DELIVERY TARGET ITEM SORTING SYSTEM

FIELD

[0001] Embodiments of the present invention relate to delivery target item sorting systems for sorting delivery target items.

BACKGROUND

[0002] Conventional delivery target item sorting systems can sort delivery target items by delivery area. However, in the delivery of delivery target items, if a receiver at a delivery destination is absent when a delivery person visits the delivery destination, the delivery person drops a delivery notice into a mailbox at the delivery destination, and redelivers the delivery target item on the same day or a later day.

[0003] When a delivery target item needs to be redelivered, the following problems arise. Costs such as gasoline costs and labor costs for redelivery are necessary. Moreover, in order to store delivery target items that the delivery person has brought back, it is necessary to provide a storage space for the delivery target items in a delivery center or expand the storage space for the delivery target items in some cases.

[0004] An object of the present invention is to provide a delivery target item sorting system with which delivery of more delivery target items can be completed on the first visit.

SUMMARY OF THE PRESENT INVENTION

[0005] To solve the foregoing problem, a delivery target item sorting system according to an embodiment includes: a destination address recognition unit that

recognizes a destination address from a delivery target item; a delivery result database that stores delivery result information for each destination address; a sorting-by-delivery-time-period processing unit that selects a delivery time period in which the delivery target item whose destination address has been recognized by the destination address recognition unit is to be delivered, based on a result of delivery to the destination address of the delivery target item recognized by the destination address recognition unit, the result being stored in the delivery result database; a map database that stores information about a delivery area in association with address information belonging to the delivery area; and a sorting-by-delivery-area processing unit that specifies a delivery area to which the destination address of the delivery target item whose delivery time period has been selected belongs, based on the map database.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Fig. 1 is a block diagram of a delivery target item sorting system according to an embodiment;

[0007] Fig. 2 is exemplary information stored in a delivery result DB in the delivery target item sorting system according to an embodiment;

[0008] Fig. 3 is exemplary information stored in a map DB in the delivery target item sorting system according to an embodiment;

[0009] Fig. 4 is a flowchart illustrating an overall flow of the delivery target item sorting system according to an embodiment;

[0010] Fig. 5 is a flowchart illustrating a flow of sorting-by-delivery-time-period processing according to an embodiment;

[0011] Fig. 6 is a flowchart illustrating a flow of sorting-by-delivery-area processing according to an embodiment; and

[0012] Fig. 7 is a diagram illustrating an exemplary state where an arbitrary delivery target item is sorted in the delivery target item sorting system according to an embodiment.

DETAILED DESCRIPTION

[0013] Hereinafter, embodiments for carrying out the present invention will be described with reference to the drawings.

First Embodiment

[0014] Fig. 1 is a block diagram of a delivery target item sorting system according to the embodiment. A configuration of the delivery target item sorting system will be described using Fig. 1. The delivery target item sorting system includes a receiving unit 100 into which delivery target items are introduced, a destination address recognition unit 200, a sorting processing unit 300, a pick-up unit 600, a delivery result DB (database) 400, a map DB 500, and a control unit 700 that controls the overall delivery target item sorting system.

[0015] The receiving unit 100, the destination address recognition unit 200, the sorting processing unit 300, and the pick-up unit 600 are provided along a conveyance path (not shown) provided with conveyance means such as a clamping conveyor belt and a belt conveyer for conveying delivery target items. The conveyance path is branched for each conveyance destination of delivery target items in order to sort the delivery target items.

[0016] An introduction opening (not shown) is provided near the receiving unit 100, and delivery target items are introduced from the introduction opening into the receiving unit 100 by an operator or a robot. The delivery target items

introduced into the receiving unit 100 are placed onto the conveyance means by an operator or a robot and sent to the destination address recognition unit 200 by the conveyance means.

