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(54) **CONTROL SYSTEM, SERVER, AND VEHICLE**

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(57) **ABSTRACT**

A control system for controlling transport of a vehicle in any of steps from production to shipment of the vehicle includes a state identification unit that identifies a vehicle state that is a state of the vehicle, and a control notification unit that determines a control content of the vehicle by using the identified vehicle state and notifies the vehicle of the control content. The control notification unit determines to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

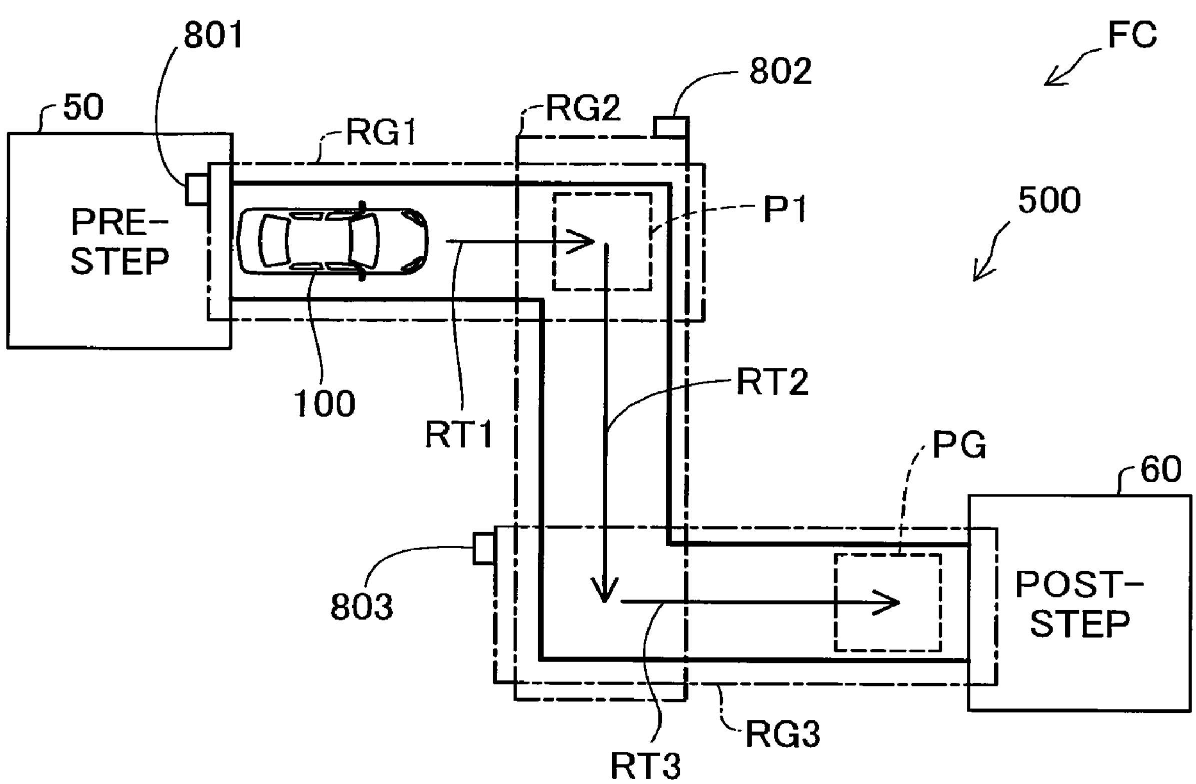


Fig.1

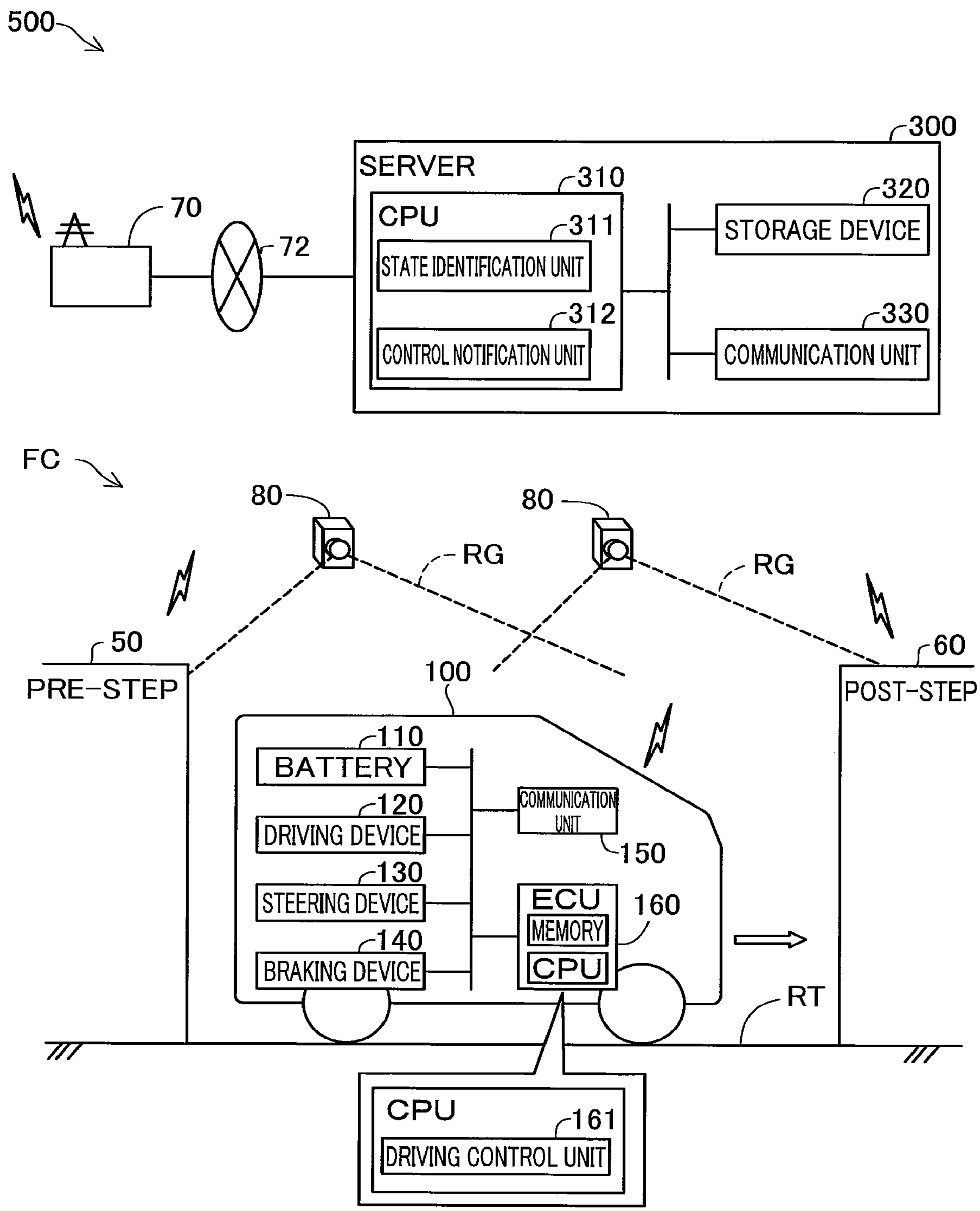

500
300
SERVER
310
CPU
311
STATE IDENTIFICATION UNIT
312
CONTROL NOTIFICATION UNIT
320
STORAGE DEVICE
330
COMMUNICATION UNIT
70
72
FC
80
80
RG
RG
50
PRE-STEP
60
POST-STEP
100
110
BATTERY
120
DRIVING DEVICE
130
STEERING DEVICE
140
BRAKING DEVICE
COMMUNICATION UNIT
150
ECU
MEMORY
CPU
160
RT
CPU
161
DRIVING CONTROL UNIT

