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(19) **United States**
(12) **Reissued Patent**
Hiura et al.

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(45) **Date of Reissued Patent: Jan. 26, 2021**

(54) **VEHICLE DATA COLLECTION SYSTEM, VEHICLE DATA COLLECTION METHOD, VEHICLE-MOUNTED DEVICE, PROGRAM, AND RECORDING MEDIUM**

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(73) Assignee: **MITSUBISHI HEAVY INDUSTRIES MACHINERY SYSTEMS, LTD.**, Hyogo-Ku (JP)

(21) Appl. No.: **16/192,024**

(22) Filed: **Nov. 15, 2018**

Related U.S. Patent Documents

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Appl. No.: **14/443,873**
PCT Filed: **Nov. 12, 2013**
PCT No.: **PCT/JP2013/080521**
§ 371 (c)(1),
(2) Date: **May 19, 2015**
PCT Pub. No.: **WO2014/080796**
PCT Pub. Date: **May 30, 2014**

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Nov. 20, 2012 (JP) 2012-254100

(51) **Int. Cl.**
G07C 5/02 (2006.01)
G08G 1/01 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G07C 5/02*** (2013.01); *G07B 15/06* (2013.01); *G08G 1/01* (2013.01); *G08G 1/017* (2013.01); *G08G 1/065* (2013.01)

(58) **Field of Classification Search**
CPC G07C 5/02; G08G 1/0967
See application file for complete search history.

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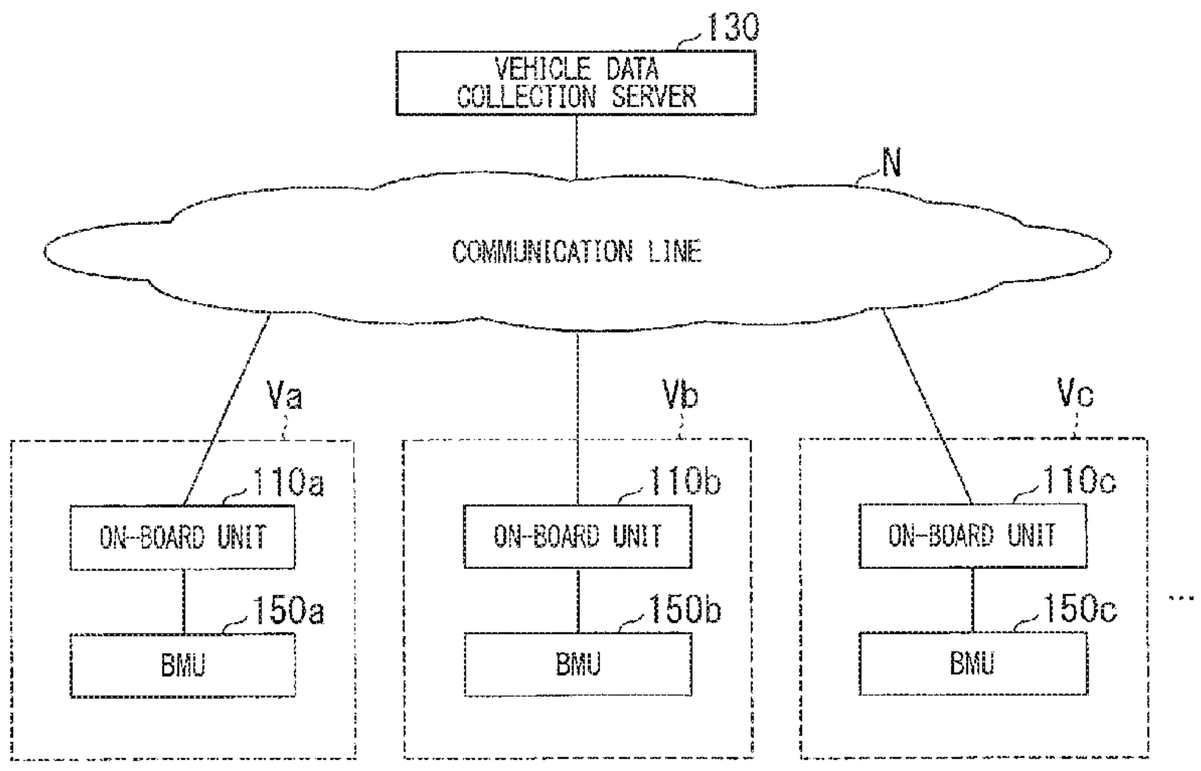
Primary Examiner — Catherine M Tarae
(74) *Attorney, Agent, or Firm* — Manabu Kanesaka; Benjamin Hauptman; Kenneth Berner

(57) **ABSTRACT**

A vehicle data collection system includes a vehicle-mounted device installed in a vehicle and configured to transmit data related to the vehicle, and a vehicle data collection device configured to collect the data related to the vehicle, wherein the vehicle-mounted device includes a vehicle data transmission unit configured to transmit first vehicle data, which includes information in which an individual related to the vehicle is to be identified, and second vehicle data, which includes information in which the individual related to the vehicle is not to be identified, to the vehicle data collection device in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle.

20 Claims, 23 Drawing Sheets



(51) **Int. Cl.**

G07B 15/06	(2011.01)
G08G 1/017	(2006.01)
G08G 1/065	(2006.01)

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U.S.P.T.O., "Office Action for U.S. Appl. No. 14/443,873," dated Feb. 23, 2016.

