

DESCRIPTION

TITLE OF INVENTION: IC CARD SYSTEM AND DATA COLLECTING METHOD

TECHNICAL FIELD

[0001]

The present invention relates to an IC card system and, more particularly, to an IC card system that collects behavior attributes of a user.

BACKGROUND ART

[0002]

According to the progress of the information communication technique, a collecting method for evaluation information obtained by evaluating purchase states of commodities and services and a marketing method using the evaluation information have been respectively changing. Further, according to the progress of the information communication technique, a more advanced analysis of the collected evaluation information and provision of services and guidance for customers (users) based on the analysis have been performed.

[0003]

In recent years, a person providing users with services can provide the services and the like after specifying the users

by using cards with barcodes, magnetic cards, or IC cards (including cellular phones having a function equivalent to the IC cards) having ID numbers recorded therein. In particular, memories included in the IC cards can record attribute (behavior attribute) information and the like concerning the behavior of the users. Therefore, the person providing the services and the like can grasp tastes and purchase states in a plurality of shops of each of the users by using the IC cards.

[0004]

Therefore, several methods explained below have been proposed concerning how the IC cards record information concerning the users or what kinds of information are stored.

[0005]

As a first method, there is proposed a method in which a center server manages points granted to railroad users (see, for example, Patent Literature 1). In the first method, since the center server manages the points, irrespective of the size of a memory capacity in an IC card, a large amount of attribute information and history information concerning the behavior of a user are accumulated in the center server.

[0006]

However, a terminal or the like providing services refers to the information accumulated in the center server. Therefore, an on-line network system is necessary between the terminal and the center server. In particular, when there are

a large number of users of services and a system required to respond quickly uses the first method, a high-performance network system is necessary.

[0007]

As a second method, there is proposed a method in which an IC card records attribute information and history information concerning the behavior of a user. The IC card according to the second method records, for example, demographic attributes such as the age of the user and the sex of the user and parameters indicating interests or tastes of the user, consumption tendencies of the user, or the like (see, for example, Patent Literature 2 and Patent Literature 3).

[0008]

Further, the IC card according to the second method records history information concerning the behavior of the user such as a purchase history of the user (see, for example, Patent Literature 4). When the history information concerning the behavior is recorded in the IC card, a service provider can calculate, on the basis of the history information recorded in the IC card, a rank based on, for example, a frequency of use by the user according to a method such as an RFM (Recency, Frequency, Monetary) analysis. The service provider can provide a service according to the calculated rank. The IC card can also record points granted during purchase by using the second method.

[0009]

However, since there is a limit in a memory capacity in the IC card, the IC card cannot record many kinds of history information. Therefore, there is proposed a method of recording only a frequency (a counter value) for each category of behavior such as purchase (see, for example, Patent Literature 5).

[0010]

As a third method, there is proposed a method in which an IC card records attribute information concerning the behavior of a user that changes as time elapses.

[0011]

The method of granting points for, for example, purchase of commodities is effective as a marketing method for improving loyalty of users. Therefore, in order to more continuously guiding users to a shop, there is proposed the third method for changing a point return rate or a service level according to an increase or a decrease in a purchase frequency of a user (see, for example, Patent Literature 6). This method is a method of calculating a score added with a purchase frequency according to attribute information concerning the behavior of a user up to the last time, purchase information of the user of this time, and the like and a simple recurrence formula and providing a service according to the calculated score.

[0012]

On the other hand, as a system of an IC card most widely spread at present, there are an IC card and an electronic ticket (an IC ticket) used in a transportation system. A system in which these IC cards are used (hereinafter described as IC card system) is a system in which a user touches an IC card reader of an automatic ticket checker with an IC-card type electronic ticket when entering and exiting stations, whereby fare calculation and charging are automatically performed. A large number of electronic tickets have functions of electronic money and an ID card and are used for settlement at the time of commodity purchase in a shop and as an admission card or the like (see, for example, Non-Patent Literature 1).

Citation List

Patent Literature

[0013]

Patent Literature 1: JP-A-2010-165307

Patent Literature 2: JP-A-2002-279368

Patent Literature 3: JP-A-2002-163727

Patent Literature 4: JP-A-11-312273

Patent Literature 5: JP-A-2006-107526

Patent Literature 6: JP-A-2003-132431

Non-Patent Literature

[0014]

Non-Patent Literature 1: Y. Shirakawa, "JR East Contract-less

IC Card Automatic Fare Collection System "Suica", "IEICE TRANS.
INF. & SYST., VOL. E86-D, NO. 10 OCTOBER 2003.

SUMMARY OF INVENTION

Technical Problem

[0015]

As one of characteristics of the IC card used in the transportation system, every time the user uses the IC card, a record of movement of the user, i.e., information concerning an activity area of the user and an activity time period of the user and information concerning purchase by the user are recorded in the IC card as history information. A person providing services can provide services for users according to a place and time by utilizing these kinds of history information recorded in the IC card.

[0016]

However, several ten million IC cards used in the transportation system have already been spread and transportation facilities and shops where the IC cards can be used are present in a wide area. Therefore, when the person providing services provides services for the users anew, the system in which the existing IC cards are used needs to be substantially changed. According to the change of the system, a large amount of costs are necessary.

[0017]

On the other hand, as described in Non-Patent Literature 1, in the IC card system, processing time during contact of the ticket checker and the IC card is limited to 0.2 second or less and history information of the user needs to be aggregated at every fixed time. Therefore, a method in which the IC card records a behavior history of the user is desirable.

[0018]

Further, the activity area of the user and the activity time period of the user change according to a transfer in work, house-moving, or a season. Therefore, the history information concerning the behavior of the user and the attribute information generated on the basis of the attribute information need to be updated every time the IC card is used.

[0019]

Therefore, it is an object of the present invention to provide a system that provides a service based on attribute information concerning the behavior of each user without changing an existing large system. It is also an object of the present invention to provide a system that dynamically changes the attribute information concerning the behavior according to use by the user.

[0020]

Further, it is an object of the present invention to realize, in a limited range of a memory and calculation resources of an IC card, in a sufficiently short time, an

acquisition and accumulation method for attribute information of a user updated every time the user uses the IC card.

Solution to Problem

[0021]

According to a representative form of the present invention, there is provided an IC card system including: an IC card; and a plurality of terminals that communicate with the IC card. The plurality of terminals include at least one first terminal of the terminals in which a first identifier is set and at least one second terminal of the terminals in which a second identifier is set. When communicating with the IC card, the first terminal transmits the first identifier and a date and time when the first terminal and the IC card communicate with each other to the IC card. The IC card calculates, on the basis of the information transmitted from the first terminal, a first score value indicating a frequency of the communication between the first terminal and the IC card and retains first attribute data including the first score value and the first identifier. When communicating with the IC card, the second terminal transmits the second identifier and a date and time when the second terminal and the IC card communicate with each other to the IC card. The IC card updates the first score value on the basis of the date and time when the first terminal and the IC card communicate with each other

and the date and time when the second terminal and the IC card communicate with each other, calculates, on the basis of the information transmitted from the second terminal, a second score value indicating a frequency of the communication between the second terminal and the IC card, generates second attribute data including the second score value and the second identifier, when a total number of the first attribute data and the second attribute data exceeds a predetermined number, compares the updated first score value and the calculated second score value, and, when the second score value is large as a result of the comparison, retains the second attribute data.

ADVANTAGEOUS EFFECT OF INVENTION

[0022]

According to an embodiment of the present invention, it is possible to provide each user with a service based on attribute information concerning the behavior of the user without changing a large system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

[Fig. 1] Fig. 1 is a block diagram showing a physical configuration of an IC card system, a charging management system, and a behavior attribute tabulation system in a first embodiment of the present invention.

[Fig. 2A] Fig. 2A is a sequence chart showing processing performed by a reader writer device and an IC card when a user enters a ticket gate in the first embodiment of the present invention.

[Fig. 2B] Fig. 2B is a sequence chart showing processing performed by the reader writer device and the IC card when the user exits a ticket gate in the first embodiment of the present invention.

[Fig. 3] Fig. 3 is an explanatory diagram showing ticket gate passage data in the first embodiment of the present invention.

[Fig. 4] Fig. 4 is an explanatory diagram showing charging data in the first embodiment of the present invention.

[Fig. 5] Fig. 5 is an explanatory diagram showing balance data in the first embodiment of the present invention.

[Fig. 6] Fig. 6 is a flowchart for explaining behavior attribute recording processing (stay) in the first embodiment of the present invention.

[Fig. 7] Fig. 7 is an explanatory diagram showing a behavior type classification in the first embodiment of the present invention.

[Fig. 8] Fig. 8 is an explanatory diagram showing behavior attribute data in the first embodiment of the present invention.

[Fig. 9] Fig. 9 is an explanatory diagram showing presentation information presented by information provision processing in

the first embodiment of the present invention.

[Fig. 10] Fig. 10 is an explanatory diagram showing a ticket checker in the first embodiment of the present invention.

[Fig. 11] Fig. 11 is a block diagram showing a physical configuration of an IC card system, a charging management system, and a behavior attribute tabulation system in a second embodiment of the present invention.

[Fig. 12] Fig. 12 is a sequence chart showing processing by a reader writer device and an IC card in the second embodiment of the present invention.

[Fig. 13] Fig. 13 is an explanatory diagram showing charging data in the second embodiment of the present invention.

[Fig. 14] Fig. 14 is an explanatory diagram showing a shop classification in the second embodiment of the present invention.

[Fig. 15] Fig. 15 is an explanatory diagram showing behavior attribute data in the second embodiment of the present invention.

[Fig. 16] Fig. 16 is a flowchart for explaining behavior attribute recording processing (purchase) in the second embodiment of the present invention.

[Fig. 17] Fig. 17 is a block diagram showing a physical configuration of an IC card system, a charging management system, and a behavior attribute tabulation system in a third embodiment of the present invention.

[Fig. 18] Fig. 18 is a sequence chart showing processing by a reader writer device and an IC card in the third embodiment of the present invention.

[Fig. 19] Fig. 19 is a block diagram showing an overall configuration of a service system in the third embodiment of the present invention.

Description of Embodiments

[0024]

In the following explanation, a function for collecting attribute information (hereinafter described as behavior attribute data) concerning the behavior of a user using an IC card used as an electronic ticket or electronic money and an IC card system in which the behavior attribute data is used are explained using the drawings.

[0025]

An IC card in an embodiment sets a period from an exit from a ticket gate until an entrance into a ticket gate as a stay and calculates a score value of behavior attribute data for the stay. The IC card in this embodiment calculates a score value of behavior attribute data for purchase in a shop. An IC card system in this embodiment provides users with services on the basis of the calculated score values.

[0026]

The IC card used herein is a non-contact IC card. However,

the same function can be implemented on a contact IC card. The IC card includes a portable terminal that retains an IC card function.

[0027]

(First Embodiment)

Fig. 1 is a block diagram showing a physical configuration of an IC card system, a charging management system, and a behavior attribute tabulation system in a first embodiment of the present invention.

[0028]

An IC card 101, a ticket checker 161, and a network 152 in this embodiment are connected to a charging management system 151 and a behavior attribute tabulation system 153.

[0029]

The IC card system in this embodiment shown in Fig. 1 includes the IC card 101, a plurality of the ticket checkers 161, and a plurality of reader writer devices 121. The plurality of ticket checkers 161 are connected to the network 152, the charging management system 151, a card history database 155, the behavior attribute tabulation system 153, and a behavior history database 154 via a plurality of gateways (GWs) 141.

[0030]

The IC card 101 communicates with the reader writer device 121 by radio. The reader writer device 121 is connected

to the ticket checker 161. The reader writer device 121 receives charging information and behavior attribute information of the IC card 101, which has passed the ticket checker 161, from the IC card 101 via radio.

[0031]

The charging management system 151 receives the charging information and the behavior attribute information from the reader writer device 121 via the GW 141 and the network 152. The charging management system 151 accumulates the received charging information in the card history database 155 and manages payment information and deposit information included in the charging information.

[0032]

The behavior attribute tabulation system 153 receives the charging information and the behavior attribute information from the charging management system 151 and calculates a behavior attribute value of each of users of the IC cards 101. Then, the behavior attribute tabulating system 153 stores the calculated behavior attribute value in the behavior history database 154.

[0033]

The plurality of ticket checkers 161 are connected to one GW 141. The plurality of GWs 141 and the plurality of ticket checkers 161 are hierarchically connected to the network 152.

[0034]

The IC card 101 includes an IC card communication IF (interface) 102, an antenna for IC card communication 103, a power supply circuit 104, a CPU 105, a work memory 106, a program memory 107, a nonvolatile data memory 108, and an authentication mechanism 109.

[0035]

The IC card communication IF 102 is an interface for the IC card 101 to communicate with the reader writer device 121 via the antenna for IC card communication 103. The power supply circuit 104 converts an electromagnetic wave used for communication with the reader writer device by the IC card 101 into electric power.

