THREE-DIMENSIONAL WAREHOUSE HANDLING AND DISPATCHING SYSTEM AND METHOD FOR IMPLEMENTING ITEM PICKING

Abstract

Three-dimensional warehouse handling and dispatching systems, devices, and methods for implementing item picking are provided. In one aspect, a system includes: one or more control centers, one or more first handling devices, one or more second handling devices, at least one lifting device, and at least one three-dimensional warehouse including floors connected by the at least one lifting device. The one or more control centers are configured to: select, according to a handling task, a first handling device, a second handling device, and a lifting device for performing the handling task, and send a handling instruction for performing the handling task separately to the first handling device, the second handling device, and the lifting device, such that the lifting device is used to handle an item indicated in the handling instruction, and the first and second handling devices cooperate to transport the item in the at least one three-dimensional warehouse.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation application of U.S. application Ser. No. 17/924,070, filed on Nov. 8, 2022, which claims priorities to PCT Application No. PCT/CN2021/097977, filed on Jun. 2, 2021 and Chinese Patent Application No. 202010722774.0, filed on Jul. 24, 2020, the disclosures of which are incorporated herein by reference in their entireties.

TECHNICAL FIELD
[0002] The present disclosure relates to the technical field of warehousing and logistics, and in particular, to a three-dimensional warehouse handling and dispatching system and method for implementing item picking.
BACKGROUND
[0003] Currently, with the rapid development of the logistics industry, to improve the operating efficiency of a warehouse, an automated handling device such as an automated guided vehicle (AGV) is usually used to implement the automated transportation of items. In addition, because a warehouse area is usually limited, the cost of acquiring and using a land is relatively high. To maximize the space utilization and reduce the operating cost, a dense storage method is also adopted in an existing warehouse for storing items.
[0004] In an existing technology, to simultaneously resolve two problems of improving the efficiency of the automated transportation and reducing the cost of dense storage, a four-way shuttle vehicle (referred to as a four-way vehicle below) for a dense storage warehouse and a dedicated warehouse for the operating of the four-way vehicle are designed, as shown in FIG. **1***a* and FIG. **1***b*. FIG. **1***a* is a cross-sectional view of a warehouse. It can be seen that each floor of the warehouse includes a plurality of adjacent storage spaces for storing items, which are interspersed with a plurality of aisles for the four-way vehicle to transport items. In addition, each rack includes a rail for the four-way vehicle to travel, a support for holding a container is arranged in each storage space, and there are uprights shared by the storage spaces for support. FIG. **1***b* is a top view of a warehouse. It can be seen that the dense stacking of items can save a lot of space. In addition, a relatively small four-way vehicle is capable of flexibly traveling between the storage spaces transports items, and transporting items on containers to a storage space, or transporting items to a docking point of the warehouse for outbound.
[0005] However, the four-way vehicle is a high-cost handling device and needs to travel on rails, so that in a warehouse in which the four-way vehicle is used for storing or picking items, the layout of the warehouse is difficult to change flexibly due to the setting of the rails, and the construction and use cost of the warehouse is relatively high.
SUMMARY
[0006] A three-dimensional warehouse handling and dispatching system, method, and apparatus for implementing item picking provided in embodiments of this specification are used for partially resolving a problem in the related art that in a dense storage warehouse applying a four-way shuttle vehicle, because rails are required to be arranged on a bottom floor, and only the four-way shuttle

vehicle can perform a handling task, the operating cost of the warehouse is relatively high and the warehouse layout cannot be flexibly changed.

[0007] The following technical solutions are adopted in the embodiments of this specification:

[0008] A three-dimensional warehouse handling and dispatching system is provided in this specification, including: one or more control centers, one or more first handling devices, one or more second handling devices, at least one three-dimensional warehouse, and at least one lifting device, where the at least one three-dimensional warehouse is provided with a plurality of floors, the floors of the three-dimensional warehouse are connected by the at least one lifting device, and the control centers each communicate with the one or more first handling devices and the one or more second handling devices, where: a bottom floor of the three-dimensional warehouse is provided with at least one bottom-floor docking point, at least some bottom-floor storage spaces of the bottom floor are provided with at least one of a container and a container support, and the container support in the bottom-floor storage spaces is configured for placing a container transported by the second handling devices; higher floors of the three-dimensional warehouse other than the bottom floor are each provided with at least one higher-floor docking point, the higher floors are each provided with a rail for the first handling devices to run on, and at least some higher-floor storage spaces of the higher floors are provided with a container; the control centers are each configured to determine, according to a handling task, a first handling device, a second handling device, and a lifting device for performing the handling task, and send a handling instruction for performing the handling task to the first handling device, the second handling device, and the lifting device separately; the first handling device is configured to take a container indicated in the handling instruction out of or put the container indicated in the handling instruction into the higher-floor storage spaces according to the handling instruction sent by the control centers, and transport the container indicated in the handling instruction between the higher-floor storage spaces and the higher-floor docking point; the second handling device is configured to take the container indicated in the handling instruction out of or put the container indicated in the handling instruction into the bottom-floor storage spaces according to the handling instruction sent by the control centers, and transport the container indicated in the handling instruction between the lifting device and the bottom-floor storage spaces and between the bottom-floor storage spaces and the bottom-floor docking point, or between the lifting device and the bottom-floor docking point; and the lifting device is configured to ascend or descend to a specified floor according to the handling instruction sent by the control centers, and transport at least one or a combination of the container indicated in the handling instruction, the first handling device, and the second handling device between the floors.

[0009] A three-dimensional warehouse handling and dispatching method is provided in this specification, where: there are at least one or more three-dimensional warehouses, floors of the three-dimensional warehouses are connected by at least one lifting device, a bottom floor of the three-dimensional warehouses is provided with at least one bottom-floor docking point, at least some bottom-floor storage spaces are provided with a container and a container support, the container support in the bottom-floor storage spaces is configured for placing a container transported by a second handling device, higher floors other than the bottom floor of the three-dimensional warehouses are each provided with at least one higher-floor docking point, the higher floors are each provided with a rail for a first handling device to run on, at least some higher-floor storage spaces of the higher floors are provided with a container, and the method includes: determining a to-be-performed handling task; determining, according to the handling task, a first handling device, a second handling device, and a lifting device for performing the handling task; and sending a handling instruction to the determined first handling device, second handling device, and lifting device separately, so that the first handling device, the second handling device, and the lifting device cooperate to transport a container from the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses to the bottom-floor docking point, or

transport a container at the bottom-floor docking point into the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses.

[0010] At least one technical solution adopted in the embodiments of this specification can achieve the following beneficial effects: through a combination of using first handling devices and second handling devices in a three-dimensional warehouse, a handling function of a lifting device in the three-dimensional warehouse is used, so that the first handling devices and the second handling devices can cooperate to transport items in a dense storage warehouse, which avoids laying rails on a bottom floor of the warehouse. The layout of the warehouse can be changed flexibly, a quantity of first handling devices required can be reduced, the operating cost of the warehouse can be reduced, and the transport efficiency can be improved.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] To describe the technical solutions in the embodiments of the present disclosure more clearly, the following briefly describes the accompanying drawings required to be used in the embodiments. The accompanying drawings herein, which are incorporated in the specification as a part of the specification, show embodiments in accordance with the present disclosure, and together with the specification are used for describing the technical solutions of the present disclosure. It should be understood that, the following accompanying drawings show only some embodiments of the present disclosure, which cannot be considered as limitation on the scope. A person of ordinary skill in the art may still derive other accompanying drawings from the accompanying drawings without creative efforts.

[0012] FIG. **1***a* is a schematic structural diagram of a cross-sectional view of an existing warehouse;

[0013] FIG. **1***b* is a schematic structural diagram of a top view of an existing warehouse;

[0014] FIG. **2** is a schematic diagram of a three-dimensional warehouse handling and dispatching system for implementing item picking according to an embodiment of this specification;

[0015] FIG. **3** is a schematic diagram of a top view of a three-dimensional warehouse according to an embodiment of this specification;

[0016] FIG. **4***a* and FIG. **4***b* are schematic diagrams of warehouse layouts according to an embodiment of this specification;

[0017] FIG. **5** is a schematic diagram of a first handling device picking and placing a container from a side according to an embodiment of this specification;

[0018] FIG. **6** is a schematic diagram of a distribution of a lifting device according to an embodiment of this specification;

[0019] FIG. **7** is a schematic diagram of arranging a rail in a lifting device of a three-dimensional warehouse according to an embodiment of this specification;

[0020] FIG. **8** is a schematic diagram of areas of a three-dimensional warehouse that are not connected according to an embodiment of this specification;

[0021] FIG. **9***a* and FIG. **9***b* are schematic diagrams of grounds of two three-dimensional warehouses that are connected with each other according to an embodiment of this specification;

[0022] FIG. **10** is a schematic diagram of a carrier in a system according to an embodiment of this specification;

[0023] FIG. **11** is a schematic diagram of a specified area being a bottom-floor docking point in a system according to an embodiment of this specification; and

[0024] FIG. **12** is a flowchart of a three-dimensional warehouse handling and dispatching process for implementing item picking according to an embodiment of this specification.

DETAILED DESCRIPTION

[0025] To clearly state the objectives, technical solutions, and advantages of this specification, the technical solutions of the present disclosure are clearly and completely described below with reference to specific embodiments of this specification and corresponding accompanying drawings. Apparently, the described embodiments are only some embodiments rather than all the embodiments of the present disclosure. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of this specification without creative efforts shall fall within the protection scope of the present disclosure.

[0026] The technical solutions provided in the embodiments of the present disclosure are described in detail below with reference to the accompanying drawings.

[0027] FIG. **2** is a schematic diagram of a three-dimensional warehouse handling and dispatching system for implementing item picking according to an embodiment of this specification, and the system includes: one or more control centers **100**, one or more first handling devices **102**, one or more second handling devices **104**, at least one three-dimensional warehouse **106**, and at least one lifting device **108**, where the at least one three-dimensional warehouse **106** is provided with a plurality of floors, the floors of the three-dimensional warehouse **106** are connected by the at least one lifting device **108**, and the control centers **100** each communicate with the one or more first handling devices **102** and the one or more second handling devices **104**. The three-dimensional warehouse **106** may be divided into a bottom floor and a plurality of higher floors. Storage spaces **122** arranged on the bottom floor are bottom-floor storage spaces **122***a*, and storage spaces arranged on the higher floors are higher-floor storage spaces **122***b*. For the convenience of understanding, only one control center **100** and one three-dimensional warehouse **106** are included in FIG. **2**.

