

[DESCRIPTION]

[Title of Invention]

PARKING FEE MANAGEMENT DEVICE, PARKING FEE MANAGEMENT
METHOD, AND PROGRAM

[Technical Field]

[0001]

The present disclosure relates to a parking fee management device, a parking fee management method, and a program.

[Background Art]

[0002]

In parking lot facilities, a so-called “parking lot rented on a time basis” to collect fees as usage fees on hourly basis or daily basis is known. For example, Patent Literature 1 discloses a fee setting system that, in a parking lot rented on a time basis, the unit price of the parking fee is dynamically changed in accordance with a ratio of the number of parked vehicles to the capacity of a parking lot.

[Citation List]

[Patent Literature]

[0003]

[PTL 1]

Japanese Patent Application Laid-Open No. 2002-288698

[Summary of Invention]

[Technical Problem]

[0004]

In a parking lot rented on a time basis installed in or around a place where a large number of visitors come, such as commercial facilities such as a department store or an outlet

mall, theme parks, amusement parks, aquariums, zoos, concert halls, movie theaters, or a stadium (baseball stadiums, soccer stadiums), the time users return home may be concentrated. In such a case, there may be congestion of outgoing vehicles in the parking lot and it will take long time for these vehicles to exit, which may lead to user dissatisfaction. Further, since such concentration of outgoing vehicles can impact significantly on congestion or traffic jam of neighboring roads, there is a concern about an impact on neighborhood residents and general persons using neighboring roads.

[0005]

It is difficult to solve such concentration of outgoing vehicles by relying on the scheme of Patent Literature 1 that dynamically changes the unit price of the parking fee in accordance with a ratio of the number of parked vehicles to the capacity, for example.

[0006]

The present disclosure has been made in view of such circumstances and intends to provide a parking fee management device, a parking fee management method, and a program that can reduce concentration of outgoing vehicles in a parking lot.

[Solution to Problem]

[0007]

The first aspect of the present disclosure is a parking fee management device configured to manage a parking fee of a parking lot, the parking fee management device includes: an estimation unit configured to estimate a vehicle exit peak time during which outgoing vehicles are concentrated; and a discount information creation unit configured to create discount information based on a result estimated by the estimation unit, the discount information including time ranges and discount rates or discount amounts associated with each other, and the discount information creation unit sets a discount rate or a discount amount applied to a time other than the vehicle exit peak time to be higher than a discount

rate or a discount amount applied to the vehicle exit peak time.

[0008]

The second aspect of the present disclosure is a parking fee management device configured to manage a parking fee of a parking lot, the parking fee management device includes: a discount information creation unit configured to create discount information, the discount information including time ranges and discount rates or discount amounts associated with each other, and the discount information creation unit updates a discount rate or a discount amount in accordance with a vehicle exit reservation state.

[0009]

The third aspect of the present disclosure is a parking fee management method for managing a parking fee of a parking lot, a computer performs steps of: estimating a vehicle exit peak time during which outgoing vehicles are concentrated; and creating discount information based on the estimated vehicle exit peak time, the discount information including time ranges and discount rates or discount amounts associated with each other, and the step of creating discount information sets a discount rate or a discount amount applied to a time other than the vehicle exit peak time to be higher than a discount rate or a discount amount applied to the vehicle exit peak time.

[0010]

The fourth aspect of the present disclosure is a parking fee management method for managing a parking fee of a parking lot, and a computer performs steps of: creating discount information, the discount information including time ranges and discount rates or discount amounts associated with each other; and updating a discount rate or a discount amount of the discount information in accordance with a vehicle exit reservation state.

[0011]

The fifth aspect of the present disclosure is a program for causing a computer to

function as the parking fee management device described above.

[0012]

The sixth aspect of the present disclosure is a program for causing a computer to perform processes of: receiving discount information from a parking fee management device configured to manage a parking fee of a parking lot, the discount information including time ranges and discount rates or discount amounts associated with each other; and displaying the received discount information on a display unit.

[0013]

The seventh aspect of the present disclosure is a program for causing a computer to perform processes of: transmitting identification information on an incoming vehicle and a fee disclosure request to a parking fee management device configured to manage a parking fee of a parking lot; receiving individual fee information from the parking fee management device, the individual fee information including vehicle exit time ranges and parking fees associated with each other; and displaying the received individual fee information on a display unit.

[Advantageous Effects of Invention]

[0014]

According to the parking fee management device, the parking fee management method, and the program of the present disclosure, an advantageous effect of being able to reduce concentration of outgoing vehicles in a parking lot is achieved.

[Brief Description of Drawings]

[0015]

[Fig. 1]

Fig. 1 is a diagram illustrating an example of a network configuration of a parking fee management device according to a first embodiment of the present disclosure.

[Fig. 2]

Fig. 2 is a schematic configuration diagram illustrating an example of a hardware configuration of the parking fee management device according to the first embodiment of the present disclosure.

[Fig. 3]

Fig. 3 is a function block diagram illustrating an example of functions of the parking fee management device according to the first embodiment of the present disclosure.

[Fig. 4]

Fig. 4 is a diagram illustrating an example of vehicle entry/exit management information according to the first embodiment of the present disclosure.

[Fig. 5]

Fig. 5 is a diagram illustrating an example of discount information according to the first embodiment of the present disclosure.

[Fig. 6]

Fig. 6 is a diagram illustrating an example of a display screen of individual fee information according to the first embodiment of the present disclosure.

[Fig. 7]

Fig. 7 is a diagram illustrating a configuration example of a single-level parking lot according to the first embodiment of the present disclosure.

[Fig. 8]

Fig. 8 is a function block diagram illustrating an example of functions of a parking fee management device according to a second embodiment of the present disclosure.

[Fig. 9]

Fig. 9 is a diagram illustrating an example of vehicle entry/exit management information according to the second embodiment of the present disclosure.

[Fig. 10]

Fig. 10 is a diagram illustrating an example of discount information in an initial state according to the second embodiment of the present disclosure.

[Fig. 11]

Fig. 11 is a diagram illustrating an example of discount information in which a discount rate of the discount information in the initial state illustrated in Fig. 10 has been changed in accordance with the number of reservations.

[Fig. 12]

Fig. 12 is a diagram illustrating an example of a display screen of the discount information according to the second embodiment of the present disclosure.

[Fig. 13]

Fig. 13 is a diagram illustrating an example of a display screen of personal fee information according to the second embodiment of the present disclosure.

[Fig. 14]

Fig. 14 is a diagram illustrating an example of a display screen of personal fee information according to the second embodiment of the present disclosure.

[Fig. 15]

Fig. 15 is a function block diagram illustrating an example of functions of a parking fee management device according to a third embodiment of the present disclosure.

[Description of Embodiments]

[0016]

[First Embodiment]

A parking fee management device, a parking fee management method, and a program according to a first embodiment of the present disclosure will be described below with reference to the drawings. The parking fee management device, the parking fee

management method, and the program according to the first embodiment are generally applicable to various parking lots, which may be, as examples, a single-level parking lot in which users park their vehicles by themselves in parking sections installed in a wide parking space, a multistory parking lot in which users park their vehicles by themselves in parking sections installed three-dimensionally, a mechanical parking lot in which a boarding room is provided, or the like. An example of the mechanical parking lot may be, for example, a tower type mechanical parking apparatus with an elevator system, a vertical circulation system, a plane surface slide system, a horizontal circulation system, a multi-level circulation system, two-storied/multi-storied system, a berth type mechanical parking apparatus, or the like. Further, the embodiment is applicable to valet parking or the like in which, after the driver gets out of its vehicle, the vehicle is transported to a predetermined parking section by a caretaker or a self-propelled vehicle transport carriage or by a self-driving vehicle running autonomously.

[0017]

Fig. 1 is a diagram illustrating an example of a network configuration of a parking fee management device 10 according to the present embodiment.

