

DESCRIPTION

Invention Title: VEHICLE PRODUCTION SYSTEM AND CONTROL METHOD OF VEHICLE PRODUCTION SYSTEM

Technical Field

- [1] The present invention relates to a vehicle production system and a control method of a vehicle production system, and more particularly, to an invention applicable to a smart factory for producing a vehicle.

[2]

Background Art

- [3] In general factories or logistics warehouses, as well as in smart factories that manufacture products of different specifications using various components, smart logistics vehicles are being introduced for flexible and efficient supply and transfer of components.
- [4] The smart logistics vehicle is a concept collectively referring to an autonomous mobile robot (AMR: Autonomous Mobile Robot), an automated guided vehicle (AGV: Automated Guided Vehicle), an unmanned forklift, and the like, and such smart logistics vehicles may perform movement and work according to control of a system.
- [5] Meanwhile, the smart logistics vehicle transfers components loaded on a pallet to a place where a process is performed in the smart factory, and the smart logistics vehicle is called to the place where the process is performed in the smart factory when the components are needed.
- [6] When only one smart logistics vehicle is considered, using a path that becomes a shortest distance to move to a called place is the most efficient movement path, but when all smart

logistics vehicles are considered, if all smart logistics vehicles move in the shortest distance, a bottleneck phenomenon in which smart logistics vehicles simultaneously rush to a specific point occurs, and delay occurs in logistics transfer.

[7] Therefore, a system capable of improving vehicle production efficiency by optimizing the movement paths of all smart logistics vehicles is required.

[8]

[9] 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 admission that they correspond to prior art already known to a person having ordinary skill in the art.

[10]

Disclosure

Technical Problem

[11] The present invention is proposed to solve these problems, and an object thereof is to provide a vehicle production system capable of improving vehicle production efficiency by optimizing the movement paths of all smart logistics vehicles.

[12]

Technical Solution

[13] A vehicle production system for managing a movement path of a logistics robot transporting components to each of multiple work spots of a smart factory, comprising: a path search unit configured to calculate and store multiple available movement paths of the logistics robot based on a departure point and a destination point of the logistics robot transporting vehicle components in the smart factory; a path analysis unit configured to derive and store an alternative path of the

logistics robot through a movement distance according to the available movement paths of the logistics robot stored in the path search unit or a degree of path overlapping between logistics robots; and a path management unit configured to perform a component transfer simulation according to the alternative path of the path analysis unit, and calculate a final path of the logistics robot in consideration of a required time for component transfer.

- [14] The path search unit may implement the available movement path of the logistics robot in the smart factory through connection between nodes by multiple nodes and a matrix.
- [15] The path search unit may select the departure point and the destination point of the logistics robot and search and store a path from the departure point to the destination point through DFS.
- [16] The system may further comprise a production scheduling system in which a work schedule for producing a vehicle is stored, and information on the work schedule may include a work name, a work time, and a departure point and a destination point of the logistics robot for each work.
- [17] The path search unit may receive the work schedule from the production scheduling system, and store multiple available movement paths of the logistics robot corresponding to the work name.
- [18] The system may further comprise a production scheduling system in which a work schedule for producing a vehicle is stored, and the path analysis unit may receive the work schedule from the production scheduling system, group works performed at a same time, and calculate a degree of path overlapping between logistics robots performing grouped works by selecting one or more of the available movement paths of the logistics robot stored in the path search unit.

- [19] The path analysis unit may calculate the degree of path overlapping between the logistics robots by mapping the work schedule received from the production scheduling system and the available movement path of the logistics robot performing the grouped works.
- [20] The path analysis unit may determine the alternative path in order of a minimum movement distance or a minimum degree of overlapping of the logistics robot performing the grouped works, and select and store the alternative paths up to a predetermined number.
- [21] Multiple alternative paths for works performed at the same time may be stored in the path analysis unit, and the path management unit may receive the multiple alternative paths from the path analysis unit, perform the component transfer simulation on the multiple alternative paths, and derive the final path at which the required time for component transfer becomes minimum.
- [22]
- [23] A control method of a vehicle production system for managing a movement path of a logistics robot transporting components to each of multiple work spots of a smart factory, comprising: calculating and storing, by a path search unit, multiple available movement paths of the logistics robot based on a departure point and a destination point of the logistics robot transporting vehicle components in the smart factory; deriving and storing, by a path analysis unit, an alternative path of the logistics robot through a movement distance according to the available movement paths of the logistics robot stored in the path search unit or a degree of path overlapping between logistics robots; and performing, by a path management unit, a component transfer simulation according to the alternative path of the path analysis unit, and calculating a final path of the logistics robot in consideration of a required time for component transfer.