[0028] An objective of storing items in a warehouse is to store a variety of items in large quantities in a centralized manner, for example, to facilitate the selection of required items according to the needs of an order. In a system provided in this specification, items in a three-dimensional warehouse are carried by a container, and the container needs to be transported by a first handling device **102**, a second handling device **104**, and a lifting device **108**. Therefore, a handling task in this specification is also for implementing item selection, and can be determined by a control center **100** according to the order.

[0029] Specifically, when sorting items in a three-dimensional warehouse, it is necessary to first determine storage spaces **122** of the items according to items that need to be sorted. Then, a handling task is performed through devices, so that the items are delivered to a sorting area and sorted. Afterwards, the remaining items are stored in the warehouse after the sorting is completed. As such, the sorting of the items is implemented. Therefore, the handling task in this specification is a task of transporting a container carrying items, which is performed in order to implement the sorting of the items.

[0030] During the sorting of items, the control center **100** is configured to determine, according to a received order, storage spaces **122** of items included in the order, then determine a path from the storage spaces **122** to a bottom-floor docking point **110**, determine, according to the path, a first handling device **102**, a second handling device **104**, and a lifting device **108** for performing a handling task, and send a handling instruction for performing the handling task to the first handling device **102**, the second handling device **104**, and the lifting device **108** separately. After the items are sorted in a sorting area, the control center **100** may then determine a path from the bottom-floor docking point **110** to the storage spaces **122**, according to the bottom-floor docking point **110** at which a container is located and positions of the storage spaces **122** in which the items need to be stored. The control center **100** can then determine, according to the path, a first handling device **102**, a second handling device **104**, and a lifting device **108** for performing a handling task. The control center **100** can send a handling instruction for performing the handling task to the first handling device **102**, the second handling device **104**, and the lifting device **108** separately. After a process described above, a three-dimensional warehouse completes the sorting of items.

[0031] Additionally, it should be further noted that, the three-dimensional warehouse and related methods for implementing item picking in this specification are not only applicable to the picking of commodity items in a warehousing scenario, but also applicable to the picking of finished products, semi-finished products, or semi-processed items in a factory production scenario, and the picked items are used for implementing a specific production link or a specific production node. The application scenario of item picking is not specifically limited in this specification. Therefore, in this specification, a bottom floor of a three-dimensional warehouse **106** is provided with at least one bottom-floor docking point **110**. At least some bottom-floor storage spaces **122***a* of the bottom floor are provided with at least one of a container **114** and a container support **116**. The container support **116** in the bottom-floor storage spaces **122***a* is configured for placing a container **114** to be transported by a second handling device **104**. The container support **116** may be mounted in the bottom-floor storage spaces **122***a* or removed from the bottom-floor storage spaces **122***a* as required. In a case that different bottom-floor storage spaces **122***a* are selected for mounting the container support **116**, the container support may be have different areas for placing the containers **114**. A space between the areas in which the container **114** is placed may be used as an aisle for the second handling device **104** carrying the container **114** to pass through. The container support **116** is used for the second handling device **104** to place the container **114**. The second handling device **104** can place the container **114** including items on the container support **116** in the bottom-floor storage spaces **122***a*, so as to store the items into the warehouse.

[0032] In addition, the bottom-floor docking point **110** of the three-dimensional warehouse **106** is a docking point outside the three-dimensional warehouse **106**. For example, a forklift or another handling device may take the container **114** that need to be transported out of the warehouse from the bottom-floor docking point **110**, or bring the container **114** that need to be stored into the warehouse to the bottom-floor docking point **110**. After the container **114** enters the bottom-floor docketing point **110**, at least one of the first handling device **102**, the second handling device **104**, and the lifting device **108** transports the container **114** from the bottom-floor docking point **110** into a storage space **122**, according to the handling instruction sent by the control center **100**.

[0033] In this specification, the container **114** is configured to carry items, but the specific form of the container **114** is not limited in this specification. For example, the container **114** may be a tray, a box, or the like, as long as it can accommodate or support items.

[0034] In addition, higher floors of the three-dimensional warehouse **106** other than the bottom floor are each provided with at least one higher-floor docking point **112**. The higher floors are each provided with a rail **118** for the first handling device **102** to run on. At least some higher-floor storage spaces **122***b* of the higher floors are provided with the container **114**. A structure configured for holding the container **114**, such as a support rod, a tray, or the like, is arranged in each of the higher-floor storage spaces **122***b* of the higher floors.

[0035] Further, in this specification, the container **114** arranged on each floor of the three-dimensional warehouse **106** may include items stored in the warehouse or other idle containers **114**. An occupancy rate of each floor may be configured as required. The occupancy rate of a floor is a ratio of a quantity of storage spaces **122** having a container **114** to a quantity of total storage spaces **122** of the floor. An occupancy rate of a higher floor may be set between 0 and 100%, and an occupancy rate of the bottom floor may be set between 0 and 100%.

[0036] Still further, due to warehouse structures such as reinforcing ribs and beams in the three-dimensional warehouse **106**, also due to some storage spaces **122** are already occupied with containers **114**, the first handling device **102** or the second handling device **104** cannot directly travel from one storage space **122** to an adjacent storage space **122** when carrying the container **114**. Therefore, each floor of the three-dimensional warehouse **106** is provided with an aisle for the first handling device **102** or the second handling device **104** carrying the container **114** to pass through.

[0037] FIG. **3** provided in this specification is a schematic diagram of a top view of a three-

dimensional warehouse. The left side of FIG. **3** is a schematic diagram of higher floors, and it can be seen that the higher floors include rails **118** on which the first handling device **103** ma travel. The right side of FIG. **3** is a schematic diagram of a bottom floor, and it can be seen that the bottom floor does not include rails **118**. Moreover, it can be seen from the top view that each floor of the three-dimensional warehouse **106** is provided with aisles **132** for the first handling device **102** or the second handling device **104** to pass through.

[0038] In addition, it should be noted that in this specification, layouts of aisles **132** of different floors may not be the same, and may be set as required. In a dense storage warehouse, in some cases, in order to transport items in storage spaces **122** that are not adjacent to an aisle, items in storage spaces **122** adjacent to the aisle need to be moved away first to make space for transporting items in storage spaces that are not adjacent to the aisle. In this case, the storage spaces **122** adjacent to the aisle can be used as a temporary aisle. Therefore, usually for the consideration of transport efficiency, a stock keeping unit (SKU) of items stored in a storage space not adjacent to an aisle is the same as an SKU of items stored in the storage spaces adjacent to the aisle. In this case, a layout of storage spaces **122** and aisles **132** in a warehouse is as follows: in a horizontal direction, 1 aisle, 4 storage spaces, and 1 aisle are arranged in sequence, as shown in FIG. **4***a*. That is, four columns of storage spaces **122** are arranged between two aisles **132**, which can increase the storage density of items without affecting the operating efficiency of the warehouse.

[0039] However, in a case that the SKU of items in adjacent storage spaces are different, e.g., there are not enough items under the same SKU to occupy two or more storage spaces, a layout shown in FIG. **4***a* may affect the operating efficiency of the warehouse. Therefore, a layout shown in FIG. **4***b* may usually be used, that is, the layout of storage spaces **122** and aisles **132** in the warehouse is: in a horizontal direction, 1 aisle, 2 storage spaces, and 1 aisle are arranged in sequence. That is, two columns of storage spaces **122** are arranged between two aisles **132**.

[0040] In this specification, each floor of the three-dimensional warehouse may adopt the layout shown in FIG. **4***a* or FIG. **4***b* or a combination of the two layouts, which is not limited in this specification. Moreover, according to the storage needs, each floor may adopt different layouts. For example, bulky commodities that take up a lot of space are stored on a floor A. As bulky commodities can occupy a storage space **122** by a small quantity of commodities, commodities under the same SKU may occupy two or more storage spaces. Therefore, the floor A may all adopt the layout of FIG. **4***a*. Small commodities are stored on a floor A+1, then the floor A+1 may all adopt the layout of FIG. **4***b*.

[0041] In this specification, the first handling device **102** may be specifically a handling device traveling on a rail, such as a four-way shuttle, and the second handling device **104** may be specifically a handling device traveling on a plane, such as an AGV. Certainly, the specific forms of the first handling device **102** and the second handling device **104** are not limited in the present disclosure. The first handling device **102** and the second handling device **104** can be set as required, as long as the first handling device **102** can travel along a rail and transport the container **114** in the higher-floor storage spaces **122***b*, and the second handling device **104** can travel on the bottom floor and transport the container **114** in the bottom-floor storage spaces **122***a*.

[0042] When a control center **100** determines a to-be-performed handling task according to an order, the control center **100** may first determine the to-be-performed handling task. The control center **100** can then determine, according to the handling task, a first handling device **102** for performing the handling task, and send a handling instruction to the first handling device **102**.

[0043] Then, the first handling device **102** may take a container **114** indicated in the handling instruction out of or into a higher-floor storage space **122***b* according to the handling instruction sent by the control center **100**, and transport the container **114** between the higher-floor storage spaces **122***b* and a higher-floor docking point **112**.

[0044] A second handling device **104** may take out a container **114** indicated in the handling instruction or put the container **114** into a bottom-floor storage space **122***a* according to the

handling instruction sent by the control center **100**. The second handling device **104** can transport the container **114** indicated in the handling instruction between a lifting device **108** and the bottom-floor storage spaces, between the bottom-floor storage spaces **122***a* and a bottom-floor docking point **110**, or between the lifting device **108** and the bottom-floor docking point **110**. A bottom surface of the three-dimensional warehouse **106** is a plane on which the second handling device **104** travels. Specifically, the bottom surface may be a ground on which the three-dimensional warehouse **106** is located, or a platform provided on the bottom floor of the three-dimensional warehouse **106** for the second handling device **104** to travel on. For example, the bottom surface can be a steel platform on the bottom floor of the three-dimensional warehouse **106** for the second handling device **104** to travel on.

