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METHOD

Abstract

An information processing apparatus used for providing an operation management system that manages operations of a plurality of vehicles acquires information on an extra service based on a GTFS file containing information on the extra service to be additionally registered in the operation management system or based on information on an operating service that has been registered in the operation management system. The information processing apparatus then creates an operation schedule for the extra service based on the information on the extra service.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION
[0001] This application claims priority to Japanese Patent Application No. 2024-0233229 filed on Feb. 19, 2024, the entire contents of which are incorporated herein by reference.
TECHNICAL FIELD
[0002] The present disclosure relates to a method.
BACKGROUND
[0003] Operation management systems that manage operation plans for vehicles are known. For example, Patent Literature (PTL) 1 discloses an operation management system for multiple transportation operators.
CITATION LIST
Patent Literature
[0004] PTL 1: JP 2020-155095 A
SUMMARY
[0005] There is room for improvement with respect to technology of operation management systems that manage operation plans for vehicles.
[0006] It would be helpful to improve technology of operation management systems that manage operation plans for vehicles.
[0007] A method according to an embodiment of the present disclosure is a method performed by an information processing apparatus used for providing an operation management system that manages operations of a plurality of vehicles, the method including: [0008] acquiring information on an extra service based on a GTFS file containing information on the extra service to be additionally registered in the operation management system or based on information on an operating service that has been registered in the operation management system; and [0009] creating an operation schedule for the extra service based on the information on the extra service.
[0010] According to an embodiment of the present disclosure, technology of operation management systems that manage operation plans for vehicles is improved.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0011] In the accompanying drawings:
[0012] FIG. **1** is a block diagram illustrating a schematic configuration of a system according to an embodiment of the present disclosure;
[0013] FIG. **2** is a block diagram illustrating a schematic configuration of a terminal apparatus;
[0014] FIG. **3** is a block diagram illustrating a schematic configuration of a vehicle;
[0015] FIG. **4** is a block diagram illustrating a schematic configuration of an information processing apparatus; and
[0016] FIG. **5** is a flowchart illustrating operations of the information processing apparatus.
DETAILED DESCRIPTION
[0017] Hereinafter, an embodiment of the present disclosure will be described.
Outline of Embodiment
[0018] An outline of a system **1** according to the embodiment of the present disclosure will be described with reference to FIG. **1**. The system **1** includes a plurality of terminal apparatuses **10**, a plurality of vehicles **20**, and an information processing apparatus **30**. The terminal apparatuses **10**, the vehicles **20**, and the information processing apparatus **30** are communicably connected to a network **40** including, for example, the Internet, a mobile communication network, and the like.

[0019] The terminal apparatuses **10** are computers, such as personal computers (PCs), smartphones, or tablet terminals. In the present embodiment, the terminal apparatuses **10** are used by users who manage operations of vehicles **20**, and are connected to the information processing apparatus **30** via the network **40** to input and output information necessary to manage the operations of the vehicles **20**. In an example, a user can use the terminal apparatus **10** to log into the operation management system of a local bus service and create an operation schedule for an operating service by assigning the vehicle **20** to the information on the operating service that has been registered in the operation management system.

[0020] The vehicles **20** are, for example, gasoline automobiles, battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), fuel cell electric vehicles (FCEVs), or the like, but not limited to these and may be any vehicle that people can board. In the present embodiment, the vehicles **20** can communicate with the information processing apparatus **30** via the network **40**. In an example, the vehicles **20** are used as route buses.

[0021] The information processing apparatus **30** is one computer or a plurality of computers, e.g., server apparatuses, that can communicate with each other. The information processing apparatus **30** can communicate with each terminal apparatus **10** and each vehicle **20** via the network **40**. In an example, the information processing apparatus **30** is used to provide an operation management system that manages the operation of the plurality of vehicles **20** in a route bus service.

[0022] First, an outline of the present embodiment will be described, and details thereof will be described later. The information processing apparatus **30** used for providing an operation management system that manages operations of the plurality of vehicles **20** acquires information on an extra service based on a GTFS file containing the information on the extra service to be additionally registered in the operation management system or based on information on an operating service that has been registered in the operation management system. The information processing apparatus **30** then creates an operation schedule for the extra service based on the information on the extra service.

