

controller and the automated guided vehicle, there are wired connection and wireless connection. In the case of a wired remote controller, it is necessary to connect a cord of the remote controller to a connector provided in the automated guided vehicle. In order to prevent the operator from coming into contact with a machine, it is necessary to operate the remote controller from a position away from the machine by a certain distance. However, when the operator is delayed in accompanying the automated guided vehicle, a cord may be caught in the automated guided vehicle, and the remote controller or the connector may be damaged. On the other hand, also when a wireless remote controller is used, it is necessary to connect a receiver necessary for pairing to a connector of the automated guided vehicle. Since the receiver is generally associated with the remote controller on a one-to-one basis, when there is a plurality of automated guided vehicles, it is necessary to prepare the remote controller and the receiver as many as the number of automated guided vehicles. In this way, connector connection is required to connect the remote controller and the automated guided vehicle, and a connector having high waterproofness is required. As described above, there has been a demand for an operation system capable of operating an automated guided vehicle with a simple configuration without using a connector or the like requiring waterproofness. In addition, when the operator operates the automated guided vehicle, it is preferable that the operation is performed after a positional relationship between the operator and the automated guided vehicle is set to an appropriate state, but the operation in consideration of such a positional relationship is disabled simply by connecting the remote controller to the automated guided vehicle.

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[0005] An object of the present invention is to provide an operation system that allows an operator to operate an automated guided vehicle from an appropriate position with a simple configuration.

30 Solution to Problem

[0006] One aspect of the present invention is an automated guided vehicle

operation of the automated guided vehicle based on a display mode of the identification information in the image acquired by the photographing unit. As a result, it is possible to improve safety when the automated guided vehicle is operated.

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Advantageous Effects of Invention

[0013] According to the present invention, there is provided an operation system that allows an operator to operate an automated guided vehicle from an appropriate position with a simple configuration.

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BRIEF DESCRIPTION OF DRAWINGS

[0014] FIG. 1 is a schematic plan view illustrating a state of a container terminal in which an automated guided vehicle operation system according to an embodiment of the present invention is used.

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FIGS. 2A and 2B are schematic side views illustrating a state of the automated guided vehicle in the container terminal illustrated in FIG. 1.

FIGS. 3A and 3B are schematic views illustrating examples of the automated guided vehicle to which identification information is assigned.

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FIG. 4 is a block diagram illustrating a system configuration of the operation system.

FIG. 5 is a diagram illustrating an example of an operation screen of a terminal.

FIGS. 6A to 6D are diagrams illustrating examples of the operation screen of the terminal.

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FIG. 7 is a schematic plan view illustrating a positional relationship between an operator and the automated guided vehicle.

FIGS. 8A and 8B are diagrams illustrating examples of the operation screen of the terminal.

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FIG. 9 is a schematic view illustrating an automated guided vehicle according to a modification.

FIGS. 10A and 10B are schematic views illustrating an automated guided vehicle according to a modification.

FIGS. 11A and 11B are diagrams illustrating examples of patterns of arrangement of marks.

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DESCRIPTION OF EMBODIMENTS

[0015] Hereinafter, embodiments of the present invention will be described in detail with reference to the drawings. In the drawings, the same or equivalent elements are denoted by the same reference numerals, and redundant description will be omitted.

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[0016] FIG. 1 is a schematic plan view illustrating a state of a container terminal in which an operation system 100 of an automated guided vehicle 10 according to an embodiment of the present invention is used. FIGS. 2A and 2B are schematic side views illustrating a state of the automated guided vehicle 10 in the container terminal illustrated in FIG. 1. First, a configuration of the automated guided vehicle 10 and an action mode of the automated guided vehicle 10 in the container terminal will be described with reference to FIGS. 1, 2A, and 2B.

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[0017] As shown in FIG. 1, in a container terminal in a harbor, a plurality of automated guided vehicles (AGV) 10 travels on a predetermined travel route R according to a command S1 from a control tower 101 as an external command unit. The automated guided vehicle 10 receives a command S1 for wirelessly controlling a traveling state of the automated guided vehicle 10 from the control tower 101, and travels on the travel route R. Each automated guided vehicle 10 stops at a loading position of a container W according to the command S1. The position of a crane 103 is controlled by the control tower 101. The crane 103 is moved to the loading position of the container W in a state of suspending the container W. Position information of the crane 103 is fed back to the control tower 101. The container W is unloaded from a container ship 102 by the crane

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to be operated and then allows the automated guided vehicle 10 to be operated. As described above, the operator allows the terminal 60 to operate the automated guided vehicle 10 with a simple configuration in which the identification information is merely assigned to the automated guided vehicle 10
5 without using a connector or the like requiring waterproofness. In addition, the operation state control unit 65 allows the terminal 60 to operate the automated guided vehicle 10 while the photographing unit 62 continues to acquire the image of the mark 55 of the identification information. That is, when the mark 55 of the identification information is not confirmed from a position of the operator, or when
10 the identification information is too far to be confirmed, the operator fails to operate the automated guided vehicle. Therefore, the operation state control unit 65 allows the terminal 60 to operate the automated guided vehicle 10 after a positional relationship between the operator and the automated guided vehicle 10 is set to an appropriate state. As described above, the simple configuration
15 allows the operator to operate the automated guided vehicle 10 from an appropriate position.