- [24] In the calculating and storing the available movement paths of the logistics robot, the available movement paths of the logistics robot corresponding to a work name may be stored.
- [25] The deriving and storing the alternative path may comprise: receiving a work schedule from a production scheduling system and grouping works performed at a same time; calculating a degree of path overlapping between logistics robots performing grouped works by selecting one or more of the available movement paths of the logistics robot stored in the path search unit; determining, by the path analysis unit, the alternative path in order of a minimum movement distance or a minimum degree of path overlapping between the logistics robots performing the grouped works; and selecting and storing the alternative paths up to a predetermined number.
- [26] In the calculating the degree of path overlapping between the logistics robots performing the grouped works, the degree of path overlapping between the logistics robots may be calculated by mapping the work schedule received from the production scheduling system and the available movement path of the logistics robot performing the grouped works.
- [27] In the deriving and storing the alternative path, multiple alternative paths for the grouped works performed at the same time may be stored, and the calculating the final path of the logistics robot may comprise: performing a component transfer simulation on the alternative paths stored in the path analysis unit; and deriving the final path at which the required time for component transfer becomes minimum as a result of the component transfer simulation.
- [28] The component transfer simulation may be performed one or more times, and as a result of the component transfer simulation, the final path at which an average value of the required time for component transfer becomes minimum may be derived.

[29]

Advantageous Effects

[30] According to the vehicle production system and the control method of the vehicle production system of the present invention, there is an effect that vehicle production efficiency may be improved because the movement paths of all smart logistics vehicles may be optimized.

[31]

Description of Drawings

[32] FIG. 1 schematically shows a part of an interior of a smart factory.

[33] FIG. 2 is for explaining a reason why a control method of a conventional logistics robot causes inefficiency.

[34] FIG. 3 is a configuration diagram of a vehicle production system according to an embodiment of the present invention.

[35] FIG. 4 is for explaining DFS.

[36] FIG. 5 is for explaining a work schedule of a production scheduling system.

[37] FIG. 6 is for explaining that the path search unit matches and stores a searched available movement path with the work schedule.

[38] FIGS. 7 and 8 show a component transport path for a TE work and a CM work performed at the same time and an overlapping node where logistics robots overlap.

[39] FIG. 9 is for explaining selection of an alternative path of the path analysis unit.

[40] FIG. 10 is for explaining derivation of a final path of the path management unit.

[41] FIGS. 11 to 13 are flowcharts of a control method of a vehicle production system according to an embodiment of the present invention.

[42]

Mode for Disclosure

[43] Hereinafter, embodiments disclosed in the present specification will be described in detail with reference to the accompanying drawings, and the same or similar components are assigned the same predetermined numbers regardless of drawing symbols, and redundant descriptions thereof will be omitted.

[44] In describing the embodiments disclosed in the present specification, when it is determined that a detailed description of related known technology may obscure the gist of the embodiments disclosed in the present specification, the detailed description will be omitted. In addition, the accompanying drawings are only for easy understanding of the embodiments disclosed in the present specification, and the technical idea disclosed in the present specification is not limited by the accompanying drawings, and it should be understood to include all changes, equivalents, and substitutes included in the spirit and technical scope of the present invention.

[45] 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.

[46] The singular expression includes the plural expression unless the context clearly dictates otherwise.

[47] In the present specification, terms such as "comprises" or "has" are intended to designate that features, numbers, steps,

operations, components, parts, or combinations thereof described in the specification exist, and it should be understood that they do not preclude the existence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[48] Hereinafter, among the configurations of the present invention to be described, a communication device configured to communicate with another controller or sensor for control of functions handled by the path search unit, the path analysis unit, the path management unit, and the production scheduling system, a memory configured to store an operating system, logic instructions, input and output information, and the like, and one or more processors configured to perform determinations, calculations, decisions, and the like necessary for control of the handled functions may be included.

