US 20190236960A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2019/0236960 A1

Sakurada et al. (43) Pub. Date: Aug. 1, 2019

(54) **INFORMATION PROCESSING DEVICE, STORAGE MEDIUM STORING INFORMATION PROCESSING PROGRAM, AND INFORMATION PROCESSING METHOD**

(71) Applicant: **Toyota Jidosha Kabushiki Kaisha**, Toyota-shi Aichi-ken (JP)

(72) Inventors: **Shin Sakurada**, Toyota-shi Aichi-ken (JP); **Tomoya Suzuki**, Toyota-shi Aichi-ken (JP); **Hideo Hasegawa**, Nagoya-shi Aichi-ken (JP); **Takao Hishikawa**, Nagoya-shi Aichi-ken (JP)

(73) Assignee: **Toyota Jidosha Kabushiki Kaisha**, Toyota-shi Aichi-ken (JP)

(21) Appl. No.: **16/259,200**

(22) Filed: **Jan. 28, 2019**

(30) **Foreign Application Priority Data**

Jan. 29, 2018 (JP) 2018-012426

Publication Classification

(51) **Int. Cl.**

G08G 1/00	(2006.01)
G06F 21/31	(2006.01)
G01C 21/34	(2006.01)
H04W 4/40	(2006.01)
H04W 4/021	(2006.01)

(52) **U.S. Cl.**

CPC ***G08G 1/205*** (2013.01); ***G06F 21/31*** (2013.01); *G06F 2221/2137* (2013.01); ***H04W 4/40*** (2018.02); ***H04W 4/021*** (2013.01); ***G01C 21/3438*** (2013.01)

(57) **ABSTRACT**

An information processing device includes a controller. The controller is configured to give temporary use authorization of a vehicle to a user. The controller is configured to receive a use end request to end using the vehicle from a terminal that the user having the temporary use authorization operates. The controller is configured to acquire current location information of the vehicle. The controller is configured to determine whether a location that is identified based on the current location information of the vehicle is in an inappropriate area. The controller is configured to, when the controller determines that the location is in the inappropriate area, provide the terminal with notification that the user is not allowed to end using the vehicle.

