APPARATUS AND METHOD FOR GENERATING DELIVERY PLAN BY LEARNING DELIVERY ROUTE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 10-2016-0100872, filed on August 8, 2016, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

1. Field of the Invention

Embodiments relate to an apparatus and method for determining a scheme of distributing delivery goods to delivery drivers and for setting a route or an order to deliver the distributed delivery goods.

2. Description of the Related Art

A vehicle routing problem (VRP) is related to determining how to distribute delivery goods to delivery drivers and how to set a route or an order to deliver the distributed delivery goods. Generally, whether a solution to solve the VRP is right or wrong is evaluated based on a total movement distance in which a delivery driver moves along a set route. Criteria other than the total movement distance may be added as criteria to determine whether the solution is right or wrong.

An optimal solution to solve the VRP may be derived by searching for a number of all cases. However, a time required to search for the number of all cases may exponentially increase based on a number of delivery drivers or a number of delivery goods.

SUMMARY

Embodiments provide an apparatus and method for generating an optimal delivery route by learning a delivery route of a delivery driver.

According to an aspect, there is provided a delivery plan generation method including receiving a delivery route including delivery points that source delivery drivers

sequentially visit to deliver delivery goods, generating a route pattern associated with a delivery point included in common in at least a preset number of delivery routes, and generating a delivery plan based on the route pattern, the delivery plan indicating an order in which a target delivery driver is to visit delivery points respectively corresponding to assigned delivery goods.

The generating of the route pattern may include analyzing the received delivery route and generating a route pattern indicating a first delivery point that each of the source delivery drivers visits among delivery points included in a delivery region.

The generating of the route pattern may include analyzing the received delivery route and generating a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points.

The generating of the route pattern may include analyzing the received delivery route and generating a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points after current locations of the source delivery drivers.

The generating of the route pattern may include generating a set of delivery points included in common in delivery routes, and generating a route pattern based on a similarity between delivery histories derived from the set.

The generating of the delivery plan may include generating the delivery plan based on at least one of the route pattern, a delivery requirement or a delivery environment during a delivery. The delivery requirement may be received from a delivery company server and determined based on at least one of a delivery operation associated with delivery goods, the target delivery driver who performs the delivery operation or a delivery route associated with delivery points corresponding to delivery goods.

The generating of the delivery plan may include generating the delivery plan along with a loading order in which the target delivery driver loads delivery goods into a delivery vehicle based on a delivery order of delivery points determined based on the delivery plan.

The generating of the delivery plan may include evaluating the delivery plan based on whether the delivery plan meets the delivery requirement and whether the delivery plan is similar to the route pattern, and changing the delivery plan.

The delivery plan generation method may further include transferring the generated delivery plan to the target delivery driver, and updating the route pattern based on a delivery route of the target delivery driver who receives the delivery plan when the delivery route of the target delivery driver is different from the delivery plan.

According to another aspect, there is provided a non-transitory computer readable recording medium storing a program to cause a computer to implement the delivery plan generation method.

According to another aspect, there is provided a delivery plan generation apparatus including a communicator configured to communicate with a delivery company server, and a processor. The processor may be configured to receive, from the delivery company server via the communicator, a delivery route including delivery points that source delivery drivers sequentially visit to deliver delivery goods, and configured to generate a delivery plan based on at least one of the received delivery route, a delivery requirement or a delivery environment during a delivery. The delivery requirement may be received from the delivery company server and determined based on at least one of a delivery operation associated with delivery goods, a target delivery driver who performs the delivery operation or a delivery route associated with delivery points corresponding to delivery goods. The delivery plan may indicate an order in which the target delivery driver is to visit delivery points respectively corresponding to assigned delivery goods.

The communicator may be further configured to transfer the generated delivery plan to the target delivery driver via the delivery company server.

The delivery plan generation apparatus may further include a delivery history database (DB) configured to store the received delivery route.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects, features, and advantages of the invention will become apparent and more readily appreciated from the following description of embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a diagram illustrating a structure of a transportation management system (TMS) including a delivery plan generation apparatus according to an embodiment;

FIG. 2 is a flowchart illustrating a process of deriving a delivery plan and delivering delivery goods based on the delivery plan according to an embodiment;

FIG. 3 is a diagram illustrating a delivery plan generated by a delivery plan generation apparatus and an actual delivery route of a delivery driver receiving the delivery plan according to an embodiment;

FIG. 4 is a flowchart illustrating operations performed by a delivery plan generation apparatus according to an embodiment;

FIG. 5 is a diagram illustrating an operation of generating a route pattern based on delivery histories in a delivery plan generation apparatus according to an embodiment;

FIG. 6 is a diagram illustrating an operation of measuring a similarity between orders of visits to delivery points in a delivery plan generation apparatus according to an embodiment;

FIG. 7 is a diagram illustrating an operation of measuring a similarity between delivery routes based on delivery points included in common in the delivery routes in a delivery plan generation apparatus according to an embodiment;

FIG. 8 is a diagram illustrating an operation of comparing a delivery plan and an actual delivery route and learning the actual delivery route in a delivery plan generation apparatus according to an embodiment; and

FIG. 9 is a diagram illustrating a structure of a delivery plan generation apparatus 910 according to an embodiment.

DETAILED DESCRIPTION

Particular structural or functional descriptions of embodiments according to the concept of the present disclosure disclosed in the present disclosure are merely intended for the purpose of describing the embodiments and the embodiments may be implemented in various forms and should not be construed as being limited to those described in the present disclosure.

Though embodiments according to the concept of the present disclosure may be variously modified and be several embodiments, specific embodiments will be shown in drawings and be explained in detail. However, the embodiments are not meant to be limited, but it is intended that various modifications, equivalents, and alternatives are also covered within the scope of the claims.

Although terms of "first," "second," etc. are used to explain various components, the components are not limited to such terms. These terms are used only to distinguish one component from another component. For example, a first component may be referred to as a second component, or similarly, the second component may be referred to as the first component within the scope of the right according to the concept of the present disclosure.

When it is mentioned that one component is "connected" or "coupled" to another component, it may be understood that the one component is directly connected or coupled to another component or that still other component is interposed between the two components. Also, when it is mentioned that one component is "directly connected" or "directly coupled" to another component, it may be understood that no component is interposed therebetween. Expressions used to describe the relationship between components should be interpreted in a like fashion, for example, "between" versus "directly between," or "adjacent to" versus "directly adjacent to."

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of embodiments. As used herein, the singular forms

are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, components or a combination thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms including technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which embodiments belong. It will be further understood that terms, such as those defined in commonly-used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

Hereinafter, embodiments will be described in detail with reference to the accompanying drawings. The scope of the right, however, should not be construed as limited to the embodiments set forth herein. Regarding the reference numerals assigned to the elements in the drawings, it should be noted that the same elements will be designated by the same reference numerals.

