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# Information processing apparatus, information processing method, and system


## Abstract

An information processing apparatus obtains first image data representing an image displayed on a first monitor provided in an autonomous vehicle after the completion of updating of first software that controls the display on the first monitor. Then, the information processing apparatus determines whether or not the items displayed on a second monitor used for remotely monitoring the operation of the autonomous vehicle after the completion of updating of second software that controls the display on the second monitor and the items displayed on the first monitor extracted from the first image data are identical to each other.



**Inventors:** **Ishihara; Takahiro (Machida, JP), Nagata; Yu (Chofu, JP)**

**Applicant:** **TOYOTA JIDOSHA KABUSHIKI KAISHA** (Toyota, JP)



**Family ID:** **1000008751160**

**Assignee:** **TOYOTA JIDOSHA KABUSHIKI KAISHA (Toyota, JP)**

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*Primary Examiner:* Mahrouka; Wassim

*Attorney, Agent or Firm:* Sughrue Mion, PLLC

## Background/Summary

CROSS REFERENCE TO THE RELATED APPLICATION

(1) This application claims the benefit of Japanese Patent Application No. 2021-127254, filed on Aug. 3, 2021, which is hereby incorporated by reference herein in its entirety.

BACKGROUND

Technical Field

(2) The present disclosure relates to a technology used to remotely monitor the operation of an autonomous vehicle.

Description of the Related Art

(3) Patent Literature 1 in the citation list below discloses a system configured to update software of devices provided in vehicles by OTA (Over The Air). The system disclosed in Patent Literature 1 includes a server that distributes updating software to vehicles according to the priority of updating of software.

CITATION LIST

Patent Literature

(4) Patent Literature 1: Japanese Patent Application Laid-Open No. 2018-132979

SUMMARY

(5) An object of this disclosure is to provide a technology that enables to determine whether or not the items displayed on a monitor provided in an autonomous vehicle and the items displayed on a monitor used for remotely monitoring the operation of the autonomous vehicle are identical to each other.

(6) According to one aspect of the technology disclosed herein, there is provided an information processing apparatus. The information processing apparatus may comprise a controller including at least one processor configured to execute the processing of: obtaining first image data representing an image displayed on a first monitor provided in an autonomous vehicle after the completion of updating of first software that controls the display on the first monitor; and determining whether or not the items displayed on a second monitor used for remotely monitoring the operation of the autonomous vehicle after the completion of updating of second software that controls the display on the second monitor and the items displayed on the first monitor extracted from the first image data are identical to each other.

(7) According a second aspect of the technology disclosed herein, there is provided an information processing method. The information processing method may comprise: obtaining first image data representing an image displayed on a first monitor provided in an autonomous vehicle after the completion of updating of first software that controls the display on the first monitor; and determining whether or not the items displayed on a second monitor used for remotely monitoring the operation of the autonomous vehicle after the completion of updating of second software that controls the display on the second monitor and the items displayed on the first monitor extracted from the first image data are identical to each other.

(8) According to a third aspect of the technology disclosed herein, there is provided a system. The system may comprise: an on-vehicle apparatus configured to send first image data representing an image displayed on a first monitor provided in an autonomous vehicle after the completion of updating of first software that controls the display on the first monitor; and an information processing apparatus provided with a controller including at least one processor, the controller being configured to execute the processing of determining whether or not the items displayed on a second monitor used for remotely monitoring the operation of the autonomous vehicle after the completion of updating of second software that controls the display on the second monitor and the items displayed on the first monitor extracted from the first image data received from the on-vehicle apparatus are identical to each other.

(9) According to this disclosure, it is possible to determine whether or not the items displayed on a monitor provided in an autonomous vehicle and the items displayed on a monitor used for remotely monitoring the operation of the autonomous vehicle are identical to each other.

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## Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a diagram illustrating the general configuration of a vehicle management system.

(2) FIG. **2** is a block diagram illustrating the hardware configurations of a vehicle and a monitoring server.