[0036]

The CPU 105 is a processor that performs calculation processing for executing a function of the IC card 101. The work memory 106 is a storage area for the calculation processing by the CPU 105. The program memory 107 is a storage area for retaining the function of the IC card 101.

[0037]

The nonvolatile data memory 108 retains data indicating a behavior history and the like of a user. The authentication mechanism 109 prevents an unauthorized access to the IC card 101.

[0038]

The IC card communication IF 102, the CPU 105, the work

memory 106, the program memory 107, the nonvolatile data memory 108, and the authentication mechanism 109 are connected by an internal bus 110.

[0039]

The program memory 107 retains ticket processing 115, charging processing 116, entrance processing 117, behavior attribute recording processing (stay) 118a, behavior attribute recording processing (purchase) 118b, and behavior attribute readout processing 119. The ticket processing 115, the charging processing 116, the entrance processing 117, the behavior attribute recording processing (stay) 118a, the behavior attribute recording processing (purchase) 118b, and the behavior attribute readout processing 119 may be implemented by a program or may be implemented by hardware.

[0040]

The ticket processing 115 and the charging processing 116 are processing executed when the user passes through the ticket checker 161 in order to exit a ticket gate of a station. The entrance processing 117 and the behavior attribute recording processing (stay) 118a are processing executed when the user passes through the ticket checker 161 in order to enter a ticket gate of a station.

[0041]

The behavior attribute recording processing (purchase) 118b is processing executed when the user purchases a commodity

or a service using the IC card 101. The behavior attribute recording processing (purchase) 118b is used in a second embodiment explained below.

[0042]

The behavior attribute readout processing 119 is processing for invoking behavior attribute data.

[0043]

The nonvolatile data memory 108 retains balance data 111, ticket gate passage data 112, and behavior attribute data 113. The balance data 111 is data indicating balances of an electronic ticket and electronic money retained in the IC card 101. The balance data 111 includes data indicating at least one balance.

[0044]

The ticket gate passage data 112 is data transmitted when the IC card 101 passes through the ticket checker 161 and includes at least two data, i.e., latest passage time and second latest passage time (most recent entrance and exit). That is, when the IC card 101 passes through the ticket checker 161, the ticket gate passage data 112 includes at least the ticket gate passage data 112 at the time when the user passed through the ticket checker 161 this time and the ticket gate passage data 112 at the time when the user passed through the ticket checker 161 immediately preceding this time (the last time).

[0045]

The behavior attribute data 113 is attribute information concerning the behavior of the user who uses the IC card 101. A value stored in the behavior attribute data 113 is calculated by the behavior attribute recording processing (stay) 118a or the behavior attribute recording processing (purchase) 118b. The behavior attribute data 113 is generated according to kinds of behavior of the user and includes at least one data.

[0046]

The reader writer device 121 includes an IC card communication IF 122, an antenna for IC card communication 123, a CPU 124, a work memory 125, a program memory 126, an authentication mechanism 127, a communication IF (interface) 128, a display IF 129, and an apparatus control mechanism 131. The reader writer device 121 is connected to a display 130, a gate 132, and a ticket checker 161.

[0047]

The IC card communication IF 122 is an interface for the reader writer device 121 to communicate with the IC card 101 via the antenna for IC card communication 123.

[0048]

The CPU 124 is a processor that performs calculation processing for executing a function of the IC card 101. The work memory 125 is a storage area for the calculation processing by the CPU 124. The program memory 126 is a storage area for retaining a function of the reader writer device 121.

[0049]

The authentication mechanism 127 prevents an unauthorized access to the IC card 101. The communication IF 128 is an interface for the reader writer device 121 to communicate with the GW 141. The display IF 129 is a function for presenting information to the display 130. The apparatus control mechanism 131 is a function for controlling opening and closing and the like of the gate 132.

[0050]

The display 130 is a display for displaying information transmitted from the reader writer device 121. The gate 132 is a device for stopping the progress of the user and is controlled to open and close by the reader writer device 121.

[0051]

The IC card communication IF 122, the CPU 124, the work memory 125, the program memory 126, the authentication mechanism 127, the communication IF 128, the display IF 129, and the apparatus control mechanism 131 are connected by an internal bus 133.

[0052]

The program memory 126 retains fare calculation processing 135, charging processing 136, entrance processing 137, behavior attribute readout processing 138, and information presentation processing 139. The fare calculation processing 135, the charging processing 136, the

entrance processing 137, the behavior attribute readout processing 138, and the information presentation processing 139 may be implemented by a program or may be implemented by hardware.

[0053]

The fare calculation processing 135 and the charging processing 136 are processing executed when the user passes through the ticket checker 161 in order to exit the ticket gate of the station (during an exit). The entrance processing 137 is processing executed when the user passes through the ticket checker 161 in order to enter the ticket gate of the station (during an entrance).

[0054]

The behavior attribute readout processing 138 and the information presentation processing 139 are processing executed when the user passes through the ticket checker 161. That is, the behavior attribute readout processing 138 and the information presentation processing 139 are executed during the entrance and the exit.

[0055]

Processing for calculation, recording, and readout of behavior attribute information performed when the user passes through the ticket checker 161 is explained below using Figs. 2 to 10.

[0056]

Sequences of communication between the reader writer device 121 of the ticket checker 161 and the IC card 101 and processing executed when the communication is performed are explained using Figs. 2A and 2B.

[0057]

The sequences shown in Figs. 2A and 2B are started in a state in which the communication between the reader writer device 121 and the IC card 101 is established. In the sequences, it is already determined during the start whether the IC card 101 is used for an entrance or used for an exit.

[0058]

Fig. 2A is a sequence chart showing processing performed by the reader writer device 121 and the IC card 101 when the user enters the ticket gate in the first embodiment of the present invention.

[0059]

The sequence chart of Fig. 2A shows processing performed by the reader writer device 121 and the IC card 101 when the user carrying the IC card 101 passes through the ticket checker 161 in order to enter the ticket gate.

[0060]

The reader writer device 121 starts the entrance processing 137. The reader writer device 121 transmits, through the entrance processing 137, data (ticket gate passage data 112a) concerning the station where the ticket checker 161,

through which the user passes, is arranged to the IC card 101.

[0061]

Upon receiving the ticket gate passage data 112a, the IC card 101 starts the entrance processing 117. The IC card 101 stores, through the entrance processing 117, the received ticket gate passage data 112a in the nonvolatile data memory 108 of the IC card 101. Thereafter, the IC card 101 in this embodiment ends the entrance processing 117.

[0062]

Thereafter, the IC card 101 starts the behavior attribute recording processing (stay) 118a. The IC card 101 calculates the behavior attribute data 113 referring to the data stored in the nonvolatile data memory 108 through the behavior attribute recording processing (stay) 118a. The IC card 101 stores the calculated behavior attribute data 113 in the nonvolatile data memory 108 of the IC card 101.

[0063]

Thereafter, the IC card 101 transmits an end notification 2001 to the reader writer device 121 in order to transmit an indication that the calculation of the behavior attribute data 113 ends to the reader writer device 121 through the behavior attribute recording processing (stay) 118a. The IC card 101 ends the behavior attribute recording processing (stay) 118a.

[0064]

Upon receiving the end notification 2001 from the IC card

101, the reader writer device 121 ends the entrance processing 137. Thereafter, the reader writer device 121 starts the behavior attribute readout processing 138. The reader writer device 121 transmits a readout request 2002 for the behavior attribute data 113 to the IC card 101 through the behavior attribute readout processing 138.

[0065]

Upon receiving the readout request 2002, the IC card 101 starts the behavior attribute readout processing 119. The IC card 101 extracts the behavior attribute data 113 from the nonvolatile data memory 108 of the IC card 101 and transmits the extracted behavior attribute data 113 to the reader writer device 121 through the behavior attribute readout processing 119. The IC card 101 ends the behavior attribute readout processing 119.

[0066]

The behavior attribute data 113 transmitted to the reader writer device 121 through the behavior attribute readout processing 119 is at least one data indicating the behavior of the user who uses the IC card 101. The behavior attribute data 113 to be transmitted may be the behavior attribute data 113 having a highest score value included therein or may be an arbitrary number of behavior attribute data 113. The score value is explained below.

[0067]

Upon receiving the behavior attribute data 113, the reader writer device 121 ends the behavior attribute readout processing 138 and, thereafter, executes the information presentation processing 139. The reader writer device 121 provides the user with a service through the information presentation processing 139 according to the score value of the received behavior attribute data 113. The service provided to the user is a service for providing, for example, information concerning weather along a railroad line used by the user or a town around the railroad line.

[0068]

Note that the reader writer device 121 may acquire, via the network 152, necessary information through the information presentation processing 139 from a server or the like that retains information.

[0069]

Fig. 2B is a sequence chart showing processing performed by the reader writer device 121 and the IC card 101 when the user exits the ticket gate in the first embodiment of the present invention.

[0070]

The sequence chart of Fig. 2B shows the processing performed by the reader writer device 121 and the IC card 101 when the user carrying the IC card 101 passes through the ticket checker 161 in order to exit the ticket gate.

[0071]

First, the reader writer device 121 starts the fare calculation processing 135. The reader writer device 121 transmits, through the fare calculation processing 135, an inquiry about the ticket gate passage data 112a received by the IC card 101 when the user enters the ticket gate in the closest date and time (the ticket gate passage data 112a at the last entrance time) and ticket gate passage data 112b at this exit time to the IC card 101.

[0072]

Upon receiving the inquiry about the ticket gate passage data 112a at the last entrance time and the ticket gate passage data 112b at this exit time, the IC card 101 starts the ticket processing 115. The IC card 101 extracts the ticket gate passage data 112a at the last entrance time from the nonvolatile data memory 108 through the ticket processing 115.

[0073]

The IC card 101 transmits the extracted ticket gate passage data 112a to the reader writer device 121 according to the inquiry transmitted from the reader writer device 121. The IC card 101 stores, through the ticket processing 115, the received ticket gate passage data 112b at this exit time in the nonvolatile data memory 108. Thereafter, the IC card 101 ends the ticket processing 115.

[0074]

Upon receiving the ticket gate passage data 112a at the last entrance time, the reader writer device 121 calculates a fare from the entrance to the exit of the user on the basis of the received ticket gate passage data 112a and the station where the reader writer device 121 is arranged. The reader writer device 121 determines a charging amount on the basis of the determined fare.

[0075]

Subsequently, the reader writer device 121 starts the charging processing 136. The reader writer device 121 transmits, through the charging processing 136, charging data 1401 including the determined charging amount to the IC card 101. The charging data 1401 includes the charging amount, information indicating the station, and time of charging.

[0076]

Upon receiving the charging data 1401, the IC card 101 starts the charging processing 116. The IC card 101 calculates, through the charging processing 116, a settlement amount from the balance data 111 stored in the nonvolatile data memory 108 and the charging amount included in the charging data 1401. The IC card 101 updates the balance data 111 of the nonvolatile data memory 108 with the calculated settlement amount.

[0077]

The IC card 101 transmits, through the charging processing 116, an end notification 2003 indicating that the

charging processing 116 ends to the reader writer device 121. Thereafter, the IC card 101 ends the charging processing 116.

[0078]

The end notification 2003 includes a value indicating whether charging (settlement) is successful, the charging amount, and the settlement amount. When the value indicating whether the charging is successful includes a value indicating "No", i.e., indicating that the charging is unsuccessful, "0" is set in the balance in this embodiment.

[0079]

Upon receiving the end notification 2003, the reader writer device 121 ends the charging processing 136 and starts the behavior attribute readout processing 138. The behavior attribute readout processing 138 and the information presentation processing 139 by the reader writer device 121 and the behavior attribute readout processing 119 by the IC card 101 shown in Fig. 2B are the same as the behavior attribute readout processing 138 and the information presentation processing 139 by the reader writer device 121 and the behavior attribute readout processing 119 by the IC card 101 shown in Fig. 2A.

[0080]

Fig. 3 is an explanatory diagram showing the ticket gate passage data 112 in the first embodiment of the present invention.

[0081]

The ticket gate passage data 112 shown in Fig. 3 includes four fields of a station code 1302, time 1303, a ticket checker ID 1304, and an entrance and exit flag 1305.

[0082]

The station code 1302 includes an identifier uniquely indicating the station where the ticket checker 161, through which the IC card 101 passes, is arranged. The time 1303 includes a value indicating a date and time when the IC card 101 passed through the ticket checker 161. The ticket checker ID 1304 includes an identifier uniquely indicating the ticket checker 161, through which the IC card 101 passes.

[0083]

The entrance and exit flag 1305 includes a value indicating whether the passage through the ticket checker 161 by the IC card 101 is an entrance into the ticket gate or an exit from the ticket gate. A value indicating the entrance is stored in the entrance and exit flag 1305 of the ticket gate passage data 112a during the entrance. A value indicating the exit is stored in the entrance and exit flag 1305 of the ticket gate passage data 112b during the exit.