As illustrated in Fig. 1, the parking fee management device 10 is communicably connected to a user terminal 50, an information terminal 60, and the like carried by the user of a parking lot via a communication network 3 such as the Internet, wireless LAN (for example, Wi-Fi) in the local communication, or the like, for example.

[0018]

The parking fee management device 10 is a device that manages parking fees of a parking lot and will be described later in detail.

The user terminal 50 is a so-called information processing device such as a smartphone, a tablet terminal, a personal computer, or the like and has a communication unit

for communicating with the Internet or the like, an input unit for the user to input its input operation, and a display unit for displaying information. For example, predetermined application software (hereafter, referred to as “parking application”) for using a parking lot has been installed in the user terminal 50. The user is able to send various requests described later to the parking fee management device 10 via this parking application and also to acquire desired information. The operation may require registration information such as a mail address used by the user, a user ID, or the like to be registered before use of the parking application.

[0019]

Although the case where the “parking application” is installed in the user terminal 50 as mentioned above will be described as an example in the present embodiment, the embodiment is not limited to this example. For example, the user may cause the function of the parking application to be executed by a server on the cloud side and use a general web browser to view a result of the parking application via the Internet without installing dedicated software to the user terminal 50.

[0020]

The information terminal 60 is installed at a place where the user of the parking lot comes and goes, such as inside the facility around the parking lot and provides information to the user. An example of the information terminal 60 may be a kiosk terminal.

Although a single user terminal 50 and a single information terminal 60 are depicted in Fig. 1, each number of these terminals is not limited to the depicted form and can be increased as appropriate in accordance with the situation.

[0021]

Fig. 2 is a schematic configuration diagram illustrating an example of a hardware configuration of the parking fee management device 10. The parking fee management

device 10 includes, for example, a CPU 11, a main memory 12 that functions as a work area during execution of each program, a storage unit (auxiliary memory) 13 for storing a program executed by the CPU 11 and data referenced by this program or the like, and a communication interface 14 for connection to a network or the like. For example, these components are connected to each other via a bus 18. An example of the storage unit 13 may be a magnetic disk, a magnetic optical disk, a semiconductor memory, or the like. An example of the magnetic disk may be a hard disk drive (HDD). An example of the semiconductor memory may be a solid state drive (SSD) or the like.

[0022]

The parking fee management device 10 may include an input device 15 such as a keyboard, a mouse, or the like and a display 16 or the like. The input device 15 and the display 16 may be provided remotely and configured to enable remote input operation or the like on the parking fee management device 10.

[0023]

Fig. 3 is a function block diagram illustrating an example of functions of the parking fee management device 10.

A series of processes for implementing various functions described later are stored in the storage unit 13 (see Fig. 2) in a form of a program (for example, a parking fee management program) as an example, and various functions are implemented when the CPU 11 loads this program into the main memory 12 and performs modification and computation processing on information. For a program, a form in which the program is installed in advance in the storage unit 13, a form in which the program is provided in a state of being stored in another computer readable storage medium, a form in which the program is delivered via a wired or wireless communication connection, or the like may be applied. The computer readable storage medium may be a magnetic disk, a magnetic optical disk, a

CD-ROM, a DVD-ROM, a semiconductor memory, or the like.

[0024]

As illustrated in Fig. 3, the parking fee management device 10 includes a communication unit 20, a vehicle entry accepting unit 21, a vehicle entry/exit management information storage unit 22, a vehicle exit accepting unit 23, a vehicle exit record information storage unit 24, an estimation unit 25, a discount information creation unit 26, a discount information storage unit 27, a fee information creation unit 28, and the like.

[0025]

The communication unit 20 communicates with external devices. For example, the communication unit 20 transfers information to and from various devices installed in the parking lot, the user terminal 50, the information terminal 60, and the like. Examples of such various devices installed in a parking lot may be a parking lot controller that controls a mechanical parking lot, a ticket machine 32, a prepayment machine 35, a payment machine 34 (see Fig. 7), and the like.

[0026]

When the vehicle entry accepting unit 21 has received vehicle entry information including information on an incoming vehicle and a vehicle entry time via the communication unit 20, the vehicle entry accepting unit 21 updates vehicle entry/exit management information stored in the vehicle entry/exit management information storage unit 22 based on the vehicle entry information. The information on an incoming vehicle may be information that can identify an incoming vehicle and, as an example, may be a vehicle ID, a parking ticket number, a user ID preregistered by a user, or the like.

[0027]

The vehicle ID is, for example, a license plate of a vehicle or an ID of an on-board device mounted on a vehicle or the like and is information linked to the vehicle. For

example, the vehicle ID may be acquired by using a camera to take a license plate of a vehicle and performing image analysis thereon at the time of vehicle entry. The on-board device ID may be acquired via communication with the on-board device mounted on the incoming vehicle at the time of vehicle entry. Further, for example, the parking ticket number may be received from a ticket machine when the ticket machine 32 (see Fig. 7) issues the parking ticket. For example, the user ID may be applied to a parking lot that does not issue parking tickets, and as an example, the user ID may be acquired via a configuration that causes an IC card reader, a two-dimensional barcode reader, or the like in the parking lot to read the user ID stored in an IC card or the user terminal 50 possessed by the user at the time of vehicle entry.

In the present embodiment, description will be provided with an example of a case where a parking ticket number is used as the information on an incoming vehicle.

[0028]

When the vehicle exit accepting unit 23 has received vehicle exit information including information on an outgoing vehicle and a vehicle exit time via the communication unit 20, the vehicle exit accepting unit 23 updates entry/exit management information stored in the vehicle entry/exit management information storage unit 22 based on the vehicle exit information.

[0029]

The vehicle entry/exit management information storage unit 22 stores vehicle entry/exit management information. Fig. 4 illustrates an example of the vehicle entry/exit management information. As illustrated in Fig. 4, in the vehicle entry/exit management information, vehicle entry times are registered in association with parking ticket numbers. Further, in the vehicle entry/exit management information, a payment time, a vehicle exit time, a billed time, a parking fee, or the like may be registered in association with a parking

ticket number. Further, in the vehicle entry/exit management information, information on a discount ticket in accordance with an amount purchased in a facility (for example, a commercial facility) affiliated with the parking lot or information on a discount rate in accordance with a vehicle exit time may be further registered.

[0030]

The vehicle exit record information storage unit 24 stores the past vehicle exit record information. For example, out of the vehicle entry/exit management information illustrated in Fig. 4, information on the vehicle exit time is accumulated over a predetermined period of time in the past and stored in the vehicle exit record information storage unit 24. Further, the vehicle exit record information may include information on a day of the week or weekday / holiday / public holiday, information on an event held around the parking lot, weather information (whether, temperature, humidity, or the like), or the like.

[0031]

The estimation unit 25 estimates the vehicle exit peak time during which outgoing vehicles are concentrated. For example, the estimation unit 25 estimates the vehicle exit peak time by using at least one of past vehicle exit record information, event information of the day, weather information of the day, day-of-the-week information of the day, and public holiday information of the day.

[0032]

For example, the estimation unit 25 may estimate the vehicle exit peak time during which outgoing vehicles are concentrated based on the past vehicle exit record information stored in the vehicle exit record information storage unit 24. Specifically, the estimation unit 25 may estimate the vehicle exit peak time from the past vehicle exit record information by using a known statistical scheme. Note that multiple vehicle exit peak times may be estimated without being limited to a single vehicle exit peak time. The estimation unit 25

may estimate the vehicle exit peak time by using machine learning.

[0033]

For example, the estimation unit 25 may determine the past vehicle exit record information whose similarity is higher than or equal to a predetermined value from at least one piece of information out of weather information of the day, information on whether or not an event is held, day-of-the-week information of the day, weekday / holiday / public holiday information, and the like and then estimate the vehicle exit peak time by using the determined vehicle exit record information. Estimation of the vehicle exit peak time by the estimation unit 25 can be performed by using a known technology such as statistical processing or machine learning, and the scheme thereof is not particularly limited.