[0023] In an operation management system that uses GTFS files, information on scheduled services in the GTFS files can be captured by registering the GTFS files in the operation management system. However, in addition to services that operate on a fixed schedule and route (hereinafter referred to as “scheduled fixed route services”), extra services may be operated on short notice. In such cases, registering extra services with the GTFS file used for scheduled fixed route services can be a complicated process for the user. In contrast, according to the present embodiment, information on extra services can be acquired based on a GTFS file containing only information on extra services to be additionally registered in the operation management system or based on information on operating services that have been registered in the operation management system. This simplifies the user's work and reduces the probability of work errors. Therefore, according to the present embodiment, the user's work when creating an operation schedule for an extra service is simplified compared to the conventional technology, and technology of operation management systems that manage operation plans for vehicles is improved in that the probability of work errors occurring can be reduced.

[0024] Next, configurations of the system I will be described in detail.

[0025] As illustrated in FIG. **2**, each terminal apparatus **10** includes a communication interface **11**, an output interface **12**, an input interface **13**, a memory **14**, and a controller **15**.

[0026] The communication interface **11** includes at least one communication interface for connecting to the network **40**. The communication interface is compliant with a mobile communication standard such as the 4th generation (4G) standard or the 5th generation (5G) standard, for example, but is not limited to these. In the present embodiment, the terminal apparatus **10** communicates with the information processing apparatus **30** via the communication interface **11** and the network **40**.

[0027] The output interface **12** includes at least one output device for outputting information. The

output device is, for example, a display for outputting information as video, a speaker for outputting information as audio, or the like, but is not limited to these. Alternatively, the output interface **12** may include an interface for connecting to an external output device.

[0028] The input interface **13** includes at least one input device for detecting an input operation by a user. The input device is, for example, a physical key, a capacitive key, a mouse, a touch panel, a touch screen integrally provided with a display of the output interface **12**, a microphone, or the like, but is not limited to these. Alternatively, the input interface **13** may include an interface for connecting to an external input device.

[0029] The memory **14** includes one or more memories. The memories are, for example, semiconductor memories, magnetic memories, optical memories, or the like, but are not limited to these. The memories included in the memory **14** may each function as, for example, a main memory, an auxiliary memory, or a cache memory. The memory **14** stores any information to be used for operations of the terminal apparatus **10**. The memory **14** may store driving record information acquired from the vehicles **20**. For example, the memory **14** may store a system program, an application program, embedded software, or the like. The information stored in the memory **14** may be updated with, for example, information acquired from the network **40** via the communication interface **11**.

[0030] The controller **15** includes at least one processor, at least one programmable circuit, at least one dedicated circuit, or a combination of these. The processor is a general purpose processor such as a central processing unit (CPU) or a graphics processing unit (GPU), or a dedicated processor that is dedicated to specific processing, for example, but is not limited to these. The programmable circuit is a field-programmable gate array (FPGA), for example, but is not limited to this. The dedicated circuit is an application specific integrated circuit (ASIC), for example, but is not limited to this. The controller **15** controls operations of the entire terminal apparatus **10**.

Configuration of Vehicle

[0031] As illustrated in FIG. **3**, each vehicle **20** includes a communication interface **21**, a sensor **22**, a memory **23**, and a controller **24**.

[0032] The communication interface **21** includes at least one communication interface for connecting to the network **40**. The communication interface is compliant with mobile communication standards such as the 4th generation (4G) standard and the 5th generation (5G) standard, for example, but not limited to these, and may be compliant with any communication standard. In the present embodiment, the vehicle **20** communicates with the information processing apparatus **30** via the communication interface **21** and the network **40**.

[0033] The sensor **22** includes one or more sensors for use in control of the vehicle **20**. The sensors include, for example, a position sensor corresponding to a global positioning system (GPS) or the like, a geomagnetic sensor, a velocity sensor, an acceleration sensor, a gyro sensor, or the like, but are not limited to these and may include any sensor.

