

DESCRIPTION

Invention Title: PATH SEARCH SYSTEM FOR ROBOT AND PATH SEARCH METHOD FOR ROBOT

Technical Field

- [1] The present invention relates to a path search system for robot and a path search method for robot, and more specifically, to setting a starting point for starting a task of a robot in a production factory such as a smart factory.

[2]

Background Art

- [3] As communication, sensing, and information processing technologies have highly developed, research on smart factories in which unmanned robots produce products or assist in product production continues.
- [4] In a smart factory, there are unmanned robots that assemble products by themselves or transport parts required for assembly.
- [5] In particular, unmanned robots that transport parts required for assembly transport necessary parts when a task is assigned, and since there are a plurality of unmanned robots in the smart factory, there is a need for a technology for searching for a path of a robot so that the unmanned robot may move along an efficient path.
- [6]
- [7] The matters described as the background art above are only 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 those of ordinary skill in the art.

[8]

Disclosure

Technical Problem

- [9] The present invention is to set a task-specific starting point of a robot moving in a smart factory, and is to provide a path search system for robot that sets a task-specific starting point of the robot so that the robot may have an efficient movement path.

[10]

Technical Solution

- [11] A path search system for robot according to the present invention for achieving the above object includes a simulation unit performing movement simulation of a robot assigned a task; a starting point changing unit searching for a possible starting point of the robot, changing a starting point of the robot, and delivering the changed starting point of the robot to the simulation unit; and a data analysis unit receiving a simulation result from the simulation unit, determining whether starting point change of the robot is required based on a travel distance of the robot, and confirming the starting point of the robot.
- [12] The starting point changing unit searches for task-specific possible starting points of the robot, and the data analysis unit may confirm task-specific starting points of the robot.
- [13] The data analysis unit calculates task-specific travel distances of the robot, compares task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the

robot according to the previous simulation result, starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task may be confirmed as the previous starting point.

- [14] The data analysis unit calculates task-specific travel distances of the robot, compares task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and in a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result, may determine that starting point change of the robot performing the corresponding task is required.
- [15] The simulation unit implements a possible movement path of the robot in a production factory through a plurality of nodes, and the starting point changing unit may search for a possible starting point of the robot based on the plurality of nodes implemented by the simulation unit.
- [16] The starting point changing unit searches for a possible starting point by sequentially searching remaining nodes from a node corresponding to an initial start position of the robot among the plurality of nodes, changes a search direction following one of a clockwise direction and a counterclockwise direction at each search of each node, and in a case where a node to be searched next according to the change of the search direction is a previously searched node, may maintain a current search direction.
- [17] The path search system further includes a starting point setting unit setting an initial starting point of the robot, wherein the simulation unit delivers the simulation result based on the initial starting point of the robot set by the starting point setting unit to the data analysis unit, and the data analysis unit may calculate task-specific travel

distances of the robot based on the simulation result and generate initial comparison data.

- [18] The data analysis unit calculates task-specific travel distances of the robot, and in a case where the calculated travel distance is shorter than or equal to the initial comparison data by comparing the calculated travel distance with the initial comparison data, may determine that starting point change of the robot performing the corresponding task is required.
- [19] In a case where it is determined that starting point change of the robot performing the corresponding task is required, the starting point changing unit changes the starting point of the robot and delivers the changed starting point to the simulation unit, the simulation unit performs movement simulation with the changed starting point and delivers the simulation result to the data analysis unit, and the data analysis unit compares the current simulation result with the previous simulation result, and in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result, starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task may be confirmed as the previous starting point.
- [20] In a case where it is determined that starting point change of the robot performing the corresponding task is required, the starting point changing unit changes the starting point of the robot and delivers the changed starting point to the simulation unit, the simulation unit performs simulation with the changed starting point and delivers the simulation result to the data analysis unit, and the data analysis unit compares the current simulation result with the previous simulation result, and in a case where the travel distance of the robot

according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result, may determine that starting point change of the robot performing the corresponding task is required.

[21] The path search system further includes a robot control system controlling and operating movement of the robot in a production factory, wherein the data analysis unit confirms task-specific starting points of the robot and delivers the confirmed starting points to the simulation unit, and when starting points of the robot for all tasks are confirmed, the simulation unit may deliver task-specific starting points of the robot to the robot control system.