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FIG. 1

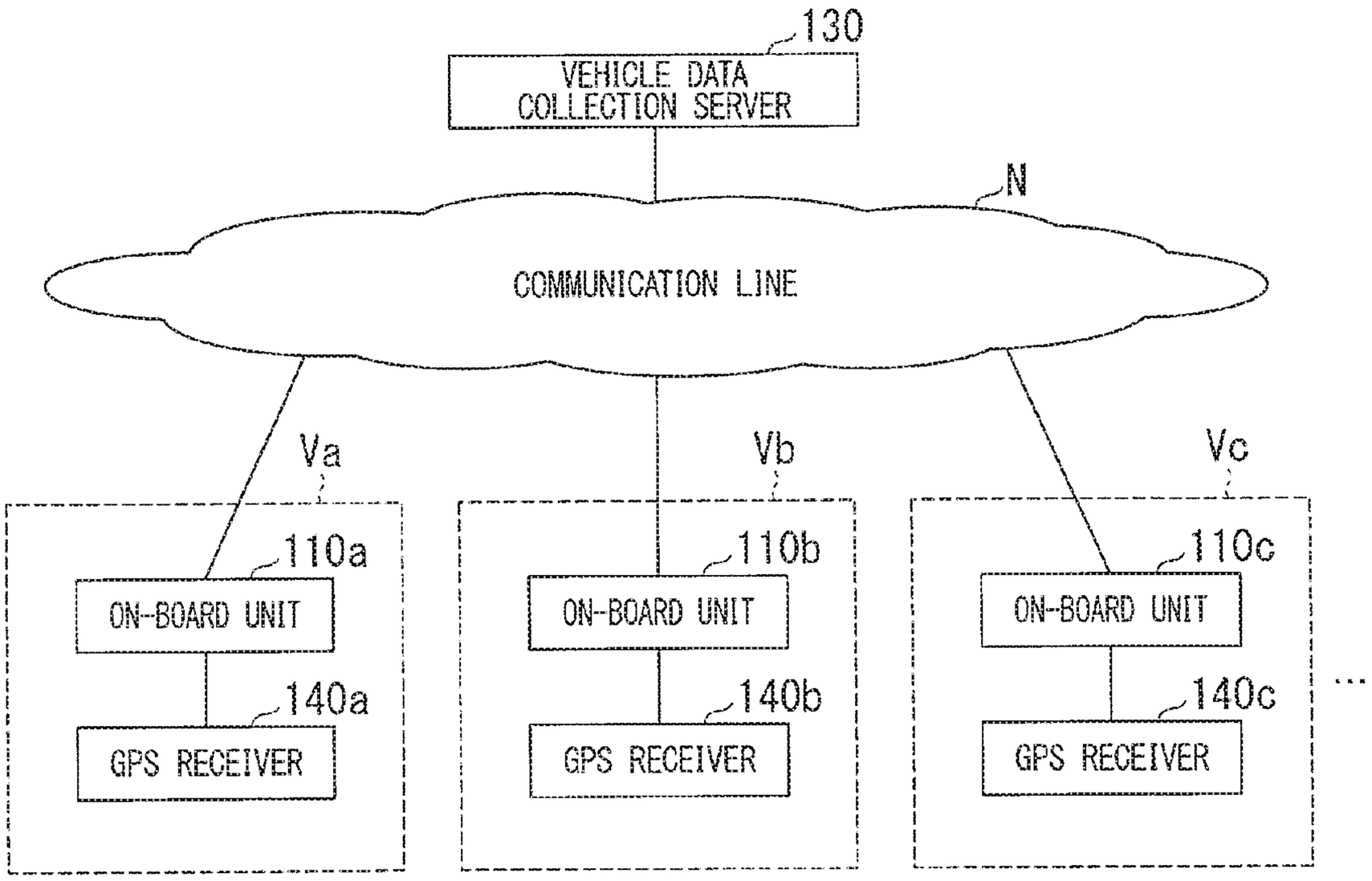

130
VEHICLE DATA COLLECTION SERVER
N
COMMUNICATION LINE
Va
Vb
Vc
110a
ON-BOARD UNIT
140a
GPS RECEIVER
110b
ON-BOARD UNIT
140b
GPS RECEIVER
110c
ON-BOARD UNIT
140c
GPS RECEIVER