[0034] The memory **23** includes one or more memories. In the present embodiment, the "memories" are semiconductor memories, magnetic memories, optical memories, or the like, for example, but are not limited to these. The memories included in the memory **23** may each function as, for example, a main memory, an auxiliary memory, or a cache memory. The memory **23** stores any information to be used for operations of the vehicle **20**. For example, the memory **23** may store a system program, an application program, embedded software, or the like. The information stored in the memory **23** may be updated with, for example, information acquired from the network **40** via the communication interface **21**.

[0035] The controller **24** includes at least one processor, at least one programmable circuit, at least one dedicated circuit, or a combination of these. The processor is a general purpose processor such as a central processing unit (CPU) or a graphics processing unit (GPU), or a dedicated processor that is dedicated to specific processing, for example, but is not limited to these. The programmable circuit is a field-programmable gate array (FPGA), for example, but is not limited to this. The

dedicated circuit is an application specific integrated circuit (ASIC), for example, but is not limited to this. The controller **24** controls operations of the entire vehicle **20**.

Configuration of Information Processing Apparatus

[0036] As illustrated in FIG. **4**, the information processing apparatus **30** includes a communication interface **31**, an output interface **32**, an input interface **33**, a memory **34**, and a controller **35**.

[0037] The communication interface **31** includes at least one communication interface for connecting to the network **40**. The communication interface is compliant with a wired LAN standard or a wireless LAN standard, for example, but is not limited to these, and may be compliant with any communication standard. In the present embodiment, the information processing apparatus **30** communicates with the terminal apparatuses **10** and the vehicles **20** via the communication interface **31** and the network **40**.

[0038] The output interface **32** includes at least one output device for outputting information. The output device is, for example, a display for outputting information as video, a speaker for outputting information as audio, or the like, but is not limited to these. Alternatively, the output interface **32** may include an interface for connecting to an external output device.

[0039] The input interface **33** includes at least one input device for detecting an input operation by a user. The input device is, for example, a physical key, a capacitive key, a mouse, a touch panel, a touch screen integrally provided with a display of the output interface **32**, a microphone, or the like, but is not limited to these. Alternatively, the input interface **33** may include an interface for connecting to an external input device.

[0040] The memory **34** includes one or more memories. The memories included in the memory **34** may each function as, for example, a main memory, an auxiliary memory, or a cache memory. The memory **34** stores any information to be used for operations of the information processing apparatus **30**. For example, the memory **34** may store a system program, an application program, embedded software, map information, and the like. In the present embodiment, the memory **34** stores information used to manage the operation of the vehicles **20**, such as operation schedules, information on the vehicles **20**, and the like.

[0041] The “operation schedule” is the information on the operating service plus the information on the vehicles assigned to the operating service. The “information on the operating service” includes information that uniquely identifies the route of the operating service, such as the route ID, information that uniquely identifies the operating service, such as the service ID described above, information on each transit point on the route of the operating service, and information on the corresponding time to pass each transit point, but may include information necessary for the operating service, not limited to the above. For example, the information on the operating service may include information on the operation date that identifies the operation date of the operating service.

[0042] The controller **35** includes at least one processor, at least one programmable circuit, at least one dedicated circuit, or a combination of these. The controller **35** controls operations of the entire information processing apparatus **30**.

Operation Flow of Information Processing Apparatus **30**

[0043] Operations of the information processing apparatus **30** according to the present embodiment will be described with reference to FIG. **5**.

[0044] S**100**: The controller **35** of the information processing apparatus **30** acquires information on an extra service based on a GTFS file containing information on the extra service to be additionally registered in the operation management system or based on information on an operating service that has been registered in the operation management system.

