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(54) **INFORMATION PROCESSING APPARATUS, SYSTEM, AND OPERATING METHOD OF SYSTEM**

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(57) **ABSTRACT**

An information processing apparatus includes a communication interface, a memory configured to store information on an operation plan that includes an operation route for each of a plurality of vehicles, a portion or whole of which is included in one or more areas, and a controller configured to communicate using the communication interface, transmit, to a terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles, and upon receiving, from the terminal apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area, transmit an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

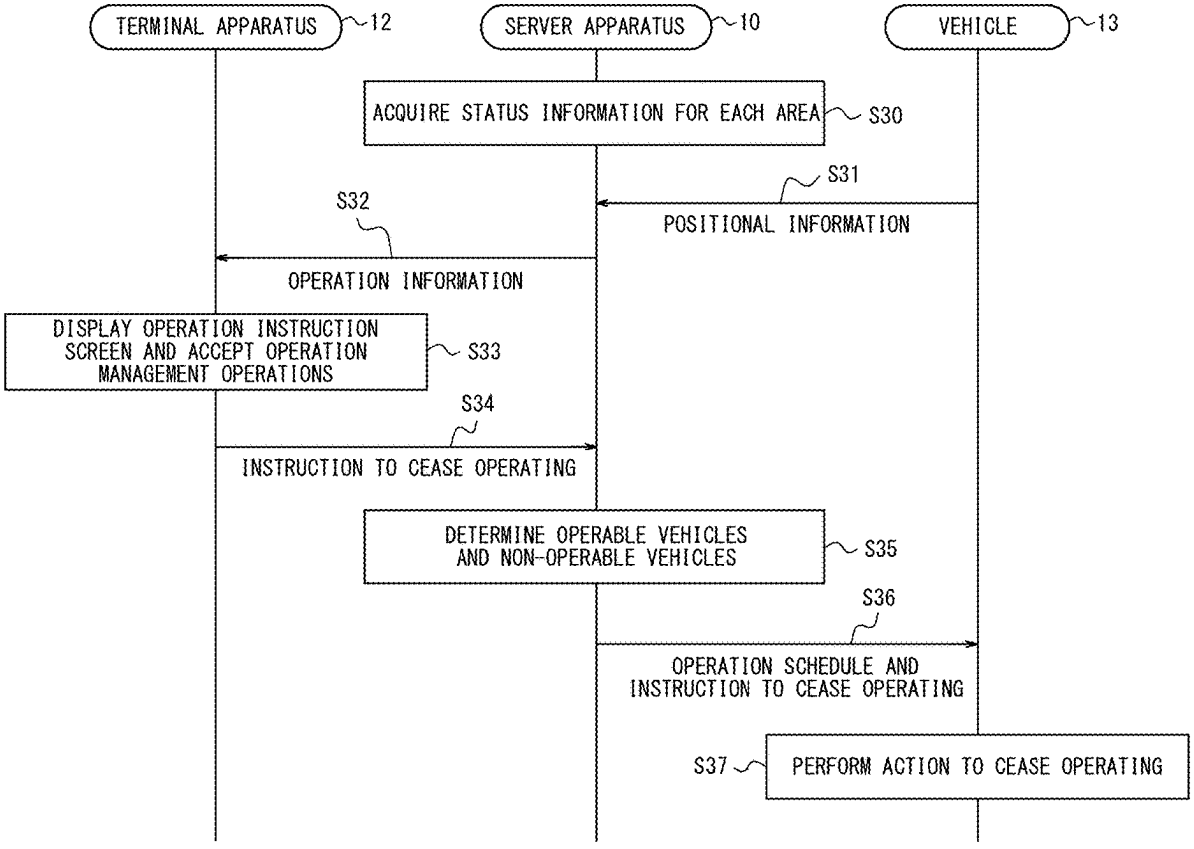

FIG. 1

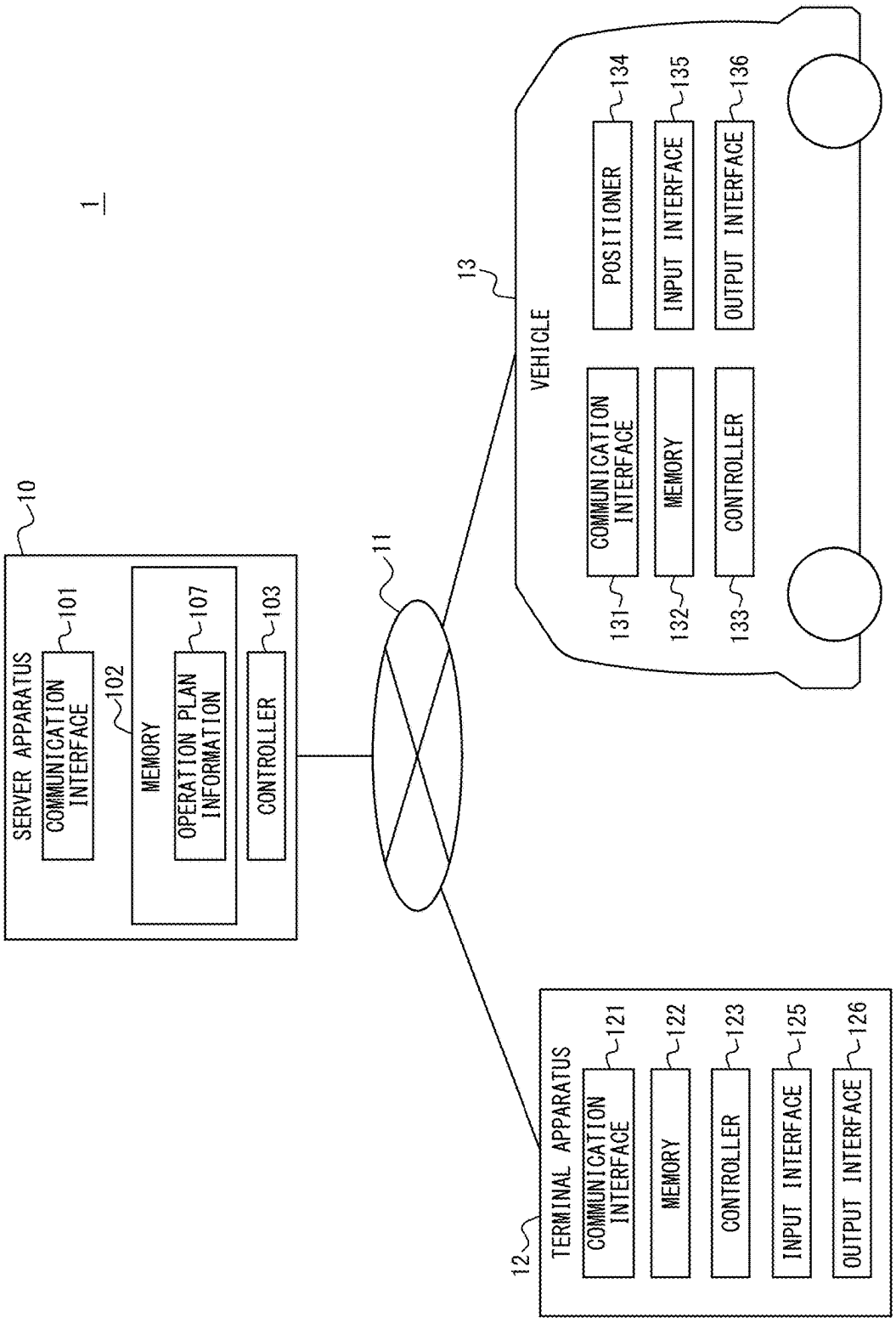
1
10
SERVER APPARATUS
101
COMMUNICATION INTERFACE
102
MEMORY
107
OPERATION PLAN INFORMATION
103
CONTROLLER
11
13
VEHICLE
131
COMMUNICATION INTERFACE
132
MEMORY
133
CONTROLLER
134
POSITIONER
135
INPUT INTERFACE
136
OUTPUT INTERFACE
12
TERMINAL APPARATUS
121
COMMUNICATION INTERFACE
122
MEMORY
123
CONTROLLER
125
INPUT INTERFACE
126
OUTPUT INTERFACE

FIG. 2

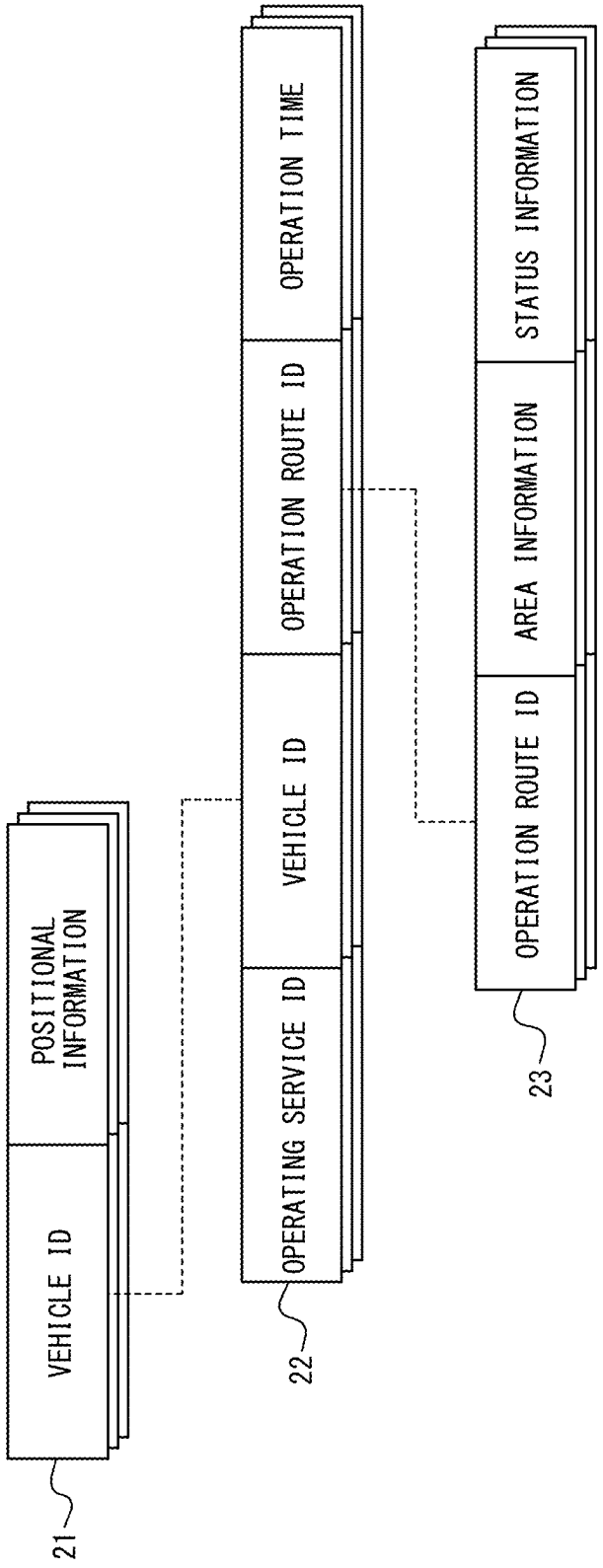
107
VEHICLE ID
POSITIONAL INFORMATION
21
OPERATING SERVICE ID
VEHICLE ID
OPERATION ROUTE ID
OPERATION TIME
22
OPERATION ROUTE ID
AREA INFORMATION
STATUS INFORMATION
23