Fig.2

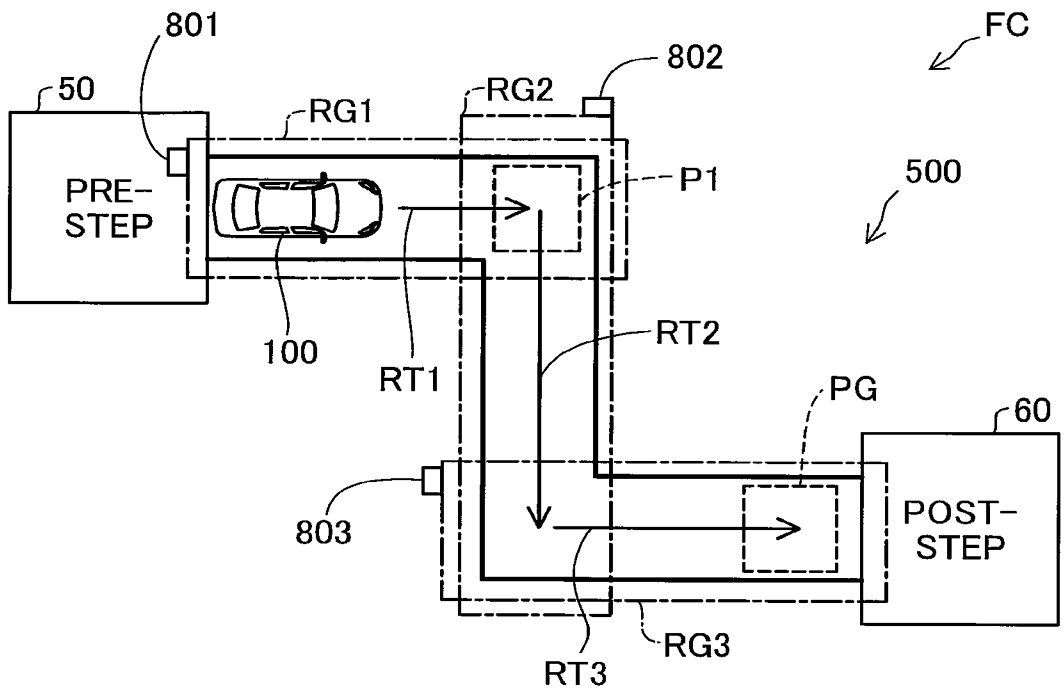

801
802
FC
50
RG1
RG2
PRE-STEP
P1
500
100
RT1
RT2
PG
60
POST-STEP
803
RG3
RT3

Fig.3A

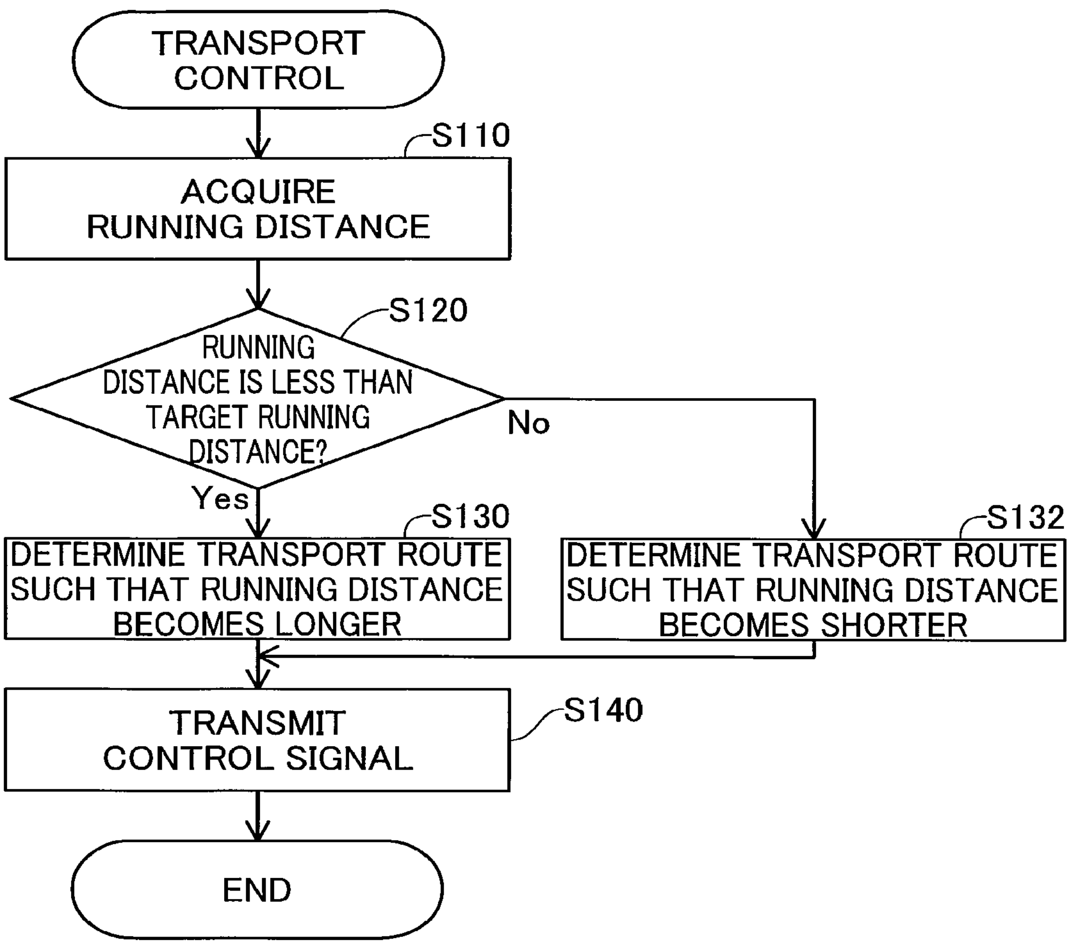

TRANSPORT CONTROL
S110
ACQUIRE RUNNING DISTANCE
S120
RUNNING DISTANCE IS LESS THAN TARGET RUNNING DISTANCE?
No
Yes
S130
DETERMINE TRANSPORT ROUTE SUCH THAT RUNNING DISTANCE BECOMES LONGER
S132
DETERMINE TRANSPORT ROUTE SUCH THAT RUNNING DISTANCE BECOMES SHORTER
S140
TRANSMIT CONTROL SIGNAL
END

Fig.3B

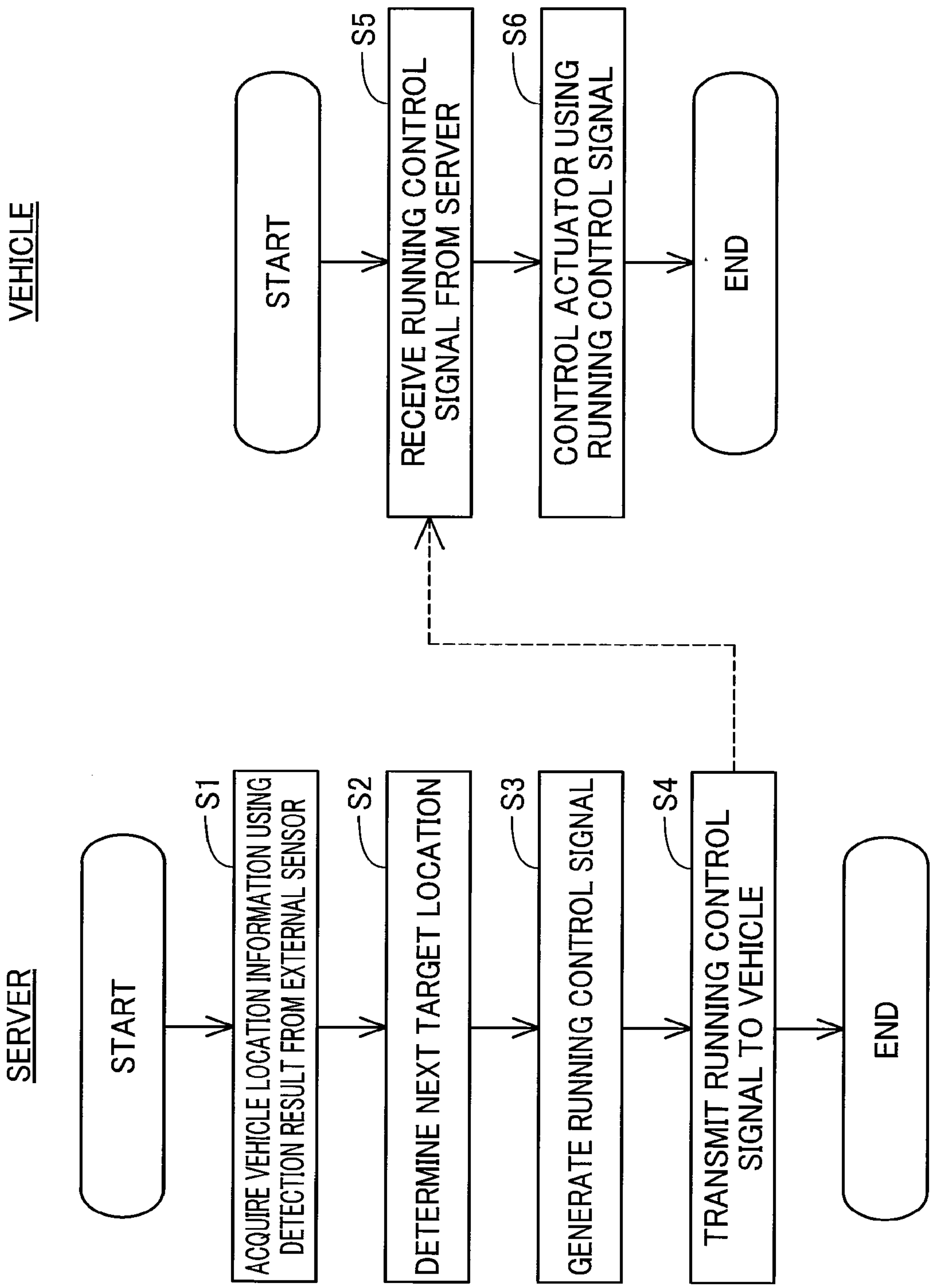

SERVER
START
S1
ACQUIRE VEHICLE LOCATION INFORMATION USING DETECTION RESULT FROM EXTERNAL SENSOR
S2
DETERMINE NEXT TARGET LOCATION
S3
GENERATE RUNNING CONTROL SIGNAL
S4
TRANSMIT RUNNING CONTROL SIGNAL TO VEHICLE
END
VEHICLE
START
S5
RECEIVE RUNNING CONTROL SIGNAL FROM SERVER
S6
CONTROL ACTUATOR USING RUNNING CONTROL SIGNAL
END

