

DESCRIPTION

CHARGING SYSTEM, CHARGING DEVICE, CHARGING METHOD, AND
PROGRAM

5

TECHNICAL FIELD

[0001]

The present invention relates to a charging system, a charging device, a charging method, and a program for charging a vehicle that is present in a charging target area.

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Priority is claimed on Japanese Patent Application No. 2011-210716, filed September 27, 2011, the contents of which are incorporated herein by reference.

BACKGROUND ART

[0002]

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As a method of charging a vehicle traveling on a road, there has been proposed a charging method that uses a positioning result of a GPS (Global Positioning System).

Examples of a charging method that uses a positioning result of a GPS include a charged-by-distance method and a charged-by-time method. The charged-by-distance method is a charging method in which a charging amount is calculated based on a distance traveled on a route within a charging target area identified by a GPS positioning result and so forth, to perform a charging process. The charged-by-time method is a charging method in which a charging amount is calculated based on a length of time of stay within a charging target area, to perform a charging process.

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[0003]

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Incidentally, within a charging target area, there may be provided a facility such as

a pay parking lot where charging is done with a charging method different from a charging method of the charging target area. In this case, it is preferable to stop charging that is based on traveling within the charging target area in order to prevent double charging.

That is to say, when a vehicle enters a pay parking lot within a charging target area, it is

5 preferable to switch the charging process from the charging process based on traveling within the charging target area to the charging process of the pay parking lot. That is to say, in a charging system that performs area-based charging, it is preferable that a pay parking lot or the like within a charging target area is set as a non-charging area.

[0004]

10 Patent Document 1 discloses a processing method of charging a vehicle entering a parking lot or a no parking area that are present within a charging target area. According to the method disclosed in Patent Document 1, the charging system stores area information that preliminarily associates map information with charging target areas and charging amounts, and performs a charging process based on vehicle location information estimated
15 by means of a GPS or the like and on the area information.

[Prior Art Documents]

[Patent Documents]

[0005]

[Patent Document 1] Japanese Patent No. 3365296

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SUMMARY OF INVENTION

[Technical Problem]

[0006]

However, in the case where the method disclosed in Patent Document 1 is used,
25 even if a vehicle enters a non-charging area, there is a possibility that the vehicle is treated

as if the vehicle does not enter the non-charging area due to an error in vehicle location estimation and the billing process is performed in the billing system. Specifically, for example, in the case where an entrance and exit of a parking lot is provided in the vicinity of a road intersection, if the method disclosed in Patent Document 1 is used, even though a vehicle actually enters the parking lot, an entry of a vehicle to the parking lot is determined as having not been made in the charging system due to an error in vehicle location estimation of the GPS. Consequently the charging process is performed twice.

The present invention takes into consideration the above problem, with an object of providing a charging system, a charging device, a charging method, and a program capable of determining an entry to a non-charging area without making a false determination.

[Solution to Problem]

[0007]

A first aspect of the present invention is a charging system that is configured to perform charging for a vehicle that is present in a charging target area. The charging system includes a charging device configured to perform a charging process for a vehicle present in the charging target area and an identification information acquisition device configured to acquire identification information of a vehicle present in a non-charging area provided in the charging target area and to notify the charging device of the identification information. The charging device includes an identification information acquisition unit configured to acquire identification information of a vehicle from the identification information acquisition device, a charging unit configured to calculate a charging amount based on traveling of a vehicle within the charging target area and to perform a charging process for the vehicle, and a charging target exclusion processing unit configured to stop the charging process of the charging unit for the vehicle indicated by the identification

information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle.

[0008]

Moreover, in the first aspect of the present invention, the identification information acquisition device may be configured to receive identification information of a vehicle from an on-vehicle device mounted on the vehicle in the non-charging area to thereby acquire identification information of a vehicle. The charging unit of the charging device may be configured to sequentially calculate a charging amount for a vehicle based on traveling of the vehicle within the charging target area. When the charging target exclusion processing unit of the charging device acquires identification information of a vehicle from the identification information acquisition device, the charging target exclusion processing unit may be configured to stop charging amount calculation performed by the charging unit for the vehicle indicated by the identification information.

[0009]

Furthermore, in the first aspect of the present invention, the identification information acquisition device may have a communication region on a border of the non-charging area, and may be configured to receive identification information from the on-vehicle device mounted on the vehicle when the vehicle is passing the border of the non-charging area.