(3) FIG. **3** is a block diagram illustrating an exemplary functional configuration of the monitoring server according to a first embodiment.

(4) FIG. **4** is a flow chart of an instruction process.

(5) FIG. **5** is a sequence diagram illustrating the procedures of updating first software and second software.

(6) FIG. **6** is a block diagram illustrating an exemplary functional configuration of the monitoring server according to a second embodiment.

(7) FIG. **7** is a flow chart of a determination process.

## DESCRIPTION OF THE EMBODIMENTS

(8) An autonomous vehicle is provided with a monitor (first monitor) that displays the state of the vehicle. In cases where the operation of the autonomous vehicle is monitored remotely, the state of the vehicle is displayed also on a monitor (second monitor) provided outside the vehicle. In order to enable remote recognition of the state of the autonomous vehicle that can be recognized from the items displayed on the first monitor, it is required to make the items displayed on the first monitor and the items displayed on the second monitor identical to each other.

(9) If the software (first software) that controls the display on the first monitor is updated, the items displayed on the first monitor may change in some cases. Therefore, in order to keep the identity of the items displayed on the first monitor and the items displayed on the second monitor, it is necessary to update the software (second software) that controls the display on the second monitor in accordance with the update of the first software.

(10) The information processing apparatus according to this disclosure has a controller. The controller may obtain first image data representing an image displayed on the first monitor after the completion of update of the first software. The first image data is image data representing an image (or screen) displayed on the first monitor by (or under the control of) the first software after the update. Therefore, the first image data reflects the items displayed on the first monitor controlled by the first software after the update.

(11) Moreover, the controller may extract the items displayed on the first monitor from the first image data obtained as above. Then, the controller may determine whether or not the items displayed on the second monitor after update of the second software and the items displayed on the first monitor extracted from the first data are identical to each other.

(12) As above, it is possible to determine whether or not the items displayed on the first monitor controlled by the first software after the update and the items displayed on the second monitor controlled by the second software after the update are identical to each other. In other words, in the case where the items displayed on the first monitor has changed due to the update of the first software, it is possible to determine whether or not the items displayed on the second monitor has also changed in conformity with the change in the items displayed on the first monitor. If the items displayed on the first monitor and the items displayed on the second monitor are not identical to each other, it is possible to execute processing for making the items displayed on the first monitor and the items displayed on the second monitor identical to each other.

(13) In the following, a specific embodiment of the technology disclosed herein will be described with reference to the drawings. It should be understood that the dimensions, materials, shapes, relative arrangements, and other features of the components that will be described in connection with the embodiment are not intended to limit the technical scope of this disclosure only to them, unless otherwise stated.

### First Embodiment

(14) System Configuration

(15) FIG. **1** is a diagram illustrating the general configuration of a vehicle management system. The vehicle management system **1** is a system that manages a vehicle **100**. The vehicle **100** is an autonomous vehicle, namely a vehicle capable of traveling autonomously according to a given operation plan. The operation of the vehicle **100** is monitored remotely by an observer. The vehicle management system **1** includes a monitoring server **200**. The monitoring server **200** is a server used to remotely monitor the operation of the vehicle **100**. The vehicle management system **1** also includes a distribution server **300**. The distribution server **300** is a server that distributes or sends to the vehicle **100** various software for autonomous vehicles that is necessary for management of the travel or operation of the vehicle **100**.

