

[DESCRIPTION]

[TITLE OF INVENTION]

VEHICLE POSITION UTILIZATION SYSTEM, ON-BOARD UNIT, AND PROGRAM

[Technical Field]

5 [0001]

The present invention relates to a vehicle position utilization system, an on-board unit, and a program.

Priority is claimed on Japanese Patent Application No. 2014-177872, filed September 2, 2014, the content of which is incorporated herein by reference.

10 [Background Art]

[0002]

For example, there is an on-board unit that performs short-range wireless communication with a roadside wireless device provided at a tollgate using radio waves and performs a data transmission/reception process necessary for paying a toll of a toll road (for example, see Patent Literature 1).

Early-morning use may be increased by making an early-morning fee cheap on this toll road and traffic congestion may be reduced during the day. Also, congestion on a general road may be reduced by making the toll cheap and use of toll roads may be promoted by allowing the same route to be taken on a toll road a plurality of times. In this manner, traffic congestion may be reduced by implementing a discount service on a toll road on which a toll is imposed.

Also, it may be possible to create a traffic flow in which vehicles visit service areas or the like by guiding vehicles to service areas or shops on their way using advertisements, promotions, etc.

25 [Citation List]

[Patent Literature]

[0003]

[Patent Literature 1]

Japanese Unexamined Patent Application, First Publication No. 2013-020474

5 [Summary of Invention]

[Technical Problem]

[0004]

However, the adjustment of traffic flow by an early-morning discount, an advertisement, or the like is limited and traffic flow may not be able to be efficiently
10 adjusted. Also, installation costs are incurred when inducers, signboards and advertisements are installed to adjust the traffic flow.

[0005]

Therefore, the present invention provides a vehicle position utilization system, an on-board unit, and a program capable of efficiently adjusting a traffic flow.

15 [Solution to Problem]

[0006]

A vehicle position utilization system (1) according to an aspect of the present invention includes a log information acquiring unit (402) configured to acquire log information based on a result of detecting a position of a vehicle; and a determination
20 unit (403) configured to determine an effect according to a satisfied assignment condition for a user of the vehicle if a situation indicated by the log information acquired by the log information acquiring unit satisfies a predetermined assignment condition.

Through this configuration, it is possible to determine a predetermined effect for the user by utilizing the detected position of the vehicle. The user is expected to travel
25 along a route that satisfies the assignment condition while expecting the predetermined

effect. Therefore, it is possible to efficiently adjust the traffic flow.

[0007]

Also, according to an aspect of the present invention, in the above-described vehicle position utilization system, the determination unit determines the result if at least
5 one of a transit point, a transit route, a transit area, the number of transits, a stop point, and a stop time of the vehicle indicated by the log information satisfies the assignment condition.

Through this configuration, it is possible to determine whether or not the assignment condition is satisfied using the detected log information.

10 For example, the present invention is effective when the guidance for a transit point such as a service area or a shopping mall is desired, when a stay at a transit point for a long time is desired, when passing through a detour route is desired, or the like.

[0008]

Also, according to an aspect of the present invention, in the above-described
15 vehicle position utilization system, the determination unit determines the result if a charging result of a toll road on which the vehicle has traveled satisfies the assignment condition.

Through this configuration, it is possible to determine whether the assignment condition is satisfied using a result of executing a charging process.

20 Thereby, it is possible to change an effect assigned according to an amount of toll road usage and further promote the use thereof.

[0009]

Also, according to an aspect of the present invention, the above-described vehicle position utilization system includes a search unit (502) configured to search for a
25 situation capable of satisfying the assignment condition on the basis of a position of the

vehicle; and a guidance information generating unit (503) configured to generate and output information for guidance to the situation capable of satisfying the assignment condition obtained by the search of the search unit.

Through this configuration, it is possible to provide information for guiding the vehicle to a predetermined route according to the current position of the vehicle by utilizing the detected position of the vehicle.

For example, when the vehicle is located at a junction, guidance information indicating that “no points are assigned if the vehicle travels to a destination along a route A, but points are assigned if the vehicle travels to the destination along a route B” can be provided. Thereby, a vehicle scheduled to travel along the route A can be guided to the route B. Also, when the vehicle is located at a route point P2, it is possible to provide guidance information indicating that points are assigned if the vehicle stays at the route point P2 for a predetermined time or more. Thereby, it is possible to promote shopping at the route point P2.

[0010]

Also, according to an aspect of the present invention, in the above-described vehicle position utilization system, the log information acquiring unit acquires the log information from an on-board unit that detects a current position using a satellite positioning system and the determination unit manages the determined effect in association with vehicle information about the vehicle equipped with the on-board unit.

Through this configuration, because the determined points and the like are associated with the vehicle information, the illegal resale of points can be prevented.

Also, even when points are used to pay the toll of the same on-board unit, it is possible to easily implement the use of points using common vehicle information.

[0011]

Also, according to an aspect of the present invention, there is provided an on-board unit including a log information acquiring unit configured to acquire log information based on a result of detecting a position of a vehicle and a communication unit configured to transmit the log information acquired by the log information acquiring unit to an external server, wherein an effect according to a satisfied assignment condition is determined by the external server for a user of the vehicle if a situation indicated by the log information acquired by the log information acquiring unit satisfies a predetermined assignment condition.

[0012]

Also, according to an aspect of the present invention, there is provided a program for causing a computer to function as: a log information acquiring means configured to acquire log information based on a result of detecting a position of a vehicle; and a determination means configured to determine an effect according to a satisfied assignment condition for a user of the vehicle if a situation indicated by the log information acquired by the log information acquiring means satisfies a predetermined assignment condition.

[0013]

Also, according to an aspect of the present invention, the above-described program is a program for causing the computer further to function as: a search means configured to search for a situation capable of satisfying the assignment condition on the basis of a position of the vehicle; and a guidance information generating means configured to generate and output information for guidance to the situation capable of satisfying the assignment condition obtained by the search of the search means.

[Advantageous Effects of Invention]

[0014]

According to the vehicle position utilization system, the on-board unit, and the program described above, it is possible to efficiently adjust a traffic flow.