FIG. 1 is a diagram illustrating a structure of a transportation management system (TMS) 100 including an apparatus 110 for generating a delivery plan according to an embodiment. In the present disclosure, an apparatus for generating a delivery plan may be referred to as a "delivery plan generation apparatus." The delivery plan generation apparatus 110 may be provided to solve a vehicle routing problem (VRP) of a delivery company. To solve the VRP of the delivery company, the delivery plan generation apparatus 110 may be connected to at least one delivery company server via a wired or wireless network. In FIG. 1, the delivery plan generation apparatus 110 is connected to a delivery company server A 121 and a delivery company server B 122.

Referring to FIG. 1, the TMS 100 may include the delivery company server A 121 and the delivery company server B 122. The delivery company server A 121 and the delivery company server B 122 may require services provided by the delivery plan generation apparatus 110. The delivery company server A 121 or the delivery company server B 122 may provide customers with delivery-related services. For example, the delivery company server A 121 or the delivery company server B 122 may provide a commerce service associated with a delivery service. The delivery company server A 121 or the delivery company server B 122 may communicate with a delivery driver to provide customers with delivery-related services.

A delivery driver may deliver delivery goods to customers, and an operation of delivering delivery goods to customers is referred to as a delivery. Delivery goods may refer to goods to be delivered. The TMS 100 may include at least one delivery driver. A delivery driver may be connected to a delivery company server using a terminal over a wired or wireless network. The terminal may include, for example, a smartphone, a personal digital assistant (PDA), a laptop computer or a tablet personal computer (PC). Referring to FIG. 1, a delivery driver "M-n" may refer to an n-th delivery driver connected to a delivery company server M. A delivery driver A-1 and a delivery driver A-2 may be connected to the delivery company server A 121, and a delivery driver B-1 may be connected to the delivery company server B 122.

A delivery order may include information about a request to pick up delivery goods from a specific region in a predetermined time slot and to deliver the delivery goods to another region in another time slot. The delivery order may be generated based on a request of a customer. For example, a customer may send a delivery order to the delivery company server A 121 or the delivery company server B 122, to request the delivery company to deliver delivery goods based on the delivery order.

A delivery point may refer to a geographic location to which delivery goods are

delivered. A delivery route may refer to a moving route of a delivery driver generated by sequentially visiting delivery points respectively corresponding to delivery goods to deliver the delivery goods.

When the delivery company server A 121 or the delivery company server B 122 processes at least one delivery order, delivery goods may need to be assigned to at least one delivery driver and a delivery route of the delivery driver may need to be set. Each of the delivery company server A 121 and the delivery company server B 122 may receive different delivery orders, and accordingly different VRPs may occur for the delivery company server A 121 and the delivery company server B 122.

The delivery plan generation apparatus 110 may solve a VRP of each of the delivery company server A 121 and the delivery company server B 122, may distribute delivery goods to delivery drivers connected to the delivery company server A 121 and the delivery company server B 122, and may determine delivery routes of the delivery drivers. A delivery route indicating an order in which a delivery driver is to visit delivery points respectively corresponding to assigned delivery goods may be referred to as a "delivery plan." The delivery plan may include information associated with delivery goods distributed to a delivery driver in addition to a delivery route. The delivery plan generation apparatus 110 may determine delivery plans of delivery drivers belonging to each of the delivery company server A 121 and the delivery company server B 122.

The delivery plan generation apparatus 110 may transfer determined delivery plans to the delivery company server A 121 and the delivery company server B 122. The delivery company server A 121 and the delivery company server B 122 may transfer the received delivery plans to the delivery drivers. The delivery drivers may receive the delivery plans through applications installed in terminals of the delivery drivers.

Hereinafter, an operation of generating a delivery plan and transferring the delivery plan to a delivery driver in the delivery plan generation apparatus 110 will be described in

detail with reference to FIG. 2. The delivery plan generation apparatus 110 may perform the operation with respect to all delivery company servers (for example, the delivery company server A 121 and the delivery company server B 122) connected to the delivery plan generation apparatus 110 and delivery drivers (for example, the delivery driver A-1 through the delivery driver B-1) connected to the delivery company servers.

FIG. 2 is a flowchart illustrating a process of deriving a delivery plan 250 and delivering delivery goods based on the delivery plan 250 according to an embodiment.

Referring to FIG. 2, a delivery plan generation apparatus 210 may receive a delivery requirement 240 from a delivery company server 220. The delivery requirement 240 may refer to a condition or information that is required to generate the delivery plan 250. The delivery company server 220 may transmit information used to generate the delivery plan 250 to the delivery plan generation apparatus 210. The information used to generate the delivery plan 250 may include, for example, information about a delivery order that needs to be processed, or a delivery driver who is to perform a delivery.

The delivery requirement 240 may include information about a delivery order (for example, a position of a delivery point, a time slot for a delivery, a loadage and a delivery type), information about at least one delivery driver who performs a delivery (for example, a maximum loadage, a start location, an end location, a start time and an end time), requirements needing to be observed for a delivery (for example, a maximum loading rate, a delivery distance, a no-cross line and a minimum movement distance), and a setting value required to calculate the delivery plan 250 (for example, a type of a geographic information system (GIS), a wait time at a delivery point, central base information and information about whether to return to a central base).

For example, the delivery requirement 240 may include a requirement to assign orders of a specific region to a designated delivery driver. The delivery requirement 240 may include information about a region preferred by each of delivery drivers and a

requirement to assign delivery orders to each of the delivery drivers based on the preferred region. Also, the delivery requirement 240 may include a requirement to prevent two different delivery drivers from visiting the same place. The delivery requirement 240 may include a requirement to prevent an overlap of delivery plans between two different delivery drivers. The delivery requirement 240 may include a requirement to minimize a movement distance of a delivery driver based on a delivery plan.

The delivery requirement 240 may include a requirement that needs to be used to distribute delivery goods to delivery drivers. For example, the delivery requirement 240 may include a requirement to assign at least a predetermined number of delivery goods to each of delivery drivers. The delivery requirement 240 may include a requirement to assign delivery goods to a delivery driver so as not to exceed a maximum loadage of a delivery vehicle.

Also, the delivery requirement 240 may be changed based on a change in a delivery environment. For example, when a delivery process or a contract of a delivery driver 230 is changed, the delivery requirement 240 may be changed. Thus, the delivery plan generation apparatus 210 may generate different delivery plans 250 based on time slots and regions despite the same delivery order.

The delivery company server 220 may send a request to generate an identification (ID) of the delivery requirement 240 along with the delivery requirement 240 to the delivery plan generation apparatus 210. In response to the request, the delivery plan generation apparatus 210 may transmit the ID of the delivery requirement 240 to the delivery company server 220. The delivery company server 220 may transfer various requests to the delivery plan generation apparatus 210 using the received ID.