Fig.4

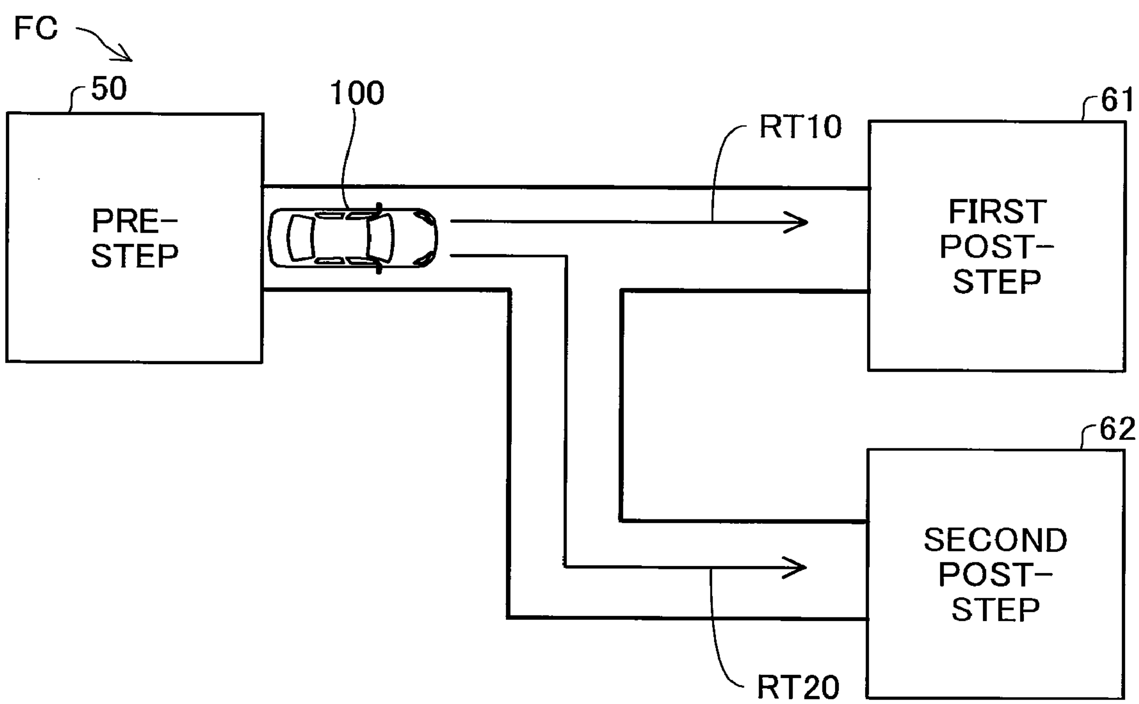

FC
50
100
RT10
61
PRE-
STEP
FIRST
POST-
STEP
62
SECOND
POST-
STEP
RT20

Fig.5

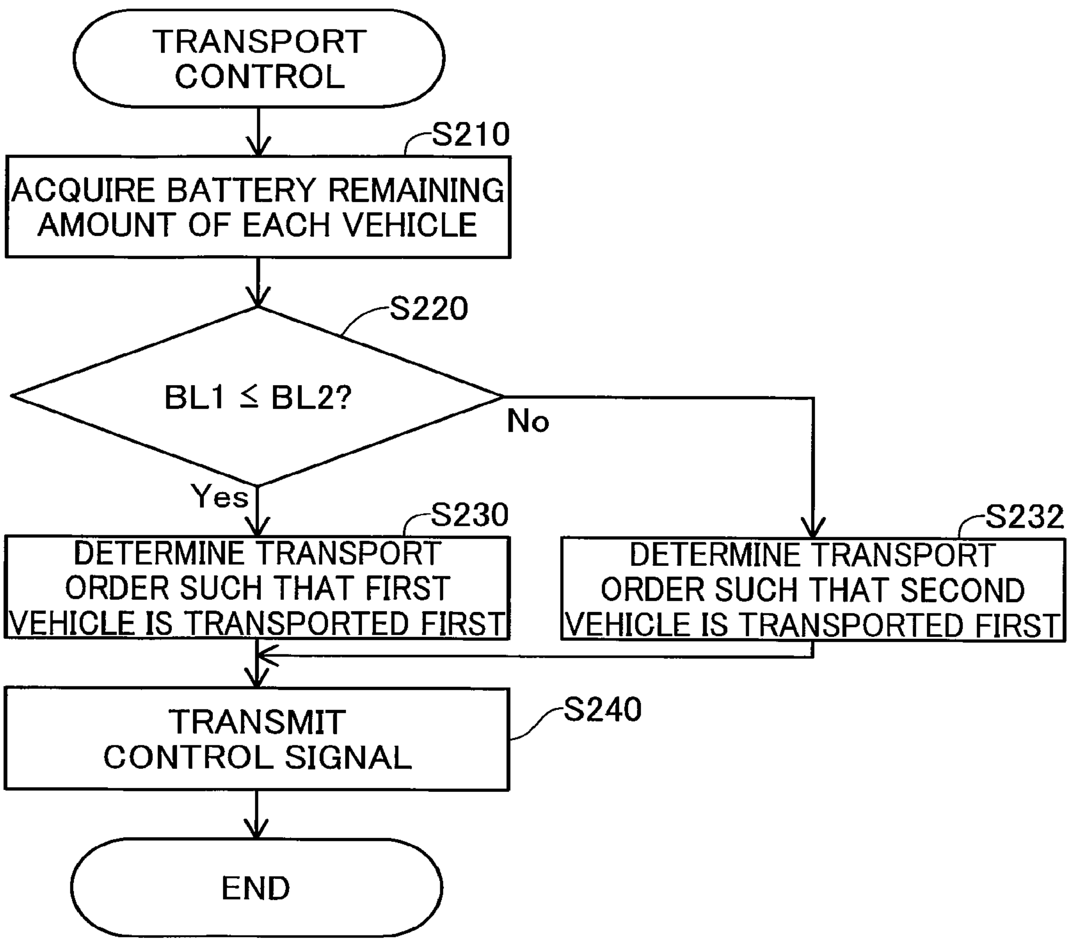

TRANSPORT CONTROL
S210
ACQUIRE BATTERY REMAINING AMOUNT OF EACH VEHICLE
S220
BL1 ≤ BL2?
No
Yes
S230
DETERMINE TRANSPORT ORDER SUCH THAT FIRST VEHICLE IS TRANSPORTED FIRST
S232
DETERMINE TRANSPORT ORDER SUCH THAT SECOND VEHICLE IS TRANSPORTED FIRST
S240
TRANSMIT CONTROL SIGNAL
END

Fig.6

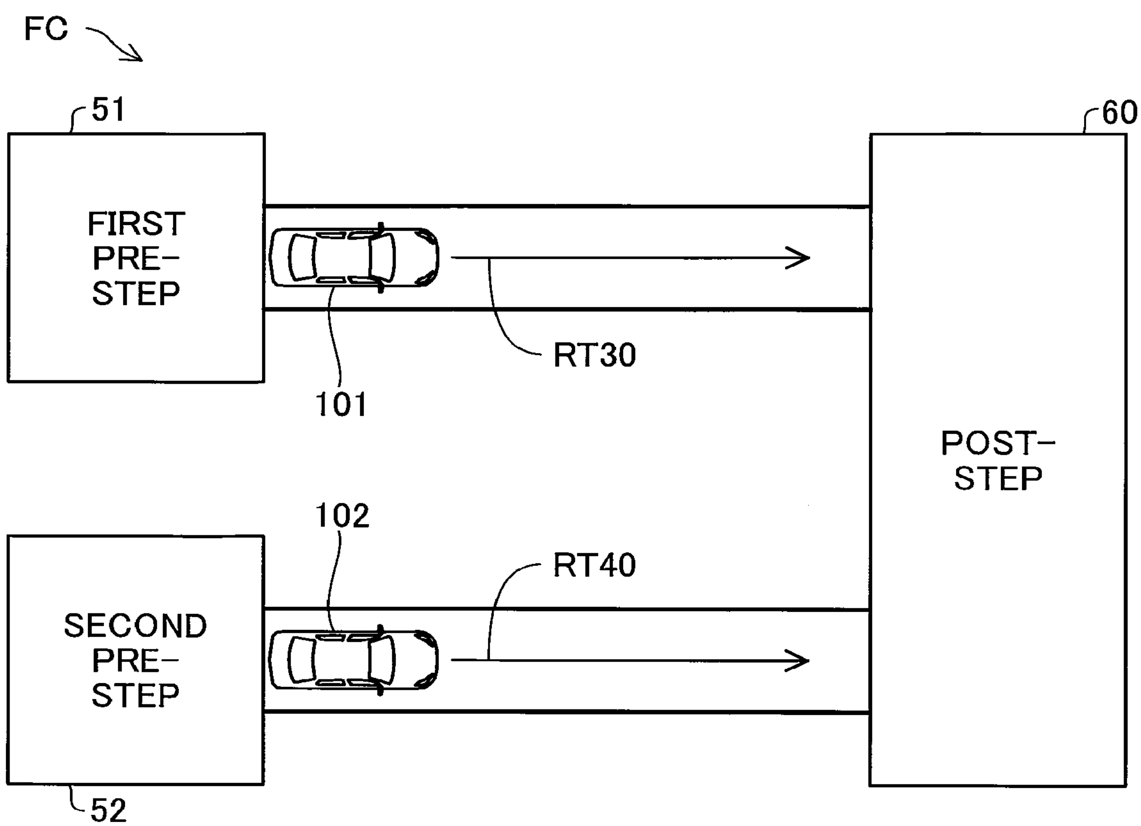
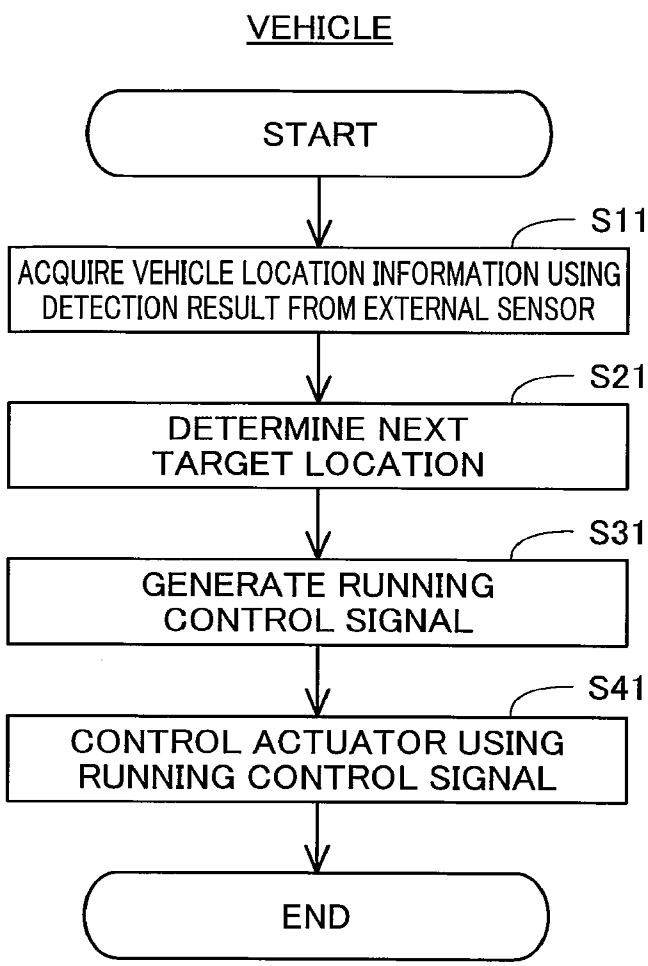

FC
51
FIRST PRE-STEP
101
RT30
60
POST-STEP
102
RT40
SECOND PRE-STEP
52

Fig.7


VEHICLE
START
S11
ACQUIRE VEHICLE LOCATION INFORMATION USING DETECTION RESULT FROM EXTERNAL SENSOR
S21
DETERMINE NEXT TARGET LOCATION
S31
GENERATE RUNNING CONTROL SIGNAL
S41
CONTROL ACTUATOR USING RUNNING CONTROL SIGNAL
END

# CONTROL SYSTEM, SERVER, AND VEHICLE

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This patent application claims priority based upon Japanese patent application No. 2023-046462, filed on Mar. 23, 2023 and Japanese patent application No. 2023-174021, filed on Oct. 6, 2023, the entire disclosure of which is incorporated herein by reference.

## BACKGROUND

### Field

**[0002]** The present disclosure relates to a control system, a server, and a vehicle.

### Related Art

**[0003]** To efficiently operate a manufacturing system for producing vehicles, known is a vehicle running method for causing a vehicle to run from a terminal end of an assembly line of the manufacturing system to a parking lot in the manufacturing system by means of remote control or the like (see, for example, Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2017-538619).