FIG. 3

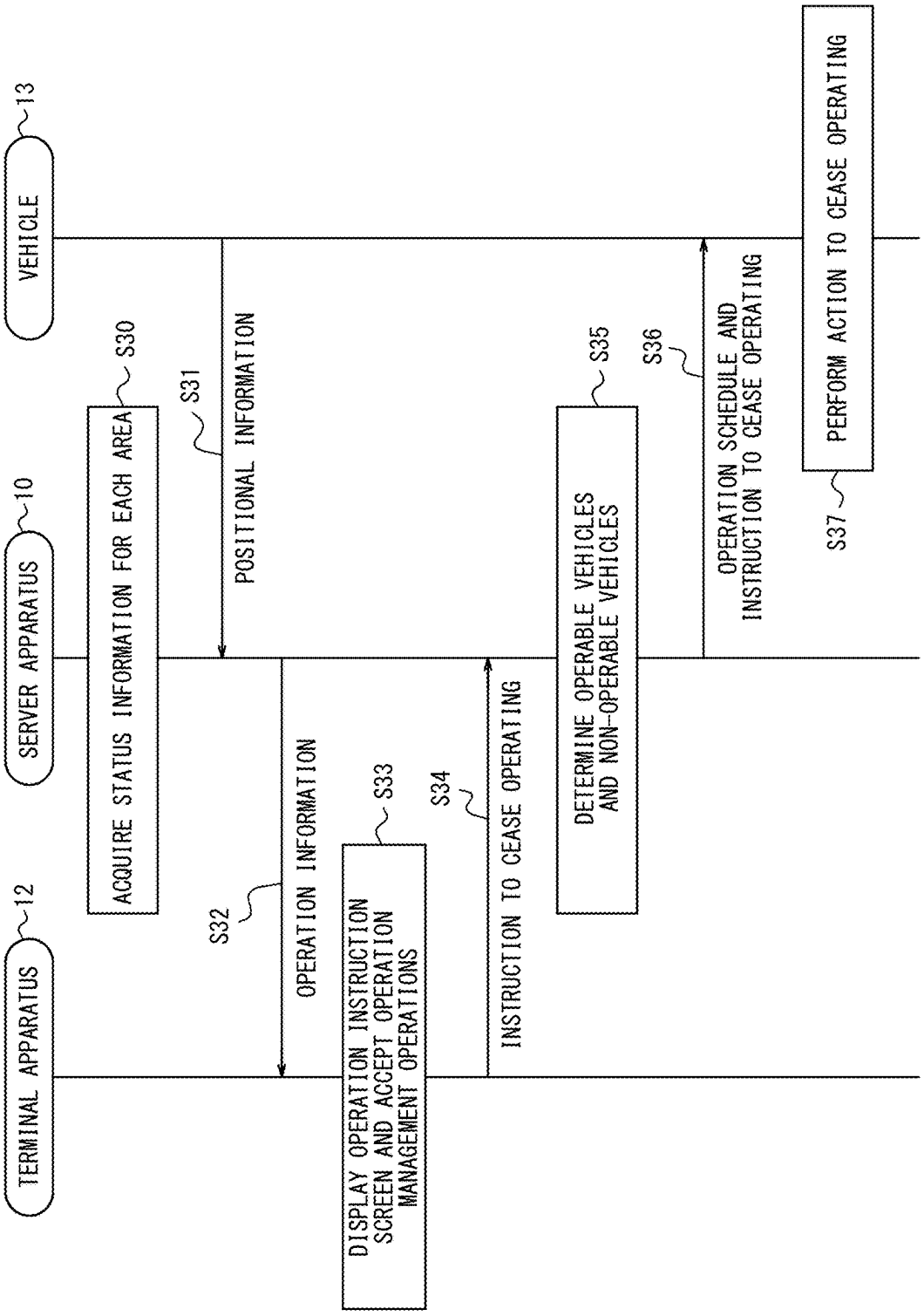
TERMINAL APPARATUS
12
SERVER APPARATUS
10
VEHICLE
13
ACQUIRE STATUS INFORMATION FOR EACH AREA
S30
POSITIONAL INFORMATION
S31
OPERATION INFORMATION
S32
DISPLAY OPERATION INSTRUCTION SCREEN AND ACCEPT OPERATION MANAGEMENT OPERATIONS
S33
INSTRUCTION TO CEASE OPERATING
S34
DETERMINE OPERABLE VEHICLES AND NON-OPERABLE VEHICLES
S35
OPERATION SCHEDULE AND INSTRUCTION TO CEASE OPERATING
S36
PERFORM ACTION TO CEASE OPERATING
S37