[0010]

Moreover, in the first aspect of the present invention, the charging target exclusion processing unit of the charging device may be configured to stop the charging process of the charging unit for the vehicle indicated by the identification information during a period of time from a time when the identification information acquisition device acquires the identification information of the vehicle to a time when the identification

information acquisition device acquires again the identification information of the vehicle.

[0011]

Furthermore, in the first aspect of the present invention, the charging device may include a target exclusion time calculation unit configured to calculate a period of time that the charging target exclusion processing unit stops the charging process and an additional charging unit. In the case where a period of time calculated by the target exclusion time calculation unit is not more than a predetermined period of time, the additional charging unit may be configured to identify a charging amount according to a standard route in the case of traveling in the charging target area from a point where the vehicle was present at a start time of a charging target exclusion period determined by the charging target exclusion processing unit, to a point where the vehicle was present at an end time of the charging target exclusion period determined by the charging target exclusion processing unit, and to perform a charging process for the vehicle.

[0012]

Moreover, in the first aspect of the present invention, the identification information acquisition device may be configured to acquire identification information of a vehicle present in the non-charging area provided in the charging target area and to notify the charging device of the identification information and the time when the identification information is acquired. The charging target exclusion processing unit of the charging device may be configured to calculate a charging amount that is charging-processed by the charging unit in a period of time from a time included in the information acquired by the identification information acquisition device to a predetermined end time, and to make a refund for the charging amount.

[0013]

A second aspect of the present invention is a charging device that is configured to

perform a charging process for a vehicle present in a charging target area. The charging device includes an identification information acquisition unit configured to acquire identification information of a vehicle from an identification information acquisition device, wherein the identification information acquisition device is configured to acquire the identification information of the vehicle present in a non-charging area provided in the charging target area and to notify the charging device of the identification information, a charging unit configured to calculate a charging amount based on traveling of a vehicle within the charging target area and to perform a charging process for the vehicle, and a charging target exclusion processing unit configured to stop the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle.

[0014]

A third aspect of the present invention is a charging method that uses a charging device that performs a charging process for a vehicle present in a charging target area. The charging method including: acquiring identification information of a vehicle, using an identification information acquisition unit of the charging device, from an identification information acquisition device that acquires the identification information of the vehicle present in a non-charging area provided in the charging target area and to notify the charging device of the identification information; calculating a charging amount based on traveling of a vehicle within the charging target area, and performing a charging process for the vehicle using a charging unit of the charging device; and stopping the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle using a charging

target exclusion processing unit of the charging device.

[0015]

A fourth aspect of the present invention is a program that causes a charging device that performs a charging process for a vehicle present in a charging target area, to function
5 as: an identification information acquisition unit that acquires identification information of a vehicle from an identification information acquisition device that acquires the identification information of the vehicle present in a non-charging area provided in the charging target area and notifies the charging device of the identification information, a
10 charging unit that calculates a charging amount based on traveling of a vehicle within the charging target area and performs a charging process for the vehicle, and a charging target exclusion processing unit that stops the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle.

15 [Advantageous Effects of Invention]

[0016]

According to the present invention, by acquiring identification information of a vehicle present in a non-charging area from the identification information acquisition device, the charging device stops charging process during a period of time from a time
20 when identification information is acquired to a predetermined end time, from the charging process target. As a result, the charging device can determine whether or not an entry to a non-charging area has been made, without making a false determination.

BRIEF DESCRIPTION OF DRAWINGS

25 [0017]

FIG. 1 is a schematic block diagram showing a configuration of a charging system according to a first embodiment of the present invention.

FIG. 2 is a flowchart showing an operation of a parking lot charging device according to the first embodiment of the present invention.

5 FIG. 3 is a flowchart showing an operation of an area charging device according to the first embodiment of the present invention.

FIG. 4 is a diagram showing an example of a parking lot and roads provided within a charging target area.

FIG. 5 is a schematic block diagram showing a configuration of a charging system
10 according to a second embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0018]

<<First Embodiment>>

15 Hereinafter, embodiments of the present invention are described in detail, with reference to the drawings.

FIG. 1 is a schematic block diagram showing a configuration of a charging system according to a first embodiment of the present invention.