FIG. 2

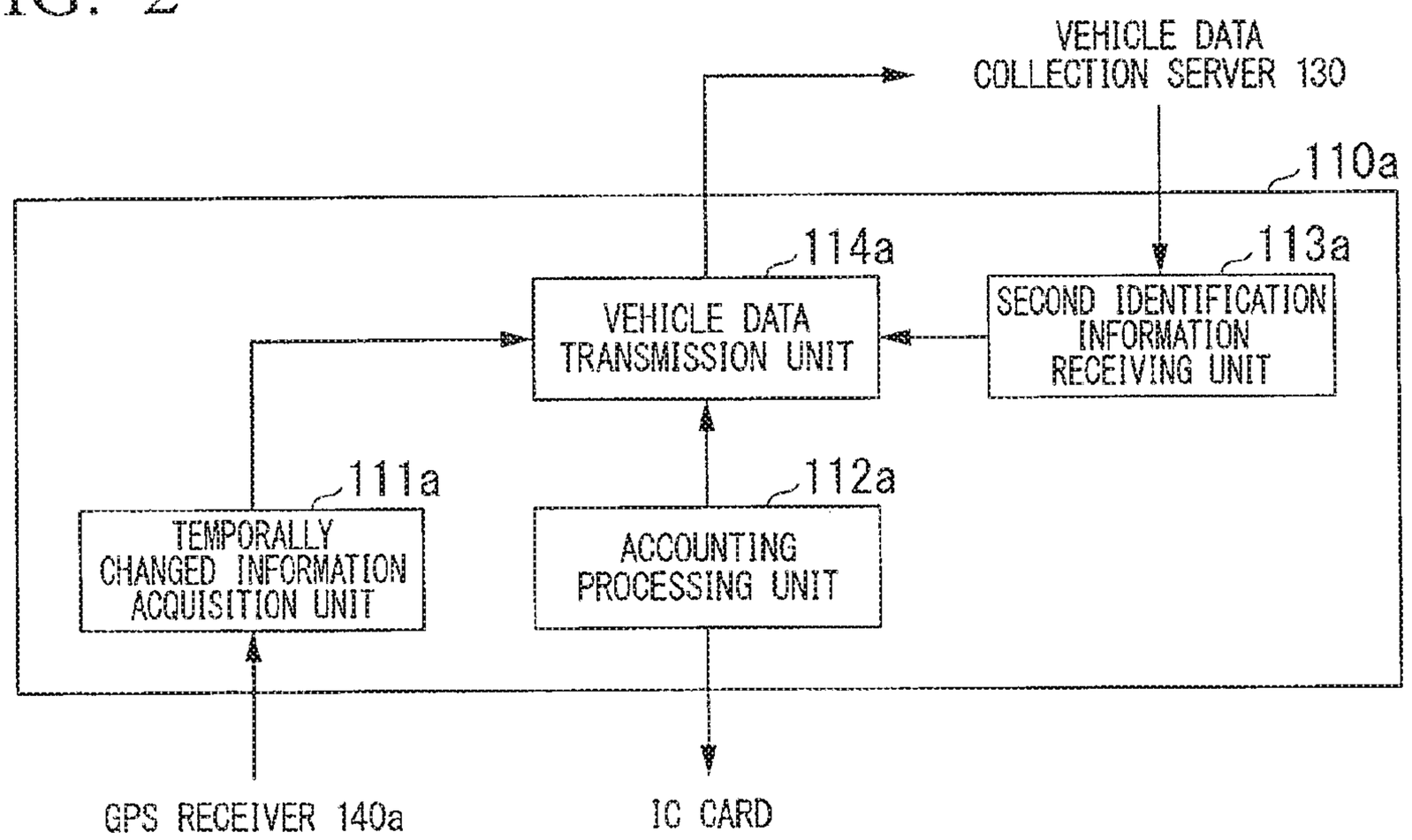

VEHICLE DATA COLLECTION SERVER 130
110a
114a
VEHICLE DATA TRANSMISSION UNIT
113a
SECOND IDENTIFICATION INFORMATION RECEIVING UNIT
111a
TEMPORALLY CHANGED INFORMATION ACQUISITION UNIT
112a
ACCOUNTING PROCESSING UNIT
GPS RECEIVER 140a
IC CARD