[0017] The destination address recognition unit 200 reads out, using an optical character reader (OCR) or the like, a character string of an address in an image of each delivery target item obtained by imaging the delivery target item using an imaging means (not shown) such as a camera. The destination address recognition unit 200 can obtain destination address information about the delivery target item by performing address recognition on the address written on the delivery target item that is conveyed by the conveyance means.

[0018] The sorting processing unit 300 performs processing for sorting delivery target items conveyed by the conveyance means, by selecting a branched conveyance destination based on predetermined criteria. The sorting processing unit 300 includes a sorting-by-delivery-time-period processing unit 310, and a sorting-by-delivery-area processing unit 320.

[0019] The business hour during which delivery is performed is divided into a plurality of delivery time periods. The sorting-by-delivery-time-period processing unit 310 sorts delivery target items by delivery time period. Also, a delivery target region is divided into a plurality of delivery areas. The sorting-by-delivery-area processing unit 320 sorts delivery target items by delivery area. The sorting-by-delivery-time-period processing unit 310 and the sorting-by-delivery-area processing unit 320 may process delivery target items in the same zone on the conveyance path, or may process delivery target items in different zones on the conveyance path. This embodiment describes the case where delivery target items are processed in the same zone on the conveyance path in the sorting-by-delivery-time-period processing and the

sorting-by-delivery-area processing.

[0020] In this embodiment, each delivery target item is conveyed twice by the same conveyor belt, and the sorting processing unit 300 performs the sorting-by-delivery-time-period processing at the first stage, and performs the sorting-by-delivery-area processing at the second stage. For this reason, this delivery target item sorting system has two modes, which are a "sorting-by-delivery-time-period mode" and a "sorting-by-delivery-area mode". These modes are switched in accordance with, for example, input from an operator to a mode selection unit 710 included in the control unit 700 that controls the overall system.

[0021] The control unit 700 includes the aforementioned mode selection unit 710 and the like, and controls the delivery target item sorting processing.

[0022] The sorting-by-delivery-time-period processing unit 310 references the later-described delivery result DB 400 and selects a delivery time period in which each conveyed delivery target item is to be delivered. Upon the delivery time period being selected, a conveyance means of the sorting-by-delivery-time-period processing unit 310 is controlled by the control unit 700 such that this delivery target item is conveyed to a conveyance destination that corresponds to to this delivery time period. The sorting-by-delivery-time-period processing unit 310 thereby sorts the delivery target items by delivery time period through the branched conveyance path.

[0023] The sorting-by-delivery-area processing unit 320 references the later-described map DB 500 and specifies the delivery area to which each conveyed delivery target item is to be delivered. Upon the delivery area being specified, a conveyance means of the sorting-by-delivery-area processing unit 320 is controlled by the control unit 700 such that this delivery target item is conveyed

to a conveyance destination that corresponds to to this delivery area. The sorting-by-delivery-area processing unit 320 thereby sorts the delivery target items by delivery area through the branched conveyance path.

[0024] In the pick-up unit 600, each conveyed delivery target item is picked up from the conveyance path by an operator or a robot. When the sorting-by-delivery-time-period mode is applied, a sorting-by-delivery-time-period box 610 corresponding to the delivery time period of the delivery target item is placed in the pick-up unit 600. When the sorting-by-delivery-area mode is applied, a sorting-by-delivery-area box 620 corresponding to the delivery area of the delivery target item is placed in the pick-up unit 600.

[0025] One or more sorting-by-delivery-time-period boxes 610 are placed at the destination of each branch of the conveyance path that is branched for the respective delivery time periods, and are portable containers, such as roll box pallets, for containing delivery target items. That is to say, the sorting-by-delivery-time-period boxes 610 are placed so as to correspond to the respective delivery time periods. After each delivery target item is conveyed so as to be sorted by delivery time period by the sorting-by-delivery-time-period processing unit 310, the delivery target item is picked up from the conveyance path and accumulated in the sorting-by-delivery-time-period box 610.