[0084]

The reader writer device 121 refers to the station code 1302 of the received ticket gate passage data 112a through the fare calculation processing 135. The reader writer device 121

calculates a fare between a station indicated by the station code 1302 and the station where the reader writer device 121 is arranged to thereby calculate a fare from the entrance to the exit of the user and determine a charging amount.

[0085]

Fig. 4 is an explanatory diagram showing the charging data 1401 in the first embodiment of the present invention.

[0086]

The charging data 1401 shown in Fig. 4 is transmitted from the ticket checker 161 to the IC card 101. The charging data 1401 includes four fields of a charging type 1402, time 1403, a charging amount 1404, and a station shop code 1405.

[0087]

The charging type 1402 includes an identifier uniquely indicating processing in which the IC card 101 was used such as fare adjustment, ticket adjustment, or commodity purchase. The time 1403 of charging includes a date and time when the processing indicated by the charging type 1402 was performed. The charging amount 1404 includes a value indicating an amount paid or deposited by the processing indicated by the charging type 1402. The station shop code 1405 includes an identifier uniquely indicating a station or a shop where the processing indicated by the charging type 1402 is performed.

[0088]

Fig. 5 is an explanatory diagram showing the balance data

111 in the first embodiment of the present invention.

[0089]

The balance data 111 shown in Fig. 5 includes three fields of a success or failure flag 1502, an actual charged amount 1503, and a balance 1504. The success or failure flag 1502 includes a value indicating whether charging processing is successful. The actual charged amount 1503 includes a value indicating a charged (settled) amount. The balance 1504 includes a value indicating a balance retained by the IC card 101 after the charging processing.

[0090]

The IC card 101 extracts, through the charging processing 116, the charging amount 1404 included in the received charging data 1401 and the balance 1504 of the balance data 111 stored in the nonvolatile data memory 108. The IC card 101 subtracts the extracted charging amount from the extracted balance 1504 to thereby calculate a settlement amount. The IC card 101 stores, in the success or failure flag 1502, a value indicating whether the calculation of the settlement amount is successful and stores, in the actual charged amount 1503, the charging amount 1404 included in the received charging data 1401.

[0091]

Fig. 6 is a flowchart for explaining the behavior attribute recording processing (stay) 118a in the first embodiment of the present invention.

[0092]

When the user passes through the ticket checker 161 in order to enter the ticket gate, upon receiving the ticket gate passage data 112a from the reader writer device 121, the IC card 101 starts the behavior attribute recording processing (stay) 118a. First, the IC card 101 classifies a behavior type of the user on the basis of the ticket gate passage data 112a received from the reader writer device 121 and the ticket gate passage data 112b obtained when the user exits at the closest date and time (the ticket gate passage data 112b at the last exit time) (step 301).

[0093]

In the first embodiment, the behavior of a person is classified into movement and stay. The stay in this embodiment indicates a state from an exit from a ticket gate until the next entrance into a ticket gate. The movement is opposite to the stay and indicates a state from an entrance into a ticket gate until an exit from a ticket gate after the use of a railroad and the like.

[0094]

In recent years, a commercial facility on the inside of a ticket gate called "EKINAKA" has been spreading. However, a main purpose of entering the ticket gate passing through the ticket checker 161 is to move to another place using a railroad. A purpose of the movement is to move to a place after an exit

from the ticket gate for work, study, shopping, dining with a friend, a play such as sightseeing, or return to the home.

[0095]

Therefore, it is possible to classify the purpose of the movement by associating the purpose of the movement and a station at a moving destination (a station where the person stays) and further associating the station at the moving destination and time of stay or a stay time in the station. For example, when a stay in a specific station is a stay for days and a frequency of the stay for days in the specific station is high, it is considered that a user has the home near the specific station and is present in the home in a stay time from the specific station.

[0096]

Further, in a stay for 15 minutes or less, it is considered that this indicates that the purpose of the movement is simply a transfer of a railroad. It is considered that a station where the user stays for a medium length of time or a long time and at a high frequency is a station where the user stays for work or attending school.

[0097]

Therefore, in step 301, the IC card 101 in this embodiment classifies the stay of the user into six types (or groups) according to whether the stay is for days, the length of a stay time, and staying start time (i.e., time of the last exit).

The IC card 101 acquires a behavior type of the user from the classified type of the stay.

[0098]

Fig. 7 is an explanatory diagram showing a behavior type classification 2010 in the first embodiment of the present invention.

[0099] The behavior type classification 2010 is retained in the nonvolatile data memory 108 of the IC card 101 and stored in the IC card 101 in advance by an administrator, an operator, or the like. The behavior type classification 2010 includes a last date 2011, a stay time 2012, exit time 2013, and a type 2014.

[0100]

The last date 2011 includes a value indicating what kind of relation a date of the last exit has with a date of this entrance time, i.e., a date when the behavior type classification 2011 is referred to. The stay time 2012 includes a stay time from the last exit time to this entrance time. The exit time 2013 includes a value indicating in which range time of the last exit is. The type 2014 includes an identifier indicating a behavior type.

[0101]

In step 301, the IC card 101 refers to the ticket gate passage data 112b at the last exit time and the ticket gate passage data 112a at this entrance time stored in the

nonvolatile data memory 108 and associates values referred to and the last date 2011, the stay time 2012, and the exit time 2013. Consequently, the IC card 101 selects which type 2014 a stay from passage through the ticket checker 161 at the last exit time until passage through the ticket checker 161 at this entrance time is.

[0102]

Specifically, the IC card 101 specifies a value corresponding to the last date 2011 by determining whether a date indicated by the time 1303 of the ticket gate passage data 112b at the last exit time is different from a date indicated by the time 1303 of the ticket gate passage data 112a at this entrance time.

[0103]

The IC card 101 specifies a value corresponding to the stay time 2012 by subtracting the time 1303 of the ticket gate passage data 112b at the exit time from the time 1303 of the ticket gate passage data 112a at the entrance time. The IC card 101 specifies a value corresponding to the exit time 2013 according to time indicated by the time 1303 of the ticket gate passage data 112b at the last exit time.

[0104]

When the date indicated by the time 1303 at the last exit time and the date indicated by the time 1303 at this entrance time are different, the behavior type classification 2010 in

Fig. 7 indicates a type 1. The type 1 indicates that it is highly likely that the purpose of the stay is to return home because the stay is a stay for days.

[0105]

When the date indicated by the time 1303 at the last exit time and the date indicated by the time 1303 at this entrance time are the same date and the stay time 2012 is equal to or shorter than 15 minutes, the behavior type classification 2010 in Fig. 7 indicates a type 2. The type 2 indicates that it is highly likely that the purpose of the stay is a transfer of a railroad or the like.

[0106]

When the date indicated by the time 1303 at the last exit time and the date indicated by the time 1303 at this entrance time are the same date, the stay time 2012 is longer than 15 minutes and equal to or shorter than 4 hours, and the time indicated by the time 1303 at the last exit time is before 16 o'clock, the behavior type classification 2010 in Fig. 7 indicates a type 3. The type 3 indicates that it is highly likely that the purpose of the stay is shopping or the like.

[0107]

When the date indicated by the time 1303 at the last exit time and the date indicated by the time 1303 at this entrance time are the same date, the stay time 2012 is longer than 15 minutes and equal to or shorter than 4 hours, and the time

indicated by the time 1303 at the last exit time is after 16 o'clock, the behavior type classification 2010 in Fig. 7 indicates a type 4. The type 4 indicates that it is highly likely that the purpose of the stay is a lesson at night or the like.

[0108]

When the date indicated by the time 1303 at the last exit time and the date indicated by the time 1303 at this entrance time are the same date, the stay time 2012 is longer than 4 hours, and the time indicated by the time 1303 at the last exit time is before 16 o'clock, the behavior type classification 2010 in Fig. 7 indicates a type 5. The type 5 indicates that it is highly likely that the purpose of the stay is work or the like.

[0109]

When the date indicated by the time 1303 at the last exit time and the date indicated by the time 1303 at this entrance time are the same date, the stay time 2012 is longer than 4 hours, and the time indicated by the time 1303 at the last exit time is after 16 o'clock, the behavior type classification 2010 in Fig. 7 indicates a type 6. The type 6 indicates that it is highly likely that the purpose of the stay is a drinking party or the like.

[0110]

Note that values stored in the behavior type

classification 2010 in this embodiment may be any value and are not limited to the values stored in the behavior type classification 2010 shown in Fig. 7. Purposes allocated to the types are not limited to the purposes explained above. In the behavior type classification 2010 shown in Fig. 7, one day is from 3 o'clock in the morning to 3 o'clock in the next morning.

[0111]

Subsequently, in processing in step 302 and subsequent steps of the behavior attribute recording processing (stay) 118a, the IC card 101 calculates the behavior attribute data 113 using a different data area for each type selected in step 301.

[0112]

The behavior attribute data 113 stored in the nonvolatile data memory 108 is explained.

[0113]

Fig. 8 is an explanatory diagram showing the behavior attribute data 113 in the first embodiment of the present invention.

[0114]

The behavior attribute data 113 in the first embodiment stores a behavior attribute indicating a stay by the user. The behavior attribute data 113 includes a station code 501, a stay date and time 502, a score value 503, a score offset value 504, a score coefficient 505, and a saturated number of days 506.

[0115]

The behavior attribute data 113 in the first embodiment includes a plurality of entry groups corresponding to the type 2014 classified by step 301 in Fig. 6 and the behavior type classification 2010 in Fig. 7. The behavior attribute data 113 shown in Fig. 8 includes six entry groups of the type 1 to the type 6 (entry groups 511 to 516).

[0116]

Rows of the behavior attribute data 113 in the first embodiment include, as attribute information indicated by numerical values, information concerning the stays by the user.

[0117]

The station code 501 includes an identifier uniquely indicating a station where the ticket checker 161, through which the user exits, is provided. That is, a station indicated by the station code 501 indicates a station where the stay is started. The station code 501 corresponds to the station code 1302 of the ticket gate passage data 112.

[0118]

The stay date and time 502 includes a date and time when the stay was started. The stay date and time 502 corresponds to the time 1303 of the ticket gate passage data 112b transmitted from the reader writer device 121 during an exit.

[0119]

The score value 503 includes a score value calculated

by the behavior attribute recording processing (stay) 118a. The IC card 101 and the reader writer device 121 provide the user with a service according to a value of the score value 503. In this embodiment, an entry with the high score value 503 indicates a stay performed at a high frequency.

[0120]

The score offset value 504 includes an offset value used in a function for calculating the score value 503. The score offset value 504 may be a value given in advance by the operator or the like or may be updated according to a frequency of a stay of the user. When the score offset value 504 is high, even if an interval of the stay decreases, the score value 503 is maintained at a high value.

[0121]

The score coefficient 505 includes a coefficient used for calculating the score value 503. The score coefficient 505 may be a value given in advance by the operator or the like or may be updated according to an interval of a stay of the user. When the score coefficient 505 is low, even if the interval of the stay decreases, the score value 503 less easily decreases.

[0122]

The saturated number of days 506 includes a value used for calculating the score value 503. The saturated number of days 506 includes a value that increases when the score value

503 exceeds a fixed value. The score offset value 504 and the score coefficient 505 may be updated according to a value of the saturated number of days 506.

[0123]

In the first embodiment, rows included in the entry groups of the behavior attribute data 113 are four rows. The rows included in the entry groups are set in advance by the operator or the like. The operator or the like sets the rows included in the entry groups according to a capacity of a memory such as the nonvolatile data memory 108 of the IC card 101. Therefore, the rows included in the entry groups may be five or more rows or may be one or more and three or less rows.

[0124]

Since the number of rows of the entry groups included in the behavior attribute data 113 is the number set in advance, the IC card 101 in the first embodiment can execute the processing in the first embodiment using the nonvolatile data memory 108 having a limited capacity.

[0125]

After step 301, the IC card 101 specifies, out of the entry groups 511 to 516 of the behavior attribute data 113, an entry group corresponding to the type 2014 selected according to the behavior type classification 2010. The IC card 101 determines whether a station code corresponding to the station code 1302 of the ticket gate passage data 112b at

the last exit time is present in the station code 501 of the specified entry group (step 302). That is, the IC card 101 determines whether a station at the last exit time is a station where the user stayed in the past and a station where the user stays at a frequency equal to or higher than a fixed frequency.

[0126]

When the station code corresponding to the station code 1302 of the ticket gate passage data 112b at the last exit time is present in the specified entry group in step 302, a stay immediately before the execution of the behavior attribute recording processing (stay) 118a (hereinafter described as stay of this time) is a stay used in the past and used at a frequency equal to or higher than a fixed frequency. The IC card 101 already retains the score value 503 of the behavior attribute data 113 concerning such a stay. Therefore, the IC card 101 shifts to step 303 in order to update the score value 503.