[0034]

For example, the vehicle exit peak time may be determined as a time range in which the number of outgoing vehicles is greater than or equal to a predetermined value. The predetermined value may be an index value set as a relative value taking the number of outgoing vehicles in another time range into consideration or may be set as an absolute value.

[0035]

The estimation of the vehicle exit peak time performed by the estimation unit 25 is not limited to the scheme described above. For example, the vehicle exit peak time that outgoing vehicles are concentrated may be estimated based on event information, weather forecast information, or the like of the day instead of using the past vehicle exit record information. For example, when an event is scheduled between 14:00 and 16:00, outgoing vehicles may be concentrated after the end of the event. In such a case, for example, one hour of 16:30 to 17:30 may be estimated as the vehicle exit peak time.

[0036]

The discount information creation unit 26 creates discount information associated

with a time range and a discount rate based on a result estimated by the estimation unit 25. At this time, the discount information creation unit 26 sets the discount rate applied to a time other than the vehicle exit peak time to be higher than the discount rate applied to the time range including the vehicle exit peak time. For example, the discount information creation unit 26 sets the discount rate applied to the time before or after the vehicle exit peak time to be higher than the discount rate applied to the vehicle exit peak time.

[0037]

Fig. 5 illustrates an example of discount information. In the discount information illustrated in Fig. 5, discount rates are set for every 30 minutes. In the discount information illustrated in Fig. 5, the discount rate is set to 0% for the time range estimated as the vehicle exit peak time, and the discount rate applied before and after the vehicle exit peak time is set higher than the discount rate applied to the vehicle exit peak time (that is, 0%).

As discussed above, by setting the discount rate applied to the time other than the vehicle exit peak time to be higher than the discount rate applied to the vehicle exit peak time, it is possible to give users an incentive to avoid the vehicle exit peak time in performing vehicle exit. This can diversify vehicle exit times and reduce concentration of outgoing vehicles. Further, diversification of vehicle exit times can contribute to a reduction in the time required for vehicle exit (waiting time for vehicle exit or time to drive out to the road) or ease of congestion or traffic jam on neighboring roads. Further, this can reduce the number of guidance staff members who cope with the congestion, reduce their working time to cope therewith, or the like.

[0038]

The discount information creation unit 26 may set the discount rate applied to a late time range to be higher than the discount rate applied to an early time range. This can reduce users' feeling of hesitation to longer parking and give users a feeling of security for

longer stay in a commercial facility or the like, and an effect of promoting users' consumption behavior can be expected. As a result, it is possible to enhance the economic impact in the commercial facility and contribute to the benefit of the commercial facility.

Although the discount rate is used in the present embodiment, the embodiment is not limited to this example. For example, a discount amount may be used instead of the discount rate.

[0039]

The discount information created by the discount information creation unit 26 is stored in the discount information storage unit 27.

Further, the discount information creation unit 26 transmits discount information to the user terminal 50 and the information terminal 60 via the communication unit 20 at a predetermined timing. The predetermined timing may be a timing that discount information is created, a time set in advance, a timing that a discount information reference request is received from the user terminal 50 or the like via the communication unit 20, or the like.

[0040]

When the fee information creation unit 28 has received a parking ticket number and a fee disclosure request via the communication unit 20, the fee information creation unit 28 acquires a vehicle entry time corresponding to the parking ticket number from the vehicle entry/exit management information stored in the vehicle entry/exit management information storage unit 22. The fee information creation unit 28 then uses the acquired vehicle entry time and the discount information stored in the discount information storage unit 27 to create individual fee information in which vehicle exit time ranges and parking fees are associated with each other and transmits the created personal fee information to the sender of the fee disclosure request via the communication unit 20. Accordingly, the personal fee information in which time ranges and parking fees are associated with each other is displayed

on the display screen of the user terminal 50 or the information terminal 60 that has received the personal fee information.

[0041]

Fig. 6 is a diagram illustrating an example of the display screen of the individual fee information. As illustrated in Fig. 6, in the individual fee information, time ranges and parking fees reflecting discount rates are displayed in association with each other. Further, when a discount service on the parking fee in accordance with the user purchase amount or the like are performed, a purchase amount linked to the parking ticket number of interest may be acquired from a POS system of the facility, and the discount amount in accordance with the purchase amount may be displayed. In the individual fee information illustrated as an example in Fig. 6, a case where a discount for two hours of the parking fee is applied in accordance with the purchase amount is illustrated. Further, in such a case, it is possible to promote purchasing behavior by displaying what additional purchase amount is needed to increase the discount of the parking fee.

The individual fee information may include a parking fee before a discount is applied and a parking fee after the discount is applied.

[0042]

Because the individual fee information is provided to the user terminal 50 or the like, the user is able to consider a vehicle exit time while referencing parking fees. Further, at this time, because the parking fee before the discount is applied and the parking fee after the discount is applied are displayed so that the user is able to compare these parking fees, it is possible to give the user a beneficial feeling.

[0043]

Next, various processes performed by the parking fee management device 10 according to the present embodiment will be described. In the following description, for

simplified illustration, a case where the embodiment is applied to a single-level parking lot 30 as illustrated in Fig. 7 will be described as an example.

[0044]

[Process of creating discount information]

The parking fee management device 10 estimates a vehicle exit peak time of the day at a predetermined timing, for example, a predetermined time before starting a service of vehicle entry of the parking lot, creates discount information based on the estimated vehicle exit peak time, and stores the created discount information in the discount information storage unit 27.

[0045]

[Process of accepting vehicle entry]

When driving into the single-level parking lot 30, the user stops its vehicle in front of an entrance gate 31, receives a parking ticket from the ticket machine 32, drives into the parking lot from the entrance gate 31, and parks the vehicle in a predetermined section. Further, in response to completion of the ticket issuance, the ticket machine 32 transmits vehicle entry information in which the parking ticket number and the vehicle entry time are associated with each other to the parking fee management device 10. In response to receiving vehicle entry information, the parking fee management device 10 updates the vehicle entry/exit management information based on the vehicle entry information. Accordingly, the parking ticket number and the vehicle entry time of interest are registered.

[0046]

[Process of providing discount information]

The parking fee management device 10 transmits discount information stored in the discount information storage unit 27 to the user terminal 50 or the information terminal 60 at a predetermined timing.

For example, when predetermined input operation is performed by the user of the parking lot at the user terminal 50 or the information terminal 60, a discount information reference request is thereby transmitted to the parking fee management device 10. For example, once the user starts up the parking application installed in advance on the user terminal 50 and presses a button for discount information reference from a menu or the like displayed in the display screen, the discount information reference request is transmitted to the parking fee management device 10. Further, once the user presses the button of the discount information reference from a menu or the like displayed on the display screen on the information terminal 60, the discount information reference request is transmitted to the parking fee management device 10.

[0047]

In response to receiving the discount information reference request, the parking fee management device 10 transmits discount information stored in the discount information storage unit 27 to the user terminal 50 or the information terminal 60 of the sender of the request. Accordingly, the discount information in which the time ranges and the discount rates are associated with each other is displayed on the display screen of the user terminal 50 or the information terminal 60. This enables the user to reference discount rates for respective time ranges and consider a vehicle exit time. In the display screen, event information in the commercial facility or information on the peak time may be displayed as supplemental information, for example, as illustrated in Fig. 5.

[0048]

[Process of providing fee information and process of accepting vehicle exit reservation]

When the user of the parking lot performs predetermined input operation on the user terminal 50 or the information terminal 60, a parking ticket number and a fee disclosure request are thereby transmitted to the parking fee management device 10.

For example, once the user starts up the parking application installed in advance on the user terminal 50 and presses a fee disclosure button from a menu or the like displayed in the display screen, an input field for inputting the parking ticket number is displayed. The user inputs the parking ticket number by using keys to input the parking ticket number written in the parking ticket or causing a two-dimensional barcode reader of the user terminal 50 to read a two-dimensional barcode printed on the parking ticket. For example, when an enter button is pressed after the parking ticket number is input, the parking ticket number and the fee disclosure request are transmitted to the parking fee management device 10.