(16) The vehicle **100**, the monitoring server **200**, and the distribution server **300** in the vehicle management system **1** are interconnected by a network N**1**. The network N**1** may be a WAN (Wide

Area Network), namely a global public communication network, such as the Internet, or a telephone communication network, such as a cellular phone communication network.
(17) FIG. **2** is a block diagram schematically illustrating the hardware configurations of the vehicle **100** and the monitoring server **200**. The vehicle **100** has a central ECU (Electronic Control Unit) **101**, a communication module **102**, a first monitor **103**, and a camera **104**. The central ECU **101** is a computer that performs centralized control of ECUs that control various devices provided in the vehicle **100**. The communication module **102** is a communication device used to connect the vehicle **100** to the network N**1**. The communication module **102** communicates with the monitoring server **200** and the distribution server **300** through the network N**1** using a certain wireless communication standard, such as 3G (3rd Generation) or LTE (Long Term Evolution).
(18) The first monitor **103** is a display device that displays the state of the vehicle **100** in the cabin of the vehicle **100**. The items displayed on the first monitor **103** as the state of the vehicle **100** includes, for example, the speed of the vehicle **100**, an indication of the state of lighting of the turn-signal lamps, an indication of the state of lighting of the headlights, various warnings (e.g. a warning as to the remaining battery capacity, a door ajar warning, and a brake warning), and various indications (e.g. an indication of the occurrence of tire slippage and an indication of operation of an anti-theft system). In the case where the travel mode of the vehicle **100** is switchable between the mode in which the vehicle **100** is driven by a human driver and the mode in which the vehicle **100** travels autonomously, the travel mode of the vehicle **100** may also be displayed on the first monitor **103** as the state of the vehicle **100**. The display of the state of the vehicle **100** on the first monitor **103** enables a person in the cabin of the vehicle **100** (a person in the cabin who is in charge of supporting the operation of the vehicle **100**) to know the state of the vehicle **100**.
(19) The first monitor **103** has a monitor ECU **1031**. The monitor ECU **1031** is a computer that controls the first monitor **103**. The monitor ECU **1031** controls the items displayed on the first monitor **103** by executing first software stored in a storage unit of the first monitor **103**. Therefore, the items displayed on the first monitor **103** is determined by the first software.
(20) The camera **104** takes images in the cabin of the vehicle **100**. The camera **104** can capture an image of the screen displayed on the first monitor **103**. The central ECU **101**, the communication module **102**, the first monitor **103**, and the camera **104** in the vehicle **100** can communicate with each other using a certain in-vehicle communication standard. This in-vehicle communication standard may be, for example, CAN (Controller Area Network) or LIN (Local Interconnect Network).
(21) The monitoring server **200** is a computer having a processor **201**, a main storage unit **202**, an auxiliary storage unit **203**, a communication interface **204**, and a second monitor **205**. The processor **201** may be a CPU (Central Processing Unit) or a DSP (Digital Signal Processor). The main storage unit **202** may be a RAM (Random Access Memory). The auxiliary storage unit **203** may be a ROM (Read Only Memory), an HDD (Hard Disk Drive), or a flash memory. The auxiliary storage unit **203** may include a removable medium (or portable medium). Examples of the removable medium include a USB memory, an SD card, and a disc recording medium, such as a CD-ROM, a DVD disc, and a Blu-ray disc. What is stored in the auxiliary storage unit **203** includes an operating system (OS), various programs, and various information tables. The processor **201** loads programs stored in the auxiliary storage unit **203** into the main storage unit **202** and executes them to implement various controls for monitoring the operation of the vehicle **100**.
(22) The communication interface **204** connects the monitoring server **200** to the network N**1**. The communication interface **204** may be a LAN (Local Area Network) interface board or a wireless communication circuit for wireless communication.
(23) The second monitor **205** is a display device used to remotely monitor the state of the vehicle **100**. As with the first monitor **103** provided in the vehicle **100**, the second monitor **205** also displays the state of the vehicle **100**. Information about the state of the vehicle **100** is sent from the

vehicle **100** to the monitoring server **200** through the network N**1**. The central ECU **101** of the vehicle **100** commands the communication module **102** to send information about the state of the vehicle **100** to the monitoring server **200**. Information about the state of the vehicle **100** is sent from the vehicle **100** to the monitoring server **200** periodically at predetermined intervals. The second monitor **205** displays the state of the vehicle **100** based on the information received from the vehicle **100**. The display of the state of the vehicle **100** on the second monitor **205** enables the observer to know the state of the vehicle **100**. The processor **201** controls the items displayed on the second monitor **205** by executing second software. Therefore, the items displayed on the second monitor **205** is determined by the second software.

