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(54) ELECTRONIC TOLL CHARGING SYSTEM AND METHOD

ELEKTRONISCHES MAUTZAHLUNGSSYSTEM UND -VERFAHREN

SYSTÈME ÉLECTRONIQUE DE PAIEMENT DE PÉAGE ET PROCÉDÉ ASSOCIÉ

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Description

TECHNICAL FIELD

[0001] The present invention relates to a charging system, a charging method, a controller, and a program for collecting predetermined tolls from owners of vehicles which have entered toll-charging facilities for vehicles, such as toll roads and toll charging areas.

[0002] Priority is claimed on Japanese Patent Application No. 2009-047188, filed February 27, 2009.

BACKGROUND ART

[0003] An ETC (electronic toll collection) system is known as a conventional charging system for toll-charging facilities. A charging device of the ETC system includes: a communication unit that communicates with an in-vehicle device mounted on a vehicle; and a charging unit that performs a charging process. In addition, the charging device installed at an entrance of a toll road writes entrance information and vehicle type information onto an ETC card via the in-vehicle device. Further, the charging device installed at an exit of the toll road obtains the entrance information and the vehicle type information of the ETC card via the in-vehicle device mounted on the vehicle, calculates a usage fee based on the obtained entrance information and the vehicle type information, and thereby charges the usage fee based on a usage-fee paying method registered on the ETC card in advance.

[0004] Moreover, in recent years, a charging method using a GPS (global positioning system) has been under consideration (see, for example, Patent Document 1). The charging method using the GPS is able to charge without installing a charging device at entrances and exits of toll-charging facilities.

CITATION LIST

Patent Document

[0005] Patent Document 1: Japanese Unexamined Patent Application, First Publication No. 2004-326263

[0006] EP 1 333 405 A1 discloses a vehicle collected fee distributing system, wherein an on-vehicle automatic charging apparatus obtains its own position information from GPS signals from GPS satellites, determines on the basis of the position information whether conditions for charging are satisfied, and subtracts a calculated charge amount from an inserted prepaid car, when the conditions for charging are satisfied. At this time, information used for calculation of the charge amount is written into the prepaid card as a charge record. When the prepaid card is inserted into a card issuing machine in order to increase the balance, the card issuing machine reads the written charge record and transmits it to a center computer. The center computer distributes the charge amount to management companies on the basis of the charge record.

[0007] Further prior art is JP 2004 024607 A and JP 11 027342 A.

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

[0008] By the way, when a charging method is changed at toll-charging facilities from a charging method using the conventional ETC system to a charging method using the GPS, the following problem arises. In other words, a user is required to exchange an in-vehicle device compatible with the ETC system to an in-vehicle device compatible with the charging system using the GPS.

[0009] The present invention has been made in view of the above situations. An object of the present invention is to provide a charging system, a charging method, a controller, and a program, which use the GPS and devices of an existing ETC system.

Means for Solving the Problems

[0010] Accordingly, there is provided a charging system as set out in independent claim 1, and a charging method as set out in independent claim 5. Advantageous developments are defined in the dependent claims.

Effects of the Invention

[0011] According to the present invention, the in-vehicle device is connected to the controller, communicates with the central system via the controller, and charges a toll. Thereby, a user of a vehicle in a charging system using the GPS can pay a toll by means of an in-vehicle device compatible with an ETC system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

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

FIG. 2 is a flowchart illustrating a process of monitoring connection of an in-vehicle device with an external device.

FIG. 3 is a flowchart illustrating operations of a charging system at the time of a charging process.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] Hereinafter, an embodiment of the present invention is explained in detail with reference to the drawings.

[0014] FIG. 1 is a schematic block diagram illustrating a configuration of a charging system according to one embodiment of the present invention. The charging sys-

tem includes: an in-vehicle device 100; an external device (controller) 200; a central system (controller) 300; and a gantry device 400. The in-vehicle device 100 is used in an ETC system, and has a function of charging a toll to an IC card. The external device 200 is connected to the in-vehicle device 100 via a serial line. The external device 200 performs wireless communication with the central system 300. The central system 300 is connected to the gantry device 400 via a network and the like. The gantry device 400 is a road-side device used in the ETC system, and has a communication function of communicating with the in-vehicle device 100 and an imaging function of imaging vehicle license plates.

[0015] The external device 200 includes: a connection unit 201; an in-vehicle device information obtaining unit 202; an in-vehicle device information storing unit 203; an in-vehicle device information comparing unit 204; a communication unit 205; a charge location storing unit (positional information storing unit) 206; a charge information storing unit (toll information storing unit) 207; a positioning processing unit 208; a charge determining unit (passage determining unit) 209; a charging unit (toll computing unit, charging processing unit) 210; and a display unit 211. The connection unit 201 performs communication with the in-vehicle device 100 via a serial line. The in-vehicle device information obtaining unit 202 obtains information such as the ID of the in-vehicle device, and the like, from the in-vehicle device 100 via the connection unit 201. The in-vehicle device information storing unit 203 stores the information obtained by the in-vehicle device information obtaining unit 202. The in-vehicle device information comparing unit 204 compares the information stored by the in-vehicle device information storing unit 203 with the information obtained by the in-vehicle device information obtaining unit 202. The communication unit 205 performs communication with the central system 300 via an antenna and the like. The charge location storing unit 206 stores charge location information which indicates a location of a charging area of a toll-charging facility. Here, the toll-charging facility indicates a facility, such as an expressway and a parking lot, which charges a toll to users of vehicles. The charge information storing unit 207 stores charge amount information which indicates a charge amount at the toll-charging facility. The positioning processing unit 208 obtains positional information of a vehicle by using the GPS. The charge determining unit 209 determines whether or not a vehicle is present at a charging area, and determines whether or not a toll charge is necessary. The charging unit 210 stores information necessary for the charging process in an internal memory, and performs the charging process on the in-vehicle device 100. The display unit 211 displays information.

[0016] In addition, the external device 200 is connected to the in-vehicle device 100, and performs wireless communication with the central system 300. The charge determining unit 209 checks positional information of a vehicle against the charge location information stored in the charge location storing unit 206, and thereby determines passage through a charge position. When the vehicle has passed through the charge position, the charging unit 210 checks information on passage through the charge position determined by the charge determining unit 209 against information on a charge amount stored by the charge information storing unit, and thereby computes a toll.

[0017] Then, the charging unit 210 notifies the in-vehicle device 100 of the computed toll, and performs the charging process. The in-vehicle device 100 writes data onto an IC card based on the charge information.