[0127]

After step 302, the IC card 101 calculates the score value 503 concerning the stay of this time on the basis of the score value 503 already retained in the behavior attribute data 113 (step 303). After step 303, the IC card 101 updates the behavior attribute data 113 according to the calculated score value 503 and a value of the time 1303 of the ticket gate passage data 112b at the last exit time (step 304).

[0128]

When a station code corresponding to the station code 1302 of the ticket gate passage data 112b at the last exit time is absent in the specified entry group in step 302, the stay of this time is a stay not used in the past or used at a frequency lower than the fixed frequency. Therefore, the IC card 101 does not retain a score value of the behavior attribute data 113 concerning such a stay. Therefore, the IC card 101 shifts to step 305 in order to generate a new row of the behavior attribute data 113 and calculate the score value 503 stored in the new row.

[0129]

After step 302, the IC card 101 calculates the score value 503 concerning the stay of this time of the behavior attribute recording processing (stay) 118a anew (step 305). After step 305, the IC card 101 updates the behavior attribute data 113 according to the score value 503 calculated anew and the ticket gate passage data 112b at the last exit time (step 306).

[0130]

A calculation method for a score value S_{n+1} for updating the score value 305 in step 303 is explained below.

[0131]

The new score value 503 (the score value S_{n+1}) is calculated using the score value 503 (a score value S_n) included in a row of the behavior attribute data 113 in which the station

code 1302 and the station code 501 match in step 302, the score offset value 504 (a score offset value A), the score coefficient 505 (a score coefficient K), and a calculation formula (1).

[0132]

[Math 1]

$$S_{n+1} = \text{sat} \{ P_{n+1} + \text{sat} (e^{-K(T_{n+1} - T_n - A)}) S_n \} \quad (1)$$

[0133]

The score coefficient K is a value of the score coefficient 505. The score offset value A is a value of the score offset value 504. A date T_{n+1} is a date indicated by the time 1303 of the ticket gate passage data 112b at the last exit time. A date T_n is a date indicated by the stay date and time 502 of the row of the behavior attribute data 113 in which the station code 1302 and the station code 501 match in step 302. That is, a value calculated according to a calculation formula $(T_{n+1} - T_n)$ is the number of days from the stay of the last time to the stay of this time. In the following explanation, a value calculated by the calculation formula $(T_{n+1} - T_n)$ is described as use interval $T_{n+1} - T_n$. The use interval indicates an interval of a stay.

[0134]

A function $\text{sat}(X)$ is calculated using a calculation formula (2).

[0135]

[Math 2]

$\text{sat}(X)=1 \quad (X \geq 1)$

$=X \quad (X < 1) \quad (2)$

[0136]

The function $\text{sat}(X)$ is a saturation function.

[0137]

That is, when the use interval $T_{n+1}-T_n$ is set on the abscissa, the score value S_{n+1} is given by an exponential distribution in which a maximum value is saturated at 1.

[0138]

A point value P_{n+1} is a value selected according to a condition of a stay. As the point value P_{n+1} in this embodiment, four values, i.e., a new value, a new indefinite value, a normal value, and a same day value are selected. When the point value P_{n+1} is large, the score value S_{n+1} is also large. In this embodiment, the new value is 0.75, the new indefinite value is 0.5, the same day value is 0.5, and the normal value is 0.25.

[0139]

In step 303, i.e., when the score value 503 is updated, the IC card 101 selects the same day value or the normal value as the point value P_{n+1} . For example, when a value of the use interval $T_{n+1}-T_n$ is a multiple of 7, the IC card 101 selects the same day value as the point value P_{n+1} . When the value of the use interval $T_{n+1}-T_n$ is not a multiple of 7, the IC card 101 selects the normal value as the point value P_{n+1} .

[0140]

That is, when the same day value is selected as the point value P_{n+1} , the score value S_{n+1} is set to a value higher than the score value S_{n+1} set when the normal value is selected as the point value P_{n+1} . By selecting the same day value as the point value P_{n+1} , when the stay is started in the same day every week, the score value S_{n+1} can be set to a high value.

[0141]

When the score offset value A is high, the use interval $T_{n+1}-T_n$ at which the score value S_{n+1} starts to decrease from the maximum value 1 can be increased. That is, as the score offset value A is higher, the score value S_{n+1} less easily decreases.

[0142]

When the score coefficient K is high, a degree of a decrease in the score value S_{n+1} with respect to the use interval $T_{n+1}-T_n$ increases. Specifically, a degree (a gradient) of a decrease in an exponential distribution of the score value S_{n+1} becomes steep. That is, as the score coefficient K is higher, the score value S_{n+1} more easily decreases.

[0143]

In this embodiment, the operator or the like sets an initial value of the score offset value A to 3 and sets an initial value of the score coefficient K to 0.1 in advance.

[0144]

Further, when a value of (3) is equal to or larger than

1, i.e., when the score value S_{n+1} is 1, the IC card 101 adds a value of the use interval $T_{n+1}-T_n$ to the saturated number of days 506. Conversely, when the score value S_{n+1} is not saturated, the IC card 101 sets the saturated number of days 506 to 0. That is, the saturated number of days 506 includes the number of days in which the score value S_{n+1} is saturated at 1.

[0145]

[Math 3]

$$P_{n+1} + \text{sat}(e^{-K(T_{n+1}-T_n-A)}) S_n \quad (3)$$

[0146]

The IC card 101 increases the score offset value A every time the saturated number of days 506 reaches a fixed value and reduces the score coefficient K every time the saturated number of days exceeds the fixed value. Consequently, the IC card 101 can update the calculation formula (1) such that a calculation formula for preventing the score value S_{n+1} from easily decreasing is used for a stay in which a high state of the score value S_{n+1} continues.

[0147]

For example, when the saturated number of days 506 indicates fourteen days and twenty-eight days, the IC card 101 increases the score offset value A by 1 and, when the saturated number of days is forty-two days and fifty-six days, reduces the score coefficient K by 0.01. When the saturated number of days 506 is 0, the IC card 101 resets the score offset value

A and the score coefficient K to the initial values.

[0148]

When the saturated number of days 506 explained above is not used, for example, when a user who repeats a stay for the purpose of, for example, returning home cannot, for example, return home because of a long-term business trip or the like, the initial values of the score offset value A and the score coefficient K are used to calculate the score value S_{n+1} , the score value S_{n+1} of the stay for the purpose of, for example, returning home immediately decreases. However, since the saturated number of days 506 is used, the score offset value A and the score coefficient K are updated from the initial values. Therefore, even after the long-term business trip, the score value S_{n+1} corresponding to the stay for the purpose of, for example, returning home less easily decreases.

[0149]

The IC card 101 stores the score value S_{n+1} calculated by the processing explained above in the score value 503, stores the score offset value A in the score offset value 504, stores the score coefficient K in the score coefficient 505, and stores the time 1303 of the ticket gate passage data 112b at the last exit time in the stay date and time 502. Consequently, the IC card 101 updates the row of the behavior attribute data 113 with which the station code 501 matches in step 302 (step 304).

[0150]

In step 305, the IC card 101 calculates the score value S_{n+1} of a new row of the behavior attribute data 113. The IC card 101 calculates a new score value S_{n+1} using a calculation formula (4).

[0151]

[Math 4]

$$S_{n+1} = P_{n+1} \quad (4)$$

[0152]

When a station indicated by the station code 1302 of the ticket gate passage data 112b at the last exit time and a station indicated by the station code 1302 of the ticket gate passage data 112a at this entrance time are the same, a new value (0.75) may be set in a value of the point value P_{n+1} in step 305 in the first embodiment. When the station indicated by the station code 1302 of the ticket gate passage data 112b at the last exit time and the station indicated by the station code 1302 of the ticket gate passage data 112a at this entrance time are different, a new indefinite value (0.5) may be set. Consequently, it is possible to calculate a low score value S_{n+1} for a stay in which a station that the user exited last time and a station that the user entered this time are different.

[0153]

Further, in step 305, the IC card 101 updates, using a calculation formula (5), the score value 503 (a score value

S_i ($i=1$ to 4) of the behavior attribute data 113 corresponding to existing rows in the entry group selected in step 301.

[0154]

[Math 5]

$$S_{i'} = \text{sat}(e^{-K(T_{n+1} - T_n - A)}) S_i \quad (5)$$

[0155]

The score value $S_{i'}$ is a new score value calculated in order to update the existing rows.

[0156]

As in the calculation method for the score value 503 in step 303, the score coefficient K is a value of the score coefficient 505 of the behavior attribute data 113 corresponding to existing rows and the score offset value A is a value of the score offset value 504 of the behavior attribute data 113 corresponding to the existing rows.

On the other hand, the date T_{n+1} is a date indicated by the time 1303 of the ticket gate passage data 112b at the last exit time. The date T_n is a date indicated by the stay date and time 502 of the behavior attribute data 113 corresponding to the existing rows.

[0157]

That is, when the score value $S_{i'}$ of the existing rows is calculated, the use interval $T_{n+1} - T_n$ indicates the number of days from a day when the stays were used last. The IC card 101 updates the score value 503 of the existing rows according

to the calculated score value S_i .

[0158]

After updating the score value 503 according to the new score value S_i , in step 305, the IC card 101 calculates a sum of the row of the behavior attribute data 113 generated anew in step 305 and rows in which values are already stored in the sentry group selected in step 301. When the calculated sum does not exceed the rows retained by the entry group selected in step 301, the IC card 101 adds the row of the behavior attribute data 113 generated anew in step 305 to the entry group selected in step 301 (step 306).

[0159]

When the calculated sum exceeds the rows retained by the entry group selected in step 301, the IC card 101 compares the smallest score value S_i in the existing rows of the entry group selected in step 301 of the behavior attribute data 113 and a value of the score value S_{n+1} of the new row generated in step 305 and determines which of the values is larger. When the value of the score value S_{n+1} of the new row is larger, the IC card 101 updates the row including the smallest score value S_i among the existing rows with the new row including the new S_{n+1} (step 306).

[0160]

Specifically, the IC card 101 replaces the row including the smallest score value S_i among the existing rows with the

station code 1302, the time 1303, the calculated score value S_{n+1} , the initial value of the score offset value A, the initial value of the score coefficient K, and the saturated number of days (=0) of the ticket gate passage data 112b at the last exit time.

[0161]

When it is determined in step 306 that the value of the score value S_{n+1} of the new row is smaller than the smallest score value S_i among the existing rows, the row of the behavior attribute data 113 generated anew does not include the score value S_{n+1} equal to or larger than a fixed value. Therefore, the IC card 101 deletes the row of the behavior attribute data 113 generated anew.

[0162]

As explained above, when the stay of this time corresponds to the row already retained in the behavior attribute data 113, the IC card 101 in the first embodiment updates the score value 503 of the existing rows. When the stay of this time is not retained in the behavior attribute data 113, the IC card 101 generates a row including a new score value 503. On the other hand, the IC card 101 updates the score value 503 of the existing rows as well. The IC card 101 deletes a row including the smallest score value 503 among the new score value 503 and the score value 503 of the existing rows.

[0163]

Consequently, the IC card 101 can always retain the behavior attribute data 113 including a high score value 503. Since it is unnecessary to retain a row in which the score value 503 is low, the capacity of the nonvolatile data memory 108 can be reduced.

[0164]

Note that, in step 303, all the score values 503 in the entry group selected in step 301 may be updated. A method of updating the score values 503 of the existing rows is the same as step 305.

[0165]

Since the score value 503 of the existing stay is updated every time a new stay is performed, the score value 503 conforming to a latest state of the user can be retained. For example, when the user changes a station in use because of house-moving or the like, the score value 503 concerning a stay in the station before the house-moving decreases every time the user stays in a new station. On the other hand, every time the user stays in the new station, the score value 503 of the behavior attribute data 113 concerning a stay in the new station increases.

[0166]

As a result, the behavior attribute data 113 in the first embodiment can retain a value conforming to the latest behavior and a life style of the user.

[0167]

Fig. 9 is an explanatory diagram showing presentation information 2030 presented by the information presentation processing 139 in the first embodiment of the present invention.

[0168]

The presentation information 2030 may be retained in the memory or the like included in the reader writer device 121. The presentation information 2030 is set in advance by the operator or the like and retained in the reader writer device 121.

[0169]

The reader writer device 121 refers to, through the information presentation processing 139, the behavior attribute data 113 and the presentation information 2030 transmitted from the IC card 101 and determines information to be presented to the user. The presentation information 2030 includes a matching station 2031, a state 2032, a time period 2033, and display contents 2034.

[0170]

The matching station 2031 includes an identifier for uniquely indicating a station where the ticket checker 161, through which the user passes, is arranged. The matching station 2031 corresponds to the station code 501 of the behavior attribute data 113. The state 2032 includes an identifier

indicating whether the passage through the ticket checker 161 by the user is an entrance into the ticket gate or an exit from the ticket gate.