[0026] One or more sorting-by-delivery-area boxes 620 are placed at the destination of each branch of the conveyance path that is branched for the respective delivery areas, and are portable containers, such as roll box pallets, for containing delivery target items. That is to say, the sorting-by-delivery area boxes 620 are placed so as to correspond to the respective delivery areas. After each delivery target item is conveyed so as to be sorted by delivery area by the sorting-by-delivery-area processing unit 320, the delivery target item is picked up

from the conveyance path and accumulated in the sorting-by-delivery-area box 620.

[0027] The sorting-by-delivery-time-period boxes 610 and the sorting-by-delivery area boxes 620 each have a sufficient capacity with which delivery target items can be accumulated. If the capacity for allowing accumulation of a delivery target item that is to be subsequently conveyed to any of the sorting boxes becomes insufficient during the sorting processing, a new sorting box having a sufficient accumulation capacity is prepared, and thereafter, delivery target items that are to be conveyed subsequently are accumulated in this new sorting box. Thereby, even if the remaining accumulation capacity of the sorting boxes becomes insufficient, the sorting processing is performed without interruption.

[0028] Note that the sorting-by-delivery-time-period boxes 610 and the sorting-by-delivery area boxes 620 may take a shape other than the shape of a roll box pallet, as long as movement and loading can be easily performed.

[0029] The sorting-by-delivery-time-period boxes 610 and the sorting-by-delivery-area boxes 620 may be applied whichever sorting mode, and may be used in common. That is to say, the sorting boxes placed in the pick-up unit 600 when the sorting-by-delivery-time-period mode is applied are used as the sorting-by-delivery-time-period boxes 610, and the sorting boxes placed in the pick-up unit 600 when the sorting-by-delivery-area mode is applied are used as the sorting-by-delivery-area boxes 620.

[0030] The delivery result DB 400 stores, for each destination address, a time period in which a receiver at a delivery destination was present (i.e., the time period in which the delivery was completed) and the number of times or the percentage of completed deliveries during this time period in the past. That is to

say, the delivery result DB stores, for each destination address, information about a delivery result of past successful deliveries by delivery time period. The delivery result DB 400 is referenced by the sorting-by-delivery-time-period processing unit 310 and is used to select the best delivery time period for each destination address.

[0031] Note that the delivery result DB 400 is updated by a delivery information management system 800. The delivery information management system 800 is a system that stores information about completion of delivery of a delivery target item and the delivery completion time in the case where delivery is completed, and information about the absence of a receiver at a delivery destination and the visit time in the case where the receiver at the delivery destination is absent. Upon a delivery person delivering a delivery target item to a delivery destination, the above information is transmitted from a terminal carried by the delivery person to the delivery information management system 800. That is to say, the delivery information management system 800 manages information (delivery log) that serves as a source for constructing the delivery result DB 400.

[0032] The delivery result DB 400 is constructed based on the delivery result information updated by the delivery information management system 800. Thereby, a time period can be selected in which a receiver at a delivery destination is more likely to be present.

[0033] Note that the delivery information management system 800 may store information regarding the presence/absence such as a desired time period for receipt stated by a receiver at a delivery destination, or store information regarding designation of a delivery time period designated by a sender at the time of dispatch of a delivery target item. In this case, the

sorting-by-delivery-time-period processing unit 310 can also select the delivery time period by combining the delivery result information, the information stated by a receiver at a delivery destination, and the information designated by a sender at the time of dispatch.

[0034] That is to say, in the case where the information stated by a receiver at a delivery destination or the information designated by a sender at the time of dispatch of a delivery target item exists, the sorting-by-delivery-time-period processing unit 310 may preferentially select the delivery time period based on the information stated by the receiver at the delivery destination or the information designated by the sender at the time of dispatch of the delivery target item.

[0035] The map DB 500 stores information about the plurality of delivery areas obtained by dividing the delivery target region to which this delivery target item sorting system is applied into a plurality of areas. As for the method for dividing the delivery target region, any dividing method is used such as dividing into areas each of which is an area in which a delivery person who delivers delivery target items to delivery destinations can perform delivery with the delivery truck having been loaded once, for example.