[0018] Thereby, a user of the vehicle in a charging system using the GPS can pay a toll using an in-vehicle device compatible with an existing ETC system.

[0019] Next, operations of the charging system are explained.

[0020] First, a process of monitoring the connection of the in-vehicle device 100 with the external device 200 is explained. The external device 200 intermittently monitors a state of connection with the in-vehicle device 100 in order to prevent misuse, such as replacement of the in-vehicle device 100, an identify-theft by tampering, and alteration of data.

[0021] FIG. 2 is a flowchart illustrating a process of monitoring the connection of the in-vehicle device with an external device. First, the in-vehicle device information obtaining unit 202 of the external device 200 reads out the ID of the in-vehicle device from the in-vehicle device 100 via the connection unit 201 (Step S1). At this time, the communication number is serially allocated to communication of the in-vehicle device 100 with the external device 200. When the in-vehicle device information obtaining unit 202 obtains the ID of the in-vehicle device, the in-vehicle device information comparing unit 204 determines whether or not the ID of the in-vehicle device obtained by the in-vehicle device information obtaining unit 202 matches the ID of the previously communicated in-vehicle device stored in the in-vehicle device information storing unit 203 (Step S2). At this time, when the external device 200 performs communication with the in-vehicle device 100 for the first time, the in-vehicle device information storing unit 203 does not store any ID of the in-vehicle device. However, it is assumed in this case that the ID of the in-vehicle device is matched.

[0022] When the in-vehicle device information obtaining unit 202 determines that the ID of the in-vehicle device obtained by the in-vehicle device information obtaining unit 202 matches the ID of the in-vehicle device stored in the in-vehicle device information storing unit 203 (Step S2: YES), the in-vehicle device information comparing unit 204 determines whether or not the communication number (serial number) allocated to the communication with the in-vehicle device 100 is a value obtained by adding 1 to the communication number stored in the in-vehicle device information storing unit 203 (Step S3). In other words, the continuity of the communication number is determined. At this time, when the external device 200

performs communication with the in-vehicle device 100 for the first time, the in-vehicle device information storing unit 203 does not store any communication number. However, it is assumed in this case that the communication number is in serial order.

[0023] When the in-vehicle device information comparing unit 204 determines that the communication number allocated to the communication with the in-vehicle device 100 is a value obtained by adding 1 to the communication number stored in the in-vehicle device information storing unit 203 (Step S3: YES), the in-vehicle device information comparing unit 204 determines that the connection of the in-vehicle device 100 with the external device 200 is normal (Step S4). When the in-vehicle device information comparing unit 204 determines that the connection of the in-vehicle device 100 with the external device 200 is normal, the in-vehicle device information obtaining unit 202 registers, to the in-vehicle device information storing unit 203, the ID of the in-vehicle device and the communication number which are received from the in-vehicle device in Step S1 (Step S5). When the in-vehicle device information obtaining unit 202 registers the information to the in-vehicle device information storing unit 203, the routine returns to Step S1 where communication with the in-vehicle device 100 is monitored continuously.

[0024] On the other hand, when the in-vehicle device information obtaining unit 202 determines in Step S2 that the ID of the in-vehicle device obtained by the in-vehicle device information obtaining unit 202 does not match the ID of the in-vehicle device stored in the in-vehicle device information storing unit 203 (Step S2: NO), or when the in-vehicle device information comparing unit 204 determines in Step S3 that the communication number allocated to the communication with the in-vehicle device 100 is not a value obtained by adding 1 to the communication number stored in the in-vehicle device information storing unit 203 (Step S3: NO), the in-vehicle device information determination unit 202 determines that the connection of the in-vehicle device 100 with the external device 200 is abnormal (Step S6).

[0025] Thereby, the external device 200 detects misuse resulting from tampering with the in-vehicle device 100.

[0026] Next, operations of the charging process using the charging system are explained.

[0027] Before execution of the charging process, the communication unit 205 of the external device 200 performs communication with the central system 300 and receives, from the central system 300, the charge location information indicating a charging area of a toll-charging facility and the charge amount information indicating a charge amount. Then, the communication unit 205 registers the charge location information and the charge amount information to the charge location storing unit 206 and the charge information storing unit 207, respectively. Here, the charge amount information is information for uniquely calculating a charge amount based on a travel distance and a travel time inside the charging area.

[0028] FIG. 3 is a flowchart illustrating operations of the charging system at the charging process.

[0029] First, while a vehicle is traveling, the charging unit 210 of the external device 200 determines whether or not information to be used for the charging process is stored in an internal memory (Step S11). Here, the information to be used for the charging process includes, for example, a time of stay inside a charging area, a travel distance inside the charging area, or the like. When the vehicle enters the charging area, these information pieces are registered by a process that will be explained later.

[0030] When the charging unit 210 determines that the information necessary for charge is not stored in the internal memory (Step S11: NO), the positioning processing unit 208 specifies a position of a vehicle based on a GPS signal transmitted from a GPS satellite and a vehicle speed signal obtained from the vehicle (Step S12). At this time, when the vehicle is present at a position where the vehicle can communicate with the gantry device 400, the positioning processing unit 208 may perform communication with the gantry device 400 via the communication unit 205 or the in-vehicle device 100 to obtain positional information from the gantry device 400, and thereby correct a position specified by the GPS.

[0031] When the positioning processing unit 208 specifies the position of the vehicle, the charge determining unit 209 checks the position of the vehicle specified by the positioning processing unit against the charge location information stored in the charge location storing unit 206, and determines whether or not the vehicle is present inside a charging area (Step S13).

[0032] When the charge determining unit 209 determines that the vehicle is not present inside the charging area (Step S13: NO), the process returns to Step S11 since the vehicle is present outside the charging area.

[0033] On the other hand, when the charge determining unit 209 determines that the vehicle is inside the charging area (Step S13: YES), which indicates that the vehicle has entered the charging area from outside the charging area, the charging unit 210 calculates a time of stay inside the charging area and a travel distance inside the charging area, and thereby stores these information pieces (information pieces used for the charging process) in the internal memory (Step S14). When the charging unit 210 stores the information pieces to be used for the charging process, the process returns to Step S11. At this time, the display unit 211 displays information indicating that the vehicle has entered the charging area.

[0034] When the charging unit 210 determines in step S11 that the information necessary for charge is stored in the internal memory (Step S11: YES), the positioning processing unit 208 specifies the position of the vehicle based on a GPS signal transmitted from a GPS satellite and a vehicle speed signal obtained from the vehicle (Step S15). At this time, when the vehicle is present at a position where the vehicle can communicate with the gantry device 400, the positioning processing unit 208 may communicate with the gantry device 400 via the

communication unit 205 or the in-vehicle device 100 to obtain the positional information from the gantry device 400, and thereby correct the position specified by the GPS.