**[0004]** In a manufacturing factory for manufacturing vehicles, for example, differences in vehicle transport routes or differences in inspection time and the number of inspections in the inspection step may cause variations in the vehicle state such as the remaining amounts of fuel and battery at the time of shipment or the number of operations of the driving device. Such variations in the vehicle state may lead to variations in the vehicle quality, which is thus not preferable.

**[0005]** In a manufacturing factory for manufacturing vehicles, for example, differences in vehicle transport routes or differences in inspection time and the number of inspections in the inspection step may cause variations in the vehicle state such as the remaining amounts of fuel and battery at the time of shipment or the number of operations of the driving device. Such variations in the vehicle state may lead to variations in the vehicle quality, which is thus not preferable.

## SUMMARY

**[0006]** According to one aspect of the present disclosure, a control system is provided. The control system controls transport of a vehicle in any of steps from production to shipment of the vehicle and includes a state identification unit that identifies a vehicle state that is a state of the vehicle, and a control notification unit that determines a control content of the vehicle by using the identified vehicle state and notifies the vehicle of the control content, wherein the control notification unit determines to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** FIG. **1** is an explanatory view illustrating a schematic configuration of a control system of a first embodiment;

**[0008]** FIG. **2** is an explanatory view illustrating automatic driving control of a vehicle by means of remote control;

**[0009]** FIG. **3**A is a flowchart illustrating a procedure of transport control of the first embodiment;

**[0010]** FIG. **3**B is a flowchart illustrating a procedure of running control of the first embodiment;

**[0011]** FIG. **4** is an explanatory view illustrating an example of how the vehicle is transported by the transport control of the first embodiment;

**[0012]** FIG. **5** is a flowchart illustrating a procedure of transport control of a second embodiment;

**[0013]** FIG. **6** is an explanatory view illustrating an example of how the vehicle is transported by the transport control of the second embodiment; and

**[0014]** FIG. **7** is a flowchart illustrating a processing procedure of running control of the vehicle in a third embodiment.

## DETAILED DESCRIPTION

### A. First Embodiment

#### A-1. System Configuration

**[0015]** FIG. **1** is an explanatory view illustrating a schematic configuration of a control system **500** of a first embodiment. The control system **500** controls transport of a vehicle **100**, which is an example of a "moving object," in any of steps from production to shipment of the vehicle **100**. The vehicle **100** is controlled by the control system **500** and transported by running by itself in a manufacturing process in a factory FC. In the present embodiment, the control system **500** controls automatic driving of the vehicle **100** by remote control and causes the vehicle **100** to automatically run in the manufacturing process in the factory FC where the vehicle **100** is manufactured. In the present embodiment, the vehicle **100** is configured to be able to run by unmanned driving. The vehicle **100** is configured as an electric automobile in the present embodiment. Note that the vehicle **100** is not limited to an electric automobile and may be, for example, a gasoline automobile, a hybrid automobile, or a fuel cell automobile. A vehicle in a complete state as a product and a vehicle in a state of a semi-finished or in-process product being manufactured are herein collectively referred to as the "vehicle."

**[0016]** In the present disclosure, the "moving object" means an object capable of moving, and is a vehicle or an electric vertical takeoff and landing aircraft (so-called flying-automobile), for example. The vehicle may be a vehicle to run with a wheel or may be a vehicle to run with a continuous track, and may be a passenger car, a track, a bus, a two-wheel vehicle, a four-wheel vehicle, a construction vehicle, or a combat vehicle, for example. The vehicle includes a battery electric vehicle (BEV), a gasoline automobile, a hybrid automobile, and a fuel cell automobile. When the moving object is other than a vehicle, the term "vehicle" or "car" in the present disclosure is replaceable with a "moving object" as appropriate, and the term "run" is replaceable with "move" as appropriate.

**[0017]** The running operation means operation relating to at least one of "run," "turn," and "stop" of the vehicle **100**. The unmanned driving is realized by automatic remote control or manual remote control using a device provided outside the vehicle **100** or by autonomous control by the vehicle **100**. A passenger not involved in running operation may be on-board the vehicle **100** running by the unmanned driving. The passenger not involved in running operation includes a person simply sitting in a seat of the vehicle **100** and a person doing work such as assembly, inspection, or operation of switches different from running operation while on-board the vehicle **100**. Driving by running operation by a passenger may also be called "manned driving."

**[0018]** In the present specification, the "remote control" includes "complete remote control" by which all motions of the vehicle **100** are completely determined from outside the vehicle **100**, and "partial remote control" by which some of the motions of the vehicle **100** are determined from outside the vehicle **100**. The "autonomous control" includes "complete autonomous control" by which the vehicle **100** controls a motion of the vehicle **100** autonomously without receiving any information from a device outside the vehicle **100**, and "partial autonomous control" by which the vehicle **100** controls a motion of the vehicle **100** autonomously using information received from a device outside the vehicle **100**.

**[0019]** As illustrated in FIG. **1**, the factory FC includes a pre-step **50**, a post-step **60**, a track RT of the vehicle **100**, and a vehicle detector. The track RT is a section connecting the pre-step **50** and the post-step **60** for transporting the vehicle **100** in the factory FC. The factory FC is not limited to cases where it is a single building, it is located at a single site or address, and the like. For example, each of the steps in the manufacturing process may exist over a plurality of buildings, a plurality of sites, a plurality of addresses, or the like. "In the factory FC" also includes a range from completion of the vehicle **100** to a standby location for loading the completed vehicle **100** onto a loading vehicle for shipment. In addition, "the vehicle **100** runs in the factory FC" includes a case where the vehicle **100** runs transport sections between steps present in a plurality of locations, such as the track RT, and a case where the vehicle **100** runs in a step, and further, for example, a case where, to move between factories located in a plurality of locations, the vehicle **100** runs not only private roads but also public roads between the factories.

**[0020]** The pre-step **50** is, for example, an assembly step for assembling components to a vehicle body. The post-step **60** is, for example, an inspection step of the vehicle **100**. The vehicle **100** let out of the pre-step **50** becomes an in-process item of the post-step **60** and runs the track RT to reach the post-step **60** that is a running destination. The vehicle **100** enters the post-step **60** upon acquiring permission for entering the post-step **60**. The vehicle **100** is completed as a product upon finishing the inspection step as the post-step **60** and then runs to the standby location in the factory FC for standby of the shipment. Thereafter, the vehicle **100** is shipped to a corresponding shipping destination for each vehicle **100**. Note that the pre-step **50** and the post-step **60** are not limited to an assembly step and an inspection step, and various steps may be employed as long as the vehicle **100** having been processed by the pre-step **50** and the post-step **60** can run by remote control.

**[0021]** The vehicle detector is used for detecting a position or orientation of the vehicle **100**, for example. In the present embodiment, the vehicle detector is a camera **80**. The camera **80** is fixed to a position that allows capturing an image of the track RT and the vehicle **100** that is running. The camera **80** acquires an image from which a position of the vehicle **100** relative to the track RT can be checked. The image captured by the camera **80** is used for remote control of the vehicle **100**. By using the image captured by the camera **80**, automatic running of the vehicle **100** by remote control can be executed without using a detector mounted on the vehicle **100**, such as a camera, millimeter wave radar, or LiDAR. However, a detector mounted on the vehicle **100** may be supplementarily used to prevent collisions during remote control by the control system **500**. For the vehicle detector, other than the camera **80**, various detectors capable of detecting the vehicle **100** may be employed such as an infrared sensor, a laser sensor, an ultrasonic sensor, millimeter wave radar, or LiDAR, as long as it is installed in the factory FC and can acquire a position or orientation of the vehicle **100**.

**[0022]** The control system **500** of the present embodiment includes a plurality of the vehicles **100** and a server **300**. In FIG. **1**, only one of the plurality of vehicles **100** is illustrated, and the other vehicles **100** are not illustrated.

**[0023]** The vehicle **100** includes a battery **110**, a driving device **120**, a steering device **130**, a braking device **140**, a communication unit **150**, and an ECU **160**. The battery **110** stores electric power used for running of the vehicle **100**. The driving device **120** is a device group for accelerating the vehicle **100** and, in the present embodiment, includes a motor that is driven by the electric power of the battery **110** and a driving wheel that rotates by the motor. The steering device **130** is a device group for changing a traveling direction of the vehicle **100**. The braking device **140** is a device group for decelerating the vehicle **100**.

**[0024]** The communication unit **150** is configured to be remotely communicable with an external device of the vehicle **100** via, for example, an access point **70** in the factory FC. The external device of the vehicle **100** is, for example, the server **300** connected to a network **72**, an unillustrated production management device that generally manages production management information on the vehicle **100**, or the other vehicle **100**. In the present embodiment, the communication unit **150** receives a control signal of remote control of the vehicle **100** from the server **300** as described later. In addition, in the present embodiment, the communication unit **150** transmits information indicating a state of the vehicle **100** (hereinafter also referred to as a "vehicle state") to an external device of the vehicle **100**. The "vehicle state" includes a state of the vehicle **100** that changes depending on a running status of the vehicle **100**, such as a running distance of the vehicle **100**, a battery remaining amount, the number of operations of the driving device **120**, or the number of uses of a consumable component such as a brake pad. Further, "a state of the vehicle **100** that changes depending on a running status of the vehicle **100**" includes a state of the vehicle **100** that affects the quality of the vehicle **100** in a completed state. Such a vehicle state can be acquired by using output from a sensor that detects an operation status of each of the battery **110**, the driving device **120**, the steering device **130**, and the braking device **140**. In the present embodiment, the communication unit **150** transmits to the server **300** information including at least a running distance of the vehicle **100** as the information indicating the vehicle state.

**[0025]** The ECU **160** is mounted on the vehicle **100** and executes various kinds of control of the vehicle **100**. The ECU **160** has a CPU and a memory.

**[0026]** The CPU executes a program stored in the memory in advance to function as a driving control unit **161** that executes driving control of the vehicle **100**. The "driving control" means, for example, adjustment of acceleration, speed, and steering angle of the vehicle **100**.

**[0027]** The server **300** includes a CPU **310** as a central processing unit, a storage device **320**, and a communication unit **330**, and these are connected to each other via an internal bus, an interface circuit, and the like. The communication unit **330** communicates with the vehicle **100**, the unillustrated production management device, and the like, via the network **72**.

**[0028]** The storage device **320** is, for example, RAM, ROM, a hard disk drive (HDD), or a solid state drive (SSD). In the present embodiment, the CPU **310** executes a computer program stored in the storage device **320** to function as a state identification unit **311** and a control notification unit **312**. Note that some or all of these functions may be configured by a hardware circuit.