[0036] Each delivery area is assigned a serial number, and the map DB 500 stores delivery areas A1 to Am and address information that belongs to the delivery areas A1 to Am in association with each other. When a destination address recognized by the destination address recognition unit 200 is referenced in the map DB 500 by the sorting-by-delivery-area processing unit 320, the delivery area to which this destination address belongs is specified.

[0037] Fig. 2 is exemplary information stored in the delivery result DB 400 in the delivery target item sorting system according to the embodiment. The

delivery result DB 400 will be described using Fig. 2. Here, information about a result of delivery to an arbitrary address ABC is shown as an example.

[0038] In this example, the delivery time period is divided into three, namely a delivery time period T1 (8:00 to 12:00), a delivery time period T2 (12:00 to 16:00), and a delivery time period T3 (16:00 to 20:00). The number of times that delivery to a receiver at the address ABC was successful is stored separately for these delivery time periods. That is to say, of the results of a total of six deliveries, five deliveries were successful in the delivery time period T2. In other words, it can be understood that the receiver at the address ABC was present in the delivery time period T2 and received delivery target items five times.

[0039] Based on this information, in the later-described sorting-by-delivery-time-period processing, it is determined that the receiver is highly likely to be present in the delivery time period T2, the delivery time period T2 is selected, and the delivery target item is conveyed to the sorting-by-delivery-time-period box 610 that corresponds to this delivery time period T2.

[0040] Similarly, regarding addresses (address DEF and address GHI etc.) with delivery results, delivery result information for the respective delivery time periods is stored for each address.

[0041] Although the delivery time period is divided into three in this example, the delivery time period may be divided in other modes, e.g., by hour, by day of the week, or by a combination of the day of the week and the hour.

[0042] As long as the probability that a receiver at a delivery destination is present can be estimated from the information, the delivery result information may be other kinds of information, such as records of a delivery time period in which a receiver was absent when a delivery person visited a delivery destination.

[0043] Fig. 3 is exemplary information stored in the map DB 500 in the delivery target item sorting system according to the embodiment. The map DB 500 will now be described using Fig. 3. Here, information regarding an arbitrary delivery target region is shown as an example.

[0044] In this example, the delivery target region is divided into four delivery areas, namely a delivery area A1 (Shibaura 1-chome to 4-chome, Minato-ku), a delivery area A2 (Shiba-Koen, Minato-ku and Shiba-Daimon, Minato-ku), a delivery area A3 (Mita, Minato-ku), and a delivery area A4 (Shiba 1-chome to 5-chome, Minato-ku). For example, in the case where the destination address of a delivery target item is "1-1, Shibaura 1-chome, Minato-ku", it is specified that the destination address of this delivery target item belongs to the delivery area A1 by the sorting-by-delivery-area processing unit 320.

[0045] Based on the information about the specified delivery area, in the later-described sorting-by-delivery-area processing, it is specified by the sorting-by-delivery-area processing unit 320 that the delivery area to which the destination address belongs is the delivery area A1, and the delivery target item is conveyed to the sorting-by-delivery-area box 620 that corresponds to this delivery area A1.

[0046] Fig. 4 is a flowchart illustrating an overall flow of the delivery target item sorting system according to the embodiment. A description will be given, with reference to Fig. 4, of the flow from introduction of delivery target items into the delivery target item sorting system until loading thereof onto a delivery truck.

[0047] Initially, the mode selection unit 710 included in the control unit 700 sets the mode of the delivery target item sorting system to the sorting-by-delivery-time-period mode.

[0048] A serial number is assigned to each delivery target item processed in

the delivery target item sorting system in the embodiment. This serial number is indicated as a variable i, which is set so as to start from 1. The delivery target items are sequentially introduced from the introduction opening to the receiving unit 100 by an operator or a robot, and furthermore, the delivery target items are placed onto the conveyance path from the receiving unit 100 by an operator or a robot. Initially, a first delivery target item is set as a processing target (step S101).

