulation and is unable to be sold, the less value it has which results in a loss for the retailer. This second type of cost may also apply to new products that have never been sold.

[003] Conventional inventory management systems transfer a return item without defects from a return center storing the return item to a fulfillment center for resale at the original price. For example, these conventional computerized systems

may only rely on the original price or an arbitrary discount to assign a price to returned products or products that have been stored in a fulfillment center for a long time. These computerized systems do not determine new prices that are consistent with the true value of the products.

[004] Therefore, there is a need for improved methods and systems for managing inventory by determining product prices based on product characteristics.

Summary

[005] One aspect of the present disclosure is directed to a system for managing inventory by determining product prices based on product characteristics. The system may include a memory storing instructions and at least one processor configured to execute instructions. The instructions may include scanning, via a user device associated with a fulfillment center, an indicia of a product; transmitting, via the user device, a request for assigning a product price to the product, wherein the request comprises a product identifier associated with the product; based on the product identifier, searching a database for an original price of the product and identifying the original price of the product; retrieving, from the database, the original price of the product; and determining, based on the product identifier, whether the product is a returned product from a customer. Based on a determination that the product is a returned product from a customer: modifying the database to assign, to the product identifier, the determination that the product is a returned product; determining a condition of the product; determining an age of the product; modifying the database to assign, to the product identifier, the condition of the product and the age of the product; based on the condition of the product and the age of the product, determining a new price of the product, wherein the new price is a discount of the original price; and modifying the database to assign the new price to the product

identifier. Based on a determination that the product is not a returned product from a customer: modifying the database to assign, to the product identifier, the determination that the product is not a returned product; calculating an inventory rate associated with the product; based on the calculated inventory rate, determining a new price of the product, wherein the new price is a discount of the original price; and modifying the database to assign, to the product identifier, the inventory rate and the new price. The instructions further include transmitting a request, to the user device, to list the product for sale at the new price.

[006] Another aspect of the present disclosure is directed to a method for managing inventory by determining product prices based on product characteristics. The method may include scanning, via a user device associated with a fulfillment center, an indicia of a product; transmitting, via the user device, a request for assigning a product price to the product, wherein the request comprises a product identifier associated with the product; based on the product identifier, searching a database for an original price of the product and identifying the original price of the product; retrieving, from the database, the original price of the product; and determining, based on the product identifier, whether the product is a returned product from a customer. Based on a determination that the product is a returned product from a customer: modifying the database to assign, to the product identifier, the determination that the product is a returned product; determining a condition of the product; determining an age of the product; modifying the database to assign, to the product identifier, the condition of the product and the age of the product; based on the condition of the product and the age of the product, determining a new price of the product, wherein the new price is a discount of the original price; and modifying the database to assign the new price to the product identifier. Based on a

determination that the product is not a returned product from a customer: modifying the database to assign, to the product identifier, the determination that the product is not a returned product; calculating an inventory rate associated with the product; based on the calculated inventory rate, determining a new price of the product, wherein the new price is a discount of the original price; and modifying the database to assign, to the product identifier, the inventory rate and the new price. The method may further include transmitting a request, to the user device, to list the product for sale at the new price.

[007] Yet another aspect of the present disclosure is directed to a system for managing inventory by determining product prices based on product characteristics. The system may include a memory storing instructions and at least one processor configured to execute instructions. The instructions may include scanning, via a user device associated with a fulfillment center, an indicia of a product; transmitting, via the user device, a request for assigning a product price to the product, wherein the request comprises a product identifier associated with the product; based on the product identifier, searching a database for an original price of the product and identifying the original price of the product; retrieving, from the database, the original price of the product; and determining, based on the product identifier, whether the product is a returned product from a customer. Based on a determination that the product is a returned product from a customer: modifying the database to assign, to the product identifier, the determination that the product is a returned product; transmitting a pickup request to a user device associated with an inventory worker to pick up the returned product from a return center and deliver the returned product to the fulfillment center; determining a condition of the product; determining an age of the product; modifying the database to assign, to the product identifier, the condition

of the product and the age of the product; based on the condition of the product and the age of the product, determining a new price of the product, wherein the new price is a discount of the original price; and modifying the database to assign the new price to the product identifier. Based on a determination that the product is not a returned product from a customer: modifying the database to assign, to the product identifier, the determination that the product is not a returned product; calculating an inventory rate associated with the product; based on the calculated inventory rate, determining a new price of the product, wherein the new price is a discount of the original price; and modifying the database to assign, to the product identifier, the inventory rate and the new price. The instructions further include transmitting a request, to the user device, to list the product for sale at the new price.

[008] Other systems, methods, and computer-readable media are also discussed herein.

Brief Description of the Drawings

[009] FIG. 1A is a schematic block diagram illustrating an exemplary embodiment of a network comprising computerized systems for communications enabling shipping, transportation, and logistics operations, consistent with the disclosed embodiments.

[0010] FIG. 1B depicts a sample Search Result Page (SRP) that includes one or more search results satisfying a search request along with interactive user interface elements, consistent with the disclosed embodiments.

[0011] FIG. 1C depicts a sample Single Display Page (SDP) that includes a product and information about the product along with interactive user interface elements, consistent with the disclosed embodiments.

[0012] FIG. 1D depicts a sample Cart page that includes items in a virtual shopping cart along with interactive user interface elements, consistent with the disclosed embodiments.

[0013] FIG. 1E depicts a sample Order page that includes items from the virtual shopping cart along with information regarding purchase and shipping, along with interactive user interface elements, consistent with the disclosed embodiments.

[0014] FIG. 2 is a diagrammatic illustration of an exemplary fulfillment center configured to utilize disclosed computerized systems, consistent with the disclosed embodiments.

[0015] FIG. 3 depicts an exemplary network of devices and systems automatically managing inventory by determining product prices based on product characteristics, consistent with the disclosed embodiments.

[0016] FIG. 4 depicts an exemplary multi-dimensional data structure that may access relationships between the condition of the product and the age of the product, consistent with the disclosed embodiments.

[0017] FIG. 5 depicts an exemplary multi-dimensional data structure that may access relationships between the inventory rate of the product and the age of the product, consistent with the disclosed embodiments.

[0018] FIG. 6 depicts a process for managing inventory by determining product prices based on product characteristics, consistent with the disclosed embodiments.

Detailed Description

[0019] The following detailed description refers to the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the following description to refer to the same or similar parts. While several

illustrative embodiments are described herein, modifications, adaptations and other implementations are possible. For example, substitutions, additions, or modifications may be made to the components and steps illustrated in the drawings, and the illustrative methods described herein may be modified by substituting, reordering, removing, or adding steps to the disclosed methods. Accordingly, the following detailed description is not limited to the disclosed embodiments and examples. Instead, the proper scope of the invention is defined by the appended claims.

[0020] Embodiments of the present disclosure are directed to systems and methods configured for managing inventory by determining product prices based on product characteristics. The disclosed embodiments are capable of determining whether a product is a returned product from a customer. Based on a determination that the product is a returned product from a customer, a price determination system may modify a database to assign, to a product identifier, the determination that the product is a returned product.

[0021] The price determination system may determine a condition of the product based on the product identifier. The condition may be one of repackaged, package damaged, refurbished, used best, used good, or used normal. The price determination system may modify the database to assign, to the product identifier, the condition of the product and the age of the product. In some embodiments, a data structure may calculate an optimum discount for the product by accessing the relationships between the condition of the product and the age of the product. The price determination system may access the data structure according to the product identifier and determine the new price of the product based on an optimum discount calculated by the data structure. The price determination system may modify the database to assign the new price to the product identifier and transmit a request to a

user device to list the product for sale at the new price. In some embodiments, the price determination system may automatically transmit a notification to a web server to list the product for sale at the new price.

[0022] Based on a determination that the product is not a returned product from a customer, the price determination system may modify the database to assign, to the product identifier, the determination that the product is not a returned product. In some embodiments, a data structure may calculate the inventory rate associated with the product by dividing the quantity of usable inventory by the average daily sales volume.

In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the inventory rate of the product and the age of the product. The price determination system may access the data structure according to the product identifier and determine the new price of the product based on an optimum discount calculated by the data structure. The price determination system may modify the database to assign, to the product identifier, the inventory rate and the new price and transmit a request to the user device to list the product for sale at the new price. In some embodiments, the price determination system may automatically transmit a notification to a web server to list the product for sale at the new price.

[0023] Referring to FIG. 1A, a schematic block diagram 100 illustrating an exemplary embodiment of a system comprising computerized systems for communications enabling shipping, transportation, and logistics operations is shown. As illustrated in FIG. 1A, system 100 may include a variety of systems, each of which may be connected to one another via one or more networks. The systems may also be connected to one another via a direct connection, for example, using a cable. The

depicted systems include a shipment authority technology (SAT) system 101, an external front end system 103, an internal front end system 105, a transportation system 107, mobile devices 107A, 107B, and 107C, seller portal 109, shipment and order tracking (SOT) system 111, fulfillment optimization (FO) system 113, fulfillment messaging gateway (FMG) 115, supply chain management (SCM) system 117, warehouse management system 119, mobile devices 119A, 119B, and 119C (depicted as being inside of fulfillment center (FC) 200), 3rd party fulfillment systems 121A, 121B, and 121C, fulfillment center authorization system (FC Auth) 123, and labor management system (LMS) 125.

