

5

Description

INFORMATION PROCESSING METHOD, INFORMATION PROCESSING
DEVICE, AND PROGRAM

Technical Field

10 [0001]

The present disclosure relates to an information processing method, an information processing device, and a program.

Background Art

15 [0002]

There is a known technology for setting travel routes for a plurality of mobile bodies that move automatically. For example, Patent Document 1 describes an operation management method in which a basic travel route that is a shortest distance from a current position of a cargo handling vehicle to a start
20 position of a work is set, and when the basic travel route interferes with a basic travel route of another cargo handling vehicle, the basic travel route of the vehicle having a higher priority is adopted and a detour route is set for the vehicle having a lower priority.

25

Citation List

Patent Literature

[0003]

Patent Document 1: JP 6599139 B

30

Summary of Invention

Technical Problem

[0004]

However, there may be a case where a failure occurs in a mobile body during actual movement of the mobile bodies and thus the movement along
35 scheduled routes cannot be appropriately executed. In such a case, for example, it is conceivable that after all the mobile bodies are stopped, the failed mobile body is manually recovered and then the movement is resumed. However, when such measures are taken, it takes time to complete the movement of the mobile bodies, and if there is no operator for recovery, it needs more time, and thus an
40 operating ratio is reduced. Therefore, there is a need for suppressing a reduction in the operating ratio of the mobile body.

[0005]

[0006]

[0007]

[0008]

[0009]

[0010]

- 5 FIG. 1 is a schematic view of a movement control system according to the present embodiment.
- FIG. 2 is a schematic view of a configuration of a mobile body.
- FIG. 3 is a schematic block diagram of a management device.
- FIG. 4 is a schematic block diagram of an information processing device.
- 10 FIG. 5 is a schematic block diagram of a control device for the mobile body.
- FIG. 6 is a table showing an example of movement destination information.
- FIG. 7 is a table for explaining the setting of a work.
- 15 FIG. 8 is a schematic view illustrating a process of recovering a target object by another mobile body.
- FIG. 9 is a flowchart illustrating a processing flow for recovering a recovery target.
- FIG. 10 is a schematic view illustrating a process of recovering a failed
- 20 mobile body by another mobile body.

Description of Embodiments

[0011]

25 Hereinafter, preferred embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Note that the present disclosure is not limited to these embodiments, and when there are a plurality of embodiments, the present disclosure is intended to include a configuration combining these embodiments.

[0012]

30 First Embodiment

Movement Control System

 FIG. 1 is a schematic view of a movement control system according to the present embodiment. As illustrated in FIG. 1, a movement control system 1 according to the present embodiment includes a mobile body 10, a management

35 device 12, and an information processing device 14. The movement control system 1 is a system that controls the movement of the mobile body 10 belonging to a facility W. The facility W is a facility, such as a warehouse, that is logistically managed. The movement control system 1 causes the mobile body 10 to pick up and convey a target object P disposed within an area AR in the

40 facility W. The area AR is, for example, a floor surface of the facility W, and is an area in which the target object P is placed and through which the mobile body 10 moves. In the present embodiment, the target object P is a conveyance

5 target object composed of a pallet and a burden loaded on the pallet. The target
 object P includes an opening Pb into which a fork 24 of the mobile body 10 to
 be described later is inserted, and the opening Pb is formed in a front surface Pa
 of the target object P. However, the target object P is not limited to an object
 composed of a pallet and a burden loaded on the pallet, and may be only a
 10 burden without a pallet, for example.

[0013]

Hereinafter, an operation including movement along a route R (to be
 described later) by the mobile body 10 will be appropriately referred to as a
 work of the mobile body 10. Further, in the present embodiment, the mobile
 15 body 10 moves along the route R to load, convey, and unload the target object P,
 and thus a series of operations by the mobile body 10 to move along the route
 R, and load, convey, and unload the target object P can be said to be the work of
 the mobile body 10. Hereinafter, one direction along the area AR is referred to
 as an X direction, and a direction along the area AR that is orthogonal to the X
 20 direction is referred to as a Y direction. In the present embodiment, the Y
 direction is a direction orthogonal to the X direction. The X direction and the Y
 direction may be horizontal directions. A direction orthogonal to the X direction
 and the Y direction, more specifically, an upward direction in the vertical
 direction is referred to as a Z direction. In the present embodiment, unless
 25 otherwise specified, a "position" refers to a position (coordinates) in a
 coordinate system in a two dimensional plane on the area AR (the coordinate
 system of the area AR). Also, unless otherwise specified, an "orientation" of the
 mobile body 10 or the like refers to an orientation of the mobile body 10 in the
 coordinate system of the area AR, and means a yaw angle (rotation angle) of the
 30 mobile body 10 with the X direction defined as 0 degrees when viewed from the
 Z direction.

[0014]

A plurality of placement areas AR1 is disposed in the area AR in the
 facility W. The placement areas AR1 are configured to be used as areas in which
 35 the target object P is placed. The target object P may be placed or may not be
 placed in each placement area AR1 depending on the situation of the facility W.
 The position (coordinates), the shape, and the size of the placement area AR1
 are determined in advance. In the example illustrated in FIG. 1, the placement
 areas AR1 are set on a shelf provided in the area AR, but are not limited thereto,
 40 and may be provided on the area AR (i.e., on the floor of the facility W), or may
 be provided in a loading platform of a vehicle that has conveyed the target
 object P into the facility W. In addition, in the present embodiment, the

5 placement area AR1 is defined for each target object P, and one target object P
is placed in each placement area AR1, but the present disclosure is not limited
thereto. For example, the placement area AR1 may be set as a free space in
which a plurality of target objects P are placed. In addition, in the example in
FIG. 1, the placement area AR1 has a rectangular shape, but may have any
10 shape and any size, and the number of the placement areas AR1 is also optional.
[0015]

Waypoint

In the area AR, a waypoint A is set for each position (coordinates). The
route R along which the mobile body 10 moves is configured to connect the
15 waypoints A. That is, a route connecting the waypoints A through which the
mobile body 10 is scheduled to pass is the route R of the mobile body 10. The
waypoints A are set according to the layout of the facility W such as the
positions of the placement areas AR1 and passages. For example, the waypoints
A are set in a matrix form in the area AR, and the positions and the number of
20 the waypoints A are set such that a route R connecting a position facing one
placement area AR1 to a position facing another arbitrary placement area AR1
can be set. The position facing the placement area AR1 may be, for example, a
position at which the mobile body 10 can pick up the target object P placed in
the placement area AR1. In addition, the waypoints A include a waypoint A
25 configured to be a charging point (in the example of FIG. 1, a waypoint An at
which a charger CH is placed) or a waypoint A configured to be a waiting point
(in the example of FIG. 1, a waypoint Am). The waypoint A that is a charging
point or a waiting point may be set at any position that does not overlap with a
route (the route used for conveyance) connecting the waypoints A facing the
30 respective placement areas AR1.

[0016]

Mobile Body

FIG. 2 is a schematic view of a configuration of a mobile body. The
mobile body 10 is a device that can move automatically and convey the target
35 object P. Further, in the present embodiment, the mobile body 10 is a forklift,
and more specifically, a so-called automated guided vehicle (AGV) or a
so-called automated guided forklift (AGF). However, the mobile body 10 is not
limited to a forklift for conveying the target object P, and may be any device
capable of moving automatically.