The charging system is a system that performs charging for a vehicle that is
20 present in a charging target area. The charging system includes an on-vehicle device 10 mounted on a vehicle, an area charging device 20 (charging device) that performs area-charging within a predetermined charging target area, and a parking lot charging device 30 (identification information acquisition device) that performs charging for use of
a parking lot (non-charging area) provided within the charging target area. That is to say,
25 the parking lot charging device 30 performs the charging process for a vehicle parked at a

parking lot among vehicles that are present in the charging target area, and the area charging device 20 performs the charging process for other vehicles.

The on-vehicle device 10 is a device that is owned by a vehicle owner, the area charging device 20 is a device that is owned by an area charging operator, and the parking
5 lot charging device 30 is a device that is owned by a parking lot manager.

[0019]

The on-vehicle device 10 includes a location estimation unit 11, a card information reader unit 12, an identification information memory unit 13, a mobile communication unit 14, and a DSRC communication unit 15.

10 The location estimation unit 11 estimates a location of the device itself based on a GPS or dead reckoning.

The card information reader unit 12 reads information of a card (card number and so forth) from the card inserted into a card slot provided in the on-vehicle device 10.

The identification information memory unit 13 stores identification information
15 of a vehicle on which the device itself is mounted.

The mobile communication unit 14 performs wireless communication with an area communication device through a mobile communication network such as a mobile phone communication network or a PHS (personal handy-phone system) network.

The DSRC communication unit 15 performs wireless communication by means
20 of DSRC (dedicated short range communications) communication, with the parking lot charging device 30 through a beacon that has a communication area at an entrance and exit of a parking lot.

[0020]

The area charging device 20 includes a location information receiver unit 21, an
25 area charging unit 22 (charging unit), an identification information acquisition unit 23, a

charging target exclusion processing unit 24, a target exclusion time calculation unit 25, and an additional charging unit 26.

The location information receiver unit 21 receives identification information, card information, and location information of a vehicle on which the on-vehicle device 10 is mounted, from the on-vehicle device 10 through a mobile communication network.

The area charging unit 22 calculates a charging amount based on the location information received by the location information receiver unit 21, and uses the card information received by the location information receiver unit 21 to sequentially perform a charging process for the vehicle. Examples of a charging amount calculation method include a charged-by-distance method and a charged-by-time method.

The identification information acquisition unit 23 acquires identification information of a vehicle that enters or leaves the parking lot, from the parking lot charging device 30 through a wide area network such as the Internet.

When the identification information acquisition unit 23 acquires identification information of a vehicle that enters the parking lot from the parking lot charging device 30, the charging target exclusion processing unit 24 stops the charging process of the area charging unit 22 for this vehicle. Moreover, when the identification information acquisition unit 23 acquires from the parking lot charging device 30, identification information of a vehicle that leaves the parking lot, the charging target exclusion processing unit 24 causes the charging process of the area charging unit 22 to resume for this vehicle.

The target exclusion time calculation unit 25 calculates a period of time that the charging target exclusion processing unit 24 stops the charging process.

In the case where the period of time calculated by the target exclusion time calculation unit 25 is shorter than a predetermined period of time, the additional charging

unit 26 performs a charging process for the vehicle with a charging amount based on traveling of the vehicle during the period of time.

[0021]

The parking lot charging device 30 includes an identification information receiver unit 31, an identification information notification unit 32, a timing unit 33, and a parking lot charging unit 34.

When the vehicle passes the border of the non-charging area, the identification information receiver unit 31 receives identification information and card information of the vehicle, on which the on-vehicle device 10 is mounted, from the on-vehicle device 10 by means of DSRC communication through the beacon that has a communication area at the entrance and exit of the parking lot, that is, at the border of the parking lot.

Through the wide area network, the identification information notification unit 32 notifies the area charging device 20 of the identification information received by the identification information receiver unit 31.

For each vehicle, the timing unit 33 measures a period of time from a time when the identification information receiver unit 31 receives the identification information to when the identification information receiver unit 31 next receives the identification information of this vehicle.

The parking lot charging unit 34 calculates a charging amount based on the period of time measured by the timing unit 33, and performs the charging process for the vehicle.

[0022]

Next, an operation of the charging system according to the present embodiment is described. First, an operation of the parking lot charging device 30 is described.

FIG. 2 is a flowchart showing the operation of the parking lot charging device 30 according to the first embodiment of the present invention.

The identification information receiver unit 31 of the parking lot charging device 30 determines whether or not DSRC communication has been established between the on-vehicle device 10 and the beacon that has a communication area at the entrance and exit of the parking lot (step S1). If the identification information receiver unit 31 determines that DSRC communication has not been established (step S1: NO), the identification information receiver unit 31 repeats the determination of step S1 until DSRC communication is established.