[0024] SAT system 101, in some embodiments, may be implemented as a computer system that monitors order status and delivery status. For example, SAT system 101 may determine whether an order is past its Promised Delivery Date (PDD) and may take appropriate action, including initiating a new order, reshipping the items in the non-delivered order, canceling the non-delivered order, initiating contact with the ordering customer, or the like. SAT system 101 may also monitor other data, including output (such as a number of packages shipped during a particular time period) and input (such as the number of empty cardboard boxes received for use in shipping). SAT system 101 may also act as a gateway between different devices in system 100, enabling communication (e.g., using store-and-forward or other techniques) between devices such as external front end system 103 and FO system 113.

[0025] External front end system 103, in some embodiments, may be implemented as a computer system that enables external users to interact with one or more systems in system 100. For example, in embodiments where system 100 enables the presentation of systems to enable users to place an order for an item,

external front end system 103 may be implemented as a web server that receives search requests, presents item pages, and solicits payment information. For example, external front end system 103 may be implemented as a computer or computers running software such as the Apache HTTP Server, Microsoft Internet Information Services (IIS), NGINX, or the like. In other embodiments, external front end system 103 may run custom web server software designed to receive and process requests from external devices (e.g., mobile device 102A or computer 102B), acquire information from databases and other data stores based on those requests, and provide responses to the received requests based on acquired information.

[0026] In some embodiments, external front end system 103 may include one or more of a web caching system, a database, a search system, or a payment system. In one aspect, external front end system 103 may comprise one or more of these systems, while in another aspect, external front end system 103 may comprise interfaces (e.g., server-to-server, database-to-database, or other network connections) connected to one or more of these systems.

[0027] An illustrative set of steps, illustrated by FIGS. 1B, 1C, 1D, and 1E, will help to describe some operations of external front end system 103. External front end system 103 may receive information from systems or devices in system 100 for presentation and/or display. For example, external front end system 103 may host or provide one or more web pages, including a Search Result Page (SRP) (e.g., FIG. 1B), a Single Detail Page (SDP) (e.g., FIG. 1C), a Cart page (e.g., FIG. 1D), or an Order page (e.g., FIG. 1E). A user device (e.g., using mobile device 102A or computer 102B) may navigate to external front end system 103 and request a search by entering information into a search box. External front end system 103 may

request information from one or more systems in system 100. For example, external front end system 103 may request information from FO System 113 that satisfies the search request. External front end system 103 may also request and receive (from FO System 113) a Promised Delivery Date or “PDD” for each product included in the search results. The PDD, in some embodiments, may represent an estimate of when a package containing the product will arrive at the user’s desired location or a date by which the product is promised to be delivered at the user’s desired location if ordered within a particular period of time, for example, by the end of the day (11:59 PM). (PDD is discussed further below with respect to FO System 113.)

[0028] External front end system 103 may prepare an SRP (e.g., FIG. 1B) based on the information. The SRP may include information that satisfies the search request. For example, this may include pictures of products that satisfy the search request. The SRP may also include respective prices for each product, or information relating to enhanced delivery options for each product, PDD, weight, size, offers, discounts, or the like. External front end system 103 may send the SRP to the requesting user device (e.g., via a network).

[0029] A user device may then select a product from the SRP, e.g., by clicking or tapping a user interface, or using another input device, to select a product represented on the SRP. The user device may formulate a request for information on the selected product and send it to external front end system 103. In response, external front end system 103 may request information related to the selected product. For example, the information may include additional information beyond that presented for a product on the respective SRP. This could include, for example, shelf life, country of origin, weight, size, number of items in package, handling instructions, or other information about the product. The information could also include

recommendations for similar products (based on, for example, big data and/or machine learning analysis of customers who bought this product and at least one other product), answers to frequently asked questions, reviews from customers, manufacturer information, pictures, or the like.

[0030] External front end system 103 may prepare an SDP (Single Detail Page) (e.g., FIG. 1C) based on the received product information. The SDP may also include other interactive elements such as a “Buy Now” button, a “Add to Cart” button, a quantity field, a picture of the item, or the like. The SDP may further include a list of sellers that offer the product. The list may be ordered based on the price each seller offers such that the seller that offers to sell the product at the lowest price may be listed at the top. The list may also be ordered based on the seller ranking such that the highest ranked seller may be listed at the top. The seller ranking may be formulated based on multiple factors, including, for example, the seller’s past track record of meeting a promised PDD. External front end system 103 may deliver the SDP to the requesting user device (e.g., via a network).

[0031] The requesting user device may receive the SDP which lists the product information. Upon receiving the SDP, the user device may then interact with the SDP. For example, a user of the requesting user device may click or otherwise interact with a “Place in Cart” button on the SDP. This adds the product to a shopping cart associated with the user. The user device may transmit this request to add the product to the shopping cart to external front end system 103.

[0032] External front end system 103 may generate a Cart page (e.g., FIG. 1D). The Cart page, in some embodiments, lists the products that the user has added to a virtual “shopping cart.” A user device may request the Cart page by clicking on or otherwise interacting with an icon on the SRP, SDP, or other pages.

The Cart page may, in some embodiments, list all products that the user has added to the shopping cart, as well as information about the products in the cart such as a quantity of each product, a price for each product per item, a price for each product based on an associated quantity, information regarding PDD, a delivery method, a shipping cost, user interface elements for modifying the products in the shopping cart (e.g., deletion or modification of a quantity), options for ordering other product or setting up periodic delivery of products, options for setting up interest payments, user interface elements for proceeding to purchase, or the like. A user at a user device may click on or otherwise interact with a user interface element (e.g., a button that reads "Buy Now") to initiate the purchase of the product in the shopping cart. Upon doing so, the user device may transmit this request to initiate the purchase to external front end system 103.

[0033] External front end system 103 may generate an Order page (e.g., FIG. 1E) in response to receiving the request to initiate a purchase. The Order page, in some embodiments, re-lists the items from the shopping cart and requests input of payment and shipping information. For example, the Order page may include a section requesting information about the purchaser of the items in the shopping cart (e.g., name, address, e-mail address, phone number), information about the recipient (e.g., name, address, phone number, delivery information), shipping information (e.g., speed/method of delivery and/or pickup), payment information (e.g., credit card, bank transfer, check, stored credit), user interface elements to request a cash receipt (e.g., for tax purposes), or the like. External front end system 103 may send the Order page to the user device.

[0034] The user device may enter information on the Order page and click or otherwise interact with a user interface element that sends the information to

external front end system 103. From there, external front end system 103 may send the information to different systems in system 100 to enable the creation and processing of a new order with the products in the shopping cart.

[0035] In some embodiments, external front end system 103 may be further configured to enable sellers to transmit and receive information relating to orders.

[0036] Internal front end system 105, in some embodiments, may be implemented as a computer system that enables internal users (e.g., employees of an organization that owns, operates, or leases system 100) to interact with one or more systems in system 100. For example, in embodiments where system 100 enables the presentation of systems to enable users to place an order for an item, internal front end system 105 may be implemented as a web server that enables internal users to view diagnostic and statistical information about orders, modify item information, or review statistics relating to orders. For example, internal front end system 105 may be implemented as a computer or computers running software such as the Apache HTTP Server, Microsoft Internet Information Services (IIS), NGINX, or the like. In other embodiments, internal front end system 105 may run custom web server software designed to receive and process requests from systems or devices depicted in system 100 (as well as other devices not depicted), acquire information from databases and other data stores based on those requests, and provide responses to the received requests based on acquired information.

[0037] In some embodiments, internal front end system 105 may include one or more of a web caching system, a database, a search system, a payment system, an analytics system, an order monitoring system, or the like. In one aspect, internal front end system 105 may comprise one or more of these systems, while in another aspect, internal front end system 105 may comprise interfaces (e.g., server-to-

server, database-to-database, or other network connections) connected to one or more of these systems.

[0038] Transportation system 107, in some embodiments, may be implemented as a computer system that enables communication between systems or devices in system 100 and mobile devices 107A-107C. Transportation system 107, in some embodiments, may receive information from one or more mobile devices 107A-107C (e.g., mobile phones, smart phones, PDAs, or the like). For example, in some embodiments, mobile devices 107A-107C may comprise devices operated by delivery workers. The delivery workers, who may be permanent, temporary, or shift employees, may utilize mobile devices 107A-107C to effect delivery of packages containing the products ordered by users. For example, to deliver a package, the delivery worker may receive a notification on a mobile device indicating which package to deliver and where to deliver it. Upon arriving at the delivery location, the delivery worker may locate the package (e.g., in the back of a truck or in a crate of packages), scan or otherwise capture data associated with an identifier on the package (e.g., a barcode, an image, a text string, an RFID tag, or the like) using the mobile device, and deliver the package (e.g., by leaving it at a front door, leaving it with a security guard, handing it to the recipient, or the like). In some embodiments, the delivery worker may capture photo(s) of the package and/or may obtain a signature using the mobile device. The mobile device may send information to transportation system 107 including information about the delivery, including, for example, time, date, GPS location, photo(s), an identifier associated with the delivery worker, an identifier associated with the mobile device, or the like. Transportation system 107 may store this information in a database (not pictured) for access by other systems in system 100. Transportation system 107 may, in some

embodiments, use this information to prepare and send tracking data to other systems indicating the location of a particular package.