(24) Some or all of the functions of the monitoring server **200** may be implemented by a hardware circuit, such as an ASIC or an FPGA. The monitoring server **200** is not necessarily required to be constructed as a single integrated component, but it may be constituted by a plurality of cooperating computers. The monitoring server **200** of this embodiment corresponds to the information processing apparatus according to the present disclosure.

(25) Update of Software

(26) As described above, the monitor ECU **1031** in the vehicle **100** executes the first software to control the items displayed on the first monitor **103**. It may sometimes be necessary to update the first software stored in the storage unit of the first monitor **103**. On such occasions, data for updating the first software is sent (or distributed) from the distribution server **300** to the vehicle **100**. Such data will be also referred to as “first data” hereinafter. The communication module **102** of the vehicle **100** receives the first data sent from the distribution server **300**. The central ECU **101** commands the monitor ECU **1031** to execute the processing of updating the first software using the first data.

(27) The items displayed on the first monitor **103** may change with the update of the first software in some cases. To remotely monitor the state of the vehicle **100** through the second monitor **205** of the monitoring server **200**, it is necessary that the items displayed on the second monitor **205** be identical with the items displayed on the first monitor **103**. Hence, if the items displayed on the first monitor **103** changes, it is necessary that the items displayed on the second monitor **205** be also changed accordingly. Therefore, when the first software is updated in the vehicle **100**, it is necessary for the second software, which controls the items displayed on the second monitor **205**, to be updated in the monitoring server **200**.

(28) To this end, when the first software is updated, data for updating the second software is prepared beforehand. This data will also be referred to as “second data” hereinafter. The second data matches the first data so as to make the items displayed on the second monitor **205** after the update of the second software identical to the items displayed on the first monitor **103** after the update of the first software. The second data prepared beforehand is stored in the auxiliary storage unit **203** of the monitoring server **200**. The processor **201** reads out the second data from the auxiliary storage unit **203** to update the second software. The procedures of updating the first software and the second software will be specifically described later.

(29) Functional Configuration

(30) The functional configuration of the monitoring server **200** will now be described with reference to FIG. **3**. FIG. **3** is a block diagram illustrating an exemplary functional configuration of the monitoring server **200**.

(31) The monitoring server **200** includes, as functional components, a control part **210**, a communication part **220**, a second data storage part **230**, and an operation schedule database **240**. The communication part **220** has the function of connecting the monitoring server **200** to the network. The communication part **220** can be implemented by the communication interface **204**.

(32) The control part **210** has the function of executing computation for controlling the monitoring server **200**. The control part **210** can be implemented by the processor **201**. The second data storage part **230** stores the second data prepared to update the second software. The operation schedule

database **240** stores operation schedule of the vehicle **100**. The operation schedule of the vehicle **100** includes a schedule during periods through which the vehicle **100** is out of operation. The second data storage part **230** and the operation schedule database **240** can be implemented by the auxiliary storage unit **203**.

(33) The control part **210** includes, as functional components, an instruction part **2101** and an update execution part **2102**. The instruction part **2101** has the function of providing instructions designating the time at which the first software is to be updated to the vehicle **100**. Specifically, when updating of the first software in the vehicle **100** is needed, the monitoring server **200** determines the time at which the first software is to be updated. Then, the monitoring server **200** provides instructions designating the time at which the first software is to be updated to the vehicle **100**. By the time determined by the monitoring server **200** at which the first software is to be updated, the second data for updating the second software is prepared and stored in the second data storage part **230**. The update execution part **2102** has the function of updating the second software using the second data. The processes executed by the instruction part **2101** and the update execution part **2102** will be specifically described below.

(34) Instruction Process

(35) An instruction process executed by the monitoring server **200** will now be described with reference to FIG. **4**. The instruction process is executed to provide instructions designating the time at which the first software is to be updated to the vehicle **100**. FIG. **4** is a flow chart of the instruction process. This process is executed by the instruction part **2101** of the control part **210**.