[0047] The operation system 100 of the automated guided vehicle 10 further includes the estimation unit 66 configured to estimate the positional relationship
20 of the automated guided vehicle 10 with respect to the position of the terminal 60 based on the display mode of the information in the image acquired by the photographing unit 62. As described above, the estimation unit 66 may easily estimate the positional relationship between the terminal 60 and the automated guided vehicle 10 from the image acquired by the photographing unit 62 without
25 using a complicated process or a special sensor. Furthermore, the operation state control unit 65 may control the operation state of the terminal 60 by effectively using the estimation result of the estimation unit 66.

[0048] The operation state control unit 65 adjusts the operation mode by the
30 terminal 60 based on a comparison result between the reference regions SE1 and SE2, which are set for the image acquired by the photographing unit 62, and the content displayed in the image. The operation state control unit 65 may

66 may be provided on the automated guided vehicle 10 side. Alternatively, the functions of the operation state control unit 65 and the estimation unit 66 may be shared between the automated guided vehicle 10 side and the terminal 60 side.

5 [0054] An assigned mode of the identification information to the vehicle body 11 in the above-described embodiment is merely an example, and the identification information may be assigned in any mode. In addition, the operation state control unit 65 may perform characteristic control according to the assigned mode of the identification information.

10 [0055] For example, the configuration illustrated in FIG. 9 may be adopted to allow the operator to perform slow driving at a position close to the automated guided vehicle 10. In FIG. 9, a mark 55A smaller than the mark 55 described above is provided on the side surface 11a of the vehicle body 11. When a
15 normal operation is performed (for example, FIG. 6A), the mark 55A is so small as to be hardly recognized in the image, and therefore, the operator approaches the vehicle body 11, whereby the mark 55A has a size enough to be easily recognized in the image. When the operator approaches the side surface 11a and photographs the mark 55A, the estimation unit 66 estimates that the
20 automated guided vehicle 10 faces the terminal 60 on the side surface 11a side and the terminal 60 is considerably close to the side surface 11a. At this time, the operation state control unit 65 restricts the operation such that the automated guided vehicle 10 moves in a slow driving mode. By using such a slow driving mode, the operator allows the automated guided vehicle 10 to move slowly and
25 accurately stop at a desired position while confirming in detail the surrounding situation of the automated guided vehicle 10 when the automated guided vehicle 10 is put into a garage, or in other cases. A mark 55B having the same purpose as the mark 55A may be provided on the upper surface 11c of the vehicle body 11. At this time, the operator photographs the mark 55B while riding on the
30 upper surface 11c of the vehicle body 11.

[0056] A method used by the estimation unit 66 to judge that the marks

of the mark 55 in the image, the distance between the marks 55, and the like. Further, the estimation unit 66 may estimate the direction of the automated guided vehicle 10 from the number of the marks 55 in the image. For example, as illustrated in FIG. 10A, three marks 55 are assigned to the end surface 11b. Therefore, when four or more marks 55 are displayed in the image, the estimation unit 66 judges that the vehicle body 11 faces the terminal 60 on the side surface 11a side.

[0059] Furthermore, as illustrated in FIGS. 11A and 11B, the pattern may be formed by the plurality of marks 55 by devising the arrangement of the plurality of marks 55. For example, by applying a pattern as illustrated in FIG. 11A to the side surface 11a of the vehicle body 11 and applying a pattern as illustrated in FIG. 11B to the end surface 11b, the estimation unit 66 may estimate the direction of the automated guided vehicle 10 based on the pattern of the arrangement of the marks 55 in the image.

[0060] Furthermore, the estimation unit 66 may perform estimation based on not only the special graphic (mark 55) indicating the identification information and the edge of the vehicle body 11 but also the display mode of various information in the image. For example, when a characteristic portion such as a picture, a logo, or a character shown on the vehicle body 11, or a component that is easily recognized is shown in an image, the estimation unit 66 may perform estimation using these images.

[0061] In the above-described embodiment, a general-purpose device such as a smartphone or a tablet terminal is used as the terminal 60. Alternatively, a terminal dedicated to the operation system 100 may be used as the terminal 60. In this case, the dedicated terminal may have a structure or a function that facilitates operation on the operation system 100. For example, the dedicated terminal may have a camera on the edge surface instead of the back surface of the tablet. In this case, the operator may photograph the automated guided vehicle 10 with the camera on the edge surface while keeping the screen of the