For example, the delivery company server 220 may request the delivery plan generation apparatus 210 to recalculate the delivery plan 250 using the ID of the delivery requirement 240, instead of needing to retransmit the delivery requirement 240. Also, the

delivery company server 220 may update the delivery requirement 240 using the ID of the delivery requirement 240. Furthermore, the delivery company server 220 may request the delivery plan generation apparatus 210 to generate the delivery plan 250 based on the delivery requirement 240, using the ID of the delivery requirement 240.

Referring to FIG. 2, in operation 211, the delivery plan generation apparatus 210 may generate the delivery plan 250 in response to the request of the delivery company server 220. The delivery plan generation apparatus 210 may generate the delivery plan 250 based on an approximate value of an optimal solution of a VRP using a metaheuristic algorithm. For example, the delivery plan generation apparatus 210 may use a genetic algorithm or an adaptive large neighborhood search (ALNS) algorithm.

The delivery plan generation apparatus 210 may determine the delivery plan 250 based on the received delivery requirement 240. The delivery plan generation apparatus 210 may generate a penalty function to determine a penalty to be assigned to the delivery plan 250 based on whether the delivery plan 250 meets the delivery requirement 240. When a set of delivery plans 250 is denoted by P, a delivery requirement f may be defined as shown in Equation 1 below.

[Equation 1]

$$f: \mathbb{P} \rightarrow \mathbb{R}$$

Referring to Equation 1, the penalty function may output a penalty of a real number to be assigned to the delivery plan 250 from the delivery plan 250. An increase in the penalty may indicate that the delivery plan 250 does not meet the delivery requirement 240.

For example, when the delivery requirement 240 includes a requirement to assign at least 30 delivery goods to the delivery driver 230, the delivery plan generation apparatus 210 may generate a penalty function for a set D of delivery drivers 230 from the delivery requirement 240, as shown in Equation 2 below.

[Equation 2]

$$f(p) = \sum_{d \in \mathbb{D}} max\ (0, 30 - |delivery(d)|)$$

The delivery plan generation apparatus 210 may evaluate the delivery plan 250 based on the generated penalty function. For example, the delivery plan generation apparatus 210 may evaluate delivery plans 250 of five delivery drivers using the penalty function of Equation 2. In this example, when 22 delivery goods and 25 delivery goods are respectively assigned to two delivery drivers among the five delivery drivers, the delivery plans 250 may have a total penalty of "13" obtained by applying penalties of the five delivery drivers to the penalty function of Equation 2, that is, $f(p) = 0 + 0 + 0 + max(0, 30 - 22) + max(0, 30 - 25)$. The delivery plan generation apparatus 210 may modify the delivery plans 250 to have a penalty less than the total penalty of "13." Thus, the delivery plan generation apparatus 210 may generate the delivery plan 250 meeting the delivery requirement 240.

In another example, when the delivery requirement 240 includes a requirement that a length of a delivery route of each of delivery drivers 230 needs to be less than or equal to 10 kilometers (km), the delivery plan generation apparatus 210 may generate a penalty function for the set D from the delivery requirement 240, as shown in Equation 3 below.

[Equation 3]

$$f(p) = \sum_{d \in \mathbb{D}} max\ (0, RouteDistance(route(d)) - 10)$$

When the delivery requirement 240 includes "n" different requirements, a penalty of the delivery plan 250 may be determined as a sum of products of a weight and each of "n" penalty functions generated from the "n" different requirements. Thus, the penalty of the delivery plan 250 may be determined based on Equation 4 shown below.

[Equation 4]

$$F(p) = \sum_{i=1}^{n} w_i \cdot f_i(p)$$

For example, when the delivery requirement 240 includes a requirement to assign at

least 30 delivery goods to delivery drivers 230 and a requirement that a length of a delivery route of each of the delivery drivers 230 needs to be less than or equal to 10 km, the penalty of the delivery plan 250 may be determined by a sum of products of a weight and each of values of the penalty functions shown in Equations 2 and 3.

Referring to Equation 4, the delivery plan generation apparatus 210 may freely add a new delivery requirement 240 and may freely change the delivery requirement 240. Also, each of delivery requirements 240 may be independently combined, and accordingly each of the delivery requirements 240 may be easily modularized. Thus, the delivery plan generation apparatus 210 may cope with a sudden change in a delivery environment with more flexibility. Also, the delivery plan generation apparatus 210 may more easily respond to each of delivery company servers with different delivery requirements 240.

The delivery plan generation apparatus 210 may modify the delivery plan 250 to reduce the penalty, and may determine the delivery plan 250 meeting the delivery requirement 240. The delivery plan generation apparatus 210 may output the determined delivery plan 250. For example, the delivery plan generation apparatus 210 may transfer an ID of the delivery plan 250 to the delivery company server 220. The delivery company server 220 may access the delivery plan 250 using the ID of the delivery plan 250. The delivery company server 220 may transfer the delivery plan 250 to the delivery driver 230 through a terminal carried by the delivery driver 230.

Referring back to FIG. 2, in operation 231, the delivery driver 230 may visit a delivery point based on the received delivery plan 250 and perform a delivery. The delivery plan generation apparatus 210 may learn the delivery route of the delivery driver 230. The delivery plan generation apparatus 210 may receive and learn an actual delivery route along which the delivery driver 230 who receives the delivery plan 250 actually performs a delivery.

FIG. 3 is a diagram illustrating a delivery plan 310 generated by a delivery plan generation apparatus and an actual delivery route 320 of a delivery driver receiving the

delivery plan 310 according to an embodiment. It is assumed that a delivery company server requests the delivery plan generation apparatus to generate the delivery plan 310 so that the delivery driver delivers five items of delivery goods to five different delivery points, for example, delivery points A, B, C, D and E. In FIG. 3, the delivery plan generation apparatus may generate the delivery plan 310 by sequentially connecting the delivery points A through E based on a delivery requirement.

Referring to FIG. 3, the delivery driver may visit the delivery points A through E differently from the delivery plan 310 even though the delivery driver receives the delivery plan 310. The actual delivery route 320 of the delivery driver may be different from the delivery plan 310. The delivery driver may change a portion or all of a delivery route included in the delivery plan 310 using a terminal carried by the delivery driver. The terminal of the delivery driver may transfer the changed delivery plan 310 to the delivery company server. Also, the terminal of the delivery driver may track a delivery route of the delivery driver using a global positioning system (GPS) device in real time, and may transfer the tracked delivery route to the delivery company server.

Thus, the delivery company server may collect the actual delivery route 320. The delivery company server may track and manage a delivery route of at least one delivery driver belonging to a delivery company. Also, the delivery company server may transfer the collected actual delivery route 320 to the delivery plan generation apparatus. The delivery plan generation apparatus may learn the received actual delivery route 320, and may use the learned actual delivery route 320 to generate a delivery plan.