[0035] When the positioning processing unit 208 specifies the position of the vehicle, the charge determining unit 209 checks the position of the vehicle specified by the positioning processing unit against the charge location information stored in the charge location storing unit 206, and thereby determines whether or not the vehicle is present inside the charging area (Step S16).

[0036] When the charge determining unit 209 determines that the vehicle is present inside the charging area (Step S16: YES), which indicates that the vehicle is present inside the charging area, the charging unit 210 calculates a time of stay inside the charging area and the travel distance inside the charging area, overwrites the calculated information pieces on the information pieces stored in the internal memory, and thereby stores the calculated information pieces (Step S17). When the charging unit 210 stores the information pieces to be used for the charging process, the process returns to Step S11. At this time, the display unit 211 displays a charge amount at that time.

[0037] On the other hand, when the charge determining unit 209 determines in step S17 that no vehicle is present inside the charging area (Step S16: NO), which indicates that the vehicle has exited from the charging area, the external device 200 performs the charging process on the in-vehicle device 100. Upon the charging process, it is determined whether or not the in-vehicle device information comparing unit 204 has determined by the aforementioned processes from Step S1 to Step S6 that connection with the in-vehicle device 100 is normal (Step S18).

[0038] When it is determined that the in-vehicle device information comparing unit 204 has determined that connection with the in-vehicle device 100 is normal (Step S18: YES), the charging unit 210 calculates a charge amount based on the information used for the charging process which is stored in the internal memory, and the charge amount information stored in the charge information storing unit 207 (Step S19). For example, when the charge information stored in the charge information storing unit is expressed as a function of calculating a charge amount where a time of stay inside the charging area and a travel distance inside the charging area are used as variables, the charge amount can be calculated by substituting the time of stay and the travel distance in the function.

[0039] The charging unit 210 calculates the charge amount, and then notifies the in-vehicle device 100 of a charge order via the connection unit 201 (Step S20). At this time, the display unit 211 displays information indicating that the vehicle has exited from the charging area, and the calculated charge amount.

[0040] On the other hand, when it is determined in step S18 that the in-vehicle device information comparing unit 204 has determined that connection with the in-vehicle device 100 is abnormal (Step S18: NO), the in-vehicle device information comparing unit 204 notifies the central system 300 of an improper charge via the communication unit 205 (Step S21). Here, notification of the improper charge includes information such as the time at which the in-vehicle device information comparing unit 204 determines connection with the in-vehicle 100 to be an abnormal connection, content of tampering of the in-vehicle device 100, the ID of the in-vehicle device 100, the ID of the external device 200, and the like.

[0041] Next, operations of the charging system when the external device 200 receives notification of improper charge are explained.

[0042] When the external device 200 notifies the central system 300 of the improper charge, the central system 300 obtains the vehicle number of an improper vehicle from a vehicle number database and the like which stores the ID of the in-vehicle device or the ID of the external device in association with the vehicle number. Upon obtaining the vehicle number of the improper vehicle, the central system 300 notifies the gantry device 400 of the vehicle number. When obtaining the vehicle number of the improper vehicle, and if a vehicle having a vehicle license plate with the obtained-vehicle number is imaged by an imaging function, the gantry device 400 registers the vehicle as the improper vehicle. A process of extracting the vehicle number from the vehicle license plate can be realized by, for example, extracting from each frame of image information, character string information using OCR (optical character recognition) technology.

[0043] Thereby, based on information imaged by the gantry device 400, a business operator of a toll-charging facility can, for example, send a summons to an owner of the improper vehicle.

[0044] As explained above, according to the present embodiment, the in-vehicle device 100 compatible with an ETC system is connected to the external device 200, and thereby can be compatible with the charging system using the GPS. Thereby, a user can utilize the charging system using the GPS without replacing the in-vehicle device compatible with the ETC system with an in-vehicle device compatible with the charging system using the GPS.

[0045] Additionally, according to the present embodiment, the charging system uses the gantry device 400 to correct the positional information of the external device 200 and to detect an improper vehicle. Therefore, investment in the gantry device 400 of the ETC system will not be wasteful for a business operator of a toll-charging facility. Thus, the gantry device 400 can be effectively used as well in the charging system using the GPS.

[0046] Although preferred embodiments of the present invention have been explained above, the present invention is not limited to the above embodiments. The present invention may be subjected to addition of the configuration, omission, replacement, and other modifications

without departing from the scope of the present invention. The present invention is not limited to the above description, but may be limited only by the scope of the attached claims. Although according to the invention as claimed the in-vehicle device 100 is connected to the external device 200 by using cables such as a serial line has been explained in the present embodiment, this may be implemented in a different way. In an implementation not covered by the current invention, the in-vehicle device 100 may be wirelessly connected to the external device 200 by utilizing a wireless function of the in-vehicle device 100 used in an ETC system.

[0047] Although according to the invention as claimed the charge determining unit 209 of the external device 200 determines whether or not a vehicle is present inside a charging area this may be implemented in a different way. In an implementation not covered by the current invention, the communication unit 205 may transmit the positional information specified by the positioning processing unit 208 to the central system 300 to determine whether or not a vehicle is present inside a charging area by using functions of the central system 300.

[0048] The aforementioned external device 200 includes a computer system. Additionally, operations of each of the aforementioned processing units are stored as in a program format, in a computer-readable recording medium. This program is read by the computer to execute the aforementioned process. Here, the computer-readable recording medium includes a magnetic disk, a magneto-optical disk, CD-ROM, DVD-ROM, a semiconductor memory, and the like. Alternatively, the computer program may be distributed through communication lines to the computer so that the computer receiving the distributed program can execute the program.

[0049] Further, the above program may be a program for realizing some of the aforementioned functions. Moreover, the program may be a program which can realize the aforementioned functions in combination with a program which has been already stored in a computer system, that is, a difference file (difference program).

INDUSTRIAL APPLICABILITY

[0050] The present invention relates to a charging system including: an in-vehicle device to be mounted on a vehicle; and a controller to be connected to the in-vehicle device. The charging system performs a charging process based on utilization of a toll-charging facility by the vehicle. The in-vehicle device includes a writing unit for writing data onto a recording medium based on charge information. The controller includes: a passage determining unit that determines passage through a charge position by checking positional information of the vehicle against information stored in a positional information storing unit; a toll computing unit that computes a toll by checking information on the passage through the charge position determined by the passage determining unit against toll information stored in a toll information storing unit; and a charging processing unit that notifies the in-vehicle device of the toll computed by the toll computing unit, and performs the charging process.