FIG. 4

40

ROUTE	OPERATING SERVICE	FIRST STOP	LAST STOP	VEHICLE NAME	CURRENT POSITION	AREA
OPERATION ROUTE 1	FIRST SERVICE FOR OUTWARD	STOP A '23/12/04 10:00 DEPARTURE	STOP Z '23/12/04 11:00 ARRIVAL	AUTOMATED DRIVING VEHICLE NO. 1	BETWEEN STOPS B AND C	AREA 1
OPERATION ROUTE 2	SECOND SERVICE FOR OUTWARD	STOP P '23/12/04 12:30 DEPARTURE	STOP T '23/12/04 13:30 ARRIVAL	AUTOMATED DRIVING VEHICLE NO. 2	BETWEEN STOPS Q AND R	AREA 3
OPERATION ROUTE 3	FIRST SERVICE FOR OUTWARD	STOP M '23/12/04 11:15 DEPARTURE	STOP N '23/12/04 12:15 ARRIVAL	AUTOMATED DRIVING VEHICLE NO. 3	STOP M	AREA 2
OPERATION ROUTE 2	SECOND SERVICE FOR RETURN	STOP Z '23/12/04 13:45 DEPARTURE	STOP A '23/12/04 14:45 ARRIVAL	AUTOMATED DRIVING VEHICLE NO. 4	STOP F	AREA 3
OPERATION ROUTE 4	FIRST SERVICE FOR OUTWARD	STOP Y '23/12/04 10:00 DEPARTURE	STOP A '23/12/04 12:00 ARRIVAL	AUTOMATED DRIVING VEHICLE NO. 5	BETWEEN STOPS D AND C	AREA 3

FIG. 5

51

AREA	STATUS PREDICTION	INSTRUCTION TO EXECUTE /CEASE OPERATION
AREA 1	NOTHING IN PARTICULAR	EXECUTE
AREA 2	NOTHING IN PARTICULAR	EXECUTE
AREA 3	FLOODED SECTION DUE TO HEAVY RAIN	CEASE

52

OPERATION ROUTE	INSTRUCTION DETAILS
OPERATION ROUTE 2	OPERATE TO LAST STOP
OPERATION ROUTE 4	OPERATE TO NEAREST STOP

INFORMATION PROCESSING APPARATUS, SYSTEM, AND OPERATING METHOD OF SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Japanese Patent Application No. 2024-023126, filed on Feb. 19, 2024, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to an information processing apparatus, a system, and an operating method of a system.

BACKGROUND

[0003] Buses and other vehicles start operating according to the pre-planned start time of the service. Various technologies have been proposed to support such operation management. For example, Patent Literature (PTL) 1 discloses a system in which an operation management center transmits a travel permission to an automated driving vehicle in order to properly put the automated driving vehicle on a travel route.

CITATION LIST

Patent Literature

[0004] PTL 1: JP 2021-009431 A

SUMMARY

[0005] In vehicle operation management, various factors may prevent a vehicle from operating as planned, and in such cases, there is room to improve the efficiency of operations for operation instructions by the operation manager.

[0006] In the following, an information processing apparatus or the like that can improve operational efficiency for operation management is disclosed.

[0007] An information processing apparatus in the present disclosure includes:

[0008] a communication interface;

[0009] a memory configured to store information on an operation plan that includes an operation route for each of a plurality of vehicles, a portion or whole of the operation route being included in one or more areas; and

[0010] a controller configured to:

[0011] communicate using the communication interface;

[0012] transmit, to a terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles; and

[0013] upon receiving, from the terminal apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area, transmit an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

[0014] A system in the present disclosure includes:

[0015] an information processing apparatus configured to store information on an operation plan that includes an operation route for each of a plurality of vehicles, a portion or whole of the operation route being included in one or more areas; and

[0016] a terminal apparatus configured to communicate with the information processing apparatus, wherein the information processing apparatus is configured to transmit, to the terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles, the terminal apparatus is configured to transmit, to the information processing apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area, and the information processing apparatus is configured to transmit an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

[0017] An operating method of a system in the present disclosure is an operating method of a system, the system including an information processing apparatus configured to store information on an operation plan that includes an operation route for each of a plurality of vehicles, a portion or whole of which is included in one or more areas, and a terminal apparatus configured to communicate with the information processing apparatus, the operating method including:

[0018] transmitting, by the information processing apparatus, to the terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles;

[0019] transmitting, by the terminal apparatus, to the information processing apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area; and

[0020] transmitting, by the information processing apparatus, an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

[0021] According to the information processing apparatus or the like in the present disclosure, operational efficiency for operation management can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] In the accompanying drawings:

[0023] FIG. **1** is a diagram illustrating an example configuration of an operation management system;

[0024] FIG. **2** is a diagram illustrating an example of operation plan information;

[0025] FIG. **3** is a sequence diagram illustrating an example operations of the operation management system;

[0026] FIG. **4** is a diagram illustrating an example of an operation management instruction screen; and

[0027] FIG. **5** is a diagram illustrating an example of the operation management instruction screen.

DETAILED DESCRIPTION

[0028] An embodiment will be described below.