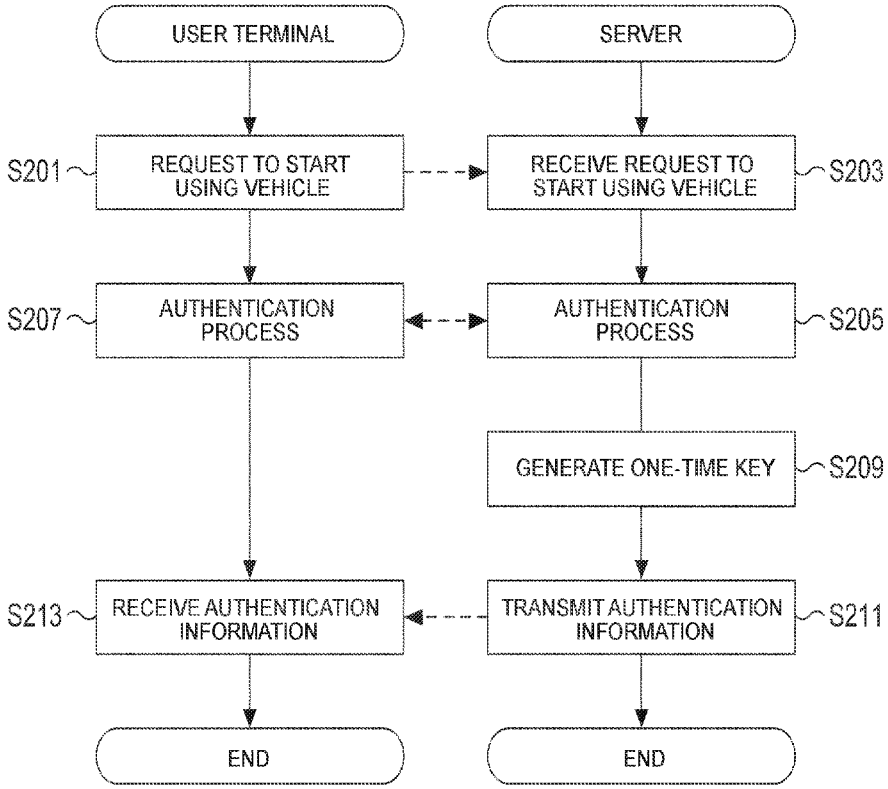


FIG. 1

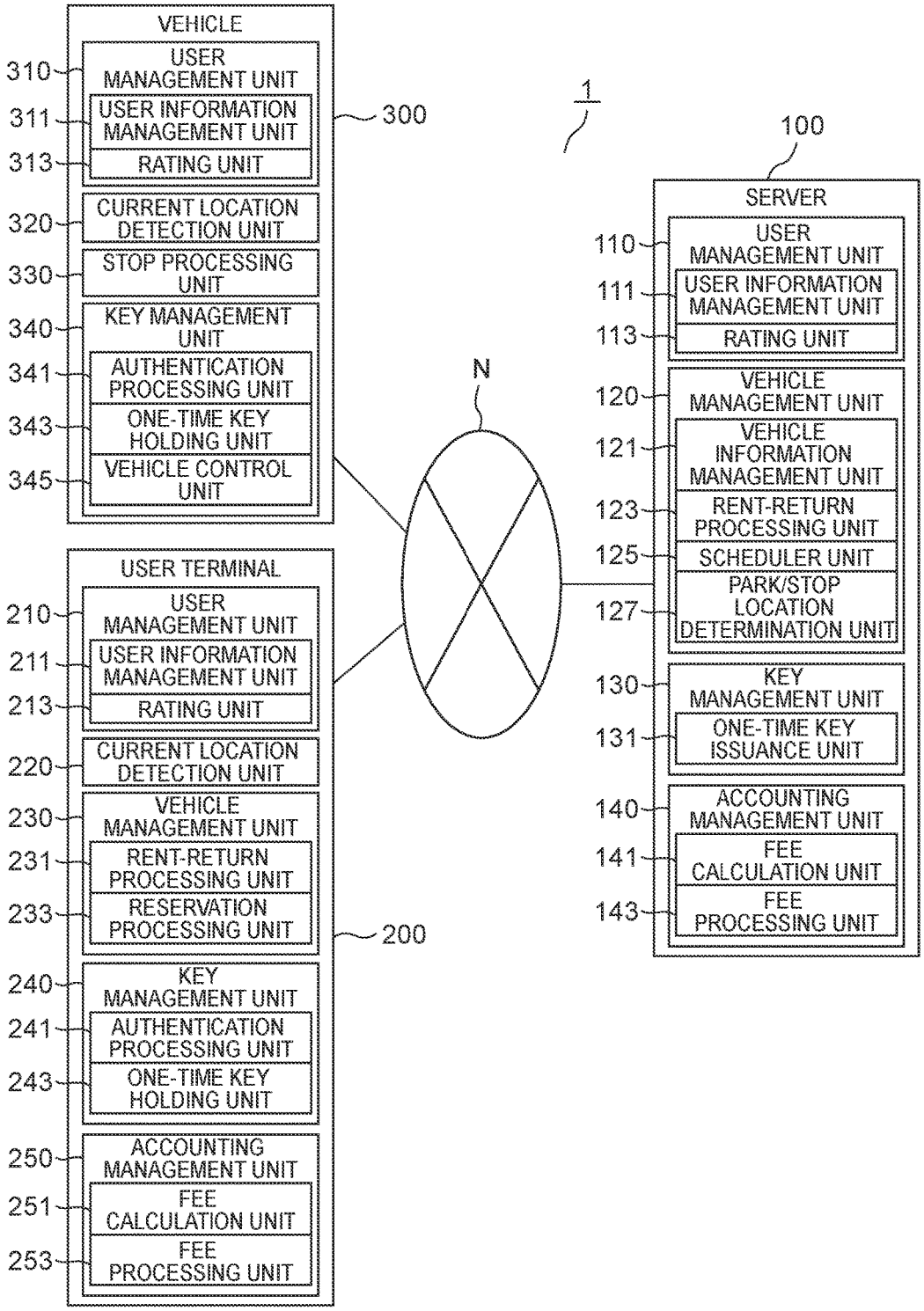

1
100
SERVER
110
USER MANAGEMENT UNIT
111
USER INFORMATION MANAGEMENT UNIT
113
RATING UNIT
120
VEHICLE MANAGEMENT UNIT
121
VEHICLE INFORMATION MANAGEMENT UNIT
123
RENT-RETURN PROCESSING UNIT
125
SCHEDULER UNIT
127
PARK/STOP LOCATION DETERMINATION UNIT
130
KEY MANAGEMENT UNIT
131
ONE-TIME KEY ISSUANCE UNIT
140
ACCOUNTING MANAGEMENT UNIT
141
FEE CALCULATION UNIT
143
FEE PROCESSING UNIT
N
VEHICLE
310
USER MANAGEMENT UNIT
311
USER INFORMATION MANAGEMENT UNIT
313
RATING UNIT
320
CURRENT LOCATION DETECTION UNIT
330
STOP PROCESSING UNIT
340
KEY MANAGEMENT UNIT
341
AUTHENTICATION PROCESSING UNIT
343
ONE-TIME KEY HOLDING UNIT
345
VEHICLE CONTROL UNIT
300
USER TERMINAL
210
USER MANAGEMENT UNIT
211
USER INFORMATION MANAGEMENT UNIT
213
RATING UNIT
220
CURRENT LOCATION DETECTION UNIT
230
VEHICLE MANAGEMENT UNIT
231
RENT-RETURN PROCESSING UNIT
233
RESERVATION PROCESSING UNIT
240
KEY MANAGEMENT UNIT
241
AUTHENTICATION PROCESSING UNIT
243
ONE-TIME KEY HOLDING UNIT
250
ACCOUNTING MANAGEMENT UNIT
251
FEE CALCULATION UNIT
253
FEE PROCESSING UNIT
200

FIG. 2

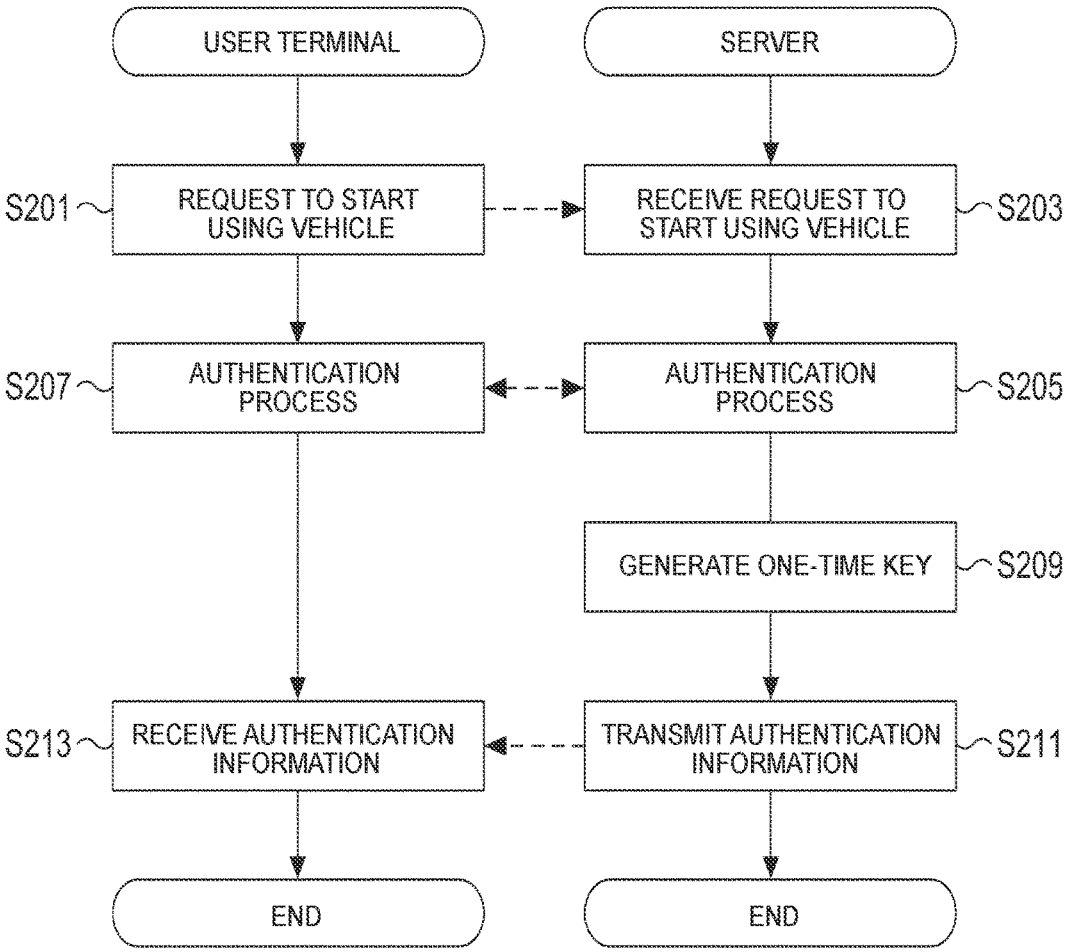

USER TERMINAL
SERVER
S201
REQUEST TO START USING VEHICLE
RECEIVE REQUEST TO START USING VEHICLE
S203
S207
AUTHENTICATION PROCESS
AUTHENTICATION PROCESS
S205
GENERATE ONE-TIME KEY
S209
S213
RECEIVE AUTHENTICATION INFORMATION
TRANSMIT AUTHENTICATION INFORMATION
S211
END
END