[0045] Specifically, the user may enter a GTFS file with information on the extra service, for example, using a form displayed on the screen of the terminal apparatus **10** or the information processing apparatus **30**. The controller **35** may then retrieve the information contained in the input GTFS file as the information on the extra service. Hereinafter, the acquisition of information on

extra services using GTFS files is also referred to as an “extra service intake”. Alternatively, the user may select, for example, from among the multiple operating services or schedules already registered in the operation management system that are displayed on the screen of the terminal apparatus **10** or the information processing apparatus **30**, the operating service or the operation schedule that the user wishes to use as the basis for the information on the additional extra service to be registered. The controller **35** then acquires the information on the selected operating service or operation schedule as the information on the extra service, except for a part of the information on the selected operating service or operation schedule (e.g., information uniquely identifying the service, such as a service ID, and the information on the assigned vehicle **20**). The acquisition of information on the selected operating service or extra service based on the operation schedule is hereinafter also referred to as “operation duplication”. Here, the controller **35** may automatically assign the service ID of the extra service so that the user can distinguish the service ID of the extra service from the service ID of the scheduled fixed route service. For example, users can distinguish between scheduled fixed route services and extra services by using a different number of digits or numerical range for the service ID.

[0046] In the case of extra import, the user has to create a GTFS file, but if there are multiple extra services that need to be registered, for example, **10** services, the controller **35** can acquire information on multiple extra services at once. In the case of operation duplication, for example, a simple user selection operation, such as one click by the user on a single operating service to be duplicated, allows the controller **35** to acquire information on extra services. Thus, by providing the user with two methods for acquiring information on extra services, the user's task of creating an operation schedule for extra services can be made more efficient.

[0047] The “information on the operation date” may be expressed in terms of a specific month, date, or day of the week. The information on the operation date may also include information such as a flag to determine whether the service is repeated (scheduled fixed route service) or one-time (extra service), for example. In the case of operation duplication, information such as a discrimination flag, etc., which the controller **35** acquires as information on an extra service, may be information that can be determined as an extra service.

[0048] In the case of operation duplication, the controller **35** may or may not acquire the information on the operation date as part of the information on the extra service. The controller **35** may or may not acquire information on the corresponding time to pass each of the transit points as information on the extra services. The controller **35** may also provide an interface that allows the user to select whether the information on the operation date and the information on the corresponding time to pass each transit point are each information on the extra service. The interface may be provided in any form, such as a check box on a screen to select the operating service or operation schedule the user wishes to use as information for an extra service, or in any form on a separate screen, for example.

[0049] S**101**: The controller **35** creates an operation schedule for the extra service based on the information on the extra service.

[0050] Specifically, the controller **35** displays the information on the extra services acquired in S**100** on the screen of the terminal apparatus **10** or the information processing apparatus **30** used by the user. The user then assigns the vehicle **20** to the information on the extra service displayed on the screen of the terminal apparatus **10** or the information processing apparatus **30**. The controller **35** then adds the information on the vehicle **20** assigned by the user to the information on the extra service, creates an operation schedule for the extra service, and displays the information on the operation schedule for the extra service on the screen of the terminal apparatus **10** or the information processing apparatus **30**.

[0051] The assignment of the vehicles **20** by the user may be made by any form, such as text boxes, check boxes, etc., on the screen where the information on the extra service is displayed, or by any form on a separate screen. The controller **35** may control the selection of the vehicles **20** to be

assigned to the extra service from among the plurality of vehicles **20** excluding each vehicle **20** that has been assigned to any of the operating services registered in the operation management system. Specifically, the controller **35** may identify the vehicles **20** that are not assigned to another operation schedule that partially overlaps with the time period between the earliest and latest times of the respective times to pass the transit points on the route of the extra service, and when the user assigns a vehicle **20** to the extra service, only the identified vehicle **20** may be displayed on the screen where the vehicles **20** are assigned as the vehicles **20** that can be assigned.

[0052] The controller **35** may also initially display the information on one of the identified vehicles **20** as the vehicle assigned to the extra service on the screen on which the information on the extra service is displayed.

[0053] As described above, the information processing apparatus **30** used for providing an operation management system that manages operations of a plurality of vehicles acquires information on an extra service based on a GTFS file containing information on the extra service to be additionally registered in the operation management system or based on information on an operating service that has been registered in the operation management system. The information processing apparatus **30** then creates an operation schedule for the extra service based on the information on the extra service.