<Configuration of Operation Management System>

[0029] FIG. **1** is a diagram illustrating a configuration example of an operation management system **1** according to an embodiment. The operation management system **1** includes one or more server apparatuses **10**, one or more terminal apparatuses **12**, and a plurality of vehicles **13** communicably connected to each other via a network **11**. The server apparatus **10** is, for example, a server computer that belongs to a cloud computing system or other computing systems and functions as a server that implements various functions. The server apparatus **10** corresponds to "information processing apparatus" in the present embodiment. The terminal apparatus **12** is an information processing terminal used by the operator of the operation management system **1**, i.e., the operation manager, and exchanges various information with the server apparatus **10**. The terminal apparatus **12** is, for example, a personal computer, a tablet terminal apparatus, or the like. The vehicle **13** is provided with communication functions and information processing functions and is connected to the network **11** via a mobile communication network. The vehicle **13** is, for example, a bus vehicle that transports passengers and operates based on an operation plan. The vehicle **13** may be driven by a driver, or driving may be automated at any level, such as one of Level 1 to Level 5 defined by the Society of Automotive Engineers (SAE). The vehicle **13** is a battery electric vehicle (BEV) or a hybrid electric vehicle (HEV) that uses battery power for at least part of the energy for driving. The network **11** may, for example, be the Internet or may include an ad hoc network, a local area network (LAN), a metropolitan area network (MAN), other networks, or any combination thereof.

[0030] In the present embodiment, the operation management system **1** supports the operation management of the plurality of vehicles **13** by the operation manager. Operations management includes instructions to execute or discontinue the operation plan for each of the vehicles **13**. Each of the vehicles **13** is assigned an operation plan that includes the operation route, start and end times, etc. Operational routes are established in any given city block or district. The city block or district may also be divided into one or more arbitrary areas. Areas may be divided geographically or by function, attribute, or administrative division. The areas may overlap each other in part or more. A portion or whole of the operation route for each of the vehicles **13** is included in one or more areas.

[0031] The server apparatus **10** includes a communication interface **101**, a memory **102**, and a controller **103** that communicates using the communication interface **101**. The memory **102** stores information on an operation plan, or operation plan information **107**, including an operation route for each of the plurality of vehicles **13**, a portion or whole of which is included in one or more areas. The controller **103** transmits, to the terminal apparatus **12**, information indicating the area for which a predetermined reason (hereinafter referred to as "non-operable reason") has occurred after the plurality of vehicles **13** has started operating on the operation route for each of the plurality of vehicles **13** (hereinafter referred to as "non-operable area"), and upon receiving, from the terminal apparatus **12**, an instruction to cease operating on at least one operation route a portion or whole of which is included in the non-operable area (hereinafter referred to as "non-operable route"), the controller **103** transmits an instruction to perform an action according to the instruction to cease operating to the vehicle **13** operating on the non-operable route. The operation manager can instruct the vehicles **13** operating in the non-operable area to cease operating, on a non-operable route basis in the non-operable area. Therefore, when multiple non-operable routes correspond to the non-operable area, it is possible to provide an instruction to cease operating with different modes of actions for each non-operable route. Thus, it is possible to improve operational efficiency for operation management.

<Configuration of Server Apparatus **10**>

[0032] The server apparatus **10** includes the communication interface **101**, the memory **102**, and the controller **103**. The server apparatus **10** is, for example, a single computer. The server apparatus **10** may be two or more computers that are communicably connected to each other and operate in cooperation. In this case, the configuration illustrated in FIG. **1** can be arranged among two or more computers as appropriate.

[0033] The communication interface **101** includes one or more interfaces for communication. The interfaces for communication include, for example, a LAN interface. The communication interface **101** receives information to be used for operations of the server apparatus **10** and transmits information obtained by the operations of the server apparatus **10**. The server apparatus **10** is connected to the network **11** by the communication interface **101** and communicates information with the terminal apparatus **12** and the vehicles **13** via the network **11**.

[0034] The memory **102** includes, for example, one or more semiconductor memories, one or more magnetic memories, one or more optical memories, or a combination of at least two of these types, to function as main memory, auxiliary memory, or cache memory. The semiconductor memories are, for example, Random Access Memory (RAM) or Read Only Memory (ROM). The RAM is, for example, Static RAM (SRAM) or Dynamic RAM (DRAM). The ROM is, for example, Electrically Erasable Programmable ROM (EEPROM). The memory **102** stores information to be used for the operations of the server apparatus **10** and information obtained by the operations of the server apparatus **10**.

[0035] The information stored in the memory **102** includes the operation plan information **107**. The operation plan information **107** includes, for example, vehicle information **21**, operating service information **22**, and operation route information **23**, as illustrated in FIG. **2**. The vehicle information **21** includes, for each vehicle **13**, a vehicle ID to identify the vehicle **13** and positional information indicating the position of the vehicle **13**. The vehicle ID may include the vehicle name. The operating service information **22** includes, for each operating service assigned to each vehicle **13**, an operating service ID to identify the operating service, a vehicle ID indicating the vehicle **13** to which the operating service is assigned, an operation route ID to identify the operation route on which the operating service is set, and operation times indicating when the operation will start and

end. The operating service ID may include the name of the operating service. Operation times may include arrival and departure times at one or more stops on the operation route. The operation route information **23** includes, for each operation route, an operation route ID to identify the operation route, area information indicating the area in which a portion or whole of the operation route is included, and status information regarding the situation in the area. The operation route ID may include the name of the operation route. Area information includes information for identifying an area and information indicating the attributes of the area. The status information is information regarding whether or not an operating service can be operated in the area. Status information includes, for example, the occurrence of road construction in an area, the occurrence of accident handling or other work, the occurrence of an event with road closures, or stormy weather affecting road traffic. Among such situations, the situation that causes a hindrance to operation corresponds to a non-operable reason. The vehicle information **21** and the operating service information **22**, and the operating service information **22** and the operation route information **23** are linked by the vehicle ID and the operating service ID, respectively. One vehicle **13** corresponds to one operating service, but the plurality of routes can correspond to one area, or the plurality of routes to one route. Furthermore, a single route can accommodate the plurality of vehicles **13**.