FIG. 3

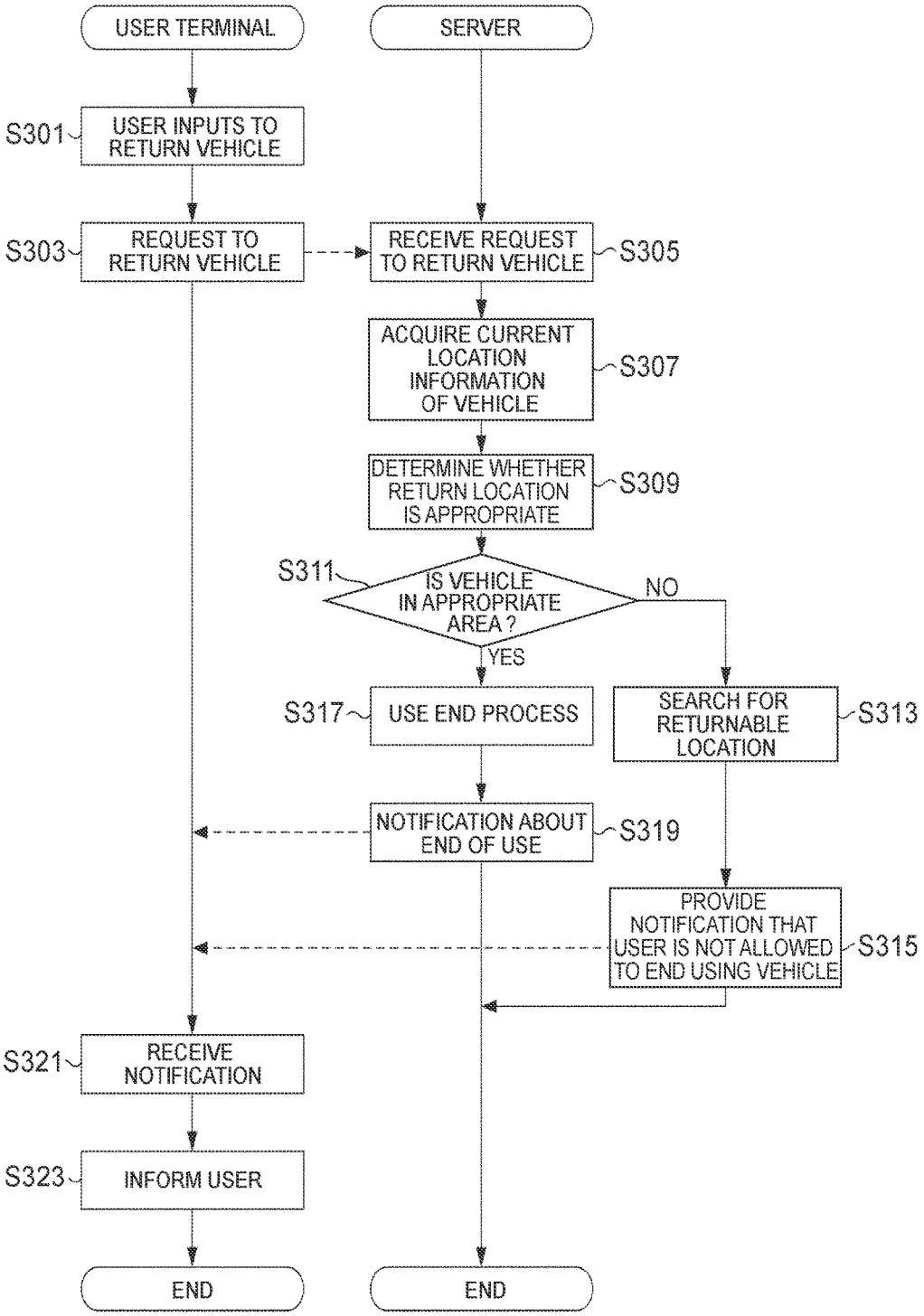

USER TERMINAL
SERVER
S301
USER INPUTS TO RETURN VEHICLE
S303
REQUEST TO RETURN VEHICLE
RECEIVE REQUEST TO RETURN VEHICLE
S305
ACQUIRE CURRENT LOCATION INFORMATION OF VEHICLE
S307
DETERMINE WHETHER RETURN LOCATION IS APPROPRIATE
S309
S311
IS VEHICLE IN APPROPRIATE AREA ?
NO
YES
S317
USE END PROCESS
SEARCH FOR RETURNABLE LOCATION
S313
NOTIFICATION ABOUT END OF USE
S319
PROVIDE NOTIFICATION THAT USER IS NOT ALLOWED TO END USING VEHICLE
S315
S321
RECEIVE NOTIFICATION
S323
INFORM USER
END
END