[0045] The lifting device **108** is configured to ascend or descend to a specified floor according to the handling instruction, and transport at least one or a combination of the container indicated in the handling instruction, the first handling device, and the second handling device between floors.

[0046] The specified floor is a floor that the lifting device **108** performing the handling task needs to reach, for example, the container **114** is transported from a third floor to the bottom floor. Then, the control center **100** may separately send two handling instructions to the lifting device **108**, the lifting device **108** reaches the third floor according to a first handling instruction (that is, a specified floor indicated in the handling instruction received for the first time), and when the container **114** has been transported into the lifting device **108**, the lifting device **108** may reach the bottom floor according to a second handling instruction (that is, a specified floor indicated in the received handling instruction for the second time). Certainly, the foregoing is only an example. Alternatively, the control center **100** may send only one handling instruction. Then, the specified floor is separately the third floor and the bottom floor in order, so that the lifting device **108** reaches the third floor and the bottom floor in sequence, according to the handling instructions, and transports a container **114** of the third floor to the bottom floor.

[0047] In addition, in this specification, at least some higher-floor storage spaces **122***b* of the higher floors are further provided with a container support **114** configured for placing the container. The container support **114** is the same as the container support **114** arranged in the bottom-floor storage spaces **122***a* described above, the specific arrangement has been described, and details are not described herein again.

[0048] In addition, in this specification, a distance between the container support **116** arranged in the higher-floor storage spaces **122***b* (or a structure for placing the container **114** in the higher-floor storage spaces **122***b*) and a rail **118** is greater than a height of the first handling device **102** not carrying the container **114**. As such, the first handling device **102** can travel to below the higher-floor storage spaces, and transport the container **114** from below the higher-floor storage spaces **122***b* in a piggyback manner and leave the higher-floor storage spaces.

[0049] In an embodiment provided in this specification, taking a process of transporting the container **114** from a higher-floor storage space **122***b* to the bottom-floor docking point **110** for item outbound as an example, a process that a handling and dispatching system of a three-dimensional warehouse performs a handling task is described as follows.

[0050] After determining that items located in higher-floor storage spaces **122***b* need to be transported to a bottom-floor docking point **110** for outbound, a control center **100** of the three-dimensional warehouse handling and dispatching system determines, according to a to-be-performed handling task, first handling devices **102** of floors on which the higher-floor storage spaces **122***b* are located.

[0051] Then, the control center **100** selects a first handling device **102** for performing the handling task from the determined first handling devices **102**, and sends a handling instruction to the selected first handling device **102**. The control center **100** may select, the first handling device **102** according to whether the first handling devices **102** are idle or a quantity of to-be-executed handling instructions,

[0052] Certainly, the policy adopted to select the first handling device **102** is not limited in the present disclosure, and can be set as required. For example, the control center **100** may simply select any one of the idle first handling devices **102** as the first handling device **102** for performing the handling task. Or, the control center **100** can select a first handling device **102** closest to the higher-floor storage spaces **122***b* in which the items of the handling task are located.

[0053] In addition, when sending a handling instruction to the first handling device **102**, the control center **100** may also send a handling instruction to a lifting device **108** asynchronously, so that the lifting device **108** ascends or descends to a floor on which the higher-floor storage spaces **122***b* are located (that is, the specified floor), that is, a floor on which a container **114** of the handling task is located. Then, the lifting device **108** may move to the floor according to the handling instruction, wait for the first handling device **102** to transport the container **114** to a higher-floor docking point **112**, and receive the container **114** through the higher-floor docking point **112**. It should be noted that, in this specification, handling instructions sent by the control center **100** to different handling devices are not the same.

[0054] Then, the first handling device **102** travels through an aisle of the located floor to below the higher-floor storage spaces **122***b* in which the container **114** of the handling task is located. The first handling device **102** then transports the container **114** in the higher-floor storage spaces **122***b* in a piggyback manner, travels through the aisle of the floor again to the higher-floor docking point **112** of the located floor, and places the container **114** into the lifting device **108** through the higher-floor docking point **112**. After placing the container **114**, the first handling device **102** sends information that the handling instruction is executed to the control center **100**.

[0055] It should be noted that, the handling instruction sent to the first handling device **102** includes identifiers of the higher-floor storage spaces **122***b* requiring transport, an identifier of the higher-floor docking point **112**, and a path from the higher-floor storage spaces **122***b* to the higher-floor docking point **112**. In a case that the three-dimensional warehouse **106** includes a plurality of higher-floor docking points **112**, the control center **100** may determine identifiers and paths of the higher-floor docking points **112** through path optimization as information included in a first handling instruction. The control center **100** can send the information to the first handling device **102**, so that the first handling device **102** transports the container **114** to the higher-floor docking point **112** according to the optimized path.

[0056] According to the information that the handling instruction is executed sent by the first handling device **102**, the control center **100** determines that the lifting device **108** has obtained the container **114** through the higher-floor docking point **112**, and sends a handling instruction to the lifting device **108**. The handling instruction includes a specified floor to be reached by the lifting device **108** next, and in this example, the specified floor is a bottom floor.

[0057] Then, the lifting device **108** may transport the currently transported container **114** to the bottom floor of the three-dimensional warehouse **106**, according to the handling instruction sent again by the control center **100**. The lifting device **108** can send information that the handling instruction is executed to the control center **100**.

[0058] The control center **100** determines, according to the information that the handling instruction is executed sent by the lifting device **108**, that the container **114** has been transported to the bottom floor. The control center **100** can then select a second handling device **104** for performing the handling task from second handling devices **104**, and send a handling instruction to the selected second handling device **104**. The logic for selecting the second handling device **104** from the second handling devices **104** may be the same as the logic for selecting the first handling device **102** from the first handling devices **102**, and details are not described herein again in this specification.

[0059] The second handling device **104** travels through an aisle of the bottom floor to the lifting device **108** according to the handling instruction sent by the control center **100**, and transports the container **114** transported by the lifting device **108**. The second handling device **104** then travels

through the aisle of the bottom floor again to the bottom-floor docking point **110**, places the container at the bottom-floor docking point **110**, and sends information that the handling instruction is executed to the control center **100**.

[0060] Finally, the control center **100** may determine that the handling task is performed according to completed information sent by the second handling device **104**.

[0061] A container support **116** may also be arranged at the bottom-floor docking point **110**. The container support **116** may be a conveyor and may be connected to a conveyor line, so that items transported by the second handling device **104** to the bottom-floor docking point **110** can be transported to a specified area (for example, a picking area or a packing area) along the conveyor line.

[0062] Finally, after receiving information that a third handling instruction is executed, the control center **100** determines that the items are correctly transported to the bottom-floor docking point **110**, and the handling task is completed.

[0063] In another embodiment of this specification, in a case that items that need to be delivered are located in bottom-floor storage spaces, the control center **100** may select a second handling device **104** for performing the handling task from the second handling devices **104**, and send a handling instruction to the determined second handling device **104**.

[0064] The second handling device **104** travels through the aisle of the bottom floor to the bottom-floor storage spaces **122***a* according to the received handling instruction, and transports a container **114** stored in the bottom-floor storage spaces.

[0065] Then, the second handling device **104** travels through the aisle of the bottom floor again to the bottom-floor docking point **110**, places the container at the bottom-floor docking point **110**, and sends information that the handling instruction is executed to the control center **100**.

[0066] Finally, after receiving the information that the handling instruction is executed sent by the second handling device **104**, the control center **100** determines that the container **114** is correctly transported to the bottom-floor docking point **110**, and the handling task is completed.

[0067] In an embodiment provided in this specification, taking a process of transporting a container **114** from a bottom-floor docking point **110** into any one of higher-floor storage spaces **122***b* for inventory as an example, a process in which a three-dimensional warehouse handling and dispatching system for implementing item picking performs a handling task is described.

[0068] First, according to the to-be-performed handling task, and when determining that a container **114** that has been transported to the bottom-floor docking point **110** needs to be transported to the higher-floor storage spaces **122***b* for inventory, a control center **100** of the system may first select a second handling device **104** for performing the handling task from second handling devices **104**, and send a handling instruction to the selected second handling device **104**. Certainly, for the logic for determining the second handling device **104** for performing the handling task, details are not described in this specification.

[0069] Then, the second handling device **104** travels through, according to the received handling instruction, an aisle of a bottom floor to the bottom-floor docking point **110** to transport the container **114**. The second handling device **104** then travels through the aisle of the bottom floor again to a lifting device **108**, and places the container on the lifting device **108**. After placing, the second handling device **104** sends information that the handling instruction is executed to the control center **100**.

[0070] In addition, when sending the handling instruction to the second handling device **104**, the control center **100** may also send a handling instruction to the lifting device **108** asynchronously, so that the lifting device **108** moves to the bottom floor (that is, a specified floor), that is, a floor on which the bottom-floor docking point **110** is located. Then, the lifting device **108** may move to the bottom floor according to the handling instruction, and wait for the second handling device **104** to transport the container **114** to the lifting device **108**.

[0071] After receiving information that the handling instruction is executed sent by the second

handling device **104**, the control center **100** may continue to send a handling instruction to the lifting device **108** according to the information that the handling instruction is performed and a floor on which higher-floor storage spaces **122***b* for storing the items are located included in the handling task. The specified floor corresponding to the handling instruction is the floor on which the higher-floor storage spaces **122***b* for storing the items are located.

[0072] The lifting device **108** transports, according to the received handling instruction sent by the control center **100** again, the container **114** to the floor on which the higher-floor storage spaces **122***b* are located, and sends information that the handling instruction is executed to the control center **100**. In addition, when the lifting device **108** reaches the specified floor, the container **114** may further be transported out of the lifting device **108** through the higher-floor docking point **112**.

[0073] The control center **100** selects, according to the information that the handling instruction is executed sent by the lifting device **108**, a first handling device **102** for performing the handling task from first handling devices **102** on the floor on which the higher-floor storage spaces **122***b* are located, and sends a handling instruction to the determined first handling device **102**.

[0074] The first handling device **102** travels to the higher-floor docking point **112** through an aisle of the located floor according to the received handling instruction, transports the container **114** lifted from the bottom floor by the lifting device **108**. The first handling device **102** then travels through the aisle of the located floor again to below the higher-floor storage spaces, and places the container **114** into the higher-floor storage spaces.