FIG. 3

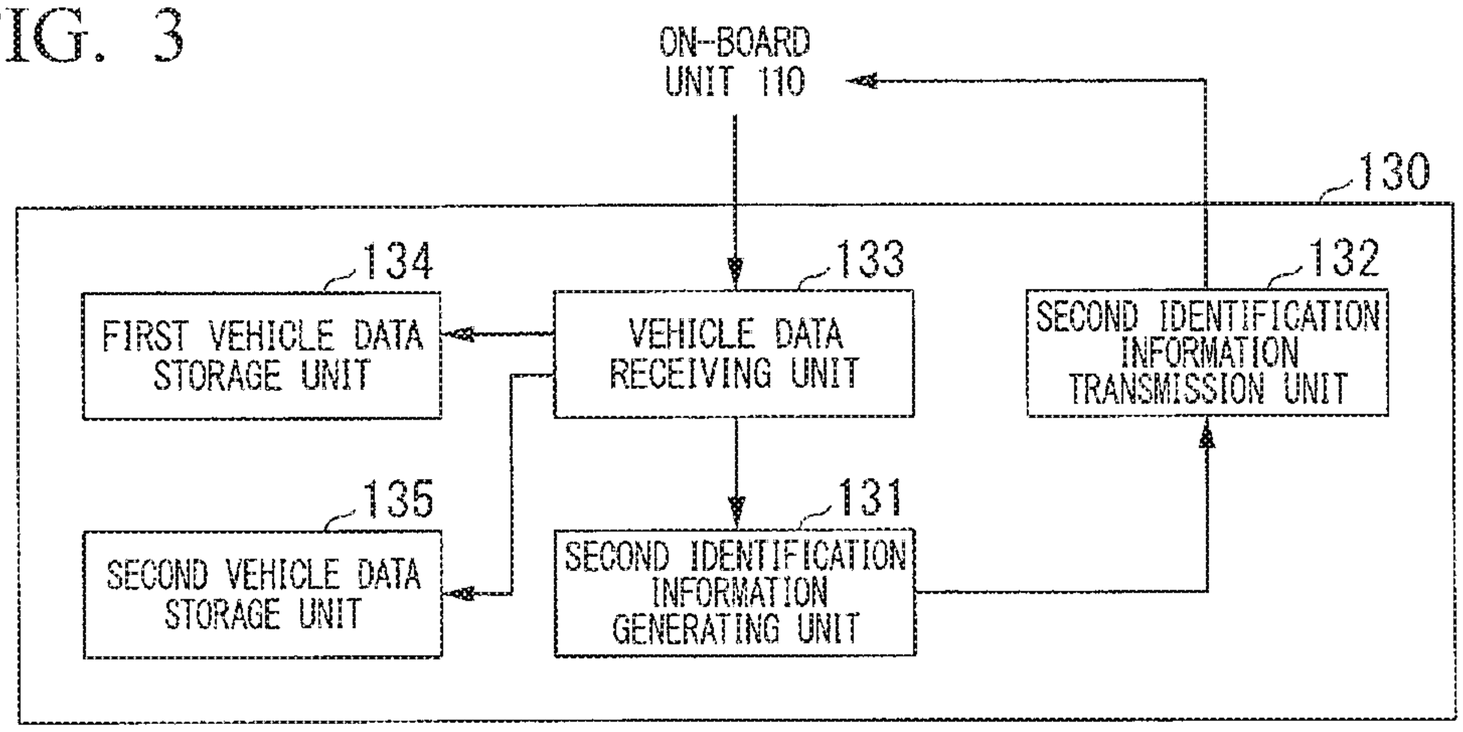


FIG. 4

134

ON-BOARD UNIT ID	ACCOUNTING TIME (YEAR/MONTH/DAY/HOUR:MINUTE:SECOND)	ACCOUNTING PLACE	ACCOUNTING PRICE (YEN)
OBU0048	2011/07/15/16:08:19	SHIODOME	600
OBU1991	2011/07/15/16:08:20	DAIBA	600
OBU2007	2011/07/15/16:08:31	SHINTOSHIN	900
⋮	⋮	⋮	⋮

FIG. 5

135

RANDOM ID	POSITION (LONGITUDE, LATITUDE)	POSITIONING TIME (YEAR/MONTH/DAY/HOUR:MINUTE:SECOND)
042YuRzKwv1C	(E1、N1)	2011/07/15/15:19:00
042YuRzKwv1C	(E2、N2)	2011/07/15/15:19:30
042YuRzKwv1C	(E3、N3)	2011/07/15/15:20:00
⋮	⋮	⋮

FIG. 6

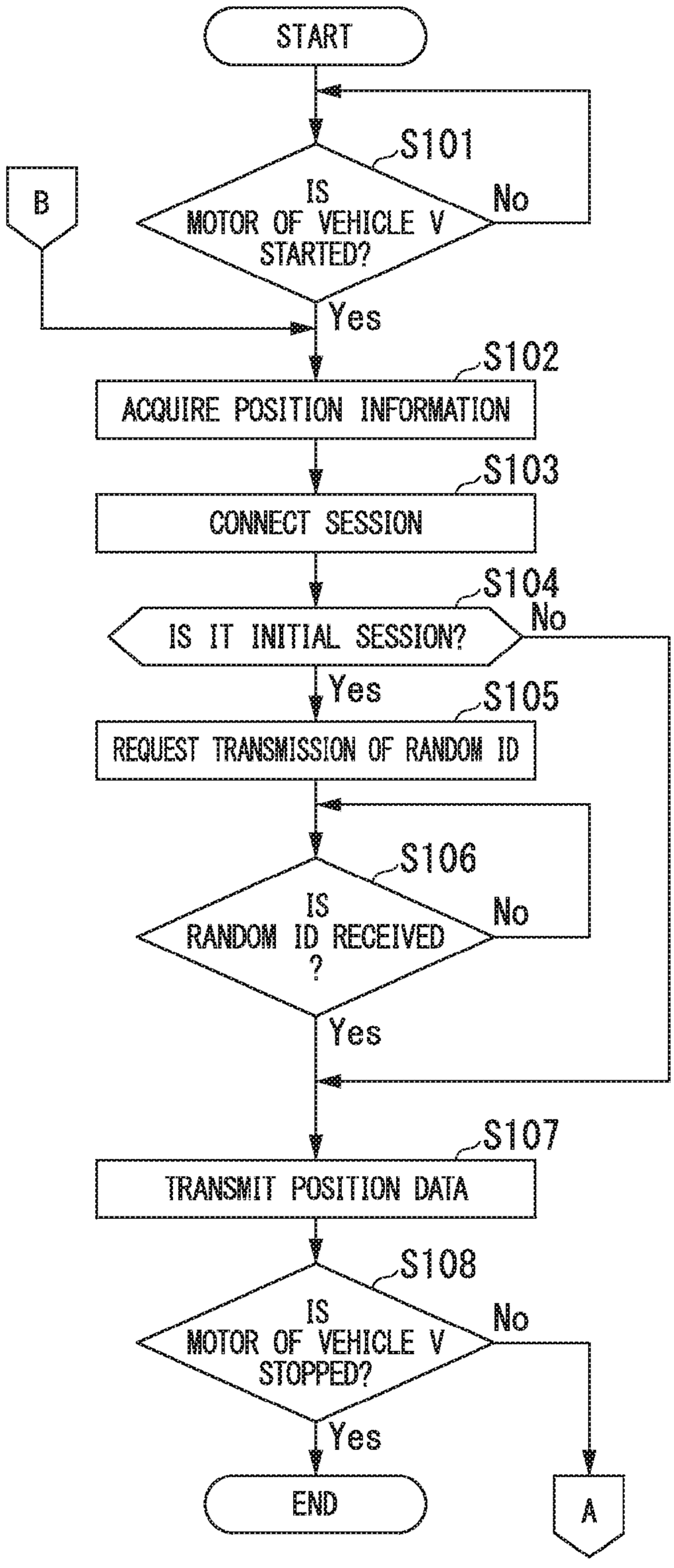

START
S101
IS MOTOR OF VEHICLE V STARTED?
No
Yes
B
S102
ACQUIRE POSITION INFORMATION
S103
CONNECT SESSION
S104
IS IT INITIAL SESSION?
No
Yes
S105
REQUEST TRANSMISSION OF RANDOM ID
S106
IS RANDOM ID RECEIVED ?
No
Yes
S107
TRANSMIT POSITION DATA
S108
IS MOTOR OF VEHICLE V STOPPED?
No
Yes
END
A