[0051] According to the charging system of the present invention, a user of a vehicle in a charging system using the GPS is able to pay a toll using an in-vehicle device compatible with an ETC system.

DESCRIPTION OF REFERENCE NUMERALS

[0052]

100: In-vehicle device
200: External device (controller)
201: Connection unit
202: In-vehicle device information obtaining unit
203: In-vehicle device information storing unit
204: In-vehicle device information comparing unit
205: Communication unit
206: Charge location storing unit
207: Charge information storing unit
208: Positioning processing unit
209: Charge determining unit
210: Charging unit
211: Display unit
300: Central system
400: Gantry device

Claims

1. A charging system comprising:

an in-vehicle device (100) to be mounted on a vehicle, the in-vehicle device (100) having a writing unit that is configured to write data onto an IC card based on charge information, whereby the in-vehicle device (100) has a function of charging a toll;
a controller (200) that is an external device and connected to the in-vehicle device (100) via a serial line;
a central system (300) configured to wirelessly communicate with the controller (200), and to store charge location information, which indicates a location of a charging area of a toll-charging facility, and charge amount information, which indicates a charge amount at the toll-charging facility,
wherein the controller (200) comprises:

a positioning processing unit (208) that is configured to obtain positional information of the vehicle based on a global positioning system signal;
a positional information storing unit (206) that is configured to store the charge location information obtained from the central

system (300);

a toll information storing unit (207) that is configured to store the charge amount information obtained from the central system (300);

a passage determining unit (209) that is configured to determine passage through a charge position by checking positional information of the vehicle obtained by the positioning processing unit (208) against positional information stored in the positional information storing unit (206) ;

a toll computing unit (210) that is configured to compute a toll based on utilization of a toll-charging facility by the vehicle by checking information on the passage through the charge position determined by the passage determining unit (209) against toll information stored in the toll information storing unit (207); and

a charging processing unit (210) that is configured to notify the toll computed by the toll computing unit (210) to the in-vehicle device (100), and

wherein the in-vehicle device (100) is configured to charge a toll computed by the toll computing unit (210) to the IC card.

2. The charging system according to claim 1, wherein the controller (200) is configured to determine whether or not an ID of a currently communicated in-vehicle device matches an ID of a presently communicated in-vehicle device (100) every time communication is performed with the in-vehicle device (100) .

3. The charging system according to claim 1 or 2, wherein the controller (200) is configured to allocate a serial number to the communication every time communication is performed with the in-vehicle device (100), and to determine the continuity of the serial number.

4. The charging system according to claim 2, further comprising:

a road-side gantry device (400) having an imaging function of imaging vehicle license plates, wherein

the controller (200) is configured to notify an improper charge to the central system (300) in a case where the controller (200) determines that an ID of the in-vehicle device (100) does not match the ID of the in-vehicle device (100) stored in the controller (200), whereby notification of the improper charge comprises the ID of the in-vehicle device (100), or the ID of the external device (200),

the central system (300) is configured to obtain the vehicle number of an improper vehicle based on the ID notified by the controller (200) and notify the vehicle number to the gantry device (400), and

the gantry device (400) is configured to register the vehicle corresponding to the improper charge as an improper vehicle in a case where the gantry device (400) images a vehicle having a vehicle license plate with the obtained-vehicle number by the imaging function.

5. A charging method using a charging system comprising: an in-vehicle device (100) mounted on a vehicle, the in-vehicle device (100) having a function of charging a toll; and a controller (200) which is an external device connected to the in-vehicle device (100) via a serial line; a central system (300) for wirelessly communicating with the controller (200), the charging method comprising:

storing charge location information, which indicates a location of a charging area of a toll-charging facility, and charge amount information, which indicates a charge amount at the toll-charging facility, at the central system (300);

obtaining positional information of the vehicle based on a global positioning system signal by a positioning processing unit (208) of the controller (200);

obtaining the charge location information from the central system (300) and storing the charge location information to a positional information storing unit (206) of the controller (200);

obtaining the charge amount information from the central system (300) and storing the charge amount information to a toll information storing unit (207) of the controller (200);

determining, by a passage determining unit (209) of the controller (200), passage through a charge position by checking positional information of the vehicle obtained by the positioning processing unit (208) against positional information stored in the positional information storing unit (206) ;

computing, by a toll computing unit (210) of the controller (200), a toll based on utilization of a toll-charging facility by the vehicle by checking information on the passage through the charge position determined by the passage determining unit (209) against toll information stored in the toll information storing unit (207);

notifying, by a charging processing unit (210) of the controller (200), the in-vehicle device (100) of the toll computed by the toll computing unit (210);

charging, by the in-vehicle device (100), the toll

computed by the toll computing unit (210) to an IC card.

Patentansprüche

1. Ein Erhebungssystem, aufweisend:

eine fahrzeuginterne Vorrichtung (100), die an einem Fahrzeug anzubringen ist, wobei die fahrzeuginterne Vorrichtung (100) eine Schreibeinheit aufweist, die konfiguriert ist, um basierend auf Gebühreninformationen Daten auf eine IC-Karte zu schreiben, wodurch die fahrzeuginterne Vorrichtung (100) eine Funktion zum Erheben einer Maut aufweist;
eine Steuereinheit (200), die ein externes Gerät ist und über eine serielle Leitung mit der fahrzeuginternen Vorrichtung (100) verbunden ist;
ein zentrales System (300), das konfiguriert ist, um drahtlos mit der Steuereinheit (200) zu kommunizieren und Gebührenortinformationen, die einen Ort eines Erhebungsbereichs einer Mauterhebungseinrichtung anzeigen, und Gebührenbetragsinformationen, die einen Gebührenbetrag an der Mauterhebungseinrichtung anzeigen, zu speichern,
wobei die Steuereinheit (200) aufweist:

eine Positionierungsverarbeitungseinheit (208), die konfiguriert ist, um Positionsinformationen des Fahrzeugs basierend auf einem globalen Positionierungssystemsignal zu erhalten;
eine Positionsinformationsspeichereinheit (206), die konfiguriert ist, um die von dem zentralen System (300) erhaltenen Gebührenortinformationen zu speichern;
eine Mautinformationsspeichereinheit (207), die konfiguriert ist, um die von dem zentralen System (300) erhaltenen Gebührenbetragsinformationen zu speichern;
eine Durchfahrtsbestimmungseinheit (209), die konfiguriert ist, um die Durchfahrt durch eine Gebührenposition zu bestimmen, indem sie Positionsinformationen des Fahrzeugs, die von der Positionsverarbeitungseinheit (208) erhalten wurden, mit Positionsinformationen vergleicht, die in der Positionsinformationsspeichereinheit (206) gespeichert sind;
eine Mautberechnungseinheit (210), die konfiguriert ist, um eine Maut basierend auf der Nutzung einer Mautgebührenerhebungseinrichtung durch das Fahrzeug zu berechnen, indem sie Informationen über die Durchfahrt durch die Gebührenposition, die von der Durchfahrtsbestimmungseinheit (209) bestimmt werden, mit Mautinformationen vergleicht, die in der Mautinformationsspeichereinheit (207) gespeichert sind; und
eine Erhebungsverarbeitungseinheit (210), die konfiguriert ist, um die von der Mautberechnungseinheit (210) berechnete Maut an die fahrzeuginterne Vorrichtung (100) zu melden, und

wobei die fahrzeuginterne Vorrichtung (100) konfiguriert ist, um eine von der Mautberechnungseinheit (210) berechnete Maut der IC-Karte zu erheben.

2. Das Erhebungssystem nach Anspruch 1, wobei die Steuereinheit (200) konfiguriert ist, um jedes Mal, wenn eine Kommunikation mit der fahrzeuginternen Vorrichtung (100) durchgeführt wird, zu bestimmen, ob eine ID einer aktuell kommunizierten fahrzeuginternen Vorrichtung mit einer ID einer aktuell kommunizierten fahrzeuginternen Vorrichtung (100) übereinstimmt oder nicht.

3. Das Erhebungssystem nach Anspruch 1 oder 2, wobei die Steuereinheit (200) konfiguriert ist, um der Kommunikation jedes Mal, wenn eine Kommunikation mit der fahrzeuginternen Vorrichtung (100) durchgeführt wird, eine Seriennummer zuzuordnen und die Kontinuität der Seriennummer zu bestimmen.

4. Das Erhebungssystem nach Anspruch 2, ferner aufweisend:

eine straßenseitige Gerüstvorrichtung (400) mit einer Abbildungsfunktion zur Abbildung von Fahrzeugkennzeichen, wobei
die Steuereinheit (200) konfiguriert ist, um dem zentralen System (300) eine nicht ordnungsgemäße Gebühr in einem Fall zu melden, in dem die Steuereinheit (200) bestimmt, dass eine ID der fahrzeuginternen Vorrichtung (100) nicht mit der in der Steuereinheit (200) gespeicherten ID der fahrzeuginternen Vorrichtung (100) übereinstimmt, wodurch die Meldung der nicht ordnungsgemäßen Gebühr die ID der fahrzeuginternen Vorrichtung (100) oder die ID der externen Vorrichtung (200) aufweist,
das zentrale System (300) konfiguriert ist, um die Fahrzeugnummer eines unzulässigen Fahrzeugs basierend auf der von der Steuereinheit (200) gemeldeten ID zu erhalten und die Fahrzeugnummer an die Gerüstvorrichtung (400) zu melden, und
die Gerüstvorrichtung (400) konfiguriert ist, um das Fahrzeug, das zu der nicht ordnungsgemäßen Gebühr korrespondiert, als ein unzulässi-

ges Fahrzeug in einem Fall zu registrieren, in dem die Gerüstvorrichtung (400) ein Fahrzeug mit einem Fahrzeugkennzeichen mit der erhaltenen Fahrzeugnummer durch die Abbildungsfunktion abbildet.

5. Ein Erhebungsverfahren unter Verwendung eines Erhebungssystems, aufweisend: eine fahrzeuginterne Vorrichtung (100), die an einem Fahrzeug angebracht ist, wobei die fahrzeuginterne Vorrichtung (100) eine Funktion zum Erheben einer Maut aufweist; und eine Steuereinheit (200), die eine externe Vorrichtung ist, die mit der fahrzeuginternen Vorrichtung (100) über eine serielle Leitung verbunden ist; ein zentrales System (300) zum drahtlosen Kommunizieren mit der Steuereinheit (200), wobei das Erhebungsverfahren aufweist:

Speichern von Gebührenortinformationen, die einen Ort eines Erhebungsbereichs einer Mauterhebungseinrichtung anzeigen, und von Gebührenbetragsinformationen, die einen Gebührenbetrag an der Mauterhebungseinrichtung anzeigen, in dem zentralen System (300);
Erhalten von Positionsinformationen des Fahrzeugs basierend auf einem globalen Positionierungssystemsignal durch eine Positionierungsverarbeitungseinheit (208) der Steuereinheit (200);
Erhalten der Gebührenortinformationen von dem zentralen System (300) und Speichern der Gebührenortinformationen in einer Positionsinformationsspeichereinheit (206) der Steuereinheit (200);
Erhalten der Gebührenbetragsinformationen von dem zentralen System (300) und Speichern der Gebührenbetragsinformationen in einer Mautinformationsspeichereinheit (207) der Steuereinheit (200) ;
Bestimmen, durch eine Durchfahrtsbestimmungseinheit (209) der Steuereinheit (200), der Durchfahrt durch eine Gebührenposition durch Vergleichen von Positionsinformationen des Fahrzeugs, die durch die Positionsverarbeitungseinheit (208) erhalten wurden, mit Positionsinformationen, die in der Positionsinformationsspeichereinheit (206) gespeichert sind;
Berechnen, durch eine Mautberechnungseinheit (210) der Steuereinheit (200), einer Maut basierend auf der Nutzung einer Mauterhebungseinrichtung durch das Fahrzeug durch Vergleichen von Informationen über die Durchfahrt durch die Gebührenposition, die durch die Durchfahrtsbestimmungseinheit (209) bestimmt wurden, mit Mautinformationen, die in der Mautinformationsspeichereinheit (207) gespeichert sind;
Benachrichtigen der fahrzeuginternen Vorrichtung (100) über die von der Mautberechnungseinheit (210) berechnete Maut durch eine Erhebungsverarbeitungseinheit (210) der Steuereinheit (200);
Erheben der von der Mautberechnungseinheit (210) berechneten Maut auf eine IC-Karte durch die fahrzeuginterne Vorrichtung (100).