[0049]

Further, once the user presses the fee disclosure button from a menu or the like displayed in the display screen on the information terminal 60, an input field for inputting the parking ticket number is displayed. The user inputs the parking ticket number by using keys to input the parking ticket number written in the parking ticket or causing a two-dimensional barcode reader of the information terminal 60 to read a two-dimensional barcode or the like printed on the parking ticket. For example, when an enter button is pressed after the parking ticket number is input, the parking ticket number and the fee disclosure request are transmitted to the parking fee management device 10.

[0050]

When the parking fee management device 10 has received the parking ticket number and the fee disclosure request from the user terminal 50 or the information terminal 60, the parking fee management device 10 acquires the vehicle entry time corresponding to the parking ticket number from the vehicle entry/exit management information stored in the vehicle entry/exit management information storage unit 22. The parking fee management device 10 then uses the acquired vehicle entry time and the discount information stored in the discount information storage unit 27 to create individual fee information in which vehicle

exit time ranges and parking fees are associated with each other and transmits the individual fee information to the user terminal 50 or the information terminal 60 of the sender of the request.

Accordingly, the personal fee information in which time ranges and parking fees are associated with each other is displayed on the display screen of the user terminal 50 or the information terminal 60. The user is able to consider a vehicle exit time while referencing the parking fee.

[0051]

[Payment process]

The user may finish payment at the prepayment machine 35 installed in a commercial facility, a parking lot, or the like prior to vehicle exit, for example. For example, the user inserts a parking ticket into a parking ticket reading slot provided to the prepayment machine 35. Accordingly, payment request information including a parking ticket number is transmitted from the prepayment machine 35 to the parking fee management device 10. In response to receiving the payment request information, the parking fee management device 10 acquires the vehicle entry time corresponding to the parking ticket number from the vehicle entry/exit management information and calculates a billed time based on the current time and the vehicle entry time. Further, the parking fee management device 10 acquires the discount rate corresponding to the current time range from the discount information and calculates a parking fee based on the billed time, the discount rate, and the basic parking fee. The parking fee management device 10 transmits the calculated parking fee to the prepayment machine 35.

Accordingly, the parking fee is displayed on the display unit of the prepayment machine 35. In response to completion of the payment, the information thereon is transmitted to the parking fee management device 10, and the current time is written as the

payment time in the vehicle entry/exit management information.

[0052]

[Vehicle exit process]

Before driving out of the single-level parking lot 30, the user gets in its vehicle that has been parked, stops the vehicle in front of the exit gate 33, and inserts the parking ticket into the payment machine 34 installed at the exit gate 33. Accordingly, vehicle exit request information including the parking ticket number is transmitted from the payment machine 34 to the parking fee management device 10. In response to receiving the vehicle exit request information, the parking fee management device 10 acquires a payment time corresponding to the parking ticket number from the vehicle entry/exit management information. Herein, when no information on a payment time is obtained, that is, when prepayment is not made, the payment process described above is performed at the payment machine 34. In contrast, when information on a payment time is acquired, it is determined whether or not the difference between the payment time and the current time is within a predetermined time, and if it is within the predetermined time, it is determined that the payment has been made, the exit gate 33 is opened, and vehicle exit is permitted. In contrast, if the difference between the payment time and the current time exceeds the predetermined time, the parking fee is re-calculated based on the payment time as a starting point of time, and the exit gate 33 is opened after the re-calculated amount is re-collected. In such a case, such operation that does not apply discount to re-collected parking fees may be employed.

[0053]

When the exit gate 33 is opened, the user moves the vehicle and exits the parking lot. Further, in response to completion of vehicle exit, the payment machine 34 transmits vehicle exit information in which the parking ticket number and the vehicle exit time are associated with each other to the parking fee management device 10. In response to receiving the

vehicle exit information, the parking fee management device 10 updates the vehicle entry/exit management information based on the vehicle exit information.

[0054]

As described above, according to the parking fee management device, the parking fee management method, and the program of the present embodiment, the following effects and advantages are achieved.

A vehicle exit peak time during which outgoing vehicles are concentrated is estimated, and discount information in which time ranges and discount rates or discount amounts are associated with each other is created based on the estimated vehicle exit peak time. Since the discount rate or the discount amount applied to the time other than the vehicle exit peak time is set higher than the discount rate or the discount amount applied to the vehicle exit peak time in the discount information, it is possible to give users an incentive to avoid the vehicle exit peak time in performing vehicle exit. This can diversify outgoing vehicles and reduce the waiting time of users for vehicle exit or reduce the impact such as a traffic jam on neighboring roads due to concentration of outgoing vehicles.

[0055]

Although the case where discount information is displayed on the user terminal 50 or the information terminal 60 has been described in the above embodiment, the embodiment is not limited to this example. For example, the discount information may be continuously displayed on a display provided in a parking lot, a commercial facility, or the like. This enables a large number of users to recognize a vehicle exit time range with a high discount rate and can reduce concentration of outgoing vehicles.

[0056]

The above embodiment has been described assuming a parking lot of a commercial facility. However, when a plurality of vehicle exit peak times are present, for example, as

with a movie theater, a concert venue, or the like, a discount time range or a discount rate may be set in accordance with the interval of the vehicle exit peak times, the capacity of the parking lot, or the handling ability (the number of incoming vehicles or the number of outgoing vehicles that can be handled per unit time by the parking facility).

[0057]

Although a discount rate is set based on a vehicle exit peak time in the embodiment described above, a discount rate may be set based on the number of users of the day (vehicle entry rate) in addition to or instead of the vehicle exit peak time. For example, when the number of users (vehicle entry rate) is less than a predetermined value, no discount is applied, or a lower discount rate may be set than when the number of users (vehicle entry rate) is greater than or equal to the predetermined value.

[0058]

In the embodiment described above, a discount rate in accordance with a vehicle exit time range is reflected to a parking fee, and the discounted fee is collected. However, for example, in a case of a parking lot rented on a daily basis, such operation that collects a uniform parking fee at the time of vehicle entry is employed. In such a case, for example, a fee in accordance with a vehicle exit time may be refunded at the time of vehicle exit. Further, instead of discounting parking fees, other schemes, such as distributing novelty goods, may be employed to reduce concentration of vehicle exit times.

[0059]

[Second Embodiment]

Next, a parking fee management device, a parking fee management method, and a program according to a second embodiment of the present disclosure will be described with reference to the drawings. The parking fee management device, the parking fee management method, and the program according to the present embodiment are applied to a

parking lot that accepts a vehicle exit reservation. Representative examples of the parking lot that accepts a vehicle exit reservation may be, for example, a mechanical parking apparatus in which a vehicle is transported between a parking space (parking area) for parking a vehicle and a boarding room by a transport unit (a lift, a pallet, a conveyer, or the like), a valet parking facility in which a vehicle is transported between a boarding room and a parking space by a worker or a self-propelled vehicle transport carriage or the like, or the like.

In the following, configurations common to those in the first embodiment will be labeled with the same references, the description thereof will be omitted, and different features will be mainly described.

[0060]

Fig. 8 is a function block diagram illustrating an example of functions of a parking fee management device 10a according to the present embodiment. As illustrated in Fig. 8, the parking fee management device 10a further includes a vehicle exit reservation accepting unit 41 to the configuration of the parking fee management device 10 described above. Further, the parking fee management device 10a includes a discount information creation unit 43 instead of the discount information creation unit 26.

[0061]

When the vehicle exit reservation accepting unit 41 has received vehicle exit reservation information including a parking ticket number and a vehicle exit reservation time range from the user terminal 50, the information terminal 60, or a vehicle exit reservation terminal (not illustrated) provided in a commercial facility or the like or a parking lot via the communication unit 20, the vehicle exit reservation accepting unit 41 accepts a reservation based on this vehicle exit reservation information.