[0049] The destination address recognition unit 200 performs address recognition on the first delivery target item and reads the destination address of the delivery target item (step S102).

[0050] Then, the sorting-by-delivery-time-period processing is executed for the first delivery target item whose destination address is recognized by the destination address recognition unit 200, by the sorting-by-delivery-time-period processing unit 310 (step S103). The delivery target item 1 is thereby sorted into the sorting-by-delivery-time-period box 610 corresponding to any one of the delivery time periods T1 to Tn. That is to say, the sorted delivery target item is accumulated in any one of sorting-by-delivery-time-period boxes BT1 to BTn that are placed so as to correspond to the respective delivery time periods.

[0051] Here, it is determined whether or not the sorting-by-delivery-time-period processing has ended for all delivery target items (step S104). When the sorting-by-delivery-time-period processing has not ended for all delivery target items (No in step S104), processing for a variable i+1-th delivery target item is then performed (step S105).

[0052] On the other hand, if the sorting-by-delivery-time-period processing has ended for all delivery target items (Yes in step S104), the delivery target items accumulated in the sorting-by-delivery-time-period box BT1 that

corresponds to the delivery time period T1, which is the earliest delivery time period, are carried, in a state of being accumulated in the sorting-by-delivery-time-period box BT1, to the vicinity of the introduction opening of the delivery target item sorting system by an operator or a robot (step S106).

[0053] Here, the mode selection unit 710 included in the control unit 700 changes the mode of the delivery target item sorting system to the sorting-by-delivery-area mode. With these two sorting modes, both the sorting-by-delivery-time-period processing and the sorting-by-delivery-area processing can be performed using the same conveyance path.

[0054] Note that, at this time, sorting-by-delivery-area boxes BT1_A1 to BT1_Am are placed in the pick-up unit 600.

[0055] Here, the delivery target items accumulated in each sorting-by-delivery-time-period box are each assigned a serial number again. This serial number is indicated as a variable k, which is set so as to start from 1. For example, a k-th delivery target item in the sorting-by-delivery-time-period box BTj is indicated as a delivery target item Tj_k. As for j, $1 \leq j \leq n$ holds. The delivery target items carried to the vicinity of the introduction opening are sequentially introduced from the introduction opening to the receiving unit 100 by an operator or a robot, and furthermore, the delivery target items are placed onto the conveyance path from the receiving unit 100 by an operator or a robot.

[0056] Initially, the delivery target item T1_1, i.e., a first delivery target item, in the sorting-by-delivery-time-period box BT1 is set as a processing target of the sorting-by-delivery-area processing (step S107).

[0057] The destination address recognition unit 200 reads the destination address of the delivery target item T1_1 and performs address recognition (step

S108).

[0058] Then, the sorting-by-delivery-area processing is executed for the delivery target item T1_1 whose destination address is recognized by the destination address recognition unit 200, by the sorting-by-delivery area processing unit 320 (step S109). Thereby, the delivery target item T1_1 is sorted into the sorting-by-delivery-area box 620 corresponding to any one of the delivery areas A1 to Am. That is to say, the sorted delivery target item is accumulated in any one of the sorting-by-delivery-area boxes BT1_A1 to BT1_Am that are placed so as to correspond to the respective delivery areas.

[0059] Here, the delivery areas A1 to Am are sequentially assigned serial numbers along a delivery route through which a delivery person can efficiently deliver the delivery target items, for example.

[0060] Here, it is determined whether or not the sorting-by-delivery-area processing has ended for all delivery target items accumulated in the sorting-by-delivery-time-period box BT1 (step S110). When the sorting-by-delivery-area processing has not ended for all delivery target items accumulated in the sorting-by-delivery-time-period box BT1 (No in step S110), processing for a variable k+1-th delivery target item in the sorting-by-delivery-time-period box BT1 is then performed (step S111).