40 [0017]

As illustrated in FIG. 2, the mobile body 10 includes a vehicle body 20, a
wheel 20A, a straddle leg 21, a mast 22, a fork 24, a sensor 26A, and a control

5 device 28. The straddle leg 21 is a shaft-like member that is disposed in pairs at one end portion of the vehicle body 20 in a front-back direction and protrudes from the vehicle body 20. The wheel 20A is disposed at a leading end of each of the straddle legs 21 and at the vehicle body 20. That is, a total of three wheels 20A are disposed, but the positions and the number of the wheels 20A disposed
 10 may be arbitrary. The mast 22 is movably attached to the straddle legs 21 and moves in the front-back direction of the vehicle body 20. The mast 22 extends along the vertical direction (here, the direction Z) orthogonal to the front-back direction. The fork 24 is attached to the mast 22 so as to be movable in the direction Z. The fork 24 may be movable in a lateral direction of the vehicle
 15 body 20 (a direction intersecting with the vertical direction and the front-back direction) with respect to the mast 22. The fork 24 includes a pair of tines 24A and 24B. The tines 24A and 24B extend, from the mast 22, toward the front direction of the vehicle body 20. The tines 24A and 24B are arranged separated from each other in the lateral direction of the mast 22. In the front-back
 20 direction, a direction to a side of the mobile body 10 where the fork 24 is disposed and a direction to a side where the fork 24 is not disposed are referred to as a front direction and a back direction, respectively.

[0018]

The sensors 26A detect at least one of the position and the orientation of
 25 a target object present in the periphery of the vehicle body 20. That is, it can be said that the sensor 26A detects at least one of the position of the target object relative to the mobile body 10 and the orientation of the target object relative to the mobile body 10. In the present embodiment, the sensor 26A is disposed at a leading end of each of the straddle legs 21 in the front direction, and at the
 30 vehicle body 20 on a back direction side. However, the positions at which the sensors 26A are disposed are not limited thereto, and the sensors 26A may be disposed at any positions, and the number of the sensors 26A disposed may be arbitrary.

[0019]

35 The sensor 26A is a sensor that emits a laser beam, for example. The sensor 26A emits the laser beam while performing scanning in one direction (here, the lateral direction), and detects the position and the orientation of the target object based on the reflected light of the laser beam emitted. That is, the sensor 26A is a so-called two-dimensional (2D) light detection and ranging
 40 (LiDAR) sensor. Note that the sensor 26A is not limited to the one described above and may be a sensor that detects the target object using any method, such as a so-called three-dimensional (3D)-LiDAR in which scanning is performed in

5 multiple directions, or may be a so-called one dimensional (1D)-LiDAR in which no scanning is performed, or may be a camera.

[0020]

The control device 28 controls the movement of the mobile body 10. The control device 28 will be described later.

10 [0021]

Management Device

FIG. 3 is a schematic block diagram of a management device. The management device 12 is a system that manages physical distribution in the facility W. The management device 12 is a warehouse control system (WCS) or
 15 a warehouse management system (WMS) in the present embodiment, but is not limited to a WCS and a WMS, and may be any system including a backend system such as any other production management system. The management device 12 may be disposed at any position, and may be disposed in the facility W, or may be disposed at a separate position from the facility W so as to
 20 manage the facility W from the separate position. The management device 12 is a computer and includes a communication unit 30, a storage unit 32, and a control unit 34 as illustrated in FIG. 3.

[0022]

The communication unit 30 is a module used by the control unit 34 to
 25 communicate with an external device such as the information processing device 14, and may include, for example, a Wi-Fi (registered trademark) module or an antenna. The communication method of the communication unit 30 is wireless communication in the present embodiment, but any communication method may be used. The storage unit 32 is a memory that stores various information such as
 30 computation contents of the control unit 34 and programs, and includes, for example, at least one of a primary storage device such as a random access memory (RAM) or a read only memory (ROM), and an external storage device such as a hard disk drive (HDD).

[0023]

35 The control unit 34 is an arithmetic device and includes, for example, an arithmetic circuit such as a central processing unit (CPU). The control unit 34 includes a movement destination information setting unit 40. The control unit 34 reads a program (software) from the storage unit 32 and executes the program to implement the movement destination information setting unit 40 and
 40 perform the processing thereof. Note that the control unit 34 may execute such processing with a single CPU, or may include a plurality of CPUs and execute the processing with the plurality of CPUs. The movement destination

5 information setting unit 40 may be implemented by a hardware circuit. The program for the control unit 34 stored in the storage unit 32 may be stored in a recording medium that is readable by the management device 12.

[0024]

10 The movement destination information setting unit 40 sets movement destination information indicating a movement destination of the mobile body 10. The processing by the movement destination information setting unit 40 will be more specifically described later.

[0025]

15 Note that the management device 12 may execute processing other than the setting of the movement destination information. For example, the management device 12 may also set information for controlling a mechanism other than the mobile body 10 disposed in the facility W (for example, an elevator and a door).

[0026]

20 Information Processing Device

FIG. 4 is a schematic block diagram of the information processing device. The information processing device 14 is a device that is disposed in the facility W and processes information related to the movement of the mobile body 10. The information processing device 14 is, for example, a fleet control system (FCS), but is not limited thereto, and may be any device that processes information related to the movement of the mobile body 10. The information processing device 14 is a computer and includes a communication unit 50, a storage unit 52, and a control unit 54 as illustrated in FIG. 4. The communication unit 50 is a module used by the control unit 54 to communicate with an external device such as the management device 12 and the mobile body 10, and may include, for example, an antenna or a WiFi module. The communication method of the communication unit 50 is wireless communication in the present embodiment, but any communication method may be used. The storage unit 52 is a memory for storing various information such as computation contents of the control unit 54 and programs, and includes, for example, at least one of a primary storage device such as a RAM or a ROM, and an external storage device such as an HDD.

[0027]

40 The control unit 54 is an arithmetic device and includes an arithmetic circuit such as a CPU, for example. The control unit 54 includes a movement destination information acquisition unit 60, a work setting unit 62, and a position information acquisition unit 64. The control unit 54 reads a program

5 (software) from the storage unit 52 and executes the program to implement the movement destination information acquisition unit 60, the work setting unit 62, and the position information acquisition unit 64 and perform the processing thereof. Note that the control unit 54 may execute such processing with a single CPU or may include a plurality of CPUs and execute the processing with the
 10 plurality of CPUs. At least a part of the movement destination information acquisition unit 60, the work setting unit 62, and the position information acquisition unit 64 may be implemented by a hardware circuit. The program for the control unit 54 stored in the storage unit 52 may be stored in a recording medium that is readable by the information processing device 14.

15 [0028]

The movement destination information acquisition unit 60 acquires the movement destination information, the work setting unit 62 sets the route R for the mobile body 10, and the position information acquisition unit 64 acquires the position information of the mobile body 10. Specific contents of the
 20 above-described processing will be described later.

[0029]

Note that, in the present embodiment, the management device 12 and the information processing device 14 are separate devices, but may be an integrated device. That is, the management device 12 may have at least a part of the
 25 function of the information processing device 14, and the information processing device 14 may have at least a part of the function of the management device 12.

[0030]

Control Device for Mobile Body

30 Next, the control device 28 for the mobile body 10 will be described. FIG. 5 is a schematic block diagram of a control device for the mobile body. The control device 28 is a device for controlling the mobile body 10. The control device 28 is a computer and includes a communication unit 70, a storage unit 72, and a control unit 74 as illustrated in FIG. 5. The communication unit
 35 70 is a module used by the control unit 74 to communicate with an external device such as the information processing device 14, and may include, for example, an antenna or a WiFi module. The communication method of the communication unit 70 is wireless communication in the present embodiment, but any communication method may be used. The storage unit 72 is a memory
 40 for storing various information such as computation contents of the control unit 74 and programs, and includes, for example, at least one of a primary storage

5 device such as a RAM or a ROM, and an external storage device such as an HDD.