[0062]

Specifically, the vehicle exit reservation accepting unit 41 has an upper limit value of the number of vehicle exit reservations that can be accepted per time unit (for example, 15 minutes, 30 minutes, or the like). For example, this upper limit value is a value determined in advance in accordance with the handling ability of a parking facility, the traffic condition (traffic jam condition) around the parking lot, or the like. Further, considering users who perform vehicle exit without making a vehicle exit reservation, it may be preferable to set the upper limit value may to a value with a predetermined margin.

[0063]

For example, the vehicle exit reservation accepting unit 41 has vehicle exit reservation information in which time ranges, the number of vehicle exit reservations, and the reservation upper limit value are associated with each other. When the vehicle exit reservation accepting unit 41 has received vehicle exit reservation information from the user terminal 50 or the like, the vehicle exit reservation accepting unit 41 determines whether or not the number of reservations in the vehicle exit reservation time range included in the vehicle exit reservation information reaches the upper limit value, and if the upper limit value is not reached, accepts and reflects the vehicle exit reservation to the vehicle exit reservation information and updates the vehicle entry/exit management information stored in the vehicle entry/exit management information storage unit 22. Fig. 9 illustrates an example of the vehicle entry/exit management information according to the present embodiment. As illustrated in Fig. 9, the vehicle exit reservation time is further registered in the vehicle entry/exit management information in association with the parking ticket number.

Further, if the number of reservations in the vehicle exit reservation time range included in the vehicle exit reservation information reaches the upper limit value, the vehicle exit reservation accepting unit 41 does not accept the vehicle exit reservation and thus transmits information indicating that no reservation is accepted to the user terminal 50 or the

like of the sender of the vehicle exit reservation information.

[0064]

The discount information creation unit 43 is similar to the discount information creation unit 26 described above in creating discount information in which time ranges and discount rates or discount amounts are associated with each other but is different in the scheme of setting the discount rates. Specifically, the discount information creation unit 43 dynamically changes the discount rate in accordance with the vehicle exit reservation state. That is, the vehicle exit reservation state changes time by time. Therefore, the discount information creation unit 43 dynamically changes the discount rate in accordance with the vehicle exit reservation state. More specifically, in each time range, when the number of reservations increases, the discount rate is reduced. Further, the discount information creation unit 43 may compare the numbers of reservations in respective time ranges and increase the discount rate in a time range in which the number of reservations is less than or equal to a predetermined value. This makes it possible to facilitate diversification of reservations.

[0065]

More specifically, the discount information creation unit 43 sets a discount rate based on a peak time estimated by the estimation unit 25 in the same manner as in the first embodiment described above. This discount rate is set as the initial value. Fig. 10 is a diagram illustrating an example of the discount information in the initial state. In the discount information illustrated in Fig. 10 as an example, discount rates and reservation states are registered in association with time ranges. At this time, however, no reservation has been made, and the number of reservations is thus zero in all the time ranges.

Since the discount rate varies in accordance with the reservation state, the discount rate in the initial state may be set higher than the discount rate in the first embodiment

described above, as illustrated in Fig. 10 as an example.

[0066]

The discount information creation unit 43 updates the discount information at a predetermined timing. Specifically, the discount information creation unit 43 acquires vehicle exit reservation information possessed by the vehicle exit reservation accepting unit 41 at a predetermined timing and updates the discount information based on the acquired latest vehicle exit reservation information. For example, the discount information creation unit 43 compares the latest vehicle exit reservation information with the previously acquired vehicle exit reservation information, sets the discount rate lower than the previous value for a time range in which the number of reservations has increased, and sets the discount rate higher than the previous value for a time range in which the number of reservations has decreased due to cancellation of a reservation. This makes it possible to guide a vehicle exit reservation to a time range with a smaller number of reservations.

[0067]

Fig. 11 illustrates an example of discount information when the discount rate has been changed in accordance with the number of reservations. In the discount information illustrated in Fig. 11 as an example, the discount rate in the time range in which the number of reservations reaches the upper limit value of 30 is set to 0%. Further, compared to the discount information in the initial state illustrated in Fig. 10, it is found that, as the number of reservation increases, the discount rate is set to decrease stepwise. The discount information created by the discount information creation unit 43 is stored in the discount information storage unit 27.

[0068]

Next, the process performed by the parking fee management device 10a according to the present embodiment will be described. The description for the same processes as those

in the first embodiment described above will be omitted, and different processes therefrom will be mainly described.

[0069]

[Process of providing discount information and process of accepting vehicle exit reservation]

When the user of the parking lot performs predetermined input operation on the user terminal 50 or the information terminal 60, a discount information reference request is thereby transmitted to the parking fee management device 10a. For example, once the user starts up the parking application installed in advance on the user terminal 50 and presses a button for discount information reference from a menu or the like displayed in the display screen, the discount information reference request is transmitted to the parking fee management device 10a. Further, once the user presses the button of the discount information reference from a menu or the like displayed in the display screen on the information terminal 60, the discount information reference request is transmitted to the parking fee management device 10a.

[0070]

In response to receiving the discount information reference request, the parking fee management device 10a transmits discount information stored in the discount information storage unit 27 to the user terminal 50 or the information terminal 60 of the sender of the request. Accordingly, the discount information in which time ranges and discount rates are associated with each other is displayed in the display screen of the user terminal 50 or the information terminal 60. In this display screen, the number of vehicle exit reservations and the upper limit value thereof for each time range may be displayed.

[0071]

Fig. 12 is a diagram illustrating an example of the display screen of the information terminal 60 on which the discount information is displayed. As illustrated in Fig. 12, in the

display screen of the information terminal 60, for example, a screen indicating a discount rate and a reservation state (the number of reservations relative to the upper limit value) for each time range is displayed. Further, reservation buttons 52 for making a vehicle exit reservation are displayed in this display screen. For example, these reservation buttons 52 are displayed only for time ranges in which the number of reservations does not reach the upper limit value. This enables the user to easily make a vehicle exit reservation by pressing the reservation button 52 for a time range desired for a vehicle exit reservation.

[0072]

Once the user presses the reservation button 52, an input field for inputting the parking ticket number is displayed, for example. The user inputs the parking ticket number by using keys to input the parking ticket number written in the parking ticket or causing a two-dimensional barcode reader of the user terminal 50 to read a two-dimensional barcode printed on the parking ticket. For example, when an enter button is pressed after the parking ticket number is input, a vehicle exit reservation request including the parking ticket number and the time range desired for a vehicle exit reservation is transmitted to the parking fee management device 10a.

[0073]

In response to receiving the vehicle exit reservation request, the parking fee management device 10a updates the vehicle exit reservation information based on the vehicle exit reservation request and updates the vehicle entry/exit management information.

[0074]

[Process of providing fee information and process of accepting vehicle exit reservation]

When the user of the parking lot performs predetermined input operation on the user terminal 50 or the information terminal 60, a parking ticket number and a fee disclosure request are thereby transmitted to the parking fee management device 10a.

For example, once the user starts up the parking application installed in advance on the user terminal 50 and presses a fee disclosure button from a menu or the like displayed in the display screen, an input field for inputting the parking ticket number is displayed. The user inputs the parking ticket number by using keys to input the parking ticket number written in the parking ticket or causing a two-dimensional barcode reader of the user terminal 50 to read a two-dimensional barcode printed on the parking ticket. For example, when an enter button is pressed after the parking ticket number is input, the parking ticket number and the fee disclosure request are transmitted to the parking fee management device 10a.

[0075]

Further, once the user presses the fee disclosure button from a menu or the like displayed in the display screen on the information terminal 60, an input field for inputting the parking ticket number is displayed. The user inputs the parking ticket number by using keys to input the parking ticket number written in the parking ticket or causing a two-dimensional barcode reader of the information terminal 60 to read a two-dimensional barcode or the like printed on the parking ticket. For example, when an enter button is pressed after the parking ticket number is input, the parking ticket number and the fee disclosure request are transmitted to the parking fee management device 10a.