[Brief Description of Drawings]

[0015]

5 Fig. 1 is a schematic diagram illustrating an example of a vehicle position utilization system 1 according to an embodiment of the present invention.

Fig. 2 is a diagram illustrating examples of configurations of a global navigation satellite system (GNSS) on-board unit 10 and an IC card 20.

10 Fig. 3 is a diagram illustrating an example of a configuration of a point assigning server 40.

Fig. 4 is a diagram illustrating an example of assignment condition information 406.

Fig. 5 is a diagram illustrating examples of a route and an area.

15 Fig. 6 is a diagram illustrating an example of a configuration of a guidance information providing server 50.

Fig. 7 is a flowchart illustrating an example of a vehicle position utilization method of a vehicle position utilization system 1.

Fig. 8 is a flowchart illustrating an example of a processing flow of the GNSS on-board unit 10.

20 Fig. 9 is a flowchart illustrating an example of a processing flow of the point assigning server 40.

Fig. 10 is a flowchart illustrating an example of a processing flow of the guidance information providing server 50.

[Description of Embodiments]

25 [0016]

[First embodiment]

Hereinafter, an example of a vehicle position utilization system 1 according to an embodiment of the present invention is shown. Fig. 1 is a schematic diagram illustrating an example of the vehicle position utilization system 1 according to the
5 embodiment of the present invention.

[0017]

(Overall configuration)

As illustrated in Fig. 1, the vehicle position utilization system 1 includes a GNSS on-board unit 10, an IC card 20, a user terminal 30, a point assigning server 40,
10 and a guidance information providing server 50. The GNSS on-board unit 10 and the user terminal 30 are connected via a third generation (3G) network or dedicated short range communication (DSRC) communication.

[0018]

The GNSS on-board unit 10 is mounted on a vehicle and acquires position
15 information of the vehicle using a GNSS. Also, the GNSS on-board unit 10 performs a process of paying a toll or the like on the basis of wireless communication with a roadside antenna provided at an entrance/exit or the like of a toll road using so-called DSRC communication.

[0019]

20 The IC card 20 communicates with the GNSS on-board unit 10 in a state in which the IC card 20 has been inserted into a predetermined card insertion slot of the GNSS on-board unit 10. In the IC card 20, for example, information about the vehicle equipped with the GNSS on-board unit 10 (hereinafter referred to as vehicle information) is pre-registered. The vehicle information includes, for example, identification
25 information specific to the GNSS on-board unit 10, an identification number specific to

the on-board unit, a vehicle number, and the like.

[0020]

The user terminal 30 is a terminal such as a mobile phone, a smartphone, a tablet terminal, a personal computer, or the like. The user terminal 30 is a terminal of a user who uses the vehicle equipped with the GNSS on-board unit 10, and information for associating the GNSS on-board unit 10 and the user terminal 30 is stored in the guidance information providing server 50.

[0021]

The point assigning server 40 is communicably connected to the GNSS on-board unit 10 and the user terminal 30 via the network. When the state of the vehicle equipped with the GNSS on-board unit 10 (for example, a traveling route, a stop position for a long time, or the like) satisfies a predetermined assignment condition, the point assigning server 40 assigns an effect according to the satisfied assignment condition to a user of the vehicle equipped with the GNSS on-board unit 10. In the embodiment, the point assigning server 40 assigns positive points as the effect according to the assignment condition, but the present invention is not limited thereto. For example, negative points may be assigned. The information for associating the GNSS on-board unit 10 and the user terminal 30 with the points assigned to the user is stored in the point assigning server 40.

[0022]

The guidance information providing server 50 is communicably connected to the GNSS on-board unit 10 and the user terminal 30 via the network. The guidance information providing server 50 generates guidance information according to the current position of the vehicle equipped with the GNSS on-board unit 10. In the embodiment, the guidance information is information for guiding the vehicle to a situation capable of

satisfying the assignment condition. For example, when it is predetermined that points are assigned to a vehicle traveling along a predetermined traveling route as the assignment condition, the guidance information providing server 50 generates information for guiding the vehicle to travel along the predetermined traveling route.

- 5 Also, when it is predetermined that points are assigned to a vehicle stopping at a predetermined point as an assignment condition, the guidance information providing server 50 generates guidance information for the vehicle to stop for a predetermined time or more at a predetermined point.

[0023]

10 (Configurations of GNSS on-board unit 10 and IC Card 20)

Next, the configuration of the GNSS on-board unit 10 and the IC card 20 will be described in detail with reference to Fig. 2. Fig. 2 is a diagram illustrating examples of configurations of the GNSS on-board unit 10 and the IC card 20.

- As illustrated in Fig. 2, the GNSS on-board unit 10 includes a communication
15 unit 101, a sensor 102, a GNSS reception unit 103, a clock 104, a reader-writer 105, an on-board unit control unit 106, and a storage unit 107.

[0024]

- The communication unit 101 transmits information indicating a current position of the GNSS on-board unit 10 and the like to the point assigning server 40 and the
20 guidance information providing server 50 via a wide area network such as the Internet. Also, the communication unit 101 receives entrance information, a command, and/or the like from the roadside antenna 60 via a narrow area network of DSRC or the like and transmits information and the like read from the IC card 20.

[0025]

- 25 The sensor 102 includes an acceleration sensor, a vehicle speed sensor, a gyro

sensor, and the like, detects a state change of the vehicle equipped with the GNSS on-board unit 10, and outputs a detection result to the on-board unit control unit 106.

[0026]

The GNSS reception unit 103 receives radio waves from satellites and outputs
5 information extracted from the radio waves to the on-board unit control unit 106.

The clock 104 outputs information indicating a current date and time
(hereinafter referred to as date and time information) to the on-board unit control unit
106.

The reader-writer 105 accesses the IC card 20 to read and write information.

10 [0027]

The on-board unit control unit 106 is, for example, a central processing unit
(CPU), and generally controls the GNSS on-board unit 10. The GNSS on-board unit 10
includes a log information generating unit 161 and a charging processing unit 162 as
functional units that function by the on-board unit control unit 106, which is the CPU,
15 executing a program. Some or all of these functional units may be hardware functional
units such as a large scale integration (LSI) and an application specific integrated circuit
(ASIC).