[0054] In an operation management system that uses GTFS files, information on scheduled services in the GTFS files can be captured by registering the GTFS files in the operation management system. However, in addition to services that operate on a fixed schedule and route (hereinafter referred to as “scheduled fixed route services”), extra services may be operated on short notice. In such cases, registering extra services with the GTFS file used for scheduled fixed route services can be a complicated process for the user. In contrast, according to the present embodiment, information on extra services can be acquired based on a GTFS file containing only information on extra services to be additionally registered in the operation management system or based on information on operating services that have been registered in the operation management system. This simplifies the user's work and reduces the probability of work errors. Therefore, according to the present embodiment, the user's work when creating an operation schedule for an extra service is simplified compared to the conventional technology, and technology of operation management systems that manage operation plans for vehicles is improved in that the probability of work errors occurring can be reduced.

[0055] While the present disclosure 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 component, each step, or the like can be rearranged without logical inconsistency, and a plurality of components, steps, or the like can be combined into one or a single component, step, or the like can be divided.

[0056] For example, an embodiment in which the configuration and operations of the terminal apparatus **10** and/or the information processing apparatus **30** in the above embodiment are distributed to multiple computers capable of communicating with each other can be implemented. For example, an embodiment in which some or all of the components of the information processing apparatus **30** are provided in the terminal apparatus **10** is also possible, and vice versa, an embodiment in which some or all of the components of the terminal apparatus **10** are provided in the information processing apparatus **30** is also possible. For example, the terminal apparatus **10** may have some or all of the components of the information processing apparatus **30**, and the information processing apparatus **30** may have some or all of the components of the terminal apparatus **10**. For example, the information processing apparatus **30** according to the above embodiment may be used to provide Mobility as a Service (MaaS), a service that leverages mobility.

[0057] For example, in the embodiment described above, the controller **35** may provide an interface that allows modification of the transit points included and the times to pass the transit points in the created operation schedule.
[0058] Specifically, for example, the controller **35** provides a button for modifying the information of the operation schedule on the screen displaying the information of the operation schedule created in S**101**. When the user presses the button, the controller **35** displays a form for modifying the information contained in the operation schedule on the screen of the terminal apparatus **10** or the information processing apparatus **30**. When the user modifies information included in the operation schedule, such as transit points, times to pass the transit points, and vehicles, on the screen, the controller **35** reflects the modification in the information on the operation schedule and redisplays the operation schedule on the screen displaying the information on the operation schedule. The operation schedule that can be modified by the interface is not limited to the operation schedule that has been created, but may include the operation schedules for other extra services and scheduled fixed route services.
[0059] For example, in the embodiment described above, the controller **35** may output the information on the created operation schedule to a GTFS file.
[0060] Specifically, for example, the controller **35** provides a button on the screen displaying the information on the operation schedule created in S**101** to output the information on the operation schedule to a GTFS file. When the user presses the button, the controller **35** outputs the information on the operation schedule to the GTFS file. The controller **35** may provide a form for specifying the position for the output in the memory **14** or the memory **34**, such as an output folder designation, for example, or output to a predetermined position in the memory **14** or the memory **34**. Thus, by outputting the information on the created operation schedule to the GTFS file, the user's work can be made more efficient when operating a new extra service.
[0061] For example, in the embodiment described above, the controller **35** may output information on the operation schedules for all operating services to a single GTFS file.
[0062] Specifically, for example, the controller **35** provides a button on the screen of the terminal apparatus **10** or the information processing apparatus **30** on which information on multiple operation schedules, including the operation schedules created in S**101**, is displayed, to output the information on the multiple operation schedules into a single GTFS file. When the user presses the button, the controller **35** outputs the information on the multiple operation schedules to a single GTFS file. The controller **35** may provide a form for specifying the position for the output in the memory **14** or the memory **34**, such as an output folder designation, for example, or output to a predetermined position in the memory **14** or the memory **34**.
[0063] The information on multiple operation schedules to be output to a single GTFS file is not limited to those displayed on the screen of the terminal apparatus **10** or the information processing apparatus **30**, but may be all those that satisfy the specified conditions. The controller **35** may also output information on multiple operation schedules to multiple GTFS files. Thus, by outputting the operation schedule information to a GTFS file, the user can modify the operation schedule on an apparatus other than the terminal apparatus **10** or the information processing apparatus **30**, for example.
[0064] The “specified conditions” may be any conditions related to the operation schedule, such as a schedule selected by the user, a schedule to be managed by the user, or a schedule at a time specified by the user, or the like.
[0065] For example, in the embodiment described above, the controller **35** may provide an interface to modify a scheduled fixed route service to an extra service and an extra service to a scheduled fixed route service.
[0066] Specifically, for example, the controller **35** provides a button on the screen displaying information on multiple operation schedules, including the operation schedule created in S**101**, that allows the user to specify and modify any of the multiple operation schedules, from a scheduled