[0031]

The control unit 74 is an arithmetic device and includes an arithmetic circuit such as a CPU, for example. The control unit 74 includes a work
10 acquisition unit 80, a movement control unit 82, and a position detection unit 84. The control unit 74 reads a program (software) from the storage unit 72 and executes the program to implement the work acquisition unit 80, the movement control unit 82, and the position detection unit 84 and perform the processing thereof. Note that the control unit 74 may execute such processing with a single
15 CPU or may include a plurality of CPUs and execute the processing with the plurality of CPUs. At least a part of the work acquisition unit 80, the movement control unit 82, and the position detection unit 84 may be implemented by a hardware circuit. In addition, the program for the control unit 74 stored in the storage unit 72 may be stored in a recording medium that is readable by the
20 control device 28.

[0032]

The work acquisition unit 80 acquires information indicating the route R of the mobile body 10, the movement control unit 82 controls a movement mechanism such as a drive unit or a steering device of the mobile body 10 so as
25 to control the movement of the mobile body 10. The position detection unit 84 detects the position of the mobile body 10. Specific contents of the above-described processing will be described later.

[0033]

Processing of Movement Control System

30 Next, the processing contents of the movement control system 1 will be described.

[0034]

Setting of Movement Destination Information

The movement destination information setting unit 40 of the
35 management device 12 sets movement destination information indicating a movement destination of the mobile body 10. The movement destination information includes information indicating the position of the movement destination of the mobile body 10. More specifically, in the present embodiment, the movement destination information setting unit 40 sets the
40 movement destination information so as to include first position information (position information of a first position) and second position information (position information of a second position). The first position is a position

5 which the mobile body 10 reaches first, and the second position is a position
 which the mobile body 10 reaches next to the first position. That is, in the
 example of the present embodiment, the first position is the position of a
 conveyance source of the target object P, and the second position is the position
 of a conveyance destination of the target object P. The movement destination
 10 information setting unit 40 may directly specify the position (coordinates) of
 the first position as the first position information. In addition, an identifier may
 be assigned to each waypoint A, and the movement destination information
 setting unit 40 may specify the identifier of a waypoint A corresponding to the
 first position as the first position information. The same applies to the second
 15 position information.
 [0035]

FIG. 6 is a table showing an example of movement destination
 information. In the present embodiment, the movement destination information
 setting unit 40 sets the movement destination information for each target object
 20 P to be conveyed, in other words, for each work. That is, the movement
 destination information setting unit 40 associates target object information
 indicating a target object P to be conveyed, the first position information that is
 the conveyance source of the target object P, and the second position
 information indicating the conveyance destination of the target object P with
 25 each other so as to set the movement destination information for each target
 object P. Note that, for example, an identifier may be assigned to each target
 object P, and information indicating the identifier may be used as the target
 object information. Further, as illustrated in FIG. 6, in the present embodiment,
 it is preferable for the movement destination information setting unit 40 to
 30 associate the target object information, the first position information, the second
 position information, and priority information with each other so as to set the
 movement destination information for each target object P. The priority
 information is information indicating a priority order for conveying a target
 object P among a group of movement destination information for each target
 35 object P. That is, for example, a target object P having the highest priority in the
 priority information is to be conveyed first. FIG. 6 shows an example in which
 pieces of movement destination information are set as follows: movement
 destination information in which the priority is 0001 (first), the target object is
 P1, the first position is A1, and the second position is A2; movement destination
 40 information in which the priority is 0002 (second), the target object is P11, the
 first position is A11, and the second position is A3; movement destination
 information in which the priority is 0003 (third), the target object is P21, the

5 first position is A21, and the second position is A4; movement destination
information in which the priority is 0004 (fourth), the target object is P2, the
first position is A31, and the second position is A5; and movement destination
information in which the priority is 0005 (fifth), the target object is P21, the
first position is A41, and the second position is A6. However, FIG. 6 is only an
10 example, and the movement destination information may be arbitrarily set in
accordance with an order status or the like.

[0036]

In addition, the movement destination information setting unit 40 may
set the movement destination information so as to include designation
15 information for designating a mobile body 10 to move from the first position to
the second position (a mobile body 10 to perform the work). That is, in the
example of the present embodiment, the movement destination information
setting unit 40 may associate the target object information, the first position
information, the second position information, the priority information, and the
20 designation information with each other so as to set the movement destination
information for each target object P. In that case, for example, an identifier may
be assigned to each mobile body 10, and information indicating the identifier
may be used as the designation information.

[0037]

25 The movement destination information setting unit 40 may set the
movement destination information in any method. For example, the movement
destination information setting unit 40 may acquire an order information
indicating a target object P to be conveyed, a conveyance source, and a
conveyance destination, and set the movement destination information based on
30 the order information. The movement destination information setting unit 40
transmits the set movement destination information to the information
processing device 14 via the communication unit 30.

[0038]

Acquisition of Movement Destination Information

35 The movement destination information acquisition unit 60 of the
information processing device 14 acquires the movement destination
information from the management device 12 via the communication unit 50.

[0039]

Setting of Work

40 The work setting unit 62 of the information processing device 14 sets a
work of the mobile body 10 based on the movement destination information.
The work setting unit 62 sets the route R of the mobile body 10 to the

5 movement destination as the work of the mobile body 10. In the present
embodiment, the work setting unit 62 sets, as the route R of the mobile body 10,
a first route to the first position (conveyance source) indicated by the first
position information from an initial position at which the mobile body 10 is
located immediately before starting to move to the first position, and a second
10 route to the second position (conveyance destination) indicated by the second
position information from the first position. That is, the work setting unit 62
sets the route R of the mobile body 10 such that respective waypoints A from
the initial position to the first position are set as the first route, and respective
waypoints A from the first position to the second position are set as the second
15 route. In the example of FIG. 1, the movement destination information indicates
that the first position is a waypoint Ab and the second position is a waypoint
Ac, and the work setting unit 62 sets, as the route R of the mobile body 10, the
first route passing through respective waypoints A from the waypoint Aa, which
is the initial position of the mobile body 10 selected, to the waypoint Ab, and
20 the second route passing through respective waypoints A from the waypoint Ab
to the waypoint Ac.

[0040]

FIG. 7 is a table for explaining the setting of the work. When a plurality
of mobile bodies 10 are deployed in the facility W, the work setting unit 62
25 selects a mobile body 10 that conveys a target object P as the work of the
mobile body 10. Also, when the movement destination information is set for a
plurality of target objects P, the work setting unit 62 sets the route R of a mobile
body 10 for each target object P. That is, the work setting unit 62 selects, for
each target object P, a mobile body 10 that conveys the target object P, and sets
30 the route of the selected mobile body 10. In the example of FIG. 7, the work
setting unit 62 selects a mobile body 10A as the mobile body 10 that conveys a
target object P1 indicated by the movement destination information, and sets a
route from the initial position of the mobile body 10A, through A1 as the first
position, to A2 as the second position (...waypoint A1...). Descriptions of
35 mobile bodies selected for other target objects P illustrated in FIG. 7 and the
routes (waypoints) thereof are the same as those above, and thus are omitted.
Note that the work setting unit 62 may select a mobile body 10 in any manner,
and may select a mobile body 10 for each target object P such that the time until
the completion of the conveyance of all the target objects P is the shortest, for
40 example. In the case where a target mobile body 10 has been designated as the
designation information in the movement destination information, it is only

5 necessary to select the mobile body 10 designated in the designation information.