[0028]

On the basis of information from the sensor 102 and the GNSS reception unit
20 103, the log information generating unit 161 obtains a current position (for example,
coordinate values on the Earth) of the vehicle equipped with the GNSS on-board unit 10
and captures the traveling route. For example, the log information generating unit 161
compares map information 171 stored in the storage unit 107 with the current position of
the vehicle, and captures a link ID of a road on which the vehicle is traveling. The map
25 information includes a link ID for identifying each road. Links are connected by nodes

corresponding to intersections and the like, and the map information includes a node ID for identifying each node.

[0029]

The log information generating unit 161 controls the reader-writer 105 so that
5 information indicating the captured traveling route and the traveling date and time
(hereinafter referred to as traveling log information) is written to the IC card 20. In the
embodiment, the traveling log information is information in which the captured link ID
and the traveling date and time are associated.

An interval for capturing the link ID is predetermined.

10 Also, the log information generating unit 161 determines whether or not the
vehicle equipped with the GNSS on-board unit 10 is stopped. If it is determined that
the vehicle is stopped, the log information generating unit 161 writes information
indicating a stop position, a stop date and time, a stop time, and the like (hereinafter
referred to as stop log information) to the IC card 20. The log information generating
15 unit 161 may determine that the vehicle is stopped when the current position of the
vehicle does not change for a predetermined time or more or determine that the vehicle is
stopped when it is detected that the ignition of the vehicle has been turned off.

[0030]

The charging processing unit 162 executes a charging process of a toll on the
20 basis of information received from the roadside antenna 60 via the communication unit
101. For example, when the vehicle passes through an entrance gate of a toll road, the
GNSS on-board unit 10 receives entrance information indicating an entrance from the
roadside antenna 60 installed at an entrance gate and writes the entrance information to
the IC card 20. When the vehicle passes through an exit gate of the toll road, the GNSS
25 on-board unit 10 receives a command for requesting the execution of the charging

process from the roadside antenna 60 installed at the exit gate and executes the charging process of the toll on the basis of entrance information and the vehicle information stored in the IC card 20. The charging processing unit 162 writes a result of the information indicating a toll obtained by executing the charging process and the date and time of the process (hereinafter referred to as charging result information) to the IC card 20.

[0031]

Also, the charging processing unit 162 may execute the toll charging process using electronic money stored in the IC card 20 or may request an external server of a credit card company or the like to perform the charging process using vehicle information stored in the IC card 20. Also, the process of the charging processing unit 162 may be a process of deducting the toll calculated by a server on the toll road side connected to the roadside antenna 60 or the toll may be calculated independently.

[0032]

The IC card 20 includes an IC card control unit 201 and a storage unit 202.

The IC card control unit 201 is, for example, a CPU, and reads and writes information from and to the storage unit 202 on the basis of a command from the reader-writer 105 of the GNSS on-board unit 10.

In the storage unit 202, entrance information 203, vehicle information 204, charging result information 205, traveling log information 206, and stop log information 207 are stored.

The entrance information 203 is entrance information received by the GNSS on-board unit 10 from the roadside antenna 60.

[0033]

The vehicle information 204 is information about the vehicle equipped with the GNSS on-board unit 10. The vehicle information 204 includes identification

information specific to the GNSS on-board unit 10, a number of the vehicle, and/or the like.

The charging result information 205 is information in which the result of the charging process executed by the GNSS on-board unit 10 and the date and time on which the charging process has been executed are associated.

The traveling log information 206 is a log of the traveling route of the vehicle acquired by the GNSS on-board unit 10. In the embodiment, the traveling log information 206 is information in which the captured link ID is associated with the traveling date and time.

The stop log information 207 is a log of a stopped state of the vehicle acquired by the GNSS on-board unit 10. In the embodiment, the stop log information 207 is information in which a stop position, a stop date and time, a stop time, and the like are associated. If the stop time is less than 0 min, simply passing is determined.

[0034]

(Configuration of point assigning server 40)

Next, the configuration of the point assigning server 40 will be described in detail with reference to Fig. 3. Fig. 3 is a diagram illustrating an example of a configuration of the point assigning server 40.

As illustrated in Fig. 3, the point assigning server 40 includes a communication unit 401, a log information acquiring unit 402, a determination unit 403, and a storage unit 404.

The communication unit 401 receives charging result information, traveling log information, stop log information, and the like from the GNSS on-board unit 10 via a wide area network such as the Internet. Also, the communication unit 401 transmits information indicating details of points assigned to the user terminal 30 of the user to

whom points are assigned (hereinafter referred to as point information).

[0035]

The log information acquiring unit 402 acquires the log information from the GNSS on-board unit 10 via the communication unit 401 and writes the acquired log
5 information to the storage unit 404. The log information is log information based on the position of the vehicle and includes traveling log information, stop log information, and the like. In the embodiment, the log information includes vehicle information, payment result information, point information, and/or the like.

[0036]

10 When a situation indicated by the log information acquired by the log information acquiring unit 402 satisfies a predetermined assignment condition, the determination unit 403 determines an effect according to the satisfied assignment condition for the user of the vehicle.

[0037]

15 The storage unit 404 stores log information 405 and assignment condition information 406. The log information 405 includes log information acquired from each on-board unit. In the assignment condition information 406, points assigned according to the traveling route and points assigned according to the stop point are defined.

[0038]

20 Here, the assignment condition information 406 will be described in detail with reference to Fig. 4. Fig. 4 is a diagram illustrating an example of the assignment condition information 406.

As illustrated in Fig. 4, the assignment condition information 406 is stored in a table in which an assignment condition number, an area ID, a route ID, a stop time-
25 condition, a number-of-times condition, an effective period, points, and remarks are

associated.

The assignment condition number is a sequentially allocated number for each assignment condition.

5 The area ID is identification information indicating a predetermined area. In the embodiment, the area ID is a management area for each business operator of a toll road, but the present invention is not limited thereto. The area ID may be a unit such as a municipality or a prefecture.