Referring back to FIG. 2, a delivery route 270 changed by the delivery driver 230 may be transferred to the delivery company server 220. The terminal of the delivery driver 230 may derive the changed delivery route 270 by comparing the delivery plan 250 to a movement route of the delivery driver 230. The delivery company server 220 may transfer the changed delivery route 270 to the delivery plan generation apparatus 210. For example,

the delivery company server 220 may notify the delivery plan generation apparatus 210 of a completion of deliveries of delivery goods along the changed delivery route 270 instead of the delivery plan 250, using the ID of the received delivery plan 250.

In operation 212, the delivery plan generation apparatus 210 may learn the changed delivery route 270. A result obtained by learning the changed delivery route 270 may be accumulated in a storage included in the delivery plan generation apparatus 210. By repeatedly performing the process of FIG. 2, the delivery plan generation apparatus 210 may continue to collect delivery routes of delivery drivers 230. Also, the delivery plan generation apparatus 210 may collect delivery routes of delivery drivers belonging to each of at least one connected delivery company server from the at least one connected delivery company server. A delivery route generated by a delivery previously performed by the delivery driver 230 may be referred to as a "delivery history" that is distinguished from the delivery plan 250. The delivery plan generation apparatus 210 may receive a delivery history from the delivery company server 220 before generating the delivery plan 250.

FIG. 4 is a flowchart illustrating operations performed by a delivery plan generation apparatus according to an embodiment. Hereinafter, a process by which the delivery plan generation apparatus collects a delivery history and generates a delivery plan based on the collected delivery history will be described with reference to FIG. 4.

According to an embodiment, a non-transitory computer-readable recording medium that stores a program to implement a delivery plan generation method may be provided. The program may include at least one of an application program storing the delivery plan generation method, a device driver, firmware, middleware, a dynamic link library (DLL) or an applet. The delivery plan generation apparatus may include a processor, and the processor may read a recording medium that stores the delivery plan generation method, to perform the process of FIG. 4. Also, the delivery plan generation apparatus may be included as a cloud server in a TMS.

Referring to FIG. 4, in operation 410, the delivery plan generation apparatus may receive a delivery history from a delivery company server. For example, the delivery plan generation apparatus may receive a delivery route including delivery points that source delivery drivers sequentially visit to deliver delivery goods. The source delivery drivers may refer to drivers who deliver delivery goods based on delivery histories. Also, the delivery history may include information about an order in which a source delivery driver visits delivery points respectively corresponding to delivery goods or a time at which the source delivery driver visits the delivery points.

In operation 420, the delivery plan generation apparatus may analyze the delivery history and may generate a route pattern from the delivery history. For example, the delivery plan generation apparatus may generate a route pattern associated with a delivery point included in common in at least a preset number of delivery routes. The delivery plan generation apparatus may detect delivery points included in common in a plurality of delivery histories. Also, the delivery plan generation apparatus may detect an order in which the delivery points are included in common in the delivery histories. The delivery plan generation apparatus may detect a pattern of the delivery histories based on a result of detection.

The route pattern may be generated using various schemes. The delivery plan generation apparatus may analyze the delivery route and may generate a route pattern indicating a first delivery point that a source delivery driver visits among delivery points included in a delivery region. For example, when a delivery driver performs a delivery in Seocho-gu, the delivery plan generation apparatus may detect Yangjae-dong as a first delivery point that a majority of delivery drivers visited. Based on a detection result, the delivery plan generation apparatus may designate Yangjae-dong as a first stop when generating a delivery route for Seocho-gu.

The delivery plan generation apparatus may analyze the delivery route and may

generate a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points. Also, the delivery plan generation apparatus may analyze the delivery route and may generate a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points after current locations of the source delivery drivers. An operation by which the delivery plan generation apparatus generates a route pattern based on a delivery order will be further described below. In addition, the delivery plan generation apparatus may generate a set of delivery points included in common in delivery routes and may generate a route pattern based on a similarity between delivery histories derived from the set.

Furthermore, the delivery plan generation apparatus may generate a route pattern based on a time slot of a delivery history. In an example, the delivery plan generation apparatus may generate a route pattern based on a difference in a delivery route or a delivery time between a commuting time and the middle of the night. In another example, the delivery plan generation apparatus may generate a route pattern based on a difference in a delivery route or a delivery time between weekends and weekdays. The delivery plan generation apparatus may generate a delivery plan based on a route pattern of a time slot corresponding to the delivery plan.

In operation 430, the delivery plan generation apparatus may generate a delivery plan based on the route pattern. The delivery plan may indicate an order in which a target delivery driver is to visit delivery points respectively corresponding to assigned delivery goods. For example, the delivery plan may include a common delivery route of the source delivery drivers. The target delivery driver may refer to a delivery driver who is to carry out the delivery plan. In the present disclosure, although the term "target delivery driver" is used to be distinguished from the source delivery drivers, the source delivery drivers and the target delivery driver may refer to the same type of delivery drivers. For example, the target delivery driver may be a portion or all of the source delivery drivers, and a source delivery

driver who provides a delivery history and requires a delivery plan may be referred to as a target delivery driver.

The delivery plan generation apparatus may provide a service to the delivery company server via a published application programming interface (API). The delivery plan generation apparatus may receive information required to determine a delivery plan from the delivery company server via the API. As described above, the information required to determine a delivery plan may include a delivery requirement.

The delivery plan generation apparatus may generate a penalty function from a received delivery requirement, and may determine whether the delivery plan meets the delivery requirement using the generated penalty function. The delivery plan generation apparatus may modify the delivery plan based on a determination result. Also, the delivery plan generation apparatus may generate a delivery plan based on a delivery environment.

In addition, the delivery plan generation apparatus may determine whether the delivery plan is similar to the route pattern, and may generate a penalty function used to apply a higher penalty when a similarity between the delivery plan and the route pattern decreases. The delivery plan generation apparatus may use the route pattern to evaluate the delivery plan, similarly to the delivery requirement. The delivery plan generation apparatus may evaluate the delivery plan based on whether the delivery plan meets the delivery requirement and whether the delivery plan is similar to the route pattern, and may change the delivery plan. Thus, the delivery plan may be changed to be similar to the route pattern while meeting the delivery requirement.

Therefore, the delivery plan generation apparatus may generate the delivery plan based on at least one of the route pattern, the delivery requirement or a delivery environment during a delivery. The delivery requirement may be received from the delivery company server, and may be determined based on at least one of a delivery operation associated with delivery goods, the target delivery driver who performs the delivery operation or a delivery

route associated with delivery points corresponding to delivery goods.

