

DESCRIPTION

Invention Title: METHOD AND APPARATUS FOR CONTROLLING PROCESS

Technical Field

- [1] The present invention relates to a method and an apparatus for controlling process that enable conveniently checking process information at a desired time point.

Background Art

- [2] In general logistics warehouses or factories, as well as in smart factories that manufacture goods of different specifications using various parts, logistics robots are being introduced for flexible and efficient supply and transport of parts and the like.
- [3] A logistics robot is a concept collectively referring to autonomous mobile robots (AMR: Autonomous Mobile Robot) and automated guided vehicles (AGV: Automated Guided Vehicle), and such logistics robots may perform movement and tasks under the control of a control apparatus.
- [4] In a smart factory, a logistics robot may move along an optimal movement route based on path planning in order to carry out a mission assigned from a control apparatus.
- [5] Meanwhile, in a production process, problems such as mis-assembly or mis-supply of parts may occur, and such problems may affect the entire process and cause additional damages such as process delays.
- [6] In order to prevent such damages, there is a need to present a method that enables swift and accurate identification of the cause, time point, location, and the like of a problem so that early countermeasures may be taken.

[7]

[8] The matters described as the background art above are merely for enhancing understanding of the background of the present invention and should not be taken as an acknowledgment that they correspond to prior art already known to a person having ordinary skill in the art.

Disclosure

Technical Problem

[9] The purpose of the present invention is to provide a method and an apparatus for process management that enable conveniently checking process information at a desired time point so that process analysis becomes easy.

[10]

[11] The tasks of the present invention are not limited to the tasks mentioned above, and other tasks not mentioned may be clearly understood by a person skilled in the art from the description below.

Technical Solution

[12] A method for controlling process according to an embodiment of the present invention for solving the above-described tasks comprises: obtaining process information including logistics robot information on at least one logistics robot that moves while passing between a plurality of facilities within a predetermined operation boundary, logistics information on an article transported by the logistics robot, and facility information on the plurality of facilities, and storing the process information by time period; and when a replay request designating an output condition of the process information is input, displaying a movement state of the at least one logistics robot based on process information of a time period corresponding to the output condition, together with at least one of the process information of the time

period corresponding to the output condition, on a process map configured to include an area in which the plurality of facilities are disposed.

- [13] For example, the logistics robot information includes at least one of route information of the logistics robot, current location information, loading state information, entry/exit condition information on the plurality of facilities, and operation state information.
- [14] For example, the logistics information includes unique identification information of the logistics.
- [15] For example, the facility information includes at least one of work state information of the plurality of facilities and production sequence information among the plurality of facilities.
- [16] For example, the displaying the process information comprises displaying a part of the process information on the process map according to a priority among the process information.
- [17] For example, the priority is determined based on the output condition.
- [18] For example, the method further comprises displaying a process state alarm on a process map configured to include an area in which the plurality of facilities are disposed when the process information satisfies a predetermined alarm condition.
- [19] For example, the process information corresponding to the output condition may be at least a part of process information corresponding to a time point at which a specific process state alarm included in the output condition is displayed.
- [20] An apparatus for controlling process according to an embodiment of the present invention for solving the above-described tasks comprises: a collection unit that obtains process information including logistics robot information on

at least one logistics robot that moves while passing between a plurality of facilities within a predetermined operation boundary, logistics information on an article transported by the logistics robot, and facility information on the plurality of facilities, and stores the process information by time period; a display unit that displays a process map configured to include an area in which the plurality of facilities are disposed; and a determination unit that, when a replay request designating an output condition of the process information is input, causes a movement state of the at least one logistics robot based on process information of a time period corresponding to the output condition to be displayed on the process map together with at least one of the process information of the time period corresponding to the output condition.