**[0029]** The state identification unit **311** acquires information transmitted from each of the vehicles **100** and identifies the vehicle state of each of the vehicles **100**. The control notification unit **312** executes automatic running of the vehicle **100** in the factory FC by remote control. More specifically, the control notification unit **312** transmits a control signal for notifying a control content of the vehicle **100** to the vehicle **100** via the communication unit **330**. In the present embodiment, the control notification unit **312** uses the identified vehicle state to determine the control content of the vehicle **100** such that a magnitude of a difference between the vehicle state and a preset target state is suppressed. In addition, the control notification unit **312** transmits a control signal indicating the determined control content to the vehicle **100**. The "target state" means a target value of a vehicle state preset for standardization of the quality of the vehicle **100**.

**[0030]** When the vehicle **100** receives the control signal, the driving control unit **161** executes driving control in accordance with the control signal notified from the control notification unit **312**, and consequently the vehicle **100** automatically runs. Transport of the vehicle **100** using automatic running by remote control is also referred to as a "Remote Control auto Driving system." Thus, in the present embodiment, the vehicle **100** is configured as a "vehicle with a Remote Control auto Driving system" that is capable of performing a Remote Control auto Driving system. The Remote Control auto Driving system of the vehicle **100** can suppress or prevent a human-induced accident when the vehicle **100** runs.

**[0031]** FIG. **2** is an explanatory view illustrating automatic driving control of the vehicle **100** by remote control. In an example of FIG. **2**, the track RT includes a first track RT**1**, a second track RT**2**, and a third track RT**3**, which are continuous with each other. The control notification unit **312** causes the vehicle **100** to run to a position PG for entering the post-step **60** along the track RT.

**[0032]** The camera **80** as the vehicle detector acquires an image showing the track RT from above. The number of the cameras **80** is set in consideration of the angles of view of the cameras **80** and the like so that the entire track RT can be captured. In the example of FIG. **2**, the camera **80** includes a camera **801** capable of capturing a range RG**1** including the entire first track RT**1**, a camera **802** capable of capturing a range RG**2** including the entire second track RT**2**, and a camera **803** capable of capturing a range RG**3** including the entire third track RT**3**. Note that the camera **80** is not limited to capturing an image from above of the vehicle **100** and may capture an image from front, back, side, or the like of the vehicle **100**. In addition, cameras that capture these images may be combined as appropriate.

**[0033]** The track RT includes a preset target route where the vehicle **100** needs to run. The control notification unit **312** causes the driving control unit **161** to execute driving control of the vehicle **100** while analyzing an image of the track RT and the vehicle **100** acquired by the camera **80** at a predetermined time interval. The control notification unit **312** sequentially adjusts the position of the vehicle **100** relative to the target route to allow the vehicle **100** to run along the target route. Note that the remote control may use an image of the entire vehicle **100** or an image of a part of the vehicle **100** such as an alignment mark provided in the vehicle **100**.

**[0034]** As in a position P**1** illustrated in FIG. **2**, the angles of view of the cameras **80** corresponding to the respective connected tracks are configured to overlap with each other at the position connecting the tracks. In an example of the position P**1**, the angle of view of the camera **801** corresponding to the first track RT**1** and the angle of view of the camera **802** corresponding to the second track RT**2** overlap with each other. The vehicle **100** let out of the pre-step **50** runs to the position P**1** by remote control using an image captured by the camera **801**. When the vehicle **100** reaches the position P**1**, the vehicle **100** switches to remote control using an image captured by the camera **802** instead of the camera **801** and then runs the second track RT**2**. Similarly, an image captured by the camera **803** is used for running on the third track RT**3**. Thus, the control notification unit **312** performs remote control of the vehicle **100** while appropriately switching the captured images to be analyzed according to the ranges of the track RT.

## A-2. Transport Control

**[0035]** FIG. **3**A is a flowchart illustrating a procedure of transport control of the first embodiment. FIG. **3**B is a flowchart illustrating a procedure of running control of the first embodiment. FIG. **4** is an explanatory view illustrating an example of how the vehicle **100** is transported by the transport control of the first embodiment. In the present embodiment, in the transport control, the server **300** acquires a running distance of the vehicle **100** from the vehicle **100**, determines a transport route of the vehicle **100** such that the running distance of the vehicle **100** approaches a preset target running distance, then performs the notification. Machine learning may be performed in the vehicle **100** for improving the driving quality. In this case, a small running distance may fail to sufficiently improving the driving quality due to insufficient learning. The "target running distance" corresponds to the above-described target state and is preset as a running distance that achieves learning enough to obtain sufficient driving quality. The machine learning is performed in order to appropriately control acceleration and deceleration timings, recognition of an object by a camera, a headlamp illumination angle, and the like. In the present embodiment, the transport control is executed after completion of a certain step and before transport of the vehicle **100** to the next step. The running control is control that is a prerequisite for the transport control. In other words, the running control is executed as basic control, and the transport control is combined with the running control and executed. First, the running control will be described with reference to FIG. **3**B.

**[0036]** As shown in FIG. **3**, in step S**1**, the server **300** acquires vehicle location information of the vehicle **100** using detection result output from an external sensor. The external sensor is located outside the vehicle **100**. The vehicle location information is locational information as a basis for generating a running control signal. In the present embodiment, the vehicle location information includes the location and orientation of the vehicle **100** in a reference coordinate system of the factory. In the present embodiment, the reference coordinate system of the factory is a global coordinate system and a location in the factory can be expressed by X, Y, and Z coordinates in the global coordinate system. In the present embodiment, the external sensor is a camera **80** as a vehicle detector that is disposed in the factory and outputs a captured image as detection result. In step S**1**, the server **300** acquires the vehicle location information using the captured image acquired from the camera **80** as the external sensor.

**[0037]** More specifically, in step S**1**, the server **300** for example, determines the outer shape of the vehicle **100** from the captured image, calculates the coordinates of a positioning point of the vehicle **100** in a coordinate system of the captured image, namely, in a local coordinate system, and converts the calculated coordinates to coordinates in the global coordinate system, thereby acquiring the location of the vehicle **100**. The outer shape of the vehicle **100** in the captured image may be detected by inputting the captured image to a detection model using artificial intelligence, for example. The detection model is prepared in the control system **500** or outside the control system **500**. The detection model is stored in advance in the storage device **320** of the server **300**, for example. An example of the detection model is a learned machine learning model that was learned so as to realize either semantic segmentation or instance segmentation. For example, a convolution neural network (CNN) learned through supervised learning using a learning dataset is applicable as this machine learning model. The learning dataset contains a plurality of training images including the vehicle **100**, and a label showing whether each region in the training image is a region indicating the vehicle **300** or a region indicating a subject other than the vehicle **100**, for example. In training the CNN, a parameter for the CNN is preferably updated through backpropagation in such a manner as to reduce error between output result obtained by the detection model and the label. The server **300** can acquire the orientation of the vehicle **100** through estimation based on the direction of a motion vector of the vehicle **100** detected from change in location of a feature point of the vehicle **100** between frames of the captured images using optical flow process, for example.

**[0038]** In step S**2**, the server **300** determines a target location to which the vehicle **100** is to move next. In the present embodiment, the target location is expressed by X, Y, and Z coordinates in the global coordinate system. The storage device **320** of the server **300** contains a reference route stored in advance as a route along which the vehicle **100** is to run. The route is expressed by a node indicating a departure place, a node indicating a way point, a node indicating a destination, and a link connecting nodes to each other. The server **300** determines the target location to which the vehicle **100** is to move next using the vehicle location information and the reference route. The server **300** determines the target location on the reference route ahead of a current location of the vehicle **100**.

**[0039]** In step S**3**, the server **300** generates a running control signal (also referred to simply as "control signal") for causing the vehicle **100** to run toward the determined target location. In the present embodiment, the running control signal includes an acceleration and a steering angle of the vehicle **100** as parameters. The server **300** calculates a running speed of the vehicle **100** from transition of the location of the vehicle **100** and makes comparison between the calculated running speed and a target speed of the vehicle **100** determined in advance. If the running speed is lower than the target speed, the server **300** generally determines an acceleration in such a manner as to accelerate the vehicle **100**. If the running speed is higher than the target speed as, the server **300** generally determines an acceleration in such a manner as to decelerate the vehicle **100**. If the vehicle **100** is on the reference route, server **200** determines a steering angle and an acceleration in such a manner as to prevent the vehicle **100** from deviating from the reference route. If the vehicle **100** is not on the reference route, in other words, if the vehicle **100** deviates from the reference route, the server **300** determines a steering angle and an acceleration in such a manner as to return the vehicle **100** to the reference route. In other embodiments, the running control signal may include the speed of the vehicle **100** as a parameter instead of or in addition to the acceleration of the vehicle **100**.

**[0040]** In step S**4**, the server **300** transmits the generated running control signal to the vehicle **100**. The server **300** repeats the acquisition of vehicle location information, the determination of a target location, the generation of a running control signal, the transmission of the running control signal, and others in a predetermined cycle.

**[0041]** In step S**5**, the driving controller of the vehicle **100** receives the running control signal transmitted from the server **300**. In step S**6**, the vehicle **100** controls an actuator of the vehicle **100** using the received running control signal, thereby causing the vehicle **100** to run at the acceleration and the steering angle indicated by the running control signal. The vehicle **100** repeats the reception of a running control signal and the control over the actuator in a predetermined cycle. According to the control system **500** in the present embodiment, it becomes possible to move the vehicle **100** without using a transport unit such as a crane or a conveyor.

**[0042]** In an example illustrated in FIG. **4**, the factory FC includes the pre-step **50**, a first post-step **61**, a second post-step **62**, a track RT**10**, and a track RT**20**. The pre-step **50** is an assembly step of the vehicle **100**. The first post-step **61** and the second post-step **62** are both inspection steps for inspecting the vehicle **100** after completion of the pre-step **50** and perform the same inspection at different locations, for example, in different buildings. Note that the first post-step **61** and the second post-step **62** may be performed at different areas in the same building. Further, the pre-step **50** is not limited to an assembly step, and the first post-step **61** and the second post-step **62** are not limited to inspection steps. In addition, the pre-step **50**, the first post-step **61**, and the second post-step **62** may be steps for assembling different components in an assembly step.