[0039] In some embodiments, certain users may use one kind of mobile device (e.g., permanent workers may use a specialized PDA with custom hardware such as a barcode scanner, stylus, and other devices) while other users may use other kinds of mobile devices (e.g., temporary or shift workers may utilize off-the-shelf mobile phones and/or smartphones).

[0040] In some embodiments, transportation system 107 may associate a user with each device. For example, transportation system 107 may store an association between a user (represented by, e.g., a user identifier, an employee identifier, or a phone number) and a mobile device (represented by, e.g., an International Mobile Equipment Identity (IMEI), an International Mobile Subscription Identifier (IMSI), a phone number, a Universal Unique Identifier (UUID), or a Globally Unique Identifier (GUID)). Transportation system 107 may use this association in conjunction with data received on deliveries to analyze data stored in the database in order to determine, among other things, a location of the worker, an efficiency of the worker, or a speed of the worker.

[0041] Seller portal 109, in some embodiments, may be implemented as a computer system that enables sellers or other external entities to electronically communicate with one or more systems in system 100. For example, a seller may utilize a computer system (not pictured) to upload or provide product information, order information, contact information, or the like, for products that the seller wishes to sell through system 100 using seller portal 109.

[0042] Shipment and order tracking system 111, in some embodiments, may be implemented as a computer system that receives, stores, and forwards

information regarding the location of packages containing products ordered by customers (e.g., by a user using devices 102A-102B). In some embodiments, shipment and order tracking system 111 may request or store information from web servers (not pictured) operated by shipping companies that deliver packages containing products ordered by customers.

[0043] In some embodiments, shipment and order tracking system 111 may request and store information from systems depicted in system 100. For example, shipment and order tracking system 111 may request information from transportation system 107. As discussed above, transportation system 107 may receive information from one or more mobile devices 107A-107C (e.g., mobile phones, smart phones, PDAs, or the like) that are associated with one or more of a user (e.g., a delivery worker) or a vehicle (e.g., a delivery truck). In some embodiments, shipment and order tracking system 111 may also request information from warehouse management system (WMS) 119 to determine the location of individual products inside of a fulfillment center (e.g., fulfillment center 200). Shipment and order tracking system 111 may request data from one or more of transportation system 107 or WMS 119, process it, and present it to a device (e.g., user devices 102A and 102B) upon request.

[0044] Fulfillment optimization (FO) system 113, in some embodiments, may be implemented as a computer system that stores information for customer orders from other systems (e.g., external front end system 103 and/or shipment and order tracking system 111). FO system 113 may also store information describing where particular items are held or stored. For example, certain items may be stored only in one fulfillment center, while certain other items may be stored in multiple fulfillment centers. In still other embodiments, certain fulfillment centers may be designed to

store only a particular set of items (e.g., fresh produce or frozen products). FO system 113 stores this information as well as associated information (e.g., quantity, size, date of receipt, expiration date, etc.).

[0045] FO system 113 may also calculate a corresponding PDD (promised delivery date) for each product. The PDD, in some embodiments, may be based on one or more factors. For example, FO system 113 may calculate a PDD for a product based on a past demand for a product (e.g., how many times that product was ordered during a period of time), an expected demand for a product (e.g., how many customers are forecast to order the product during an upcoming period of time), a network-wide past demand indicating how many products were ordered during a period of time, a network-wide expected demand indicating how many products are expected to be ordered during an upcoming period of time, one or more counts of the product stored in each fulfillment center 200, which fulfillment center stores each product, expected or current orders for that product, or the like.

[0046] In some embodiments, FO system 113 may determine a PDD for each product on a periodic basis (e.g., hourly) and store it in a database for retrieval or sending to other systems (e.g., external front end system 103, SAT system 101, shipment and order tracking system 111). In other embodiments, FO system 113 may receive electronic requests from one or more systems (e.g., external front end system 103, SAT system 101, shipment and order tracking system 111) and calculate the PDD on demand.

[0047] Fulfilment messaging gateway (FMG) 115, in some embodiments, may be implemented as a computer system that receives a request or response in one format or protocol from one or more systems in system 100, such as FO system 113, converts it to another format or protocol, and forward it in the converted format or

protocol to other systems, such as WMS 119 or 3rd party fulfillment systems 121A, 121B, or 121C, and vice versa.

[0048] Supply chain management (SCM) system 117, in some embodiments, may be implemented as a computer system that performs forecasting functions. For example, SCM system 117 may forecast a level of demand for a particular product based on, for example, based on a past demand for products, an expected demand for a product, a network-wide past demand, a network-wide expected demand, a count products stored in each fulfillment center 200, expected or current orders for each product, or the like. In response to this forecasted level and the amount of each product across all fulfillment centers, SCM system 117 may generate one or more purchase orders to purchase and stock a sufficient quantity to satisfy the forecasted demand for a particular product.

[0049] Warehouse management system (WMS) 119, in some embodiments, may be implemented as a computer system that monitors workflow. For example, WMS 119 may receive event data from individual devices (e.g., devices 107A-107C or 119A-119C) indicating discrete events. For example, WMS 119 may receive event data indicating the use of one of these devices to scan a package. As discussed below with respect to fulfillment center 200 and FIG. 2, during the fulfillment process, a package identifier (e.g., a barcode or RFID tag data) may be scanned or read by machines at particular stages (e.g., automated or handheld barcode scanners, RFID readers, high-speed cameras, devices such as tablet 119A, mobile device/PDA 119B, computer 119C, or the like). WMS 119 may store each event indicating a scan or a read of a package identifier in a corresponding database (not pictured) along with the package identifier, a time, date, location, user identifier, or other information,

and may provide this information to other systems (e.g., shipment and order tracking system 111).

[0050] WMS 119, in some embodiments, may store information associating one or more devices (e.g., devices 107A-107C or 119A-119C) with one or more users associated with system 100. For example, in some situations, a user (such as a part- or full-time employee) may be associated with a mobile device in that the user owns the mobile device (e.g., the mobile device is a smartphone). In other situations, a user may be associated with a mobile device in that the user is temporarily in custody of the mobile device (e.g., the user checked the mobile device out at the start of the day, will use it during the day, and will return it at the end of the day).

[0051] WMS 119, in some embodiments, may maintain a work log for each user associated with system 100. For example, WMS 119 may store information associated with each employee, including any assigned processes (e.g., unloading trucks, picking items from a pick zone, rebin wall work, packing items), a user identifier, a location (e.g., a floor or zone in a fulfillment center 200), a number of units moved through the system by the employee (e.g., number of items picked, number of items packed), an identifier associated with a device (e.g., devices 119A-119C), or the like. In some embodiments, WMS 119 may receive check-in and check-out information from a timekeeping system, such as a timekeeping system operated on a device 119A-119C.

[0052] 3rd party fulfillment (3PL) systems 121A-121C, in some embodiments, represent computer systems associated with third-party providers of logistics and products. For example, while some products are stored in fulfillment center 200 (as discussed below with respect to FIG. 2), other products may be stored off-site, may be produced on demand, or may be otherwise unavailable for storage in fulfillment

center 200. 3PL systems 121A-121C may be configured to receive orders from FO system 113 (e.g., through FMG 115) and may provide products and/or services (e.g., delivery or installation) to customers directly. In some embodiments, one or more of 3PL systems 121A-121C may be part of system 100, while in other embodiments, one or more of 3PL systems 121A-121C may be outside of system 100 (e.g., owned or operated by a third-party provider).

[0053] Fulfillment Center Auth system (FC Auth) 123, in some embodiments, may be implemented as a computer system with a variety of functions. For example, in some embodiments, FC Auth 123 may act as a single-sign on (SSO) service for one or more other systems in system 100. For example, FC Auth 123 may enable a user to log in via internal front end system 105, determine that the user has similar privileges to access resources at shipment and order tracking system 111, and enable the user to access those privileges without requiring a second log in process. FC Auth 123, in other embodiments, may enable users (e.g., employees) to associate themselves with a particular task. For example, some employees may not have an electronic device (such as devices 119A-119C) and may instead move from task to task, and zone to zone, within a fulfillment center 200, during the course of a day. FC Auth 123 may be configured to enable those employees to indicate what task they are performing and what zone they are in at different times of day.

[0054] Labor management system (LMS) 125, in some embodiments, may be implemented as a computer system that stores attendance and overtime information for employees (including full-time and part-time employees). For example, LMS 125 may receive information from FC Auth 123, WMS 119, devices 119A-119C, transportation system 107, and/or devices 107A-107C.

[0055] The particular configuration depicted in FIG. 1A is an example only. For example, while FIG. 1A depicts FC Auth system 123 connected to FO system 113, not all embodiments require this particular configuration. Indeed, in some embodiments, the systems in system 100 may be connected to one another through one or more public or private networks, including the Internet, an Intranet, a WAN (Wide-Area Network), a MAN (Metropolitan-Area Network), a wireless network compliant with the IEEE 802.11 a/b/g/n Standards, a leased line, or the like. In some embodiments, one or more of the systems in system 100 may be implemented as one or more virtual servers implemented at a data center, server farm, or the like.