Revendications

1. Système de péage comprenant :

un dispositif embarqué (100) à monter sur un véhicule, le dispositif embarqué (100) comportant une unité d'écriture qui est conçue pour écrire des données sur une carte à circuit intégré, sur la base d'informations de péage, moyennant quoi le dispositif embarqué (100) possède une fonction d'imputation d'un péage ;
une unité de commande (200) qui est un dispositif externe et qui est connectée au dispositif embarqué (100) par l'intermédiaire d'une ligne série ;
un système central (300) conçu pour communiquer sans fil avec l'unité de commande (200), et pour stocker des informations d'emplacement de péage qui indiquent l'emplacement d'une zone de péage d'une installation à péage, et des informations de montant de péage qui indiquent un montant de péage au niveau de l'installation à péage,
dans lequel l'unité de commande (200) comprend :

une unité de traitement de positionnement (208) qui est conçue pour obtenir des informations de position du véhicule, sur la base d'un signal de système de positionnement mondial ;
une unité de stockage d'informations de position (206) qui est conçue pour stocker les informations d'emplacement de péage obtenues à partir du système central (300) ;
une unité de stockage d'informations de péage (207) qui est conçue pour stocker les informations de montant de péage, obtenues à partir du système central (300) ;
une unité de détermination de passage (209) qui est conçue pour déterminer le passage par une position de péage en contrôlant des informations de position du véhicule, obtenues par l'unité de traitement de positionnement (208), par rapport à des informations de position stockées dans l'unité de stockage d'informations de position (206) ;
une unité de calcul de péage (210) qui est

conçue pour calculer un péage sur la base de l'utilisation d'une installation à péage par le véhicule, en contrôlant des informations sur le passage par la position de péage, déterminé par l'unité de détermination de passage (209), par rapport à des informations de péage stockées dans l'unité de stockage d'informations de péage (207) ; et
une unité de traitement d'imputation (210) qui est conçue pour notifier le péage calculé par l'unité de calcul de péage (210) au dispositif embarqué (100), et

dans lequel le dispositif embarqué (100) est conçu pour imputer un péage calculé par l'unité de calcul de péage (210) à la carte à circuit intégré.

2. Système de péage selon la revendication 1, dans lequel l'unité de commande (200) est conçue pour déterminer si l'identificateur d'un dispositif embarqué en cours de communication concorde ou non avec l'identificateur d'un dispositif embarqué (100) actuellement en communication, à chaque fois qu'une communication est réalisée avec le dispositif embarqué (100).

3. Système de péage selon la revendication 1 ou 2, dans lequel l'unité de commande (200) est conçue pour attribuer un numéro de série à la communication, à chaque fois qu'une communication est réalisée avec le dispositif embarqué (100), et pour déterminer la continuité du numéro de série.

4. Système de péage selon la revendication 2, comprenant en outre :
un dispositif de portique en bord de route (400) possédant une fonction d'imagerie permettant d'obtenir une image de plaques d'immatriculation de véhicules, dans lequel :

l'unité de commande (200) est conçue pour notifier au système central (300) une imputation erronée dans le cas où l'unité de commande (200) détermine qu'un identificateur du dispositif embarqué (100) ne concorde pas avec l'identificateur du dispositif embarqué (100), stocké dans l'unité de commande (200), moyennant quoi la notification de l'imputation erronée comprend l'identificateur du dispositif embarqué (100) ou l'identificateur du dispositif externe (200),
le système central (300) est conçu pour obtenir le numéro de véhicule d'un véhicule erroné, sur la base de l'identificateur notifié par l'unité de commande (200) et notifier le numéro de véhicule au dispositif de portique (400), et
le dispositif de portique (400) est conçu pour enregistrer le véhicule correspondant à l'imputation erronée en tant que véhicule erroné dans le cas où le dispositif de portique (400) obtient une image d'un véhicule ayant une plaque d'immatriculation de véhicule avec le numéro de véhicule obtenu, au moyen de la fonction d'imagerie.

5. Procédé de péage utilisant un système de péage comprenant : un dispositif embarqué (100) monté sur un véhicule, le dispositif embarqué (100) possédant une fonction d'imputation d'un péage ; et une unité de commande (200) qui est un dispositif externe connecté au dispositif embarqué (100) par l'intermédiaire d'une ligne série ; un système central (300) destiné à communiquer sans fil avec l'unité de commande (200), le procédé de péage comprenant les étapes suivantes :

stocker des informations d'emplacement de péage qui indiquent l'emplacement d'une zone de péage d'une installation à péage, et des informations de montant de péage qui indiquent un montant de péage au niveau de l'installation à péage, dans le système central (300) ;
obtenir des informations de position du véhicule, sur la base d'un signal de système de positionnement mondial, au moyen d'une unité de traitement de positionnement (208) de l'unité de commande (200) ;
obtenir les informations d'emplacement de péage à partir du système central (300) et stocker les informations d'emplacement de péage dans une unité de stockage d'informations de position (206) de l'unité de commande (200) ;
obtenir les informations de montant de péage à partir du système central (300) et stocker les informations de montant de péage dans une unité de stockage d'informations de péage (207) de l'unité de commande (200) ;
déterminer, au moyen d'une unité de détermination de passage (209) de l'unité de commande (200), le passage par une position de péage en contrôlant des informations de position du véhicule, obtenues par l'unité de traitement de positionnement (208), par rapport à des informations de position stockées dans l'unité de stockage d'informations de position (206) ;
calculer, au moyen d'une unité de calcul de péage (210) de l'unité de commande (200), un péage sur la base de l'utilisation d'une installation à péage par le véhicule, en contrôlant des informations sur le passage par la position de péage, déterminé par l'unité de détermination de passage (209), par rapport à des informations de péage stockées dans l'unité de stockage d'informations de péage (207) ;
notifier, au moyen d'une unité de traitement d'imputation (210) de l'unité de commande

(200), le péage calculé par l'unité de calcul de péage (210) au dispositif embarqué (100) ;
imputer, au moyen du dispositif embarqué (100), le péage calculé par l'unité de calcul de péage (210) à une carte à circuit intégré.