(36) As described above, in this vehicle management system **1**, when the first software is to be updated in the vehicle **100**, the distribution server **300** sends the first data to the vehicle **100**. Before sending the first data to the vehicle **100**, the distribution server **300** sends to the monitoring server **200** information about the time at which sending (or distribution) of the first data will become possible. This information will also be referred to as “distribution time information” hereinafter. The monitoring server **200** receives the distribution time information sent from the distribution server **300** through the communication part **220**. When the monitoring server **200** receives the distribution time information from the distribution server **300**, the instruction part **2101** executes the process according to the flow chart of FIG. **4**.

(37) In step S**101** of the process according to the flow chart of FIG. **4**, the distribution time information received through the communication part **220** is obtained. Then, in step S**102**, the operation schedule of the vehicle **100** stored in the operation schedule database **240** is retrieved.

(38) Then, in step S**103**, the time at which the first software is to be updated is determined based on the distribution time information obtained in step S**101** and the operation schedule retrieved in step S**102**. Specifically, selected as the time at which the first software is to be updated is the time at which the operation of the vehicle **100** is scheduled to be suspended after the time at which sending of the first data from the distribution server **300** will become possible. As the time at which the first software is to be updated is selected in this way, the first software can be updated during the vehicle **100** is not in operation.

(39) Then, in step S**104**, instruction information that designates the time determined in step S**103** at which the first software is to be updated is sent to the vehicle **100**. The instruction information is sent from the communication part **220** to the vehicle **100**. The vehicle **100** receives the instruction information sent to it through the communication module **102**. Thus, the central ECU **101** of the vehicle **100** can recognize the time at which the first software is to be updated.

(40) Updating Process

(41) Next, the process of updating the first software executed in the vehicle **100** and the process of updating the second software executed in the monitoring server **200** will be described with reference to FIG. **5**. FIG. **5** is a sequence diagram illustrating the process of updating the first software and the process of updating the second software.

(42) When the time at which the first software is to be updated, which is designated by the

instruction information received from the monitoring server **200**, comes, the vehicle **100** sends request information that requests sending of data for updating to the distribution server **300** (S**10**). Specifically, the central ECU **101** commands the communication module **102** to send this request information. When the distribution server **300** receives the request information from the vehicle **100**, the distribution server **300** sends the first data to the vehicle **100** (S**11**). When the vehicle **100** receives the first data through the communication module **102**, the central ECU **101** commands the monitor ECU **1031** to execute the processing of updating the first software using the first data. Thus, the first software stored in the storage unit of the first monitor **103** is updated (S**12**).
(43) After the completion of updating of the first software in the vehicle **100**, the vehicle **100** sends a completion notification to the monitoring server **200** (S**13**). The completion notification is information notifying that the updating of the first software has been completed. Specifically, the central ECU **101** commands the communication module **102** to send the completion notification.
(44) The monitoring server **200** receives the completion notification sent from the vehicle **100** through the communication part **220**. When the communication part **220** receives the completion notification, the update execution part **2102** of the control part **210** executes the processing of updating the second software. Specifically, the update execution part **2102** retrieves the second data stored in the second data storage part **230** (S**14**). Then, the update execution part **2102** executes the processing of updating the second software using the retrieved second data (S**15**). Thus, the second software is updated in the monitoring server **200**.
(45) In the above process, updating of the second software in the monitoring server **200** is triggered by the reception of the completion notification sent from the vehicle **100**. Thus, it is possible to update the second software immediately following the update of the first software in the vehicle **100**. In consequence, even if the items displayed on the first monitor **103** changes due to the update of the first software, it is possible to change the items displayed on the second monitor **205** in conformity with the change in the items displayed on the first monitor **103**. Therefore, even if the first software is updated, the identity of the items displayed on the first monitor **103** and the items displayed on the second monitor **205** can be maintained.
(46) When the first software and the second software are to be updated, another possible way of updating them is to update the second software first and then update the first software after the completion of updating of the second software in the order reverse to the above-described process according to the embodiment. However, the possibility of troubles occurring during the reception of data for updating the software or during the process of updating the software is higher in the vehicle **100** than in the monitoring server **200**. Therefore, updating the second software after the completion of updating of the first software as in the above process according to the embodiment can achieve the identity of the items displayed on the first monitor **103** and the items displayed on the second monitor **205** more quickly.