FIG. 7

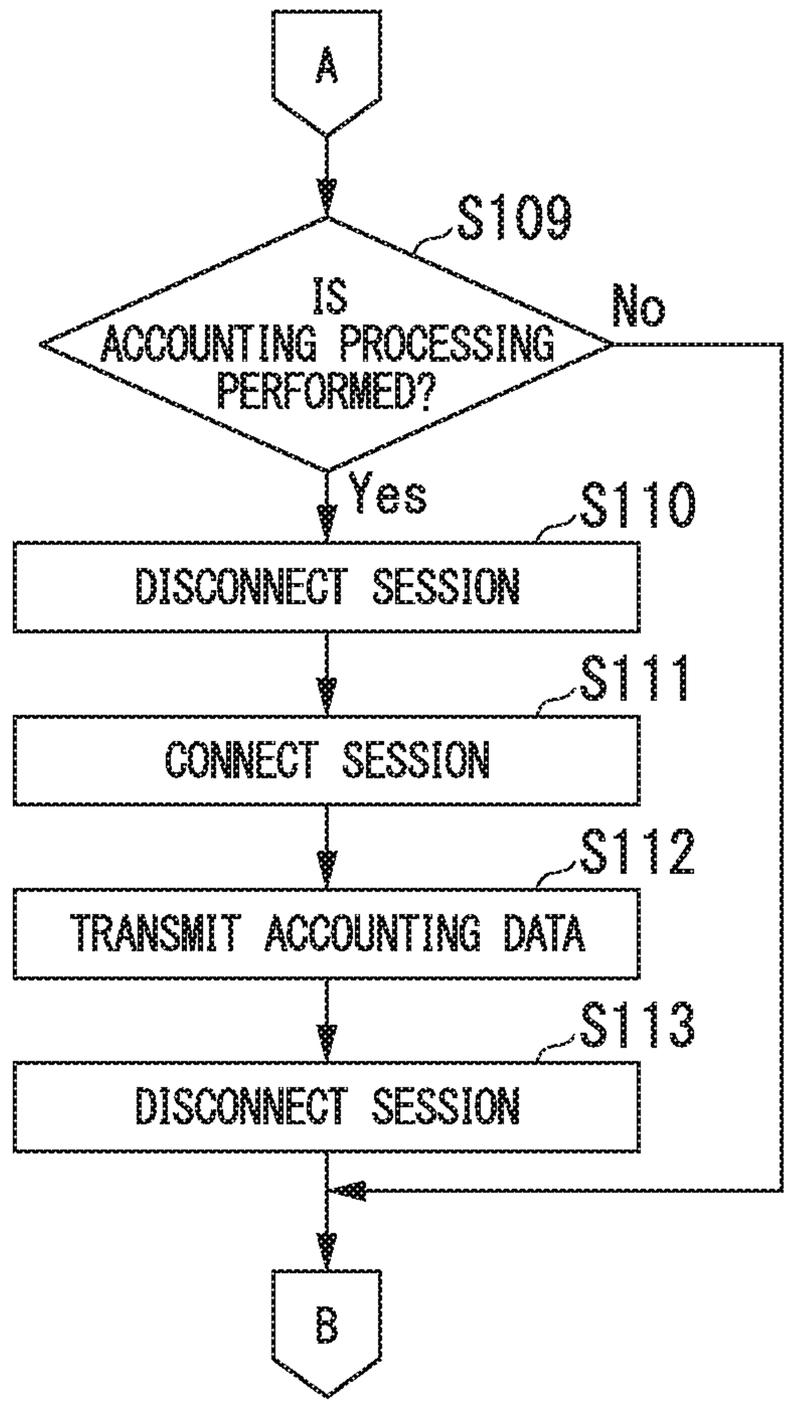

A
S109
IS ACCOUNTING PROCESSING PERFORMED?
No
Yes
S110
DISCONNECT SESSION
S111
CONNECT SESSION
S112
TRANSMIT ACCOUNTING DATA
S113
DISCONNECT SESSION
B