[0041]

10 The work setting unit 62 also sets a reserved time period during which the selected mobile body 10 passes through the route R (waypoints A) as the work of the mobile body 10. In this case, other mobile bodies 10 are prohibited from passing through the route R during the reserved time period. That is, the selected mobile body 10 occupies the set route R during the reserved time period. In setting the route R for each of a plurality of target objects P, the work setting unit 62 sets a mobile body 10, a route R (waypoints A), and a reserved time period for each target object P such that, in the reserved time period of one mobile body 10, the same waypoints A as those for the one mobile body 10 are not set for other mobile bodies (such that there is no overlapping of reserved time periods) and such that no deadlock occurs even when there is no overlapping of reserved time periods. Further, the work setting unit 62 may set a route R and a reserved time period also based on the priority information in the movement destination information. That is, the work setting unit 62 sets a mobile body 10, a route R, and a reserved time period for each target object P such that there is no overlapping of reserved time periods and that the conveyance of a target object P having a higher priority is completed sooner.

25 Note that the route R includes a plurality of waypoints A, and thus the work setting unit 62 may set a reserved time period for each waypoint A included in the route R.

[0042]

30 Note that the deadlock refers to a phenomenon in which each of a plurality of running programs or the like mutually waits for a result of other programs, and remains in a standby state and does not operate. In the present embodiment, the deadlock may refer to a phenomenon in which the mobile bodies 10 remain stopped if there is a possibility that the mobile bodies 10 will collide with each other when the mobile bodies 10 keep moving along the current routes, and if it is impossible to set avoidance routes toward travel direction sides.

[0043]

40 The work setting unit 62 transmits information on the set work to the mobile body 10 to which the set work is assigned. In the example of FIG. 7, the work setting unit 62 transmits information on the work for the target object P1 and information on the work for the target object P2 to the mobile body 10A. The work setting unit 62 transmits information on the route R as the

5 information on the work. The work setting unit 62 transmits information
 indicating respective waypoints A through which the route R passes as the
 information on the route R. For example, the work setting unit 62 may transmit
 position (coordinate) information of respective waypoints A through which the
 route R passes to the mobile body 10 as the information on the route R, or may
 10 transmit information indicating the identifiers of respective waypoints A
 through which the route R passes to the mobile body 10 as the information on
 the route R. Further, in the present embodiment, the work setting unit 62 also
 transmits information on the reserved time period, that is, information
 indicating the reserved time period during which the mobile body 10 passes
 15 through the route (waypoints A) to the mobile body 10 as the information on the
 work.

[0044]

Movement of Mobile Body

The work acquisition unit 80 of a mobile body 10 acquires information
 20 on the route R set for the mobile body 10 from the information processing
 device 14. The movement control unit 82 of the mobile body 10 moves the
 mobile body 10 along the route R acquired. In the present embodiment, the
 work acquisition unit 80 also acquires information on the reserved time period
 together with the information on the route R. The movement control unit 82
 25 causes the mobile body 10 to pass through each waypoint A through which the
 route R passes during the reserved time period set for each waypoint A. The
 movement control unit 82 causes the mobile body 10 to move so as to pass
 through each waypoint A on the route R by sequentially grasping the position
 information of the mobile body 10 through the position detection unit 84. The
 30 method of acquiring the position information of the mobile body 10 by the
 position detection unit 84 is arbitrary. In the present embodiment, for example,
 a detection body (not illustrated) is disposed in the facility W, and the position
 detection unit 84 acquires the information on the position and the orientation of
 the mobile body 10 based on the detection of the detection body. Specifically,
 35 the mobile body 10 irradiates the detection body with a laser beam, receives
 light of the laser beam reflected from the detection body, and detects the
 position and the orientation of the mobile body 10 in the facility W. The method
 of acquiring the information on the position and the orientation of the mobile
 body 10 is not limited to using a detection body, and simultaneous localization
 40 and mapping (SLAM) may be used, for example. In this case, the position
 information acquisition unit 64 of the information processing device 14 may

5 sequentially acquire the position information of the mobile body 10 detected by the position detection unit 84 from the mobile body 10.

[0045]

10 In the example of FIG. 1, the movement control unit 82 causes the mobile body 10 to move from the waypoint Aa, which is the initial position, to the waypoint Ab, which is the first position, so as to pass through each waypoint A from the waypoint Aa to the waypoint Ab. When the mobile body 10 reaches the waypoint Ab, the movement control unit 82 controls the fork 24 to insert the fork 24 into the opening Pb of the target object P placed in the placement area AR1 facing the waypoint Ab so as to pick up (load) the target object P. In this case, the movement control unit 82 may cause the sensor 26A to detect the position and the orientation of the target object P at the waypoint Ab or at any position before reaching the waypoint Ab. Then, the movement control unit 82 may set an approach route to the target object P based on the position and the orientation of the target object P, and approach the target object P along the approach route to pick up the target object P. That is, in that case, the movement control unit 82 may set a new approach route that allows a predetermined position and a predetermined orientation with respect to the position and the orientation of the target object P detected (the position and the orientation at which the mobile body 10 can pick up the target object P), and approach the target object P along the approach route. Alternatively, for example, the movement control unit 82 may cause the mobile body 10 to approach the target object P by performing feedback control (direct feedback control) based on the detection result of the position and the orientation of the target object P and the detection result of the position and the orientation of the mobile body 10. In that case, switching to the direct feedback control may be performed during the approach along a route based on the position and the orientation of the target object P.

[0046]

35 After the mobile body 10 picks up the target object P, the movement control unit 82 causes the mobile body 10 to return to the waypoint Ab and then move to the waypoint Ac, which is the second position, so as to pass through each waypoint A from the waypoint Ab to the waypoint Ac. When the mobile body 10 reaches the waypoint Ac, the movement control unit 82 controls the fork 24 to drop (unload) the target object P in the placement area AR1 facing the waypoint Ac.

[0047]

5 After the mobile body 10 drops the target object P, the movement control unit 82 causes the mobile body 10 to return to the waypoint Ac. When a next route R in which the waypoint Ac is the initial position has already been set, the movement control unit 82 causes the mobile body 10 to move along that route R.

10 [0048]

Failure of Mobile Body

 Here, when the mobile body 10 fails, the work cannot be continued, and the operating ratio of the mobile body 10 is reduced. In contrast, in the present embodiment, the reduction in the operating ratio is suppressed by recovering a recovery target by another mobile body 10. Further, in the present embodiment, another mobile body 10 recovers a target object P conveyed by the mobile body 10 that has failed and conveys the target object P as substitute for the mobile body 10 that has failed. In the detailed description below, the mobile body 10 that has failed is referred to as a mobile body 10A, and the mobile body 10 that recovers a recovery target is referred to as a mobile body 10B (recovery mobile body). Note that, in the present embodiment, the mobile body 10B for recovering the recovery target may be arbitrarily designated. For example, the mobile body 10B dedicated for the recovery of the recovery target may be set, or a mobile body 10 for conveying a target object P may be designated as the mobile body 10B.