Second Embodiment

(47) A vehicle management system according to a second embodiment will be described next. The vehicle management system according to the second embodiment has the basically same configuration as the system according to the first embodiment, and similar components will be designated by similar reference signs. In the vehicle management system according to the second embodiment also, the first software and the second software are updated in a manner similar to that in the above-described system according to the first embodiment. In the system according to the second embodiment, a determination process is performed by the monitoring server **200** after the completion of updating of the first and second software. This determination process is the process of determining whether or not the items displayed on the first monitor **103** controlled by the first software after the update and the items displayed on the second monitor **205** controlled by the second software after the update are identical to each other. In the following description, features of the second embodiment that are different from or absent in the first embodiment will be described.
(48) Functional Configuration

(49) FIG. **6** is a block diagram illustrating an exemplary functional configuration of the monitoring server **200** in the system according to the second embodiment. As in the first embodiment, the monitoring server **200** in the second embodiment includes, as functional components, the control part **210**, the communication part **220**, the second data storage part **230**, and the operation schedule database **240**. The control part **210** in the second embodiment includes a determination part **2103** in addition to the instruction part **2101** and the update execution part **2102**. The determination part **2103** has the function of executing the determination process.
(50) The camera **104** provided in the vehicle **100** is capable of capturing an image of the image or screen displayed on the first monitor **103**. The camera **104** in the vehicle **100** captures an image of the screen displayed on the first monitor **103** after the completion of updating of the first software. Thus, first image data representing the screen displayed on the first monitor **103** under the control of the first software after the update is created. In consequence, the first image data reflects the items displayed on the first monitor **103** controlled by the first software after the update.
(51) The vehicle **100** sends the first image data created as above to the monitoring server **200**. Specifically, the central ECU **101** commands the communication module **102** to send the first image data. The vehicle **100** may send the first image data to the monitoring server **200** together with the completion notification notifying the completion of updating of the first software.
(52) The monitoring server **200** receives the first image data sent from the vehicle **100** through the communication part **220**. Then, the monitoring server **200** executes the determination process using the first image data received from the vehicle **100**.
(53) Determination Process
(54) The determination process executed by the monitoring server **200** will be described with reference to FIG. **7**. FIG. **7** is a flow chart of the determination process. This process is executed by the determination part **2103** in the control part **210**.
(55) In the process according to the flow chart of FIG. **7**, the first image data received by the communication part **220** is obtained in step S**201**. Then, in step S**202**, the items displayed on the first monitor **103** is extracted from the first image data obtained in step S**201**. Specifically, image processing is performed on the first image data to extract the items displayed on the first monitor **103**. Thus, the items displayed on the first monitor **103** controlled by the first software after the update is extracted.
(56) Then, in step S**203**, the items displayed on the second monitor **205** controlled by the second software after the update is obtained. The items displayed on the second monitor **205** may be obtained based on the second data for updating the second software. Then, in step S**204**, it is determined whether or not the items displayed on the first monitor **103** and the items displayed on the second monitor **205** are identical to each other.
(57) If the first data used for updating the first software and the second data used for updating the second software match each other, and updating of the first and second software has been completed satisfactorily in the vehicle **100** and the monitoring server **200**, step S**204** will be answered in the affirmative. If step S**204** is answered in the affirmative, the determination process ends.
(58) In contrast, if step S**204** is answered in the negative, namely if it is determined that the items displayed on the first monitor **103** and the items displayed on the second monitor **205** are not identical, the processing of step S**205** is executed next. In the case where step S**204** is answered in the negative, there is a possibility that there is something wrong with the update of the first software in the vehicle **100**. For example, there may be a case where the version of the first data for updating the first software sent from the distribution server **300** to the vehicle **100** is different from the proper version. There may also be a case where the update is completed with some trouble occurring in the process of updating the first software executed by the monitor ECU **103** remaining unsolved.
(59) In step S**205**, instruction information instructing to check the updated subject matter in the