FIG. 8

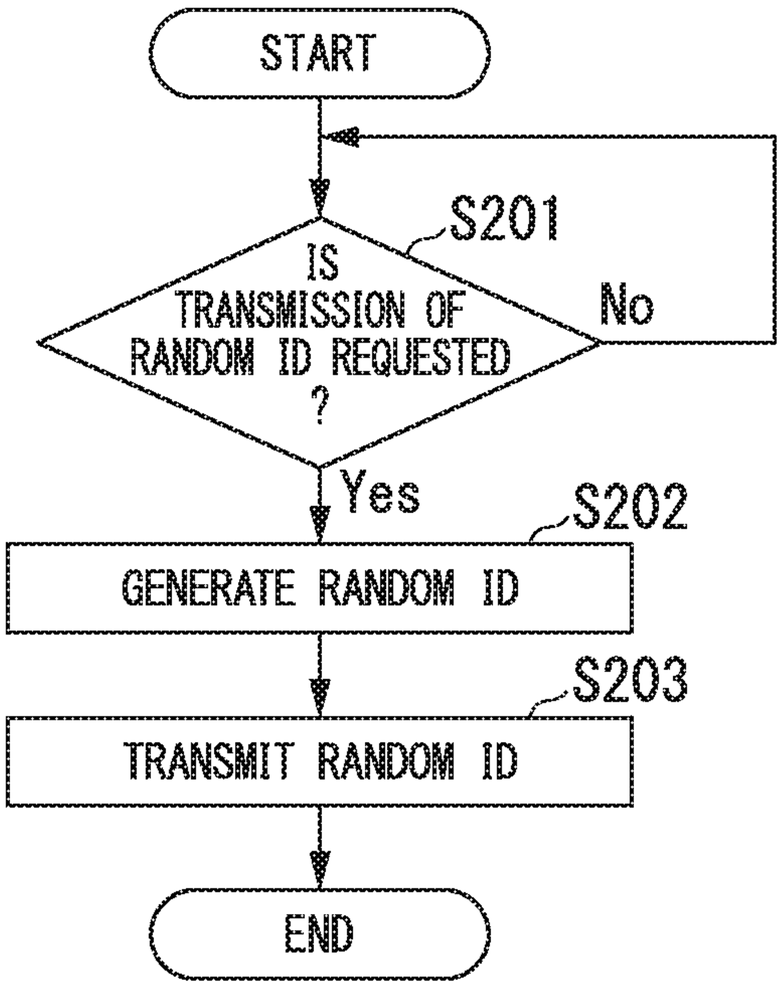

START
S201
IS TRANSMISSION OF RANDOM ID REQUESTED ?
No
Yes
S202
GENERATE RANDOM ID
S203
TRANSMIT RANDOM ID
END

FIG. 9

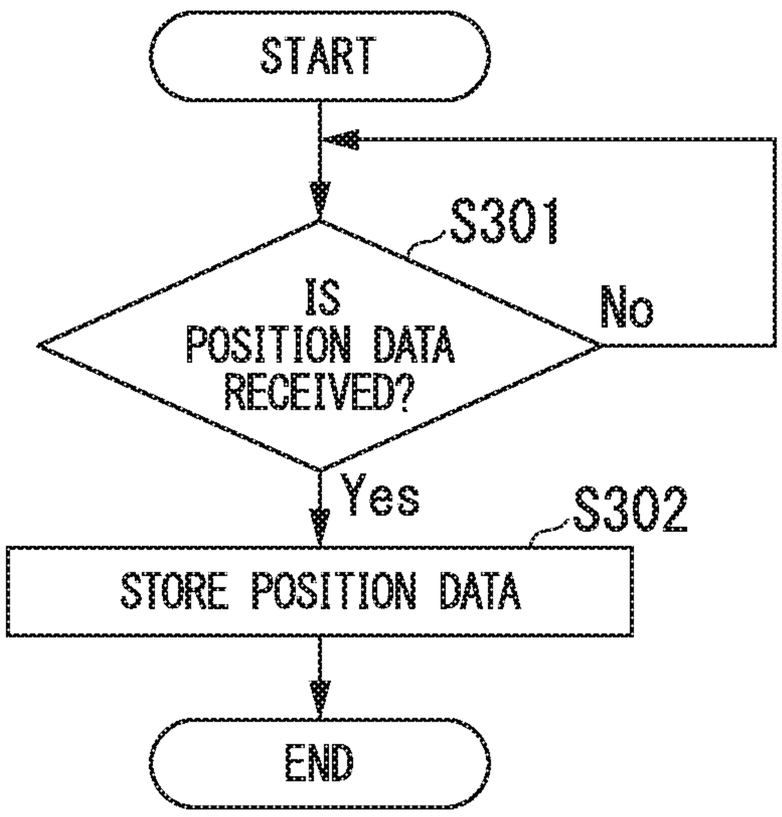

START
S301
IS POSITION DATA RECEIVED?
No
Yes
S302
STORE POSITION DATA
END

FIG. 10

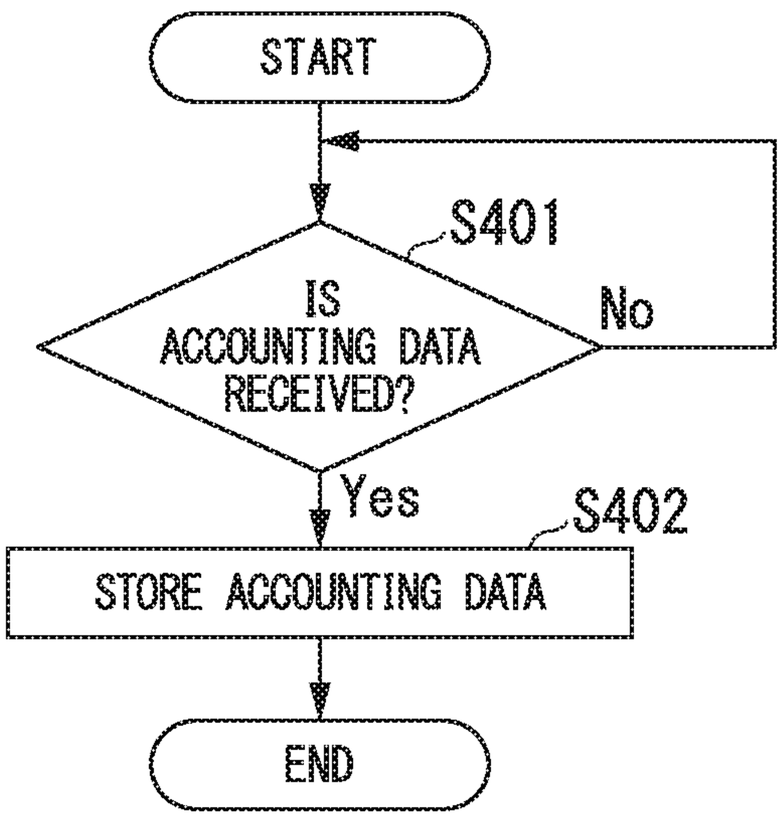

START
S401
IS ACCOUNTING DATA RECEIVED?
No