[0039]

10 The route ID is identification information indicating a route of a route point to which points are assigned. Each route may have only one route point and the route also includes an order of route points when a plurality of route points is included.

Information indicating the details of each route is associated with a route ID in another table. In the embodiment, in the details of each route, a route point is indicated by a node ID of a road or coordinate values indicating a predetermined position.

15 [0040]

The stop time condition is the condition of the stop time to which points are assigned.

The number-of-times condition is a condition of the number of iterations in which points are assigned.

20 The effective period is a deadline before which the assigned points are available.

The points are points to be assigned when the assignment condition is satisfied.

The remarks are other information such as reference information when points are converted.

[0041]

25 Here, an example in which the assignment condition prescribed in the

assignment condition information 406 illustrated in Fig. 4 is satisfied will be described.

By setting assignment condition No. 1, 5 points are assigned to a vehicle passing through route points “P1” → “P3” in this order once.

By setting assignment condition No. 3, 20 points are assigned to a vehicle
5 passing through route points “P1” → “P3” in this order five or more times.

By setting assignment condition No. 5, 30 points are assigned to a vehicle passing through route points “P1” → “P2” → “P3” in this order once.

By setting assignment condition No. 2, 20 points are assigned to a vehicle passing through the route points “P1” → “P2” → “P3” in this order once and stopping
10 for 10 min or more at each of route points “P1,” “P2,” and “P3.”

By setting assignment condition No. 4, 20 points are assigned to a vehicle stopping for 60 min or more at the route point “P2.”

[0042]

Assignment condition No. 1 is an effective condition when transiting along the
15 route connecting the route points “P1” and “P3” is desired to be promoted.

Assignment condition No. 3 is an effective condition when the number of transits of the route connecting the route points “P1” and “P3” is desired to be increased.

Assignment condition No. 5 is an effective condition when transiting along the route connecting the route points “P1,” “P2,” and “P3” is desired to be promoted.

20 Assignment condition No. 2 is an effective condition when transiting along the route connecting the route points “P1,” “P2,” and “P3” is desired to be promoted and a stay at each route point is desired to be promoted.

Assignment condition No. 4 is an effective condition when a stay for a long time at the route point “P2” is desired to be promoted.

25 [0043]

By combining a plurality of assignment conditions, it is possible to set the assignment condition according to a request. For example, when the assignment condition No. 4 is additionally set in a state in which assignment condition No. 5 is established, it is possible to set an assignment condition for promoting a stay for a long
5 time at the route point “P2.”

[0044]

Next, a route and an area will be described with reference to Fig. 5. Fig. 5 is a diagram illustrating examples of a route and an area.

As illustrated in Fig. 5, a group α includes an area A including a toll road of a
10 business operator A, an area B including a toll road of a business operator B, and an area C including a toll road of a business operator C. Each of points “P1 to P3” in the areas A to C is a service area or an interchange of a toll road.

[0045]

(Configuration of guidance information providing server 50)

15 Next, the configuration of the guidance information providing server 50 will be described in detail with reference to Fig. 6. Fig. 6 is a diagram illustrating an example of a configuration of the guidance information providing server 50.

As illustrated in Fig. 6, the guidance information providing server 50 includes a communication unit 501, a search unit 502, a guidance information generating unit 503,
20 and a storage unit 504. The storage unit 504 stores assignment condition information 505 and map information 506. In the embodiment, the assignment condition information 505 is the same information as the information illustrated in Fig. 4.

The communication unit 501 receives information indicating the current position of the vehicle (hereinafter referred to as current position information) from the GNSS
25 on-board unit 10 via a wide area network such as the Internet. Also, the communication

unit 401 transmits the guidance information generated by the guidance information generating unit 503 to the user terminal 30.

[0046]

The search unit 502 acquires the current position information from the GNSS on-board unit 10 via the communication unit 501, refers to the assignment condition information 505 stored in the storage unit 504, and searches for a situation in which the current position of the vehicle equipped with the GNSS on-board unit 10 can satisfy the assignment condition. For example, when the vehicle equipped with the GNSS on-board unit 10 is located at “P1” of the area A, the search unit 502 obtains assignment condition Nos. 1 to 5 by a search because assignment condition Nos. 1 to 5 can be satisfied.

[0047]

The guidance information generating unit 503 generates information for guidance to a situation in which the assignment condition obtained by the search of the search unit 502 can be satisfied and transmits the information to the user terminal 30 via the communication unit 501. For example, when assignment condition Nos. 1 to 5 are obtained by the search and when assignment conditions of assignment condition Nos. 1 to 5 are satisfied, the guidance information generating unit 503 creates a message indicating that each assignment condition and points corresponding thereto are assigned. Here, the guidance information generating unit 503 may include assignable points in the guidance information and present the guidance information.

Here, when there is a plurality of assignment conditions obtained by the search unit 502, the guidance information generating unit 503 may extract some assignment conditions from among the plurality of assignment conditions in descending order of the number of points to be assigned and generate guidance information on the basis of the

extracted assignment conditions. For example, information for guidance to only assignment condition No. 5 with the largest number of points among assignment condition Nos. 1 to 5 may be generated.

[0048]

5 (Vehicle position utilization method of vehicle position utilization system 1)

Next, the vehicle position utilization method of the vehicle position utilization system 1 will be described with reference to Fig. 7. Fig. 7 is a flowchart illustrating an example of the vehicle position utilization method of the vehicle position utilization system 1.

10 The GNSS on-board unit 10 receives a GNSS signal (step ST1) and obtains a current position of the vehicle equipped with the GNSS on-board unit 10 on the basis of the received GNSS signal.

Next, the GNSS on-board unit 10 reads the vehicle information from the IC card 20, associates the vehicle information with information indicating the obtained current position, and transmits the associated information to the guidance information providing server 50 (step ST2).