[0075] Finally, after placing the container **114**, the first handling device **102** may send information that the handling instruction is executed to the control center **100**. After receiving the information that the handling instruction is executed sent by the first handling device **102**, the control center **100** determines that the container **114** is correctly transported to the higher-floor storage spaces, and the handling task is performed.

[0076] Further, in this specification, the first handling device **102** may use various methods for transporting the container **114** out of or storing the container **114** into the higher-floor storage spaces.

[0077] Specifically, the control center **100** determines, according to the handling task, the higher-floor storage spaces **122***b* corresponding to the handling task. For example, higher-floor storage spaces **122***b* for storing the container **114** may be considered as the higher-floor storage spaces **122***b* corresponding to the handling task, or higher-floor storage spaces **122***b* determined when the container **114** is stored for inventory may also be considered as the higher-floor storage spaces **122***b* corresponding to the handling task.

[0078] Then, the control center **100** may send a handling instruction to the determined first handling device **102** according to positions of the higher-floor storage spaces **122***b* and positions of aisles **132** adjacent to the higher-floor storage spaces.

[0079] Then, the first handling device **102** may, at a rail position adjacent to the higher-floor storage spaces, take out the container **114** from a side of the higher-floor storage spaces **122***b* according to the handling instruction sent by the control center **100** to the first handling device **102**, or put the transported container **114** in the first handling device **102** into the higher-floor storage spaces **122***b* from the side of the higher-floor storage spaces. As shown in FIG. **5**, FIG. **5** is a schematic diagram of a first handling device picking and placing a container from a side provided in this specification. The first handling device **102** is located at an aisle **132** position adjacent to a higher-floor storage space, and picks and places items from the side of the higher-floor storage space.

[0080] Alternatively, after determining the higher-floor storage spaces corresponding to the handling task, the control center **100** sends a handling instruction to the determined first handling device **102** according to positions of the higher-floor storage spaces and positions of other storage spaces above the higher-floor storage spaces.

[0081] Then, the first handling device **102** may take out the container **114** from above the higher-

floor storage spaces into the first handling device **102** according to the handling instruction sent by the control center **100**. Or, the first handling device **102** may put the container **114** in the first handling device **102** into the higher-floor storage spaces from above the higher-floor storage spaces.

[0082] Still further, in this specification, the second handling device **104** may also use various methods for transporting the container **114** out of or storing the container **114** into the bottom-floor storage spaces.

[0083] Specifically, the control center **100** determines, according to the handling task, the bottom-floor storage spaces corresponding to the handling task. For example, bottom-floor storage spaces for storing the container **114** may be considered as the bottom-floor storage spaces corresponding to the handling task, or bottom-floor storage spaces determined when the container **114** is stored for inventory may also be considered as the bottom-floor storage spaces corresponding to the handling task.

[0084] Then, the control center **100** may send a handling instruction to the determined second handling device **104** according to positions of the bottom-floor storage spaces and positions of aisles **132** adjacent to the bottom-floor storage spaces.

[0085] Then, the second handling device **104** may, at an aisle **132** position adjacent to the bottom-floor storage spaces, take out the container **114** from a side of the bottom-floor storage spaces according to the handling instruction sent by the control center **100** to the second handling device **104**, or put the transported container **114** in the second handling device **104** into the bottom-floor storage spaces from the side of the bottom-floor storage spaces.

[0086] Alternatively, after determining the bottom-floor storage spaces corresponding to the handling task, the control center **100** sends a handling instruction to the determined second handling device **104** according to the positions of the bottom-floor storage spaces.

[0087] Then, the second handling device **104** may, at an aisle **132** position adjacent to the bottom-floor storage spaces, enter to below the bottom-floor storage spaces according to the handling instruction sent by the control center **100**, and take out the container **114** from below the bottom-floor storage spaces to the second handling device **104**. Or the first handling device **102** may place the container **114** indicated in the handling instruction in the second handling device **104** into the bottom-floor storage spaces.

[0088] In addition, in this specification, because for each three-dimensional warehouse **106**, at least one lifting device **108** may be arranged in the three-dimensional warehouse **106**, to allow the container **114** to be placed on any floor of the three-dimensional warehouse **106**. In a case that the three-dimensional warehouse **106** includes a plurality of lifting devices **108**, at least an overlap exists between specified floors reachable by the plurality of lifting devices **108**.

[0089] That is, through the overlapping floors, the lifting devices **108** can connect floors of the three-dimensional warehouse **106**. As shown in FIG. **6**, the three-dimensional warehouse **106** includes a total of four floors, and three lifting devices **108** respectively communicating a bottom floor and a first floor, the first floor and a second floor, and the second floor and a third floor. Certainly, the lifting device **108** may be located at different positions of the three-dimensional warehouse **106**.

[0090] A control center **100** may transport a container to any floor of the three-dimensional warehouse **106** through one or more lifting devices **108**. For example, in FIG. **6** described above, in a case that items on the third floor need to be transported to the bottom floor, the control center may dispatch first handling devices **102** and corresponding lifting devices **108** of the first to third floors respectively, so that the lifting devices **108** and the first handling devices **102** on the floors transport the items from the third floor to the bottom floor in a relay manner.

[0091] In this specification, rails **118** may be arranged in the lifting devices **108**, so that the rails **118** in the lifting devices **108** can be connected to rails **118** arranged in higher floors of the three-dimensional warehouse **106**. Then, when moving along the rails on the higher floors, the first

handling devices **102** may travel into the lifting devices **108**, and directly place the container **114** into the lifting devices **108**, or the first handling devices **102** may be transported by the lifting devices **108** to other floors, as shown in FIG. **7**.

[0092] Still further, in this specification, in a case that rails **118** are also arranged in the lifting devices **108**, the control center **100** may also dispatch the first handling devices **102** between different floors through the lifting devices **108**.

[0093] Specifically, in this specification, the control center **100** may determine, according to a to-be-performed handling task corresponding to some or all of the higher floors, a quantity of first handling devices **102** required by the higher floors. The control center **100** may determine a floor on which higher-floor storage spaces involved in the handling task are located as a higher floor corresponding to the handling task. For example, in a case that in a handling task A, a container **114** needs to be transported from the third floor, then the third floor is a higher floor corresponding to the handling task A. In a case that in a handling task B, a container **114** needs to be transported to a specific higher-floor storage space of the third floor, then the third floor is a higher floor corresponding to the handling task B. In addition, the control center **100** may determine, according to a quantity of to-be-performed handling tasks corresponding to the higher floors, the quantity of first handling devices **102** required by the higher floors. In a case that there are more to-be-performed handling tasks corresponding to the higher floors, the quantity of first handling devices **102** required by the higher floors is more. Certainly, due to a limited space of each floor in the warehouse, an excessive quantity of first handling devices **102** may result in a reduction in travel paths for devices or congestion in paths. Therefore, in this specification, the control center **100** may also determine, according to a preset maximum quantity of first handling devices **102** of each higher floor, the quantity of first handling devices **102** required by the higher floors. The maximum quantity of first handling devices **102** may vary according to the layout of each floor. In a case that a quantity of containers **114** arranged in the higher floors is less, it means that a quantity of areas through which the first handling devices **102** can pass is greater.

[0094] Then, the control center **100** may determine, according to the quantity of first handling devices **102** required by the each of the higher floors and a current quantity of first handling devices **102** of the each of the higher floors, first handling devices **102** that need to be dispatched to the each of the higher floors. The control center **100** may send a dispatching instruction to the first handling devices **102** that need to be dispatched.

[0095] Then, the first handling devices **102** are further configured to travel into the lifting devices **108** along the rails **118** according to the received dispatching instruction sent by the control center **100**, and reach a higher floor specified in the dispatching instruction through the lifting devices **108**.

[0096] In addition, in the description of the structure of the three-dimensional warehouse **106** described above in this specification, higher-floor docking points **112** respectively set on the higher floors are independent of the lifting devices **108**. This is because if the first handling devices **102** cannot reach the lifting devices **108**, a container **114** needs to be transported to the lifting devices **108** through the higher-floor docking points **112**, and then the lifting devices **108** transport the container **114** to a specified floor.

[0097] However, if rails **118** are also arranged in the lifting devices **108** and the first handling devices **102** can travel into the lifting devices **108**, the higher-floor docking points **112** may alternatively be set in the lifting devices **108** in this specification.

[0098] Then, the first handling devices **102** are further configured to travel to the higher-floor docking points **112** in the lifting devices **108** according to a handling instruction sent by the control center **100**. The first handling devices **102** can place the container **114** at the higher-floor docking points **112**, or take out the container **114** from the higher-floor docking points **112**.

[0099] Further, in this specification, because the construction of a warehouse may be affected by various aspects, the layout of floors may be different. In a case that there is a floor where not all

areas are connected by rails among the higher floors of the three-dimensional warehouse **106**, as shown in FIG. **8**, if a first handling device **102** needs to be dispatched between two areas, the control center **100** may be configured to: [0100] for the floor where not all areas are connected by rails **118**, in a case that a first handling device **102** needs to be dispatched between different areas of the floor, determine an area from which the first handling device **102** is to be dispatched as a departure area, and determine an area into which the first handling device **102** is to be dispatched as a destination area, and determine another floor closest to the floor where all areas are connected by rails as a transit floor.

[0101] The control center **100** sends a dispatching instruction to the first handling device **102** in the departure area, sends a handling instruction to a lifting device **108** communicating the transit floor and the departure area, and sends a handling instruction to a lifting device **108** communicating the transit floor and the destination area, so that the first handling device **102** reaches the destination area from the departure area through the two lifting devices **108** and a rail **116** of the transit floor.

[0102] Still further, in the system provided in this specification, in a case that there are two or more three-dimensional warehouses **106**, bottom surfaces of the three-dimensional warehouses **106** are connected with each other. As shown in FIG. **9***a* and FIG. **9***b*, FIG. **9***a* is a simple schematic diagram corresponding to FIG. **8** in which the bottom surfaces of the two three-dimensional warehouses are connected with each other. Because the bottom floors of the two three-dimensional warehouses are connected, the two three-dimensional warehouses can be considered as a whole. FIG. **9***b* is a detailed schematic diagram, it can be seen that the two three-dimensional warehouses are independently arranged on the bottom surfaces.