[0076]

When the parking fee management device 10a has received the parking ticket number and the fee disclosure request from the user terminal 50 or the information terminal 60, the parking fee management device 10a acquires the vehicle entry time corresponding to the parking ticket number from the vehicle entry/exit management information stored in the vehicle entry/exit management information storage unit 22. The parking fee management device 10a then uses the acquired vehicle entry time and the discount information stored in the discount information storage unit 27 to create individual fee information in which vehicle

exit time ranges and parking fees are associated with each other and transmits the individual fee information to the user terminal 50 or the information terminal 60 of the sender of the request.

Accordingly, the personal fee information in which time ranges and parking fees are associated with each other is displayed in the display screen of the user terminal 50 or the information terminal 60.

[0077]

Fig. 13 and Fig. 14 illustrate examples of the display screen of personal fee information. As illustrated in Fig. 13 and Fig. 14, a bar 51 for selecting a time range is displayed in the display screen, and in response to operation to move the bar 51, a parking fee for a time range selected by the bar 51 is displayed larger in the upper part in the screen. Fig. 13 illustrates an example of the display screen when a time range from 16:00 is selected, and Fig. 14 illustrates an example of the display screen when a time range from 16:45 is selected.

[0078]

Further, as illustrated in Fig. 13 and Fig. 14 as an example, the reservation button 52 for making a vehicle exit reservation is displayed in the display screen of personal fee information. The user is able to easily make a vehicle exit reservation by moving the bar 51 to a time range for desired a vehicle exit reservation and pressing the reservation button 52.

When the reservation button 52 is pressed by the user, the vehicle exit reservation information including the selected time range for the vehicle exit reservation and the parking ticket number is transmitted to the parking fee management device 10a. In response to receiving the vehicle exit reservation information, the parking fee management device 10a updates the vehicle exit reservation information based on the vehicle exit reservation information and updates the vehicle entry/exit management information.

[0079]

[Payment process and vehicle exit process]

For example, when the time range of the vehicle exit reservation comes, the user finishes payment at the prepayment machine and walks to the parking lot to perform vehicle exit. Since the prepayment process and the vehicle exit process are the same as those in the first embodiment described above, the description thereof will be omitted here.

The prepayment may be made via electronic settlement using the user terminal 50.

When vehicle exit is not performed in the reservation time range despite the fact that a vehicle exit reservation was made, a parking fee based on the basic parking fee may be collected without application of a discount rate.

[0080]

As described above, according to the parking fee management device, the parking fee management method, and the program of the present embodiment, the following effects and advantages are achieved.

Since discount information in which time ranges and discount rates or discount amounts are associated with each other is created, and the discount rates or the discount amounts are updated in accordance with a vehicle exit reservation state, the vehicle exit reservation state can be reflected to the discount rate of the parking fee. As discussed above, because the discount rate of the parking fee varies with the vehicle exit reservation state, vehicle exit reservations can be diversified, and concentration of outgoing vehicles can be reduced.

[0081]

Although the initial value of discount information is determined in accordance with a result estimated by the estimation unit 25 in the embodiment described above, the embodiment is not limited to this example. For example, the initial value of discount

information may be set to a preset value (for example, 20%).

[0082]

[Third Embodiment]

Next, a parking fee management device, a parking fee management method, and a program according to a third embodiment of the present disclosure will be described with reference to the drawings. Although each embodiment described above intends to reduce concentration of outgoing vehicles, the present embodiment differs in also intending to reduce concentration of incoming vehicles. For example, in a facility or the like where an event is held, visitors may be concentrated shortly before the start time of the event. Thus, concentration of incoming vehicles to a parking lot may occur, the parking lot may be congested, or neighboring roads may be congested or jammed due to vehicles waiting for vehicle entry.

Therefore, the present embodiment is to diversify incoming vehicles by estimating the time that concentration of incoming vehicles occurs and giving users a discount or a benefit in accordance with the estimated vehicle entry peak time.

[0083]

Fig. 15 is a function block diagram illustrating an example of functions of the parking fee management device 10b according to the present embodiment. In Fig. 15, the same configurations as those of the parking fee management device 10 according to the first embodiment described above will be labeled with the same references, the description thereof will be omitted, and different features will be mainly described.

[0084]

A vehicle entry/exit record information storage unit 24a stores the past vehicle entry record information in addition to the past vehicle exit record information described in the above first embodiment.

An estimation unit 25a estimates a vehicle entry peak time based on at least one of the past vehicle entry record information, event information of the day, weather information of the day, and day-of-the-week information of the day. For this estimation scheme, the same scheme as that for estimation of a vehicle exit peak time described above can be employed.

As an example, when an event is scheduled, a period of time from a predetermined time before (for example, one hour before) the start time of the event to the start time of the event may be estimated as the vehicle entry peak time.

[0085]

A benefit information creation unit 44 creates benefit information in which a predetermined period before or after a time range determined from a vehicle entry peak time estimated by the estimation unit 25a and information on a benefit given to the user are associated with each other.

Herein, the predetermined period before or after a time range may be constant or may be changed in accordance with a vehicle entry peak time. For example, when the vehicle entry peak time is between 14:00 and 15:00, if the user is guided to come to the facility around 11:00, it can be expected that the user will have lunch in the facility. In such a case, the predetermined period before the vehicle entry peak time may be set to three hours of 11:00 to 14:00. Further, the predetermined period after the vehicle entry peak time may be set to a preset standard time (for example, one hour), for example.

[0086]

The benefit may be, for example, a discount amount increase ticket for a parking fee, a free ticket for a parking fee, or the like. Herein, as the free ticket for a parking fee, a free ticket valid for a predetermined period such as one hour, for example, may be given. In this example, the predetermined period may be determined in accordance with the feature of a facility near the parking lot. For example, the predetermined period may be set to about one

hour for a place or a time range expecting shopping or tea drinking and set to about one hour to two hours for a place or a time range expecting meals. Further, instead of the above, for example, a free ticket corresponding to a period from a vehicle entry time with the free ticket to the vehicle entry peak time may be given.

[0087]

A benefit to be given may be changed before and after a vehicle entry peak time. For example, a benefit given in a predetermined period before a vehicle entry peak time may be more attractive (for example, the discount amount is higher, or the valid time of the free ticket is longer) than a benefit given in a predetermined period after the vehicle entry peak time. This makes it possible to give users an incentive for earlier vehicle entry. As a result, it is possible to have users stay at a facility or the like longer, which may lead to the users' purchasing behavior in the facility, and thereby an increase in revenue as a whole including the parking lot and the facility can be expected.

[0088]

The benefit information creation unit 44 may transmit the created benefit information to the user terminal via the communication unit 20. Accordingly, the benefit information in which a vehicle entry time range and a benefit are associated with each other can be presented to the user before performing vehicle entry. It can be expected that the users reference this benefit information and chose an earlier vehicle entry time, and concentration of incoming vehicles can be reduced.

[0089]

In response to receiving vehicle entry information via the communication unit 20, a vehicle entry accepting unit 21a determines based on the benefit information whether or not the vehicle entry time is within a time range eligible for a benefit, and if it is within the time range eligible for the benefit, registers not only the vehicle entry time but also information on

the benefit to be given to the user to the vehicle entry/exit management information.

Accordingly, benefit information in accordance with a vehicle entry time will be registered to the vehicle entry/exit management information according to the present embodiment in association with the parking ticket number.

[0090]

Further, the benefit information registered to the vehicle entry/exit management information will be taken into consideration at the time of payment of the parking fee if the benefit is a discount of the fee, and the parking fee will be reduced. When the benefit is a ticket that can be used in a facility, the ticket may be displayed on the user terminal 50 and can be used as an electronic ticket, or the ticket may be distributed at an information counter or the like of the facility after confirmation of the vehicle entry information with presentation of a parking ticket number or the like.