[0023]

On the other hand, if the identification information receiver unit 31 determines that DSRC communication has been established (step S1: YES), the identification information receiver unit 31 determines that the vehicle has entered the parking lot, and reads the identification information of the vehicle, on which the on-vehicle device 10 is mounted, from the on-vehicle device 10 through the beacon (step S2). Next, the identification information notification unit 32 notifies the area charging device 20 of the identification information read by the identification information receiver unit 31 (step S3). Moreover, the timing unit 33 starts measuring a period of time elapsed from a time when the identification information receiver unit 31 received the identification information (step S4).

[0024]

Next, it is determined whether or not DSRC communication has been established between the beacon having a communication area at the entrance and exit of the parking lot and the on-vehicle device 10 from which the identification information has been read in step S2 (step S5). If the identification information receiver unit 31 determines that DSRC communication has not been established (step S5: NO), the identification information receiver unit 31 repeats the determination of step S5 until DSRC communication is

established.

[0025]

On the other hand, if the identification information receiver unit 31 determines that DSRC communication has been established (step S5: YES), the identification information receiver unit 31 determines that the vehicle has left the parking lot, and reads the identification information and the card information of the vehicle, on which the on-vehicle device 10 is mounted, from the on-vehicle device 10 through the beacon (step S6). Next, the identification information notification unit 32 notifies the area charging device 20 of the identification information read by the identification information receiver unit 31 (step S7). Furthermore, the timing unit 33 ends the measurement of the period of time, which started in step S4 (step S8). Then, the parking lot charging unit 34 calculates a charging amount based on the elapsed time measured by the timing unit 33, and performs the charging process according to the card information read in step S6 by the identification information receiver unit 31 (step S9).

As a result, the parking lot charging device 30 can perform the charging process for this vehicle, with a charging amount according to the period of time the vehicle stayed in the parking lot.

[0026]

Next, an operation of the area charging device 20 is described.

FIG. 3 is a flowchart showing an operation of the area charging device 20 according to the first embodiment of the present invention.

The area charging device 20 repeatedly executes processes of steps S11 to S22 described below, for all vehicles at all times (step S10).

[0027]

First, the location information receiver unit 21 of the area charging device 20

receives identification information, location information, and card information from the on-vehicle device 10 through the mobile communication network (step S11). Next, the area charging unit 22 determines whether or not the location information received by the location information receiver unit 21 indicates a location within the charging target area (step S12). If the area charging unit 22 determines that the location information indicates a location outside the charging target area (step S12: NO), the area charging unit 22 does not perform the charging process and executes the next loop process by step S10.

[0028]

On the other hand, if the area charging unit 22 determines that the location information indicates a location within the charging target area (step S12: YES), the area charging unit 22 determines whether or not the vehicle indicated by the identification information received in step S11 is in a charging-stop state (step S13). The charging-stop state refers to a state where the area charging process is stopped since the vehicle is present in the parking lot. Moreover, the area charging unit 22 stores the state of each vehicle in its built-in memory, and by making reference to this state, determines whether or not a vehicle is in the charging-stop state.

[0029]

If the area charging unit 22 determines that the vehicle indicated by the identification information received in step S11 is not in the charging-stop state (step S13: NO), the area charging unit 22 calculates a charging amount based on the location information received by the location information receiver unit 21 in step S11, and performs the charging process according to the card information received by the location information receiver unit 21 (step S14). Next, the identification information acquisition unit 23 determines whether or not the same identification information as the identification information received in step S11 has been notified from the parking lot charging device 30

(step S15). Identification information that is notified when not in a charging-stop state is notified by the parking lot charging device 30 in step S3 when a vehicle enters the parking lot. If the identification information acquisition unit 23 determines that the same identification information as the identification information received in step S11 has not been notified from the parking lot charging device 30 (step S15: NO), the next loop process is executed in step S10. That is to say, the area charging unit 22 sequentially performs the charging process as long as the vehicle is present in the charging target area and is outside the parking lot.

[0030]

On the other hand, if the identification information acquisition unit 23 determines that the same identification information as the identification information received in step S11 has been notified from the parking lot charging device 30 (step S15: YES), the charging target exclusion processing unit 24 outputs to the area charging unit 22 a charging stop instruction to stop the charging process (step S16). As a result, the area charging unit 22 rewrites the vehicle state stored in the built-in memory with a charging-stop state. Next, the target exclusion time calculation unit 25 records into the built-in memory, the time at which the identification information acquisition unit 23 acquired the identification information, and the location information acquired in step S11 (step S17), and executes the next loop process by step S10.