[0103] In addition, the control center **100** may determine, according to at least some to-be-performed handling tasks corresponding to the three-dimensional warehouses **106**, a quantity of first handling devices **102** required by each of the three-dimensional warehouses **106**.

[0104] The control center **100** may determine, according to the quantity of first handling devices **102** required by the each of the three-dimensional warehouses **106** and a current quantity of first handling devices **102** of the each of the three-dimensional warehouses **106**, first handling devices **102** that need to be dispatched to the each of the three-dimensional warehouses **106**.

[0105] The control center **100** may determine a three-dimensional warehouse **106** from which first handling devices **102** are to be dispatched as a departure warehouse, and determine a three-dimensional warehouse **106** into which the first handling devices **106** are to be dispatched as a destination warehouse. The control center **100** may send a dispatching instruction to the first handling devices **102** in the departure warehouse, and send a handling instruction to second handling devices **104**, a lifting device **108** of the departure warehouse, and a lifting device **108** of the destination warehouse, so that the first handling devices **102** are dispatched from the departure warehouse to the destination warehouse through the two lifting devices **108** and the second handling devices **104**.

[0106] The second handling devices **104** are configured to transport the first handling devices **102** from a bottom floor of the departure warehouse to a bottom floor of the destination warehouse according to the dispatching instruction.

[0107] It should be noted that, because the first handling devices **102** can travel into the lifting devices **108** through rails, the second handling devices **104** may consider the first handling devices **102** in the lifting devices **108** as the container **114** in the lifting devices **108**, and transport the first handling devices **102** out of the lifting devices **108** in the same manner as transferring the container **114**. Moreover, because the bottom floors of the three-dimensional warehouses **106** are in connection, the second handling devices **104** can reach another three-dimensional warehouse **106** from one three-dimensional warehouse **106** through the bottom floors, so as to dispatch the first handling devices **102** between different three-dimensional warehouses **106**.

[0108] In addition, in this specification, an unpowered carrier **120** or a powered carrier **120** is arranged in the lifting device **108**, and the higher-floor docking point **112** is provided with at least

the carrier **120** located in the lifting device. The powered carrier **120**, such as a roller line, a transport line, a two-way telescopic fork, or the like, may actively move a container **114** placed on the carrier **120**, and the specific form is not limited, while the unpowered carrier **120** may include at least a container support **116** for placing a container **114** thereon.

[0109] The first handling device **102** is further configured to travel to the carrier **120** used as a higher-floor docking point **112** in the lifting device **108**, and place the container **114** on the carrier **120**, or take out the container **114** from the carrier **120** used as the higher-floor docking point **112**.

[0110] Further, in this specification, the unpowered carrier **120** or the powered carrier **120** is arranged outside at least some positions at which the lifting devices **108** are docked with the higher floors on the higher floors of the three-dimensional warehouse **106**. Then, the higher-floor docking point in this specification is at least further provided with the carrier located outside the lifting device, as shown in FIG. **10**.

[0111] In a case that the lifting device **108** is located on a higher floor, the carrier **120** located outside the lifting device **108** is docked with the carrier **120** located in the lifting device **108**. As such, the container **114** is transported from the carrier **120** in the lifting device **108** to the carrier **120** outside the lifting device **108**, or the container **114** is transported from the carrier **120** outside the lifting device **108** to the carrier **120** in the lifting device **108**.

[0112] It should be noted that, in this specification, in a case that the carriers **120** inside and outside the lifting devices **108** are all unpowered carriers **120**, the first handling devices **102** may take out or store the container **114** from the side, and push the container **114** onto the carrier **120**. In a case that any one of the carriers **120** inside and outside the lifting devices **108** is a powered carrier **120**, the container **114** may be pushed by the powered carrier **120**.

[0113] In addition, in this specification, a specified area of the bottom floor of the three-dimensional warehouse **106** is provided with at least one bottom-floor docking point **110**, that is, the bottom-floor docking point **110** may also be a specified area of the bottom floor.

[0114] Then, the second handling device **104** is configured to take the container **114** out of the bottom-floor storage spaces or the lifting devices **108**, transport the container **114** to the bottom-floor docking point **110**, and place the container **114** in the specified area; or take out the container **114** from the bottom-floor docking point **110** in the specified area, and transport the container **114** into the bottom-floor storage spaces or the lifting devices **108**.

[0115] Because the bottom-floor storage spaces may be provided with a container support **116** for placing the container **114**, and a minimum distance between the container support **116** and the bottom floor may be greater than a height of the second handling device **104**, there is usually a height difference between the container support **116** of the bottom-floor storage spaces and the bottom floor. Similarly, because the lifting device **108** needs to obtain items from the higher-floor docking point **112**, and a height of the higher-floor docking point **112** is adapted to the first handling devices **102**, there is usually a height difference between the lifting device **108** and the bottom floor.

[0116] Then, in a case that the bottom-floor docking point **110** is located in a specified area on the bottom floor, an apparatus for lifting the container **114** and placing the container **114** needs to be arranged in the second handling device **104**, such as a fork that can be lifted or lowered, so that the second handling device **104** transport the container **114** from the specified area on the bottom floor into the bottom-floor storage spaces or the lifting devices **108** at different heights.

[0117] Further, in this specification, when the lifting device **108** include a built-in carrier **120**, the bottom floor of the three-dimensional warehouse **106** may also be provided with a powered carrier **120**. When the lifting device **108** is located on the bottom floor, the carrier **120** on the bottom floor is docked with the carrier **120** located in the lifting device **108**, to transport the container **114** from the carrier **120** in the lifting device **108** to the carrier **120** on the bottom floor, so that the second handling device **104** can take out the container **114** from the carrier **120** on the bottom floor. Or when the second handling device **104** places the container **114** on the carrier **120** on the bottom

floor, the carrier **120** on the bottom floor can transport the container **114** from the carrier **120** on the bottom floor to the carrier **120** in the lifting device **108**.

[0118] Therefore, the second handling device **104** in this specification is further configured to take out the container **114** from the carrier **120** on the bottom floor, transport the container to the bottom-floor docking point **112**, and place the container **114** in the specified area. Or, the second handling device **104** may take out the container **114** from the bottom-floor docking point **112** in the specified area, and transport the container **114** to the carrier **120** on the bottom floor. As shown in FIG. **11**, a dashed line indicates a movement path of the container **114**.

[0119] Further, in another implementation of this specification, the control center **100** may send a handling instruction for transporting to a specified area outside the three-dimensional warehouse **106** as required to a second handling device **104**, and the second handling device **104** may transport the container **114** to the specified area according to the handling instruction. That is, in this specification, the second handling device **104** is not limited to only operating in the three-dimensional warehouse **106**. Because the second handling device **104** operates on a platform of the bottom floor, the second handling device is not limited by a rail, and can be more flexibly connected to an device outside the system or outside the three-dimensional warehouse **106**, so as to transport the container **114** out of or transport the container **114** into the three-dimensional warehouse **106**. The device outside may be a forklift controlled by a worker, a roller line for conveying the container **114**, a production line, an area where workers sort items, or the like, which is not limited in this specification.

[0120] Still further, the system may further include: at least one external temporary storage area, where the external temporary storage area is in a form of at least one of three-dimensional storage or planar storage, which is not limited in this specification. In a case that the external temporary storage area is in the form of three-dimensional storage, a lifting device **108** may also be arranged in the external temporary storage area for communicating floors of the external temporary storage area. Certainly, if the external temporary storage area is not provided with a lifting device **108**, a container **114** of middle and higher floors of the external temporary storage area may also be transported by a three-dimensional handling device, such as a forklift, and a layout structure of the external temporary storage area may also be in the form shown in FIG. **2** to FIG. **4***b*.

[0121] In this specification, the external temporary storage area and the three-dimensional warehouse **106** may share second handling devices **104**, and the second handling devices **104** transport the container **114** between the external temporary storage area and at least one three-dimensional warehouse **106**, or are docked with the container **114**. For example, when items in the three-dimensional warehouse **106** need to be transported to the external temporary storage area, the control center **100** may send a handling instruction to the second handling devices, and the second handling devices **104** may transport the container **114** to the external temporary storage area for temporary storage.

[0122] Certainly, in a case that the external temporary storage area is in the form of planar storage, the external temporary storage area may also be a temporary storage area including a container support **116** arranged on a ground. The external temporary storage area may be used for storing items with a relatively high inbound and outbound frequency, reducing the inbound and outbound frequency of the three-dimensional warehouse **106** by using the container **114**, and reducing the time occupying the handling devices during transporting the items with a relatively high inbound frequency. Generally, the storage capacity of the external temporary storage area is less than that of the three-dimensional warehouse **106**, and the structure is simpler, as long as items can be temporarily stored. Therefore, the external temporary storage area may only include a container support **116** arranged on a ground as described above.

[0123] Based on a three-dimensional warehouse handling and dispatching system for implementing item picking shown in FIG. **2** and the description of the process of performing the handling task described above, it can be seen that in the system provided in this specification implements a

combination of using first handling devices and second handling devices in a three-dimensional warehouse, and using a handling function of a lifting device in the three-dimensional warehouse is used. In such way, the first handling devices and the second handling devices can cooperate to transport items in a dense storage warehouse, which avoids laying rails on a bottom floor of the warehouse. Therefore, the layout of the warehouse can be changed flexibly, a quantity of first handling devices required can be reduced, the operating cost of the warehouse can be reduced, and the handling efficiency can be improved.

[0124] In addition, in this specification, to increase the flexibility of the path selection of a second handling device **104** not transporting the container **114**, a height of the container support **116** in at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse **106** is greater than a height of the second handling device **104** not carrying the container **114**.

[0125] The second handling device **104** not carrying the container **114** is further configured to selectively pass to below the at least some bottom-floor storage spaces, or transport the container **114** from below the at least some bottom-floor storage spaces in a piggyback manner.

[0126] Further, an interval between uprights in the at least some bottom-floor storage spaces of the bottom floor of the three-dimensional warehouse **106** is greater than a width of the second handling device **104**. A height of a lowest point of a connector between at least some two adjacent uprights of the bottom floor of the three-dimensional warehouse **106** is higher than the height of the second handling device **104** not carrying the container **114**. The second handling device **104** not carrying the container **114** is further configured to selectively travel between at least some two adjacent uprights of the bottom floor.