[49] In addition, the logistics robot below is used as a concept collectively referring to a smart logistics vehicle, such as an Autonomous Mobile Robot (AMR: Autonomous Mobile Robot), an Automated Guided Vehicle (AGV: Automated Guided Vehicle), and an unmanned forklift.

[50]

[51] FIG. 1 schematically shows a part of an interior of a smart factory 100, and referring to FIG. 1, a work spot 130 where a process necessary for vehicle production is performed exists inside the smart factory 100. The logistics robot transfers components necessary for the vehicle production to the work spot 130 according to a type of the process necessary for the vehicle production.

[52] To explain a specific component transfer procedure, the necessary components are loaded on a pallet, and the logistics robot may support and lift a lower point of the pallet on which the components are loaded to move the pallet to the work spot.

- [53] That is, when the logistics robot is called, the logistics robot moves to a place where the components are loaded on the pallet, lifts the pallet on which the components are loaded, and moves this to the work spot 130 again.
- [54]
- [55] FIG. 2 is for explaining a reason why a control method of a conventional logistics robot causes inefficiency. Referring to FIG. 2, the logistics robot may transport components to the work spot where TE work, CM work, and FD work are performed. The logistics robot transporting components necessary for the TE work, the CM work, and the FD work may be five or more for each work, and each logistics robot is set to have a minimum movement distance. The logistics robot in charge of transporting components necessary for the TE work moves from a position of ①, the logistics robot in charge of transporting components necessary for the CM work moves from a position of ②, and the logistics robot in charge of transporting components necessary for the FD work moves from a position of ③ to each called place (as will be described later, a departure point, a destination point, and a movement path of the logistics robot may be expressed as nodes). In addition, each of the positions ①, ②, and ③ may be a place where a pallet on which components necessary for each work are loaded is located.
- [56] The logistics robot transporting the components necessary for the FD work does not have a point overlapping with other overlapping logistics robots, but the logistics robots transporting the components necessary for the TE work and the CM work have a point overlapping each other.
- [57] When the logistics robots overlap, a movement speed of the logistics robots may be lowered, or when multiple logistics robots overlap at one point, a manager may also turn off a

power of the logistics robots and readjust the positions of the logistics robots again.

[58] That is, even if each logistics robot is set to have the minimum movement distance, when considering an entire work, inefficiency in component transport may be caused by multiple overlappings between the logistics robots.

[59]

[60] The present invention may provide a vehicle production system capable of minimizing a component transport delay by calculating a movement path of the logistics robot in consideration of movement of the entire logistics robot.

[61] FIG. 3 is a configuration diagram of a vehicle production system according to an embodiment of the present invention. Referring to FIG. 3, the vehicle production system according to an embodiment of the present invention includes a path search unit 400, a path analysis unit 500, and a path management unit 600.

[62] To explain functions of each configuration, the path search unit 400 calculates and stores multiple available movement paths of the logistics robot based on a departure point and a destination point of the logistics robot transporting vehicle components in the smart factory 100.

[63] The path analysis unit 500 derives and stores an alternative path of the logistics robot through a movement distance according to the available movement paths of the logistics robot stored in the path search unit 400 or a degree of path overlapping between logistics robots.

[64] The path management unit 600 performs a component transfer simulation according to the alternative path of the path analysis unit 500, and calculates a final path of the logistics robot in consideration of a required time for component transfer.