[0056] FIG. 2 depicts a fulfillment center 200. Fulfillment center 200 is an example of a physical location that stores items for shipping to customers when ordered. Fulfillment center (FC) 200 may be divided into multiple zones, each of which are depicted in FIG. 2. These “zones,” in some embodiments, may be thought of as virtual divisions between different stages of a process of receiving items, storing the items, retrieving the items, and shipping the items. So while the “zones” are depicted in FIG. 2, other divisions of zones are possible, and the zones in FIG. 2 may be omitted, duplicated, or modified in some embodiments.

[0057] Inbound zone 203 represents an area of FC 200 where items are received from sellers who wish to sell products using system 100 from FIG. 1A. For example, a seller may deliver items 202A and 202B using truck 201. Item 202A may represent a single item large enough to occupy its own shipping pallet, while item 202B may represent a set of items that are stacked together on the same pallet to save space.

[0058] A worker will receive the items in inbound zone 203 and may optionally check the items for damage and correctness using a computer system (not pictured).

For example, the worker may use a computer system to compare the quantity of items 202A and 202B to an ordered quantity of items. If the quantity does not match, that worker may refuse one or more of items 202A or 202B. If the quantity does match, the worker may move those items (using, e.g., a dolly, a handtruck, a forklift, or manually) to buffer zone 205. Buffer zone 205 may be a temporary storage area for items that are not currently needed in the picking zone, for example, because there is a high enough quantity of that item in the picking zone to satisfy forecasted demand. In some embodiments, forklifts 206 operate to move items around buffer zone 205 and between inbound zone 203 and drop zone 207. If there is a need for items 202A or 202B in the picking zone (e.g., because of forecasted demand), a forklift may move items 202A or 202B to drop zone 207.

[0059] Drop zone 207 may be an area of FC 200 that stores items before they are moved to picking zone 209. A worker assigned to the picking task (a “picker”) may approach items 202A and 202B in the picking zone, scan a barcode for the picking zone, and scan barcodes associated with items 202A and 202B using a mobile device (e.g., device 119B). The picker may then take the item to picking zone 209 (e.g., by placing it on a cart or carrying it).

[0060] Picking zone 209 may be an area of FC 200 where items 208 are stored on storage units 210. In some embodiments, storage units 210 may comprise one or more of physical shelving, bookshelves, boxes, totes, refrigerators, freezers, cold stores, or the like. In some embodiments, picking zone 209 may be organized into multiple floors. In some embodiments, workers or machines may move items into picking zone 209 in multiple ways, including, for example, a forklift, an elevator, a conveyor belt, a cart, a handtruck, a dolly, an automated robot or device, or

manually. For example, a picker may place items 202A and 202B on a handtruck or cart in drop zone 207 and walk items 202A and 202B to picking zone 209.

[0061] A picker may receive an instruction to place (or “stow”) the items in particular spots in picking zone 209, such as a particular space on a storage unit 210. For example, a picker may scan item 202A using a mobile device (e.g., device 119B). The device may indicate where the picker should stow item 202A, for example, using a system that indicate an aisle, shelf, and location. The device may then prompt the picker to scan a barcode at that location before stowing item 202A in that location. The device may send (e.g., via a wireless network) data to a computer system such as WMS 119 in FIG. 1A indicating that item 202A has been stowed at the location by the user using device 119B.

[0062] Once a user places an order, a picker may receive an instruction on device 119B to retrieve one or more items 208 from storage unit 210. The picker may retrieve item 208, scan a barcode on item 208, and place it on transport mechanism 214. While transport mechanism 214 is represented as a slide, in some embodiments, transport mechanism may be implemented as one or more of a conveyor belt, an elevator, a cart, a forklift, a handtruck, a dolly, a cart, or the like. Item 208 may then arrive at packing zone 211.

[0063] Packing zone 211 may be an area of FC 200 where items are received from picking zone 209 and packed into boxes or bags for eventual shipping to customers. In packing zone 211, a worker assigned to receiving items (a “rebin worker”) will receive item 208 from picking zone 209 and determine what order it corresponds to. For example, the rebin worker may use a device, such as computer 119C, to scan a barcode on item 208. Computer 119C may indicate visually which order item 208 is associated with. This may include, for example, a space or “cell” on

a wall 216 that corresponds to an order. Once the order is complete (e.g., because the cell contains all items for the order), the rebin worker may indicate to a packing worker (or “packer”) that the order is complete. The packer may retrieve the items from the cell and place them in a box or bag for shipping. The packer may then send the box or bag to a hub zone 213, e.g., via forklift, cart, dolly, handtruck, conveyor belt, manually, or otherwise.

[0064] Hub zone 213 may be an area of FC 200 that receives all boxes or bags (“packages”) from packing zone 211. Workers and/or machines in hub zone 213 may retrieve package 218 and determine which portion of a delivery area each package is intended to go to, and route the package to an appropriate camp zone 215. For example, if the delivery area has two smaller sub-areas, packages will go to one of two camp zones 215. In some embodiments, a worker or machine may scan a package (e.g., using one of devices 119A-119C) to determine its eventual destination. Routing the package to camp zone 215 may comprise, for example, determining a portion of a geographical area that the package is destined for (e.g., based on a postal code) and determining a camp zone 215 associated with the portion of the geographical area.

[0065] Camp zone 215, in some embodiments, may comprise one or more buildings, one or more physical spaces, or one or more areas, where packages are received from hub zone 213 for sorting into routes and/or sub-routes. In some embodiments, camp zone 215 is physically separate from FC 200 while in other embodiments camp zone 215 may form a part of FC 200.

[0066] Workers and/or machines in camp zone 215 may determine which route and/or sub-route a package 220 should be associated with, for example, based on a comparison of the destination to an existing route and/or sub-route, a

calculation of workload for each route and/or sub-route, the time of day, a shipping method, the cost to ship the package 220, a PDD associated with the items in package 220, or the like. In some embodiments, a worker or machine may scan a package (e.g., using one of devices 119A-119C) to determine its eventual destination. Once package 220 is assigned to a particular route and/or sub-route, a worker and/or machine may move package 220 to be shipped. In exemplary FIG. 2, camp zone 215 includes a truck 222, a car 226, and delivery workers 224A and 224B. In some embodiments, truck 222 may be driven by delivery worker 224A, where delivery worker 224A is a full-time employee that delivers packages for FC 200 and truck 222 is owned, leased, or operated by the same company that owns, leases, or operates FC 200. In some embodiments, car 226 may be driven by delivery worker 224B, where delivery worker 224B is a “flex” or occasional worker that is delivering on an as-needed basis (e.g., seasonally). Car 226 may be owned, leased, or operated by delivery worker 224B.

[0067] Referring to FIG. 3, an exemplary network of devices and systems for managing inventory by determining product prices based on product condition is shown. As illustrated in FIG. 3, a system 300 may include a price determination system 330, which may communicate with a user device 320 associated with a user 320A via a network 310. In some embodiments, price determination system 330 may communicate with the other components of system 300 via a direct connection, for example, using a cable. In some other embodiments, system 300 may be a part of system 100 of Fig. 1A and may communicate with the other components of system 100 via network 310 or via a direct connection, for example, using a cable. Price determination system 330 may comprise a single computer or may each be configured as a distributed computer system including multiple computers that

interoperate to perform one or more of the processes and functionalities associated with the disclosed examples.

[0068] As shown in FIG. 3, price determination system 330 may comprise a processor 332, a memory 334, and a database 336. Processor 332 may be one or more known processing devices, such as a microprocessor from the Pentium™ family manufactured by Intel™ or the Turion™ family manufactured by AMD™. Processor 332 may constitute a single core or multiple core processor that executes parallel processes simultaneously. For example, processor 332 may use logical processors to simultaneously execute and control multiple processes. Processor 332 may implement virtual machine technologies or other known technologies to provide the ability to execute, control, run, manipulate, store, etc. multiple software processes, applications, programs, etc. In another example, processor 332 may include a multiple-core processor arrangement configured to provide parallel processing functionalities to allow price determination system 330 to execute multiple processes simultaneously. One of ordinary skill in the art would understand that other types of processor arrangements could be implemented that provide for the capabilities disclosed herein.

[0069] Memory 334 may store one or more operating systems that perform known operating system functions when executed by processor 332. By way of example, the operating system may include Microsoft Windows, Unix, Linux, Android, Mac OS, iOS, or other types of operating systems. Accordingly, examples of the disclosed invention may operate and function with computer systems running any type of operating system. Memory 334 may be a volatile or non-volatile, magnetic, semiconductor, tape, optical, removable, non-removable, or other type of storage device or tangible computer readable medium.