[0043] The track RT10 connects the pre-step 50 and the first post-step 61. The track RT20 connects the pre-step 50 and the second post-step 62. The transport distance when the vehicle 100 is transported by running the track RT20 is longer than the transport distance when the vehicle 100 is transported by running the track RT10. In the example illustrated in FIG. 4, the control notification unit 312 transports the vehicle 100 by using any of the track RT10 and the track RT20 as a transport route. Note that the number of candidates for the transport route of the vehicle 100 is not limited to two and may be three or more.

[0044] The transport control will be described with reference to FIG. 3A. In step S110 illustrated in FIG. 3A, the state identification unit 311 identifies the running distance of the vehicle 100. More specifically, the state identification unit 311 identifies the running distance from the time when the vehicle 100 becomes able to autonomously run by remote control to the time when the pre-step 50 ends. The running distance of the vehicle 100 can be identified by, for example, acquiring information from a sensor for measuring temporal changes in rotational frequency of driving wheels included in the vehicle 100.

[0045] In step S120, the control notification unit 312 determines whether the running distance of the vehicle 100 is less than a preset target running distance. When the running distance is less than the target running distance (Yes in step S120), the control notification unit 312 determines the transport route in step S130 such that the running distance of the vehicle 100 becomes longer. In the example of FIG. 4, the control notification unit 312 determines the transport route such that the vehicle 100 is transported by running the track RT20 that has a longer transport distance than the track RT10. The vehicle 100 is transported by running the track RT20, so that the running distance of the vehicle 100 becomes longer than in the case where the vehicle 100 is transported by running the track RT10, suppressing the magnitude of the difference between the running distance of the vehicle 100 and the target running distance.

[0046] On the other hand, as illustrated in FIG. 3A, when the running distance is equal to or more than the target running distance (No in step S120), the control notification unit 312 determines the transport route in step S132 such that the running distance of the vehicle 100 becomes shorter. In the example of FIG. 4, the control notification unit 312 determines the control content of the vehicle 100 such that the vehicle 100 is transported by running the track RT10 that has a shorter transport distance than the track RT20. The vehicle 100 is transported by running the track RT10, so that the time required for transport of the vehicle 100 can be suppressed.

[0047] In step S140, the control notification unit 312 transmits to the vehicle 100 a control signal (running control signal) for notifying of running in accordance with the determined transport route as the control content. The driving control unit 161 executes driving control of the own vehicle in accordance with the control signal from the control notification unit 312. Then, the transport control of the present embodiment ends.

[0048] According to the control system 500 of the first embodiment described above, the transport route of the vehicle 100 is determined such that the magnitude of the difference between the running distance of the vehicle 100 and the target running distance is suppressed, and running the determined transport route is determined as the control content and notified to the vehicle 100, so that the control content notified to the vehicle 100 is executed by the vehicle itself, suppressing occurrence of variations in the running distance of the vehicle 100.

## B. Second Embodiment

[0049] FIG. 5 is a flowchart illustrating a procedure of transport control of a second embodiment. FIG. 6 is an explanatory view illustrating an example of how the vehicle 100 is transported by the transport control of the second embodiment. The control system 500 of the second embodiment is different from the control system 500 of the first embodiment in that the communication unit 150 transmits a remaining amount of the battery 110 to the server 300 as the vehicle state, and in that the transport control illustrated in FIG. 5 is executed instead of the transport control illustrated in FIG. 3A. Note that the system configurations of the control system 500 of the second embodiment is the same as those of the control system 500 of the first embodiment, and accordingly the same configurations are denoted by the same reference numerals, and a detailed description thereof will be omitted.

[0050] In the present embodiment, in the transport control, the server 300 acquires the battery remaining amount of each of the plurality of vehicles 100, determines the transport order of the plurality of vehicles 100 such that the magnitude of the difference between the battery remaining amount of the vehicle 100 and a preset target battery remaining amount is suppressed, and notifies each of the vehicles 100 of the transport order. The "target battery remaining amount" corresponds to the above-described target state and means a target value of a battery remaining amount preset for standardization of the performance of the battery 110 mounted on each of the vehicles 100. In the present embodiment, the same target battery remaining amount is set for each of the vehicles.

[0051] In the present embodiment, the server 300 determines the transport order of, among the plurality of vehicles 100, vehicles 100 that are present within a preset distance and have the same destination as the transport destination within a preset time. The transport destination of each of the vehicles 100 is set by, for example, the unillustrated production management device installed in each of the steps upon the end of this step and is transmitted to the server 300.

[0052] In the example illustrated in FIG. 6, the factory FC includes a first pre-step 51, a second pre-step 52, the post-step 60, a track RT30, and a track RT40. The first pre-step 51 and the second pre-step 52 are both assembly steps of the vehicle 100 and are performed at different locations, for example, in different buildings. Note that the first pre-step 51 and the second pre-step 52 may be performed at different areas in the same building. Further, the first pre-step 51 and the second pre-step 52 may be steps for assembling different components or steps for targeting different vehicle types, as long as these steps are performed before the post-step 60. The post-step 60 is an inspection step for inspecting the vehicle 100 after completion of the first pre-step 51 or the second pre-step 52. Note that the first pre-step 51 and the second pre-step 52 are not limited to assembly steps, and the post-step 60 is not limited to an inspection step. Further, the first pre-step 51, the second pre-step 52, and the post-step 60 may be, for example, steps for assembling different components in an assembly step.

**[0053]** The track RT**30** connects the first pre-step **51** and the post-step **60**. In FIG. **6**, a first vehicle **101** runs the track RT**30** and is transported from the first pre-step **51** to the post-step **60**. The track RT**40** connects the second pre-step **52** and the post-step **60**. In FIG. **6**, a second vehicle **102** runs the track RT**40** and is transported from the second pre-step **52** to the post-step **60**. In FIG. **6**, the first vehicle **101** and the second vehicle **102** are in a state of waiting for transport. Note that the number of the vehicles **100** waiting for transport to the post-step **60** is not limited to two and may be three or more. Further, two or more vehicles **100** may wait for transport to the post-step **60** in each of the first pre-step **51** and the second pre-step **52**. In addition, in a pre-step different from the first pre-step **51** and the second pre-step **52**, a vehicle different from the first vehicle **101** and the second vehicle **102** may wait for transport to the post-step **60**.

**[0054]** In step S**210** illustrated in FIG. **5**, the state identification unit **311** identifies the battery remaining amount of each of the vehicles **100**. In the example illustrated in FIG. **6**, the state identification unit **311** identifies a battery remaining amount BL**1** of the battery **110** mounted on the first vehicle **101** and a battery remaining amount BL**2** of the battery **110** mounted on the second vehicle **102**.

**[0055]** In step S**120** illustrated in FIG. **5**, the control notification unit **312** determines whether the battery remaining amount BL**1** is equal to or less than the battery remaining amount BL**2**. When the battery remaining amount BL**1** is equal to or less than the battery remaining amount BL**2** (Yes in step S**220**), the control notification unit **312** determines the transport order in step S**230** such that the first vehicle **101** having a smaller battery remaining amount than the second vehicle **102** is transported first. The transport order is thus determined, so that the standby time of the first vehicle **101** becomes shorter than in the case where the transport order of the first vehicle **101** is after the second vehicle **102**. This can suppress electric power (standby power) consumed in the first vehicle **101** during the standby time, suppressing an increase in the magnitude of the difference between the battery remaining amount BL**1** and the target battery remaining amount.

**[0056]** On the other hand, when the battery remaining amount BL**1** is larger than the battery remaining amount BL**2** (No in step S**220**), the control notification unit **312** determines the transport order as the control content in step S**232** such that the second vehicle **102** having a smaller battery remaining amount than the first vehicle **101** is transported first. The transport order is thus determined, so that the standby time of the second vehicle **102** becomes shorter than in the case where the transport order of the second vehicle **102** is after the first vehicle **101**. This can suppress standby power in the second vehicle **102**, suppressing an increase in the magnitude of the difference between the battery remaining amount BL**2** and the target battery remaining amount.

**[0057]** In step S**240**, the control notification unit **312** transmits to each of the first vehicle **101** and the second vehicle **102** a control signal for notifying of running in accordance with the determined transport order as the control content. The driving control unit **161** mounted on each of the first vehicle **101** and the second vehicle **102** executes driving control of the own vehicle in accordance with the control signal from the control notification unit **312**. Then, the transport control of the present embodiment ends.

**[0058]** According to the control system **500** of the second embodiment described above, the battery remaining amount is acquired as the vehicle state, the transport order is determined such that, between the first vehicle **101** and the second vehicle **102**, a vehicle having a smaller battery remaining amount is transported earlier, and running in accordance with the transport order is notified to each of the vehicles as the control content, so that the vehicles can run in the transport order determined in accordance with the control content notified to each of the vehicles, suppressing occurrence of variations in the vehicle state.

## C. Third Embodiment

**[0059]** FIG. **7** is a flowchart showing a processing procedure for running control of the vehicle **100** in the third embodiment. Since the configuration of the vehicle **100** in the present embodiment is the same as in the first embodiment, the vehicle in the present embodiment is denoted as vehicle **100** for convenience. In step S**101**, the vehicle **100** acquires vehicle location information using detection result output from the camera **80** as an external sensor. In step S**102**, the vehicle **100** determines a target location to which the vehicle **100** is to move next. In step S**103**, the vehicle **100** generates a running control signal for causing the vehicle **100** to run to the determined target location. In step S**104**, the vehicle **100** controls an actuator using the generated running control signal, thereby causing the vehicle **100** to run by following a parameter indicated by the running control signal. The vehicle **100** repeats the acquisition of vehicle location information, the determination of a target location, the generation of a running control signal, and the control over the actuator in a predetermined cycle. According to the automatic driving system **500** in the present embodiment, it is possible to cause the vehicle **100** to run by autonomous control without controlling the vehicle **100** remotely using the server **300**.

## D. Other Embodiments

**[0060]** (D1) In the above embodiments, the control notification unit **312** determines the transport route or the transport order as the control for suppressing the magnitude of the difference between the vehicle state and the target state; however, the present disclosure is not limited to this. In addition to the above-described control, for example, the control notification unit **312** may cause the vehicle **100** being transported to accelerate or decelerate. The vehicle **100** is caused to accelerate or decelerate, so that the power consumption amount can be adjusted, suppressing the magnitude of the difference between the battery remaining amount and the target battery remaining amount. Further, the vehicle **100** is caused to accelerate or decelerate, so that the number of uses of the brake pad can be adjusted, suppressing the magnitude of the difference between such the number of uses and the target number of uses. "The target number of uses" corresponds to the above-described target state and means a target value of the number of uses of the brake pad preset for standardization of the wear state of the brake pad.