[0127] Based on the system shown in FIG. **2**, this specification also provides a three-dimensional warehouse handling and dispatching method, as shown in FIG. **12**.

[0128] FIG. **12** is a flowchart of a three-dimensional warehouse handling and dispatching process provided in this specification. There are at least one or more three-dimensional warehouses, floors of the three-dimensional warehouses are connected by at least one lifting device. A bottom floor of the three-dimensional warehouses is provided with at least one bottom-floor docking point. At least some bottom-floor storage spaces are provided with a container and a container support, and the container support in the bottom-floor storage spaces is configured for placing a container transported by a second handling device. Higher floors above the bottom floor of the three-dimensional warehouses are each provided with at least one higher-floor docking point. The higher floors are each provided with a rail for a first handling device to run on, at least some higher-floor storage spaces of the higher floors are provided with a container, and the handling process may specifically include the following steps: [0129] S**200**: Determine a to-be-performed handling task.

[0130] It should be noted that, the handling task is used for a three-dimensional warehouse to implement the sorting of items, so that a task of a handling device transporting a container can be determined according to a received order. [0131] S**202**: Select, according to the handling task, a first handling device, a second handling device, and a lifting device for performing the handling task. [0132] S**204**: Send a handling instruction to the selected first handling device, second handling device, and lifting device separately, so that the first handling device, the second handling device, and the lifting device cooperate to transport the container from the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses to the bottom-floor docking point, or transport the container at the bottom-floor docking point into the higher-floor storage spaces or the bottom-floor storage spaces of the three-dimensional warehouses.

[0133] The handling method provided in this specification may be specifically performed by a control center. The control center may be one or more devices, such as a distributed server including a plurality of servers, which is not limited in this specification. Certainly, because there can be one or more three-dimensional warehouses, a control center may be set to determine handling tasks of the plurality of three-dimensional warehouses, and dispatch devices for performing the handling tasks, or a plurality of control centers may respectively determine different

handling tasks and dispatch devices for performing the handling tasks. In a case that there are a plurality of control centers, the control centers may share determined handling tasks, to allow the plurality of control centers to cooperate to perform the plurality of handling tasks.

[0134] In addition, for the detailed process of performing the method, reference may be made to the description of the process of performing the handling task in the three-dimensional warehouse handling and dispatching system for implementing item picking described above, and details are not described herein again in this specification.

[0135] Further, in this specification, an example in which the control center executes the handling and dispatching process is used for description. Because the first handling device can transport the container from above or from the side of the higher-floor storage spaces, when a handling instruction is sent to the determined first handling device, to enable the first handling device to perform the handling task, the control center may determine, according to the handling task, a higher-floor storage space corresponding to the handling task. The control center can send a handling instruction to the determined first handling device according to a position of the higher-floor storage space and an aisle position adjacent to the higher-floor storage space. The first handling device, at the aisle position, may thus take out a container indicated in the handling instruction from a side of the higher-floor storage space to the first handling device according to the handling instruction. Or, the first handling device may place the container indicated in the handling instruction in the first handling device into the higher-floor storage space from the side according to the handling instruction.

[0136] The aisle position adjacent to the higher-floor storage spaces is an aisle position where there is no warehouse structure such as a three-dimensional warehouse reinforcement structure (such as reinforcing ribs) or partitions between higher-floor storage spaces. Because an aisle is a passage for the first handling device to travel through when transporting the container, there needs to be an unblocked passage between each of the higher-floor storage spaces and an adjacent aisle. Certainly, in the system described above, there may be various plane layouts of the three-dimensional warehouse. Then, at least by transporting other containers, any one of the higher-floor storage spaces can also be in connection with the aisle.

[0137] Alternatively, the control center may determine, according to a handling task, a higher-floor storage space corresponding to the handling task, and send the handling instruction to the selected first handling device according to a position of the higher-floor storage space and positions of other storage spaces above the higher-floor storage space. The first handling device may thereby take out a container indicated in the handling instruction from the positions of other higher-floor storage spaces above the higher-floor storage space, or the first handling device may lower the container to the higher-floor storage space.

[0138] In addition, in this specification, the second handling device may also take items out of the bottom-floor storage spaces in different manners, such as transporting the container from below or from the side of the bottom-floor storage spaces. Therefore, when sending a handling instruction to the selected second handling device to enable the second handling device to perform the handling task, the control center may determine, according to a handling task, a bottom-floor storage space corresponding to the handling task. The control center may send the handling instruction to the second handling device according to a position of the bottom-floor storage space and an aisle position adjacent to the bottom-floor storage space. The second handling device, at the aisle position adjacent to the bottom-floor storage space, may thereby take out a container indicated in the handling instruction from a side of the bottom-floor storage space to the second handling device, or may place the container in the second handling device into the bottom-floor storage space.

[0139] Further, the control center may further determine, according to a handling task, a bottom-floor storage space corresponding to the handling task, and send the handling instruction to the second handling device according to a position of the bottom-floor storage space. The second

handling device may therefore, at an aisle position adjacent to the bottom-floor storage space, enters to below the bottom-floor storage space, and takes out a container indicated in the handling instruction from below the bottom-floor storage space to the second handling device, or may place the container in the second handling device into the bottom-floor storage space.

[0140] In addition, in a case, a rail is arranged in the lifting device, and is configured to be connected to the rail arranged in each of the higher floors, to allow the first handling device to travel into the lifting device.

[0141] The control center may further be configured to determine, at least in part according to a to-be-performed handling task of each of the higher floors, a quantity of first handling devices required by the each of the higher floors. The control center may further be configured to determine, according to the quantity of first handling devices required by the each of the higher floors and a current quantity of first handling devices of the each of the higher floors, first handling devices that need to be dispatched to the each of the higher floors. The control center can then send a dispatching instruction to the determined first handling devices that need to be dispatched, so that the first handling devices are further configured to travel into the lifting devices according to the received dispatching instruction, and reach a higher floor specified in the dispatching instruction through the lifting devices.

[0142] Further, if the higher-floor docking point is set to be located in the lifting device, when sending a handling instruction to the first handling device, the control center may determine, according to a handling task, a higher-floor docking point in the lifting device corresponding to the handling task. The control center may send the handling instruction to the determined first handling device according to a position of the higher-floor docking point in the lifting device. The first handling device may thereby travel to the higher-floor docking point in the lifting device, and place a container at the higher-floor docking point, or take out a container from the position of the higher-floor docking point.

[0143] Still further, an unpowered carrier or a powered carrier is arranged in the lifting device, and the higher-floor docking point is provided with at least the carrier located in the lifting device. Then, the control center may determine, according to a handling task, a higher-floor docking point in a lifting device corresponding to the handling task; and send the handling instruction to the determined first handling device according to a position of the higher-floor docking point in the lifting device. The first handling device may thereby travel to a carrier that is used as the higher-floor docking point in the lifting device, and place a container on the carrier, or take out a container from the carrier that is used as the higher-floor docking point.

[0144] In addition, if an unpowered carrier or a powered carrier is further arranged outside the lifting device, and the higher-floor docking point is further provided with at least the carrier outside the lifting device, the control center may further determine, according to a handling task, a higher-floor docking point corresponding to the handling task. The control center may send the handling instruction to the lifting device according to a floor on which the higher-floor docking point is arranged, so that the lifting device, on the floor on which the higher-floor docking point is arranged, is docked with the carrier located in the lifting device through the carrier located outside the lifting device. The lifting device can then transport the container from the carrier located in the lifting device to the carrier that is located outside the lifting device and used as the higher-floor docking point. Or, the lifting device can transport the container on the carrier that is located outside the lifting device and used as the higher-floor docking point to the carrier in the lifting device.

[0145] In addition, in this specification, the bottom-floor docking point of the bottom floor of the three-dimensional warehouse is an area of the three-dimensional warehouse for the docking with a container outside. If there is a device such as a forklift outside the three-dimensional warehouse that can fork and pick a container from the bottom floor, at least one bottom-floor docking point can be arranged in a specified area on the bottom floor of the three-dimensional warehouse. When sending the handling instruction to the determined second handling device, the control center may

also determine, according to a handling task, a bottom-floor docking point arranged in a specified area corresponding to the handling task. The control center may send a handling instruction to the second handling device according to the bottom-floor docking point arranged in the specified area, so that the second handling device can take a container indicated in the handling instruction out of the bottom-floor storage spaces or the lifting devices, transport the container to the bottom-floor docking point, and place the container in the specified area. Or the second handling device can take outs a container indicated in the handling instruction from the bottom-floor docking point in the specified area, and transport the container into the bottom-floor storage spaces or the lifting devices.

[0146] Further, a powered carrier may further be arranged in the lifting device, and correspondingly, the bottom ground of the three-dimensional warehouse is provided with a powered carrier. When controlling the lifting device to transport the container, the control center may determine, according to a handling task, a bottom-floor docking point corresponding to the handling task. The control center can send a handling instruction for moving to the bottom floor to the lifting device, so that the lifting device moves to the bottom floor. The carrier on the bottom ground is docked with the carrier located in the lifting device, to transport the container from the carrier in the lifting device to the carrier on the bottom ground, or transport the container on the carrier on the bottom ground to the carrier in the lifting device.

[0147] In a case described above, the container on the bottom floor is transported from the lifting device to the carrier on the bottom floor. Then, the control center may determine, according to a handling task, a bottom-floor docking point arranged in a specified area corresponding to the handling task, and send a handling instruction to the second handling device according to the bottom-floor docking point arranged in the specified area. The second handling device takes out a container from the carrier on the bottom ground, transports the container to the bottom-floor docking point, and places the container in the specified area. Or when the second handling device is to transport the container to the lifting device, the container can be lifted to other floors by the lifting device. The second handling device may take out a container indicated in the handling instruction from the bottom-floor docking point in the specified area according to the received handling instruction, and transport the container to the carrier on the bottom ground.