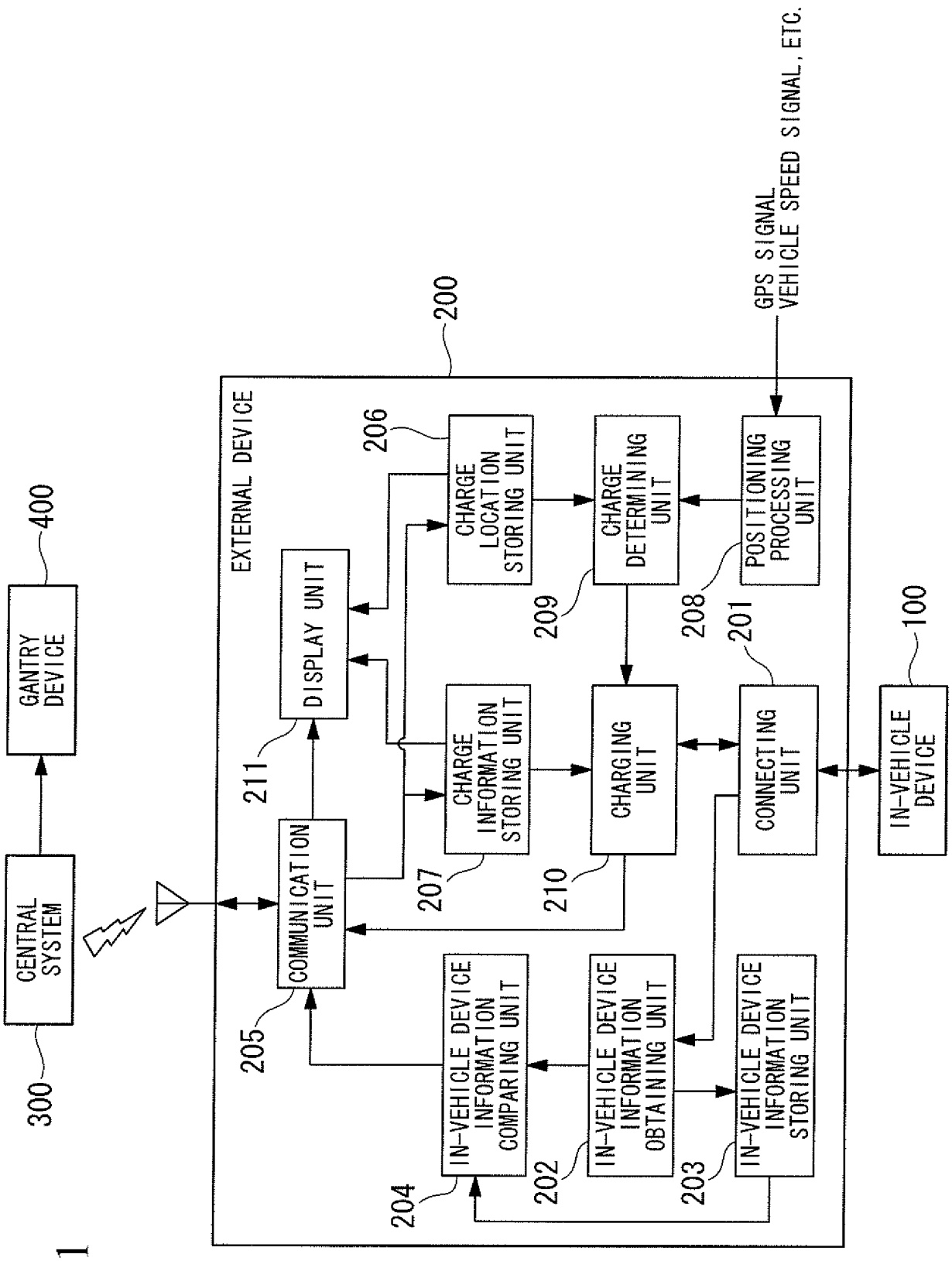
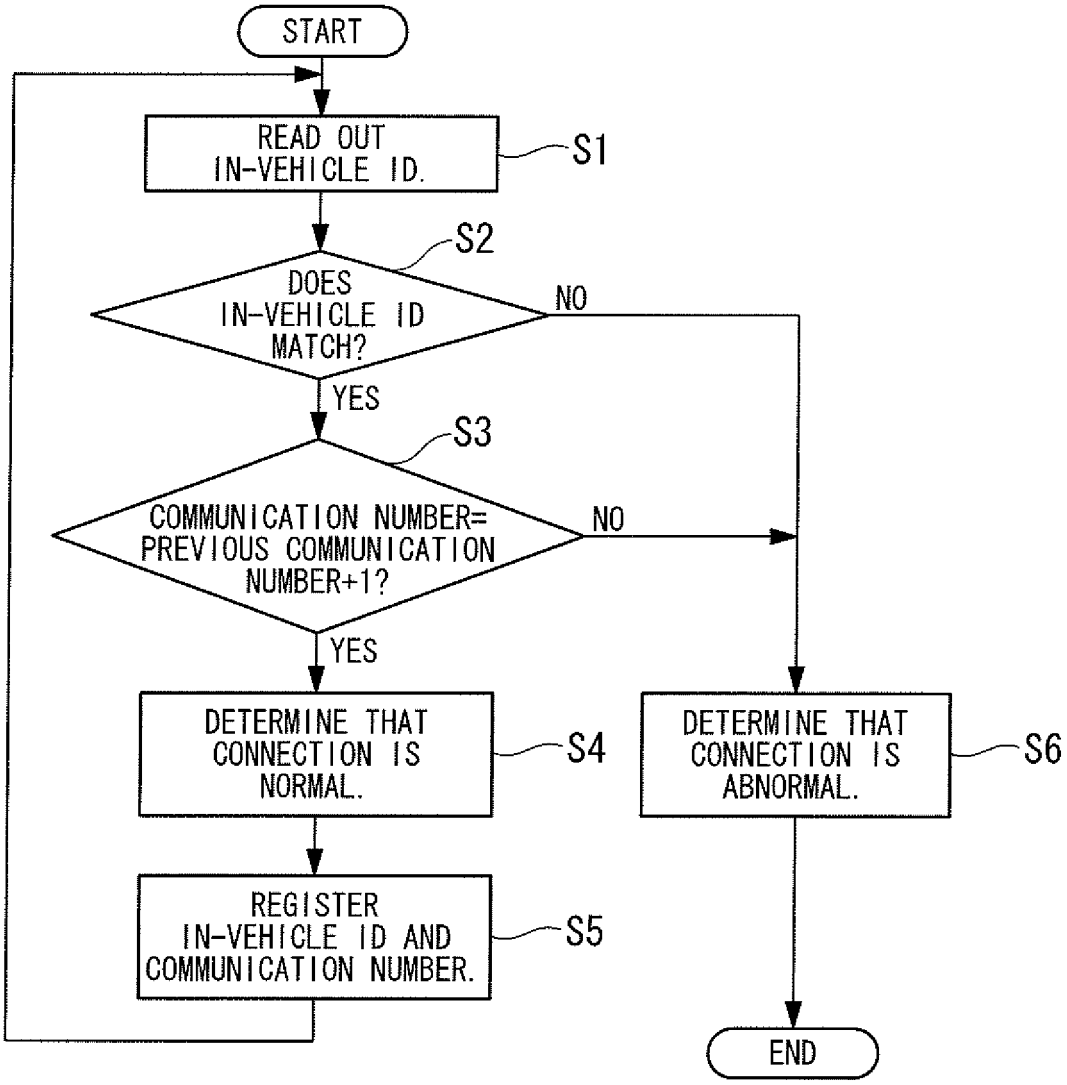