[0171]

The time period 2033 indicates a time period in one day. In the time period 2033 shown in Fig. 9, values indicating "morning" (e.g., first train to 10 o'clock), "daytime" (e.g., 10 o'clock to 16 o'clock), "evening" (e.g., 16 o'clock to 19 o'clock), and "night" (e.g., 19 o'clock to last train) are stored.

[0172]

The display contents 2034 include contents of information presented to the user by the reader writer device 121.

[0173]

For example, when the user passes through the ticket checker 161 of the station in the morning to commute from the home to a place of work and enters the ticket gate, the station where the reader writer device 121, through which the user passes, is arranged is highly likely to be a station where the user stays for days, i.e., a station present near the home (equivalent to the type 1). The user is highly likely to move to a station where the user stays for the purpose of work (equivalent to the type 5).

[0174]

Therefore, in the presentation information 2030 in this embodiment, information that should be presented to the user is set according to a purpose of the next stay to which the user moves.

[0175]

Fig. 10 is an explanatory diagram showing the ticket checker 161 in the first embodiment of the present invention.

[0176]

When the user passes through the ticket checker 161, the user holds the IC card 101 over the reader writer device 121. The reader writer device 121 receives, through the behavior attribute readout processing 138, the behavior attribute data 113 from the IC card 101 via the antenna for IC card communication 123 and the antenna for IC card communication 103. The reader writer device 121 presents, through the information presentation processing 139, information for the user passing through the ticket checker 161 to the display 130 on the basis of the received behavior attribute data 113.

[0177]

Specifically, when the user passes through the ticket checker 161, the reader writer device 121 refers to the behavior attribute data 113 received from the IC card 101 and compares identifiers stored in the station code 501 of the type 1 to the type 6 (the entry group 511 to the entry group 516) and an identifier (retained in advance) indicating the station

where the reader writer device 121 itself is arranged. The reader writer device 121 determines whether the station where the reader writer device 121 is arranged is included in the type 1 to the type 6 of the behavior attribute data 113.

[0178]

When the station where the reader writer device 121 is arranged is included in the type 1 to the type 6 of the behavior attribute data 113, the station where the reader writer device 121 is arranged is a station where the user started stay in the past for the purposes indicated by the type 1 to the type 6. Therefore, the reader writer device 121 refers to the presentation information 2030 in order to present, to the user, information concerning a station (a stay destination) to which the user is highly likely to move from the station where the reader writer device 121 is arranged.

[0179]

The reader writer device 121 specifies a row of the presentation information 2030 on the basis of a type including the station where the reader writer device 121 is arranged, a direction in which the user passes through the ticket checker 161 (an entrance or an exit), and a time period when the user passes through the ticket checker 161.

[0180]

For example, when the user passes through the ticket checker 161, if the matching station 2031 of the presentation

information 2030 is the "type 1", the direction in which the user passes through the ticket checker 161 is the entrance, and the time period is morning, the reader writer device 121 specifies a row in which the display contents 2034 is "type 5 station direction service information".

[0181]

The reader writer device 121 specifies the station code 501 in a row in which a value stored in the score value 503 is the highest in the type 5 (the entry group 513) of the behavior attribute data 113 received from the IC card 101. The reader writer device 121 presents, on the display 130, service information in a station direction indicated by the specified station code 501.

[0182]

The example explained above indicates that, in the example shown in Fig. 7, when the user enters the ticket gate in order to move from the home (equivalent to the type 1) to the place of work (the type 5), the reader writer device 121 presents, to the user, service information of a railroad in a station direction in which the place of work is present.

[0183]

For example, when the user passes through the ticket checker 161, if the matching station 2031 of the presentation information 2030 is the "type 1" and the direction in which the user passes through the ticket checker 161 is the exit,

the reader writer device 121 specifies a row in which the display contents 2034 is "type 1 station periphery service information".

[0184]

The example explained above indicates that, in the example shown in Fig. 7, the user arrives at the station near the home and the reader writer device 121 presents, to the user, information concerning a service provided in the periphery of the station near the home.

[0185]

According to the first embodiment, the IC card 101 calculates the score value 503 concerning a stay on the basis of the ticket gate passage data 112 transmitted during passage through the ticket checker 161. The IC card 101 transmits the behavior attribute data 113 including the score value 503 for each stay to the reader writer device 121. Therefore, it is possible to provide a service based on the behavior attribute data 113 for each user only by changing the IC card 101 and the ticket checker 161 including the reader writer device 121 without involving a change of an entire large and wide-area system that treats the electronic ticket of the IC card 101.

[0186]

The IC card 101 in the first embodiment dynamically changes the score value 503 of the behavior attribute data 113 according to a use interval of a stay, periodicity of the stay,

or the like. Therefore, it is possible to cause the score value 503 of the behavior attribute data 113 to automatically follow a station in use, a range of behavior, or a rhythm of life that changes according to a transfer in work, house-moving, or the like of the user. As a result, it is possible to provide a service most suitable for the user conforming to a latest state of the user.

[0187]

Further, the numbers of rows of each entry group included in the behavior attribute data 113 are set in advance and only the behavior attribute data 113 having the high score value 503 is retained. Therefore, the IC card 101 in the first embodiment can execute the processing in the first embodiment using the nonvolatile data memory 108 having a limited capacity.

[0188]

Further, the IC card 101 in the first embodiment can transmit, through the behavior attribute readout processing 119, only the behavior attribute data 113 having the high score value 503 to the reader writer device 121. Therefore, it is possible to end the communication between the IC card 101 and the reader writer device 121 in a sufficiently short time.

[0189]

(Second Embodiment)

Fig. 11 is a block diagram showing a physical

configuration of an IC card system, the charging management system 151, and the behavior attribute tabulation system 153 in a second embodiment of the present invention.

[0190]

The system shown in Fig. 11 includes the IC card 101, a POS register terminal 145, a reader writer device 621, the gateways (GWs) 141, the network 152, the charging management system 151, the behavior attribute tabulation system 153, the behavior history database 154, and the card history database 155.

[0191]

The IC card 101 in the second embodiment and the IC card 101 in the first embodiment may be the same IC card 101. The reader writer device 621 communicates with the IC card 101 via radio and is connected to the POS register terminal 145 via a communication line 146. The reader writer device 621 transmits charging information and the behavior attribute information of the IC card 101 to the charging management system 151 via the GW 141 and the network 152.

[0192]

The GWs 141, the network 152, the charging management system 151, the behavior attribute tabulation system 153, the behavior history database 154, and the card history database 155 in the second embodiment are the same as the GWs 141, the network 152, the charging management system 151, the behavior

attribute tabulation system, the behavior history database 154, and the card history database 155 in the first embodiment. Therefore, explanation thereof is omitted.

[0193]

One GW 141 is connected to a plurality of the reader writer devices 621 via a network 142. A plurality of the GWs 141 and the reader writer devices 621 are hierarchically connected to the network 152.

[0194]

Like the IC card 101 in the first embodiment, the IC card 101 in the second embodiment includes the IC card communication IF (interface) 102, the antenna for IC card communication 103, the power supply circuit 104, the CPU 105, the work memory 106, the program memory 107, the nonvolatile data memory 108, and the authentication mechanism 109. Like the program memory 107 in the first embodiment, the program memory 107 in the second embodiment retains the ticket processing 115, the charging processing 116, the entrance processing 117, the behavior attribute recording processing (stay) 118a, the behavior attribute recording processing (purchase) 118b, and the behavior attribute readout processing 119.

[0195]

Further, like the nonvolatile data memory 108 in the first embodiment, the nonvolatile data memory 108 in the second embodiment retains the balance data 111, the ticket gate

passage data 112, and the behavior attribute data 113.

[0196]

Like the reader writer device 121 in the first embodiment, the reader writer device 621 in the second embodiment includes the IC card communication IF 122, the antenna for IC card communication 123, the CPU 124, the work memory 125, the program memory 126, the authentication mechanism 127, the communication IF (interface) 128, and the display IF 129.

[0197]

The reader writer device 621 in the second embodiment is connected to the display 130. The reader writer device 921 displays, through the information presentation processing 139 and the display IF 129, information presented to users on the display 130.

[0198]

The program memory 126 retains the charging processing 136, the behavior attribute readout processing 138, and the information presentation processing 139. The behavior attribute readout processing 138 and the information presentation processing 139 in the second embodiment are the same as the behavior attribute readout processing 138 and the information presentation processing 139 in the first embodiment. The charging processing 136 in the second embodiment includes the same function as the charging processing 136 in the first embodiment and performs electronic

money settlement in purchase.

[0199]

Fig. 12 is a sequence chart showing processing performed by the reader writer device 621 and the IC card 101 in the second embodiment of the present invention.

[0200]

The sequence chart in Fig. 12 shows processing executed when a user holds the IC card 101 over the reader writer device 621 connected to the POS register terminal 145 in order to purchase a commodity and the purchase of the commodity is settled by electronic money of the IC card 101. The sequence in Fig. 12 is started in a state in which communication between the reader writer device 621 and the IC card 101 is established.

[0201]

First, the POS register terminal 145 transmits a charging amount 711 to the reader writer device 621. The charging amount 711 includes a value indicating an amount (a charging amount) that should be subtracted from the balance of the electronic money retained by the IC card 101. Upon receiving the charging amount 711, the reader writer device 621 starts the charging processing 136.

[0202]

Processing from transmission of charging data 1201 to the IC card 101 by the reader writer device 121 until an end notification 2020 is transmitted from the IC card 101 to the

reader writer device 621 in the second embodiment is the same as the processing from the transmission of the charging data 1401 to the IC card 101 by the reader writer device 121 until the transmission of the end notification 2003 from the IC card 101 to the reader writer device 621 in the first embodiment shown in Fig. 2A.

[0203]

Specifically, the reader writer device 621 transmits the charging data 1201, in which the charging amount included in the charging amount 711 is stored, to the IC card 101. The charging data 1201 includes the charging amount, a value indicating a shop where the POS register terminal 145 is arranged, and time when purchase was performed.

[0204]

Upon receiving the charging data 1201, the IC card 101 updates the balance data 111 stored in the nonvolatile data memory 108 with the charging amount stored in the charging data 1201. Thereafter, the IC card 101 transmits the end notification 2020 including a value indicating whether the charging processing 116 is successful and a value indicating the balance 1504 of the balance data 111 to the reader writer device 621.

[0205]

After transmitting the end notification 2020 to the reader writer device 621, the IC card 101 ends the charging

processing 116 and starts the behavior attribute recording processing (purchase) 118b. The IC card 101 calculates, through the behavior attribute recording processing (purchase) 118b, score values included in the behavior attribute data 113 corresponding to kinds of purchase. The IC card 101 updates the behavior attribute data 113 with the calculated score values. Concerning the behavior attribute recording processing (purchase) 118b, details are explained below.

[0206]

After the behavior attribute data 113 is updated by the behavior attribute recording processing (purchase) 118b, IC card 101 transmits an end notification 2021 to the reader writer device 621 and ends the behavior attribute recording processing (purchase) 118b.

[0207]

Upon receiving the end notification 2021, the reader writer device 621 transmits an end notification 712 to the POS register terminal 145 and ends the charging processing 136. The end notification 712 includes a value indicating whether the charging processing 116 by the IC card 101 is successful and a value indicating the balance 1504 of the balance data 111 of the IC card 101.

[0208]

After ending the charging processing 136, the reader

writer device 621 starts the behavior attribute readout processing 138. The behavior attribute readout processing 138 in the second embodiment is the same function as the behavior attribute readout processing 138 in the first embodiment. The behavior attribute readout processing 119 by the IC card 101 is also the same function as the behavior attribute readout processing 119 in the first embodiment.

[0209]

The IC card 101 may transmit, through the behavior attribute readout processing 119, the behavior attribute data 113 including the highest score value to the reader writer device 621 or transmit several behavior attribute data 113 to the reader writer device 621.

[0210]

However, upon receiving the behavior attribute data 113 from the IC card 101, the reader writer device 621 transmits the received behavior attribute data 113 to the POS register terminal 145 through the behavior attribute readout processing 138 in the second embodiment.

[0211]

Consequently, the POS register terminal 145 can present shopping information and the like to the user according to the score values included in the received behavior attribute data 113. Note that the reader writer device 621 may specify, through the information presentation processing 139,

information presented to the user according to the score values included in the behavior attribute data 113 and transmit the specified information to the POS register terminal 145.

[0212]

Note that the reader writer device 621 may acquire, through the information presentation processing 139, necessary information from a server or the like, which retains information, via the network 152.

[0213]

The behavior attribute readout processing 119 in the second embodiment is the same as the behavior attribute readout processing 119 in the first embodiment.