25 [0049]

Occurrence of Failure

 FIG. 8 is a schematic view illustrating a process of recovering a target object by another mobile body. In the following, an example will be described in which a failure occurs in the mobile body 10A conveying a target object PA as illustrated in step S1 of FIG. 8. Here, the failure refers to an event in which the mobile body 10A is unable to move. For example, when a drive system of the mobile body 10A fails, or when the mobile body 10A cannot detect a self-position (position information of the mobile body 10A), the mobile body 10A becomes unable to move. Further, in the present embodiment, the mobile body 10A that has failed cannot move, but can drop the target object PA. That is, in the mobile body 10A, the mast 22, the fork 24, and the like can be operated, and the movement control unit 82 can control these components so as to drop the target object PA. Thus, in the present embodiment, as illustrated in step S2 of FIG. 8, when the mobile body 10A cannot move due to the failure, the movement control unit 82 of the mobile body 10A drives the mast 22, the

5 fork 24, and the like to drop the target object PA at the position where the mobile body 10A is stopped.

[0050]

Acquisition of Position Information

The position information acquisition unit 64 of the information
 10 processing device 14 acquires the position information of the mobile body 10A that has failed. The position information acquisition unit 64 acquires information on the position where the mobile body 10A is stopped due to the failure as the position information of the mobile body 10A. The position
 15 information acquisition unit 64 may acquire the position information of the mobile body 10A in any manner. For example, when the mobile body 10A can detect a self-position by the position detection unit 84, the position information acquisition unit 64 may acquire the position information on the position of the mobile body 10A kept in stopped state due to the failure detected by the
 20 position detection unit 84 as the position information of the mobile body 10A. In addition, for example, when detection of a self-position by the position detection unit 84 is not possible, the position information acquisition unit 64 may acquire the position information on the position of the mobile body 10A last detected by the position detection unit 84 as the position information of the mobile body 10A. As illustrated in step S2 in the example of FIG. 8, the
 25 position information acquisition unit 64 acquires the information of a position Ad of the mobile body 10A stopped due to the failure.

[0051]

Setting of Area of Interest

The position information acquisition unit 64 of the information
 30 processing device 14 acquires the position information of an area of interest AR2. The area of interest AR2 is an area in which a recovery target (target object PA in the present embodiment) of the mobile body 10B is expected to be present. The position information acquisition unit 64 may set the position
 35 information of the area of interest AR2 based on, for example, the position information of the mobile body 10A. In addition, for example, the position detection unit 84 of the mobile body 10A may set the position information of the area of interest AR2 based on the position information of the mobile body 10A. In that case, the position information acquisition unit 64 acquires the position information of the area of interest AR2 from the mobile body 10A. The
 40 method of setting the area of interest AR2 based on the position information of the mobile body 10A may be arbitrary. For example, an area occupying a predetermined area located at a predetermined position with respect to the

5 position of the mobile body 10A may be set as the area of interest AR2. Note that the process of setting the area of interest AR2 is not necessary.
[0052]

Setting of Recovery Route

10 The work setting unit 62 of the information processing device 14 sets a recovery route R1 for recovering the recovery target (target object PA) by the mobile body 10B based on the position information of the mobile body 10A that has failed. The recovery route R1 is a route leading to the mobile body 10A, but is not limited to a route exactly reaching the position Ad of the mobile body 10A, and may be a route reaching a predetermined position Ae near the position
15 Ad of the mobile body 10A. The predetermined position Ae here is a position (waypoint) within a predetermined range from the position Ad of the mobile body 10A, but is not limited thereto, and may be the position Ad of the mobile body 10A. Further, in the first embodiment, the predetermined position Ae is preferably a position on a side on which the target object PA is held with respect
20 to the position Ad of the mobile body 10A (front side of the mobile body 10A on which the fork 24 is disposed) so that the target object PA can be recovered.
[0053]

Specifically, the work setting unit 62 sets a first route from the initial position of the mobile body 10B (the position of the mobile body 10B
25 immediately before starting to move along the recovery route R1) to the predetermined position Ae, and a second route from the predetermined position Ae to the second position of the target object PA as the recovery route R1. The work setting unit 62 transmits information on the set recovery route R1 to the mobile body 10B. In the present embodiment, the work setting unit 62 also
30 transmits information on the area of interest AR2 together with the information on the set recovery route R1 to the mobile body 10B.
[0054]

Recovery of Recovery Target

As illustrated in step S3 of FIG. 8, upon acquisition of the information
35 on the recovery route R1, the movement control unit 82 causes the mobile body 10B to move along the recovery route R1 toward the mobile body 10A. When the mobile body 10B reaches within a predetermined distance range from the mobile body 10A (the predetermined position Ae in the present embodiment), the movement control unit 82 causes the sensor 26A to detect the position and
40 the orientation of the recovery target (the target object PA in the present embodiment). In the present embodiment, when the mobile body 10B reaches within the predetermined distance range from the mobile body 10A, the

5 movement control unit 82 causes the sensor 26A to detect the area of interest
AR2, that is, causes the sensor 26A to detect the area of interest AR2 as a
detection area so as to detect the position and the orientation of the target object
PA. Then, as illustrated in step S4 of FIG. 8, the movement control unit 82 sets
10 an approach route R2 to the target object PA based on the position and the
orientation of the target object PA detected. The movement control unit 82 sets
the approach route R2 that allows a predetermined position and a predetermined
orientation with respect to the position and the orientation of the target object
PA detected (the position and the orientation at which the mobile body 10B can
15 pick up the target object PA). Note that, in the example of FIG. 8, the target
object PA is detected at the predetermined position Ae that is the arrival point of
the first route of the recovery route R1, and a route from the predetermined
position Ae to the target object PA is set as an approach route, but the present
embodiment is not limited thereto. For example, the movement control unit 82
20 may detect the target object PA at any position on the recovery route R1 before
reaching the predetermined position Ae, and set a route from the detection
position to the target object PA as the approach route R2.

[0055]

As illustrated in step S5 of FIG. 8, the movement control unit 82 causes
the mobile body 10B to move along the approach route R2 so as to approach the
25 target object PA and pick up the target object PA. Alternatively, for example, the
movement control unit 82 may cause the mobile body 10B to approach the
target object PA by performing feedback control (direct feedback control) based
on the detection result of the position and the orientation of the target object PA
and the detection result of the position and the orientation of the mobile body
30 10B. In that case, switching to the direct feedback control may be performed
during the movement along the approach route.

[0056]

After the mobile body 10B picks up the target object PA, the movement
control unit 82 causes the mobile body 10B to return to the start position of the
35 approach route R2 (the predetermined position Ae in the example of FIG. 8) and
then move from the predetermined position Ae to the second position of the
target object PA. When the mobile body 10B reaches the second position, the
movement control unit 82 controls the fork 24 to drop the target object PA in the
placement area AR1 facing the second position.