fixed route service to an extra service, or from an extra service to a scheduled fixed route service.
[0067] For example, in the embodiment described above, if the vehicle **20** includes an automated driving vehicle, the information on the vehicle **20** may include information on the automated driving control apparatus (hereinafter also referred to as “automated driving development kit” or “ADK”) that the vehicle **20** is equipped with.
[0068] In this case, the information on the operating service may include information on one or more corresponding pieces of ADK information.
[0069] “ADK information” may include, for example, Level 1 to 5 as defined by the Society of Automotive Engineers (SAE), or the setting of an operational category, such as manual driving.
[0070] If corresponding ADK information is included in the “information on the operating service”, the controller **35** may also acquire the ADK information among the information on the operating service or the operation schedule selected in S**100** as the information on the extra service. In this case, the controller **35** may perform control in S**101** so that a vehicle **20** can be assigned to an extra service only if any ADK information included in the information on the extra service matches the ADK information included in the information on the vehicle **20**.
[0071] For example, in the variation described above, the one or more corresponding pieces of ADK information may be included in each piece of information on the transit points included in the information on the operating service. In this case, the controller **35** may perform control in S**101**, for all of the information on the transit points included in the information on the extra service, so that the vehicle **20** can be assigned to the extra service only if any ADK information included in each piece of information on the transit points matches the ADK information included in the information on the vehicle **20**.
[0072] For example, in the embodiment described above, the controller **35** may display information on the screen of the terminal apparatus **10** or the information processing apparatus **30** in a manner that makes it possible to distinguish between information on the operation schedule for the scheduled fixed route service and information on the operation schedule for the extra service.
[0073] For example, “a manner that makes it possible to distinguish” can be in any manner, such as using a different color only for the extra service, or displaying an extra service sign on the extra service.
[0074] For example, an embodiment in which a general purpose computer functions as the terminal apparatus **10** or the information processing apparatus **30** according to the above embodiment can also be implemented. Specifically, a program in which processes for realizing the functions of the terminal apparatus **10** or the functions of the information processing apparatus **30** according to the above embodiment are written may be stored in a memory of a general purpose computer, and the program may be read and executed by a processor. Accordingly, the present disclosure can also be implemented as a program executable by a processor, or a non-transitory computer readable medium storing the program.

Claims

1. A method performed by an information processing apparatus used for providing an operation management system that manages operations of a plurality of vehicles, the method comprising: acquiring information on an extra service based on a GTFS file containing information on the extra service to be additionally registered in the operation management system or based on information on an operating service that has been registered in the operation management system; and creating an operation schedule for the extra service based on the information on the extra service.
2. The method according to claim 1, wherein the information processing apparatus selects a vehicle to be assigned to the extra service from among the plurality of vehicles excluding each vehicle that has already been assigned to any of operating services registered in the operation management system, and creates the operation schedule for the extra service by assigning the selected vehicle to

the extra service.

3. The method according to claim 1, further comprising providing an interface that allows modification of a transit point and a time to pass the transit point included in the created operation schedule.

4. The method according to claim 1, further comprising outputting information on the created operation schedule to a GTFS file.

5. The method according to claim 1, wherein the information processing apparatus changes a service ID included in the information on the operating service that has been registered and acquires the information on the extra service.

6. A method, by a processor, for improving travel mobility as a service (MaaS), comprising processing steps executed by the information processing apparatus according to claim 1.