FIG. 4

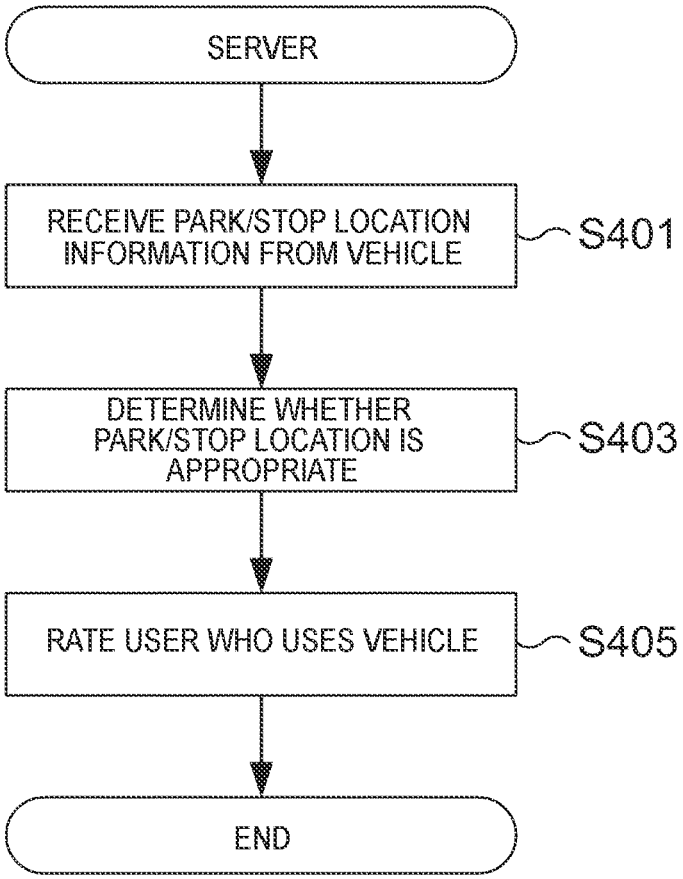
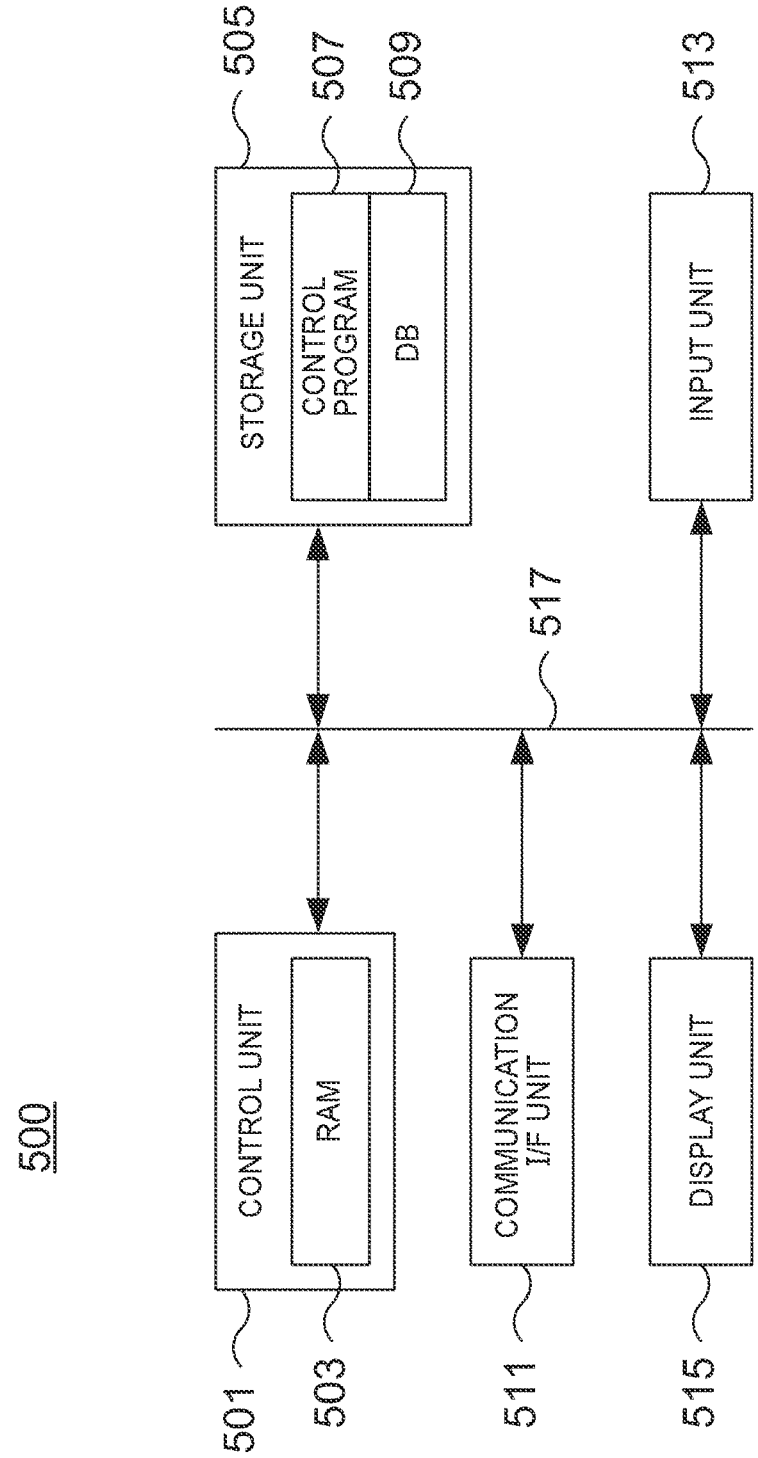

SERVER
RECEIVE PARK/STOP LOCATION INFORMATION FROM VEHICLE
S401
DETERMINE WHETHER PARK/STOP LOCATION IS APPROPRIATE
S403
RATE USER WHO USES VEHICLE
S405
END

FIG. 5


500
CONTROL UNIT
RAM
STORAGE UNIT
CONTROL PROGRAM
DB
COMMUNICATION I/F UNIT
INPUT UNIT
DISPLAY UNIT
501
503
505
507
509
511
513
515
517

INFORMATION PROCESSING DEVICE, STORAGE MEDIUM STORING INFORMATION PROCESSING PROGRAM, AND INFORMATION PROCESSING METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Japanese Patent Application No. 2018-012426 filed on Jan. 29, 2018, incorporated herein by reference in its entirety.

BACKGROUND

1. Technical Field

[0002] The present disclosure relates to an information processing device, a storage medium storing an information processing program, and an information processing method.

2. Description of Related Art

[0003] When a vehicle is parked in a dangerous area, there is a high possibility of becoming a victim of theft, or the like. Japanese Unexamined Patent Application Publication No. 2011-085478 (JP 2011-085478 A) describers an in-vehicle electronic device. The in-vehicle electronic device allows a user to optionally register a desired point into data of theft-prone areas, and, when a location at which a vehicle is stopped is in any one of the theft-prone areas, cautions the user.

SUMMARY

[0004] However, the technique described in JP 2011-085478 A is not made in consideration of a situation in which an owner of a vehicle allows another user to use the vehicle, that is, for example, car sharing or car rental.

[0005] Some aspects of the disclosure provide an information processing device, a storage medium storing an information processing program, and information processing method, which allow a user having temporary use authorization to suitably use a vehicle.

[0006] An aspect of the disclosure relates to an information processing device. The information processing device includes a controller. The controller is configured to give temporary use authorization of a vehicle to a user. The controller is configured to receive a use end request to end using the vehicle from a terminal that the user having the temporary use authorization operates. The controller is configured to acquire current location information of the vehicle. The controller is configured to determine whether a location that is identified based on the current location information of the vehicle is in an inappropriate area. The controller is configured to, when the controller determines that the location is in the inappropriate area, provide the terminal with notification that the user is not allowed to end using the vehicle.

[0007] An aspect of the disclosure relates to a storage medium storing an information processing program. The information processing program causes a computer to execute instructions for: receiving, from a server, authentication information for allowing a user having temporary use authorization to use a vehicle; transmitting, to the server, a use end request to allow the user to end using the vehicle; determining whether a location of the vehicle is in an inappropriate area; when the location is in the inappropriate area, receiving notification that the user is not allowed to end using the vehicle; and notifying the user that the user is not allowed to end using, the vehicle, in response to the notification that the user is not allowed to end using the vehicle.

[0008] An aspect of the disclosure relates to an information processing method. The information processing method includes: receiving, by a user terminal, from a server, authentication information for allowing a user having temporary use authorization to use a vehicle; transmitting, by the user terminal, to the server, a use end request to allow the user to end using the vehicle; determining, by the user terminal, whether a location of the vehicle is in an inappropriate area; when it is determined that the location is in the inappropriate area, receiving, by the user terminal, notification that the user is not allowed to end using the vehicle; and notifying, by the user terminal, the user that the user is not allowed to end using the vehicle, in response to the notification that the user is not allowed to end using the vehicle.