Also, the delivery plan generation apparatus may generate a loading order in which the target delivery driver loads delivery goods into a delivery vehicle, along with the delivery plan based on a delivery order of delivery points determined based on the delivery plan. The loading order may be determined based on the delivery plan so that delivery goods corresponding to a last delivery point may be loaded in an innermost side of the delivery vehicle and that delivery goods corresponding to a first delivery point may be loaded in an outermost side of the delivery vehicle.

In operation 440, the delivery plan generation apparatus may transfer the generated delivery plan to the target delivery driver. The delivery company server may receive the delivery plan from the delivery plan generation apparatus via an API, and may transmit the received delivery plan to a terminal carried by the target delivery driver. The target delivery driver may verify the received delivery plan using the terminal. When the delivery plan generation apparatus transfers the loading order together with the delivery plan to the target delivery driver, the target delivery driver may verify both the loading order and the delivery plan using the terminal. The target delivery driver may modify the delivery plan or the loading order using the terminal.

In operation 450, the delivery plan generation apparatus may update the route pattern based on a delivery route of the target delivery driver who receives the delivery plan, when the delivery route of the target delivery driver is different from the delivery plan. When the target delivery driver modifies the delivery plan or the loading order using the terminal, the terminal may transfer the modified delivery plan or the modified loading order to the delivery company server. The modified delivery plan or the modified loading order may be transferred to the delivery plan generation apparatus via the delivery company server.

Also, the terminal of the target delivery driver may track the delivery route of the target delivery driver. The terminal may transfer the delivery route of the target delivery

driver to the delivery company server, and the delivery company server may transfer the delivery route of the target delivery driver to the delivery plan generation apparatus. The delivery plan generation apparatus may compare the received delivery route of the target delivery driver to the delivery plan, and may determine whether the delivery route of the target delivery driver is different from the delivery plan. The delivery plan generation apparatus may determine the delivery route of the target delivery driver to be the same as a delivery history of a source delivery driver, and may use the delivery route of the target delivery driver to generate a route pattern.

Thus, the delivery plan generation apparatus may continue to collect a delivery history generated based on a delivery plan while generating the delivery plan. The delivery plan generation apparatus may continue to update the route pattern based on the collected delivery history. The delivery plan generation apparatus may learn the collected delivery history. Thus, the delivery plan generation apparatus may generate a more optimal delivery plan by collecting delivery histories.

FIG. 5 is a diagram illustrating an operation of generating a route pattern based on delivery histories in a delivery plan generation apparatus according to an embodiment. In FIG. 5, the delivery plan generation apparatus may collect seven delivery histories from at least one delivery company server. For convenience of description, FIG. 5 illustrates delivery points included in the delivery histories based on delivery orders. The delivery plan generation apparatus may classify delivery points based on GPS coordinates, a postcode or a unit of an administrative division (for example, eup, myeon, dong or gu in a Korean administrative district). In FIG. 5, the delivery plan generation apparatus may classify delivery points based on a unit of "dong" in the Korean administrative district. For convenience of description, a portion of delivery points that have no relevance to description of FIG. 5 is not illustrated.

The delivery plan generation apparatus may analyze the delivery route and may

generate a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points. For example, when delivery points A, B and C are sequentially included in a delivery route, the delivery plan generation apparatus may learn a delivery of a delivery driver in an order of the delivery points A, B and C. The delivery plan generation apparatus may generate a route pattern based on a ratio of a number of delivery drivers who perform a delivery in the order of the delivery points A, B and C to a total number of delivery drivers.

Referring to FIG. 5, delivery drivers corresponding to five delivery histories, for example, delivery histories 1, 2, 3, 5 and 6, among the seven delivery histories may perform deliveries in an order of Dogok-dong, Daechi-dong and Samseong-dong. Thus, the delivery plan generation apparatus may generate a route pattern 1 510 to generate a delivery plan in the order of Dogok-dong, Daechi-dong and Samseong-dong. The delivery plan generation apparatus may generate a delivery plan based on the route pattern 1 510. For example, when Dogok-dong, Daechi-dong and Samseong-dong are included as delivery points, the delivery plan generation apparatus may set delivery points in the order of Dogok-dong, Daechi-dong and Samseong-dong and may generate a delivery plan.

The delivery plan generation apparatus may include, in the route pattern 1 510, information associated with a confidence or a basis of the route pattern 1 510. The route pattern 1 510 may include information, for example, Support 5, indicating that a delivery route along which deliveries are performed in the order of Dogok-dong, Daechi-dong and Samseong-dong appeared five times. For example, when a new delivery history including a delivery route along which deliveries are performed in the order of Dogok-dong, Daechi-dong and Samseong-dong is received, the delivery plan generation apparatus may modify the information Support 5 of the route pattern 1 510 to Support 6.

The information associated with the basis or the confidence included in the route pattern 1 510 may be used to update the route pattern 1 510. For example, when a delivery

route along which deliveries are performed in a order of Daechi-dong, Samseong-dong and Dogok-dong appears at least seven times that exceed a number of times the route pattern 1 510 appears, the delivery plan generation apparatus may remove the route pattern 1 510, or may modify the route pattern 1 510 so that the route pattern 1 may have the order of Daechi-dong, Samseong-dong and Dogok-dong.

The delivery plan generation apparatus may generate or update a route pattern based on a relationship between a plurality of route patterns. Among the five delivery histories representing the deliveries performed in the order of Dogok-dong, Daechi-dong and Samseong-dong, three delivery histories show visits to Sinsa-dong after Samseong-dong. The delivery plan generation apparatus may generate a route pattern 2 520 based on the route pattern 1 510. The route pattern 2 520 may represent that a 60% probability that a delivery route with an order of Dogok-dong, Daechi-dong, Samseong-dong and Sinsa-dong appeared in the five delivery histories similar to the route pattern 1 510. The delivery plan generation apparatus may continue to receive delivery histories, and may update or remove the route pattern 1 510 in response to an appearance probability of the route pattern 2 520 to the route pattern 1 510 exceeding a preset probability.

The delivery plan generation apparatus may analyze the delivery route and may generate a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points after a current location of a delivery driver. For example, when a delivery driver is currently located in a delivery point A, and when delivery points B, C and D are included in a next delivery route, the delivery plan generation apparatus may learn that the delivery driver sequentially visits the delivery points B, C and D.

For example, when delivery drivers corresponding to the delivery histories 1, 2, 3, 5 and 6 are currently located in Dogok-dong and when Daechi-dong and Samseong-dong are included as next delivery points, as shown in FIG. 5, deliveries may be performed in an order of Daechi-dong and Samseong-dong. In this example, the delivery plan generation

apparatus may generate the route pattern 1 510 so that the delivery drivers may perform deliveries in the order of Daechi-dong and Samseong-dong after Dogok-dong.