[22]

[23] A path search method for robot according to the present invention includes performing, by a simulation unit, movement simulation of a robot assigned a task; receiving, by a data analysis unit, a simulation result from the simulation unit, and determining whether starting point change of the robot is required based on a travel distance of the robot; and in a case where it is determined that starting point change of the robot is required, changing, by a starting point changing unit, a starting point of the robot and delivering the changed starting point of the robot to the simulation unit.

[24] The data analysis unit determines task-specific whether starting point change of the robot is required, and the starting point changing unit may search for task-specific possible starting points of the robot.

[25] The determining whether starting point change of the robot is required comprises the data analysis unit calculating task-specific travel distances of the robot, comparing task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and in a

case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result, starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task may be confirmed as the previous starting point.

- [26] The determining whether starting point change of the robot is required comprises the data analysis unit calculating task-specific travel distances of the robot, comparing task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and in a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result, may determine that starting point change of the robot performing the corresponding task is required.

[27]

Advantageous Effects

- [28] According to the path search system for robot and the like of the present invention, a task-specific starting point of the robot may be set so that the robot may have an efficient movement path.

[29]

Description of Drawings

- [30] FIG. 1 is a block diagram of a path search system for robot according to an embodiment of the present invention.
- [31] FIG. 2 is a simplified illustration of the inside of a smart factory, and FIG. 3 illustrates a product production schedule in the smart factory.
- [32] FIG. 4 is a simplified illustration of the inside of a smart factory of FIG. 2.

[33] FIG. 5 illustrates a plurality of nodes for explaining starting point search of the starting point setting unit.

[34] FIG. 6 is a flowchart of a path search method for robot according to an embodiment of the present invention.

[35]

Mode for Disclosure

[36] Hereinafter, embodiments disclosed in this specification will be described in detail with reference to the accompanying drawings, wherein the same or similar components are assigned the same reference numerals regardless of drawing numerals, and redundant description thereof will be omitted.

[37] In describing the embodiments disclosed in this specification, when it is determined that 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 easily understanding the embodiments disclosed in this specification, and the technical idea disclosed in this specification is not limited by the accompanying drawings, and it should be understood that all changes, equivalents, and substitutes included in the spirit and technical scope of the present invention are included.

[38] Terms including ordinal numbers such as first and second 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] Singular expressions include plural expressions unless the context clearly indicates otherwise.

[40] In this specification, terms such as "comprises" or "has" should be understood as not pre-excluding the existence or possibility of addition of one or more other features, numbers,

steps, operations, components, parts, or combinations thereof described in the specification.

- [41] The simulation unit, starting point setting unit, starting point changing unit, and data analysis unit may include a communication device communicating with other controllers or sensors for control of functions in charge, a memory storing an operating system or logic instructions and input/output information, and one or more processors performing judgment, calculation, determination, and the like required for control of functions in charge.
- [42] Also, in this specification, a robot is used as a concept collectively referring to an autonomous mobile robot (AMR: Autonomous Mobile Robot), an automated guided vehicle (AGV: Automated Guided Vehicle), and an unmanned forklift, which are smart logistics vehicles.
- [43]
- [44] FIG. 1 is a block diagram of a path search system for robot according to an embodiment of the present invention. Referring to FIG. 1, the path search system for robot includes a simulation unit 100, a starting point changing unit 300, and a data analysis unit 500.
- [45] Prior to describing specifically the functions of each configuration, the present invention may be applied to searching for a path of a robot existing in a smart factory. In a smart factory, there are a plurality of robots for product production, and a task may be assigned to each robot among the plurality of robots. As an example, a task may be transportation of parts required for product production, and a product may be a vehicle.
- [46] The plurality of robots may move from a starting point to a destination point to perform an assigned task. The destination point may be a work place where parts transported

by the robot are assembled, and the location of the work place may be fixed in the smart factory.

[47] On the other hand, the starting point of the robot may be variable. In other words, a point from which the robot departs may be variable depending on the situation, and may change depending on a task performed by the robot. A travel distance to a destination point at which the robot arrives varies depending on a point from which the robot departs.

[48] Therefore, a system is needed that allows the robot to determine a starting point from which the robot may move most efficiently to perform a task.

[49]

[50] To achieve the above object, the simulation unit 100 may perform movement simulation of a robot assigned a task. That is, the simulation unit may receive information about a plan for product production, parts required for product production, inventory of parts, and the like from an APS system 11, an ERP system 12, and a HALO system 13, and allocate a task to the robot.