- [21] For example, the logistics robot information includes at least one of route information of the logistics robot, current location information, loading state information, entry/exit condition information on the plurality of facilities, and operation state information.
- [22] For example, the logistics information includes unique identification information of the logistics.
- [23] For example, the facility information includes at least one of work state information of the plurality of facilities and work sequence information among the plurality of facilities.
- [24] For example, the determination unit causes a part of the process information to be displayed on the process map according to a priority among the process information.
- [25] For example, the priority is determined based on the output condition.
- [26] For example, the determination unit causes a process state alarm to be displayed on the process map when the process information satisfies a predetermined alarm condition.

[27] For example, the process information corresponding to the output condition may be at least a part of process information corresponding to a time point at which a specific alarm included in the output condition is displayed.

Advantageous Effects

[28] According to various embodiments of the present invention as described above, not only the current state of a process but also the past state of a process may be conveniently checked.

[29] Through this, when a problem occurs in a process, the process state at the time point of the problem occurrence may be easily identified, and swift and accurate measures may be taken.

[30]

[31] The effects obtainable from the present invention are not limited to the effects mentioned above, and other effects not mentioned may be clearly understood by a person skilled in the art in the technical field to which the present invention pertains from the description below.

Description of Drawings

[32] FIG. 1 is a block diagram illustrating an example of an operation boundary configuration applicable to embodiments of the present invention.

[33] FIG. 2 is a block diagram illustrating an example of a control apparatus configuration applicable to embodiments of the present invention.

[34] FIG. 3 is a block diagram illustrating an example of a logistics robot configuration applicable to embodiments of the present invention.

[35] FIG. 4 is a view illustrating an example of a process map screen configuration applicable to embodiments of the present invention.

[36] FIG. 5 is a sequence diagram for explaining a process control procedure according to an embodiment of the present invention.

Mode for Disclosure

[37] Hereinafter, embodiments disclosed in this specification will be described in detail with reference to the accompanying drawings, and the same or similar components will be assigned the same reference numerals regardless of drawing reference numerals, and redundant description thereof will be omitted. The suffixes "module" and "unit" for components used in the following description are given or used interchangeably only in consideration of the ease of writing the specification, and do not in themselves have meanings or roles that are distinguished from each other. Also, in describing the embodiments disclosed in this specification, when it is determined that a detailed description of related known technologies may obscure the gist of the embodiments disclosed in this specification, the detailed description thereof will be omitted. Also, the accompanying drawings are only for facilitating easy understanding of the embodiments disclosed in this specification, and the technical ideas disclosed in this specification are not limited by the accompanying drawings, and should be understood as including all modifications, equivalents, and substitutes included in the spirit and technical scope of the present invention.

[38] Terms including ordinal numbers such as first, second, and the like may be used to describe various components, but the components are not limited by the terms. The terms are used only for the purpose of distinguishing one component from another component.

[39] When a component is referred to as being "connected to" or "coupled to" another component, it should be understood that the component may be directly connected to or coupled to the other component, but other components may exist in between. On the other hand, when a component is referred to as being

"directly connected to" or "directly coupled to" another component, it should be understood that no other components exist in between.

[40] Singular expressions include plural expressions unless the context clearly indicates otherwise.

[41] In this specification, terms such as "includes" or "has" should be understood as designating that features, numbers, steps, operations, components, parts, or combinations thereof described in the specification exist, and do not preclude the possibility of existence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[42] Also, a unit or control unit included in the names of internal configurations of a logistics robot or a control apparatus is merely a term widely used in naming a controller that controls a specific function, and does not mean a generic function unit. For example, each controller may include a modem/transceiver that communicates with other controllers or sensors for control of the function in charge, a memory that stores an operating system, logic instructions, and input/output information, and one or more processors that perform determination, computation, decision, and the like necessary for control of the function in charge. Depending on implementation, one processor may be responsible for computation for a plurality of controllers.

[43]

[44] First, a configuration of an operation boundary in which a logistics robot according to an embodiment is disposed and operated will be described with reference to FIG. 1.