[0031]

On the other hand, if the area charging unit 22 determines in step S13 that the vehicle indicated by the identification information received in step S11 is in the charging-stop state (step S13: YES), the area charging unit 22 does not perform the charging process.

Next, the identification information acquisition unit 23 determines whether or not

the same identification information as the identification information received in step S11 has been notified by the parking lot charging device 30 (step S18). Identification information that is notified when in a charging-stop state is notified by the parking lot charging device 30 in step S7 when a vehicle leaves the parking lot. If the identification information acquisition unit 23 determines that the same identification information as the identification information received in step S11 has not been notified by the parking lot charging device 30 (step S18: NO), the next loop process is executed in step S10. That is to say, while a vehicle is present in the parking lot, the area charging unit 22 stops the charging process for this vehicle.

10 [0032]

On the other hand, if the identification information acquisition unit 23 determines that the same identification information as the identification information received in step S11 has been notified by the parking lot charging device 30 (step S18: YES), the charging target exclusion processing unit 24 outputs to the area charging unit 22 a charging resume instruction to resume the charging process (step S19). As a result, the area charging unit 22 rewrites the vehicle state stored in the built-in memory with the charging state. Next, by calculating a difference between the time at which the identification information acquisition unit 23 acquired the identification information and the time stored in the built-in memory, the target exclusion time calculation unit 25 calculates a target exclusion time which is a time that the area charging unit 22 stopped charging (step S20). Then, the additional charging unit 26 determines whether or not the target exclusion time calculated by the target exclusion time calculation unit 25 is shorter than a predetermined threshold value (for example, five minutes) (step S21). If the additional charging unit 26 determines that the target exclusion time is longer than the predetermined threshold value (step S21: NO), the next loop process by step S10 is executed.

[0033]

On the other hand, if the additional charging unit 26 determines that the target exclusion time is shorter than the predetermined threshold value (step S21: YES), the additional charging unit 26 identifies a charging amount according to the standard route in the case of traveling in the charging target area, based on the location stored in the built-in memory and the location information received in step S11. Then, the additional charging unit 26 performs an additional charging process, which is a charging process for the identified additional charging amount, according to the card information received in step S11 (step S22). The charging amount calculation in the additional charging may be performed, for example, in the case of the charged-by-distance method, by calculating a charging amount corresponding to the standard route distance from the entrance to the exit of the parking lot, or for example, in the case of the charged-by-time method, by calculating a charging amount corresponding to the period of time found as a result of dividing the standard route distance from the entrance to the exit of the parking lot by a standard speed. Examples of the standard vehicle speed include a predefined vehicle speed, a vehicle speed defined for each route, a vehicle speed at the time of entering the parking lot, and a vehicle speed of another vehicle traveling on the same road at the time. Then, the next loop process by step S10 is executed.

By repeatedly executing the above processes, the area charging device 20 can perform the charging process when the vehicle is present within the charging target area and outside the parking lot, and can stop the charging process when the vehicle is present within the parking lot.

[0034]

Here, the reason for performing the additional charging process by step S22 is described.

FIG. 4 is a diagram showing an example of a parking lot and roads provided within a charging target area.

In the example shown in FIG. 4, within the charging target area there are provided a first road that extends from the bottom left of the figure toward the top left of the figure, a second road that extends from the bottom right of figure toward the top right of the figure, a third road that connects the first road and the second road, and a parking lot that is provided below the third road in the figure and between the first road and the second road, and that has an entrance and exit on each of the first road side and on the second road side.

In the example shown in FIG. 4, in order to move from the lower side of the figure of the first road to the lower side of the figure of the second road, it is necessary to travel on the third road (the chain-lined route in FIG. 4). However, by shortcut-traveling through the parking lot and moving from the lower side of the figure of the first road to the lower side of the figure of the second road (the dot-lined route in FIG. 4), it is possible to reduce the traveling distance and traveling time compared to the case of traveling on the third road, and illegitimately avoid charging for legitimate road traveling.