[51] Also, the simulation unit 100 may implement a virtual space identical to a smart factory existing in reality, and perform simulation of performing a task allocated to the robot. When the simulation is completed, a simulation result is calculated, and the simulation result may include information such as UPH (Unit Per Hour), time required to complete all tasks, operation time of the robot, operation rate of the robot, and waiting time of the robot.

[52] Meanwhile, the data analysis unit 500 may receive a simulation result from the simulation unit, determine whether starting point change of the robot is required based on a travel distance of the robot, and confirm the starting point of the robot.

- [53] That is, the data analysis unit 500 may determine whether starting point change of the robot is required or starting point change of the robot is not required according to the travel distance of the robot, and in a case where starting point change of the robot is not required, may confirm the starting point of the robot.
- [54] In a case where the data analysis unit 500 determines that starting point change of the robot is required, the starting point changing unit 300 searches for a possible starting point of the robot, changes the starting point of the robot, and delivers the changed starting point of the robot to the simulation unit 100.
- [55] And, the simulation unit 100 performs simulation again based on data with the changed starting point and delivers the simulation result to the data analysis unit 500, and the data analysis unit 500 may determine again whether starting point change of the robot is not required based thereon.
- [56]
- [57] FIG. 2 is a simplified illustration of the inside of a smart factory, and FIG. 3 illustrates a product production schedule in the smart factory. The present invention will be described in more detail with reference to FIGS. 2 and 3.
- [58] Robots for performing tasks in the smart factory may be plural, and types of tasks performed in the smart factory may also be plural. For example, types of tasks that may be performed in the smart factory may be three types (TE, CM, FD tasks), and a total of 5 robots may be operated to perform the three types of tasks in the smart factory.
- [59] Since there may be various types of tasks, the starting point changing unit 300 searches for task-specific possible starting points of the robot. That is, referring to FIG. 3, it is possible to search for a possible starting point of a robot performing a TE task, a possible starting point of a

robot performing a CM task, and a possible starting point of a robot performing an FD task. And, the starting point changing unit may change the starting point of the robot for the corresponding task to one of the searched points according to a command of the data analysis unit 500.

- [60] Also, the data analysis unit 500 may also confirm task-specific starting points of the robot.
- [61] For example, in tasks No. 1 to 6, there are robots performing each task, and since each robot needs information about a starting point when performing each task, task-specific starting points of the robot should be confirmed.
- [62] Assuming that a starting point of a robot performing a CM task, which is task No. 2, is determined, the starting point changing unit 300 may search for a possible starting point of a robot performing the CM task.
- [63] When one of the searched points is selected and delivered to the simulation unit 100, the simulation unit 100 performs simulation reflecting this and delivers the simulation result to the data analysis unit 500, and the data analysis unit 500 determines whether starting point change for the CM task is required.
- [64] Referring to FIG. 3, at a time when task No. 2 is in progress, task No. 4, which is a TE task, may be in progress at the same time. However, the simulation unit may determine a starting point for task No. 4 after confirming a starting point for task No. 2.
- [65] That is, if a starting point of the robot for the CM task is before being confirmed, the starting point of the robot for the CM task may be changed, but the starting point of the robot for the TE task is not changed. And, until the starting point of the robot for the CM task is confirmed, the starting point is controlled so that simulation is performed at starting point a.

- [66] After the starting point of the robot for the CM task is confirmed as y' , in a state where the starting point of the robot for the CM task is fixed as y' , a task for confirming the starting point for the TE task may be performed in the same manner as performed for the CM task.
- [67] Through a series of processes as above, according to the present invention, task-specific starting points of the robot may be sequentially confirmed. That is, if there are 100 tasks to be performed, starting points for 100 tasks may be sequentially confirmed.
- [68]
- [69] The data analysis unit 500 receives the simulation result and calculates task-specific travel distances of the robot, and thereby determines whether starting point change of the robot for the corresponding task is required. This will be described in detail with reference to FIG. 4.
- [70] As a specific example, assume that the data analysis unit 500 has determined that change of starting point x is required for the CM task, which is task No. 2, and the starting point changing unit 300 has changed the starting point to starting point y for the CM task.
- [71] As a result of simulation, in a case where travel distance is calculated as 7 when changing to starting point y , and as a result of previous simulation with starting point x , travel distance is calculated as 6, the data analysis unit 500 determines that starting point change of the robot performing the corresponding task is not required, and may confirm the starting point of the robot performing the corresponding task as the previous starting point, that is, starting point x .
- [72] If, as a result of simulation, travel distance is calculated as 5 when changing to starting point y' , and as a result of previous simulation with starting point x , travel distance is calculated as 6, the data analysis unit 500 may determine

that starting point change of the robot performing the corresponding task is required.