[0061] On the other hand, if the sorting-by-delivery-area processing has ended for all delivery target items accumulated in the sorting-by-delivery-time-period box BT1 (Yes in step S110), all sorting-by-delivery-area boxes in which the delivery target items are accumulated are loaded into the delivery truck in the order from the sorting-by-delivery-area box BT1_A1 to the sorting-by-delivery-area box BT1_Am, for example, such that the delivery person can efficiently pick up the delivery target items and perform delivery (step S112).

[0062] Subsequently, it is determined whether or not the sorting-by-delivery-area processing has ended for all sorting-by-delivery-time-period boxes BT1 to BTn that have been sorted by the sorting-by-delivery-time-period processing (step S113). When the sorting-by-delivery-area processing has not ended for all sorting-by-delivery-time-period boxes BT1 to BTn sorted by the sorting-by-delivery-time-period processing (No in step S113), processing for a variable j+1-th sorting-by-delivery-time-period box is then performed (step S114).

[0063] On the other hand, if the sorting-by-delivery-area processing has ended for the delivery target items in all sorting-by-delivery-time-period boxes BT1 to BTn sorted by the sorting-by-delivery-time-period processing (Yes in step S113), the processing of the delivery target item sorting system ends.

[0064] By thus performing the sorting processing in two steps, the delivery target items can be loaded into the delivery truck by delivery time period and also by delivery area, and accordingly, the efficiency in delivery operations increases.

[0065] Subsequently, the details of the sorting-by-delivery-time-period processing in step S103 and the sorting-by-delivery-area processing in step S109 in Fig. 4 will be respectively described using Figs. 5 and 6.

[0066] Fig. 5 is a flowchart illustrating a flow of sorting-by-delivery-time-period processing according to the embodiment. The flow of the sorting-by-delivery-time-period processing for an arbitrary delivery target item i will now be described using Fig. 5.

[0067] The sorting-by-delivery-time-period processing unit 310 initially references the delivery result DB 400 regarding the delivery target item i and obtains information about the result of delivery to the destination address recognized by the destination address recognition unit 200 (step S301). The

sorting-by-delivery-time-period processing unit 310 selects the best delivery time period for delivery of the delivery target item based on the result of delivery to this destination address (step S302). The selected delivery time period is a time period in which the receiver at the delivery destination is most likely to be present. That is to say, the delivery time period with the largest number of deliveries is selected based on the delivery result.

[0068] Note that, if the information stated by the receiver at the delivery destination or the information designated by the sender at the time of dispatch exists in the delivery information management system 800, the sorting-by-delivery-time-period processing unit 310 may preferentially select the delivery time period that is based on the information stated by the receiver at the delivery destination or the information designated by the sender at the time of dispatch.

[0069] The delivery target item i is sorted into the sorting-by-delivery-time-period box 610 that corresponds to the selected delivery time period (steps S3031 to S303n).

[0070] Note that, if the best delivery time period cannot be selected from the delivery result DB 400 because no result of delivery to the destination address existing, a delivery result exists but the receiver was always absent, or for other reasons at the point when the sorting-by-delivery-time-period processing is executed, the delivery target item i is sorted into the sorting-by-delivery-time-period box BT1 that corresponds to the earliest delivery time period (step S304). Thereby, the delivery target item can be delivered as early as possible. This is because, if the receiver is absent, the delivery person drops a delivery notice indicating that the delivery person visited for delivery but could not deliver because the receiver was absent, and waits for contact from the

receiver, thereby increasing the possibility that the delivery person can receive a redelivery request at an earlier timing.

[0071] Note that, if the best delivery time period cannot be selected from the delivery result DB 400, the delivery target item may be temporarily suspended from being sorted, and sorted into the sorting-by-delivery-time-period box 610 that contains the smallest number of delivery target items after the sorting-by-delivery-time-period processing has ended for all delivery target items. In this case, the available space in the sorting-by-delivery-time-period boxes 610 can be efficiently used. Also, in this case, delivery can be performed while avoiding a busy time period.