[0214]

Fig. 13 is an explanatory diagram showing the charging data 1201 in the second embodiment of the present invention.

[0215]

The reader writer device 621 transmits the charging data 1201 to the IC card 101 through the charging processing 136. The charging data 1201 includes a terminal ID 1202, time 1203, a charging amount 1204, a shop type 1205, and a shop taste 1206.

[0216]

The terminal ID 1202 includes an identifier for uniquely indicating the reader writer device 621 and corresponds to a shop where the reader writer device 621 is provided. Note that a plurality of the reader writer devices 621 may be provided

in one shop.

[0217]

The time 1203 includes a value indicating a date and time when purchase was performed. The charging amount 1204 includes a value that should be subtracted from the balance 1504 of the IC card 101 according to the purchase.

[0218]

The shop type 1205 and the shop taste 1206 are values indicating a type and a tendency of a shop where purchase was performed. The shop type 1205 and the shop taste 1206 are set by an operator or the like in advance according to the shop where the reader writer device 621 is provided. The reader writer device 621 stores, in the charging data 1201, the shop type 1205 and the shop taste 1206 retained by the reader writer device 621.

[0219]

Fig. 14 is an explanatory diagram showing a shop classification 1208 in the second embodiment of the present invention.

[0220]

The shop classification 1208 is set by the operator or the like in advance. The shop type 1205 and the shop taste 1206 of shops are set in advance according to the shop classification 1208. The reader writer device 621 retains the shop type 1205 and the shop taste 1206 of the shop, where the

reader writer device 621 is provided, in a memory or the like in advance.

[0221]

One shop type 1205 and one shop taste 1206 are set for each of the shops in the second embodiment. However, a plurality of the shop types 1205 and a plurality of the shop tastes 1206 may be set for each of the shops. The retained shop type 1205 and shop taste 1206 may be updated according to time.

[0222]

The shop classification 1208 includes a name 1207, the shop type 1205, and the shop taste 1206. The name 1207 indicates a name of a type of a commodity or a service treated by the shop. The shop type 1205 is an identifier uniquely indicating the name 1207. The shop taste 1206 is an identifier for classifying the shop type 1205 into a predetermined type and uniquely indicating the type.

[0223]

There are sixteen types as the shop type 1205 in the second embodiment and there are three types as the shop taste 1206 in the second embodiment. The shop taste 1206 in the second embodiment is classified according to convenience and entertainment. 1 is set for the shop taste 1206 of a shop having high convenience such as a convenience store. 2 is set for the shop taste 1206 of a shop having high entertainment such

as a sweets shop. 3 is set for the shop taste 1206 of a shop having both the characteristics.

[0224]

Fig. 15 is an explanatory diagram showing the behavior attribute data 113 in the second embodiment of the present invention.

[0225]

The behavior attribute data 113 in the second embodiment retains the score values calculated on the basis of kinds of behavior concerning kinds of purchase by the user. Therefore, rows of the behavior attribute data 113 indicate kinds of purchase by the user as numerical values. The behavior attribute data 113 in the second embodiment includes a shop terminal group 517, a shop type group 518, and a shop taste group 519.

[0226]

The shop terminal group 517 includes score values for each shop where the user performed purchase. That is, the shop terminal group 517 retains score values of shops where frequencies of purchase by the user are high.

[0227]

The shop type group 518 includes score values of each shop type 1205 of a shop where the user performed purchase. That is, the shop type group 518 retains score values of the shop type 1205 with high frequencies of purchase by the user.

[0228]

The shop taste group 519 includes score values for each shop taste 1206 of shops where the user performed purchase. That is, the shop taste group 519 retains score values of the shop taste 1206 with high frequencies of purchase by the user.

[0229]

The shop terminal group 517 includes a terminal ID 521-1. The shop type group 518 includes a shop type 521-2. The shop taste group 519 includes a shop taste 521-3. Each of the shop terminal group 517, the shop type group 518, and the shop taste group 519 includes a use date and time 522, a score value 523, a score offset 524, a score coefficient 525, and a saturated number of days 526.

[0230]

The terminal ID 521-1 includes an identifier uniquely indicating the POS register terminal 145 with which the user performed purchase and including the reader writer device 621. The terminal ID 521 corresponds to the terminal ID 1202 of the charging data 1201.

[0231]

The shop type 521-2 includes an identifier uniquely indicating the shop type 1205 of a shop where the user performed purchase. The shop type 521-2 corresponds to the shop type 1205 of the charging data 1201.

[0232]

The shop taste 521-3 includes an identifier uniquely indicating the shop taste 1206 of the shop where the user performed the purchase. The shop taste 521-3 corresponds to the shop taste 1206 of the charging data 1201.

[0233]

The use date and time 522 indicates a date and time when the purchase was performed and corresponds to the time 1203 of the charging data 1201. The score value 523, the score offset 524, the score coefficient 525, and the saturated number of days 526 are the same as the score value 503, the score offset value 504, the score coefficient 505, and the saturated number of days 506 in the first embodiment.

[0234]

In the second embodiment, the shop terminal group 517 includes four rows and the shop type group 518 includes four rows. The shop taste group 519 includes two rows because there are only three kinds of the shop taste 1206. The rows included in the shop terminal group 517 and the shop type group 518 are set in advance by the operator or the like.

[0235]

The operator or the like sets the rows included in the shop terminal group 517 and the shop type group 518 according to the capacity of the memory such as the nonvolatile data memory 108 of the IC card 101. Therefore, the rows included in the shop terminal group 517 and the shop type groups 518

may be five or more rows or may be one or more and three or less rows.

[0236]

In the second embodiment, the rows included in the shop taste group 519 of the behavior attribute data 113 are two rows. This is because, in the second embodiment, there are three kinds of the shop taste 1206. However, when there are four or more kinds of the shop taste 1206, three or more rows may be included in the shop taste group 519 as in the shop terminal group 517 and the shop type group 518.

[0237]

The numbers of rows of the shop terminal group 517, the shop type group 518, and the shop taste group 519 included in the behavior attribute data 113 are set in advance. Therefore, the IC card 101 in the second embodiment can execute the processing in the second embodiment using the nonvolatile data memory 108 having the limited capacity.

[0238]

Fig. 16 is a flowchart for explaining the behavior attribute recording processing (purchase) 118b in the second embodiment of the present invention.

[0239]

The behavior attribute recording processing (purchase) 118b is executed when the user performs purchase in a shop. The behavior attribute recording processing (purchase) 118b

roughly includes three kinds of processing.

[0240]

Processing in steps 1101 to 1105 is generation of the behavior attribute data 113 concerning the shop where the reader writer device 621 is provided and accumulation of the generated behavior attribute data 113. Processing in steps 1106 to 1110 is generation of the behavior attribute data 113 concerning the shop type 1205 and accumulation of the generated behavior attribute data 113. Processing in steps 1111 and 1112 is calculation of a score value of the behavior attribute data 113 concerning the shop taste 1206 and accumulation of the calculated behavior attribute data 113.

[0241]

First, the IC card 101 determines whether the terminal ID 521-1 corresponding to the terminal ID 1202 of the received charging data 1201 is stored in the shop terminal group 517 of the behavior attribute data 113 (step 1101).

[0242]

When the terminal ID 521-1 corresponding to the terminal ID 1202 is stored in the shop terminal group 517, the user performed the purchase in a shop where the user frequently performs purchase and performed purchase before. Therefore, in order to update the score value 523 of a row including the terminal ID 521-1 same as the terminal ID 1202, the IC card 101 shifts to step 1102.

[0243]

When the terminal ID 521-1 corresponding to the terminal ID 1202 is not stored in the shop terminal group 517, the user performed purchase in a shop where the user visited first or a shop where the user rarely visits. Therefore, in order to generate the behavior attribute data 113 anew and calculate the score value 523 anew, the IC card 101 shifts to step 1104.

[0244]

After step 1101, in order to update the score value 523 of the row including the terminal ID 521-1 same as the terminal ID 1202, the IC card 101 calculates a new score S_{n+1} (step 1102).

[0245]

The IC card 101 calculates the new score value S_{n+1} using the score value 523, the score offset 524, and the score coefficient 525 of a row (an existing row) of the shop terminal group 517 in which the terminal ID 521-1 same as the terminal ID 1202 is stored in step 1101. The new score value S_{n+1} is calculated by the calculation formula (1) in the first embodiment.

[0246]

In the second embodiment, the score coefficient K is a value of the score coefficient 525, the score offset value A is a value of the score offset 524, the date T_{n+1} is a date (a purchase date of this time) indicated by the time 1203 of the received charging data 1201, and the date T_n is a date (a

purchase date of the last time) indicated by the use date and time 522 of the existing row. That is, a value calculated by the calculation formula $(T_{n+1}-T_n)$ is the number of days from purchase of the last time until purchase of this time. The value calculated by the calculation formula $(T_{n+1}-T_n)$ is described as use interval $T_{n+1}-T_n$ below.

[0247]

As the point value P_{n+1} in the second embodiment, three values, i.e., a new value, a normal value, and a same day value are selected according to conditions for purchase. In the calculation of the score value S_{n+1} in step 1102, when a value of the use interval $T_{n+1}-T_n$ is a multiple of 7, the same day value is selected as the point value P_{n+1} . When the value of the use interval $T_{n+1}-T_n$ is not a multiple of 7, the normal value is selected.

[0248]

In the second embodiment, for example, 0.75 is set as the new value, 0.5 is set as the same day value, and 0.25 is set as the normal value. For example, an initial value of the score offset value A is set to 3 and an initial value of the score coefficient K is set to 0.1. These numerical values in the present invention may be changed to any values by the operator or the like.

[0249]

In the second embodiment, as in the first embodiment,

when the value of (3) is equal to or larger than 1, that is, when the score value S_{n+1} is 1, the IC card 101 adds the value of the use interval $T_{n+1}-T_n$ to the saturated number of days 526. Conversely, when the score value S_{n+1} is not saturated, the IC card 101 stores 0 in the saturated number of days 526.

[0250]

As in the first embodiment, the IC card 101 increases the score offset value A every time the saturated number of days 526 reaches a fixed value and decreases the score coefficient K every time the saturated number of days 526 exceeds the fixed value. Consequently, the IC card 101 can update the calculation formula (1) such that a calculation formula for preventing the score value S_{n+1} from easily decreasing is used for purchase in which a high state of the score value S_{n+1} continues.

[0251]

For example, when the saturated number of days 526 indicates fourteen days and twenty-eight days, the IC card 101 increases the score offset value A by 1 and, when the saturated number of days is forty-two days and fifty-six days, reduces the score coefficient K by 0.01. When the saturated number of days 526 is 0, the IC card 101 resets the score offset value A and the score coefficient K to the initial values.

[0252]

When the saturated number of days 506 explained above

is not used, for example, when a user who repeats purchase in the same shop cannot perform purchase in the same shop because of a long-term business trip or the like, the score value S_{n+1} of the purchase in the shop immediately decreases. However, since the saturated number of days 526 is used, the score offset value A and the score coefficient K are updated from the initial values. Therefore, even after the long-term business trip, the score value S_{n+1} corresponding to the purchase in the same shop less easily decreases.

[0253]

The IC card 101 in this embodiment stores the score value S_{n+1} calculated by the processing explained above in the score value 523, stores the score offset value A in the score offset value 524, stores the score coefficient K in the score coefficient 525, and stores the time 1203 of the charging data 1201 in the use date and time 522. Consequently, the IC card 101 updates the row in which it is determined in step 1101 that the terminal ID 521-1 corresponding to the terminal ID 1202 is stored (step 1103).

[0254]

After step 1101, in step 1104, the IC card 101 calculates anew the score value S_{n+1} included in a new row of the behavior attribute data 113 according to the calculation formula (4) in the first embodiment. The new value is set as a value of the point value P_{n+1} in step 1104 in the second embodiment. The

IC card 101 generates a new row of the behavior attribute data 113 including the score value S_{n+1} calculated in step 1104.

[0255]

Further, in step 1104, in order to update the score values 523 (score values S_i ($i=1$ to 4)) already stored in the shop terminal group 517, the IC card 101 calculates a new score value S_i' according to the calculation formula (5) in the first embodiment.

[0256]

Values of the score coefficient K , the score offset value A , the date T_{n+1} when purchase was performed this time, and the data T_n when purchase was performed last time are the same as the values in step 1101. By calculating the score value S_i' using the calculation formula (5) in the first embodiment, concerning other purchase rather than the purchase of this time, the IC card 101 can update the score value 523 according to the number of days from a day when purchase was performed last. As the number of days from the day when the purchase was performed last is larger, the score value S_i' is calculated as a smaller value.

[0257]

In step 1104, the IC card 101 updates, with the score value S_i' calculated by the calculation formula (5), the score value 523 of a row corresponding to the score value S_i' .