- [65] Specifically, the functions of each configuration are described.
- [66] The path search unit 400 calculates and stores the available movement path in the smart factory 100. Specifically, the path search unit 400 may implement the interior of the smart factory 100 in a simplified manner through connection between nodes by multiple nodes and a matrix, and the available movement path may be expressed by nodes.
- [67] When the departure point and the destination point of the logistics robot are selected by the nodes implemented in this way, the path search unit 400 may search and store a path from the departure point to the destination point through DFS.
- [68] The path search unit 400 performs path search based on a recursive function through DFS, and may store all paths moving from the departure point to the destination point.
- [69] Referring to FIG. 4, to explain this, a layout of the smart factory 100 for searching the available movement path may be implemented with a grid structure of 1m X 1m, and the logistics robot may move around nodes of each intersection.
- [70] For example, for the TE work, the logistics robot departs from a node 1 and the node 1 becomes the departure point, and is called to a node 12 and the node 12 becomes the destination point. Between the nodes, some nodes may be unavailable due to reasons such as products being loaded or other work spots being located, and serial numbers are not assigned to these nodes.
- [71] A method of searching the available movement path by DFS is as follows.
- [72] First, a movement priority of the logistics robot may be defined. For example, if the logistics robot has a movement priority in order of north, east, south, and west, visit processing is performed at a visited node.

- [73] The logistics robot performs visit processing on the node 1, which is the departure point. Thereafter, movement to the node 2 and the node 3 is possible, but according to the movement priority, the node 2 is visited, and visit processing is performed. A node that can move from the node 2 is only the node 4, and the node 4 is visited, and visit processing is performed. Similarly, a node that can move from the node 4 is only the node 5, so the node 5 is visited, and visit processing is performed. A process of moving from the node 5 to the node 7 and then to the node 10 is also the same.
- [74] After visit processing is performed on the node 10, nodes that can move are the node 8 and the node 12. According to the movement priority, the node 8 is visited, and visit processing is performed. Since the node 10 has already been visited, the logistics robot moves to the node 11, and from the node 11, the logistics robot moves to the node 12 and performs visit processing, and performs next path search.
- [75] In this way, by using a recursive function, all cases of moving from the node 1 to the node 12 may be searched and stored. A movement path may be stored as a number of the node in the path search unit 400, and the above example is stored as 1, 2, 4, 5, 7, 10, 8, 11, 12, and meanwhile, the movement distance may be stored as 8.
- [76] The movement distance may be stored in real-time with a distance moved to the arrival node when visiting each node, or may be stored by batch processing by searching the passed node when arriving at a destination.
- [77] Furthermore, all paths departing from an n-th node and arriving at an m-th node may be searched and stored. As all paths are stored in this way, alternative path calculation based on nodes is enabled, and there is an advantage that even if the departure node and the destination node of the logistics robot are changed, a flexible response is possible.

[78]

[79] Meanwhile, the vehicle production system according to the present invention may further include a production scheduling system (APS: Advanced Planning and Scheduling) 300 in which a work schedule for producing a vehicle is stored, and the path search unit 400 may receive information on the work schedule from the production scheduling system 300.

[80] Specifically, referring to FIG. 5, the information on the work schedule may include a work name, a work time, and a departure point and a destination point of the logistics robot for each work.

[81] The path search unit 400 may receive the information on the work schedule from the production scheduling system 300, and store multiple available movement paths of the logistics robot corresponding to the work name through the work name, the work time, and the departure point and the destination point.

[82] Referring to FIG. 6, the path search unit 400 may match the received work schedule and the available movement path, and store the available movement path corresponding to the work name.

[83] For example, since component transport for the TE work starting at 09:00 departs from the node 1 and arrives at the node 15, the available movement path departing from the node 1 and arriving at the node 15 among the searched paths may be matched and stored with the TE work.

[84] In addition, since component transport for the CM work starting at 09:00 departs from the node 3 and arrives at the node 22, the available movement path departing from the node 3 and arriving at the node 22 among the searched paths may be matched and stored with the CM work.

- [85] Accordingly, multiple available movement paths exist in the TE work and the CM work.
- [86]
- [87] Meanwhile, the path analysis unit 500 is a configuration for calculating an alternative path with a low degree of overlapping through a degree of overlapping of nodes that may occur while the logistics robots move among the available movement paths searched and stored in the path search unit 400.
- [88] Here, overlapping means that a start order of the available movement path and positions of two consecutive nodes are the same.
- [89] In order to analyze the path searched in the path search unit 400, the path search unit 400 may transmit the stored available movement path to the path analysis unit 500.
- [90] Thereafter, the path analysis unit 500 may calculate a degree of overlapping that may occur while the logistics robots move as shown in FIGS. 7 and 8. FIGS. 7 and 8 show a component transport path for the TE work and the CM work performed at the same time and an overlapping node where logistics robots overlap.
- [91] First, to explain that the path search unit 400 determines the degree of overlapping with reference to FIG. 7, when comparing overlapping of a path a among component transport paths for the TE work and a path b among component transport paths for the CM work, it may be determined that there are a total of five overlapping nodes.
- [92] That is, when selecting the path a for the TE work and the path b for the CM work, a number of nodes where the logistics robots overlap at the same time is five. At this time, it can be known that a movement distance of the path a is 7, a