[0049]

The guidance information providing server 50 receives information indicating the current position of the vehicle from the GNSS on-board unit 10 (step ST3) and searches for assignment conditions that the vehicle can satisfy in the future on the basis of the received current position of the vehicle. When an assignment condition capable of being satisfied is obtained by the search, the guidance information providing server 50 generates guidance information for guidance to a situation in which the assignment condition obtained by the search can be satisfied.

25 When the guidance information has been generated (Yes in step ST4), the

guidance information providing server 50 transmits the generated guidance information to the user terminal 30 of an email address associated with vehicle information (step ST5).

[0050]

5 The user terminal 30 outputs guidance information received from the guidance information providing server 50 from its own display or the like (step ST6).

 Thereby, it is possible to provide the guidance information to the user terminal 30 of the user associated with the vehicle equipped with the GNSS on-board unit 10.

 The user viewing the guidance information may change a route from a current position to
10 a destination to a route according to the guidance information. Consequently, it is possible to guide the vehicle to a predetermined route using the current position of the vehicle equipped with the GNSS on-board unit 10.

[0051]

 Also, the GNSS on-board unit 10 creates traveling log information and/or stop
15 log information from the current position of the vehicle obtained on the basis of a GNSS signal (step ST7).

 The GNSS on-board unit 10 writes the created traveling log information and/or stop log information to the IC card 20 (step ST8) and the storage unit of the IC card 20 stores the traveling log information and the stop log information (step ST9).

20 Next, the GNSS on-board unit 10 reads the vehicle information from the IC card 20, and associates the vehicle information with the created traveling log information and/or stop log information, and transmits the associated information to the point assigning server 40 (step ST10). The point assigning server 40 associates the vehicle information with the traveling log information and/or the stop log information and writes
25 the associated information in its own storage unit (step ST11).

[0052]

Further, when a command indicating a charging process has been received from the roadside antenna 60 (Yes in step ST12), the GNSS on-board unit 10 executes the charging process.

5 After executing the charging process, the GNSS on-board unit 10 prepares charging result information (step ST13) and writes the charging result information into the IC card 20 (step ST14). The storage unit of the IC card 20 stores the charging result information (step ST15).

Also, the GNSS on-board unit 10 reads the vehicle information from the IC card
10 20, associates the vehicle information with the generated charging result information, and transmits the associated information to the point assigning server 40 (step ST16). The point assigning server 40 associates the vehicle information with the charging result information and writes the associated information to its own storage unit (step ST17). In the embodiment, as described above, the traveling log information and/or the stop log
15 information written in step ST11 and the charging result information written in step ST17 are referred to as log information.

[0053]

The point assigning server 40 reads the log information associated with the same vehicle information from the storage unit and determines whether or not the situation
20 indicated by the log information satisfies the assignment condition (step ST18). When it is determined that the assignment condition is satisfied, the point assigning server 40 assigns points according to the assignment condition and writes the number of points to the storage unit in association with the vehicle information.

Then, the point assigning server 40 transmits information indicating details of
25 the assigned points to the user terminal 30 of the email address associated with the

vehicle information (step ST19).

The user terminal 30 outputs the details of the points received from the point assigning server 40 from its own display or the like (step ST20).

[0054]

5 (Processing flow of GNSS on-board unit 10)

Next, the processing flow of the GNSS on-board unit 10 will be described with reference to Fig. 8. Fig. 8 is a flowchart illustrating an example of the processing flow of the GNSS on-board unit 10.

The GNSS reception unit 103 receives radio waves from a satellite (step ST101),
10 and outputs information extracted from the radio waves to the on-board unit control unit 106.

On the basis of the information from the sensor 102 and the GNSS reception unit 103, the log information generating unit 161 obtains the current position (for example, coordinate values on the Earth) of the vehicle equipped with the GNSS
15 on-board unit 10 (step ST102).

For example, the log information generating unit 161 compares the map information 171 stored in the storage unit 107 with the current position of the vehicle and captures a link ID of a road on which the vehicle is traveling (step ST103).

Then, the log information generating unit 161 generates information indicating
20 the captured link ID and its traveling date and time (hereinafter referred to as “traveling log information”) and controls the reader-writer 105 so that the generated information is written to the IC card 20 (step ST104).

[0055]

Next, the log information generating unit 161 determines whether or not the
25 vehicle equipped with the GNSS on-board unit 10 has been stopped (step ST105). For

example, the log information generating unit 161 may determine that the vehicle has been stopped when the current position of the vehicle does not change for a predetermined time or more, and determine that the vehicle has been stopped when it is detected that the ignition of the vehicle has been turned off.

5 When it is determined that the vehicle has been stopped (YES in step ST105), the log information generating unit 161 determines whether or not the vehicle has been started (step ST106). For example, the log information generating unit 161 may determine that the vehicle has been started when the current position of the vehicle has changed or determine that the vehicle has been started when it is detected that the
10 ignition of the vehicle has been turned on.

[0056]

 When it is determined that the vehicle has started (YES in step ST106), the log information generating unit 161 calculates a time period from the time when it was determined that the vehicle had been stopped until it was determined that the vehicle had
15 started (hereinafter referred to as a stop time) (step ST107).

 Then, in addition to the calculated stop time, the log information generating unit 161 generates information indicating the stop position, the stop date and time and the like (stop log information), and writes the generated information to the IC card 20 (step ST108).

20 Also, the process of writing the traveling log information and the stop log information to the IC card 20 has been described here. However, when a command for requesting the execution of the charging process has been received from the roadside antenna 60, the charging processing unit 162 executes a process of performing the charging process and writing charging result information to the IC card 20.

25 [0057]

(Processing flow of point assigning server 40)

Next, the processing flow of the point assigning server 40 will be described with reference to Fig. 9.

Fig. 9 is a flowchart illustrating an example of the processing flow of the point
5 assigning server 40.

The log information acquiring unit 402 of the point assigning server 40 acquires the log information from the GNSS on-board unit 10 and writes the acquired information to the storage unit 404 (step ST201).

The determination unit 403 reads the traveling log information and the
10 assignment condition information 406 from the log information 405 of the storage unit 404, compares the read traveling log information with the assignment condition information 406, and determines whether the traveling log information satisfies at least one assignment condition (step ST202). For example, when the traveling log information includes a history indicating that the vehicle has traveled along the route of
15 transit points “P1” → “P3” of an area ID “A,” the determination unit 403 determines that assignment condition No. 1 and assignment condition No. 3 are satisfied.