[0036] Returning to FIG. **1**, the controller **103** includes one or more processors, one or more dedicated circuits, or a combination thereof. The processors are general purpose processors, such as central processing units (CPUs), or dedicated processors, such as graphics processing units (GPUs), specialized for particular processes. The dedicated circuits are, for example, field-programmable gate arrays (FPGAs), application specific integrated circuits (ASICs), or the like. The controller **103** executes information processing related to the operations of the server apparatus **10** while controlling the components of the server apparatus **10**.

[0037] The functions of the server apparatus **10** are realized by a processor included in the controller **103** executing a control program. The control program is a program for causing a computer to execute the processing of steps included in the operations of the server apparatus **10**, thereby enabling the computer to realize the functions corresponding to the processing of the steps. That is, the control program is a program for causing a computer to function as the server apparatus **10**. Some or all of the functions of the server apparatus **10** may be realized by a dedicated circuit included in the controller **103**. The control program may be stored on a non-transitory recording/storage medium readable by the server apparatus **10**, and be read from the medium by the server apparatus **10**.

<Configuration of Terminal Apparatus **12**>

[0038] The terminal apparatus **12** includes a communication interface **121**, a memory **122**, a controller **123**, an input interface **125**, and an output interface **126**.

[0039] The communication interface **121** includes a communication module compliant with a wired or wireless LAN standard, a module compliant with a mobile communication standard such as Long Term Evolution (LTE), 4th Generation (4G), or 5th Generation (5G), or the like. The terminal apparatus **12** connects to the network **11** via a nearby router apparatus or mobile communication base station using the communication interface **121** and communicates information with other apparatuses over the network **11**.

[0040] The memory **122** includes, for example, one or more semiconductor memories, one or more magnetic memories, one or more optical memories, or a combination of at least two of these types. The semiconductor memories are, for example, RAM or ROM. The RAM is, for example, SRAM or DRAM. The ROM is, for example, EEPROM. The memory **122** functions as, for example, a main memory, an auxiliary memory, or a cache memory. The memory **122** stores information to be used for operations of the controller **123** and information obtained by the operations of the controller **123**.

[0041] The controller **123** has one or more general purpose processors such as CPUs or micro processing units (MPUs) or one or more dedicated processors that are dedicated to specific processing. Alternatively, the controller **123** may have one or more dedicated circuits such as FPGAs or ASICs. The controller **123** is configured to perform overall control of operations of the terminal apparatus **12** by operating according to control/processing programs or operating according to operating procedures implemented in the form of circuits. The controller **123** then transmits and receives various types of information to and from the server apparatus **10** and the like via the communication interface **121**, to execute operations according to the present embodiment.

[0042] The input interface **125** includes one or more interfaces for input. The interface for input includes, for example, a physical key, a capacitive key, a pointing device, a touch screen integrally provided with the display, a camera that captures images or image codes, or an IC card reader. The interface for input may include a microphone that accepts audio input. The input interface **125** accepts input of information to be used in the operations of the controller **123** and transmits the inputted information to the controller **123**.

[0043] The output interface **126** includes one or more interfaces for output. The interfaces for output include, for example, a display or a speaker. The display is, for example, a liquid crystal display (LCD) or an organic electro-luminescent (EL) display. The output interface **126** outputs information obtained by the operations of the controller **123**.

[0044] The functions of the controller **123** are realized by a processor included in the controller **123** executing a control program. The control program is a program for causing the processor to function as the controller **123**. Some or all of the functions of the controller **123** may be realized by a dedicated circuit included in the controller **123**.

<Configuration Example of Vehicle **13**>

[0045] The vehicle **13** includes a communication interface **131**, a memory **132**, a controller **133**, a positioner **134**, an input interface **135**, and an output interface **136**. One or more of these may be configured as a single control apparatus, or may be configured by a personal computer including a tablet terminal, a smartphone terminal, a navigation apparatus, or the like. Alternatively, each component may be connected via an in-vehicle network compliant with a standard such as controller area network (CAN) to enable communication of information.

[0046] The memory **132**, the controller **133**, the input interface **135** and the output interface **136** have configurations equivalent to those of the memory **122**, the controller **123**, the input interface **125** and the output interface **126** of the terminal apparatus **12**, respectively.

[0047] The communication interface **131** includes one or more interfaces for communication. Examples of the interface for communication include an interface corresponding to mobile communication standards, such as LTE, 4G, or 5G. The communication interface **131** receives information to be used for the operations of the controller **133** and transmits information obtained by the operations of the controller **133**. The controller **133** connects to the network **11** using the communication interface **131** through a mobile communication base station and communicates information with other apparatuses via the network **11**.

[0048] The positioner **134** includes one or more Global Navigation Satellite System (GNSS) receivers. The GNSS includes, for example, Global Positioning System (GPS), Quasi-Zenith Satellite System (QZSS), BeiDou, Global Navigation Satellite System (GLONASS), and/or Galileo. Based on the information acquired by the positioner **134**, the positional information for the vehicle **13** is obtained.