[0258]

After updating the score value 503 with the new score value S_i , in step 1104, the IC card 101 determines whether a sum of the row of the behavior attribute data 113 generated anew and rows in which values are already stored in the shop terminal group 517 exceeds the rows retained by the shop terminal group 517.

[0259]

When the sum of the row of the behavior attribute data 113 generated anew and the rows in which values are already stored in the shop terminal group 517 does not exceed the rows retained by the shop terminal group 517, in step 1105, the IC card 101 adds the row generated anew to the shop terminal group 517.

[0260]

When the sum of the row of the behavior attribute data 113 generated anew and the rows in which values are already stored in the shop terminal group 517 exceeds the rows retained by the shop terminal group 517, in step 1105, the IC card 101 compares the smallest score value S_i , in the score values 523 of the shop terminal group 517 of the behavior attribute data 113 and the score value S_{n+1} of the row generated anew in step 1104 and determines whether a value of the score value S_{n+1} calculated anew in step 1104 is larger.

[0261]

When the value of the score value S_{n+1} calculated anew

in step 1104 is larger, in step 1105, the IC card 101 stores, in a row including the smallest score value 523, data of the terminal ID 521-1, the use date and time 522, the score value 523, and the score value S_{n+1} , initial values of the score offset 524 and the score coefficient 525, and the saturated number of days (=0) of the behavior attribute data 113 generated anew corresponding to the purchase of this time.

[0262]

After step 1103 or step 1105, the IC card 101 determines whether the shop type 521-2 including an identifier same as the identifier of the shop type 1205 of the received charging data 1201 is stored in the shop type group 518 of the behavior attribute data 113 (step 1106).

[0263]

Processing in steps 1107 to 1110 is the same as the processing in steps 1102 to 1105. The IC card 101 updates the score values 523 of the rows of the shop type group 518 according to the processing in steps 1107 to 1110.

[0264]

In step 1110, as in step 1104, when the sum of the row of the behavior attribute data 113 generated anew and the rows in which values are already stored in the shop type group 518 exceeds the rows retained by the shop type group 518, the IC card 101 updates, with the row of the behavior attribute data 113 generated anew, the row including the smallest score value

S_i , among the rows in which the values are already stored. When the sum of the row of the behavior attribute data 113 generated anew and the rows in which values are already stored in the shop type group 518 does not exceed the rows retained by the shop type group 518, the IC card 101 adds the row of the behavior attribute data generated anew to the shop type group 518.

[0265]

After step 1108 or step 1110, the IC card 101 calculates the score value 523 of the shop taste group 519 (step 1111). In step 1111, the IC card 101 uses the shop taste 1206 of the received charging data 1201.

[0266]

The shop taste group 519 of the behavior attribute data 113 in the second embodiment includes only two rows. This is because, since there are only three kinds of the shop taste 1206, it is possible to discriminate magnitudes of all score values of the shop taste 1206 if the behavior attribute data 113 concerning the two shop tastes 1206 are fixedly retained.

[0267]

The shop taste group 519 in the second embodiment includes the behavior attribute data 113 in the case in which the shop taste 1206 is "1" and the behavior attribute data 113 in the case in which the shop taste 1206 is "3". The score values 523 of the shop taste group 519 are calculated using the calculation formula (1) used in step 1102 and step 1107.

[0268]

Information concerning in which shops users perform purchase, in what kinds of shop types the users perform purchase, and in which shop tastes the users perform purchase is calculated as the score values 523 by the behavior attribute recording processing (purchase) 118b. Therefore, the behavior attribute data 113 is transmitted to the reader writer device 621 in the behavior attribute readout processing 138 by the reader writer device 621 and the behavior attribute readout processing 119 by the IC card 101. Consequently, the reader writer device 621 can present information conforming to the tendencies of the behavior of the users to the users according to the score values 523 of the received behavior attribute data 113.

[0269]

For example, the reader writer device 621 or the POS register terminal 145 in the second embodiment refers to the score value 523 of the behavior attribute data 113 received from the IC card 101 and, when the shop type 1205 is a high value of the score value 523 of the behavior attribute data 113 indicating sweets, presents information concerning a shop for purchasing the sweets to the user. When the shop taste 1206 is "1", the reader writer device 621 or the POS register terminal 145 presents information concerning a shop with high convenience to the user.

[0270]

As in the first embodiment, the IC card 101 in the second embodiment uses the score offset 524, the score coefficient 525, and the saturated number of days 526 in order to calculate a score value. By using these values, the IC card 101 can calculate the score values 523 conforming to, for example, changes in life styles of users. For example, the IC card 101 can calculate high score values 523 for purchase by a user who performs purchase in the same shop on the same day every week. The reader writer device 621 or the like can present information concerning shops with the high score values 523 to more users.

[0271]

According to the second embodiment, the IC card 101 calculates a score value concerning purchase on the basis of the charging data 1201 transmitted when the POS register terminal 145 is used in a shop. The IC card 101 transmits the behavior attribute data 113 including the score value for each purchase to the reader writer device 121. Therefore, the IC card system in the second embodiment can provide a service based on the behavior attribute data 113 of each user through only a change of the POS register terminal 145 including the IC card 101 and the reader writer device 621 without involving a change of an entire large and wide-area system in which the IC card 101 is used.

[0272]

The IC card 101 in the second embodiment dynamically changes a score value of the behavior attribute data 113 according to a use interval of purchase, periodicity of the purchase, or the like. Therefore, it is possible to cause the score value of the behavior attribute data 113 to automatically follow, for example, a change of a life style of the user. As a result, it is possible to provide a service most suitable for the user conforming to a latest state of the user.

[0273]

The IC card 101 in the second embodiment calculates the behavior attribute data 113 for each type of a shop where the user performed purchase and each taste of the shop. Therefore, it is possible to provide a service most suitable for the user conforming to a taste, an interest, or the like of the user.

[0274]

Further, the numbers of rows of the shop terminal group 517, the shop type group 518, and the shop taste group 519 included in the behavior attribute data 113 are set in advance and only the behavior attribute data 113 having a high score value is retained. Therefore, the IC card 101 in the second embodiment can execute the processing in the second embodiment using the nonvolatile data memory 108 having a limited capacity.

[0275]

Further, the IC card 101 in the second embodiment can

transmit, through the behavior attribute readout processing 119, only the behavior attribute data 113 having the high score value 523 to the reader writer device 621. Therefore, it is possible to end the communication between the IC card 101 and the reader writer device 621 in a sufficiently short time.

[0276]

(Third Embodiment)

Fig. 17 is a block diagram showing a physical configuration of an IC card system, a charging management system, and a behavior attribute tabulation system in a third embodiment of the present invention.

[0277]

The systems shown in Fig. 17 include the IC card 101, an information terminal 961, a reader writer device 921, the gateways (GWs) 141, the network 152, the charging management system 151, the behavior attribute tabulation system 153, the behavior history database 154, and the card history database 155.

[0278]

The IC card 101 in the third embodiment and the IC card 101 in the first embodiment and the second embodiment may be the same IC card 101. The reader writer device 921 communicates with the IC card 101 via radio and is connected to the information terminal 961.

[0279]

The information terminal 961 and the reader writer device 921 may be connected to the GW 141 via the network 142. The information terminal 961 and the reader writer device 921 may be arranged stand-alone without being connected to the GW 141. When connected to the GW 141, the reader writer device 921 transmits charging information and behavior attribute information of the IC card 101 to the charging management system 151 via the GW 141 and the network 152.

[0280]

The GWs 141, the network 152, the charging management system 151, the behavior attribute tabulation system 153, the behavior history database 154, and the card history database 155 in the third embodiment are the same as the GWs 141, the network 152, the charging management system 151, the behavior attribute tabulation system, the behavior history database 154, and the card history database 155 in the first embodiment and the second embodiment. Therefore, explanation thereof is omitted.

[0281]

The IC card 101 in the third embodiment retains the same function as the IC card 101 in the first embodiment and the second embodiment and retains the same data.

[0282]

Like the reader writer device 121 in the first embodiment and the reader writer device 621 in the second embodiment, the

reader writer device 921 in the third embodiment includes the IC card communication IF 122, the antenna for IC card communication 123, the CPU 124, the work memory 125, the program memory 126, the authentication mechanism 127, the communication IF (interface) 128, and the display IF 129.

[0283]

The reader writer device 921 in the third embodiment is connected to the display 130. The reader writer device 921 displays information to users on the display 130 through the information presentation processing 139 and the display IF 129.

[0284]

The program memory 126 retains functions of the behavior attribute readout processing 138 and the information presentation processing 139. The behavior attribute readout processing 138 and the information presentation processing 139 in the third embodiment are the same as the behavior attribute readout processing 138 and the information presentation processing 139 in the first embodiment and the second embodiment.

[0285]

Fig. 18 is a sequence chart showing processing by the reader writer device 921 and the IC card 101 in the third embodiment of the present invention.

[0286]

The sequence chart of Fig. 18 is processing started when

a user holds the IC card 101 of the user over the reader writer device 921 of the information terminal 961. The sequence in Fig. 18 is started in a state in which communication between the reader writer device 921 and the IC card 101 is established.

[0287]

In the sequence chart in Fig. 18, the reader writer device 921 acquires the behavior attribute data 113 from the IC card 101 through the behavior attribute readout processing 138. The IC card 101 transmits the behavior attribute data 113 to the reader writer device 921 through the behavior attribute readout processing 119 according to the readout request 2002 from the reader writer device 921.

[0288]

Processing shown in Fig. 18 is the same as the processing by the behavior attribute readout processing 138, the information presentation processing 139, and the behavior attribute readout processing 119 in the first embodiment and the second embodiment. Note that the reader writer device 921 may acquire necessary information from a server or the like, which retains information, through the information presentation processing 139 via the network 152.

[0289]

Note that the IC card 101 in the first embodiment, the second embodiment, and the third embodiment can communicate with the reader writer devices (121, 621, and 921) in the

respective embodiments mutually.

[0290]

Fig. 19 is a block diagram showing an overall configuration of a service system in the third embodiment of the present invention.

[0291]

The service system shown in Fig. 19 includes the IC card system in the first embodiment, the second embodiment, and the third embodiment. The service system shown in Fig. 19 includes IC cards (8021, 8022, 8023, 8024, and 8025), a ticket checker 8031, ticket vending machines (8032 and 8033), a POS register terminal 8034, an information terminal 8035, reader writer devices (8041, 8042, 8043, 8044, and 8045), GWs (8051, 8052, 8053, 8054, and 8055), a network 8061, a charging management system 8071, a card history database 8072, a behavior attribute tabulation system 8073, a behavior history database 8074, and a terminal 8081.

[0292]

The IC cards (8021, 8022, 8023, 8024, and 8025) are IC cards used by a user. The IC cards (8021, 8022, 8023, 8024, and 8025) may be implemented by one IC card or may be implemented by a plurality of IC cards.

[0293]

The ticket checker 8031 and the ticket vending machines (8032 and 8033) are terminal devices for using a railroad, which

are arranged in, for example, a shop in the premise of a station, around the station, or outside the station. The POS register terminal 8034 is a terminal device for settlement involved in purchase of a commodity or a service and service benefiting. The information terminal 8035 is a terminal device for providing information.

[0294]

The reader writer devices (8041, 8042, 8043, 8044, and 8045) are respectively connected to the ticket checker 8031, the ticket vending machines (8032 and 8033), the POS register terminal 8034, and the information terminal 8035. The reader writer devices (8041, 8042, 8043, 8044, and 8045) may be implemented in devices same as the ticket checker 8031, the ticket vending machines (8032 and 8033), the POS register terminal 8034, and the information terminal 8035 or may be implemented in different devices.

[0295]

The reader writer device 8041 is connected to the ticket checker 8031 and communicates with the IC card 8021 via an antenna 8141 and an antenna 8121. Further, the reader writer device 8041 communicates with the charging management system 8071 via the GW 8051 and the network 8061.

[0296]

Like the reader writer device 8041, the reader writer devices (8042, 8043, 8044, and 8045) communicate with the IC

cards (8022, 8023, 8024, and 8025) via antennas (8142, 8143, 8144, and 8145) and antennas (8122, 8123, 8124, and 8125). The reader writer devices (8042, 8043, 8044, and 8045) communicate with the charging management system 8071 via the GWs (8052, 8053, 8054, and 8055) and the network 8061.

[0297]

The IC card 8021 corresponds to the IC card 101 in the first embodiment, the reader writer device 8041 corresponds to the reader writer device 121 in the first embodiment, and the ticket checker 8031 corresponds to the ticket checker 161 in the first embodiment. The antenna 8121 corresponds to the antenna for IC card communication 103 in the first embodiment, the antenna 8141 corresponds to the antenna for IC card communication 123 in the first embodiment, and the GW 8051 corresponds to the GW 141 in the first embodiment.