[0072] The delivery target item i is sorted into one of the sorting-by-delivery-time-period boxes BT1 to BTn through the above processes, and the sorting-by-delivery-time-period processing ends.

[0073] Fig. 6 is a flowchart illustrating a flow of sorting-by-delivery-area processing according to the embodiment. A description will be given, using Fig. 6, of the case where, after the delivery target item i is sorted into the sorting-by-delivery-time-period box BTj by the above-described sorting-by-delivery-time-period processing, this delivery target item i is deemed to be a k-th delivery target item Tj_k in the sorting-by-delivery-time-period box BTj, and the sorting-by-delivery-area processing is executed therefor.

[0074] The sorting-by-delivery-area processing unit 320 initially references the map DB 500 regarding the delivery target item Tj_k, and obtains information about the delivery area to which the destination address recognized by the destination address recognition unit 200 belongs (step S901). Thereby, the delivery area to which the delivery target item is to be delivered is specified (step S902).

[0075] The delivery target item Tj_k is sorted into the sorting-by-delivery-area box 620 corresponding to the selected delivery area (steps S9031 to S903m).

[0076] The delivery target item Tj_k is sorted to one of the sorting-by-delivery-area boxes BTj_A1 to BTj_Am with the above processes, and the sorting-by-delivery-area processing ends.

Second Embodiment

[0077] In the first embodiment, the sorting processing is divided into the sorting-by-delivery-time-period processing and the sorting-by-delivery-area processing, and the same conveyance path is used in both processes. That is to say, in the first embodiment, each delivery target item is introduced twice from the same introduction opening into the receiving unit 100, and the same conveyance path is used in the sorting-by-delivery-time-period processing and the sorting-by-delivery-area processing.

[0078] In the second embodiment, the sorting-by-delivery-time-period processing and the sorting-by-delivery-area processing are executed along different conveyance paths. That is to say, the sorting-by-delivery-time-period processing is executed for a first conveyance path in the upstream part of the conveyance path, and the sorting-by-delivery-area processing is executed for a second conveyance path in the downstream part of the conveyance path.

[0079] Fig. 7 shows an exemplary state where an arbitrary delivery target item i is sorted in the delivery target item sorting system according to the second embodiment. Fig. 7 illustrates the case of executing the sorting processing while a conveyance path for which the sorting-by-delivery-time-period processing is performed is connected in series to a conveyance path for which the

sorting-by-delivery-area processing is performed. Note that black arrows in the diagram indicate routes through which the delivery target item i passes.

[0080] In the delivery target item sorting system, initially, the destination address of the arbitrary delivery target item i is recognized by the destination address recognition unit 200. Upon the destination address being recognized by the destination address recognition unit 200, the sorting-by-delivery-time-period processing unit 310 references the delivery result DB 400. It is determined, for example, that, among the delivery time periods T1 to Tn, the receiver is most likely to be present in the delivery time period T2 according to the information about the result of delivery to the destination address of the delivery target item i. For this reason, the delivery target item i is sent to the conveyance path that is branched to the sorting-by-delivery-time-period box BT2.

[0081] Subsequently, the delivery target item i is picked up from the sorting-by-delivery-time-period box BT2, and the destination address thereof is again recognized by the destination address recognition unit 200. Upon the destination address being recognized by the destination address recognition unit 200, the sorting-by-delivery-area processing unit 320 references the map result DB 500. It is specified that, among the delivery areas A1 to Am, the destination address of the delivery target item i belongs to the delivery area A1, for example. Accordingly, the delivery target item i is sent to the conveyance path that is branched to a sorting-by-delivery-area box B¯2_A1.

[0082] After the sorting-by-delivery-time-period processing and the sorting-by-delivery-area processing end for all delivery target items in the sorting-by-delivery-area boxes B¯2_A1 to B¯2_Am, the sorting-by-delivery-area boxes B¯2_A1 to B¯2_Am, which include the sorting-by-delivery area box B¯2_A1 in which the delivery target item i is accumulated, are loaded into the delivery

truck, and the delivery is started.