**[0061]** Further, when the vehicle **100** is configured as a gasoline automobile, the control notification unit **312** may repeatedly cause the vehicle **100** to execute start and stop of the engine. Start and stop of the engine is repeatedly executed, so that the number of starts of the engine can be adjusted, suppressing the magnitude of the difference between such the number of starts and the target number of starts. "The target number of starts" corresponds to the above-described standard state and means the number of starts of the engine preset for sufficiently stabilizing a catalytic reaction in the engine.

**[0062]** Further, the control notification unit **312** may control the operation of an auxiliary machine such as an air conditioner or an audio device included in the vehicle **100**, during transport or standby for the transport order. The auxiliary machine is operated when the battery remaining amount exceeds the target battery remaining amount, so that the power consumption is promoted, suppressing the magnitude of the difference between the battery remaining amount and the target battery remaining amount. According to the control described above, not limited to the running distance and the battery remaining amount, the magnitudes of the differences between various vehicle states of the vehicle **100** and the target states can be suppressed.

**[0063]** (D2) In the above embodiments, the vehicle **100** is configured as a vehicle with a remote Control auto Driving system that receives a control signal transmitted from the server **300** and is remotely controlled to execute the Remote Control auto Driving system; however, the present disclosure is not limited to this. The vehicle **100** may be transported by driving control performed by a driver. In such a configuration, the vehicle **100** may notify the driver of the control content upon reception of the control signal through, for example, displaying the control content on a display included in the vehicle **100** or notifying of the control content with a speaker included in the vehicle **100**. The driver performing driving control of the vehicle **100** in accordance with the control content thus notified also can suppress the magnitude of the difference between the vehicle state and the target state, similarly to the above-described embodiments.

**[0064]** (D3) In the above embodiments, the server **300** includes the state identification unit **311** and the control notification unit **312**, and the control content is determined by using the vehicle state acquired from the vehicle **100**; however, the present disclosure is not limited to this. The vehicle **100** may include the state identification unit **311** and the control notification unit **312**. In such a configuration, the state identification unit **311** may acquire the vehicle state of the own vehicle, and the control notification unit **312** may determine the transport route of the own vehicle by using the acquired vehicle state of the own vehicle. Further, the state identification unit **311** may acquire the vehicle state of the other vehicle **100** in addition to the vehicle state of the own vehicle and determine the transport order of the plurality of vehicles **100** by using the vehicle state of each of the vehicles **100**. Such a configuration also provides effects similar to those of the above-described embodiments.

**[0065]** (D4) In the second embodiment, the control notification unit **312** compares the battery remaining amount BL**1** and the battery remaining amount BL**2** and determines the transport order such that, between the first vehicle **101** and the second vehicle **102**, a vehicle having a smaller battery remaining amount is transported earlier; however, the present disclosure is not limited to this. When different target battery remaining amounts are set in a plurality of the vehicles **100**, the control notification unit **312** may calculate the magnitude of the difference between the battery remaining amount of the vehicle and the target battery remaining amount for each of the vehicles **100** and determine the transport order such that a vehicle having a larger magnitude of the difference is transported earlier. Further, the control notification unit **312** may calculate the proportion of the battery remaining amount to the target battery remaining amount for each of the vehicles **100** and determine the transport order such that a vehicle having the smaller proportion is transported earlier. According to such a configuration, even when a target state different for each of the vehicles **100** is set, the magnitude of the difference between the vehicle state of the vehicle **100** and the target state can be suppressed for each of the vehicles **100**.

**[0066]** (D5) In the second embodiment, the control notification unit **312** suppresses the magnitude of the difference between the battery remaining amount and the target battery remaining amount by determining the transport order of the first vehicle **101** and the second vehicle **102**, in other words, by determining the timing of starting transport of each of the first vehicle **101** and the second vehicle **102**; however, the present disclosure is not limited to this. The control notification unit **312** may target one vehicle **100** and determine the timing of starting transport of the vehicle. For example, when the control notification unit **312** determines the timing of starting transport of the vehicle **100** such that start of transport of the vehicle **100** is delayed, the standby time of the vehicle **100** becomes longer than in the case of starting transport immediately after the end of the pre-step, increasing standby power. Further, start and stop of the engine is repeatedly executed during standby, so that stabilization of a catalytic reaction in the engine can be promoted. In addition, an auxiliary machine is operated during standby, so that power consumption can be promoted. As described above, the magnitudes of the differences between various vehicle states of the vehicle **100** and the target states can be suppressed according to the timing of starting transport of the vehicle **100**.

**[0067]** (D6) In each of the above-described embodiments, the vehicle detector (the external sensor) is not limited to the camera **80** but may be the distance measuring device, for example. The distance measuring device is a light detection and ranging (LIDAR) device, for example. In this case, detection result output from the external sensor may be three-dimensional point cloud data representing the vehicle **100**. The server **300** and the vehicle **100** may acquire the vehicle location information through template matching using the three-dimensional point cloud data as the detection result and reference point cloud data, for example.

**[0068]** (D7) In the above-described first and the second embodiments, the server **300** performs the processing from acquisition of vehicle location information to generation of a running control signal. By contrast, the vehicle **100** may perform at least part of the processing from acquisition of vehicle location information to generation of a running control signal. For example, embodiments (1) to (3) described below are applicable, for example.

**[0069]** (1) The server **300** may acquire vehicle location information, determine a target location to which the vehicle **100** is to move next, and generate a route from a current location of the vehicle **100** indicated by the acquired vehicle location information to the target location. The server **300** may generate a route to the target location between the current location and a destination or generate a route to the destination. The server **300** may transmit the generated route to the vehicle **100**. The vehicle **100** may generate a running control signal in such a manner as to cause the vehicle **100** to run along the route received from the server **300** and control an actuator of the vehicle **100** using the generated running control signal.

**[0070]** (2) The server **300** may acquire vehicle location information and transmit the acquired vehicle location information to the vehicle **100**. The vehicle **100** may determine a target location to which the vehicle **100** is to move next, generate a route from a current location of the vehicle **100** indicated by the received vehicle location information to the target location, generate a running control signal in such a manner as to cause the vehicle **100** to run along the generated route, and control an actuator using the generated running control signal.

**[0071]** (3) In the foregoing embodiments (1) and (2), an internal sensor may be mounted on the vehicle **100**, and detection result output from the internal sensor may be used in at least one of the generation of the route and the generation of the running control signal. The internal sensor is a sensor mounted on the vehicle **100**. More specifically, the internal sensor might include a camera, LiDAR, a millimeter wave radar, an ultrasonic wave sensor, a GPS sensor, an acceleration sensor, and a gyroscopic sensor, for example. For example, in the foregoing embodiment (1), the server **300** may acquire detection result from the internal sensor, and in generating the route, may reflect the detection result from the internal sensor in the route. In the foregoing embodiment (1), the vehicle **100** may acquire detection result from the internal sensor, and in generating the running control signal, may reflect the detection result from the internal sensor in the running control signal. In the foregoing embodiment (2), the vehicle **100** may acquire detection result from the internal sensor, and in generating the route, may reflect the detection result from the internal sensor in the route. In the foregoing embodiment (2), the vehicle **100** may acquire detection result from the internal sensor, and in generating the running control signal, may reflect the detection result from the internal sensor in the running control signal.

**[0072]** (D8) In the above-described fourth embodiment, the vehicle **100** may be equipped with an internal sensor, and detection result output from the internal sensor may be used in at least one of generation of a route and generation of a running control signal. For example, the vehicle **100** may acquire detection result from the internal sensor, and in generating the route, may reflect the detection result from the internal sensor in the route. The vehicle **100** may acquire detection result from the internal sensor, and in generating the running control signal, may reflect the detection result from the internal sensor in the running control signal.

**[0073]** (D9) In the above-described third embodiment, the vehicle **100** acquires vehicle location information using detection result from the external sensor. By contrast, the vehicle **100** may be equipped with an internal sensor, the vehicle **100** may acquire vehicle location information using detection result from the internal sensor, determine a target location to which the vehicle **100** is to move next, generate a route from a current location of the vehicle **100** indicated by the acquired vehicle location information to the target location, generate a running control signal for running along the generated route, and control an actuator of the vehicle **100** using the generated running control signal. In this case, the vehicle **100** is capable of running without using any detection result from an external sensor. The vehicle **100** may acquire target arrival time or traffic congestion information from outside the vehicle **100** and reflect the target arrival time or traffic congestion information in at least one of the route and the running control signal. The functional configuration of the control system **500** may be entirely provided at the vehicle **100**. Specifically, the processes realized by the control system **500** in the present disclosure may be realized by the vehicle **100** alone.

**[0074]** (D10) In the above-described first and the second embodiments, the server **300** automatically generates a running control signal to be transmitted to the vehicle **100**. By contrast, the server **300** may generate a running control signal to be transmitted to the vehicle **100** in response to operation by an external operator existing outside the vehicle **100**. For example, the external operator may operate an operating device including a display on which a captured image output from the external sensor is displayed, steering, an accelerator pedal, and a brake pedal for operating the vehicle **100** remotely, and a communication device for making communication with the server **300** through wire communication or wireless communication, for example, and the server **300** may generate a running control signal responsive to the operation on the operating device. Note that driving of the vehicle **100** by such control is referred to as "unmanned driving." In the above configuration, the information on the determined transport route or transport order may be displayed on a display of an operating device (remote cockpit). Further, when the transport route or the transport order is changed, the changed transport route or transport order may be displayed on the above display. In addition, when the transport route or the transport order is changed, the unmanned driving may be canceled, and the remote automatic driving may be started to run the changed transport route or to run in the changed transport order.

**[0075]** (D11) In each of the above-described embodiments, the vehicle **100** is simply required to have a configuration to become movable by unmanned driving. The vehicle **100** may embodied as a platform having the following configuration, for example. The vehicle **100** is simply required to include at least actuators and a controller. More specifically, in order to fulfill three functions including "run," "turn," and "stop" by unmanned driving, the actuators may include a driving device, a steering device and a breaking device. The actuators are controlled by the controller that controls running of the vehicle **100**. In order for the vehicle **100** to acquire information from outside for unmanned driving, the vehicle **100** is simply required to include the communication device further. Specifically, the vehicle **100** to become movable by unmanned driving is not required to be equipped with at least some of interior components such as a driver's seat and a dashboard, is not required to be equipped with at least some of exterior components such as a bumper and a fender or is not required to be equipped with a bodyshell. In such cases, a remaining component such as a bodyshell may be mounted on the vehicle **100** before the vehicle **100** is shipped from a factory, or a remaining component such as a bodyshell may be mounted on the vehicle **100** after the vehicle **100** is shipped from a factory while the remaining component such as a bodyshell is not mounted on the vehicle **100**. Each of components may be mounted on the vehicle **100** from any direction such as from above, from below, from the front, from the back, from the right, or from the left. Alternatively, these components may be mounted from the same direction or from respective different directions. The location determination for the platform may be performed in the same way as for the vehicle **100** in the first and the second embodiments.