movement distance of the path b is 8, and a total movement distance is 15.

- [93] In addition, referring to FIG. 8, when comparing overlapping of a path c among component transport paths for the TE work and a path d among component transport paths for the CM work, it may be determined that there are a total of zero overlapping nodes. In addition, it can be known that a movement distance of the path c is 5, a movement distance of the path d is 8, and a total movement distance is 13.
- [94] Comparing FIGS. 7 and 8, it can be known that selecting the paths c and d rather than the paths a and b for component transport for the TE work and the CM work performed at the same time is efficient in terms of the degree of overlapping and the movement distance.
- [95] Referring to FIG. 9, the path analysis unit 500 may compare all component transfer paths for works to be performed through mapping, calculate the degree of overlapping and the movement distance, and through this, derive an alternative path.
- [96] Specifically, since there are a total of 10 paths for performing the TE work, and there are a total of 20 paths for performing the CM work, a total of 200 paths may be derived by combining them, and the path analysis unit may derive an alternative path through the degree of overlapping and the movement distance for the 200 paths.
- [97]
- [98] Meanwhile, the path analysis unit 500 receives the work schedule from the production scheduling system 300, groups works performed at the same time, and performs the above work. That is, referring to FIG. 5, the path analysis unit 500 groups component transport for the TE work and the CM work for the first vehicle starting at the same time (xx:xx). In addition, component transport for the FE work of the first vehicle and the TE work of the second vehicle starting at the

same time (yy:yy) is grouped. In addition, component transport for the CM work and the FE work of the second vehicle starting at the same time (zz:zz) is grouped.

[99] For example, the path analysis unit 500 divides and groups the work received from the production scheduling system 300 in 30-minute units, and calculates the degree of overlapping in the work performed within the group.

[100] As described above, through the path corresponding to the work name, the path analysis unit 500 may calculate the degree of path overlapping and the movement distance between the logistics robots performing the grouped work through mapping.

[101] That is, the path analysis unit 500 may calculate the degree of path overlapping between the logistics robots by mapping the work schedule received from the production scheduling system 300 and the available movement path of the logistics robot performing the grouped work, and based on this, derive an alternative path.

[102] Meanwhile, the path analysis unit 500 determines the alternative path in order of a minimum movement distance or a minimum degree of overlapping of the logistics robot performing the grouped work. The alternative path may be determined in order of a low degree of overlapping of the logistics robot, and if the degree of overlapping of the logistics robot is the same, the alternative path may be determined in order of a low movement distance.

[103] The path analysis unit 500 may select and store alternative paths up to a predetermined number for selecting an alternative path to be transmitted to the path management unit 600 to be described later, and the predetermined number may be 20 or less.

[104]

- [105] The path management unit 600 performs a component transfer simulation on the alternative path stored in the path analysis unit 500. That is, the path management unit 600 may evaluate the alternative path through simulation, and as a result of the simulation, that is, derive a path at which the required time for component transfer becomes minimum as the final path.
- [106] Specifically, referring to FIG. 10, when the component transfer simulation is performed according to the existing path, the required time is 3 hours and 49 minutes, and when the component transfer simulation is performed on the alternative path 1, the required time is 3 hours and 20 minutes. Since the required time of the alternative path 1 is shorter than the alternative paths 2 to 20, the path management unit 600 may derive the alternative path 1 as the final path.
- [107] At this time, the component transfer simulation is performed one or more times, and as a result of the component transfer simulation, the alternative path at which an average value of the required time for component transfer becomes minimum may be derived as the final path.
- [108] However, a user may access the path management unit 600 and arbitrarily change the final path. That is, since there may be a difference between a result of the component transfer simulation and a result after actual application, the user may arbitrarily access the path management unit to allow component transfer to be performed through another alternative path.
- [109] When the final path is derived, the path management unit 600 may transmit the final path to a control system configured to control and drive the logistics robot.
- [110]