[0035]

By performing the processes of steps S21 to S22 above, in a case where the residence time in the parking lot is extremely short, the vehicle is estimated as having taken a shortcut, and the additional charging unit 26 identifies a charging amount in the case of traveling from the entrance and exit of the parking lot on the first road side to the entrance and exit of the parking lot on the second road side via the third road, and performs an additional charging process. Thereby, it is possible to prevent illegitimate avoidance of charging for legitimate road traveling. Moreover, since the time of entry to and the time of exit from the parking lot remain as logs in the built-in memory of the area charging device 20, the logs can be used as evidence in the determination of the shortcut traveling.

[0036]

As described above, according to the present embodiment, the charging device acquires identification information of a vehicle present in a non-charging area from the identification information acquisition device, to thereby stop the charging process during a
5 period from a time when identification information is acquired to a predetermined end time. As a result, the charging device can determine whether or not an entry to a non-charging area has been made, without making a false determination.

[0037]

As described above, the first embodiment of the present invention has been
10 described in detail with reference to the drawings. However, the specific configuration of the invention is not limited to that described above, and various design modifications or the like may be made without departing from the scope of the invention.

[0038]

For example, in the first embodiment, the case where the identification
15 information receiver unit 31 of the parking lot charging device 30 receives identification information from a beacon having a communication area at the border of the parking lot has been described. However, it is not limited to this. For example, instead of providing a beacon at the parking lot, a toll collector of the parking lot may have a handy terminal that performs DSRC communication, and the toll collector may perform communication with
20 the on-vehicle device 10 mounted on the vehicle parked at the parking lot using the handy terminal. Then, the identification information received on this handy terminal may be transmitted to the parking lot charging device 30. By using a handy terminal in this manner, it is possible to perform area charging according to the present invention even in the case where no beacon can be provided on the border of the parking area, such as the case where
25 a road side strip is used as a parking area.

[0039]

In the case of using the handy terminal mentioned above, the area charging device
20 may determine the end of parking and resume charging when the identification
information is received again from the handy terminal, and the charging may be resumed
5 when the vehicle starts to move.

[0040]

Moreover, in the first embodiment described above, the case where a beacon with
a communication area at the entrance and exit is provided, and identification information is
received twice, that is, at the time of entrance and at the time of exit has been described.
10 However, it is not limited to this. For example, in the case where an entrance and an exit
are separately provided, a beacon may be provided only at the entrance side. In this case,
the area charging device 20 may treat the time after a predetermined period of time has
elapsed from the time of identification information acquisition, as the time to resume
charging, and also, it may treat the time at which an exit from the parking lot is determined
15 by means of GPS/DR positioning for the vehicle, as the time to resume charging. That is to
say, the parking lot charging device 30 may perform the charging process based on a
predetermined period of time from the time of identification information acquisition, or it
may perform the charging process based on the period of time from the time of
identification information acquisition to the time at which an exit from the parking lot is
20 determined by means of GPS/DR positioning of the vehicle.

[0041]

<<Second Embodiment>>

Next, a second embodiment of the present invention is described.

FIG. 5 is a schematic block diagram showing a configuration of a charging system
25 according to the second embodiment of the present invention.

The second embodiment differs from the first embodiment in the configuration of the parking lot charging device 40, and it differs in the method of the charging target exclusion process in the area charging device 20.

The parking lot charging device 40 according to the second embodiment is a
5 ticket-issuing type charging device provided at an entrance and exit of a parking lot. That is to say, the parking lot charging device 40 performs a charging process based on a period of time from when an issued ticket is removed to a time when this ticket is received.

[0042]

Specifically, the parking lot charging device 40 includes a ticket issuing unit 41, a
10 ticket receiving unit 42, a parking time calculation unit 43, a parking lot charging unit 44, an identification information identification unit 45, and an identification information notification unit 46.

The ticket issuing unit 41 issues a ticket that stores unique identification
information, from a ticket issuing port provided in a casing, to a vehicle that enters the
15 parking lot.

The ticket receiving unit 42 receives a ticket from a vehicle exiting the parking lot, through a ticket receiving port provided in a casing.

The parking time calculation unit 43 calculates a period of time from a time when a ticket issued by the ticket issuing unit 41 is removed therefrom, to a time when a ticket
20 storing the same identification information as that of the ticket removed is received.

The parking lot charging unit 44 calculates a charging amount based on the period of time calculated by the parking time calculation unit 43, and receives the charging amount through a fare receiving port that is provided in the casing.