[0058]

When the traveling log information satisfies at least one assignment condition (YES in step ST202), the determination unit 403 determines whether or not the
20 corresponding number of times satisfies the assignment condition (step ST203). For example, when the history indicating that the vehicle has traveled along the route of the transit points “P1” → “P3” of the area ID “A” is included only once in the traveling log information, the determination unit 403 determines that assignment condition No. 1 is satisfied but assignment condition No. 3 is not satisfied.

25 [0059]

When it is determined that the corresponding number of times satisfies the assignment condition (YES in step ST203), the determination unit 403 determines whether or not the stop log information satisfies the assignment condition (step ST204).

For example, in assignment condition No. 1, a stop time condition is 0 min, so
 5 the determination unit 403 determines that the stop log information satisfies the assignment condition. On the other hand, because the stop time condition is 10 min in the case of assignment condition No. 2, the determination unit 403 determines that the stop log information satisfies the assignment condition when the vehicle has been stopped for 10 min or more at each of transit points “P1, P2, and P3.”

10 When it is determined that the stop log information satisfies the assignment condition (YES in step ST204), the determination unit 403 determines points according to the assignment condition (step ST205). The determination unit 403 assigns the determined points in a predetermined method.

[0060]

15 When it is determined that the traveling log information does not satisfy the assignment condition in step ST202 (NO in step ST202), when it is determined that the corresponding number of times does not satisfy the assignment condition in step ST203 (NO in step ST203), or when it is determined that the stop log information does not satisfy the assignment condition in step ST204 (NO in step ST204), the determination
 20 unit 403 determines whether or not the charging result information satisfies the assignment condition (step ST206). For example, when a total amount of tolls collected for a toll road of a certain section (for example, an area A, a group α , etc.) for a certain period (for example, for a past month or the like) exceeds a predetermined amount of money, the determination unit 403 determines that the charging result information
 25 satisfies the assignment condition. When it is determined that the charging result

information satisfies the assignment condition (YES in step ST206), the determination unit 403 determines points according to the assignment condition (step ST205).

[0061]

(Processing flow of guidance information providing server 50)

5 Next, the processing flow of the guidance information providing server 50 will be described with reference to Fig. 10. Fig. 10 is a flowchart illustrating an example of the processing flow of the guidance information providing server 50.

The communication unit 501 acquires current position information from the GNSS on-board unit 10 (step ST301).

10 The search unit 502 refers to the assignment condition information 505 stored in the storage unit 504 and searches for a situation in which the current position of the vehicle equipped with the GNSS on-board unit 10 can satisfy the assignment condition (step ST302). For example, when the vehicle equipped with the GNSS on-board unit 10 is located at “P1” of the area A, the search unit 502 obtains assignment condition Nos. 1
15 to 5 by the search because assignment condition Nos. 1 to 5 can be satisfied.

Next, the search unit 502 determines whether at least one assignment condition has been obtained by the search (step ST303).

[0062]

When at least one assignment condition is obtained by the search (YES in step
20 ST303), the search unit 502 determines whether or not the number of assignment conditions obtained by the search is greater than or equal to a threshold value (step ST304).

When the number of assignment conditions obtained by the search is greater than or equal to the threshold value (YES in step ST304), the search unit 502 extracts
25 some of the assignment conditions obtained by the search (step ST305).

For example, when the threshold value = 3, the number of assignment conditions Nos. 1 to 5 obtained by the search is greater than or equal to the threshold value. In this case, the search unit 502 extracts, for example, assignment condition No. 5 having the largest number of points, from among assignment conditions Nos. 1 to 5. Also, the search unit 502 may extract, for example, assignment condition No. 1 having the smallest number of points, from among assignment conditions Nos. 1 to 5.

[0063]

When the number of assignment conditions obtained by the search is less than the threshold value (NO in step ST304) or when some of the assignment conditions obtained by the search are extracted, the guidance information generating unit 503 generates guidance information for guidance to a situation capable of satisfying the assignment condition obtained by the search (step ST306).

The guidance information generating unit 503 transmits the generated guidance information to the user terminal 30 associated with the GNSS on-board unit 10 (step ST307).

[0064]

(Operation and effect)

As described above, the vehicle position utilization system 1 according to the present embodiment includes the log information acquiring unit 402 configured to acquire log information based on a result of detecting a position of a vehicle from the GNSS on-board unit 10; and the determination unit 403 configured to determine an effect according to a satisfied assignment condition for a user of the vehicle if a situation indicated by the log information satisfies a predetermined assignment condition.

Through this configuration, it is possible to assign a predetermined effect for the user by utilizing the position of the vehicle detected by the GNSS on-board unit 10.

The user is expected to travel along a route that satisfies the assignment condition while expecting the predetermined effect. Therefore, it is possible to efficiently adjust the traffic flow. Also, in order to obtain the predetermined effect, the introduction of the GNSS on-board unit 10 is promoted.

5 [0065]

Also, in the above-described vehicle position utilization system 1 according to the present embodiment, the determination unit 403 determines an effect of points or the like if at least one of a transit point, a transit route, a transit area, the number of transits, a stop point, and a stop time of the vehicle indicated by the log information satisfies the
10 assignment condition.

Through this configuration, it is possible to determine whether or not the assignment condition is satisfied using the log information detected by the GNSS on-board unit 10.

For example, the present invention is effective when the guidance for a transit
15 point such as a service area or a shopping mall is desired, when a stay at a transit point for a long time is desired, when passing through a detour route is desired, or the like.

[0066]

Also, in the vehicle position utilization system 1 according to the present embodiment, the determination unit 403 determines the effect if a charging result of a toll
20 road on which the vehicle has traveled satisfies the assignment condition.

Through this configuration, it is possible to determine whether the assignment condition is satisfied using a result of executing a charging process by the GNSS on-board unit 10.