40 [0057]

Processing Flow

5 The above-described processing flow for recovering a recovery target will be described below with reference to a flowchart. FIG. 9 is a flowchart illustrating the processing flow for recovering a recovery target. As illustrated in FIG. 9, the information processing device 14 causes the position information acquisition unit 64 to acquire the position information of the mobile body 10A that has failed (step S10) and acquire the information on the area of interest AR2 (step S12), and causes the work setting unit 62 to set the recovery route R1 for the mobile body 10B based on the position information of the mobile body 10A (step S14). The mobile body 10B (recovery mobile body) acquires the information on the recovery route R1 from the information processing device 14 (step S16), and then the movement control unit 82 causes the mobile body 10B to move along the recovery route R1 (step S18). After reaching within a predetermined distance range from the mobile body 10A, the mobile body 10B causes the sensor 26A to detect the area of interest AR2 so as to detect the position and the orientation of the recovery target (the target object PA in the present embodiment) (step S20). The mobile body 10B sets the approach route R2 to the target object PA based on the position and the orientation of the target object PA (step S22), moves along the approach route R2 to recover the recovery target (the target object PA in the present embodiment) (step S24).
[0058]

25 Note that, in the above description, the information processing device 14 sets the recovery route R1 based on the position information of the mobile body 10A that has failed. However, the subject that performs this processing is not limited to the information processing device 14. For example, the mobile body 10B may acquire the position information of the mobile body 10A that has failed, and set the recovery route R1.
[0059]

35 As described above, in the present embodiment, when the mobile body 10A fails, the mobile body 10B sets the recovery route R1 for recovering the recovery target based on the position information of the mobile body 10A that has failed. Accordingly, even when the mobile body 10A fails, the reduction in the operating ratio can be suppressed by causing another mobile body 10B to recover the recovery target. Further, in the present embodiment, the mobile body 10B recovers the target object PA conveyed by the mobile body 10A as the recovery target. Accordingly, interruption of the conveyance of the target object PA can be reduced.

[0060]

Second Embodiment

5 Next, a second embodiment will be described. The second embodiment differs from the first embodiment in that the mobile body 10A that has failed is a recovery target. That is, the recovery target may be the target object PA, or may be the mobile body 10A. In the second embodiment, the description of parts having the same configuration as those in the first embodiment will be
 10 omitted.
 [0061]

FIG. 10 is a schematic view illustrating a process of recovering a failed mobile body by another mobile body. In FIG. 10, an example is given in which a failure occurs in the mobile body 10A that is conveying a target object PA as
 15 illustrated in step S1A. However, the present embodiment is not limited thereto, and processing similar to the processing described below may be performed even when a failure occurs in the mobile body 10A that is not conveying a target object PA. In addition, the failure in the second embodiment is not limited to referring to a state in which movement is impossible, but a dropping
 20 of a target object PA is possible as in the case of the first embodiment. That is, the failure in the second embodiment may refer to a state in which movement is impossible, and dropping of a target object PA is also impossible.
 [0062]

The position information acquisition unit 64 of the information
 25 processing device 14 acquires the position information of the mobile body 10A that has failed. The position information acquisition unit 64 also acquires the position information of an area of interest AR2. The method of acquiring the position information of the mobile body 10A and the area of interest AR2 may be the same as that in the first embodiment.
 30 [0063]

The work setting unit 62 of the information processing device 14 sets a recovery route R1 for recovering a recovery target (mobile body 10A) by the mobile body 10B based on the position information of the mobile body 10A that has failed. The recovery route R1 is a route leading to the mobile body 10A, but
 35 is not limited to a route exactly reaching the position Ad of the mobile body 10A, and may be a route reaching a predetermined position Ae near the position Ad of the mobile body 10A. That is, the predetermined position Ae here is a position (waypoint) within a predetermined range from the position Ad of the mobile body 10A, but is not limited thereto, and may be the position Ad of the
 40 mobile body 10A. Further, in the second embodiment, the predetermined position Ae is preferably a position on a side on which the target object PA is not held with respect to the position Ad of the mobile body 10A (back side of

5 the mobile body 10A on which the fork 24 is not disposed) so that the mobile body 10A can be recovered.

[0064]

Specifically, the work setting unit 62 sets a first route from the initial position of the mobile body 10B to the predetermined position Ae, and a second
 10 route from the predetermined position Ae to a conveyance destination of the mobile body 10A as the recovery route R1. The conveyance destination of the mobile body 10A may be set arbitrarily, and may be any position that does not overlap with a route (the route used for conveyance) connecting waypoints A facing respective placement areas AR1, such as a waypoint A that is a charging
 15 point or a waiting point. The work setting unit 62 transmits information on the set recovery route R1 to the mobile body 10B. In the present embodiment, the work setting unit 62 also transmits information on the area of interest AR2 together with the information on the set recovery route R1 to the mobile body 10B.

20 [0065]

Recovery of Recovery Target

As illustrated in step S3A of FIG. 10, upon acquisition of the information on the recovery route R1, the movement control unit 82 causes the mobile body 10B to move along the recovery route R1 toward the mobile body 10A. When
 25 the mobile body 10B reaches within a predetermined distance range from the mobile body 10A (the predetermined position Ae in the present embodiment), the movement control unit 82 causes the sensor 26A to detect the position and the orientation of the recovery target (the mobile body 10A in the present embodiment). In the present embodiment, when the mobile body 10B reaches
 30 within the predetermined distance range from the mobile body 10A, the movement control unit 82 causes the sensor 26A to detect the area of interest AR2, that is, causes the sensor 26A to detect the area of interest AR2 as a detection area so as to detect the position and the orientation of the mobile body 10A. Then, as illustrated in step S4A of FIG. 10, the movement control unit 82
 35 sets an approach route R2 to the mobile body 10A based on the position and the orientation of the mobile body 10A detected. The movement control unit 82 sets the approach route R2 that allows a predetermined position and a predetermined orientation with respect to the position and the orientation of the mobile body 10A detected (the position and the orientation at which the mobile body 10B can get coupled with the mobile body 10A). Note that, in the example of FIG.
 40 10, the mobile body 10A is detected at the predetermined position Ae that is the arrival point of the first route of the recovery route R1, and a route from the

5 predetermined position Ae to the mobile body 10A is set as an approach route, but the present embodiment is not limited thereto. For example, the movement control unit 82 may detect the mobile body 10A at any position on the recovery route R1 before reaching the predetermined position Ae, and set a route from the detection position to the mobile body 10A as the approach route R2.

10 [0066]

As illustrated in step S5A of FIG. 10, the movement control unit 82 causes the mobile body 10B to move along the approach route R2 so as to approach the mobile body 10A, and thus causes the mobile body 10A to be coupled (connected) with the mobile body 10B. The method of coupling
15 between the mobile body 10A and the mobile body 10B is arbitrary. For example, the mobile body 10B may be provided with a coupling mechanism for coupling with the mobile body 10A, and the mobile body 10B may control the coupling mechanism so as to get coupled with the mobile body 10A. Alternatively, for example, the movement control unit 82 may cause the mobile
20 body 10B to approach the mobile body 10A by performing feedback control (direct feedback control) based on the detection result of the position and the orientation of the mobile body 10A and the detection result of the position and the orientation of the mobile body 10B. In that case, switching to the direct feedback control may be performed during the movement along the approach
25 route R2. Also, coupling with the mobile body 10A may be made without using the approach route R2 as described above. In that case, for example, a marker may be attached to the mobile body 10A, the marker may be recognized by a camera of the mobile body 10B, and the mobile body 10B may approach the marker from the predetermined position Ae. Alternatively, for example, the
30 coupling may be made by controlling the coupling mechanism of the mobile body 10B to extend so as to get coupled with the mobile body 10A while the mobile body 10B is kept at the predetermined position Ae.

[0067]

When the mobile body 10B gets coupled with the mobile body 10A, the
35 movement control unit 82 causes the mobile body 10B to move along the second route of the recovery route R1 so as to move (tow) the mobile body 10A to the conveyance destination.

[0068]

As described above, in the second embodiment, the mobile body 10B
40 recovers the mobile body 10A that has failed as the recovery target. Accordingly, interruption of the movement of other mobile bodies 10 due to the

5 mobile body 10A can be reduced, and the operating ratio of the mobile bodies
10 can be improved.