[0070] Database 336 may include, for example, Oracle™ databases, Sybase™ databases, or other relational databases or non-relational databases, such as Hadoop™ sequence files, HBase™, or Cassandra™. Database 336 may include computing components (e.g., database management system, database server, etc.) configured to receive and process requests for data stored in memory devices of the database(s) and to provide data from the database(s). Database 336 may include NoSQL databases such as HBase, MongoDB™ or Cassandra™. Alternatively, database 336 may include relational databases such as Oracle, MySQL and Microsoft SQL Server. In some embodiments, database 336 may take the form of servers, general purpose computers, mainframe computers, or any combination of these components.

[0071] Database 336 may store data that may be used by processor 332, respectively, for performing methods and processes associated with disclosed examples. Database 336 may be located in price determination system 330 as shown in FIG. 3, or alternatively, it may be in external storage devices located outside of price determination system 330. Data stored in 336 may include any suitable data associated with products (e.g., age of product, condition of product, inventory rate, status from return center, relationships between age of product and condition of product, relationships between age of product and inventory rate of product, assignments to product identifiers associated with products, historical data of products, the original price of products, discounts to be applied to products, etc.).

[0072] User device 320 may be a tablet, mobile device, computer, or the like. User device 320 may include a display. The display may include, for example, liquid crystal displays (LCD), light emitting diode screens (LED), organic light emitting diode screens (OLED), a touch screen, and other known display devices. The

display may show various information to a user. For example, it may display a user interface element, which includes an option to scan an indicia (e.g., a barcode, an image, a text string, an RFID tag, or the like) of a product (e.g., items 202A or 202B of FIG. 2), to submit a request for assigning a product price to a product, to submit a selection of a product or product identifier, to submit a pickup request to pick up a returned product from a return center and deliver the returned product to FC 200, to submit a request to list a product for sale (e.g., at a new price), etc. In some embodiments, the display may show historical data of the product (e.g., previous sales of the product or related products, previous conditions of the product and whether it was sold at the conditions, the price or discount at which the product was sold and the condition associated with the product for that sale, previous inventory rates of the product and whether it was sold at the inventory rates, the price or discount at which the product was sold and the inventory rate associated with the product for that sale, etc.), the original price of a product, a discount to be applied to a product, a condition of the product, an inventory rate of a product, an age of a product, a "returned" status of a product, a listing of a product for sale, etc. User device 320 may include one or more input/output (I/O) devices. The I/O devices may include one or more devices that allow user device 320 to send and receive information from user 320A or another device. The I/O devices may include various input/output devices, a camera, a microphone, a keyboard, a mouse-type device, a gesture sensor, an action sensor, a physical button, an oratory input, etc. The I/O devices may also include one or more communication modules (not shown) for sending and receiving information from price determination system 330 by, for example, establishing wired or wireless connectivity between user device 320 and

network 310. In some embodiments, user device 320 may be devices 119A-119C of FIG. 1A associated with FC 200.

[0073] In some embodiments, user 320A may be an internal user (e.g., employees of an organization that owns, operates, or leases systems 100 or 300). Internal front end system 105 may be implemented as a computer system that enables user 320A to interact with system 300. For example, in embodiments where systems 100 or 300 enable the presentation of systems to enable users to scan an indicia of a product, submit a request for assigning a product price to a product, submit a selection of a product or product identifier, submit a pickup request to pick up a returned product from a return center and deliver the returned product to FC 200, or submit a request to list a product for sale, internal front end system 105 may be implemented as a web server that enables user 320A to view historical data of products, the original prices of products, discounts to be applied to products, conditions of products, inventory rates of products, ages of products, "returned" statuses of products, listings of products for sale, etc. In some embodiments, internal front end system 105 may run custom web server software designed to receive and process requests from systems or devices depicted in systems 100 or 300, acquire information from databases (e.g., database 336) and other data stores based on those requests, and provide responses to the received requests based on acquired information.

[0074] In some embodiments, user device 320 may scan an indicia (e.g., a barcode, an image, a text string, an RFID tag, or the like) of a product (e.g., items 202A or 202B of FIG. 2). User device 320 may transmit a request for assigning a product price to the product to price determination system 330, where the request comprises a product identifier associated with the product. Price determination

system 330 may receive the request and based on the received product identifier, price determination system 330 may search database 336 for an original price of the product and identify the original price of the product. Price determination system 330 may retrieve the original price of the product from database 336.

[0075] Price determination system 330 may determine, based on the product identifier, whether the product is a returned product from a customer. For example, a return center may receive a product returned from a customer and evaluate the condition of the product. The return center may determine that the condition of the product is high enough to be resold and may assign a “returned” status to the product based on the determination. The return center may be part of or separate from system 100. Price determination system 330 may transmit to the return center a request for a status associated with the product identifier and the return center may send a status associated with the product identifier to FC 200 or system 300.

[0076] Based on a determination that the product is a returned product from a customer, price determination system 330 may modify database 336 to assign, to the product identifier, the determination that the product is a returned product. Price determination system 330 may transmit a pickup request to a user device associated with a user associated with either the return center or FC 200 (e.g., an inventory worker) to pick up the returned product from the return center and deliver the returned product to FC 200.

[0077] Price determination system 330 may determine a condition of the product based on the product identifier. For example, the “returned” status assigned to the product may include a condition of the product. For example, the condition of the product may be determined (e.g., by an internal user, by a system of system 100, etc.) at the return center before the returned product is delivered to FC 200. In some

embodiments, the condition may be one of repackaged, package damaged, refurbished, used best, used good, or used normal. A repackaged condition may indicate that the quality or performance of the product is the same as a new product or only the packaging (e.g., box) may need to be replaced. A package damaged condition may indicate that the quality or performance of the product is the same as a new product or only the packaging may be damaged, but unopened. A refurbished condition may indicate that the product has been used, but a manufacturer or vendor has repaired the product so that the quality or performance of the product is high with no problems or missing components. A used best condition may indicate that the product has been used, but the quality or performance of the product is high with no problems or missing components (e.g., like a new product). A used good condition may indicate that the product has been used, but there is only a trace indication of prior product use and the product has no problems in performance or missing components. A used normal condition may indicate that the product has been used and there is an indication of prior product use, but the product has no problems in performance.

[0078] Price determination system 330 may modify database 336 to assign, to the product identifier, the condition of the product and the age of the product. Price determination system 330 may determine a new price of the product based on the condition of the product and the age of the product, where the new price is a discount of the original price. Price determination system 330 may determine the age of the product by determining a time duration in which the product is in FC 200 after determining the condition of the product. For example, if a product arrives at FC 200 after price determination system 330 determines a condition of the product on April 1st and today's date is April 11th, then the age of the product is 10 days. For

example, price determination system 330 may consult the product identifier stored in database 336 to identify and access a multi-dimensional data structure. In some embodiments, price determination system 330 may use different accessor methods based on the type of the product (e.g., returned, not returned, etc.). For example, the data structure may quickly access relationships between the condition of the product and the age of the product based on historical data of the product or related products based on the product identifier. The historical data may include previous sales of the product or related products, previous conditions of the product, the price or discount at which the product was sold and the condition associated with the product for that sale, etc. In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the condition of the product and the age of the product. Price determination system 330 may access the data structure according to the product identifier and determine the new price of the product based on an optimum discount calculated by the data structure. The optimum discount may be a discount of the product at which the product is most likely to be sold to a customer. In some embodiments, the optimum discount may depend on the seasonality of the product or the product webpage view count.

[0079] In some embodiments, price determination system 330 may periodically determine the age of unsold products. For example, price determination system 330 may determine that the age of the product has increased by an increment of time. In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the condition of the product and the increased age of the product. Based on the product identifier and the determined increment of time, price determination system 330 may access the data structure to determine an optimum discount calculated by the data

structure and increase the discount of the original price of the product based on the calculated optimum discount. For example, price determination system 330 may determine that the age of a used best product has increased from 210 days to 240 days. Based on the determination that the age of the product has increased from 210 days to 240 days, price determination system 330 may access the data structure and increase the discount of the original price of the product from 19% to 21%, which may be calculated by the data structure. Price determination system 330 may modify database 336 to assign the new price to the product identifier and transmit a request, to user device 320, to list the product for sale at the new price. In some embodiments, price determination system 330 may automatically transmit a notification to a web server (e.g., external front end system 103) to list the product for sale at the new price.

[0080] Based on a determination that the product is not a returned product from a customer, price determination system 330 may modify database 336 to assign, to the product identifier, the determination that the product is not a returned product. Price determination system 330 may determine a new price of the product based on the calculated inventory rate, where the new price is a discount of the original price. Price determination system 330 may determine the age of the product by determining a time duration in which the product is in FC 200. For example, if a product arrives at FC 200 on April 1st and today's date is April 11th, then the age of the product is 10 days.

[0081] In some embodiments, price determination system 330 may consult the product identifier stored in database 336 to identify and access a multi-dimensional data structure. In some embodiments, the multi-dimensional data structure may be the same data structure that is accessed for returned products. In some

embodiments, different multi-dimensional data structures may be accessed for returned products and non-returned products. In some embodiments, price determination system 330 may use different accessor methods based on the type of the product (e.g., returned, not returned, etc.). For example, the data structure may calculate an inventory rate associated with the product. In some embodiments, the data structure may determine a quantity of usable inventory in all FCs at a national level and calculate an average daily sales volume (e.g., average daily number of units sold) during a time span (e.g., the age of the product). In some embodiments, the data structure may calculate the inventory rate associated with the product by dividing the quantity of usable inventory by the average daily sales volume.