[45] Referring to FIG. 1, an operation boundary 100 may include a logistics robot 110, a facility 120, a surveillance device 130, and a control apparatus 140.

- [46] In the operation boundary 100, a plurality of logistics robots 110, a plurality of facilities 120, and a plurality of detection devices 130 may be provided according to a production process and a target production speed of a product. The operation boundary 100 may be implemented as a smart factory, and the plurality of facilities may be implemented as production devices, but is not necessarily limited thereto. Hereinafter, each component will be described.
- [47] First, the logistics robot 110 may include an autonomous mobile robot (Autonomous Mobile Robot, hereinafter referred to as 'AMR' for convenience) and an automated guided vehicle (Automated Guided Vehicle, hereinafter referred to as 'AGV' for convenience). Depending on an operation policy of the logistics robot 110 in the operation boundary 100, only one type of AGV or AMR may be operated, or AGV and AMR may be operated together within the operation boundary 100.
- [48] An AGV generally performs operations (movement, direction change, stop, etc.) required within the operation boundary 100 by recognizing and following a guidance facility disposed on a floor for guidance of the AGV. Here, the guidance facility may mean an optically recognizable marker (spot, 2D code, etc.), a tag recognizable in a non-contact manner at a short distance (for example, NFC tag, RFID tag, etc.), a magnetic strip, a wire, and the like, but this is illustrative and is not necessarily limited thereto. The guidance facility may be disposed continuously on the floor, or may be disposed discontinuously spaced apart from each other. Because the AGV basically performs operations through recognition and following of the guidance facility, the guidance facility is required to be installed in advance before operation, and when the AGV needs to be moved to a new route or an existing route needs to be modified, new installation or modification of the guidance facility needs to be physically performed. Also, because the AGV does not deviate from a route set through the guidance facility, when an obstacle is detected

on or around the route, it is general for the AGV to stop until the detected obstacle disappears or separate control is received. In operation of the AGV, because the control apparatus 140 needs to control the AGV based on the guidance facility, the control apparatus 140 may transmit commands with meanings such as 'drive until the 3rd marker is recognized from the current location', 'change the heading direction by 90 degrees when the 3rd marker is recognized', and the like to the AGV in units of individual commands or in units of a mission (for example, retrieval, supply, charging, patrol, etc.) including a plurality of commands.

[49] An AMR may determine its current location (i.e., localization) through surrounding detection, and the point that is most distinguished from the AGV is that self path planning is possible using localization and a map. Therefore, when a map with compatible coordinates is shared between the AMR and the control apparatus 140, the control apparatus 140 may control the AMR in a manner of instructing a route to the AMR based on coordinates. Also, when an obstacle is detected during driving, the AMR may set an avoidance route on its own to avoid the obstacle and then return to the original route. A function in which the control apparatus 140 sets a route of the AMR as one or more waypoint coordinates may be referred to as global path planning, and a function in which the AMR sets a movement route or sets an avoidance route between waypoint coordinates according to global path planning may be referred to as local path planning.

[50]

[51] Next, the facility 120 may mean, for example, a device (robot arm, conveyor belt, etc.) that performs a production process of a product within the operation boundary 100, and in a broader sense, when a production process is performed by a person, may also mean a device disposed to assist mission performance such as entry and exit of the logistics robot 110.

A device disposed to assist mission performance may be a device that detects a state of a designated location where a pallet transported by the logistics robot 110 may be put down or collected within an area where a specific production process is performed, a device that determines process progress, an entry/exit blocking means within the area, and the like, but is not necessarily limited thereto.