- [73] If, as a result of simulation, travel distance is calculated as 6 when changing to starting point y'' , and as a result of previous simulation with starting point x , travel distance is calculated as 6, the data analysis unit 500 may also determine that starting point change of the robot performing the corresponding task is required.
- [74] That is, by comparing task-specific travel distances of the robot according to the current simulation result and the previous simulation result, in a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result, it may be determined that starting point change of the robot performing the corresponding task is required.
- [75] Conversely, by comparing task-specific travel distances of the robot according to the current simulation result and the previous simulation result, in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result, starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task may be confirmed as the previous starting point.
- [76] Therefore, in a case where travel distance is calculated as 5 or 6 when changing to starting point y' or y'' , and as a result of previous simulation with starting point x , travel distance is calculated as 6, the data analysis unit 500 determines that starting point change of the robot performing the corresponding task is required, and the starting point changing unit 300 may change the starting point of the robot performing the corresponding task to starting point z . And,

the simulation unit performs simulation reflecting starting point z , and delivers the simulation result to the data analysis unit 500.

[77] The data analysis unit determines whether starting point change is required again by comparing the previous simulation result with starting point y' and the current simulation result with starting point z .

[78] As a result of previous simulation, that is, if travel distance was 5 at starting point y' , and as a result of current simulation, that is, if travel distance is calculated as 6 at starting point z , the data analysis unit 500 determines that starting point change is not required, and may confirm the starting point of the robot performing the corresponding task as the previous starting point, that is, starting point y' .

[79]

[80] Meanwhile, the simulation unit 100 may implement a possible movement path of the robot in a smart factory (production factory) through a plurality of nodes. The simulation unit 100 may implement a possible movement path of the robot through a plurality of nodes as shown in FIG. 2, and the starting point changing unit 300 may search for a possible starting point of the robot based on the plurality of nodes implemented by the simulation unit 100.

[81] Specifically, the starting point changing unit 300 may search for a possible starting point by sequentially searching remaining nodes from a node corresponding to an initial start position of the robot among the plurality of nodes. For example, the starting point changing unit 300 changes a search direction following one of a clockwise direction and a counterclockwise direction at each search of each node, and in a case where a node to be searched next according to the

change of the search direction is a previously searched node, may maintain a current search direction.

- [82] For example, the starting point changing unit 300 may search for a possible starting point of the robot in the order of north, east, south, and west following a clockwise direction, and when searching for a possible node in the order of north, east, south, and west, it has a search order as shown in FIG. 5, and through this, it is possible to search for all possible nodes without missing any.
- [83] Specifically, nodes are searched in the order of north, east, south, and west, but in a case where a node is a previously searched node, proceeding one more step in the same direction to search nodes, so that nodes may be searched in a spiral shape.
- [84] In a case where it is determined by the data analysis unit 500 that starting point change of the robot for an arbitrary task is required, the starting point changing unit 300 may arbitrarily select one of the searched possible nodes and transmit it to the simulation unit 100, and the simulation unit 100 may perform simulation reflecting this.
- [85]
- [86] Meanwhile, in order for the data analysis unit 500 to compare task-specific travel distances by the current simulation and the previous simulation, initial data is needed. For this, the path search system for robot may further include a starting point setting unit 700 setting an initial starting point of the robot.
- [87] The starting point setting unit 700 may arbitrarily set task-specific initial starting points of the robot, or an administrator may input task-specific initial starting points of the robot to the starting point setting unit 700.

- [88] That is, referring to FIG. 2, it may be seen that an initial starting point for the TE task is selected as a, and it may be seen that an initial starting point for the CM task is selected as x.
- [89] When task-specific initial starting points of the robot are selected, the simulation unit 100 delivers a simulation result based on task-specific initial starting points of the robot to the data analysis unit 500, and the data analysis unit 500 may calculate task-specific travel distances of the robot based on the simulation result and generate initial comparison data.
- [90] Thereafter, the starting point changing unit 300 selects one of the searched possible nodes and delivers it to the simulation unit 100, and the data analysis unit 500 may compare the calculated travel distance with the initial comparison data by receiving the simulation result from the simulation unit 100.
- [91] In a case where the calculated travel distance is shorter than or equal to the initial comparison data, it may be determined that starting point change of the robot performing the corresponding task is required.
- [92] In a case where the calculated travel distance is longer than the initial comparison data, it is determined that starting point change of the robot performing the corresponding task is not required.
- [93] In a case where the calculated travel distance is shorter than or equal to the initial comparison data and it is determined that starting point change of the robot performing the corresponding task is required, the starting point changing unit 300 changes the starting point of the robot and delivers it to the simulation unit 100.