[0148] In addition, in some cases, the higher floors of the three-dimensional warehouse include a higher floor where not all areas are connected by rails. For the higher floor where not all areas are connected by rails, in a case that the control center determines that a first handling device needs to be dispatched between different areas of the higher floor, for example, according to the need to perform the handling task as described in the foregoing system, then the control center may determine an area from which the first handling device is to be dispatched as a departure area, determine an area into which the first handling device is to be dispatched as a destination area. The control center may further determine another higher floor closest to the higher floor where all areas are connected by rails as a transit floor. The control center may send a dispatching instruction to the first handling device in the departure area, send a handling instruction to a lifting device communicating the transit floor and the departure area, and send a handling instruction to a lifting device communicating the transit floor and the destination area. In such way, the first handling device can reach the destination area from the departure area through the two lifting devices and the transit floor.

[0149] Still further, in some cases, there are two or more three-dimensional warehouses. For example, the bottom surfaces of the three-dimensional warehouses are connected with each other. When determining that the first handling device needs to be dispatched between different three-dimensional warehouses, the control center may determine a three-dimensional warehouse from which the first handling device is to be dispatched as a departure warehouse, and determine a three-dimensional warehouse into which the first handling device is to be dispatched as a destination warehouse.

[0150] The control center may send a dispatching instruction to the first handling device in the departure warehouse, and send a handling instruction to a second handling device, a lifting device of the departure warehouse, and a lifting device of the destination warehouse. In such way, the first handling device is dispatched from the departure warehouse to the destination warehouse through the two lifting devices and the second handling device.

[0151] In addition, in another embodiment provided in this specification, one or more external temporary storage areas are arranged outside the three-dimensional warehouses. The external temporary storage areas can be in a form of three-dimensional storage or planar storage. The external temporary storage areas and the three-dimensional warehouses share at least some of the second handling devices, or the second handling devices transport and/or are docked with the container between the external temporary storage areas and at least one of the three-dimensional warehouses.

[0152] Then, when determining a to-be-performed handling task, the control center may determine the to-be-performed handling task according to item inventory information and order information stored in the external temporary storage areas and the three-dimensional warehouses. That is, items stored in the external temporary storage areas and the item storage capacity of the external temporary storage areas need to be taken into consideration.

[0153] Based on the method shown in FIG. **12**, the first handling devices and second handling devices in a three-dimensional warehouse are used in combination, and a handling function of a lifting device in the three-dimensional warehouse is used. As such, the first handling devices and the second handling devices can cooperate to transport items in a dense storage warehouse, which avoids laying rails on a bottom floor of the warehouse. The layout of the warehouse can therefore by changed flexibly, a quantity of first handling devices required can be reduced, the operating cost of the warehouse can be reduced, and the transport efficiency can be improved.

[0154] In the 1990s, improvements of a technology can be clearly distinguished between hardware improvements (for example, improvements to a circuit structure such as a diode, a transistor, or a switch) and software improvements (improvements to a method procedure). However, with the development of technology, improvements of many method procedures can be considered as direct improvements of hardware circuit structures. Designers almost all program an improved method procedure to a hardware circuit, to obtain a corresponding hardware circuit structure. Therefore, it does not mean that the improvement of a method procedure cannot be implemented by using a hardware entity module. For example, a programmable logic device (PLD) (for example, a field programmable gate array (FPGA)) is a type of an integrated circuit whose logic function is determined by a user by programming the device. The designers perform voluntary programming to "integrate" a digital system into a single PLD without requiring a chip manufacturer to design and prepare a dedicated integrated circuit chip. Moreover, nowadays, instead of manually making integrated circuit chips, this programming is mostly implemented by using "logic compiler" software, which is similar to the software compiler used in program development and writing. The original code is written in a specific programming language before compiling, and this language is referred to as a hardware description language (HDL). There are various kinds of HDLs, for example, advanced Boolean expression language (ABEL), altera hardware description language (AHDL), Confluence, Cornell university programming language (CUPL), HDCal, Java hardware description language (JHDL), Lava, Lola, MyHDL, PALASM, Ruby hardware description language (RHDL), and the like. Currently, the most commonly used HDLs are very-high-speed integrated circuit hardware description language (VHDL) and Verilog. A person skilled in the art should also understand that provided that a method procedure is logically programmed and then programmed to an integrated circuit by using the foregoing hardware description languages, a hardware circuit that implements the logical method procedure can be easily obtained.

[0155] The controller can be implemented in any appropriate manner. For example, the controller can take the form of, for example, a microprocessor or processor and a computer-readable medium

storing computer-readable program code (for example, software or firmware) executable by the (micro)processor, a logic gate, a switch, an application-specific integrated circuit (ASIC), a programmable logic controller, and an embedded microcontroller. Examples of the controller include, but are not limited to, the following microcontrollers: ARC 625D, Atmel AT91SAM, Microchip PIC18F26K20, and Silicone Labs C8051F320. The memory controller can also be implemented as a part of the memory control logic. A person skilled in the art also appreciates that, in addition to implementing the controller in the form of pure computer-readable program code, it is also possible to implement, by logically programming the method steps, the controller in the form of a logic gate, switch, ASIC, programmable logic controller, and embedded microcontroller and other forms to achieve the same function. Such a controller can thus be considered as a hardware component, and apparatuses included therein for implementing various functions can also be considered as structures inside the hardware component. Alternatively, apparatuses configured to implement various functions can be considered as both software modules implementing the method and structures inside the hardware component.

[0156] The system, the apparatus, the module or the unit described in the foregoing embodiments may be implemented by a computer chip or an entity, or implemented by a product having a certain function. A typical implementation device is a computer. Specifically, the computer may be, for example, a personal computer, a laptop computer, a cellular phone, a camera phone, a smartphone, a personal digital assistant, a media player, a navigation device, an email device, a game console, a tablet computer, a wearable device, or a combination of any of these devices.

[0157] For ease of description, when the apparatus is described, the apparatus is divided into units according to functions, which are separately described. Certainly, during implementation of this specification, the functions of the units may be implemented in the same piece of or a plurality of pieces of software and/or hardware.

[0158] A person skilled in the art can understand that the embodiments of the present disclosure may be provided as a method, a system, or a computer program product. Therefore, the present disclosure may use a form of hardware-only embodiments, software-only embodiments, or embodiments combining software and hardware. In addition, the present disclosure may use a form of a computer program product that is implemented on one or more computer-usable storage media (including but not limited to a disk memory, a CD-ROM, an optical memory, and the like) that include computer-usable program code.

[0159] The present disclosure is described with reference to flowcharts and/or block diagrams of the method, device (system), and computer program product in the embodiments of the present disclosure. It should be understood that computer program instructions can implement each procedure and/or block in the flowcharts and/or block diagrams and a combination of procedures and/or blocks in the flowcharts and/or block diagrams. These computer program instructions may be provided to a general-purpose computer, a dedicated computer, an embedded processor, or a processor of another programmable data processing device to generate a machine, so that an apparatus configured to implement functions specified in one or more procedures in the flowcharts and/or one or more blocks in the block diagrams is generated by using instructions executed by the general-purpose computer or the processor of another programmable data processing device.

[0160] These computer program instructions may also be stored in a computer readable memory that can instruct a computer or any other programmable data processing device to work in a specific manner, so that the instructions stored in the computer readable memory generate an artifact that includes an instruction apparatus. The instruction apparatus implements a specific function in one or more processes in the flowcharts and/or in one or more blocks in the block diagrams.

[0161] These computer program instructions may also be loaded into a computer or another programmable data processing device, so that a series of operation steps are performed on the computer or another programmable data processing device to generate processing implemented by

a computer, and instructions executed on the computer or another programmable data processing device provide steps for implementing functions specified in one or more procedures in the flowcharts and/or one or more blocks in the block diagrams.

[0162] In a typical configuration, a computing device includes one or more processors (CPUs), an input/output (I/O) interface, a network interface, and an internal memory.

[0163] The internal memory may include a form such as a volatile memory, a random-access memory (RAM) and/or a non-volatile memory such as a read-only memory (ROM) or a flash RAM in a computer-readable medium. The internal memory is an example of the computer-readable medium.

[0164] The computer-readable medium includes a non-volatile medium and a volatile medium, a removable medium and a non-removable medium, which may implement storage of information by using any method or technology. Information may be a computer-readable instruction, a data structure, a program module, or other data. Examples of computer storage media include but are not limited to a phase change memory (PRAM), a static random access memory (SRAM), a dynamic random access memory (DRAM), another type of RAM, a ROM, an electrically erasable programmable read-only memory (EEPROM), a flash memory or another memory technology, a CD-ROM, a digital versatile disc (DVD) or another optical storage, a cassette magnetic tape, tape and disk storage or another magnetic storage device or any other non-transmission media that may be configured to store information that a computing device can access. Based on the definition in this specification, the computer-readable medium does not include transitory computer readable media (transitory media), such as a modulated data signal and a carrier.

[0165] It should be further noted that the terms "include", "comprise", or any variants thereof are intended to cover a non-exclusive inclusion. Therefore, a process, method, article, or device that includes a series of elements not only includes such elements, but also includes other elements not specified expressly, or may include inherent elements of the process, method, article, or device. Unless otherwise specified, an element limited by "include a/an . . . " does not exclude other same elements existing in the process, the method, the article, or the device that includes the element.

[0166] A person skilled in the art should understand that the embodiments of this specification may be provided as a method, a system, or a computer program product. Therefore, this specification may use a form of hardware only embodiments, software only embodiments, or embodiments with a combination of software and hardware. Moreover, this specification may use a form of a computer program product that is implemented on one or more computer-usable storage media (including but not limited to a disk memory, a CD-ROM, an optical memory, and the like) that include computer-usable program code.

[0167] This specification can be described in the general context of computer-executable instructions executed by a computer, for example, program modules. Generally, the program module includes a routine, a program, an object, a component, a data structure, and the like for executing a particular task or implementing a particular abstract data type. This specification may also be implemented in a distributed computing environment in which tasks are performed by remote processing devices connected by using a communication network. In a distributed computing environment, the program module may be located in both local and remote computer storage media including storage devices.

[0168] The embodiments of this specification are all described in a progressive manner, for same or similar parts in the embodiments, refer to these embodiments, and descriptions of each embodiment focus on a difference from other embodiments. Especially, a system embodiment is basically similar to a method embodiment, and therefore is described briefly; for related parts, reference may be made to partial descriptions in the method embodiment.