The identification information identification unit 45 identifies a license plate
25 value (identification information) of the vehicle present at the entrance of the parking lot

when the ticket issued by the ticket issuing unit 41 is removed from the ticket issuing port. Specifically, the toll collector may identify the license plate value by visually confirming and inputting the license plate value, or the license plate value may be identified by using a camera to capture an image of the license plate and processing the image capturing result by means of OCR (optical character recognition).

The identification information notification unit 46 associates the identification information identified by the identification information identification unit 45 with the time at which the ticket issued by the ticket issuing unit 41 is removed therefrom and the time at which the ticket receiving unit 42 receives the ticket, and notifies the associated identification information to the area charging device 20.

[0043]

The identification information acquisition unit 23 of the area charging device 20 acquires the identification information associated with the two times from the parking lot charging device 40. The charging target exclusion processing unit 24 calculates a charging amount charged for the vehicle indicated by the identification information acquired by the identification information acquisition unit 23 for the period of time between the associated times, and outputs a command for deducting the charging amount (making a refund) to the area charging unit 22. When the area charging unit 22 receives the charging amount deducting command from the charging target exclusion processing unit 24, the area charging unit 22 executes a charging amount deducting process for the vehicle.

As a result, a refund is made for the area charging amount incurred for the period of time where double charging has been made for the area charging and the parking lot charging, and thereby the area charging device 20 can perform a process for the time intended for the area charging target.

[0044]

As described above, the second embodiment of the present invention has been described in detail with reference to the drawings. However, the specific configuration of the invention is not limited to that described above, and various design modifications or the like may be made without departing from the scope of the invention.

5 For example, in the second embodiment, the case where the parking lot charging device 40 is an automatic machine that performs a charging process based on a ticket has been described. However, it is not limited to this, and this charging system may also be applied to a parking lot where a toll collector manually calculates and collects tolls. Specifically, by having a PC (personal computer) receive from the toll collector, an input
10 of vehicle identification information, parking start time, and parking end time, and then execute a program that transmits information indicating the information input by the toll collector to the area charging device 20, it is possible to make the PC function as an identification information acquisition device.

[0045]

15 The on-vehicle device 10, the area charging device 20, and the parking lot charging device 30 and the parking lot charging device 40 mentioned above respectively have a computer system thereinside. The operations of the respective processing units described above are stored in a program format on a computer-readable recording medium, and the above processes are performed by the computer reading and executing of this
20 program. The "computer-readable recording medium" here refers to a magnetic disc, a magnetic-optical disc, a CD-ROM, a DVD-ROM, a semiconductor memory or the like. Moreover, this computer program may be distributed through a communication line, and a computer that receives this distribution may execute the program.

[0046]

25 Furthermore, the above program may realize part of the functions described

above.

Moreover, the program may be a program capable of realizing the above functions in combination with a preliminarily recorded program on a computer system, that is, a so-called differential file (differential program).

5

INDUSTRIAL APPLICABILITY

[0047]

The present invention is a charging system, a charging device, a charging method, and a program, capable of determining whether or not an entry to a non-charging area has
 10 been made without making a false determination. The charging system, the charging device, the charging method, and the program acquire from an identification information acquisition device identification information of a vehicle present in the non-charging area, to thereby stop the charging process during a period of time from the time when the identification information is acquired to a predetermined end time. As a result, the
 15 charging device can determine whether or not an entry to a non-charging area has been made, without making a false determination.

[Reference Signs List]

[0048]

- 10 On-vehicle device
- 20 11 Location estimation unit
- 12 Card information reader unit
- 13 Identification information memory unit
- 14 Mobile communication unit
- 15 DSRC communication unit
- 25 20 Area charging device

- 21 Location information receiver unit
- 22 Area charging unit
- 23 Identification information acquisition unit
- 24 Charging target exclusion processing unit
- 5 25 Target exclusion time calculation unit
- 26 Additional charging unit
- 30 Parking lot charging device
- 31 Identification information receiver unit
- 32 Identification information notification unit
- 10 33 Timing unit
- 34 Parking lot charging unit
- 40 Parking lot charging device
- 41 Ticket issuing unit
- 42 Ticket receiving unit
- 15 43 Parking time calculation unit
- 44 Parking lot charging unit
- 45 Identification information identification unit
- 46 Identification information notification unit