Yes
S402
STORE ACCOUNTING DATA
END

FIG. 11

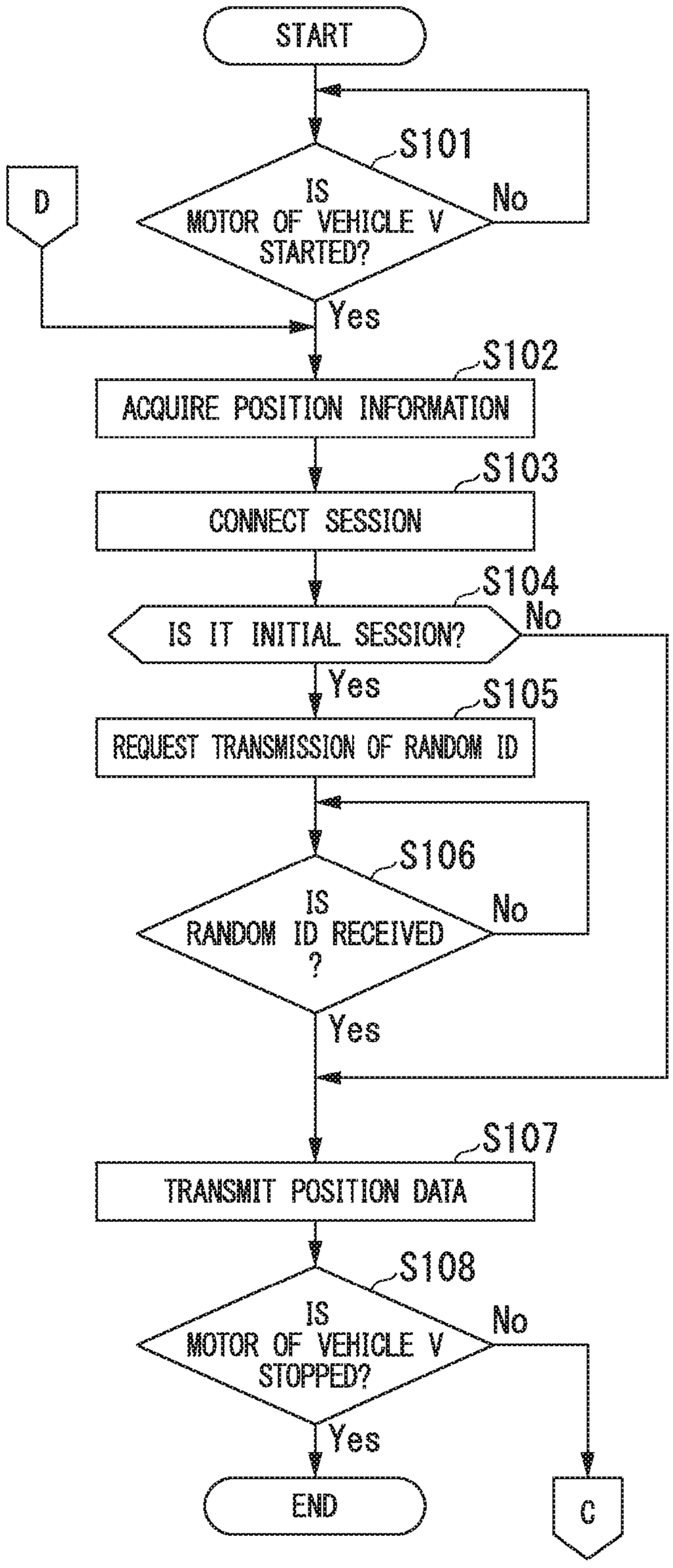

START
S101
IS MOTOR OF VEHICLE V STARTED?
No
Yes
D
S102
ACQUIRE POSITION INFORMATION
S103
CONNECT SESSION
S104
IS IT INITIAL SESSION?
No
Yes
S105
REQUEST TRANSMISSION OF RANDOM ID
S106
IS RANDOM ID RECEIVED ?
No
Yes
S107
TRANSMIT POSITION DATA
S108
IS MOTOR OF VEHICLE V STOPPED?
No
Yes
END
C