- [52] For example, the facility 120 is controlled through a PLC (Programmable Logic Controller), and may perform communication with the control apparatus 140 in relation to process progress.
- [53] The surveillance device 130 may perform a function of obtaining information for determining a situation within the operation boundary 100 and transmitting the information to the control apparatus 140. For example, the surveillance device 130 may include a camera, a proximity sensor, and the like, but is not necessarily limited thereto.
- [54] The control apparatus 140 may perform communication with the aforementioned components 110, 120, 130 to obtain information necessary for operation of the operation boundary 100 or control each component. For example, the control apparatus 140 may perform dispatch of the logistics robot 110, route setting, mission assignment, process management per product, material management, and the like.
- [55] In implementation, the control apparatus 140 may include a local control apparatus (ACS: AMR/AGV Control System) that controls surrounding process facilities based on locations of AGV/AMR and performs mission-based control of AGV/AMR, and an integrated control apparatus (MoRIMS: Mobile Robot Integrated Monitoring System) that integrates and controls two or more local control apparatuses. The integrated control apparatus may perform status and route of all logistics robots 110 within the operation boundary 100, logistics flow setting, and traffic control from each of the plurality of local

control apparatuses. For example, when the local control apparatus (ACS) is provided in units of logistics robots of the same manufacturer or the same model, the integrated control apparatus may perform integrated control for collision prevention such as bottleneck level analysis of crossing/overlapping areas, driving acceleration/deceleration control, avoidance route regeneration, and the like through heterogeneous traffic distribution control based on information obtained through the plurality of local control apparatuses (ACS).

- [56] In addition, the integrated control apparatus may also have a manufacturing execution system (MES: Manufacturing Execution System) as a higher-level control entity thereof, and the manufacturing execution system (MES) may in turn be linked with an automated scheduler (APS: Advanced Planning & Scheduling).
- [57] In addition to the configuration 110, 120, 130, 140 of the aforementioned operation boundary 100, it goes without saying that devices for mutual communication between each component such as a beacon, a relay, an AP (Access Point), and the like, a charger for charging the logistics robot 110, a loading space for storing or loading parts, a space where finished products or intermediate products are stored, a traffic light, a barrier, a standby space for idle logistics robots 110, and the like may be appropriately disposed within the operation boundary 100.
- [58] Hereinafter, a configuration of the control apparatus 140 applicable to embodiments of the present invention will be described with reference to FIG. 3.
- [59]
- [60] FIG. 2 is a block diagram illustrating an example of a control apparatus configuration applicable to embodiments of the present invention. Each component illustrated in FIG. 2 is

mainly showing components related to the embodiments of the present invention, and in actual implementation of the control apparatus 140, more or fewer components may be included.

- [61] Referring to FIG. 3, the control apparatus 140 may include a firmware management unit 141, a traffic control unit 142, a process management unit 143, a production/logistics management unit 144, an inventory management unit 145, a communication unit 146, a monitoring unit 147, a map management unit 148, and a work schedule management unit 149.
- [62] The firmware management unit 141 may obtain the latest firmware of the logistics robot 110 through the communication unit 146, and transmit it to the logistics robot 110 so that a firmware update is performed, thereby maintaining the firmware of the logistics robot 110 in the latest state.
- [63] The traffic control unit 142 controls a traffic light and a barrier based on a route of the logistics robot 110, and may also recalculate a route of the logistics robot 110 according to traffic.
- [64] The process management unit 143 may define a process per product, and manage missions such as process progress, progress location, and the like.
- [65] The production/logistics management unit 144 may dispatch the logistics robot 110 based on a mission.
- [66] The inventory management unit 145 manages a location and a quantity per material, and such information may be useful for more efficient process operation, such as dispatching the logistics robot 110 to a destination in advance of a time point at which actual assembly/consumption of the material is detected for pallet pickup or retrieval.
- [67] The communication unit 146 may perform communication with internal components of the operation boundary 100 such as the

logistics robot 110, the facility 120, and the surveillance device 130, as well as communication with external entities such as a firmware update server and the like.