[0009] In the aspects of the disclosure, a unit or device does not merely mean a physical means, and includes a case where the function of the unit or device is implemented by software. The function of the unit or device is implemented by two or more physical means or devices. The functions of the two or more units or devices may be implemented by a physical means or device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Features, advantages, and technical and industrial significance of exemplary embodiments will be described below with reference to the accompanying drawings, in which like numerals denote like elements, and wherein:

[0011] FIG. **1** is a block diagram that shows the functional configuration of a vehicle system according to an embodiment;

[0012] FIG. **2** is a flowchart that shows the flow of a process that is executed in the vehicle system shown in FIG. **1**;

[0013] FIG. **3** is a flowchart that shows the flow of a process that is executed in the vehicle system shown in FIG. **1**;

[0014] FIG. **4** is a flowchart that shows the flow of a process that is executed in the vehicle system shown in FIG. **1**; and

[0015] FIG. **5** is a block diagram that shows a specific example of hardware configuration that is able to implement each of a server, a user terminal, and a vehicle, shown in FIG. **1**.

DETAILED DESCRIPTION

[0016] Hereinafter, an embodiment will be described with reference to the accompanying drawings. The embodiment that will be described below is only illustrative, and is not intended to exclude application of various modifications or techniques unless otherwise specified. Like reference numerals denote the same or similar portions in the drawings. The drawings are schematic, and do not necessarily reflect actual dimensions, ratios, or the like. There may be portions having a different relation or ratio in dimensions among the drawings.

Embodiment

1 Functional Configuration

1.1 Overall Configuration

[0017] The functional configuration of a vehicle system **1** according to the present embodiment will be described with reference to FIG. **1**. The vehicle system **1** includes a server **100**, a user terminal **200**, and a vehicle .**300**. The user terminal **200** is a terminal, such as a cellular phone, that a user operates. The server **100**, the user terminal **200**, and the vehicle **300** are communicable with one another via a network N, such as the Internet, a public telephone network, and a combination of the Internet and the public telephone network. The user terminal **200** and the vehicle **300** may be communicable with each other by near field communication. (NFC), such as Bluetooth (registered trademark), without intervening the network N. FIG. **1** shows only the single user terminal **200** and the single vehicle **300**. Instead, a plurality of the user terminals **200** communicable with the server **100** may be provided, and a plurality of vehicles **300** communicable with the server **100** may be provided. The server **100** does not need to be physically implemented by a single information processing device. It is also conceivable that a plurality of information processing devices cooperatively implements the functions of the server **100**.

[0018] The server **100** is a device for realizing a car sharing service or car rental service that temporarily rents one or more vehicles **300** registered in advance to a user and allows the user to use the one or more vehicles **300**. At this time, the server **100** gives temporary use authorization to the user, and transmits, for example, authentication information to the user terminal **200** that the user operates. The authentication information is a key to use the vehicle **300**. The user unlocks the vehicle **300** or starts up an engine or a motor by, for example, bringing the user terminal **200**, having the downloaded authentication information, close to the vehicle **300**. In the following description, the server **100** will be described as a device that offers car sharing service in the vehicle system **1**. The server **100** may also be applied to car rental service with a similar mechanism.

1.2 Server **100**

[0019] The functional configuration of the server **100** will be described. The server **100** includes a user management unit **110**, a vehicle management unit **120**, a key management unit **130**, and an accounting management unit **140**.

[0020] The user management unit **110** manages information about users who use the car sharing service. The user management unit **11.0** includes a user information management unit **111** and a rating unit **113**.

[0021] The user information management unit **111** manages information about one or more users who are allowed to use the car sharing service. Examples of the user information that is managed by the user information management unit **111** include not only information, such as user's name and user's phone number, but also the identification information of the user terminal **200** to be used, service use history, accounting information, and rating information of the user. For a user who is currently renting out the vehicle **300**, the user information management unit **111** may also manage information about the vehicle **300** being rented out and information, such as rental start time and scheduled rental end time.

[0022] The rating unit **113** updates and manages rating information of users. The rating unit **113**, for example, in the car sharing service that is operated by a business operator, gives a high rating to a user who has performed a desirable use, and gives a low rating to a user who has performed an undesirable use. More specifically, for example, the rating unit **113** should lower a rating value that is managed in the rating information for users who have conducted activities, such as parking the vehicle **300** in an area in which theft, or the like, frequently occurs (hereinafter, referred to as inappropriate area), damaging the body of the vehicle **300**, and leaving garbage at the time of return. On the other hand, the rating unit **113** should raise a rating value for users who repeatedly use the service without any inappropriate activities. Other than the above, for example, when a user has performed maintenance, such as replacement of tires of the vehicle **300** and refilling oil, the rating unit **113** may raise the rating value of the user.

[0023] Since the rating unit **113** manages the rating information of users in this way, it is possible to, for example, offer special incentives to users who have a high rating value; whereas it is possible to provide restrictions to uses who have a low rating. The special incentives are, for example, to allow users to rent expensive vehicles. The restrictions are, for example, to limit vehicle models or a time for which a vehicle is allowed to be rented.

[0024] The vehicle management unit **120** manages the rentable vehicles **300** in the car sharing service. The vehicle management unit **120** includes a vehicle information management unit **121**, a rent-return processing unit **123**, a scheduler unit **125**, and a park/stop location determination unit **127**.

[0025] The vehicle information management unit **121** manages information about one or more rentable vehicles **300** in the car sharing, service. Examples of the vehicle information that is managed by the vehicle information management unit **121** may include the identification information of each vehicle **300** and specifications information of each vehicle **300**. Examples of the specifications information include vehicle model, piston displacement, and the number of available passengers. The vehicle information management unit **121** may also manage information about users currently using the vehicles **300**, and information, such as rental start time and scheduled rental end time.

[0026] As the rent-return processing unit **123** receives a request from the user terminal **200** that a user operates, the rent-return processing unit **123** rents the vehicle **300** to the user, and executes a process for accepting a process of returning the vehicle **300** from the user. More specifically, at the time of renting the vehicle **300** to a user, the rent-return processing unit **123** gives temporary use authorization to the user, and causes the key management unit **130** to transmit authentication information that is a substitute for a key to the user terminal **200** and the vehicle **300**. At the time of returning the vehicle **300** from the user, the rent-return processing unit **123** stops the temporary use authorization of the user, and causes the key management unit **130** to disable the use of the authentication information transmitted to the user terminal **200** and the vehicle **300**.

[0027] The scheduler unit **125** manages the status of rental or rental schedule for each of the one or more vehicles **300**

that are managed in the vehicle information management unit **121**. More specifically, the scheduler unit **125** should manage, for example, which user the vehicle **300** is rented to or scheduled to be rented to from when to when for each vehicle **300**.

[0028] The park/stop location determination unit **127** acquires location information from the vehicle **300** at the time of parking or stopping the vehicle **300**, and determines whether the location is in a predetermined appropriate area. For example, when the rent-return processing unit **123** has detected that the user made a procedure to return the vehicle **300**, the park/stop location determination unit **127** acquires the location information of the vehicle **300**, and determines whether the vehicle **300** is in an appropriate area. If the park/stop location determination unit **127** determines that the vehicle **300** is in a theft-prone dangerous area or an area around a port where illegal export is induced, it is conceivable that the rent-return processing unit **123**, for example, does not accept the procedure to return the vehicle **300**. Alternatively, when the park/stop location determination unit **127** determines that a user frequently parks or stops the vehicle **300** in a dangerous area during use of the vehicle **300**, it is conceivable that the rating unit **113** lowers the rating value of the user to reduce the use of the vehicle **300** by the user in a dangerous area. The key management unit **130**, for example, manages authentication information for a user to use the vehicle **300**. The key management unit **130** includes a one-time key issuance unit **131**.