first software is sent to the vehicle **100**. The instruction information is sent from the communication part **220** to the vehicle **100**. The vehicle **100** receives the instruction information sent as above through the communication module **102**. When the vehicle **100** receives the instruction information, the central ECU **101** commands the monitor ECU **1031** to execute a processing for checking the updated subject matter in the first software. If it is found that the update of the first software has some trouble, the vehicle **100** may inform the monitoring server **200** of this fact. Moreover, if it is found that the update of the first software has some trouble, the monitor ECU **1031** may execute the processing of updating the first software again. In the case where the processing of updating the first software is executed again, the processing of checking the updated subject matter in the first software is also executed again.

(60) Then, in step S**206**, a notification is given to the observer who remotely monitors the operation of the vehicle **100** through the second monitor **205** to notify that the items displayed on the first monitor **103** and the items displayed on the second monitor **205** are not identical to each other. This notification to the observer may be displayed on the screen of the second monitor **205**. Alternatively, this information may be given by sound or voice. This enables the observer to know that the items displayed on the first monitor **103** and the items displayed on the second monitor **205** are no longer identical to each other. This can invite the observer to take some measure to make the items displayed on the first monitor **103** and the items displayed on the second monitor **205** identical to each other.

Other Embodiments

(61) The embodiments described above are merely examples, and the present disclosure may be changed and implemented as appropriate within the scope of the disclosure. Furthermore, processes and means described in the present disclosure may be freely combined to the extent that no technical conflict exists.

(62) Furthermore, a process that is described to be performed by one apparatus may be shared and performed by a plurality of apparatuses. Processes described to be performed by different apparatuses may be performed by one apparatus. Which function is to be implemented by which hardware configuration (server configuration) in a computer system may be flexibly changed.

(63) The present disclosure may also be implemented by supplying computer programs for implementing the functions described in the embodiments described above to a computer, and by one or more processors of the computer reading out and executing the programs. Such computer programs may be provided to the computer by a non-transitory computer-readable storage medium that can be connected to a system bus of the computer, or may be provided to the computer through a network. The non-transitory computer-readable storage medium may be any type of disk including magnetic disks (floppy (registered trademark) disks, hard disk drives (HDDs), etc.) and optical disks (CD-ROMs, DVD discs, Blu-ray discs, etc.), and any type of medium suitable for storing electronic instructions, such as read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic cards, flash memories, or optical cards.

## Claims

1. An information processing apparatus comprising a controller including at least one processor, the controller being configured to execute the processing of: receiving first image data representing an image displayed on a first monitor provided in an autonomous vehicle after the completion of updating of first software that controls the display on the first monitor, together with a completion notification that indicates the completion of updating of first software in the autonomous vehicle; updating, triggered by the reception of the completion notification, second software that controls the display on a second monitor used for remotely monitoring the operation of the autonomous vehicle; extracting items displayed on the first monitor from the first image data; obtaining items displayed on the second monitor after the completion of updating of second software based on data