Thereby, it is possible to change an effect assigned according to an amount of
25 use of a toll road and promote further use thereof.

[0067]

Also, the vehicle position utilization system 1 according to the present embodiment includes the search unit 502 configured to search for a situation capable of satisfying the assignment condition on the basis of a position of the vehicle; and the
5 guidance information generating unit 503 configured to generate and output information for guidance to the situation capable of satisfying the assignment condition obtained by the search of the search unit 502.

Through this configuration, it is possible to provide information for guiding the vehicle to a predetermined route according to the current position of the vehicle by
10 utilizing the position of the vehicle detected by the GNSS on-board unit 10.

For example, when the vehicle equipped with the GNSS on-board unit 10 is at a junction, guidance information indicating that “no points are assigned if the vehicle travels to a destination along a route A, but points are assigned if the vehicle travels to the destination along a route B” can be provided. Thereby, a vehicle scheduled to travel
15 along the route A can be guided to the route B. Also, when the vehicle equipped with the GNSS on-board unit 10 is located at a route point P2, it is possible to provide guidance information indicating that points are assigned if the vehicle stays at the route point P2 for a predetermined time or more. Thereby, it is possible to promote shopping or the like at the route point P2.

20 [0068]

Also, in the vehicle position utilization system 1 according to the present embodiment, the log information acquiring unit 402 acquires the log information from the GNSS on-board unit 10 that detects a current position using a satellite positioning system and the determination unit 403 manages the determined points or the like in
25 association with vehicle information about the vehicle equipped with the GNSS on-board

unit 10.

Through this configuration, because the assigned points and the like are associated with the vehicle information, the illegal resale of points can be prevented.

Also, even when points are used to pay the toll of the same GNSS on-board unit 10, it is possible to easily implement the use of points using common vehicle information.

[0069]

Also, in the vehicle position utilization system 1 according to the present embodiment, it is possible to control enlargement and reduction of the use range in units of areas by setting the assignment condition for each area ID.

10 [0070]

(Replacement and change of each component)

In addition, it is possible to replace the components in the above-described embodiment with well-known components without departing from the spirit and scope of the present invention. Also, the technical scope of the present invention is not limited to the above-described embodiments and various modifications can be made without departing from the spirit and scope of the present invention.

15 to the above-described embodiments and various modifications can be made without departing from the spirit and scope of the present invention.

[0071]

For example, the components of the point assigning server 40 and the guidance information providing server 50 may be mounted on the GNSS on-board unit 10.

20 [0072]

Also, the GNSS on-board unit 10 may include a display unit and a speaker and the guidance information providing server 50 may transmit guidance information to the GNSS on-board unit 10, so that information to be output to the user terminal 30 can be output to the GNSS on-board unit 10.

25 [0073]

Also, the vehicle position utilization system 1 may include a charging processing server that receives a payment of part or all of the toll according to assigned points. Thereby, the GNSS on-board unit 10 can pay a toll for a toll road using the points assigned using the toll road. Also, because vehicle information is associated with the assigned points and the points are used for the GNSS on-board unit 10 that transmits the same vehicle information, the reliability of authentication can be improved and processing becomes easy.

[0074]

Also, the vehicle position utilization system 1 may include a charging processing server that discounts the toll of the toll road at a discount rate corresponding to the assigned points. For example, when the cumulative number of points is 5, the toll in the predetermined section may be discounted by 5%.

[0075]

Also, the point assigning server 40 may convert assigned points into another type of points and provide the converted points to the user. For example, a cumulative number of points = 10 or more may be converted into a mileage of 100.

[0076]

Also, the point assigning server 40 may convert the assigned points into a value corresponding to a service ticket such as a parking ticket, a special preferential ticket, an admission ticket, a gift certificate, or a discount ticket and provide the value to the user.

[0077]

Also, when the assigned points are converted into various effects and the effects are assigned as described above, the point assigning server 40 may convert the assigned points into a determined type of points, an assignment condition, or an effect corresponding to the user and assign the determined type of points, the assignment

condition, or the effect corresponding to the use.

[0078]

Also, the assignment condition may be set for each group ID. Thereby, it is possible to control enlargement and reduction of the use range in units of groups.

5 [0079]

Also, the type of points may be changed for each area ID or each group ID, or all points may be made common and cumulative calculation may be performed.

[0080]

Although the transit points P1 to P3 have been described as service areas of toll
10 roads, the present invention is not limited thereto. P2 may be a point on a general road and all of P1 to P3 may be points on a general road.

[0081]

Also, although the example in which the GNSS on-board unit 10 executes the charging process by short-range communication with the roadside antenna 60 has been
15 described, the present invention is not limited thereto. For example, when the GNSS on-board unit 10 detects a predetermined charging point as the current position, the charging process may be executed.

[0082]

Also, when a situation capable of satisfying the assignment condition on the
20 basis of the current position of the vehicle is searched for, the search unit 502 may predict a future traveling route on the basis of the current position of the vehicle and search for a situation capable of satisfying the assignment condition. For example, if the vehicle is located in front of the toll road P1, the vehicle is predicted to travel as it is and arrive at P1. In this case, when a position in front of P1 is detected, the search unit
25 502 may predict a route from P1 to P2 or a route from P1 to P3 as a future traveling route

and search for a situation in which the predicted route can satisfy the assignment condition.

[0083]

Also, the guidance information providing server 50 may acquire the traveling
 5 log information, the stop log information, the charging result information, and/or the like
 of the vehicle, predict the current situation of the vehicle and the future traveling route
 from the past state of the vehicle, and search for a situation capable of satisfying the
 assignment condition. For example, after it is determined whether the vehicle is
 traveling on an upward or downward lane of the toll road P1 from the traveling log
 10 information, a situation capable of satisfying the assignment condition may be searched
 for. If the user just took a break in a service area, a traveling route on which a break in a
 service area is not taken may be predicted and a situation capable of satisfying the
 assignment condition may be searched for in the stop log information. Further, when
 the usage rate of the past toll road is high, a route using a toll road may be predicted as a
 15 future traveling route and a situation capable of satisfying the assignment condition may
 be searched for in the charging result information.