[0091]

As described above, according to the parking fee management device, the parking fee management method, and the program of the present embodiment, the vehicle entry peak time is estimated, a discount or a benefit about the parking fee is given to users who perform vehicle entry within a predetermined period before or after a time range determined from a vehicle entry peak time, and thereby concentration of incoming vehicles can be reduced. Accordingly, this can reduce the waiting time for vehicle entry or ease a traffic jam in neighboring roads.

[0092]

Although the present embodiment has been described as a combination with the parking fee management device according to the first embodiment, the present embodiment can also be combined with the parking fee management device according to the second embodiment. In such a case, for example, the embodiment may be configured such that a

vehicle entry reservation can be made from the user terminal 50.

[0093]

It is not necessarily required to employ both giving a benefit at the time of vehicle entry and giving a discount rate or a discount amount at the time of vehicle exit. For example, only the benefit at the time of vehicle entry may be employed, only the discount rate or the discount amount at the time of vehicle exit may be given, or both of the above may be employed depending on a day based on the past vehicle entry/exit record or the like.

[0094]

In the embodiment described above, a benefit is given. Instead of giving a benefit, however, one way to reduce concentration of incoming vehicles may be to impose penalties, such as not applying any discount at the time of vehicle exit, on users who perform vehicle entry in a time range corresponding to the vehicle entry peak time, that is, users who are not cooperative to diversification of incoming vehicles and thereby reduce the incentive for vehicle entry during a vehicle entry peak time.

Instead of or in addition to a free ticket or a discount ticket for a parking lot, a free ticket or a discount ticket that can be used in a shop affiliated with the parking lot may be given as a benefit.

[0095]

Although the embodiments have been described above for the present disclosure, the technical scope of the present disclosure is not limited to the scope described in the above embodiments. Various changes or alternations can be applied to the embodiments described above within the scope not departing from the spirit of the present disclosure, and any forms to which such a change or an alternation is applied also fall in the technical scope of the present disclosure. Further, all or some of these embodiments can be combined.

Further, the flow of various processes described in the above embodiments are

examples, an unnecessary step may be deleted, a new step may be added, or processing order may be exchanged within the scope not departing from the spirit of the present disclosure.

[0096]

For example, although the case where the parking fee management device includes the vehicle entry accepting unit 21, the vehicle entry/exit management information storage unit 22, the vehicle exit accepting unit 23, and the like have been illustrated as an example in each embodiment described above, the parking fee management device is not limited to this example. For example, the parking fee management device may implement the processes described above in cooperation with a parking lot control device that controls the entire parking lot. That is, when the parking lot control device includes configurations such as the vehicle entry accepting unit 21, the vehicle entry/exit management information storage unit 22, and the vehicle exit accepting unit 23, various processes or the like may be performed by acquiring information required for implementing the parking fee management method according to the above embodiments from these configurations.

[0097]

The parking fee management device according to each embodiment may be configured to implement various functions described above incorporated in a parking lot control device that controls a parking lot.

The storage unit or various information included in the parking fee management device according to each embodiment is not necessarily required to be provided within the parking fee management device and may be, for example, provided on a cloud server and configured to be able to perform reference, update, or the like on information if necessary.

[0098]

The parking fee management device, the parking fee management method, and the program according to each embodiment described above are understood as follows, for

example.

[0099]

The parking fee management device (10) according to the present disclosure is a parking fee management device configured to manage a parking fee of a parking lot, the parking fee management device includes: an estimation unit (25) configured to estimate a vehicle exit peak time during which outgoing vehicles are concentrated; and a discount information creation unit (26) configured to create discount information based on a result estimated by the estimation unit, the discount information including time ranges and discount rates or discount amounts associated with each other, and the discount information creation unit sets a discount rate or a discount amount applied to a time other than the vehicle exit peak time to be higher than a discount rate or a discount amount applied to the vehicle exit peak time.

[0100]

According to the parking fee management device described above, since the discount rate or the discount amount applied to the time other than the vehicle exit peak time is set higher than the discount rate or the discount amount applied to the vehicle exit peak time in the discount information, it is possible to give users an incentive to avoid the vehicle exit peak in performing vehicle exit. This can diversify outgoing vehicles and reduce the waiting time of users for vehicle exit or reduce the impact such as a traffic jam on neighboring roads due to concentration of outgoing vehicles.

[0101]

In the parking fee management device described above, the estimation unit may estimate the vehicle exit peak time by using at least one of past vehicle exit record information, event information of the day, weather information of the day, day-of-the-week information of the day, and public holiday information of the day.

[0102]

The parking fee management device (10a) according to the present disclosure is a parking fee management device configured to manage a parking fee of a parking lot, and the parking fee management device includes: a discount information creation unit (43) configured to create discount information, the discount information including time ranges and discount rates or discount amounts associated with each other, and the discount information creation unit updates a discount rate or a discount amount in accordance with a vehicle exit reservation state.

[0103]

According to the parking fee management device described above, since discount information in which time ranges and discount rates or discount amounts are associated with each other is created, and the discount rates or the discount amounts are updated in accordance with a vehicle exit reservation state, the vehicle exit reservation state can be reflected to the discount rate of the parking fee. As discussed above, because the discount rate of the parking fee varies with the vehicle exit reservation state, vehicle exit reservations can be diversified, and concentration of outgoing vehicles can be reduced.

[0104]

In the parking fee management device described above, the discount information creation unit may set a discount rate or a discount amount of one time range such that, as the number of vehicle exit reservations in the one time range increases, the discount rate or the discount amount for the one time range decreases continuously or stepwise.

[0105]

According to the parking fee management device described above, vehicle exit reservations made by users can be guided to a time range with less vehicle exit reservations. This can reduce concentration of outgoing vehicles.

[0106]

The parking fee management device described above may include: an estimation unit (25) configured to estimate a vehicle exit peak time during which outgoing vehicles are concentrated, and the discount information creation unit may set an initial value of a discount rate or a discount amount for each time range in accordance with a result estimated by the estimation unit and update the initial value in accordance with a vehicle exit reservation state.

[0107]

According to the parking fee management device described above, it is possible to set a discount rate taking the vehicle exit peak time into consideration. Accordingly, a further reduction in concentration of outgoing vehicles can be expected.

[0108]

The parking fee management device described above may include a communication unit (20) configured to transmit the discount information to a user terminal (50) used by a user or an information terminal (60) installed in a parking lot or in a facility built around the parking lot and used by a user.

[0109]

According to the parking fee management device described above, discount information in which time ranges and discount rates or discount amounts are associated with each other can be provided to the user. Accordingly, user vehicle exit can be guided to a time range during which no concentration of outgoing vehicles occurs.

[0110]

The parking fee management device described above may include: a fee information creation unit (28) configured to, when the fee information creation unit received a fee disclosure request including identification information on an incoming vehicle from a user terminal used by a user or an information terminal installed in a parking lot or in a facility

built around the parking lot and used by a user, create individual fee information from a vehicle entry time associated with the identification information on the incoming vehicle and from the discount information, the individual fee information including a vehicle exit time range and a parking fee associated with each other; and a communication unit (20) configured to transmit the individual fee information to the sender of the fee disclosure request.

[0111]

According to the parking fee management device described above, parking fees customized on a user basis can be provided to users. This enables the user to intuitively recognize a parking fee, and a beneficial feeling in performing vehicle exit in a time range without concentration of outgoing vehicles can be transferred in an intuitive manner.

[0112]

In the parking fee management device described above, the fee information creation unit may reflect discount information to the individual fee information, the discount information being in accordance with purchase information on a user within a facility associated with a parking lot.

[0113]

According to the parking fee management device described above, a more accurate parking fee can be presented to the user.

[0114]

In the parking fee management device (10b) described above, the estimation unit (25a) may estimate a vehicle entry peak time during which incoming vehicles are concentrated, and the parking fee management device may further include: a benefit information creation unit (44) configured to create benefit information, the benefit information including a predetermined period and information on a benefit associated with

each other, the predetermined period being before or after a time range determined from the vehicle entry peak time estimated by the estimation unit, and the information on a benefit being given to a user.