[0069]

Note that, also in the second embodiment, the subject that performs the
process of setting a recovery route R1 based on the position information of the
10 mobile body 10A that has failed is not limited to the information processing
device 14. For example, the mobile body 10B may acquire the position
information of the mobile body 10A that has failed, and set the recovery route
R1.

[0070]

15 Third Embodiment

The third embodiment differs from the second embodiment in that, when
the mobile body 10A fails, a process of determining whether or not to recover a
recovery target is performed. In the third embodiment, the description of parts
having the same configuration as those in the second embodiment will be
20 omitted. Note that the third embodiment can be also applied to the first
embodiment. That is, in the third embodiment, the recovery target may be the
mobile body 10A, or may be the target object PA.

[0071]

In the third embodiment, the work setting unit 62 of the information
25 processing device 14 acquires information on a scheduled work that is a work
assigned to the mobile body 10. In the present embodiment, the work setting
unit 62 acquires the information on scheduled works for mobile bodies 10 other
than the mobile body 10A that has failed. The work of each mobile body 10 is
set in advance by the work setting unit 62, and thus the work setting unit 62
30 acquires information about the works of the mobile bodies 10 scheduled after
the current time as the information on the scheduled works.

[0072]

The work setting unit 62 determines whether or not to recover the
recovery target based on the information on the scheduled works for the mobile
35 bodies 10. An example of the determination method will be described below.

[0073]

For example, the work setting unit 62 determines to recover the recovery
target if there is any mobile body 10 to which no scheduled work is assigned.
Specifically, the work setting unit 62 selects a mobile body 10 to which no
40 scheduled work is assigned as a recovery mobile body, and causes the mobile
body 10 to recover the recovery target. That is, if there is a mobile body 10 to
which no scheduled work is assigned (which has completed a work), the mobile

5 body 10 is caused to recover the recovery target as the recovery mobile body.
On the other hand, in the present example, if there is no mobile body 10 to
which no scheduled work is assigned, the work setting unit 62 determines not to
recover the recovery target. However, for example, the work setting unit 62 may
10 acquire the information on the scheduled works for each predetermined time,
and may determine for each predetermined time whether or not there is any
mobile body 10 to which no scheduled work is assigned. Accordingly, even in a
case where there is no mobile body 10 to which no scheduled work is assigned
at a certain timing, upon appearance of a mobile body 10 that has completed a
15 work after the certain timing and has no scheduled work assigned, the mobile
body 10 may be selected as a recovery mobile body to recover the recovery
target.

[0074]

In addition, for example, the work setting unit 62 may determine whether
or not to recover the recovery target based on whether or not it is possible to
20 complete all the scheduled works while avoiding the recovery target.
Completing the scheduled work while avoiding the recovery target means that
the mobile body 10 can loads, conveys, and unloads the target object P while
avoiding the recovery target (the mobile body 10A that has failed, or the target
object PA). In the present embodiment, the work setting unit 62 determines that
25 a scheduled work cannot be completed while the recovery target is avoided
when the recovery target is located on the route R for the scheduled work, or
determines that a scheduled work can be completed while the recovery target is
avoided when the recovery target is not located on the route R for the scheduled
work. Note that the route R for the scheduled work in this case is not limited to
30 a route that was set before the failure of the mobile body 10A, and may be a
route that has been reset so as not to pass through the position of the recovery
target. That is, the work setting unit 62 determines that a scheduled work can be
completed while the recovery target is avoided if a route starting from the initial
position, passing through the first position of the scheduled work, and reaching
35 the second position of the scheduled work can be set without passing through
the position of the recovery target, or determines that a scheduled work cannot
be completed while the recovery target is avoided if the above-described route
cannot be set. The work setting unit 62 determines for every scheduled work
whether or not the scheduled work can be completed while the recovery target
40 is avoided.

[0075]

5 Upon determining that all the scheduled works can be completed while
the recovery target is avoided, the work setting unit 62 calculates a first total
time and a second total time. The first total time is an estimated value of a total
time required to complete all the scheduled works while recovering the recovery
target. In other words, the first total time means a total value obtained by
10 summing a total value of the estimated time from the start of a scheduled work
until the end of the scheduled work for every scheduled work and an estimated
time from when the mobile body 10 starts the recovery of the recovery target
until when the recovery is completed. Further, in calculating the first total time,
the work setting unit 62 calculates the estimated time from the start of a
15 scheduled work to the end of the scheduled work on the assumption that the
mobile body 10 can pass through the position of the recovery target. That is, the
work setting unit 62 calculates the estimated time to complete a scheduled work
based on the route for each scheduled work set on the assumption that the
position of the recovery target is passable. On the other hand, the second total
20 time is an estimated value of a total time required to complete all the scheduled
works without recovering the recovery target. That is, the second total time
means a total value of the estimated time from the start of a scheduled work
until the end of the scheduled work for every scheduled work. Further, in
calculating the second total time, the work setting unit 62 calculates the
25 estimated time from the start of a scheduled work to the end of the scheduled
work on the assumption that the mobile body 10 cannot pass through the
position of the recovery target. That is, the work setting unit 62 calculates the
estimated time to complete a scheduled work based on the route for each
scheduled work set on the assumption that the position of the recovery target is
30 impassable.
[0076]

The work setting unit 62 determines to recover the recovery target when
it is determined that all the scheduled works can be completed while the
recovery target is avoided, and when the first total time is shorter than the
35 second total time. On the other hand, the work setting unit 62 determines not to
recover the recovery target when it is determined that all the scheduled works
can be completed while the recovery target is avoided, and when the first total
time is longer than the second total time. That is, when the first total time is
shorter than the second total time, it is determined to recover the recovery target
40 because the entire work time is shortened by recovering the recovery target. On
the other hand, when the first total time is longer than the second total time, it is
determined not to recover the recovery target because the entire work time is

5 shortened by leaving the recovery target without recovering the recovery target.
Note that when the first total time and the second total time are the same, it may
be determined to recover, or not to recover the recovery target.

[0077]

10 In addition, the work setting unit 62 determines to recover the recovery
target when it is determined that not all the scheduled works can be completed
while the recovery target is avoided, that is, when there is any scheduled work
that cannot be completed while the recovery target is not recovered. In this case,
the work setting unit 62 determines whether or not there are scheduled works
15 that can be completed while the recovery target is avoided, and if there are
scheduled works that can be completed while the recovery target is avoided,
causes such scheduled works to be executed in sequence before the recovery
target is recovered. Then, when a mobile body 10 having no scheduled work
(mobile body 10 that has completed a work) appears during the execution of the
scheduled works that can be completed while the recovery target is avoided, the
20 mobile body 10 is caused to recover the recovery target as a recovery mobile
body. In addition, for example, when all the scheduled works that can be
completed while the recovery target is avoided are completed before a mobile
body 10 having no scheduled work appears, a work for recovering the recovery
target may be executed as the subsequent work, and then remaining scheduled
25 works may be executed.

[0078]

In the third embodiment, since it is determined whether or not to recover
the recovery target as described above, the recovery target can be recovered
while the reduction in work efficiency is suppressed, for example.