[0084]

Also, the point assigning server 40 and the guidance information providing
 server 50 may select and replace the assignment condition information according to a
 20 time period, a day of the week, and a date. For example, a plurality of tables of
 assignment condition information corresponding to time periods, days of the week, and
 dates may be prepared in the storage unit of each server, and each server may select a
 table corresponding to the current date and time and replace the selected table with a
 table to be referred to in executing each process.

25 [0085]

Also, the point assigning server 40 and the guidance information providing server 50 may change a point assignment rate or change guidance information according to the points assigned to each user and the charging processing result. For example, because a user for which the number of points is greater than or equal to a threshold value is likely to collect points, more guidance information may be actively distributed, the point assignment rate may be increased or bonus points combined with other uses may be assigned. Also, because a user paying a total toll which is greater than or equal to the threshold value in the charging process is a user frequently using toll roads, more guidance information may be actively distributed as described above.

10 [0086]

Also, the point assigning server 40 and the guidance information providing server 50 may dynamically change the assignment condition. For example, each server may acquire information about traffic congestion and create an assignment condition so that points are assigned to a route for detouring from a road where traffic congestion occurs. Also, calendar information about a date and time on which a festival or a fireworks display is held may be acquired, and an assignment condition for dispersing the traffic volume may be created to prevent traffic congestion on a road in accordance with the holding of the event.

[0087]

20 Also, the vehicle information may be information stored in a storage unit built into the GNSS on-board unit 10.

[0088]

Also, in the system that executes the charging process on the basis of the position information of the vehicle detected by the on-board unit, it is possible to collect a correct fee according to the traveling route because it is possible to find round trips.

25

Thus, the introduction of an on-board unit capable of detecting the current position (hereinafter referred to as a GNSS on-board unit) may be hindered. By the vehicle position utilization system 1 according to the present embodiment, the introduction of the GNSS on-board unit can be promoted because points are assigned to users who use the GNSS on-board unit.

[Industrial Applicability]

[0089]

According to the vehicle position utilization system, the on-board unit, and the program described above, it is possible to efficiently adjust a traffic flow.

[Reference Signs List]

[0090]

1	Vehicle position utilization system
10	On-board unit
20	IC card
15	30 User terminal
	40 Point assigning server
	50 Guidance information providing server
	60 Roadside antenna
	101 Communication unit
20	102 Sensor
	103 GNSS reception unit
	104 Clock
	105 Reader-writer
	106 On-board unit control unit
25	107 Storage unit

	161	Log information generating unit
	162	Charging processing unit
	171	Map information
	201	IC card control unit
5	202	Storage unit
	203	Entrance information
	204	Vehicle information
	205	Charging result information
	206	Traveling log information
10	207	Stop log information
	401	Communication unit
	402	Log information acquiring unit
	403	Determination unit
	404	Storage unit
15	405	Log information
	406	Assignment condition information
	501	Communication unit
	502	Search unit
	503	Guidance information generating unit
20	504	Storage unit
	505	Assignment condition information
	506	Map information

[CLAIMS]

1. A vehicle position utilization system comprising:
 - a log information acquiring unit configured to acquire log information based on a result of detecting a position of a vehicle;
 - a determination unit configured to determine an effect according to an assignment condition which is satisfied for a user of the vehicle if a situation of traveling or stop of the vehicle indicated by the log information acquired by the log information acquiring unit satisfies the assignment condition which is predetermined;
 - a search unit configured to search for the assignment condition capable of being satisfied depending on the future situation of traveling or stop of the vehicle at a current position; and
 - a guidance information generating unit configured to generate and output information for guidance to the future situation of traveling or stop of the vehicle so that the assignment condition obtained by the search of the search unit is satisfied,
 - wherein the log information acquiring unit acquires a traveling log information indicating a route which the vehicle traveled, and stop log information indicating a stop position and stop time of the vehicle as the log information,
 - wherein the determination unit determines the effect according to the assignment condition for the user of the vehicle if the route indicated by the traveling log information and the stop position and the stop time indicated by the stop log information satisfy the assignment condition, and
 - wherein the search unit searches the situation in which the assignment condition is capable of being satisfied when the vehicle does not stay at a route point which is predetermined at a predetermined time or more right after the vehicle arrives at the route point.
2. The vehicle position utilization system according to claim 1, wherein the determination unit determines the effect if at least one of a transit point, a transit route, a transit area, the number of transits, a stop point, and a stop time of the vehicle indicated by the log information satisfies the assignment condition.
3. The vehicle position utilization system according to claim 1 or 2, wherein the determination unit determines the effect if a charging result of a toll road on which the vehicle has traveled satisfies the assignment condition.
4. The vehicle position utilization system according to any one of claims 1 to 3,
 - wherein the log information acquiring unit acquires the log information from an on-board unit that detects the current position using a satellite positioning system, and
 - wherein the determination unit manages the determined effect in association with vehicle information about the vehicle equipped with the on-board unit.
5. A program for causing a computer to function as:
 - a log information acquiring means configured to acquire log information based on a result of detecting a position of a vehicle;
 - a determination means configured to determine an effect according to an assignment condition which is satisfied for a user of the vehicle if a situation of traveling or stop of the vehicle indicated by the log information acquired by the log information acquiring means satisfies the assignment condition which is predetermined;

a search means configured to search for the assignment condition capable of being satisfied depending on the future situation of traveling or stop of the vehicle at a current position; and

a guidance information generating means configured to generate and output information for guidance to the future situation of traveling or stop of the vehicle so that the assignment condition obtained by the search of the search means is satisfied,

wherein the log information acquiring means acquires a traveling log information indicating a route which the vehicle traveled, and stop log information indicating a stop position and stop time of the vehicle as the log information,

wherein the determination means determines the effect according to the assignment condition for the user of the vehicle if the route indicated by the traveling log information and the stop position and the stop time indicated by the stop log information satisfy the assignment condition, and

wherein the search means searches the situation in which the assignment condition is capable of being satisfied when the vehicle does not stay at a route point which is predetermined at a predetermined time or more right after the vehicle arrives at the route point.