**[0076]** (D12) The vehicle **100** may be manufactured by combining a plurality of modules. The module means a unit composed of one or more components grouped according to a configuration or function of the vehicle **100**. For example, a platform of the vehicle **100** may be manufactured by combining a front module, a center module and a rear module. The front module constitutes a front part of the platform, the center module constitutes a center part of the platform, and the rear module constitutes a rear part of the platform. The number of the modules constituting the platform is not limited to three but may be equal to or less than two, or equal to or greater than four. In addition to or instead of the platform, any parts of the vehicle **100** different from the platform may be modularized. Various modules may include an arbitrary exterior component such as a bumper or a grill, or an arbitrary interior component such as a seat or a console. Not only the vehicle **100** but also any types of moving object may be manufactured by combining a plurality of modules. Such a module may be manufactured by joining a plurality of components by welding or using a fixture, for example, or may be manufactured by forming at least part of the module integrally as a single component by casting. A process of forming at least part of a module as a single component is also called Giga-casting or Mega-casting. Giga-casting can form each part conventionally formed by joining multiple parts in a moving object as a single component. The front module, the center module, or the rear module described above may be manufactured using Giga-casting, for example.

**[0077]** (D13) A configuration for realizing running of a vehicle **100** by unmanned driving is also called a "Remote Control auto Driving system". Conveying a vehicle using Remote Control Auto Driving system is also called "self-running conveyance". Producing the vehicle **100** using self-running conveyance is also called "self-running production". In self-running production, for example, at least part of the conveyance of vehicles is realized by self-running conveyance in a factory where the vehicle **100** is manufactured.

**[0078]** The present disclosure is not limited to the above-described embodiments and can be carried out with various configurations without departing from the spirit and scope of the present disclosure. For example, the technical features in the embodiments corresponding to the technical features in the aspects described in the column of summary can be replaced or combined, as appropriate, to solve some or all of the problems described above or achieve some or all of the effects described above. In addition, the technical features can be deleted, as appropriate, unless such technical features are described as essential herein. For example, the present disclosure may be implemented by aspects described below.

**[0079]** (1) According to one aspect of the present disclosure, a control system is provided. The control system controls transport of a vehicle in any of steps from production to shipment of the vehicle and includes a state identification unit that identifies a vehicle state that is a state of the vehicle, and a control notification unit that determines a control content of the vehicle by using the identified vehicle state and notifies the vehicle of the control content, wherein the control notification unit determines to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**[0080]** According to the control system of this aspect, controlling at least either one of the transport route of the vehicle and the timing of starting the transport such that the magnitude of the difference between the vehicle state and the target state is suppressed is determined as the control content of the vehicle by using the identified vehicle state and is notified to the vehicle, so that occurrence of variations in the vehicle state can be suppressed by the vehicle itself or an operator executing the control content notified to the vehicle.

**[0081]** (2) In the above aspect, the vehicle may be configured as a vehicle with a Remote Control auto Driving system including a driving control unit that executes driving control of the vehicle in accordance with the control content notified from the control notification unit.

**[0082]** According to the control system of this aspect, it is possible to suppress occurrence of variations in the vehicle state of the vehicle configured as a vehicle with a Remote Control auto Driving system.

**[0083]** (3) In the above aspect, the control system may control the transport of a plurality of the vehicles, the state identification unit may identify the vehicle state of each of the vehicles, and the control notification unit may determine a transport order of each of the vehicles by using the vehicle state of each of the vehicles such that a magnitude of a difference between the vehicle state and the target state for at least some of the plurality of vehicles is suppressed, and notify each of the vehicles of running in accordance with the transport order as the control content.

**[0084]** According to the control system of this aspect, the vehicle state of each of the vehicles is identified, the transport order is determined by using the vehicle state of each of the vehicles such that, for at least some of the vehicles, the vehicle state approaches the target state, and running in accordance with the transport order is notified to the vehicle as the control content, so that the vehicles can run in the transport order determined in accordance with the control content notified to each of the vehicles, suppressing occurrence of variations in the vehicle state.

**[0085]** (4) In the above aspect, each of the vehicles may include a battery that stores electric power used for running of the vehicle, the state identification unit may acquire a remaining amount of the battery as the vehicle state, and the control notification unit may determine the transport order such that, among the plurality of vehicles, a second vehicle having a smaller remaining amount of the battery than a first vehicle is transported earlier than the first vehicle.

**[0086]** According to the control system of this aspect, the remaining amount of the battery is acquired as the vehicle state, the transport order is determined such that the second vehicle having a smaller battery remaining amount than the first vehicle is transported earlier than the first vehicle, and running in accordance with the transport order is notified to each of the vehicles as the control content, so that the vehicles can run in the transport order determined in accordance with the control content notified to each of the vehicles, suppressing occurrence of variations in the remaining amount of the battery of each of the vehicles.

**[0087]** (5) According to another aspect of the present disclosure, provided is a server used in a control system for controlling transport of a vehicle in any of steps from production to shipment of the vehicle. The server includes a state identification unit that identifies a vehicle state that is a state of the vehicle, and a control notification unit that determines a control content of the vehicle by using the identified vehicle state and transmits a running control signal indicating the control content to the vehicle. The control notification unit determines to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**[0088]** According to the server of this aspect, controlling at least either one of the transport route of the vehicle and the timing of starting the transport such that the magnitude of the difference between the vehicle state and the target state is suppressed is determined as the control content of the vehicle by using the identified vehicle state and is notified to the vehicle as the running control signal, so that occurrence of variations in the vehicle state can be suppressed by the vehicle itself or an operator executing the control content notified to the vehicle.

**[0089]** (6) According to another aspect of the present disclosure, provided is a vehicle transported in any of steps from production to shipment. The vehicle includes a driving control unit that executes driving control during transport of the vehicle, a state identification unit that identifies a vehicle state that is a state of the vehicle, and a control notification unit that determines a control content of the driving control by using the identified vehicle state and transmits a running control signal indicating the control content to the driving control unit. The control notification unit determines to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**[0090]** According to the vehicle of this aspect, the control notification unit uses the identified vehicle state to determine to control at least either one of the transport route of the vehicle and the timing of starting the transport as the control content of the vehicle such that the magnitude of the difference between the vehicle state and the target state is suppressed, and notifies the driving control unit of it as the running control signal. In addition, the driving control unit uses the received running control signal to execute driving control. Therefore, occurrence of variations in the vehicle state can be suppressed.

**[0091]** (7) According to another aspect of the present disclosure, provided is a vehicle transported in any of steps from production to shipment. The vehicle receives from a server a running control signal indicating a control content of driving control during transport of the vehicle and executes the driving control by using the received running control signal. The server includes a state identification unit that identifies a vehicle state that is a state of the vehicle, and a control notification unit that determines the control content by using the identified vehicle state and transmits the running control signal to the vehicle. The control notification unit determines to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**[0092]** According to the vehicle of this aspect, the driving control is executed by using the received running control signal, and this running control signal is a signal transmitted to the vehicle by the server using the identified vehicle state and determining to control at least either one of the transport route of the vehicle and the timing of starting the transport as the control content of the vehicle such that the magnitude of the difference between the vehicle state and the target state is suppressed, so that occurrence of variations in the vehicle state can be suppressed.

What is claimed is:

**1**. A control system for controlling transport of a vehicle in any of steps from production to shipment of the vehicle, the system comprising:

a state identification unit configured to identify a vehicle state that is a state of the vehicle; and

a control notification unit configured to determine a control content of the vehicle by using the identified vehicle state and notify the vehicle of the control content,

wherein the control notification unit is configured to determine to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**2**. The control system according to claim **1**, wherein the vehicle is configured as a vehicle with a Remote Control auto Driving system including a driving control unit configured to execute driving control of the vehicle in accordance with the control content notified from the control notification unit.

**3**. The control system according to claim **1**,

wherein the control system is configured to control the transport of a plurality of the vehicles,

the state identification unit is configured to identify the vehicle state of each of the vehicles, and

the control notification unit is configured to determine a transport order of each of the vehicles by using the vehicle state of each of the vehicles such that a magnitude of a difference between the vehicle state and the target state for at least some of the plurality of vehicles is suppressed, and notify each of the vehicles of running in accordance with the transport order as the control content.

**4**. The control system according to claim **3**,

wherein each of the vehicles includes a battery that stores electric power used for running of the vehicle,

the state identification unit is configured to acquire a remaining amount of the battery as the vehicle state, and

the control notification unit is configured to determine the transport order such that, among the plurality of vehicles, a second vehicle having a smaller remaining amount of the battery than a first vehicle is transported earlier than the first vehicle.

**5**. A server used in a control system for controlling transport of a vehicle in any of steps from production to shipment of the vehicle, the server comprising:

a state identification unit configured to identify a vehicle state that is a state of the vehicle; and

a control notification unit configured to determine a control content of the vehicle by using the identified vehicle state and transmit a running control signal indicating the control content to the vehicle,

wherein the control notification unit is configured to determine to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**6**. A vehicle transported in any of steps from production to shipment, the vehicle comprising:

a driving control unit configured to execute driving control during transport of the vehicle;

a state identification unit configured to identify a vehicle state that is a state of the vehicle; and

a control notification unit configured to determine a control content of the driving control by using the identified vehicle state and transmit a running control signal indicating the control content to the driving control unit,

wherein the control notification unit is configured to determine to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

**7**. A vehicle transported in any of steps from production to shipment,

the vehicle being configured to receive from a server a running control signal indicating a control content of driving control during transport of the vehicle and execute the driving control by using the received running control signal,

the server comprising:

a state identification unit configured to identify a vehicle state that is a state of the vehicle; and

a control notification unit configured to determine the control content by using the identified vehicle state and transmit the running control signal to the vehicle,

wherein the control notification unit is configured to determine to control at least either one of a transport route of the vehicle and a timing of starting the transport as the control content such that a magnitude of a difference between the vehicle state and a preset target state is suppressed.

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