[0029] For example, at the time of giving temporary use authorization of the vehicle **300** to a user, the one-time key issuance unit **131** generates a one-time key to use the vehicle **300**, and transmits authentication information including the one-time key to the user terminal **200** and the vehicle **300**. The user terminal **200** executes an authentication process with the vehicle **300** using the authentication information. When the authentication process is successful, the user terminal **200** is allowed to, for example, unlock the vehicle **300** or start up the engine or motor.

[0030] At the time of accepting a procedure to return the vehicle **300** from a user, the one-time key issuance unit **131** should rewrite authentication information by transmitting a new one-time key to the vehicle **300**, or should make the user not to be able to use the vehicle **300** with the user terminal **200** by invalidating the authentication information of the user terminal **200** and/or the vehicle **300**.

[0031] The accounting management unit **140** executes an accounting process for charging a user who has rented the vehicle **300** through the car sharing service for a fee. The accounting management unit **140** includes a fee calculation unit **141** and a fee processing unit **143**.

[0032] The fee calculation unit **141** calculates a fee for which a user is charged, in accordance with the vehicle model of the vehicle **300** rented by the user, a time for which the user has rented the vehicle **300**, and the like. The fee processing unit **143**, for example, executes an accounting process for the fee calculated by the fee calculation unit **141** with the use of a fee charging method registered by the user in advance (for example, payment information of a credit card, deduction information from a bank account, or the like). At this time, it is conceivable that the fee processing unit **143** provides notification about the fee for which the user is charged, the fee processing method, and the like, to the user terminal **200**.

1.3 User Terminal **200**

[0033] Next, the functional configuration of the user terminal **200** will be described. The user terminal **200** includes a user management unit **210**, a current location detection unit **220**, a vehicle management unit **230**, a key management unit **240**, and an accounting management unit **250**.

[0034] The user management unit **210** manages information about a user who uses the user terminal **200**. The user management unit **210** includes a user information management unit **211** and a rating unit **213**.

[0035] The user information management unit **211** manages information about the user who uses the user terminal **200**. Examples of the user information that is managed by the user information management unit **211** include not only information, such as user's name and user's phone number, but also the identification information of the user terminal **200**, service use history, accounting information, and rating information of the user. The user information management unit **211** is able to correct the user information that is managed by the user information management unit **111** of the server **100** and bring both pieces of user information into coincidence with each other by carrying out communication with the server **100** as needed. The user information management unit **211** does not need to store or manage the user information on the user terminal **200**. The user information management unit **211** may, for example, update or display the user information by carrying out communication with the server **100** as needed.

[0036] The rating unit **213** updates and manages rating information that is the rating of the user who uses the user terminal **200** in using the car sharing service. The rating unit **213**, for example, in the car sharing service, gives a high rating to a user who has performed a desirable use, and gives a low rating to a user who has performed an undesirable use. The rating unit **213** may be configured to be able to update the rating information that is managed by the server **100** by carrying out communication with the server **100** as needed.

[0037] The current location detection unit **220** acquires the current location of the user terminal **200** based on, for example, information from a global positioning system (GPS), information from a surrounding Wi-Fi, and the like. The current location information detected by the current location detection unit **220** may be transmitted to the server **100** where necessary.

[0038] The vehicle management unit **230** manages the vehicle **300**. That is, for example, the vehicle management unit **230** allows the user to rent the vehicle **300** or return the rented vehicle **300**. The vehicle management unit **230** includes a rent-return processing unit **231** and a reservation processing unit **233**.

[0039] The rent-return processing unit **231** executes a process for accepting a process of renting the vehicle **300** to the user and returning the vehicle **300** from the user in response to user's operation. More specifically, at the time of renting the vehicle **300** to the user, the rent-return processing unit **231** makes a request of the server **100** to give temporary use authorization, and causes the key management unit **240** to execute, for example, an authentication process that is a substitute for a key. At the time of returning the vehicle **300** from the user, the rent-return, processing unit **231** makes a request of the server **100** to stop temporary use authorization of the user. If the return is admitted, the rent-return processing unit **231** may cause the key management unit **240** to, for example, make a request to invalidate authentication infor-

mation that is a substitute for a key. The reservation processing unit **233** transmits reservation for getting the rental vehicle **300** to the server **100** in response to user's operation, or the like.

[0040] The key management unit **240**, for example, manages authentication information for the user to use the vehicle **300**. The key management unit **240** includes an authentication processing unit **241** and a one-time key holding unit **243**.

[0041] At the time of getting issuance of authentication information that is a substitute for a key, the authentication processing unit **241** executes an authentication process with the server **100**. When the authentication process by the authentication processing unit **241** is successful, the one-time key holding unit **243** receives authentication information including a one-time key from the server **100**, and holds the authentication information. When the user uses the vehicle **300**, the authentication processing unit **241** executes an authentication process with the vehicle **300** with the use of the authentication information. When the authentication process is successful, the user is allowed to, for example, unlock the vehicle **300** or start up the engine or motor. When the user returns the vehicle **300**, the one-time key holding unit **243** should delete or invalidate the authentication information that is a substitute for a key based on a request from the server **100**.

[0042] The accounting management unit **250** executes an accounting process for charging the user who has rented the vehicle **300** through the car sharing service for a fee. The accounting management unit **250** includes a fee calculation unit **251** and a fee processing unit **253**.

[0043] The fee calculation unit **251**, in cooperation with the fee calculation unit **141** of the server **100**, calculates a fee for which the user is charged, in accordance with the vehicle model of the vehicle **300** rented by the user, a time for which the user has rented the vehicle **300**, and the like. The fee processing unit **253**, in cooperation with the fee processing unit **143** of the server **100**, executes an accounting process for the fee calculated by the fee calculation unit **251** with the use of the fee charging method registered by the user in advance. At this time, the fee calculation unit **251** may inform the user of, for example, the fee for which the user is charged, the fee processing method, and the like.

1.4 Vehicle **300**

[0044] Next, the functional configuration of the vehicle **300** will be described. The vehicle **300** is, for example, an automobile that runs while loading a user. The vehicle **300** is bilaterally communicable with the server **100** via the network N that is, for example, the Internet, a public telephone network, or the like. The vehicle **300** and the user terminal **200** may be provided so as to be communicable with each other via, for example, near field communication (NFC), or the like. The vehicle **300** includes a user management unit **310**, a current location detection unit **320**, a stop processing unit **330**, and a key management unit **340**.