[0169] The descriptions are merely embodiments of this specification, and are not intended to limit this specification. For a person skilled in the art, various modifications and changes may be made to this specification. Any modification, equivalent replacement, and improvement made within the

spirit and principle of this specification shall fall within the scope of the claims of this specification.

Claims

1. A warehouse system, comprising: one or more control centers; one or more first handling devices; one or more second handling devices; a plurality of lifting devices; and at least one three-dimensional warehouse comprising a plurality of floors that are connected with one another by at least one of the plurality of lifting devices, wherein the one or more control centers are configured to communicate with the one or more first handling devices and the one or more second handling devices, wherein the plurality of floors of the at least one three-dimensional warehouse comprise: a bottom floor having at least one bottom-floor docking point and one or more bottom-floor storage spaces, wherein the bottom floor is provided with the one or more second handling devices, and one or more higher floors above the bottom floor, each of the one or more higher floors having at least one higher-floor docking point and one or more higher-floor storage spaces, wherein each of the one or more higher floors is provided with a rail and a first handling device that runs on the rail, wherein at least one higher-floor storage space is provided with a corresponding container, and wherein the at least one of the plurality of lifting devices comprises a rail configured to be connected to a rail arranged in each of the one or more higher floors to allow the one or more first handling devices to travel into the at least one of the plurality of lifting devices, and wherein the one or more control centers are configured to: select, according to a handling task, a first handling device, a second handling device, and a lifting device for performing the handling task, and send a handling instruction for performing the handling task separately to the first handling device, the second handling device, and the lifting device, wherein the first handling device is configured to: take a container indicated in the handling instruction out of a higher-floor storage space of a higher floor of the one or more higher floors according to the handling instruction, and transport, on the higher floor, the container from the higher-floor storage space to a higher-floor docking point of the higher floor, wherein the lifting device is configured to: ascend to the higher floor according to the handling instruction, and transport, from the higher floor to the bottom floor, the container from the higher-floor docking point to the bottom-floor docking point; and wherein the second handling device is configured to: transport the container on the bottom floor according to the handling instruction.

2. The warehouse system according to claim 1, wherein the one or more higher-floor storage spaces have at least one container support on which a container is placed, and wherein a distance between the container support and the rail of a corresponding high floor is greater than a height of the first handling device.

3. The warehouse system according to claim 1, wherein the one or more first handling devices comprise one or more vehicles configured to travel in four directions along rails.

4. The warehouse system according to claim 1, wherein the one or more second handling devices comprises one or more automated guided vehicles.

5. The warehouse system according to claim 1, wherein the bottom-floor docking point comprises a conveyor configured to transport a carrier to a conveyor line.

6. The warehouse system according to claim 1, wherein the one or more control centers are configured to send the handling instruction by: determining, according to the handling task, a position of a bottom-floor storage space corresponding to the handling task; and sending the handling instruction to the second handling device according to the position of the bottom-floor storage space and an aisle adjacent to the bottom-floor storage space, such that the second handling device, at the aisle adjacent to the bottom-floor storage space, takes out the container from the bottom-floor storage space from a side of the bottom-floor storage space, or places the container in the second handling device into the bottom-floor storage space from the side.

7. The warehouse system according to claim 1, wherein the first handling device is configured to: at a rail adjacent to the higher-floor storage space, take out the container from a side of the higher-floor storage space; or take out the container from a top of the higher-floor storage space.

8. The warehouse system according to claim 1, wherein the first handling device is further configured to: travel to a location below the one or more higher-floor storage spaces, carry a container from the one or more higher-floor storage spaces in a piggyback manner, and leave the one or more higher-floor storage spaces.

9. The warehouse system according to claim 1, wherein the second handling device is configured to take out a container from a bottom-floor storage space from a bottom of the bottom-floor storage space.

10. The warehouse system according to claim 1, wherein the one or more control centers are configured to: determine, at least partially according to a handling task of each of the one or more higher floors, a quantity of first handling devices required by a higher floor of the one or more higher floors, determine, according to the quantity of first handling devices required by the higher floor and a current quantity of first handling devices on the higher floor, one or more first handling devices to be dispatched to the higher floor, and send a dispatching instruction to the one or more first handling devices to be dispatched to the higher floor, wherein the dispatching instruction specifies the higher floor that the one or more first handling devices are to be dispatched to, wherein each of the one or more first handling devices is configured to travel into a corresponding lifting device of the plurality of lifting devices according to the dispatching instruction, wherein the corresponding lifting device transports the first handling device to the higher floor specified in the dispatching instruction, and places the first handling device at the higher-floor docking point of the higher floor.

11. The warehouse system according to claim 9, comprising at least two three-dimensional warehouses, wherein bottom surfaces of the three-dimensional warehouses are connected with each other, wherein the one or more control centers are configured to: in response to determining that a particular first handling device is to be dispatched between different three-dimensional warehouses, determine a first three-dimensional warehouse from which first handling devices are to be dispatched as a departure warehouse, and determine a second three-dimensional warehouse into which the first handling devices are to be dispatched as a destination warehouse, and send a dispatching instruction to the first handling devices in the departure warehouse, a first lifting device of the departure warehouse, and a second lifting device of the destination warehouse, such that the first handling devices are dispatched from the departure warehouse to the destination warehouse through the first lifting device, the second lifting device, and the second handling devices, wherein the second handling devices are configured to transport the first handling devices from a bottom floor of the departure warehouse to a bottom floor of the destination warehouse according to the handling instruction.

12. The warehouse system according to claim 1, further comprising: a first carrier arranged in a lifting device of the plurality of lifting devices, and a second carrier arranged outside of the lifting device, wherein the first carrier or the second carrier comprises an unpowered carrier or a powered carrier, wherein the unpowered carrier comprises at least a container support configured for placing the container, and the powered carrier comprises at least one of a conveyor or a two-way telescopic fork, wherein the first handling device is configured to travel to the first carrier and place the container on the first carrier, and wherein the second carrier is configured to be docked with the first carrier, such that the container is transported from the first carrier to the second carrier.

13. The warehouse system according to claim 1, wherein a height of a container support in the at least one of the one or more bottom-floor storage spaces is higher than a height of the second handling device that is not carrying a container, and the second handling device that is not carrying a container is configured to pass under the container placed on the container support, and wherein an interval between uprights in the at least one of the one or more bottom-floor storage spaces is

greater than a width of the second handling device, and a height of a lowest point of a connector between at least two adjacent uprights of the bottom floor is higher than the height of the second handling device that is not carrying a container, and the second handling device that is not carrying a container is configured to travel between the at least two adjacent uprights.

14. The warehouse system according to claim 1, wherein the second handling device is configured to: at an aisle adjacent to a bottom-floor storage space, load the container into the bottom-floor storage space from a side of the bottom-floor storage space, or at the aisle adjacent to the bottom-floor storage space, load the container into the bottom-floor storage space from a bottom of the bottom-floor storage space.

15. The warehouse system according to claim 1, wherein a specified area of the bottom floor is provided with the bottom-floor docking point, and the second handling device is configured to: take the container out of the bottom-floor storage space or the lifting device, transport the container to the bottom-floor docking point, and place the container in the specified area, wherein a first powered carrier is further arranged in the lifting device, and the bottom floor is provided with a second powered carrier, and wherein, when the lifting device reaches the bottom floor, the second power carrier is configured to be docked next to the first powered carrier, wherein the first powered carrier transports the container from the first powered carrier to the second powered carrier, and wherein the second handling device is further configured to: take out the container from the second powered carrier, transport the container to the bottom-floor docking point, and and place the container in the specified area.

16. The warehouse system according to claim 1, further comprising one or more external temporary storage areas, wherein the one or more external temporary storage areas are in a form of at least one of a three-dimensional storage or a planar storage, wherein the one or more external temporary storage areas and the at least one three-dimensional warehouse share at least one of the one or more second handling devices, or the one or more second handling devices are configured to transport the container between the one or more external temporary storage areas and the at least one three-dimensional warehouse, and wherein the one or more control centers are further configured to store item inventory information of the one or more external temporary storage areas and the at least one three-dimensional warehouse.

17. A warehouse system, comprising: one or more control centers; one or more first handling devices; a plurality of lifting devices; and at least one three-dimensional warehouse comprising a plurality of floors that are connected with one another by at least one of the plurality of lifting devices, wherein the plurality of floors of the at least one three-dimensional warehouse comprise: a bottom floor, and one or more higher floors above the bottom floor, each of the one or more higher floors having at least one higher-floor docking point and one or more higher-floor storage spaces, wherein each of the one or more higher floors is provided with a rail and one or more first handling devices that runs on the rail, wherein the one or more control centers are configured to: in response to determining that a particular first handling device is to be dispatched between different areas of a particular higher floor: determine an area from which the particular first handling device is to be dispatched as a departure area, determine an area into which the particular first handling device is to be dispatched as a destination area, and determine another higher floor where all areas are connected by rails as a transit floor, and send a dispatching instruction to the particular first handling device in the departure area, send a first handling instruction to a first lifting device connecting the transit floor and the departure area, and send a second handling instruction to a second lifting device connecting the transit floor and the destination area, such that the particular first handling device reaches the destination area from the departure area through the first lifting device, the transit floor, and the second lifting device.

18. The warehouse system according to claim 17, wherein the transit floor is closest to the particular higher floor among the one or more higher floors.

19. The warehouse system according to claim 17, further comprising: one or more first handling

devices configured to travel between a bottom-floor docking point and bottom-floor storage spaces.

20. A warehouse system comprising: more than one warehouse each comprising a bottom floor and higher floors above the bottom floor, wherein bottom floors of the more than one warehouse are connected with each other, one or more first handling devices configured to travel on bottoms floors; one or more second handling devices configured to travel on rails of higher floors; a plurality of lifting device configured to ascend or descend between different floor; and one or more control centers configured to: in response to determining that a particular first handling device is to be dispatched between a first warehouse and a second warehouse, control a lifting device of the first warehouse to transport the particular first handling device to the bottom floor of the first warehouse; control a second handling device to transport the particular first handling device from the bottom floor of the first warehouse to the bottom floor of the second warehouse; and control to a lifting device of the second warehouse to transport the particular first handling device from the bottom floor of the second warehouse to a higher floor of the second warehouse.