CENTRAL SYSTEM
300
GANTRY DEVICE
400
EXTERNAL DEVICE
200
GPS SIGNAL
VEHICLE SPEED SIGNAL, ETC.
COMMUNICATION UNIT
205
DISPLAY UNIT
211
CHARGE LOCATION STORING UNIT
206
CHARGE INFORMATION STORING UNIT
207
CHARGE DETERMINING UNIT
209
POSITIONING PROCESSING UNIT
208
CHARGING UNIT
210
CONNECTING UNIT
201
IN-VEHICLE DEVICE
100
IN-VEHICLE DEVICE INFORMATION COMPARING UNIT
204
IN-VEHICLE DEVICE INFORMATION OBTAINING UNIT
202
IN-VEHICLE DEVICE INFORMATION STORING UNIT
203

FIG. 1

FIG. 2


START
READ OUT IN-VEHICLE ID.
S1
S2
DOES IN-VEHICLE ID MATCH?
NO
YES
S3
COMMUNICATION NUMBER= PREVIOUS COMMUNICATION NUMBER+1?
NO
YES
DETERMINE THAT CONNECTION IS NORMAL.
S4
DETERMINE THAT CONNECTION IS ABNORMAL.
S6
REGISTER IN-VEHICLE ID AND COMMUNICATION NUMBER.
S5
END

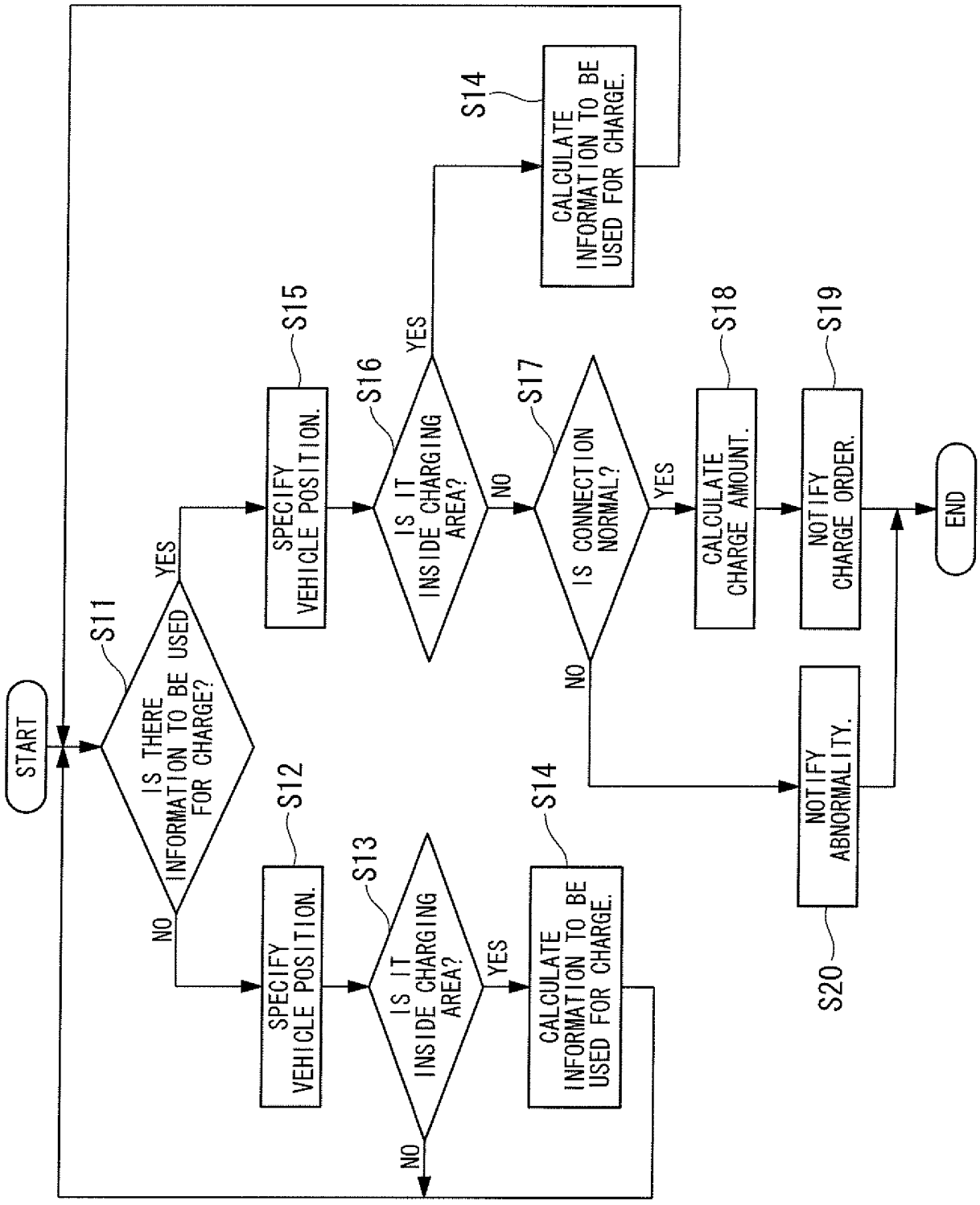

START
S11
IS THERE INFORMATION TO BE USED FOR CHARGE?
YES
NO
S15
SPECIFY VEHICLE POSITION.
S16
IS IT INSIDE CHARGING AREA?
YES
NO
S14
CALCULATE INFORMATION TO BE USED FOR CHARGE.
S17
IS CONNECTION NORMAL?
YES
NO
S18
CALCULATE CHARGE AMOUNT.
S19
NOTIFY CHARGE ORDER.
END
S12
SPECIFY VEHICLE POSITION.
S13
IS IT INSIDE CHARGING AREA?
YES
NO
S14
CALCULATE INFORMATION TO BE USED FOR CHARGE.
NOTIFY ABNORMALITY.
S20

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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- JP 2004326263 A **[0005]**
- EP 1333405 A1 **[0006]**
- JP 2004024607 A **[0007]**
- JP 11027342 A **[0007]**