- [68] The monitoring unit 147 may monitor a location, a route, a battery state, a communication state, a power train state, and the like of an individual logistics robot 110. Here, the route is a concept including a global route based on a waypoint and a real-time local route. Also, the battery state may include a voltage, a current, a temperature, a peak value of voltage and current, a state of charge (SOC: State Of Charge), a state of health (SOH: State Of Health), and the like. The communication state may include information on a currently activated communication protocol (Wi-Fi, etc.), a connected AP, a distance to an AP, a channel in use, and the like. In addition, the power train state may include a load, a temperature, an RPM, and the like of a driving system.
- [69] In addition, the vehicle monitoring unit 147 may also check a mission currently assigned to an individual logistics robot 110, an operation mode, a firmware version, and the like.
- [70] The map management unit 148 obtains map data in a grid map form obtained by the AMR among the logistics robots 110 while driving within the operation boundary 100, and may provide a tool that allows a factory manager to edit the obtained map data. Through editing of the map data, a zone in which the logistics robot 110 performs one or more preset operations upon entry, a virtual lane, an intersection, a restricted area, and the like may be set, but this is illustrative and is not necessarily limited thereto. Also, the map management unit 148 may distribute the map to the remaining logistics robots 110 other than the logistics robot 110 that obtained the initial grid map through actual driving through the communication unit 146.
- [71] The work schedule management unit 149 may manage and monitor a mission of the logistics robot 110 based on process

information of the operation boundary 100 received from the facility 120 and the surveillance device 130 through the communication unit 146. Also, the work schedule management unit 149 may select a specific logistics robot 110 and assign a mission, and set a global route of the logistics robot 110 according to the assigned mission.

[72] Meanwhile, in an embodiment of the present invention, the control apparatus 140 may further include a collection unit 140a, a determination unit 140b, and a display unit 140c. The collection unit 140a, the determination unit 140b, and the display unit 140c may be implemented as a partial function of each configuration 141-148 of the control apparatus 140 described above, but may also be implemented as a separate configuration. Detailed content in relation to this will be described later with reference to FIG. 5.

[73] Next, a logistics robot will be described with reference to FIG. 3.

[74] FIG. 3 is a block diagram illustrating an example of a logistics robot configuration applicable to embodiments of the present invention.

[75] Referring to FIG. 3, the logistics robot 110 may include a driving unit 111, a sensing unit 112, a loading unit 113, a communication unit 114, and a control unit 115. Hereinafter, each component will be described.

[76] The driving unit 111 may include a driving source, a wheel, a suspension, and the like involved in movement, steering, and stopping of the logistics robot 110. An electric motor that receives power from a built-in battery (not shown) may be used as the driving source. The wheel may include one or more driving wheels that receive driving force from the driving source, and a non-driving wheel that rotates by movement of a vehicle body without receiving driving force. Depending on implementation, when a plurality of driving

wheels are provided, a driving source may be matched for each driving wheel so that rotation of each driving wheel may be independently controlled. In such a case, by making rotation directions of different driving wheels different, steering may be achieved by rotating the vehicle body without a separate steering means. At least some of the non-driving wheels may be configured as a caster type wheel, but this is illustrative and is not necessarily limited thereto.

- [77] The sensing unit 112 is for detecting a surrounding environment or a self-operation state and the like of the logistics robot 110, and may include at least one of a 2D laser scanner (for example, LiDAR), a 3D vision (stereo) camera, a multi-axis gyro sensor, an acceleration sensor, a wheel encoder, and a proximity sensor.
- [78] An encoder may output information capable of determining how much a wheel has rotated using light emitted from a light-emitting element (for example, an optical diode). For example, an encoder may count the number of slits disposed along a circumferential direction on a wheel or a disc rotating together with a wheel during a unit time. The control unit 115 is capable of performing odometry that estimates displacement by analyzing a position change amount with respect to time using data obtained through the encoder and a gyro sensor. However, due to slip or wear (change of wheel co-radius) of the wheel, a displacement estimated based on encoder data may have an error from an actual displacement. Therefore, when performing odometry, the control unit 115 may perform correction for noise and error using a predetermined algorithm (for example, EKF: Extended Kalman Filter) on information collected from the wheel and a gyro sensor, and output a result having a tendency close to an actual value. Such odometry may be particularly useful when current location determination (Localization) using a 2D laser scanner to be described later is not possible.