[111] FIGS. 11 to 13 are flowcharts of a control method of a vehicle production system according to an embodiment of the present invention. Referring to FIGS. 11 to 13, the control method of the vehicle production system of the present invention includes a step in which the path search unit 400 calculates and stores multiple available movement paths of the logistics robot based on a departure point and a destination point of the logistics robot transporting vehicle components in the smart factory 100 in step S100, a step in which the path analysis unit 500 derives and stores an alternative path of the logistics robot through a movement distance according to the available movement paths of the logistics robot stored in the path search unit 400 or a degree of path overlapping between logistics robots in step S200, and a step in which the path management unit 600 performs a component transfer simulation according to the alternative path of the path analysis unit 500, and calculates a final path of the logistics robot in consideration of a required time for component transfer in step S300.

[112] In the step of calculating and storing the available movement path of the logistics robot in step S100, the available movement path of the logistics robot corresponding to the work name may be stored.

[113] The step of deriving and storing the alternative path in step S200 includes a step of receiving the work schedule from the production scheduling system 300 and grouping works performed at the same time in step S210, a step of selecting one or more of the available movement paths of the logistics robot stored in the path search unit 400 and calculating a degree of path overlapping between the logistics robots performing the grouped works in step S320, a step in which the path analysis unit 500 determines the alternative path in order of a minimum movement distance or a minimum degree of path overlapping between the logistics robots performing the grouped works in step S250, and a step of selecting and

storing the alternative paths up to a predetermined number in step S270.

[114] The step of calculating the degree of path overlapping between the logistics robots performing the grouped works in step S230 may calculate the degree of path overlapping between the logistics robots by mapping the work schedule received from the production scheduling system 300 and the available movement path of the logistics robot performing the grouped work.

[115] In the step of deriving and storing the alternative path in step S250, multiple alternative paths for the grouped works performed at the same time are stored, and the step of calculating the final path of the logistics robot in step S300 may include a step of performing a component transfer simulation on the alternative paths stored in the path analysis unit 500 in step S310, and a step of deriving the final path at which the required time for component transfer becomes minimum as a result of the component transfer simulation in step S330.

[116] Meanwhile, in the step of deriving the final path in step S300, the component transfer simulation may be performed one or more times, and as a result of the component transfer simulation, the final path at which an average value of the required time for component transfer becomes minimum may be derived.

[117]

[118] According to the present invention, in case of some logistics robots, the movement distance may increase, but the component transport path is optimized in movement of the entire logistics robot, so the time required for component transfer may be reduced, and a bottleneck phenomenon may be suppressed, so logistics transfer may be suppressed from being delayed.

[119] In addition, in the existing method, since a path of the logistics robot is written in a code used for programming, a change resource increases when the path of the logistics robot is changed, and code modification must be performed by a professional programmer, but according to the present invention, even if there is a change of a departure node or a change of a destination node, since paths for all departure and destination nodes are searched and stored, there is an advantage that a flexible response to node change is possible.

[120]

[121] Although shown and described in relation to specific embodiments of the present invention, it will be obvious to those of ordinary skill in the art that the present invention may be variously improved and changed within a scope not departing from the technical spirit of the present invention provided by the following claims.

CLAIMS

[Claim 1]

A vehicle production system for managing a movement path of a logistics robot transporting components to each of multiple work spots of a smart factory, the system comprising:

a path search unit configured to determine and store multiple available movement paths of the logistics robot based on a departure point and a destination point of the logistics robot transporting vehicle components in the smart factory;

a path analysis unit configured to derive and store an alternative path of the logistics robot through a movement distance according to the available movement paths of the logistics robot stored in the path search unit or a degree of path overlapping between logistics robots; and

a path management unit configured to perform a component transfer simulation according to the alternative path of the path analysis unit, and determine a final path of the logistics robot in consideration of a required time for component transfer.