[0045] The user management unit **310** manages information about a user who uses the vehicle **300** and a user who owns the vehicle **300**. The user management unit **310** includes a user information management unit **311** and a rating unit **313**.

[0046] The user information management unit **311** manages information about a user who uses the vehicle **300** and a user who owns the vehicle **300**. Examples of the user information that is managed by the user information management unit **311** include not only information, such as user's name and user's phone number, but also the identification information of the user terminal **200**, service use history, accounting information, and rating information of the user. The user information management unit **311** is able to correct the user information that is managed by the user information management unit **111** of the server **100** or the user information management unit **211** of the user terminal **200** and bring both pieces of user information into coincidence with each other by carrying out communication with the server **100** or the user terminal **200** as needed. The user information management unit **311** does not need to directly store or manage user information on the vehicle **300**. The user information management unit **311** may, for example, update or display user information by carrying out communication with the server **100** or the user terminal **200** as needed.

[0047] The current location detection unit **320** acquires the current location of the vehicle **300** based on, for example, information from the GPS or the surrounding Wi-Fi. The current location information detected by the current location detection unit **320** is transmitted to the server **100** where necessary.

[0048] The stop processing unit **330** executes a process of stopping the vehicle **300** in response to user's driving operation. At this time, the stop processing unit **330** acquires current location information with the use of the current location detection unit **320**. That is, the stop processing unit **330** detects the park/stop location of the vehicle **300**, and transmits the park/stop location to the server **100** where necessary. Thus, the server **100** is able to determine whether the vehicle **300** is parked or stopped in an inappropriate area.

[0049] The key management unit **340**, for example, manages authentication information for a user to use the vehicle **300**. The key management unit **340** includes an authentication processing unit **341**, a one-time key holding unit **343**, and a vehicle control unit **345**.

[0050] When the authentication processing unit **341** gets issuance of authentication information substitute for a key, the authentication processing unit **341** executes an authentication process with the server **100**. When the authentication process by the authentication processing unit **341** is successful, the one-time key holding unit **343** receives authentication information including a one-time key from the server **100**, and holds the authentication information. When the user uses the vehicle **300**, the authentication processing unit **341** executes an authentication process with the user terminal **200** with the use of the authentication information. When the authentication process is successful, the vehicle control unit **345**, for example, unlocks or starts up the engine or the motor in response to user's operation.

2 Flow of Process

[0051] Hereinafter, the flow of a process that is executed by the vehicle system **1** will be described with reference to FIG. **2** to FIG. **4**. FIG. **2** to FIG. **4** are flowcharts that show the flows of processes that are executed by the server **100**, user terminal **200**, and vehicle **300** that constitute the vehicle system **1**.

[0052] Processing steps (described later) may be executed in a selected order or in parallel without any contradiction in processing details, and an additional step may be added between the processing steps. A step described as a single

step for the sake of convenience may also be executed as a plurality of separated steps. Steps described in a plurality of separated steps for the sake of convenience may also be executed as a single step.

2.1 Flow of Process at Time of Renting Out Vehicle **300**

[0053] Hereinafter, the flow of a process at the time of renting the vehicle **300** to a user will be described with reference to FIG. **2**. FIG. **2** is a flowchart that shows the flow of the process that is executed by the server **100** and the user terminal **200** at the time renting the vehicle **300** to a user.

[0054] As the user operates the user terminal **200** to conduct a procedure to start using the vehicle **300**, the rent-return processing unit **231** of the user terminal **200** makes a request of the server **100** to start using the vehicle **300**, that is, to set temporary use authorization (S**201**).

[0055] As the rent-return processing unit **123** of the server **100** receives a request to start using the vehicle **300** from the user terminal **200** (S**203**), the rent-return processing unit **123** makes a request of the one-time key issuance unit **131** of the key management unit **130** for an authentication process. The one-time key issuance unit **131** of the server **100** and the user terminal **200** execute the authentication process in cooperation with each other (S**205** and S**207**). When the authentication is successful, the user information management unit **111** of the server **100** sets temporary use authorization for the user. The one-time key issuance unit **131** generates a one-time key (S**209**), and transmits authentication information including the one-time key to the user terminal **200** (S**211**). The server **100** is also able to transmit the authentication information to the vehicle **300**.

[0056] As the one-time key holding unit **243** of the user terminal **200** receives the authentication information (S**213**), the one-time key holding unit **243** stores the authentication information in an internal storage area. The user terminal **200** executes the authentication process in cooperation with the vehicle **300** with the use of the authentication information. When the authentication process is successful, the user terminal **200** is able to unlock the vehicle **300** or start up the engine or motor.

2.2 Flow of Process at Time of Returning Vehicle **300**

[0057] Next, the flow of a process at the time returning the vehicle **300** from a user to which the vehicle **300** has been rented will be descried with reference to FIG. **3**. FIG. **3** is a flowchart that shows the flow of the process that is executed by the server **100** and the user terminal **200** at the time of returning the vehicle **300** from a user.

[0058] As the user operates the user terminal **200** to conduct a procedure to return the vehicle **300** (S**301**), the rent-return processing unit **231** of the user terminal **200** makes a request of the server **100** to return (end using) the vehicle **300**, that is, to stop the set temporary use authorization (S**303**).

[0059] As the rent-return processing unit **123** of the server **100** receives a request to return the vehicle **300** (use end request) from the user terminal **200** (S**305**), the park/stop location determination unit **127** acquires the current location information of the vehicle **300** (S**307**). The park/stop location determination unit **127** determines whether the current location of the vehicle **300** is not in a predetermined inappropriate area or whether the current location of the vehicle **300** is in an appropriate area (S**309**). As a result, if the park/stop location determination unit **127** determines that the vehicle **300** is in the inappropriate area or the vehicle is not in the appropriate area (No in S**311**), the rent-return processing unit **123** searches for a returnable location that is located near the current location of the vehicle **300** and that is not in the inappropriate area (that is in the appropriate area) (S**313**). Then, the rent-return processing unit **123** provides information about the returnable location to the user terminal **200** together with information that the user is not allowed to return (end using) the vehicle **300** at the current location of the vehicle **300** (S**315**).

[0060] Alternatively, when the park/stop location determination unit **127** determines in S**311** that the vehicle **300** is not in the inappropriate area, that is, the vehicle **300** is in the appropriate area (Yes in S**311**), the rent-return processing unit **123** executes various processes to end using the vehicle **300**, that is, for example, the rent-return processing unit **123** makes a request of the user information management unit **111** to stop temporary use authorization or makes a request of the key management unit **130** to invalidate authentication information issued for the user to use the vehicle **300** (S**317**). Then, the rent-return processing unit **123** provides the user terminal **200** with notification about the normal end of use (S**319**).

[0061] As the rent-return processing unit **231** of the user terminal **200** receives the notification about the end of use (S**321**), the rent-return processing unit **231** executes the process of, for example, invalidating authentication information by the key management unit **240** where necessary, and informs the user of the end of use (S**323**).