[0082] For example, the data structure may quickly access relationships between the calculated inventory rate and the age of the product based on historical data of the product or related products. The historical data may include previous sales of the product or related products, previous inventory rates of the product, the price or discount at which the product was sold and the inventory rate associated with the product for that sale, etc. In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the inventory rate of the product and the age of the product. Price determination system 330 may access the data structure according to the product identifier and determine the new price of the product based on an optimum discount calculated by the data structure. The optimum discount may be a discount of the product at which the product is most likely to be sold to a customer. In some embodiments, the optimum discount may depend on the seasonality of the product or the product webpage view count. Price determination system 330 may modify

database 336 to assign, to the product identifier, the inventory rate and the new price.

[0083] In some embodiments, price determination system 330 may periodically determine the age of unsold products. For example, price determination system 330 may determine that the age of the product has increased by an increment of time. In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the inventory rate of the product and the increased age of the product. Based on the product identifier and the determined increment of time, price determination system 330 may access the data structure to determine an optimum discount calculated by the data structure and increase the discount of the original price of the product based on the calculated optimum discount. For example, price determination system 330 may determine that the age of a product with an inventory rate of 240 days has increased from 210 days to 240 days. Based on the determination that the age of the product has increased from 210 days to 240 days, price determination system 330 may access the data structure and increase the discount of the original price of the product from 9% to 10%, which may be calculated by the data structure. Price determination system 330 may transmit a request, to user device 320, to list the product for sale at the new price. In some embodiments, price determination system 330 may automatically transmit a notification to a web server (e.g., external front end system 103) to list the product for sale at the new price.

[0084] In some embodiments, based on a determination that the discount is less than a specific percentage of the original price and a determination that the new price is less than a predetermined minimum price, price determination system 330 may modify database 336 to assign the predetermined minimum price to the product

identifier. For example, if price determination system 330 determines that the discount is less than 10%, then the minimum discount applied to the original price is 50,000 ₩.

[0085] In some embodiments, based on a determination that the discount is greater than a specific percentage of the original price and a determination that the new price is greater than a predetermined maximum price, price determination system 330 may modify database 336 to assign the predetermined maximum price to the product identifier. For example, if price determination system 330 determines that the discount is greater than 10%, then the maximum discount applied to the original price is 100,000 ₩.

[0086] In some embodiments, price determination system 330 may determine that no sales of the product were generated during a time period and based on the determination, price determination system 330 may increase the discount of the original price. Price determination system 330 may modify database 336 to assign an updated price to the product identifier, where the updated price is the increased discount applied to the original price. For example, price determination system 330 may determine that no sales of the product were generated in the past 360 days. Based on this determination, price determination system 330 may access the data structure, increase the discount of the original price from 18% to 20% based on a calculation by the data structure, and modify database 336 to assign an updated price to the product identifier.

[0087] In some embodiments, price determination system 330 may periodically determine whether or not discounts should be applied to products and, if discounts should be applied, the value of the discount. For example, price determination system 330 may access a data structure, which may calculate

discounts for products on the first business day of each week. In some embodiments, price determination system 330 may apply a discount to a product based on the category of the product. For example, price determination system 330 may determine that a product belongs to the “book” category, access the data structure, and determine that no discounts should be applied to the product.

[0088] Referring to FIG. 4, an exemplary multi-dimensional data structure 400 that may access relationships between the condition of the product and the age of the product is shown. As illustrated in FIG. 4, data structure 400 may calculate discount rates according to relationships between an age 401 of a product and a condition 403 of the product. The relationships between the condition of the product and the age of the product may be based on historical data of the product or related products based on the product identifier associated with the product. The historical data may include previous sales of the product or related products, previous conditions of the product, the price or discount at which the product was sold and the condition associated with the product for that sale, etc. For example, data structure 400 may quickly access relationships between condition 403 of the product and age 401 of the product based on historical data of the product or related products based on the product identifier. In some embodiments, data structure 400 may calculate an optimum discount for the product by accessing the relationships between condition 403 of the product and age 401 of the product. Price determination system 330 may access data structure 400 according to the product identifier and determine the new price of the product based on an optimum discount calculated by data structure 400. The optimum discount may be a discount of the product at which the product is most likely to be sold to a customer. In some embodiments, the optimum discount may depend on the seasonality of the product or the product webpage view count.

[0089] Price determination system 330 may determine age 401 of a product by determining a time duration in which the product is in FC 200. For example, if a product arrives at FC 200 on April 1st and today's date is April 11th, then the age of the product is 10 days.

[0090] Price determination system 330 may determine condition 403 of a product based on the product identifier associated with the product. For example, a "returned" status assigned to the product may include a condition of the product. For example, the condition of the product may be determined (e.g., by an internal user, by a system of system 100, etc.) at a return center before the returned product is delivered to FC 200. The condition may be one of repackaged, package damaged, refurbished, used best, used good, or used normal. A repackaged condition may indicate that the quality or performance of the product is the same as a new product or only the packaging (e.g., box) may need to be replaced. A package damaged condition may indicate that the quality or performance of the product is the same as a new product or only the packaging may be damaged, but unopened. A refurbished condition may indicate that the product has been used, but a manufacturer or vendor has repaired the product so that the quality or performance of the product is high with no problems or missing components. A used best condition may indicate that the product has been used, but the quality or performance of the product is high with no problems or missing components (e.g., like a new product). A used good condition may indicate that the product has been used, but there is only a trace indication of prior product use and the product has no problems in performance or missing components. A used normal condition may indicate that the product has been used and there is an indication of prior product use, but the product has no problems in performance.

[0091] Price determination system 330 may modify database 336 to assign, to the product identifier, age 401 of the product and condition 403 of the product. Price determination system 330 may determine a new price of the product based on age 401 of the product and condition 403 of the product, where the new price is a discount of the original price. For example, price determination system 330 may determine that age 401 of a product is 120 days and condition 403 of the product is refurbished. Price determination system 330 may consult the product identifier stored in database 336 to identify and access data structure 400. Data structure 400 may calculate an optimum discount 405 of 13% of the original price of the product by accessing the relationships between age 401 of the product and condition 403 of the product. Price determination system 330 may modify database 336 to assign the new price to the product identifier and transmit a request, to user device 320, to list the product for sale at the new price. In some embodiments, price determination system 330 may automatically transmit a notification to a web server (e.g., external front end system 103) to list the product for sale at the new price.

[0092] Although FIG. 4 shows an exemplary data structure 400 of relationships between age 401 of the product and condition 403 of the product, the embodiments of FIG. 4 are not limited to this specific data structure or specific relationships and may have other data structures or relationships as well.

[0093] Referring to FIG. 5, an exemplary multi-dimensional data structure 500 that may access relationships between the inventory rate of the product and the age of the product is shown. As illustrated in FIG. 5, data structure 500 may calculate discount rates according to relationships between an age 501 of a product and an inventory rate 503 of the product. The relationships between the inventory rate of the product and the age of the product may be based on historical data of the product or

related products based on the product identifier associated with the product. The historical data may include previous sales of the product or related products, previous inventory rates of the product, the price or discount at which the product was sold and the inventory rate associated with the product for that sale, etc. For example, data structure 500 may calculate an inventory rate associated with the product. In some embodiments, data structure 500 may determine a quantity of usable inventory in all FCs at a national level and calculate an average daily sales volume (e.g., average daily number of units sold) during a time span (e.g., the age of the product). In some embodiments, data structure 500 may calculate the inventory rate associated with the product by dividing the quantity of usable inventory by the average daily sales volume. For example, data structure 500 may quickly access relationships between calculated inventory rate 503 of the product and age 501 of the product based on historical data of the product or related products based on the product identifier. In some embodiments, data structure 500 may calculate an optimum discount for the product by accessing the relationships between inventory rate 503 of the product and age 501 of the product. Price determination system 330 may access data structure 500 according to the product identifier and determine the new price of the product based on an optimum discount calculated by data structure 500. The optimum discount may be a discount of the product at which the product is most likely to be sold to a customer. In some embodiments, the optimum discount may depend on the seasonality of the product or the product webpage view count.

[0094] Price determination system 330 may determine age 501 of a product by determining a time duration in which the product is in FC 200. For example, if a product arrives at FC 200 on April 1st and today's date is April 11th, then the age of the product is 10 days.

[0095] Price determination system 330 may modify database 336 to assign, to the product identifier, age 501 of the product and inventory rate 503 of the product. Price determination system 330 may determine a new price of the product based on age 501 of the product and inventory rate 503 of the product, where the new price is a discount of the original price. For example, price determination system 330 may determine that age 501 of a product is 120 days and data structure 500 may calculate inventory rate 503 of 180 days of the product. Price determination system 330 may consult the product identifier stored in database 336 to identify and access data structure 500. Data structure 500 may calculate an optimum discount 505 of 5% of the original price of the product by accessing the relationships between age 501 of the product and inventory rate 503 of the product. Price determination system 330 may modify database 336 to assign the new price to the product identifier and transmit a request, to user device 320, to list the product for sale at the new price. In some embodiments, price determination system 330 may automatically transmit a notification to a web server (e.g., external front end system 103) to list the product for sale at the new price.