- [94] And, the simulation unit 100 performs simulation with the changed starting point and delivers the simulation result to the data analysis unit 500.
- [95] Thereafter, the data analysis unit 500 compares the current simulation result with the previous simulation result, and in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result, starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task may be confirmed as the previous starting point.
- [96] In a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result, it may be determined that starting point change of the robot performing the corresponding task is required.
- [97]
- [98] Through such a series of processes, the path search system for robot according to the present invention may search for task-specific efficient movement paths of the robot.
- [99]
- [100] Meanwhile, the path search system for robot may further include a robot control system 900 controlling and operating movement of the robot in a production factory.
- [101] The data analysis unit 500 confirms task-specific starting points of the robot and delivers them to the simulation unit 100, and when starting points of the robot for all tasks are confirmed, the simulation unit 100 may deliver task-specific starting points of the robot to the robot control system 900.

[102] And, the robot control system 900 reflects task-specific starting points of the robot received from the simulation unit 100, so that the robot may move efficiently for each task as the simulation was performed.

[103]

[104] FIG. 6 is a flowchart of a path search method for robot according to an embodiment of the present invention.

[105] The path search method for robot according to the present invention includes performing, by a simulation unit, movement simulation of a robot assigned a task in step S101; receiving, by a data analysis unit, a simulation result from the simulation unit, and determining whether starting point change of the robot is required based on a travel distance of the robot in step S102; and in a case where it is determined that starting point change of the robot is required, changing, by a starting point changing unit, a starting point of the robot and delivering the changed starting point of the robot to the simulation unit in step S104.

[106] Specifically, in the determining whether starting point change of the robot is required in step S102, the data analysis unit calculates task-specific travel distances of the robot, and compares task-specific travel distances of the robot according to a current simulation result and a previous simulation result.

[107] If the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result, it is determined that starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task may be confirmed as the previous starting point in step S105.

[108] If the travel distance of the robot according to the current simulation result is shorter than or equal to the

travel distance of the robot according to the previous simulation result, it is determined that starting point change of the robot performing the corresponding task is required, and the starting point for the corresponding task is changed by the starting point changing unit in step S103.

[109] If a starting point for one task is confirmed, the simulation unit performs movement simulation for another task, and by repeating the above process, starting points for all tasks may be confirmed.

[110] The starting point changing unit may search for task-specific possible starting points of the robot, and the data analysis unit determines task-specific whether starting point change of the robot is required and confirms task-specific starting points of the robot.

[111] When starting points of the robot for all tasks are confirmed, the simulation unit transmits information thereon to the robot control system, so that the robot may move efficiently.

[112]

[113] Although the present invention has been shown and described with respect to specific embodiments, it will be apparent to those of ordinary skill in the art that the present invention may be variously improved and changed without departing from the technical idea of the present invention provided by the following claims.

[114]

[115] [Description of Reference Numerals]

[116] 100 : simulation unit

[117] 300 : starting point changing unit

[118] 500 : data analysis unit

[119] 700 : starting point setting unit

[120] 900 : robot control system

CLAIMS

[Claim 1]

A path search system for robot, comprising:

a simulation unit performing movement simulation of a robot assigned a task;

a starting point changing unit searching for a possible starting point of the robot, changing a starting point of the robot, and delivering the changed starting point of the robot to the simulation unit; and

a data analysis unit receiving a simulation result from the simulation unit, determining whether starting point change of the robot is required based on a travel distance of the robot, and confirming the starting point of the robot.

[Claim 2]

The path search system for robot of claim 1, wherein the starting point changing unit searches for task-specific possible starting points of the robot, and

the data analysis unit confirms task-specific starting points of the robot.

[Claim 3]

The path search system for robot of claim 1, wherein the data analysis unit calculates task-specific travel distances of the robot, compares task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and

in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result,

starting point change of the robot performing the corresponding task is not required, and the starting point of the

robot performing the corresponding task is confirmed as the previous starting point.