2.3 Flow of Process of Rating User Based on Park/stop Location

[0062] Hereinafter, the flow of a process of rating a user based on a park/stop location will be described with reference to FIG. **4**. FIG. **4** is a flowchart that shows the flow of the process that is executed by the server **100** at the time of rating a user based on a park/stop location.

[0063] As the server **100** receives information about a park/stop location from the vehicle **300** (S**401**), the park/stop location determination unit **127** of the server **100** determines whether the park/stop location is appropriate (S**403**). The rating unit **113** rates a user by, for example, raising the rating value of the user when the park/stop location is in an appropriate area (the park/stop location is not in an inappropriate area) and lowering the rating value of the user when the park/stop location is not in the appropriate area (the park/stop location is in the inappropriate area) (S**405**).

3 Hardware Configuration

[0064] The hardware configuration of a computer **500** that is able to implement each of the server **100**, the user terminal **200**, and the vehicle **300** will be described with reference to FIG. **5**. The computer **500** includes a control unit **501**, a storage unit **505**, a communication interface (I/F) unit **511**, an input unit **513**, and a display unit **515**. The units are connected to one another via a bus line **517**.

[0065] The control unit **501** includes a central processing unit (CPU) (not shown), a read only memory (ROM) (not shown), a random access memory (RAM) **503**, and the like.

The control unit **501** is configured to be able to execute processes associated with the components of the server **100**, user terminal **200**, and vehicle **300**, shown in FIG. **1** in addition to the functions of a general computer by executing a control program **507** stored in the storage unit **505**. For example, the user management unit **110**, vehicle management unit **120**, key management unit **130**, and accounting management unit **140** of the server **100** may be implemented as the control program **507** that runs on the CPU after the control program **507** is temporarily stored in the RAM **503**. This also applies to the user management unit **210**, current location detection unit **220**, vehicle management unit **230**, key management unit **240**, and accounting management unit **250** of the user terminal **200**, and the user management unit **310**, current location detection unit **320**, stop processing unit **330**, and key management unit **340** of the vehicle **300**.

[0066] The RAM **503** temporarily stores part or all of codes included in the control program **507** and part or all of pieces of information that is managed by a DB **509**. The RAM **503** is also used as a work area at the time when the CPU executes various processes.

[0067] The storage unit **505** is a nonvolatile storage medium, such as a hard disk drive (HDD) and a flash memory. The storage unit **505** stores the control program **507** and the DB **509**. The control program **507** includes an operating system (OS) and application programs for implementing the functions of a general computer. The DB **509** manages required information. The communication I/F unit **511** is a device for carrying out wireless or wired data communication among the server **100**, the user terminal **200**, and the vehicle **300** where necessary.

[0068] The input unit **513** is a device for accepting an input operation from a user. Specific examples of the input unit **513** may include various buttons, a touch panel, a microphone, and a keyboard.

[0069] The display unit **515** is a display device for providing various pieces of information to a user who operates the computer **500**. Specific examples of the display unit **515** may include a liquid crystal display and an electro-luminescence (EL) display.

4 Advantageous Effects of Present Embodiment

[0070] As described above, in the vehicle system **1** according to the present embodiment, when a user conducts a procedure to return the vehicle **300**, it is determined whether the location of the vehicle **300** is not in an inappropriate area, and, when the location of the vehicle **300** is in the inappropriate area, the user is not allowed to return the vehicle **300**. Thus, it is possible to prevent the vehicle **300** from becoming a victim of theft, or the like, as a result of, for example, dropping off the vehicle **300** in a dangerous inappropriate area. Even not at the time of returning the vehicle **300**, it is determined whether a location at which a user parks or stops the vehicle **300** is in an inappropriate area, and, for example, parking or stopping the vehicle **300** in an inappropriate area is reduced by changing the rating value of the user based on the determined result. Thus, it is possible to prompt a user to use the vehicle **300** in an appropriate area.

5 Adding

[0071] The above-described embodiment is intended to easily understand the disclosure, and is not intended to interpret the disclosure in a limited way. Elements of the embodiment, and the arrangement, materials, conditions, shapes, sizes, and the like, of the elements are not limited to the illustrated ones, and may be modified as needed. Components described in different embodiments may be partially replaced or may be combined.

What is claimed is:

1. An information processing device comprising a controller configured to:

give temporary use authorization of a vehicle to a user,

receive a use end request to end using the vehicle from a terminal that the user having the temporary use authorization operates,

acquire current location information of the vehicle,

determine whether a location that is identified based on the current location information of the vehicle is in an inappropriate area, and

when the location is in the inappropriate area, provide the terminal with notification that the user is not allowed to end using the vehicle.

2. The information processing device according to claim **1**, wherein:

the controller is configured to transmit authentication information to the terminal that the user having the temporary use authorization operates; and

the controller is configured to transmit the authentication information to the vehicle which the user is allowed to use.

3. The information processing device according to claim **2**, wherein:

the controller is configured to, when the controller determines that the location that is identified based on the current location information of the vehicle is not in the inappropriate area, stop the temporary use authorization set for the user; and

the controller is configured to provide notification about the stop of the temporary use authorization to the vehicle.

4. The information processing device according to claim **1**, wherein the controller is configured to provide a stop location, which is outside of the inappropriate area and which the vehicle is recommended to stop, to the terminal together with notification that the user is not allowed to end using the vehicle.

5. The information processing device according to claim **1**, wherein:

the controller is configured to acquire a stop location at which the vehicle stops, from the vehicle; and

the controller is configured to update rating information of the user in accordance with the stop location.

6. The information processing device according to claim **5**, wherein the controller is configured to change service that is offered to the user, in accordance with the rating information.

7. A nonvolatile storage medium storing an information processing program, the information processing program causing a computer to execute instructions for:

receiving, from a server, authentication information for allowing a user having temporary use authorization to use a vehicle;

transmitting, to the server, a use end request to allow the user to end using the vehicle;

determining whether a location of the vehicle is in an inappropriate area;

when the location is in the inappropriate area, receiving notification that the user is not allowed to end using the vehicle; and

notifying the user that the user is not allowed to end using the vehicle, in response to the notification that the user is not allowed to end using the vehicle.

8. The nonvolatile storage medium according to claim **7**, wherein the program further causes the computer to execute instructions for:

when it is determined that the location of the vehicle is not in the inappropriate area, receiving notification that the temporary use authorization of the vehicle is stopped; and

notifying the user that the user is not allowed to end using the vehicle, in response to the notification that the temporary use authorization is stopped.

9. An information processing method comprising:

receiving, by a user terminal, from a server, authentication information for allowing a user having temporary use authorization to use a vehicle;

transmitting, by the user terminal, to the server, a use end request to allow the user to end using the vehicle;

determining, by the user terminal, whether a location of the vehicle is in an inappropriate area;

when it is determined that the location of the vehicle is in the inappropriate area, receiving, by the user terminal, notification that the user is not allowed to end using the vehicle; and

notifying, by the user terminal, the user that the user is not allowed to end using the vehicle, in response to the notification that the user is not allowed to end using the vehicle.

* * * * *