The delivery plan generation apparatus may detect that deliveries are performed in an order of delivery points A and B in a plurality of delivery routes, even though the plurality of delivery routes include different delivery points between the delivery points A and B. A number of the different delivery points may be less than or equal to a preset number. Referring to FIG. 5, the delivery history 1 may include two arbitrary delivery points between Dogok-dong and Daechi-dong, and the delivery history 6 may include three arbitrary delivery points between Dogok-dong and Daechi-dong. The delivery plan generation apparatus may detect that deliveries are performed in an order of Dogok-dong and Daechi-dong in the delivery histories 1 and 6, even though the delivery points between Dogok-dong and Daechi-dong in the delivery history 1 are different from the delivery points between Dogok-dong and Daechi-dong in the delivery history 6.

As described above, the delivery plan generation apparatus may generate a route pattern based on delivery points included in common in at least a preset number of delivery routes and based on an order of visits to the delivery points. Also, the delivery plan generation apparatus may generate a route pattern based on a similarity between orders of visits to the delivery points.

FIG. 6 is a diagram illustrating an operation of measuring a similarity between orders of visits to delivery points in a delivery plan generation apparatus according to an embodiment. The delivery plan generation apparatus may measure a similarity between an order of visits to delivery points in a delivery route 1 610 and each of orders of visits to delivery points in a delivery route 2 620, a delivery route 3 630 and a delivery route 4 640.

In FIG. 6, all the delivery route 1 610 through the delivery route 4 640 may include delivery points A, B, C and D. The delivery route 1 610 through the delivery route 4 640 may a portion or all of delivery histories. The delivery plan generation apparatus may

extract the delivery route 1 610 through the delivery route 4 640 that each include the delivery points A through D from a plurality of delivery histories, and may measure a similarity between orders of visits to the delivery points A through D. The measured similarity may be used to generate a route pattern.

For example, the delivery plan generation apparatus may measure a similarity between delivery routes by one-to-one matching of movements between delivery points included in the delivery routes. The delivery plan generation apparatus may measure a similarity between delivery routes by calculating a route similarity as shown in Equation 5 below.

[Equation 5]

$$Route\ similarity = \frac{Number\ of\ delivery\ points\ with\ the\ same\ delivery\ order}{Number\ of\ common\ delivery\ points}$$

Referring to FIG. 6, four delivery points, for example, the delivery points A through D, may overlap between the delivery route 1 610 and the delivery route 2 620, and the delivery points A and D are a first delivery point and a fourth delivery point, respectively. Thus, a route similarity between the delivery route 1 610 and the delivery route 2 620 may be determined as "0.5" using Equation 5. Similarly, a route similarity between the delivery route 1 610 and the delivery route 3 630 may be determined as "0.5" using Equation 5. A route similarity between the delivery route 1 610 and the delivery route 4 640 may be determined as "0" using Equation 5.

The delivery plan generation apparatus may use the route similarity to learn a delivery route or to generate a delivery plan. As described above, the delivery plan generation apparatus may generate a route pattern based on delivery routes with a highest similarity. Also, the delivery plan generation apparatus may measure a similarity between a delivery plan and a route pattern based on the route similarity. The delivery plan generation apparatus may modify a delivery plan so that the route similarity may increase. Thus, the

delivery plan generation apparatus may generate a delivery plan similar to a route pattern.

The delivery plan generation apparatus may measure a similarity between delivery routes based on a number of delivery points included in common in the delivery routes. FIG. 7 is a diagram illustrating an operation of measuring a similarity between delivery routes based on delivery points included in common in the delivery routes in a delivery plan generation apparatus according to an embodiment. The delivery plan generation apparatus may generate a set of delivery points included in common in delivery routes, and may generate a route pattern based on a similarity between delivery histories derived from the set.

For example, the delivery plan generation apparatus may generate a set corresponding to a delivery history. Referring to FIG. 7, the delivery plan generation apparatus may generate a set S_1 including delivery points A, B, C, D, E, F and Z of a delivery history 1 710, and a set S_2 including delivery points A, X, Y, D, C, E, U and Z of a delivery history 2 720.

The delivery plan generation apparatus may calculate a similarity between delivery histories based on a union and an intersection of the sets S_1 and S_2. The delivery plan generation apparatus may calculate a similarity between the sets S_1 and S_2 using a Jaccard similarity based on Equation 6 shown below.

[Equation 6]

$$J(S_1, S_2) = \frac{n(S_1 \cap S_2)}{n(S_1 \cup S_2)}$$

In Equation 6, the union of the sets S_1 and S_2 is {A, B, C, D, E, F, U, X, Y, Z}, and the intersection of the sets S_1 and S_2 is {A, C, D, E, Z}, and thus the delivery plan generation apparatus may determine the similarity between the sets S_1 and S_2 as "0.4" using Equation 6.

The delivery plan generation apparatus may calculate a similarity between delivery histories based on an importance of delivery points. For example, the delivery plan generation apparatus may calculate a higher similarity as a number of densely populated

areas or delivery points included in common in delivery histories increases. For example, the delivery plan generation apparatus may calculate the similarity between the sets S_1 and S_2 using an importance W_k of a delivery point k based on Equation 7 shown below.

[Equation 7]

$$J_w(S_1, S_2) = \frac{\sum_{i \in S_1 \cap S_2} W_i}{\sum_{j \in S_1 \cup S_2} W_j}$$

For example, when an importance W_A of a delivery point A, an importance W_X of a delivery point X, and an importance W_Y of a delivery point Y are set to "2.0," "5.0," and "6.0," respectively, and when weights of the other delivery points are set to "1.0," the delivery plan generation apparatus may determine the similarity between the sets S_1 and S_2 as "0.25" using Equation 7. Thus, the similarity may be determined based on whether the delivery points A, X and Y with relatively high importance are included in both the sets S_1 and S_2.

The delivery plan generation apparatus may measure a similarity between delivery routes based on Equation 6 or 7, and may use the similarity to generate a route pattern or to evaluate a delivery plan. The delivery plan generation apparatus may measure a similarity between delivery histories from delivery points included in common in the delivery histories based on Equation 6 or 7, and may use the similarity to generate a route pattern based on delivery routes with a similarity greater than or equal to a preset similarity.

Also, the delivery plan generation apparatus may measure a degree by which a delivery plan matches a route pattern based on Equation 6 or 7. The delivery plan generation apparatus may modify a delivery plan so that a similarity between the delivery plan and the route pattern may increase. For example, the delivery plan generation apparatus may add a delivery point with a relatively high importance to a delivery plan based on Equation 7. Thus, the delivery plan may be determined to be similar to the route pattern.

FIG. 8 is a diagram illustrating an operation of comparing a delivery plan 810 and an actual delivery route 820 and learning the actual delivery route 820 in a delivery plan

generation apparatus according to an embodiment. A delivery driver may visit delivery points differently from the received delivery plan 810, and thus the actual delivery route 820 may be different from the delivery plan 810. The delivery plan generation apparatus may receive the actual delivery route 820 by performing the operations described above with reference to FIGS. 2, 3 and 4.