[0115]

According to the parking fee management device described above, it is possible to reduce not only concentration of outgoing vehicles but also concentration of incoming vehicles.

[0116]

The parking fee management device described above may include a communication unit (20) configured to transmit benefit information to a user terminal (50) used by a user.

[0117]

According to the parking fee management device described above, benefit information in which a vehicle entry time range and a benefit are associated with each other can be presented to users before performing vehicle entry. It can be expected that the users reference this benefit information and chose an earlier vehicle entry time, and concentration of incoming vehicles can be reduced.

[0118]

The parking fee management method according to the present disclosure is a parking fee management method for managing a parking fee of a parking lot, a computer performs steps of: estimating a vehicle exit peak time during which outgoing vehicles are concentrated; and creating discount information based on the estimated vehicle exit peak time, the discount information including time ranges and discount rates or discount amounts associated with each other, and the step of creating discount information sets a discount rate or a discount amount applied to a time other than the vehicle exit peak time to be higher than a discount rate or a discount amount applied to the vehicle exit peak time.

[0119]

The parking fee management method according to the present disclosure is a parking fee management method for managing a parking fee of a parking lot, and a computer performs steps of: creating discount information, the discount information including time ranges and discount rates or discount amounts associated with each other; and updating a discount rate or a discount amount of the discount information in accordance with a vehicle exit reservation state.

[0120]

The program according to the present disclosure is a program for causing a computer to function as the parking fee management device described above.

[0121]

The program according to the present disclosure causes a computer to perform processes of: receiving discount information from a parking fee management device configured to manage a parking fee of a parking lot, the discount information including time ranges and discount rates or discount amounts associated with each other; and displaying the received discount information on a display unit.

[0122]

The program according to the present disclosure is a program for causing a computer to perform processes of: transmitting identification information on an incoming vehicle and a fee disclosure request to a parking fee management device configured to manage a parking fee of a parking lot; receiving individual fee information from the parking fee management device, the individual fee information including vehicle exit time ranges and parking fees associated with each other; and displaying the received individual fee information on a display unit.

[0123]

The program described above may include processes of: displaying a vehicle exit reservation input used for making a vehicle exit reservation on a display screen of the individual fee information; and in response to the vehicle exit reservation input being operated, transmitting a vehicle exit reservation request including a vehicle exit time range to a predetermined destination.

[Reference Signs List]

[0124]

- 3 communication network
- 10 parking fee management device
- 10a parking fee management device
- 10b parking fee management device
- 20 communication unit
- 21 vehicle entry accepting unit
- 21a vehicle entry accepting unit
- 22 vehicle entry/exit management information storage unit
- 23 vehicle exit accepting unit
- 24 vehicle exit record information storage unit
- 24a vehicle entry/exit record information storage unit
- 25 estimation unit
- 25a estimation unit
- 26 discount information creation unit
- 27 discount information storage unit
- 28 fee information creation unit
- 30 single-level parking lot
- 31 entrance gate

32	ticket machine
33	exit gate
34	payment machine
35	prepayment machine
41	vehicle exit reservation accepting unit
43	discount information creation unit
44	benefit information creation unit
50	user terminal
51	bar
52	reservation button
60	information terminal

[CLAIMS]

1. A parking fee management device configured to manage a parking fee of a parking lot, the parking fee management device comprising:

an estimation unit configured to estimate a vehicle exit peak time during which outgoing vehicles are concentrated; and

a discount information creation unit configured to create discount information based on a result estimated by the estimation unit, the discount information including time ranges and discount rates or discount amounts associated with each other,

wherein the discount information creation unit sets a discount rate or a discount amount applied to a time other than the vehicle exit peak time to be higher than a discount rate or a discount amount applied to the vehicle exit peak time.

2. The parking fee management device according to claim 1, wherein the estimation unit estimates the vehicle exit peak time by using at least one of past vehicle exit record information, event information of the day, weather information of the day, day-of-the-week information of the day, and public holiday information of the day.

3. A parking fee management device configured to manage a parking fee of a parking lot, the parking fee management device comprising:

a discount information creation unit configured to create discount information, the discount information including time ranges and discount rates or discount amounts associated with each other,

wherein the discount information creation unit updates a discount rate or a discount amount in accordance with a vehicle exit reservation state.

4. The parking fee management device according to claim 3, wherein the discount information creation unit sets a discount rate or a discount amount of one time range such that, as the number of vehicle exit reservations in the one time range increases, the discount rate or the discount amount for the one time range decreases continuously or stepwise.

5. The parking fee management device according to claim 3 or 4 further comprising an estimation unit configured to estimate a vehicle exit peak time during which outgoing vehicles are concentrated,

wherein the discount information creation unit sets an initial value of a discount rate or a discount amount for each time range in accordance with a result estimated by the estimation unit and updates the initial value in accordance with a vehicle exit reservation state.

6. The parking fee management device according to any one of claims 1 to 5 further comprising a communication unit configured to transmit the discount information to a user terminal used by a user or an information terminal installed in a parking lot or in a facility built around the parking lot and used by a user.

7. The parking fee management device according to any one of claims 1 to 5 further comprising:

a fee information creation unit configured to, when the fee information creation unit received a fee disclosure request including identification information on an incoming vehicle from a user terminal used by a user or an information terminal installed in a parking lot or in a facility built around the parking lot and used by a user, create individual fee information from a vehicle entry time associated with the identification information on the incoming

vehicle and from the discount information, the individual fee information including a vehicle exit time range and a parking fee associated with each other; and

a communication unit configured to transmit the individual fee information to the sender of the fee disclosure request.

8. The parking fee management device according to claim 7, wherein the fee information creation unit reflects discount information to the individual fee information, the discount information being in accordance with purchase information on a user within a facility associated with a parking lot.

9. The parking fee management device according to claim 1 or 5, wherein the estimation unit estimates a vehicle entry peak time during which incoming vehicles are concentrated,

the parking fee management device further comprising:

a benefit information creation unit configured to create benefit information, the benefit information including a predetermined period and information on a benefit associated with each other, the predetermined period being before or after a time range determined from the vehicle entry peak time estimated by the estimation unit, and the benefit being given to a user.

10. The parking fee management device according to claim 9 further comprising a communication unit configured to transmit the benefit information to a user terminal used by a user.

11. A parking fee management method for managing a parking fee of a parking lot,

wherein a computer performs steps of:

estimating a vehicle exit peak time during which outgoing vehicles are concentrated;

and

creating discount information based on the estimated vehicle exit peak time, the discount information including time ranges and discount rates or discount amounts associated with each other,

wherein the step of creating discount information sets a discount rate or a discount amount applied to a time other than the vehicle exit peak time to be higher than a discount rate or a discount amount applied to the vehicle exit peak time.

12. A parking fee management method for managing a parking fee of a parking lot, wherein a computer performs steps of:

creating discount information including time ranges and discount rates or discount amounts associated with each other; and

updating a discount rate or a discount amount of the discount information in accordance with a vehicle exit reservation state.

13. A program for causing a computer to function as the parking fee management device according to any one of claims 1 to 10.

14. A program for causing a computer to perform processes of:

receiving discount information from a parking fee management device configured to manage a parking fee of a parking lot, the discount information including time ranges and discount rates or discount amounts associated with each other; and

displaying the received discount information on a display unit.

15. A program for causing a computer to perform processes of:

transmitting identification information on an incoming vehicle and a fee disclosure request to a parking fee management device configured to manage a parking fee of a parking lot;

receiving individual fee information from the parking fee management device, the individual fee information including vehicle exit time ranges and parking fees associated with each other; and

displaying the received individual fee information on a display unit.

16. The program according to claim 15 further including processes of:

displaying a vehicle exit reservation input used for making a vehicle exit reservation on a display screen of the individual fee information; and

in response to the vehicle exit reservation input being operated, transmitting a vehicle exit reservation request including a vehicle exit time range to a predetermined destination.