[0298]

Further, the IC card 8024 corresponds to the IC card 101 in the second embodiment, the reader writer device 8044 corresponds to the reader writer device 621 in the second embodiment, and the POS register terminal 8034 corresponds to the POS register terminal 145 in the second embodiment. The antenna 8124 corresponds to the antenna for IC card communication 103 in the second embodiment, the antenna 8144 corresponds to the antenna for IC card communication 123 in the second embodiment, and the GW 8054 corresponds to the GW

141 in the second embodiment.

[0299]

Further, the IC card 8025 corresponds to the IC card 101 in the third embodiment, the reader writer device 8045 corresponds to the reader writer device 921 in the third embodiment, and the information terminal 8035 corresponds to the information terminal 961 in the third embodiment. The antenna 8125 corresponds to the antenna for IC card communication 103 in the third embodiment, the antenna 8145 corresponds to the antenna for IC card communication 123 in the third embodiment, and the GW 8055 corresponds to the GW 141 in the third embodiment.

[0300]

The charging management system 8071 receives history information of IC card such as entrances, exits, or purchase from the reader writer devices (8041, 8042, 8043, 8044, and 8045) of the ticket checker 8031, the ticket vending machines (8032 and 8033), the POS register terminal 8034, and the information terminal 8035. The charging management system 8071 accumulates the received history information in the card history database 8072.

[0301]

The reader writer devices (8041, 8042, 8043, 8044, and 8045) transmit behavior attribute information of the respective IC cards (8021, 8022, 8023, 8024, and 8025) to the

charging management system 8071. The charging management system 8071 transmits the transmitted behavior attribute information to the behavior attribute tabulation system 8073. The behavior attribute tabulation system 8073 accumulates the transmitted behavior attribute information in the behavior history database 8074.

[0302]

The charging management system 8071 corresponds to the charging management system 151 in Fig. 1, the behavior attribute tabulation system 8073 corresponds to the behavior attribute tabulation system 153 in Fig. 1, the card history database 8072 corresponds to the card history database 155 in Fig. 1, and the behavior history database 8074 corresponds to the behavior history database 154 in Fig. 1.

[0303]

An operator or the like inputs an instruction to the behavior attribute tabulation system 8073 using the terminal 8081. The behavior attribute tabulation system 8073 calculates statistical information of behavior attributes or calculates fluctuation in purchase attributes due to sales promotion activities of a specific shop according to the instruction input from the operator or the like. The terminal 8081 displays a result calculated by the behavior attribute tabulation system 8073.

[0304]

According to the third embodiment, information can be provided to the user by only the IC card 101 and the information terminal 961. Therefore, it is possible to provide a service conforming to the user even in an offline environment not connected to the network 152 or the like.

[0305]

The IC card 101 in the third embodiment is connected to the system including the ticket checker 161 of the station and the POS register terminal 145 of the shop via the network 152. Therefore, the IC card 101 can collect the behavior attribute data 113 generated by passage through the ticket checker 161 and the behavior attribute data 113 generated by the use of the POS register terminal 145 and can more complexly acquire behavior attributes of the user from score values of the collected behavior attribute data 113. The IC card 101 can provide a service most suitable for the user according to the complexly acquired behavior attributes.

[0306]

According to this embodiment, in the system of the electronic ticket and the electronic money in which the IC card 101 is used, it is possible to provide information provision services conforming to the behavior attributes of the user by updating and using the behavior attribute data 113 of the user retained in the IC card 101. Further, it is possible to implement these information provision services while

suppressing a substantial change of the system and reducing costs.

[0307]

The score value of the behavior attribute data 113 is dynamically changed according to a frequency of use of the ticket checker 161 or the POS register terminal 145. Therefore, the IC card system in this embodiment can cause the score values (503 and 523) of the behavior attribute data 113 to automatically follow a station in use, a behavior range, or a rhythm of life, which changes according to a transfer in work, house-moving, or the like or a change in a taste, an interest, or the like of the user. As a result, it is possible to provide a service most suitable for the user conforming to the latest state of the user.

[0308]

Further, the numbers of each entry group included in the behavior attribute data 113 are set in advance and only the behavior attribute data 113 with the high score values (503 and 523) is retained. Therefore, the IC card 101 in this embodiment can execute the processing in this embodiment using the nonvolatile data memory 108 having the limited capacity.

[0309]

Further, the IC card 101 in this embodiment can transmit, through the behavior attribute readout processing 119, only the behavior attribute data 113 with the high score value (503

and 523) to the reader writer devices (121, 621, and 921). Therefore, it is possible to end the communication between the IC card 101 and the reader writer devices (121, 621, and 921) in a sufficiently short time.

Reference Signs List

[0310]

- 101 IC card
- 102 IC card communication IF (interface)
- 103 Antenna
- 104 Power supply circuit
- 105 CPU
- 106 Work memory
- 107 Program memory
- 108 Nonvolatile data memory
- 109 Authentication mechanism
- 111 Balance data
- 112 Ticket gate passage data
- 113 Behavior attribute data
- 115 Ticket processing
- 116 Charging processing
- 117 Entrance processing
- 118a Behavior attribute recording processing (stay)
- 118b Behavior attribute recording processing
(purchase)

119 Behavior attribute readout processing
121 Reader writer device
122 IC card communication IF
123 Antenna for IC card communication
124 CPU
125 Work memory
126 Program memory
127 Authentication mechanism
129 Display IF
130 Display
131 Apparatus control mechanism
132 Gate
135 Fare calculation processing
136 Charging processing
137 Entrance processing
138 Behavior attribute readout processing
139 Information presentation processing
141 Gateways (GWs)
142 Network
151 Charging management system
152 Network
153 Behavior attribute tabulation system
154 Behavior attribute database
155 Card history database

CLAIMS

[Claim 1]

An IC card system comprising:

an IC card; and

a plurality of terminals that communicate with the IC card, wherein

the plurality of terminals include at least one first terminal of the terminals in which a first identifier is set and at least one second terminal of the terminals in which a second identifier is set,

when communicating with the IC card, the first terminal transmits the first identifier and a date and time when the first terminal and the IC card communicate with each other to the IC card,

the IC card calculates, on the basis of the information transmitted from the first terminal, a first score value indicating a frequency of the communication between the first terminal and the IC card and retains first attribute data including the first score value and the first identifier,

when communicating with the IC card, the second terminal transmits the second identifier and a date and time when the second terminal and the IC card communicate with each other to the IC card, and

the IC card updates the first score value on the basis of the date and time when the first terminal and the IC card

communicate with each other and a date and time when the second terminals and the IC card communicate with each other, calculates, on the basis of the information transmitted from the second terminals, a second score value indicating a frequency of the communication between the second terminal and the IC card, generates second attribute data including the second score value and the second identifier, when a total number of the first attribute data and the second attribute data exceeds a predetermined number, compares the updated first score value and the calculated second score value, and, when the second score value is larger than the first score value as a result of the comparison, retains the second attribute data.

[Claim 2]

The IC card system according to claim 1, wherein the communication between the terminal and the IC card is classified into a plurality of groups,

the predetermined number is a number of the attribute data included in each group, and

the IC card allocates a first group of the groups to the first attribute data and, when the second attribute data is allocated with the first group and a total number of the first attribute data and the second attribute data exceeds the predetermined number, compares the updated first score value and the calculated second score value.

[Claim 3]

The IC card system according to claim 2, wherein
the first terminal includes a third terminal of the
terminals and a fourth terminal of the terminals, and
when communicating with the fourth terminal following
communication with the third terminal, the IC card determines,
according to a date and time when the third terminal and the
IC card communicate with each other and a date and time when
the fourth terminal and the IC card communicate with each other,
the first group to which the first attribute data is allocated.

[Claim 4]

The IC card system according to claim 2, wherein
when communicating with a fifth terminal of the terminals
in which a third identifier is set, the IC card transmits the
retained attribute data to the fifth terminal, and

the fifth terminal extracts the attribute data including
the third identifier among the attribute data, specifies the
group allocated to the extracted attribute data, and presents,
according to the specified group, information related to the
group.

[Claim 5]

The IC card system according to claim 1, wherein
the terminal is classified into a plurality of types,
the first and second identifiers indicate types into
which the first and second terminals are classified,
the predetermined number is a total number of the

plurality of types, and

when the first identifier is different from the second identifier and a total number of the first identifier and the second identifier exceeds the predetermined number, the IC card compares the updated first score value and the calculated second score value.

[Claim 6]

The IC card system according to claim 1, wherein the first terminal includes a sixth terminal of the terminals and a seventh terminal of the terminals, and

when communicating with the seventh terminal following communication with the sixth terminal, the IC card calculates an interval of communication with the first terminal by subtracting a date and time when the sixth terminal and the IC card communicate with each other from a date and time when the seventh terminal and the IC card communicate with each other and calculates the score value using a damping function including the calculated interval of communication as an argument.

[Claim 7]

The IC card system according to claim 6, wherein the IC card calculates the score value using a damping function including a value obtained by subtracting an offset value from the interval of communication as an argument.

[Claim 8]

The IC card system according to claim 7, wherein
the damping function is a saturation function, and
the IC card retains a number of days in which the damping
function is saturated and sets the offset value according to
the number of days in which the damping function is saturated.

[Claim 9]

A data collecting method by an IC card system including
an IC card and a plurality of terminals that communicate with
the IC card,

the plurality of terminals including at least one first
terminal of the terminals in which a first identifier is set
and at least one second terminal of the terminals in which a
second identifier is set,

the method comprising:

when communicating with the IC card, the first terminal
transmitting the first identifier and a date and time when the
first terminal and the IC card communicate with each other to
the IC card;

the IC card calculating, on the basis of the information
transmitted from the first terminal, a first score value
indicating a frequency of the communication between the first
terminal and the IC card;

the IC card retaining first attribute data including the
first score value and the first identifier;

when communicating with the IC card, the second terminal

transmitting the second identifier and a date and time when the second terminal and the IC card communicate with each other to the IC card;

the IC card updating the first score value on the basis of the date and time when the first terminal and the IC card communicate with each other and a date and time when the second terminals and the IC card communicate with each other;

the IC card calculating, on the basis of the information transmitted from the second terminals, a second score value indicating a frequency of the communication between the second terminal and the IC card;

the IC card generating second attribute data including the second score value and the second identifier;

when a total number of the first attribute data and the second attribute data exceeds a predetermined number, the IC card comparing the updated first score value and the calculated second score value; and

when the second score value is larger than the first score value as a result of the comparison, the IC card retaining the second attribute data.

[Claim 10]

The data collecting method according to claim 9, wherein the communication between the terminal and the IC card is classified into a plurality of groups,

the predetermined number is a number of the attribute data included in each group, and

the method further comprises:

the IC card allocating a first group of the groups to the first attribute data; and

when the second attribute data is allocated with the first group and a total number of the first attribute data and the second attribute data exceeds the predetermined number, the IC card comparing the updated first score value and the calculated second score value.

[Claim 11]

The data collecting method according to claim 10, wherein the first terminal includes a third terminal of the terminals and a fourth terminal of the terminals, and

the method further comprises:

when communicating with the fourth terminal following communication with the third terminal, the IC card determining, according to a date and time when the third terminal and the IC card communicate with each other and a date and time when the fourth terminal and the IC card communicate with each other, the first group to which the first attribute data is allocated.

[Claim 12]

The data collecting method according to claim 10, further comprising:

when communicating with a fifth terminal of the terminals in which a third identifier is set, the IC card transmitting the retained attribute data to the fifth terminal;

the fifth terminal extracting the attribute data including the third identifier among the attribute data;

the fifth terminal specifying the group allocated to the extracted attribute data; and

the fifth terminal presenting, according to the specified group, information related to the group.

[Claim 13]

The data collecting method according to claim 9, wherein the terminal is classified into a plurality of types, the first and second identifiers indicate types into which the first and second terminals are classified respectively,

the predetermined number is a total number of the plurality of types, and

the method further comprises, when the first identifier is different from the second identifier and a total number of the first identifier and the second identifier exceeds the predetermined number, the IC card comparing the updated first score value and the calculated second score value.

[Claim 14]

The data collecting method according to claim 9, wherein the first terminal includes a sixth terminal of the terminals and a seventh terminal of the terminals, and

the method further comprises:

when communicating with the seventh terminal following

communication with the sixth terminal, the IC card calculating an interval of communication with the first terminal by subtracting a date and time when the sixth terminal and the IC card communicate with each other from a date and time when the seventh terminal and the IC card communicate with each other; and

the IC card calculating the score value using a damping function including the calculated interval of communication as an argument.

[Claim 15]

The data collecting method according to claim 14, further comprising the IC card calculating the score value using a damping function including a value obtained by subtracting a predetermined offset value from the interval of communication as an argument.

[Claim 16]

The data collecting method according to claim 15, wherein the damping function is a saturation function, and the method further comprises:

the IC card retaining a number of days in which the damping function is saturated; and

the IC card setting the offset value according to the number of days in which the damping function is saturated.