[0096] In some embodiments, the criteria of the discount with respect to the relationships between age 501 of the product and inventory rate 503 of the product may be different depending on a status of the product. In some embodiments, data structure 500 may use different accessor methods to calculate discounts depending on the different criteria. For example, criteria 507 of the discount may reflect the relationships between age 501 and inventory rate 503 for retail products and criteria 509 may reflect the relationships between age 501 and inventory rate 503 for global sourcing products. In some embodiments, retail products and global sourcing products may be purchased, operated, or managed by a vendor (e.g., a vendor

associated with or who owns FC 200). In some embodiments, retail products may be purchased domestically while global sourcing products may be purchased internationally (e.g., purchased from overseas vendors). Retail products and global sourcing products may be distinguished by indicia (e.g., product identification information). In some embodiments, data structure 500 may use different accessor methods to calculate discounts for retail products due to purchase orders and lead times being longer than normal products. Similarly, in some embodiments, data structure 500 may use different accessor methods to calculate discounts for global sourcing products being purchased in bulk, which may require longer periods of time to sell the products than for normal products. The criteria of the discount may vary based on lead times, bulk purchases, warehouse arrangements, etc.

[0097] Although FIG. 5 shows an exemplary data structure 500 of relationships between age 501 of the product and inventory rate 503 of the product, the embodiments of FIG. 5 are not limited to this specific data structure or specific relationships and may have other data structures or relationships as well.

[0098] Referring to FIG. 6, a process 600 for managing inventory by determining product prices based on product characteristics is shown. While in some embodiments price determination system 330 may perform several of the steps described herein, other implementations are possible. For example, any of the systems and components (e.g., system 100) described and illustrated herein may perform the steps described in this disclosure.

[0099] In step 601, user device 320 may scan an indicia (e.g., a barcode, an image, a text string, an RFID tag, or the like) of a product (e.g., items 202A or 202B of FIG. 2). User device 320 may transmit a request for assigning a product price to

the product to price determination system 330, where the request comprises a product identifier associated with the product.

[00100] In step 603, price determination system 330 may receive the request and based on the received product identifier, price determination system 330 may search database 336 for an original price of the product and identify the original price of the product. Price determination system 330 may retrieve the original price of the product from database 336. The original price of a product may be the first price at which the product was listed for sale. For example, the original price of a returned product may be the price at which the customer (who returned the product) purchased the product. In some embodiments, the original price of a non-returned product may be the first price at which the product was listed for sale.

[00101] In step 605, price determination system 330 may determine, based on the product identifier, whether the product is a returned product from a customer. For example, a return center may receive a product returned from a customer and evaluate the condition of the product. The return center may determine that the condition of the product is high enough to be resold and may assign a "returned" status to the product based on the determination. The return center may be part of or separate from system 100. Price determination system 330 may transmit to the return center a request for a status associated with the product identifier and the return center may send a status associated with the product identifier to FC 200 or system 300.

[00102] In step 607A, based on a determination that the product is a returned product from a customer, price determination system 330 may modify database 336 to assign, to the product identifier, the determination that the product is a returned product. Price determination system 330 may transmit a pickup request to

a user device associated with a user associated with either the return center or FC 200 (e.g., an inventory worker) to pick up the returned product from the return center and deliver the returned product to FC 200.

[00103] Price determination system 330 may determine a condition of the product based on the product identifier. For example, the “returned” status assigned to the product may include a condition of the product. For example, the condition of the product may be determined (e.g., by an internal user, by a system of system 100, etc.) at the return center before the returned product is delivered to FC 200. The condition may be one of repackaged, package damaged, refurbished, used best, used good, or used normal. A repackaged condition may indicate that the quality or performance of the product is the same as a new product or only the packaging (e.g., box) may need to be replaced. A package damaged condition may indicate that the quality or performance of the product is the same as a new product or only the packaging may be damaged, but unopened. A refurbished condition may indicate that the product has been used, but a manufacturer or vendor has repaired the product so that the quality or performance of the product is high with no problems or missing components. A used best condition may indicate that the product has been used, but the quality or performance of the product is high with no problems or missing components (e.g., like a new product). A used good condition may indicate that the product has been used, but there is only a trace indication of prior product use and the product has no problems in performance or missing components. A used normal condition may indicate that the product has been used and there is an indication of prior product use, but the product has no problems in performance.

[00104] Price determination system 330 may modify database 336 to assign, to the product identifier, the condition of the product and the age of the

product. Price determination system 330 may determine a new price of the product based on the condition of the product and the age of the product, where the new price is a discount of the original price. Price determination system 330 may determine the age of the product by determining a time duration in which the product is in FC 200 after determining the condition of the product. For example, if a product arrives at FC 200 after price determination system 330 determines a condition of the product on April 1st and today's date is April 11th, then the age of the product is 10 days. For example, price determination system 330 may consult the product identifier stored in database 336 to identify and access a multi-dimensional data structure. In some embodiments, price determination system 330 may use different accessor methods based on the type of the product (e.g., returned, not returned, etc.). For example, the data structure may quickly access relationships between the condition of the product and the age of the product based on historical data of the product or related products based on the product identifier. The historical data may include previous sales of the product or related products, previous conditions of the product, the price or discount at which the product was sold and the condition associated with the product for that sale, etc. In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the condition of the product and the age of the product. Price determination system 330 may access the data structure according to the product identifier and determine the new price of the product based on an optimum discount calculated by the data structure. The optimum discount may be a discount of the product at which the product is most likely to be sold to a customer. In some embodiments, the optimum discount may depend on the seasonality of the product or the product webpage view count.

[00105] Price determination system 330 may modify database 336 to assign the new price to the product identifier and, in step 609, transmit a request to user device 320 to list the product for sale at the new price. In some embodiments, in step 607, price determination system 330 may automatically transmit a notification to a web server (e.g., external front end system 103) to list the product for sale at the new price.

[00106] In step 607B, based on a determination that the product is not a returned product from a customer, price determination system 330 may modify database 336 to assign, to the product identifier, the determination that the product is not a returned product.

[00107] Price determination system 330 may determine a new price of the product based on the calculated inventory rate, where the new price is a discount of the original price. Price determination system 330 may determine the age of the product by determining a time duration in which the product is in FC 200.

[00108] In some embodiments, price determination system 330 may consult the product identifier stored in database 336 to identify and access a multi-dimensional data structure. In some embodiments, the multi-dimensional data structure may be the same data structure that is accessed for returned products. In some embodiments, different multi-dimensional data structures may be accessed for returned products and non-returned products. In some embodiments, price determination system 330 may use different accessor methods based on the type of the product (e.g., returned, not returned, etc.). For example, the data structure may calculate an inventory rate associated with the product. In some embodiments, the data structure may determine a quantity of usable inventory in all FCs at a national level and calculate an average daily sales volume (e.g., average daily number of

units sold) during a time span (e.g., the age of the product). In some embodiments, the data structure may calculate the inventory rate associated with the product by dividing the quantity of usable inventory by the average daily sales volume.

[00109] For example, the data structure may quickly access relationships between the calculated inventory rate and the age of the product based on historical data of the product or related products. The historical data may include previous sales of the product or related products, previous inventory rates of the product, the price or discount at which the product was sold and the inventory rate associated with the product for that sale, etc. In some embodiments, the data structure may calculate an optimum discount for the product by accessing the relationships between the inventory rate of the product and the age of the product. Price determination system 330 may access the data structure according to the product identifier and determine the new price of the product based on an optimum discount calculated by the data structure. The optimum discount may be a discount of the product at which the product is most likely to be sold to a customer. In some embodiments, the optimum discount may depend on the seasonality of the product or the product webpage view count.

[00110] Price determination system 330 may modify database 336 to assign, to the product identifier, the inventory rate and the new price and, in step 609, transmit a request to user device 320 to list the product for sale at the new price. In some embodiments, in step 609, price determination system 330 may automatically transmit a notification to a web server (e.g., external front end system 103) to list the product for sale at the new price.

[00111] While the present disclosure has been shown and described with reference to particular embodiments thereof, it will be understood that the

present disclosure can be practiced, without modification, in other environments. The foregoing description has been presented for purposes of illustration. It is not exhaustive and is not limited to the precise forms or embodiments disclosed. Modifications and adaptations will be apparent to those skilled in the art from consideration of the specification and practice of the disclosed embodiments. Additionally, although aspects of the disclosed embodiments are described as being stored in memory, one skilled in the art will appreciate that these aspects can also be stored on other types of computer readable media, such as secondary storage devices, for example, hard disks or CD ROM, or other forms of RAM or ROM, USB media, DVD, Blu-ray, or other optical drive media.

[00112] Computer programs based on the written description and disclosed methods are within the skill of an experienced developer. Various programs or program modules can be created using any of the techniques known to one skilled in the art or can be designed in connection with existing software. For example, program sections or program modules can be designed in or by means of .Net Framework, .Net Compact Framework (and related languages, such as Visual Basic, C, etc.), Java, C++, Objective-C, HTML, HTML/AJAX combinations, XML, or HTML with included Java applets.