[Claim 4]

The path search system for robot of claim 1, wherein the data analysis unit calculates task-specific travel distances of the robot, compares task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and

in a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result,

determines that starting point change of the robot performing the corresponding task is required.

[Claim 5]

The path search system for robot of claim 1, wherein the simulation unit implements a possible movement path of the robot in a production factory through a plurality of nodes, and

the starting point changing unit searches for a possible starting point of the robot based on the plurality of nodes implemented by the simulation unit.

[Claim 6]

The path search system for robot of claim 5, wherein the starting point changing unit searches for a possible starting point by sequentially searching remaining nodes from a node corresponding to an initial start position of the robot among the plurality of nodes, changes a search direction following one of a clockwise direction and a counterclockwise direction at each search of each node, and maintains a current search direction in a case where a node to be searched next according to the change of the search direction is a previously searched node.

[Claim 7]

The path search system for robot of claim 1, further comprising:

a starting point setting unit setting an initial starting point of the robot,

wherein the simulation unit delivers the simulation result based on the initial starting point of the robot set by the starting point setting unit to the data analysis unit, and

the data analysis unit calculates task-specific travel distances of the robot based on the simulation result and generates initial comparison data.

[Claim 8]

The path search system for robot of claim 7, wherein the data analysis unit calculates task-specific travel distances of the robot, and

in a case where the calculated travel distance is shorter than or equal to the initial comparison data by comparing the calculated travel distance with the initial comparison data,

determines that starting point change of the robot performing the corresponding task is required.

[Claim 9]

The path search system for robot of claim 8, wherein in a case where it is determined that starting point change of the robot performing the corresponding task is required,

the starting point changing unit changes the starting point of the robot and delivers the changed starting point to the simulation unit,

the simulation unit performs simulation with the changed starting point and delivers the simulation result to the data analysis unit, and

the data analysis unit compares the current simulation result with the previous simulation result, and

in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result,

starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task is confirmed as the previous starting point.

[Claim 10]

The path search system for robot of claim 8, wherein in a case where it is determined that starting point change of the robot performing the corresponding task is required,

the starting point changing unit changes the starting point of the robot and delivers the changed starting point to the simulation unit,

the simulation unit performs simulation with the changed starting point and delivers the simulation result to the data analysis unit, and

the data analysis unit compares the current simulation result with the previous simulation result, and

in a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result,

determines that starting point change of the robot performing the corresponding task is required.

[Claim 11]

The path search system for robot of claim 1, further comprising:

a robot control system controlling and operating movement of the robot in a production factory,

wherein the data analysis unit confirms task-specific starting points of the robot and delivers the confirmed starting points to the simulation unit, and

when starting points of the robot for all tasks are confirmed, the simulation unit delivers task-specific starting points of the robot to the robot control system.

[Claim 12]

A path search method for robot, comprising:

performing, by a simulation unit, movement simulation of a robot assigned a task;

receiving, by a data analysis unit, a simulation result from the simulation unit, and determining whether starting point change of the robot is required based on a travel distance of the robot; and

in a case where it is determined that starting point change of the robot is required, changing, by a starting point changing unit, a starting point of the robot and delivering the changed starting point of the robot to the simulation unit.

[Claim 13]

The path search method for robot of claim 12, wherein the data analysis unit determines, on a task-specific basis, whether starting point change of the robot is required, and

the starting point changing unit searches for task-specific possible starting points of the robot.

[Claim 14]

The path search method for robot of claim 12, wherein the determining whether starting point change of the robot is required comprises:

the data analysis unit calculating task-specific travel distances of the robot, comparing task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and

in a case where the travel distance of the robot according to the current simulation result is longer than the travel distance of the robot according to the previous simulation result,

starting point change of the robot performing the corresponding task is not required, and the starting point of the robot performing the corresponding task is confirmed as the previous starting point.

[Claim 15]

The path search method for robot of claim 12, wherein the determining whether starting point change of the robot is required comprises:

the data analysis unit calculating task-specific travel distances of the robot, comparing task-specific travel distances of the robot according to a current simulation result and a previous simulation result, and

in a case where the travel distance of the robot according to the current simulation result is shorter than or equal to the travel distance of the robot according to the previous simulation result,

determining that starting point change of the robot performing the corresponding task is required.