30 [0079]

Effects of the Present Disclosure

As described above, the information processing method according to the
present disclosure includes a step of acquiring position information of a mobile
body 10A that has failed, and a step of setting a recovery route R1 based on the
35 position information of the mobile body 10A that has failed, the recovery route
R1 being a route leading to the mobile body 10A that has failed for recovering a
recovery target by a recovery mobile body, the recovery mobile body being a
mobile body 10 (mobile body 10B) other than the mobile body 10A that has
failed. According to the present disclosure, when the mobile body 10A fails, the
40 mobile body 10B sets the recovery route R1 for recovering the recovery target
based on the position information of the mobile body 10A that has failed.
Therefore, even when the mobile body 10A fails, the reduction in the operating

5 ratio can be suppressed by causing another mobile body 10B to recover the recovery target.

[0080]

10 The information processing method according to the present disclosure includes a step of causing a recovery mobile body (mobile body 10B) to move along a recovery route R1, a step of detecting position and orientation of a recovery target by the mobile body 10B when the mobile body 10B reaches within a predetermined distance range from the mobile body 10A, a step of setting an approach route R2 to the recovery target based on the position and the orientation of the recovery target, and a step of causing the mobile body 10B to move along the approach route R2 to recover the recovery target. According to the present disclosure, even when the correct position of the recovery target is unknown due to the failure of the mobile body 10A, the mobile body 10B can appropriately approach the recovery target because the mobile body 10B detects the position and the orientation of the recovery target and sets the approach route R2.

[0081]

25 The information processing method according to the present disclosure further includes a step of setting an area of interest AR2 in which the recovery target is expected to be present based on the position information of the mobile body 10A that has failed, wherein, in the step of detecting the position and the orientation of the recovery target, the mobile body 10B is caused to detect the area of interest AR2. According to the present disclosure, by setting the area of interest AR2, it is possible to cause the mobile body 10B to appropriately detect the recovery target and appropriately approach the recovery target.

30 [0082]

The information processing method according to the present disclosure further includes a step of acquiring information on scheduled works, each of the scheduled works being a work assigned a mobile body 10 other than the mobile body 10A that has failed, and a step of determining whether or not to recover the recovery target. By determining whether or not to recover the recovery target based on the scheduled works, the recovery target can be recovered while the reduction in work efficiency is suppressed, for example.

[0083]

40 In the step of determining, if there is a mobile body 10 to which no scheduled work is assigned, the mobile body 10 is selected as a recovery mobile body and is caused to recover the recovery target. By causing the mobile body 10 to which no scheduled work is assigned to perform the recovery, the

5 recovery target can be recovered while the delay in the scheduled works is reduced.

[0084]

10 In the step of determining, it is determined to recover the recovery target when all the scheduled works can be completed while the recovery target is avoided, and when a first total time is shorter than a second total time, where the first total time is an estimated value of a total time required to complete all the scheduled works while recovering the recovery target, and the second total time is an estimated value of a total time required to complete all the scheduled works without recovering the recovery target. On the other hand, in the step of
15 determining, it is determined not to recover the recovery target when all the scheduled works can be completed while the recovery target is avoided, and when the first total time is longer than the second total time. Accordingly, since it can be determined to recover the recovery target when the entire work time is shortened by recovering the recovery target, the recovery target can be
20 recovered while the reduction in work efficiency is suppressed.

[0085]

In the step of determining, it is determined to recover the recovery target when not all the scheduled works can be completed while the recovery target is avoided. Accordingly, the recovery target can be appropriately recovered.

25 [0086]

The recovery target is a conveyance target (target object PA) conveyed by the mobile body 10A that has failed, or the mobile body 10A that has failed. According to the present disclosure, the reduction in the operating ratio can be suppressed by recovering the target object PA or the mobile body 10A.

30 [0087]

The embodiments of the present disclosure have been described above, but the embodiment is not limited by the details of the embodiments above. Furthermore, the constituent elements of the above-described embodiments include elements that are able to be easily conceived by a person skilled in the
35 art, and elements that are substantially the same, that is, elements of an equivalent scope. Furthermore, the constituent elements described above can be appropriately combined. Furthermore, it is possible to make various omissions, substitutions, and changes to the constituent elements within a range not departing from the scope of the above-described embodiments.

40

Reference Signs List

[0088]

- 5 10 Mobile body
- 12 Management device
- 14 Information processing device
- 40 Movement destination information setting unit
- 60 Movement destination information acquisition unit
- 10 62 Work setting unit
- 64 Position information acquisition unit
- 80 Work acquisition unit
- 82 Movement control unit
- 84 Position detection unit
- 15 A Waypoint
- P Target object
- R1 Recovery route

5 Claims

[Claim 1]

An information processing method comprising:
acquiring position information of a failed mobile body; and
10 setting a recovery route based on the position information of the failed mobile body, the recovery route being a route leading to the failed mobile body for recovering a recovery target by a recovery mobile body, the recovery mobile body being a mobile body other than the failed mobile body.

15 [Claim 2]

The information processing method according to claim 1, further comprising
causing the recovery mobile body to move along the recovery route,
detecting position and orientation of the recovery target by the recovery
20 mobile body when the recovery mobile body reaches a position within a predetermined distance range from the failed mobile body,
setting an approach route to the recovery target based on the position and the orientation of the recovery target, and
causing the recovery mobile body to move along the approach route to
25 recover the recovery target.

[Claim 3]

The information processing method according to claim 2, further comprising setting an area of interest in which the recovery target is expected to
30 be present, based on the position information of the failed mobile body,
wherein, in the detecting the position and the orientation of the recovery target, the recovery mobile body is caused to detect the area of interest.

[Claim 4]

35 The information processing method according to any one of claims 1 to 3, further comprising
acquiring information on a scheduled work, the scheduled work being a work assigned to a mobile body other than the failed mobile body, and
determining whether to recover the recovery target based on the
40 information on the scheduled work.

[Claim 5]

5 The information processing method according to claim 4, wherein, in the determining, when there is a mobile body to which the scheduled work is not assigned, the mobile body is selected as the recovery mobile body and is caused to recover the recovery target.

10 [Claim 6]

 The information processing method according to claim 4 or 5, wherein in the determining,

 it is determined to recover the recovery target when all of a plurality of the scheduled works can be completed while the recovery target is avoided, and
15 when a first total time is shorter than a second total time, the first total time being an estimated value of a total time required to complete all of the plurality of the scheduled works while recovering the recovery target, and the second total time being an estimated value of a total time required to complete all of the plurality of the scheduled works without recovering the recovery target, and
20 it is determined not to recover the recovery target when all of a plurality of the scheduled works can be completed while the recovery target is avoided, and when the first total time is longer than the second total time.

[Claim 7]

25 The information processing method according to any one of claims 4 to 6, wherein, in the determining, it is determined to recover the recovery target when not all of a plurality of the scheduled works can be completed while the recovery target is avoided.

30 [Claim 8]

 The information processing method according to any one of claims 1 to 7, wherein the recovery target is a conveyance target object to be conveyed by the failed mobile body.

35 [Claim 9]

 The information processing method according to any one of claims 1 to 7, wherein the recovery target is the failed mobile body.

[Claim 10]

40 An information processing device comprising:
 a position information acquisition unit configured to acquire position information of a failed mobile body; and

5 a work setting unit configured to set a recovery route based on the
position information of the failed mobile body, the recovery route being a route
leading to the failed mobile body for recovering a recovery target by a recovery
mobile body, the recovery mobile body being a mobile body other than the
failed mobile body.

10

[Claim 11]

A program for causing a computer to perform processing, the processing
comprising:

 acquiring position information of a failed mobile body; and
15 setting a recovery route based on the position information of the failed
mobile body, the recovery route being a route leading to the failed mobile body
for recovering a recovery target by a recovery mobile body, the recovery mobile
body being a mobile body other than the failed mobile body.