for updating the second software; and determining whether or not the items displayed on a second monitor after the completion of updating of second software and the items displayed on the first monitor extracted from the first image data are identical to each other.
2. The information processing apparatus according to claim 1, wherein the first monitor and the second monitor are monitors that display the state of the autonomous vehicle.
3. The information processing apparatus according to claim 1, wherein the controller receives the first image data from the autonomous vehicle.
4. The information processing apparatus according to claim 3, wherein the first image data is image data created by capturing an image of an image displayed on the first monitor by a camera provided in the autonomous vehicle.
5. The information processing apparatus according to claim 1, wherein if the controller determines that the items displayed on the second monitor and the items displayed on the first monitor are not identical to each other, the controller further executes the processing of sending instruction information instructing to check updated subject matter in the first software to the autonomous vehicle.
6. The information processing apparatus according to claim 1, wherein if the controller determines that the items displayed on the second monitor and the items displayed on the first monitor are not identical to each other, the controller further executes the processing of controlling the second monitor to output an audio a notification to an observer who remotely monitors the operation of the autonomous vehicle through the second monitor.
7. The information processing apparatus according to claim 1, wherein the controller obtains data for updating the second software corresponding to subject matter of the update of the first software from a storage unit and updates the second software using the obtained data.
8. An information processing method comprising: receiving first image data representing an image displayed on a first monitor provided in an autonomous vehicle after the completion of updating of first software that controls the display on the first monitor, together with a completion notification that indicates the completion of updating of first software in the autonomous vehicle: updating, triggered by the reception of the completion notification, second software that controls the display on a second monitor used for remotely monitoring the operation of the autonomous vehicle: extracting items displayed on the first monitor from the first image data: obtaining items displayed on the second monitor after the completion of updating of second software based on data for updating the second software; and determining whether or not the items displayed on a second monitor after the completion of updating of second software and the items displayed on the first monitor extracted from the first image data are identical to each other.
9. The information processing method according to claim 8, wherein the first monitor and the second monitor are monitors that display the state of the autonomous vehicle.
10. The information processing method according to claim 8, wherein the first image data is received from the autonomous vehicle.
11. The information processing method according to claim 10, wherein the first image data is image data created by capturing an image of an image displayed on the first monitor by a camera provided in the autonomous vehicle.
12. The information processing method according to claim 8, wherein the method further comprises, if it is determined that the items displayed on the second monitor and the items displayed on the first monitor are not identical to each other, sending instruction information instructing to check updated subject matter in the first software to the autonomous vehicle.
13. The information processing method according to claim 8, wherein the method further comprises, if it is determined that the items displayed on the second monitor and the items displayed on the first monitor are not identical to each other, giving a notification to an observer who remotely monitors the operation of the autonomous vehicle through the second monitor.
14. The information processing method according to claim 1, further comprising obtaining data for

updating the second software corresponding to subject matter of the update of the first software from a storage unit to update the second software using the obtained data.

15. A system comprising: a computer, mounted on an autonomous vehicle, configured to send first image data representing an image displayed on a first monitor provided in the autonomous vehicle after the completion of updating of first software that controls the display on the first monitor, together with a completion notification that indicates the completion of updating of first software in the autonomous vehicle; and an information processing apparatus provided with a controller including at least one processor, the controller being configured to execute the updating, triggered by the reception of the completion notification, second software that controls the display on a second monitor used for remotely monitoring the operation of the autonomous vehicle, wherein the controller, further executes extracting items displayed on the first monitor from the first image data: obtaining items displayed on the second monitor after the completion of updating of second software based on data for updating the second software; and determining whether or not the items displayed on a second monitor after the completion of updating of second software and the items displayed on the first monitor extracted from the first image data received from the computer are identical to each other.

16. The system according to claim 15, wherein the first monitor and the second monitor are monitors that display the state of the autonomous vehicle.

17. The system according to claim 15, wherein if the controller in the information processing apparatus determines that the items displayed on the second monitor and the items displayed on the first monitor are not identical to each other, the controller further executes the processing of sending instruction information instructing to check updated subject matter in the first software to the autonomous vehicle.

18. The system according to claim 15, wherein if the controller in the information processing apparatus determines that the items displayed on the second monitor and the items displayed on the first monitor are not identical to each other, the controller further executes the processing of giving a notification to an observer who remotely monitors the operation of the autonomous vehicle through the second monitor of that fact.