CLAIMS

1. A charging system that is configured to perform charging for a vehicle that is present in a charging target area, the charging system comprising:
 - 5 a charging device configured to perform a charging process for a vehicle present in the charging target area; and
 - an identification information acquisition device configured to acquire identification information of a vehicle present in a non-charging area provided in the charging target area, and to notify the charging device of the identification information,
 - 10 wherein the charging device comprises:
 - an identification information acquisition unit configured to acquire identification information of a vehicle from the identification information acquisition device;
 - a charging unit configured to calculate a charging amount based on
 - 15 traveling of a vehicle within the charging target area, and to perform a charging process for the vehicle; and
 - a charging target exclusion processing unit configured to stop the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification
 - 20 information acquisition device acquires the identification information of the vehicle.
2. The charging system according to claim 1, wherein:
 - the identification information acquisition device is configured to receive
 - identification information of a vehicle from an on-vehicle device mounted on the vehicle
 - 25 in the non-charging area to thereby acquire identification information of a vehicle;

the charging unit of the charging device is configured to sequentially calculate a charging amount for a vehicle based on traveling of the vehicle within the charging target area; and

when the charging target exclusion processing unit of the charging device
5 acquires identification information of a vehicle from the identification information acquisition device, the charging target exclusion processing unit is configured to stop charging amount calculation performed by the charging unit for the vehicle indicated by the identification information.

10 3. The charging system according to claim 2, wherein the identification information acquisition device has a communication region on a border of the non-charging area, and is configured to receive identification information from the on-vehicle device mounted on the vehicle when the vehicle is passing the border of the non-charging area.

15 4. The charging system according to any one of claims 1 to 3, wherein the charging target exclusion processing unit of the charging device is configured to stop the charging process of the charging unit for the vehicle indicated by the identification information during a period of time from a time when the identification information acquisition device acquires the identification information of the vehicle to a time when the identification
20 information acquisition device acquires again the identification information of the vehicle.

5. The charging system according to any one of claims 1 to 4, wherein the charging device comprises:

a target exclusion time calculation unit configured to calculate a period of time
25 that the charging target exclusion processing unit stops the charging process; and

an additional charging unit, in the case where a period of time calculated by the target exclusion time calculation unit is not more than a predetermined period of time, the additional charging unit being configured to identify a charging amount according to a standard route in the case of traveling in the charging target area from a point where the vehicle was present at a start time of a charging target exclusion period determined by the charging target exclusion processing unit, to a point where the vehicle was present at an end time of the charging target exclusion period determined by the charging target exclusion processing unit, and to perform a charging process for the vehicle.

6. The charging system according to claim 1, wherein:

the identification information acquisition device is configured to acquire identification information of a vehicle present in the non-charging area provided in the charging target area and to notify the charging device of the identification information and the time when the identification information is acquired; and

the charging target exclusion processing unit of the charging device is configured to calculate a charging amount that is charging-processed by the charging unit in a period of time from a time included in the information acquired by the identification information acquisition device to a predetermined end time, and to make a refund for the charging amount.

20

7. A charging device that is configured to perform a charging process for a vehicle present in a charging target area, the charging device comprising:

an identification information acquisition unit configured to acquire identification information of a vehicle from an identification information acquisition device, the

identification information acquisition device being configured to acquire the identification

information of the vehicle present in a non-charging area provided in the charging target area and to notify the charging device of the identification information;

a charging unit configured to calculate a charging amount based on traveling of a vehicle within the charging target area and to perform a charging process for the vehicle;

5 and

a charging target exclusion processing unit configured to stop the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle.

10

8. A charging method that uses a charging device that performs a charging process for a vehicle present in a charging target area, the charging method comprising:

acquiring identification information of a vehicle, using an identification information acquisition unit of the charging device, from an identification information

15 acquisition device that acquires the identification information of the vehicle present in a non-charging area provided in the charging target area and to notify the charging device of the identification information;

calculating a charging amount based on traveling of a vehicle within the charging target area, and performing a charging process for the vehicle using a charging unit of the

20 charging device; and

stopping the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle using a charging target exclusion processing unit of the charging device.

25

9. A program that causes a charging device that performs a charging process for a vehicle present in a charging target area, to function as:

an identification information acquisition unit that acquires identification information of a vehicle from an identification information acquisition device that acquires the identification information of the vehicle present in a non-charging area provided in the charging target area and notifies the charging device of the identification information;

a charging unit that calculates a charging amount based on traveling of a vehicle within the charging target area and performs a charging process for the vehicle; and

a charging target exclusion processing unit that stops the charging process of the charging unit for the vehicle indicated by the identification information during a predetermined period of time from a time when the identification information acquisition device acquires the identification information of the vehicle.