- [79] A 2D laser scanner may scan a surrounding environment by irradiating a laser around through a rotating reflector and detecting a signal reflected and returned. At this time, a detection result in a point cloud shape may be output by analyzing an intensity of the reflected signal and a time difference between irradiation/reception.
- [80] A 3D vision camera may calculate a distance to an object based on a parallax between two cameras spaced apart by a certain distance, that is, a pixel distance between images captured through each camera. At this time, a texture projector that projects infrared light of a predetermined pattern may be provided so that detection is possible even for a flat object of the same color (for example, a white wall) and the like.
- [81] Generally, a 2D laser scanner is used for mapping, navigation, object recognition, and the like, and a 3D camera may be utilized for obstacle avoidance particularly during navigation, but this is illustrative and is not necessarily limited thereto.
- [82] The loading unit 113 is a means for loading an article to be transported, and may be a top plate itself of an upper portion of a vehicle body or a table, a lift, a turntable rotating along a vertical axis, a fork lift, a conveyor, or a combination thereof disposed on the top plate. In the case of a fork lift, similarly to a forklift truck, telescopic and tilting functions may be supported.
- [83] The communication unit 114 may perform communication with other components within the operation boundary 100 such as the facility 120, the control apparatus 140, and the like, and may also support communication between logistics robots 110, and communication with a charger during a charging mission is also possible.
- [84] The control unit 115 is an entity that performs overall control of each of the aforementioned components 111, 112,

113, 114, and may perform current mission, current location, destination determination, route planning, loading unit control, and the like based on information obtained from the control apparatus 140 through the communication unit 114.

- [85] Hereinafter, a manner in which process information is provided according to an embodiment of the present invention will be described in detail with reference to FIG. 4.
- [86] FIG. 4 is a view illustrating an example of a process map screen configuration applicable to embodiments of the present invention.
- [87] The process map M is configured to include an area in which a plurality of facilities 120 are disposed, and may include all or a part of the operation boundary 100.
- [88] More specifically, the process map M may include a facility display area M1, a logistics robot movement state display area M2, an alarm display area M3, and a process information display area M4.
- [89] The facility display area M1 may be configured to correspond to a facility 120 disposition area within the actual operation boundary 100, and the logistics movement state display area M2 may be configured to indicate near which facility area M1 a logistics robot is located in a vicinity of the facility display area M1.
- [90] The alarm display area M3 is also disposed in a vicinity of the facility display area M1, and within the alarm display area M3, an alarm signal corresponding to each facility 120 may be visually displayed.
- [91] The process information display area M4 is disposed in a vicinity of the alarm display area M3, and at least a part of process information (#1-#4) related to each facility 120 and an alarm signal corresponding thereto may be visually displayed.

- [92] The process map M as described above may be implemented in a form of video based on process information collected in real time, and through this, allows a worker to visually and easily recognize a state of a process.
- [93] Meanwhile, the process map M may also be manipulated to indicate a state at a past time point as well as a state of the current process. In relation to this, description will be provided hereinafter with reference to FIG. 5.
- [94]
- [95] FIG. 5 is a sequence diagram for explaining a process control procedure according to an embodiment of the present invention. FIG. 5 is mainly showing components related to the description of an embodiment of the present invention, and it goes without saying that an actual control apparatus 140 or a control method may be implemented including more or fewer components. Hereinafter, each configuration and each process will be described.
- [96] First, the collection unit 140a may obtain process information including logistics robot information on at least one logistics robot 110 that moves while passing between a plurality of facilities 120 within a predetermined operation boundary 100, logistics information on an article transported by the logistics robot 110, and facility information on the plurality of facilities 120 in step S501.
- [97] Thereafter, the collection unit 140a may store the obtained process information by time period. The process information may be stored, for example, in real time, and may also be stored by process date in step S502.
- [98] In this case, the process information may be collected through communication with the logistics robot 110 or the facility 120 and the like, and the communication with the logistics robot 110 or the facility 120 and the like may be performed through the aforementioned communication unit 146.