[Claim 2]

The vehicle production system of claim 1, wherein the path search unit implements the available movement path of the logistics robot in the smart factory through connection between nodes by multiple nodes and a matrix.

[Claim 3]

The vehicle production system of claim 2, wherein the path search unit selects the departure point and the destination point of the logistics robot and searches and stores a path from the departure point to the destination point through DFS.

[Claim 4]

The vehicle production system of claim 1, further comprising:

a production scheduling system in which a work schedule for producing a vehicle is stored,

wherein information on the work schedule includes a work name, a work time, and a departure point and a destination point of the logistics robot for each work.

[Claim 5]

The vehicle production system of claim 4, wherein the path search unit receives the work schedule from the production scheduling system, and stores multiple available movement paths of the logistics robot corresponding to the work name.

[Claim 6]

The vehicle production system of claim 1, further comprising:

a production scheduling system in which a work schedule for producing a vehicle is stored,

wherein the path analysis unit receives the work schedule from the production scheduling system, groups works performed at a same time, and determines a degree of path overlapping between logistics robots performing grouped works by selecting one or more of the available movement paths of the logistics robot stored in the path search unit.

[Claim 7]

The vehicle production system of claim 6, wherein the path analysis unit determines the degree of path overlapping between the logistics robots by mapping the work schedule received from the production scheduling system and the available movement path of the logistics robot performing the grouped works.

[Claim 8]

The vehicle production system of claim 6, wherein the path analysis unit determines the alternative path in order of a minimum movement distance or a minimum degree of overlapping of the

logistics robot performing the grouped works, and selects and stores the alternative paths up to a predetermined number.

[Claim 9]

The vehicle production system of claim 1, wherein multiple alternative paths for works performed at the same time period are stored in the path analysis unit, and the path management unit receives the multiple alternative paths from the path analysis unit, performs the component transfer simulation on the multiple alternative paths, and derives the final path at which the required time for component transfer becomes minimum.

[Claim 10]

A control method of a vehicle production system for managing a movement path of a logistics robot transporting components to each of multiple work spots of a smart factory, the method comprising:

calculating and storing, by a path search unit, multiple available movement paths of the logistics robot based on a departure point and a destination point of the logistics robot transporting vehicle components in the smart factory;

deriving and storing, by a path analysis unit, an alternative path of the logistics robot through a movement distance according to the available movement paths of the logistics robot stored in the path search unit or a degree of path overlapping between logistics robots; and

performing, by a path management unit, a component transfer simulation according to the alternative path of the path analysis unit, and calculating a final path of the logistics robot in consideration of a required time for component transfer.

[Claim 11]

The control method of claim 10, wherein the calculating and storing the available movement paths of the logistics robot stores

the available movement paths of the logistics robot corresponding to a work name.

[Claim 12]

The control method of claim 10, wherein the deriving and storing the alternative path comprises:

receiving a work schedule from a production scheduling system and grouping works performed at a same time;

calculating a degree of path overlapping between logistics robots performing grouped works by selecting one or more of the available movement paths of the logistics robot stored in the path search unit;

determining, by the path analysis unit, the alternative path in order of a minimum movement distance or a minimum degree of path overlapping between the logistics robots performing the grouped works; and

selecting and storing the alternative paths up to a predetermined number.

[Claim 13]

The control method of claim 12, wherein the calculating the degree of path overlapping between the logistics robots performing the grouped works determines the degree of path overlapping between the logistics robots by mapping the work schedule received from the production scheduling system and the available movement path of the logistics robot performing the grouped works.

[Claim 14]

The control method of claim 10, wherein in the deriving and storing the alternative path, multiple alternative paths for the grouped works performed at the same time period are stored, and

the calculating the final path of the logistics robot comprises:

performing a component transfer simulation on the alternative paths stored in the path analysis unit; and

deriving the final path at which the required time for component transfer becomes minimum as a result of the component transfer simulation.

[Claim 15]

The control method of claim 14, wherein the component transfer simulation is performed one or more times, and as a result of the component transfer simulation, the final path at which an average value of the required time for component transfer becomes minimum is derived.