[0049] The controller **133** controls each of the communication interface **131**, the memory **132**, the positioner **134**, the input interface **135**, and the output interface **136** while exchanging various information with these components and also controls the operation of the vehicle **13**. At the time of operating the vehicle **13**, the controller **133** controls the operation of the vehicle **13** by presenting various information necessary for the operation to the driver via the output interface **136** and/or by controlling the automatic operation of the vehicle **13**.

<Operations of Operation Management System **1**>

[0050] FIG. **3** is a sequence diagram illustrating an example procedure for coordinated operations of the server apparatus **10**, the terminal apparatus **12**, and the vehicles **13**. The steps pertaining to various types of information processing by the server apparatus **10**, the terminal apparatus **12**, and the vehicles **13** in FIG. **3** are performed by the respective controllers **103**, **123**, and **133**. The steps pertaining to transmission and reception of various types of information to and from the server apparatus **10**, the terminal apparatus **12**, and the vehicles **13** are performed by the respective controllers **103**, **123**, and **133** transmitting and receiving information to and from each other via the respective communication interfaces **101**, **121**, and **131**. In the server apparatus **10**, the terminal apparatus **12**, and the vehicles **13**, the respective controllers **103**, **123**, and **133** appropriately store the information that is processed, transmitted and received in the respective memories **102**, **122**, and **132**. Furthermore, in the terminal apparatus **12** and the vehicles **13**, information input by user operation is accepted by the respective input interfaces **125** and **135**, and various information directed to the user is output by the respective output interfaces **126** and **136**.

[0051] The procedure in FIG. **3** is an example of a procedure to be performed when an operation manager uses the terminal apparatus **12** to manage the operation of the vehicles **13** via the server apparatus **10**. The procedure in FIG. **3** is performed in arbitrary cycles (e.g., tens of seconds to minutes), for example, after the vehicles **13** have started operating on each operating day.

[0052] In step S**30**, the server apparatus **10** acquires status information for each area. The server apparatus **10**, for example, acquires information from the servers of operators that distribute road traffic information, event information, weather information, etc., such as the occurrence of road construction, the occurrence of work such as accident processing, the occurrence of events involving road closures, the occurrence of stormy weather, etc., and updates the status information in the operation route information **23** using the acquired information.

[0053] In step S**31**, the server apparatus **10** acquires positional information for each vehicle **13**. When the server apparatus **10** transmits a request for positional information for each vehicle **13** using the vehicle ID of each vehicle **13**, each vehicle **13** transmits positional information to the server apparatus **10** in response to the request. In each vehicle **13**, for example, positional information is acquired by the positioner **134** and transmitted to the server apparatus **10**. The server apparatus **10** updates the positional information in the vehicle information **21** with the information transmitted from each of the vehicles **13**.

[0054] In step S**32**, the server apparatus **10** transmits operation information to the terminal apparatus **12**. The operation information transmitted from the server apparatus **10** includes at least some of the operation plan information **107**. For example, the operation plan information includes updated positional information for each of the vehicles **13** and status prediction information for each area.

[0055] In step S**33**, the terminal apparatus **12** displays the operation instruction screen and accepts operation management operations from the operation manager. Based on the operation information received from the server apparatus **10**, the terminal apparatus **12** displays, for example, an operation schedule **40** as illustrated in FIG. **4** and status information **51** for areas as illustrated in FIG. **5** as an operation instruction screen.

[0056] The operation schedule **40** in FIG. **4** includes information on items such as the name of the operation route, the name of the operating service, the departure time at the first stop, the arrival time at the last stop, the name of the vehicle, the current position of the vehicle, and the name of the area in which a portion of the route is included. The status information **51** for an area in FIG. **5** includes the name of the area and information indicating the status. By checking the operation instruction screen, the operation manager can, for example, recognize the occurrence of a non-operable reason such as a flooded section due to heavy rain in "Area 3", and can determine that "Area 3" is a non-operable area. On the other hand, the operation manager can recognize that a non-operable reason has not occurred in "Area 1" and "Area 2", and therefore, the operation is possible. For example, the operation manager enters instructions to "Execute" (i.e., continue the operation) or "Cease" the operation corresponding to each area in the "Instruction to Execute/Cease Operation" item in the status information **51** for areas. For example, the operation manager can enter instructions to execute or cease the operation by selecting or directly entering one of the "Execute" or "Cease" options that are displayed. The initial value of the "Instruction to Execute/Cease Operation" item is "Execute", and the operation manager may enter a value of "Cease" for the area subject to cease of operation. In this case, "Cease" is instructed for "Area 3", which is a non-operable area, and "Execute" is instructed for "Area 1" and "Area 2".

[0057] Furthermore, the terminal apparatus **12** displays an instruction details input screen **52** for each operation route in response to the operation "Cease" being instructed for "Area 3". The instruction details input screen **52** provides an interface for inputting the operation route corresponding to

an area and the instruction details for each operation route. For example, the instruction details input screen **52** displays "Operation Route 2" and "Operation Route 4" corresponding to "Area 3". The operation manager sets the contents of the "Instruction Details" item by selecting or inputting the instruction details, for example, "operate to the last stop" or "operate to the nearest stop". "Instruction Details" may include, for example, "wait at the current position". The operation manager can set instructions to cease operating in a different manner to the vehicles **13** for each operation route.