Referring to FIG. 8, the delivery plan generation apparatus may analyze a delivery route based on a postcode. The delivery plan generation apparatus may generate the delivery plan 810 based on a route pattern P1 830. The route pattern P1 830 may indicate that delivery drivers perform deliveries in an order of postcodes 18151, 18147 and 18143 of delivery points. A number of the delivery drivers may be greater than or equal to a preset number. Delivery points included in the delivery plan 810 may be set in an order of postcodes 18150, 18151, 17709, 18147, 18143 and 18145, and accordingly may meet the route pattern P1 830 with the order of postcodes 18151, 18147 and 18143.

In FIG. 8, the delivery drivers may perform deliveries differently from the delivery plan 810. The route pattern P1 830 may indicate that deliveries were performed by delivery drivers in delivery points with the postcodes 18151, 18147 and 18143 in the order of the postcodes 18151, 18147 and 18143. The delivery plan generation apparatus may compare the delivery plan 810 to the actual delivery route 820, and may determine a relationship between the route pattern P1 830 and a route pattern P2 840. The route pattern P2 840 may indicate that deliveries were performed in an order of postcodes 18143, 18147 and 18151. The delivery plan generation apparatus may display information Support 11 indicating that the route pattern P1 830 is included in common in 11 delivery histories, and information Confidence 1.0 indicating that all four delivery drivers who received the delivery plan 810 generated based on the route pattern P1 830 perform deliveries based on the route pattern P2 840.

When a number of delivery drivers who modify the route pattern P1 830 to the route

pattern P2 840 exceeds a preset number, the delivery plan generation apparatus may update or remove the route pattern P1 830. Thus, the delivery plan generation apparatus may learn the actual delivery route 820.

FIG. 9 is a diagram illustrating a structure of a delivery plan generation apparatus 910 according to an embodiment. Referring to FIG. 9, the delivery plan generation apparatus 910 may include a processor 920 and a communicator 930. The communicator 930 may communicate with a delivery company server 960.

The processor 920 may receive a delivery route including delivery points that source delivery drivers sequentially visit to deliver delivery goods from the delivery company server 960 via the communicator 930. The delivery plan generation apparatus 910 may extract a route pattern associated with a delivery point included in common in at least a preset number of delivery routes from the received delivery route using the processor 920.

The delivery plan generation apparatus 910 may include a delivery history database (DB) 940 configured to store the received delivery route. The delivery plan generation apparatus 910 may store the extracted route pattern in the delivery history DB 940. When a request to generate a delivery plan is received from the delivery company server 960, the delivery plan generation apparatus 910 may use information stored in the delivery history DB 940.

The delivery plan generation apparatus 910 may receive a delivery requirement that needs to be used to generate a delivery plan from the delivery company server 960 via the communicator 930. The delivery requirement may be generated based on at least one of a delivery operation associated with delivery goods, a target delivery driver who performs the delivery operation or a delivery route associated with delivery points corresponding to delivery goods. The delivery plan generation apparatus 910 may assign an ID to the delivery requirement received from the delivery company server 960.

The delivery plan generation apparatus 910 may generate a delivery plan based on at

least one of a delivery route, the delivery requirement or a delivery environment during a delivery, using the processor 920. The delivery plan may indicate an order in which a target delivery driver is to visit delivery points respectively corresponding to assigned delivery goods. The delivery plan generation apparatus 910 may include a GIS DB 950 used to generate a delivery plan.

An operation by which the delivery plan generation apparatus 910 generates a delivery plan using a penalty function to evaluate whether the delivery plan meets the delivery requirement has been described above. The delivery plan generation apparatus 910 may generate a delivery plan based on whether a route pattern matches the delivery plan using Equations 5 through 7. The delivery company server 960 may track an operation by which the delivery plan generation apparatus 910 generates a delivery requirement, based on an ID assigned to the delivery requirement. Also, the delivery company server 960 may request the delivery plan generation apparatus 910 to interrupt the generating of the delivery requirement.

The communicator 930 may transfer the generated delivery plan to a target delivery driver via the delivery company server 960. For example, the delivery plan generation apparatus 910 may transfer the generated delivery plan to the delivery company server 960 via the communicator 930, and the delivery company server 960 may transfer the delivery plan to a terminal 970 of the target delivery driver. When the target delivery driver visits a delivery point differently from the delivery plan, the terminal 970 may transfer an actual delivery route of the target delivery driver to the delivery plan generation apparatus 910 via the delivery company server 960.

The delivery plan generation apparatus 910 may learn the actual delivery route using the processor 920. The received actual delivery route may be stored in the delivery history DB 940. The delivery plan generation apparatus 910 may evaluate a degree by which the actual delivery route matches the route pattern based on Equations 5 through 7, and may

update the route pattern based on the evaluated degree. Thus, the delivery plan generation apparatus 910 may continue to learn a delivery route and may generate a more optimal delivery plan based on the learned delivery route.

The units described herein may be implemented using hardware components, software components, or a combination thereof. A processing device may be implemented using one or more general-purpose or special purpose computers, such as, for example, a processor, a controller and an arithmetic logic unit, a digital signal processor, a microcomputer, a field programmable array, a programmable logic unit, a microprocessor or any other device capable of responding to and executing instructions in a defined manner. The processing device may run an operating system (OS) and one or more software applications that run on the OS. The processing device also may access, store, manipulate, process, and create data in response to execution of the software. For purpose of simplicity, the description of a processing device is used as singular; however, one skilled in the art will appreciated that a processing device may include multiple processing elements and multiple types of processing elements. For example, a processing device may include multiple processors or a processor and a controller. In addition, different processing configurations are possible, such a parallel processors.

The software may include a computer program, a piece of code, an instruction, or some combination thereof, to independently or collectively instruct or configure the processing device to operate as desired. Software and data may be embodied permanently or temporarily in any type of machine, component, physical or virtual equipment, computer storage medium or device, or in a propagated signal wave capable of providing instructions or data to or being interpreted by the processing device. The software also may be distributed over network coupled computer systems so that the software is stored and executed in a distributed fashion. The software and data may be stored by one or more non-transitory computer readable recording mediums.

The method according to the above-described embodiments may be recorded in non-transitory computer-readable media including program instructions to implement various operations embodied by a computer. The media may also include, alone or in combination with the program instructions, data files, data structures, and the like. The program instructions recorded on the media may be those specially designed and constructed for the purposes of the embodiments, or they may be of the kind well-known and available to those having skill in the computer software arts. Examples of non-transitory computer-readable media include magnetic media such as hard disks, floppy disks, and magnetic tape; optical media such as CD ROM disks and DVDs; magneto-optical media such as optical discs; and hardware devices that are specially configured to store and perform program instructions, such as read-only memory (ROM), random access memory (RAM), flash memory, and the like. Examples of program instructions include both machine code, such as produced by a compiler, and files containing higher level code that may be executed by the computer using an interpreter. The described hardware devices may be configured to act as one or more software modules in order to perform the operations of the above-described embodiments, or vice versa.