[99] The logistics robot information may include at least one of route information of the logistics robot 110, current location information, loading state information, entry/exit condition information on the plurality of facilities, and operation state information. In this case, the route information may include an entire movement route according to a departure point, a destination, and a waypoint and the like of the logistics robot 110, and an avoidance route for avoidance maneuver during driving along the entire movement route. The loading state information may include whether there is a logistics loaded on the logistics robot 110, whether the loaded logistics has been loaded/unloaded or a history thereof, a weight or a shape of the loaded logistics, and the like. The entry/exit condition on the plurality of facilities may mean, for example, an interlock condition set for each facility. The operation state information may include whether the logistics robot 110 is operating normally, a failure history, and the like.

[100] The logistics information may include unique identification information of the logistics. In this case, the unique identification information of the logistics may include information on which type the corresponding logistics is included in, and even for logistics of the same type, a unique identification number may be assigned to each logistics.

[101] Also, the facility information may include at least one of work state information of the facility 120 and work sequence information among the plurality of facilities 120. In this case, the work state information of the facility 120 may include whether the facility 120 is operating normally, a failure history, a work progress rate, a work history, a material retrieval/input history of logistics, and the like, and the work sequence information may mean an order in which a series of works performed through different facilities 120 are performed.

- [102] Because the logistics robot information, the logistics information, and the facility information include the above-described information, detailed elements of a process state at a specific time point may be identified.
- [103] Particularly, because the logistics information includes a unique identification number of the logistics, a logistics in which a problem has occurred may be specified, and through this, measures such as retrieving the article in which a problem has occurred or supplying a replacement may be performed swiftly and accurately.
- [104]
- [105] The determination unit 140b receives process information stored in the collection unit 140a in step S503, determines whether the process information satisfies a predetermined alarm condition in step S504, and may transmit a result of the determination to the display unit 140c in step S505.
- [106] Also, the determination unit 140b determines process information to be displayed on a process map among the process information received from the collection unit 140a in step S505, and may transmit a result to the collection unit 140c in step S507.
- [107] More specifically, the determination unit 140b may cause a part of the process information to be displayed on the process map according to a priority among the process information. Through this, it becomes possible to efficiently display process information under spatial constraints on the process map, and it becomes possible to alleviate that unnecessarily much information is displayed and interferes with checking of process information.
- [108] In this case, the priority may be determined based on the output condition. Meanwhile, the process information may be displayed separately by a plurality of categories, and in such a case, the priority may be applied for each category.

In this case, the category may be divided into, for example, logistics robot information, logistics information, and facility information.

[109] Thereafter, according to a result of the determination and decision received from the determination unit 140b, a process state alarm and process information are displayed on the process map on the display unit 140c in step S508.

[110] Meanwhile, a replay request designating an output condition of the process information may be input to the determination unit 140b from outside. When a replay request is input in step S509, the determination unit 140b determines process information corresponding to the output condition in step S510, and may transmit a result of the determination to the display unit 140c so that display of the process map is replayed through the display unit 140c.

[111] Particularly, the determination unit 140b may cause process information corresponding to the output condition among the stored process information to be displayed on the process map during the replay process in step S512.

[112] More specifically, the determination unit 140b may cause a movement state of at least one logistics robot 110 to be displayed on the process map based on process information of a time period corresponding to the output condition, and in this case, the process information of the time period corresponding to the output condition may be displayed together on the process map.

[113] In this case, the output condition may be about a specific time point or a specific alarm, and the process information corresponding to the output condition may be at least a part of process information corresponding to a specific time point included in the output condition, or at least a part of process information corresponding to a time

point at which a specific alarm included in the output condition is displayed.