[00113] Moreover, while illustrative embodiments have been described herein, the scope of any and all embodiments having equivalent elements, modifications, omissions, combinations (e.g., of aspects across various embodiments), adaptations and/or alterations as would be appreciated by those skilled in the art based on the present disclosure. The limitations in the claims are to be interpreted broadly based on the language employed in the claims and not limited to examples described in the present specification or during the prosecution of the

application. The examples are to be construed as non-exclusive. Furthermore, the steps of the disclosed methods may be modified in any manner, including by reordering steps and/or inserting or deleting steps. It is intended, therefore, that the specification and examples be considered as illustrative only, with a true scope and spirit being indicated by the following claims and their full scope of equivalents.

Claims

What is claimed is:

1. A computer-implemented system for managing inventory by determining product prices based on product characteristics, comprising:
 - one or more memory devices storing instructions; and
 - one or more processors configured to execute the instructions to perform operations comprising:
 - scanning, via a user device associated with a fulfillment center, an indicia of a product;
 - transmitting, via the user device, a request for assigning a product price to the product, wherein the request comprises a product identifier associated with the product;
 - based on the product identifier, searching a database for an original price of the product and identifying the original price of the product;
 - retrieving, from the database, the original price of the product;
 - determining, based on the product identifier, whether the product is a returned product from a customer;
 - based on a determination that the product is a returned product from a customer:
 - modifying the database to assign, to the product identifier, the determination that the product is a returned product;
 - determining a condition of the product;
 - determining an age of the product;
 - modifying the database to assign, to the product identifier, the condition of the product and the age of the product;
 - based on the condition of the product and the age of the product, determining a

new price of the product, wherein the new price is a discount of the original price; and
modifying the database to assign the new price to the product identifier;
based on a determination that the product is not a returned product from a customer:
modifying the database to assign, to the product identifier, the determination that the product is not a returned product;
calculating an inventory rate associated with the product;
based on the calculated inventory rate, determining a new price of the product, wherein the new price is a discount of the original price; and
modifying the database to assign, to the product identifier, the inventory rate and the new price;
transmitting a request, to the user device, to list the product for sale at the new price.

2. The computer-implemented system of claim 1, wherein when the product is a returned product from a customer, determining the age of the product comprises:
determining a time duration in which the product is in the fulfillment center after determining the condition of the product.
3. The computer-implemented system of claim 1, wherein when the product is a returned product from a customer, determining the condition of the product comprises:
determining the product is one of repackaged, package damaged, refurbished, used best, used good, or used normal.

4. The computer-implemented system of claim 1, wherein when the product is a returned product from a customer, the operations further comprise:
 - consulting the product identifier stored in the database;
 - identifying a relationship between the condition of the product and the age of the product based on the product identifier;
 - based on the identified relationship, determining that the age of the product has increased; and
 - based on the identified relationship and the determination that the age of the product has increased, increasing the discount of the original price of the product.
5. The computer-implemented system of claim 1, wherein when the product is not a returned product from a customer, determining the age of the product comprises:
 - determining a time duration in which the product is in the fulfillment center.
6. The computer-implemented system of claim 1, wherein when the product is not a returned product from a customer, the operations further comprise:
 - consulting the product identifier stored in the database;
 - identifying a relationship between the calculated inventory rate of the product and the age of the product based on the product identifier;
 - based on the identified relationship, determining that the age of the product has increased; and
 - based on the identified relationship and the determination that the age of the product has increased, increasing the discount of the original price of the product.
7. The computer-implemented system of claim 1, wherein calculating the inventory rate associated with the product comprises:
 - determining a quantity of usable inventory at fulfillment centers nationwide;

calculating an average daily sales volume during a time span of the age; and
dividing the quantity of usable inventory by the average daily sales volume.

8. The computer-implemented system of claim 1, wherein the operations further comprise:
 - determining that the discount is less than a percentage of the original price; and
 - based on a determination that the new price is less than a predetermined minimum price, modifying the database to assign the predetermined minimum price to the product identifier.
9. The computer-implemented system of claim 1, wherein the operations further comprise:
 - determining that the discount is greater than a percentage of the original price; and
 - based on a determination that the new price is greater than a predetermined maximum price, modifying the database to assign the predetermined maximum price to the product identifier.
10. The computer-implemented system of claim 1, wherein the operations further comprise:
 - determining that no sales of the product were generated during a time period; and
 - based on the determination that no sales of the product were generated during the time period, increasing the discount of the original price; and
 - modifying the database to assign an updated price to the product identifier, wherein the updated price is the increased discount of the original price.

11. A computer-implemented method for managing inventory by determining product prices based on product characteristics, comprising:
- scanning, via a user device associated with a fulfillment center, an indicia of a product;
 - transmitting, via the user device, a request for assigning a product price to the product, wherein the request comprises a product identifier associated with the product;
 - based on the product identifier, searching a database for an original price of the product and identifying the original price of the product;
 - retrieving, from the database, the original price of the product;
 - determining, based on the product identifier, whether the product is a returned product from a customer;
 - based on a determination that the product is a returned product from a customer:
 - modifying the database to assign, to the product identifier, the determination that the product is a returned product;
 - determining a condition of the product;
 - determining an age of the product;
 - modifying the database to assign, to the product identifier, the condition of the product and the age of the product;
 - based on the condition of the product and the age of the product, determining a new price of the product, wherein the new price is a discount of the original price; and
 - modifying the database to assign the new price to the product identifier;
 - based on a determination that the product is not a returned product from a customer:
 - modifying the database to assign, to the product identifier, the determination that the product is not a returned product;

calculating an inventory rate associated with the product;

based on the calculated inventory rate, determining a new price of the product, wherein the new price is a discount of the original price; and

modifying the database to assign, to the product

identifier, the inventory rate and the new price;

transmitting a request, to the user device, to list the product for sale at the new price.

12. The method of claim 11, wherein when the product is a returned product from a customer, determining the age of the product comprises:
 - determining a time duration in which the product is in the fulfillment center after determining the condition of the product.
13. The method of claim 11, wherein when the product is a returned product from a customer, determining the condition of the product comprises:
 - determining the product is one of repackaged, package damaged, refurbished, used best, used good, or used normal.
14. The method of claim 11, wherein when the product is not a returned product from a customer, determining the age of the product comprises:
 - determining a time duration in which the product is in the fulfillment center.
15. The method of claim 11, when the product is not a returned product from a customer, further comprising:
 - consulting the product identifier stored in the database;
 - identifying a relationship between the calculated inventory rate of the product and the age of the product based on the product identifier;
 - based on the identified relationship, determining that the age of the product has increased; and

based on the identified relationship and the determination that the age of the product has increased, increasing the discount of the original price of the product.

16. The method of claim 11, wherein calculating the inventory rate associated with the product comprises:
 - determining a quantity of usable inventory at fulfillment centers nationwide;
 - calculating an average daily sales volume during a time span of the age; and
 - dividing the quantity of usable inventory by the average daily sales volume.
17. The method of claim 11, further comprising:
 - determining that the discount is less than a percentage of the original price; and
 - based on a determination that the new price is less than a predetermined minimum price, modifying the database to assign the predetermined minimum price to the product identifier.
18. The method of claim 11, further comprising:
 - determining that the discount is greater than a percentage of the original price; and
 - based on a determination that the new price is greater than a predetermined maximum price, modifying the database to assign the predetermined maximum price to the product identifier.
19. The method of claim 11, further comprising:
 - determining that no sales of the product were generated during a time period; and
 - based on the determination that no sales of the product were generated during the time period, increasing the discount of the original price; and

modifying the database to assign an updated price to the product identifier, wherein the updated price is the increased discount of the original price.

20. A computer-implemented system for managing inventory by determining product prices based on product characteristics, comprising:
- one or more memory devices storing instructions; and
 - one or more processors configured to execute the instructions to perform operations comprising:
 - scanning, via a user device associated with a fulfillment center, an indicia of a product;
 - transmitting, via the user device, a request for assigning a product price to the product, wherein the request comprises a product identifier associated with the product;
 - based on the product identifier, searching a database for an original price of the product and identifying the original price of the product;
 - retrieving, from the database, the original price of the product;
 - determining, based on the product identifier, whether the product is a returned product from a customer;
 - based on a determination that the product is a returned product from a customer:
 - modifying the database to assign, to the product identifier, the determination that the product is a returned product;
 - transmitting a pickup request to a user device associated with an inventory worker to pick up the returned product from a return center and deliver the returned product to the fulfillment center;

determining a condition of the product;
modifying the database to assign, to the
product identifier, the condition of the
product and the age of the product;
based on the condition of the product and
the age of the product, determining a
new price of the product, wherein the
new price is a discount of the original
price; and
modifying the database to assign the new
price to the product identifier;
based on a determination that the product is not a
returned product from a customer:
modifying the database to assign, to the
product identifier, the determination
that the product is not a returned
product;
calculating an inventory rate associated with
the product;
based on the calculated inventory rate,
determining a new price of the
product, wherein the new price is a
discount of the original price; and
modifying the database to assign, to the
product identifier, the inventory rate
and the new price;
transmitting a request, to the user device, to list the
product for sale at the new price.