While this disclosure includes specific examples, it will be apparent to one of ordinary skill in the art that various changes in form and details may be made in these examples without departing from the spirit and scope of the claims and their equivalents. The examples described herein are to be considered in a descriptive sense only, and not for purposes of limitation. Descriptions of features or aspects in each example are to be considered as being applicable to similar features or aspects in other examples. Suitable results may be achieved if the described techniques are performed in a different order, and/or if components in a described system, architecture, device, or circuit are combined in a different manner and/or replaced or supplemented by other components or their equivalents. Therefore, the scope of the disclosure is defined not by the detailed description, but by the

claims and their equivalents, and all variations within the scope of the claims and their equivalents are to be construed as being included in the disclosure.

WHAT IS CLAIMED IS:

1. A delivery plan generation method comprising:

receiving a delivery route comprising delivery points that source delivery drivers sequentially visit to deliver delivery goods;

generating a route pattern associated with a delivery point included in common in at least a preset number of delivery routes; and

generating a delivery plan based on the route pattern, the delivery plan indicating an order in which a target delivery driver is to visit delivery points respectively corresponding to assigned delivery goods,

wherein the generating the delivery plan further comprises,

determining the delivery plan according to the route pattern and a delivery requirement to be considered when generating the delivery plan,

estimating a similarity between the delivery plan and the route pattern using a first penalty function determined by comparing the delivery plan and the route pattern,

estimating a degree which the delivery plan satisfies the delivery requirement using a second penalty function determined in accordance with the delivery requirement,

determining whether to change the delivery plan based on a weight corresponds to the delivery requirement, the degree which the delivery plan satisfies the delivery requirement and the similarity between the delivery pattern and the route pattern,

wherein the delivery requirement comprises whether the delivery plan of the target delivery driver intersects with a delivery plan of another delivery driver, and whether the delivery driver visit delivery points the another delivery driver visited.

2. The delivery plan generation method of claim 1, wherein the generating of the route pattern comprises analyzing the received delivery route and generating a route

pattern indicating a first delivery point that each of the source delivery drivers visits among delivery points included in a delivery region.

3. The delivery plan generation method of claim 1, wherein the generating of the route pattern comprises analyzing the received delivery route and generating a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points.

4. The delivery plan generation method of claim 1, wherein the generating of the route pattern comprises analyzing the received delivery route and generating a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points after current locations of the source delivery drivers.

5. The delivery plan generation method of claim 1, wherein the generating of the route pattern comprises generating a set of delivery points included in common in delivery routes, and generating a route pattern based on a similarity between delivery routes derived from the set.

6. The delivery plan generation method of claim 1, wherein the generating of the delivery plan comprises generating the delivery plan based on at least one of the route pattern, a delivery requirement or a delivery environment during a delivery, the delivery requirement being received from a delivery company server and being determined based on at least one of a delivery operation associated with delivery goods, the target delivery driver who performs the delivery operation or a delivery route associated with delivery points corresponding to delivery goods.

7. The delivery plan generation method of claim 6, wherein the generating of the delivery plan comprises generating the delivery plan along with a loading order in which the target delivery driver loads delivery goods into a delivery vehicle based on a delivery order of delivery points determined based on the delivery plan.

8. The delivery plan generation method of claim 6, wherein the generating of the delivery plan comprises evaluating the delivery plan based on whether the delivery plan is similar to the route pattern, and changing the delivery plan.

9. The delivery plan generation method of claim 1, further comprising:

transferring the generated delivery plan to the target delivery driver; and

updating the route pattern based on a delivery route of the target delivery driver who receives the delivery plan, when the delivery route of the target delivery driver is different from the delivery plan.

10. A delivery plan generation apparatus comprising:

a communicator configured to communicate with a delivery company server; and

a processor,

wherein the processor is configured to:

receive, from the delivery company server via the communicator, a delivery route comprising delivery points that source delivery drivers sequentially visit to deliver delivery goods; and

generate a delivery plan to be provided to target delivery driver based on the received delivery route and a delivery requirement to be considered when generating the delivery plan,

estimate a similarity between the delivery plan and the route pattern using a first penalty function determined by comparing the delivery plan and the route pattern,

estimate a degree which the delivery plan satisfies the delivery requirement using a second penalty function determined in accordance with the delivery requirement,

determine whether to change the delivery plan based on a weight corresponds to the delivery requirement, the degree which the delivery plan satisfies the delivery requirement and the similarity between the delivery pattern and the route pattern,

wherein the delivery requirement comprises whether the delivery plan of the target delivery driver intersects with a delivery plan of another delivery driver, and whether the delivery driver visit delivery points the another delivery driver visited.

11. The delivery plan generation apparatus of claim 10, wherein the communicator is further configured to transfer the generated delivery plan to the target delivery driver via the delivery company server.

12. The delivery plan generation apparatus of claim 10, further comprising:

a delivery history database (DB) configured to store the received delivery route.

13. The delivery plan generation apparatus of claim 10, wherein the processor is further configured to generate a route pattern associated with a delivery point included in common in at least a preset number of delivery routes, and to generate the delivery plan based on the route pattern.

14. The delivery plan generation apparatus of claim 13, wherein the processor is further configured to evaluate the delivery plan based on whether the delivery plan meets a

delivery requirement and whether the delivery plan is similar to the route pattern, and to change the delivery plan.

15. The delivery plan generation apparatus of claim 13, wherein the processor is further configured to update the route pattern based on a delivery route of the target delivery driver received via the communicator, when the delivery route of the target delivery driver is different from the delivery plan.

16. The delivery plan generation apparatus of claim 10, wherein the processor is further configured to analyze the received delivery route and to generate a route pattern indicating a first delivery point that each of the source delivery drivers visits among delivery points included in a delivery region.

17. The delivery plan generation apparatus of claim 10, wherein the processor is further configured to analyze the received delivery route and to generate a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points.

18. The delivery plan generation apparatus of claim 10, wherein the processor is further configured to analyze the received delivery route and to generate a route pattern indicating a delivery order in which deliveries are performed in a plurality of delivery points after current locations of the source delivery drivers.

19. The delivery plan generation apparatus of claim 10, wherein the processor is further configured to generate a set of delivery points included in common in delivery routes, and to generate a route pattern based on a similarity between delivery routes derived from the set.

20. The delivery plan generation apparatus of claim 10, wherein the processor is further configured to generate the delivery plan along with a loading order in which the target delivery driver loads delivery goods into a delivery vehicle based on a delivery order of delivery points determined based on the delivery plan.