[114] Because the process information corresponding to the output condition is displayed on the process map, a worker may selectively receive process information about a situation that the worker desires to check.

[115]

[116] According to various embodiments of the present invention as described above, not only the current state of a process but also the past state of a process may be conveniently checked.

[117] Through this, when a problem occurs in a process, the process state at the time point of the problem occurrence may be easily identified, and swift and accurate measures may be taken.

[118] [Description of Reference Numerals]

[119] 100: operation boundary

[120] 110: logistics robot

[121] 120: facility

[122] 130: surveillance device

[123] 140: control apparatus

[124] 140a: collection unit

[125] 140b: determination unit

[126] 140c: display unit

CLAIMS

[Claim 1]

A method for controlling process, the method comprising:

obtaining process information including logistics robot information on at least one logistics robot that moves while passing between a plurality of facilities within a predetermined operation boundary, logistics information on an article transported by the logistics robot, and facility information on the plurality of facilities, and storing the process information by time period;

and

when a replay request designating an output condition of the process information is input, displaying a movement state of the at least one logistics robot based on process information of a time period corresponding to the output condition, together with at least one of the process information of the time period corresponding to the output condition, on a process map configured to include an area in which the plurality of facilities are disposed.

[Claim 2]

The method of claim 1, wherein the logistics robot information includes at least one of route information of the logistics robot, current location information, loading state information, entry/exit condition information on the plurality of facilities, and operation state information.

[Claim 3]

The method of claim 1, wherein the logistics information includes unique identification information of the logistics.

[Claim 4]

The method of claim 1, wherein the facility information includes at least one of work state information of the plurality

of facilities and production sequence information among the plurality of facilities.

[Claim 5]

The method of claim 1, wherein the displaying of the process information comprises displaying a part of the process information on the process map according to a priority among the process information.

[Claim 6]

The method of claim 5, wherein the priority is determined based on the output condition.

[Claim 7]

The method of claim 1, further comprising:

displaying a process state alarm on a process map configured to include an area in which the plurality of facilities are disposed when the process information satisfies a predetermined alarm condition.

[Claim 8]

The method of claim 7, wherein the process information corresponding to the output condition is at least a part of process information corresponding to a time point at which a specific process state alarm included in the output condition is displayed.

[Claim 9]

An apparatus for controlling process, comprising:

a collection unit that obtains process information including logistics robot information on at least one logistics robot that moves while passing between a plurality of facilities within a predetermined operation boundary, logistics information on an article transported by the logistics robot, and facility information on the plurality of facilities, and stores the process information by time period;

a display unit that displays a process map configured to include an area in which the plurality of facilities are disposed;

and

a determination unit that, when a replay request designating an output condition of the process information is input, causes a movement state of the at least one logistics robot based on process information of a time period corresponding to the output condition to be displayed on the process map together with at least one of the process information of the time period corresponding to the output condition.

[Claim 10]

The apparatus of claim 9, wherein the logistics robot information includes at least one of route information of the logistics robot, current location information, loading state information, entry/exit condition information on the plurality of facilities, and operation state information.

[Claim 11]

The apparatus of claim 9, wherein the logistics information includes unique identification information of the logistics.

[Claim 12]

The apparatus of claim 9, wherein the facility information includes at least one of work state information of the plurality of facilities and work sequence information among the plurality of facilities.

[Claim 13]

The apparatus of claim 9, wherein the determination unit causes a part of the process information to be displayed on the process map according to a priority among the process information.

[Claim 14]

The apparatus of claim 13, wherein the priority is determined based on the output condition.

[Claim 15]

The apparatus of claim 9, wherein the determination unit causes a process state alarm to be displayed on the process map when the process information satisfies a predetermined alarm condition.

[Claim 16]

The apparatus of claim 15, wherein the process information corresponding to the output condition is at least a part of process information corresponding to a time point at which a specific alarm included in the output condition is displayed.