[0058] Returning to FIG. **3**, in step S**34**, the terminal apparatus **12** transmits the instruction to cease operating set for each area and each operation route to the server apparatus **10**.

[0059] In step S**35**, the server apparatus **10** determines vehicles **13** that are operable and vehicles **13** that are non-operable. Using the operation plan information **107**, the server apparatus **10** determines the vehicles **13** associated with the operating services in the area and on the operation route for which cease of operation has been instructed as non-operable vehicles and the other vehicles **13** to be operable.

[0060] In step S**36**, the server apparatus **10** transmits the instruction to cease operating to each of the vehicles **13** that is non-operable, along with their respective, operation schedules based on the operating service information **22**. The instruction to cease operating includes information on the instruction details set by the instruction details input screen **52**.

[0061] In step S**37**, each vehicle **13** that is non-operable ceases operating in response to the operation schedule transmitted by the server apparatus **10** and the instruction to cease operating. In each of the vehicles **13**, the controller **133** controls the vehicles **13** pertaining to the discontinuation of operation based on the information transmitted from the server apparatus **10**. Alternatively, the controller **133** may output the operation schedule and the instruction to cease operating by display or other means, and the crew may perform the operation to cease operating. The same information as the operating service information **22** in the operation plan information **107** stored in the server apparatus **10** is stored in advance in each vehicle **13**, and each vehicle **13** may execute the operation based on the information. For example, the vehicles **13** that are non-operable perform actions such as operating to the last stop, operating to the nearest stop, or waiting at the current position, depending on the instruction details in the instruction to cease operating. For example, according to the operation instruction screen in FIG. **4** and FIG. **5**, the vehicles **13** operating on "Operation Route 2", i.e., "Automated Driving Vehicle No. 2" and "Automated Driving Vehicle No. 4", operate to the last stop, and the vehicle **13** operating on "Operation Route 4", i.e., "Automated Driving Vehicle No. 5", operates to the nearest stop, and cease operating, respectively.

[0062] According to the procedure described above, the operation manager can instruct vehicles **13** operating in the non-operable area to cease operating on a non-operable area basis and on an operation route basis. Therefore, even when the plurality of vehicles **13** is scheduled to operate on each operation route, it is possible to instruct the plurality of vehicles **13** to cease operating. Therefore, when the plurality of vehicles **13** operates on one or more operation routes in a non-operable area, the operation manager does not need to instruct each vehicle **13** to cease operating. Even when the plurality of vehicles **13** of different standards and specifications operates in a non-operable area, the communicably configuration of the server apparatus **10** and each of the vehicles **13** makes it possible to instruct the vehicles **13** to cease operating all together. Furthermore, by providing the instruction to cease operating with different actions for each operation route, for example, the vehicles **13** that operate most of the operation route can be allowed to operate to the last stop or to the nearest stop, thereby maximizing passenger convenience through detailed operation management. Thus, it is possible to improve operational efficiency for operation management.

[0063] While the embodiment has been described with reference to the drawings and examples, it should be noted that various modifications and revisions may be implemented by those skilled in the art based on the present disclosure. Accordingly, such modifications and revisions are included within the scope of the present disclosure. For example, functions or the like included in each means, each step, or the like can be rearranged without logical inconsistency, and a plurality of means, steps, or the like can be combined into one or divided.

1. An information processing apparatus comprising:

a communication interface;

a memory configured to store information on an operation plan that includes an operation route for each of a plurality of vehicles, a portion or whole of the operation route being included in one or more areas; and

a controller configured to:

communicate using the communication interface;

transmit, to a terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles; and

upon receiving, from the terminal apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area, transmit an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

2. The information processing apparatus according to claim **1**, wherein in a case in which the at least one first operation route is a plurality of first operation routes and the plurality of first operation routes corresponds to the first area, the controller receives the instruction to cease operating, which is different for each of the plurality of first operation routes, and transmits an instruction to perform an action that is different according to each instruction to cease operating to the at least one first vehicle for each of the plurality of first operation routes.

3. The information processing apparatus according to claim **1**, wherein in a case in which the at least one first vehicle is a plurality of first vehicles and the plurality of first vehicles corresponds to the at least one first operation route, the controller transmits the instruction to perform the action to the plurality of first vehicles.

4. A system comprising:

an information processing apparatus configured to store information on an operation plan that includes an

operation route for each of a plurality of vehicles, a portion or whole of the operation route being included in one or more areas; and

a terminal apparatus configured to communicate with the information processing apparatus,

wherein the information processing apparatus is configured to transmit, to the terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles,

the terminal apparatus is configured to transmit, to the information processing apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area, and

the information processing apparatus is configured to transmit an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

5. An operating method of a system, the system comprising an information processing apparatus configured to store information on an operation plan that includes an operation route for each of a plurality of vehicles, a portion or whole of which is included in one or more areas, and a terminal apparatus configured to communicate with the information processing apparatus, the operating method comprising:

transmitting, by the information processing apparatus, to the terminal apparatus, information indicating a first area for which a predetermined reason has occurred after the plurality of vehicles has started operating on the operation route for each of the plurality of vehicles;

transmitting, by the terminal apparatus, to the information processing apparatus, an instruction to cease operating on at least one first operation route a portion or whole of which is included in the first area; and

transmitting, by the information processing apparatus, an instruction to perform an action according to the instruction to cease operating to at least one first vehicle operating on the at least one first operation route.

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