[0083] According to the embodiments of the present invention, delivery target items are automatically sorted by delivery time period and by delivery area in the delivery center before delivery, and it is thereby possible to efficiently perform delivery in a delivery time period in which a receiver at a delivery destination of each delivery target item is highly likely to be present. Accordingly, delivery of more delivery target items can be completed on the first visit.

[0084] It is thereby possible to reduce the number of delivery target items to be redelivered, and also reduce costs such as gasoline costs and labor costs for redelivery, as well as reduce the delivery target item storage space in the delivery center for storing delivery target items that are brought back because the receiver at the delivery destination was absent.

[0085] Although some embodiments of the present invention have been described, these embodiments are proposed as examples, and are not intended to limit the scope of the present invention. These embodiments can be carried out in other various modes, and omission, replacement, and modification can be made in various forms without departing from the gist of the present invention. These embodiments and modifications thereof are encompassed in the scope and the gist of the present invention, and are also encompassed in the present invention described in the claims and the equivalents thereof.

WHAT IS CLAIMED IS:

1. A delivery target item sorting system comprising:

a destination address recognition unit that recognizes a destination address from a delivery target item;

a delivery result database that stores delivery result information for each destination address;

a sorting-by-delivery-time-period processing unit that selects a delivery time period in which the delivery target item whose destination address has been recognized by the destination address recognition unit is to be delivered, based on a result of delivery to the destination address of the delivery target item recognized by the destination address recognition unit, the result being stored in the delivery result database;

a map database that stores information about a delivery area in association with address information belonging to the delivery area; and

a sorting-by-delivery-area processing unit that specifies a delivery area to which the destination address of the delivery target item whose delivery time period has been selected belongs, based on the map database.

2. The delivery target item sorting system according to claim 1,

wherein the delivery result DB stores, separately for each delivery time period, delivery result information regarding successful delivery to each destination address in the past.

3. The delivery target item sorting system according to claim 2, wherein the delivery result information includes the number of times that delivery was

successful in the past.

4. The delivery target item sorting system according to claim 2, wherein the delivery result information includes a percentage of successful deliveries in the past.

5. The delivery target item sorting system according to any one of claims 2 to 4,

wherein in the delivery result DB, the delivery result information is updated by a delivery information management system that stores information about a time of visit to a delivery destination of the delivery target item and presence or absence of a receiver at the delivery destination.

6. The delivery target item sorting system according to any one of claims 1 to 5, further comprising:

a mode selection unit that selects one of processing performed by the sorting-by-delivery-time-period processing unit and processing performed by the sorting-by-delivery-area processing unit.

7. The delivery target item sorting system according to any one of claims 1 to 5, further comprising:

a first conveyance path for conveying a delivery target item that is a target of processing performed by the sorting-by-delivery-time-period processing unit; and

a second conveyance path for conveying a delivery target item that is a target of processing performed by the sorting-by-delivery-area processing unit.

8. The delivery target item sorting system according to claim 1,

wherein, in a case where the delivery result database indicates that a result of delivery to the destination address recognized by the destination address recognition unit does not exist, the sorting-by-delivery-time-period processing unit selects an earliest delivery time period for the delivery target item whose destination address has been recognized by the destination address recognition unit.

9. The delivery target item sorting system according to claim 5,

wherein the delivery information management system stores information about a desired time for receipt stated by the receiver of the delivery target item, and the sorting-by-delivery-time-period processing unit selects a delivery time period in which the delivery target item is to be delivered, giving priority to the desired time for receipt.

10. The delivery target item sorting system according to claim 5,

wherein the delivery information management system stores information about a delivery time designated by a sender of the delivery target item, and the sorting-by-delivery-time-period processing unit selects a delivery time period in which the delivery target item is to be delivered, giving priority to the designated delivery time.