FIG. 12

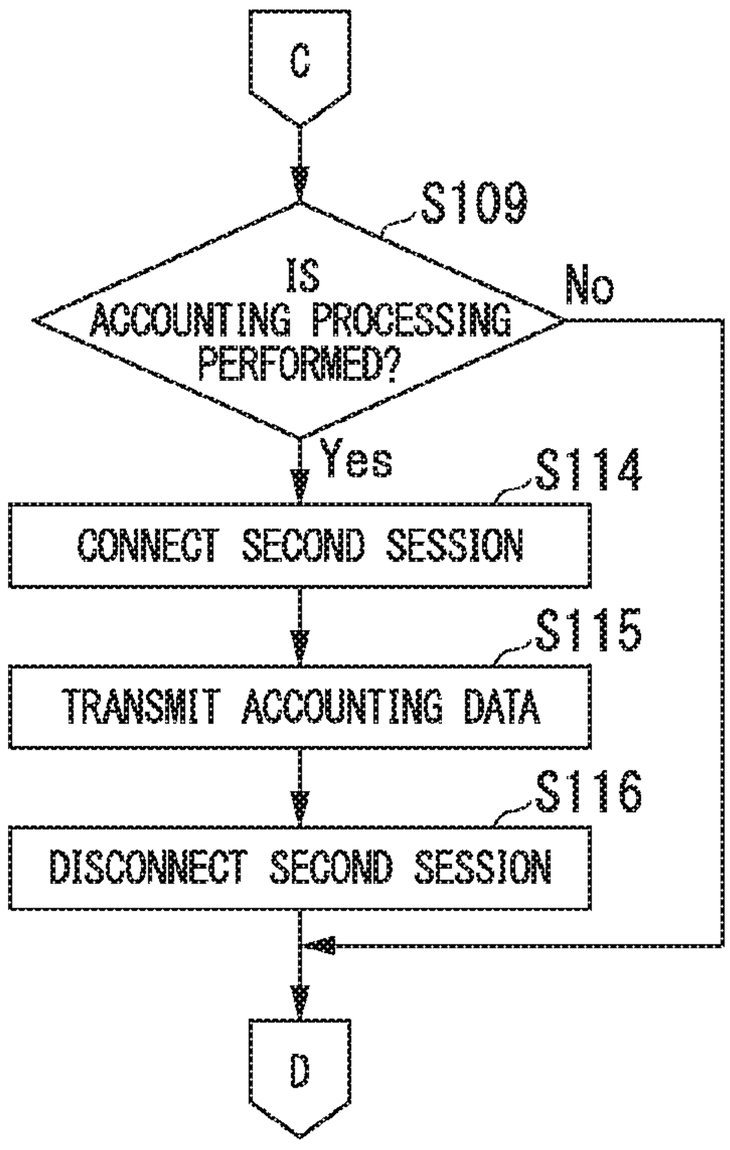

C
S109
IS ACCOUNTING PROCESSING PERFORMED?
No
Yes
S114
CONNECT SECOND SESSION
S115
TRANSMIT ACCOUNTING DATA
S116
DISCONNECT SECOND SESSION
D

FIG. 13

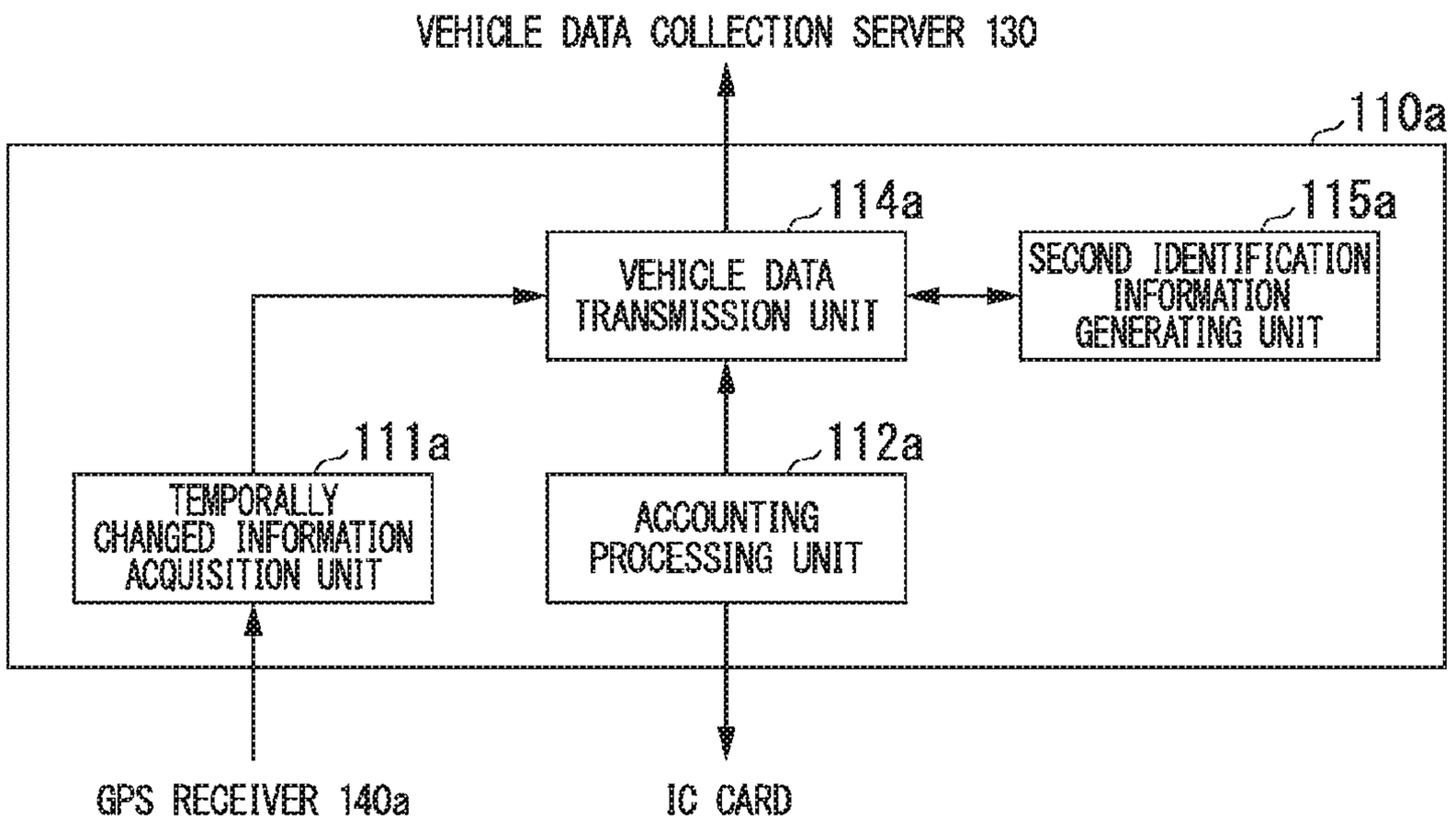

VEHICLE DATA COLLECTION SERVER 130
110a
114a
VEHICLE DATA TRANSMISSION UNIT
115a
SECOND IDENTIFICATION INFORMATION GENERATING UNIT
111a
TEMPORALLY CHANGED INFORMATION ACQUISITION UNIT
112a
ACCOUNTING PROCESSING UNIT
GPS RECEIVER 140a
IC CARD

FIG. 14

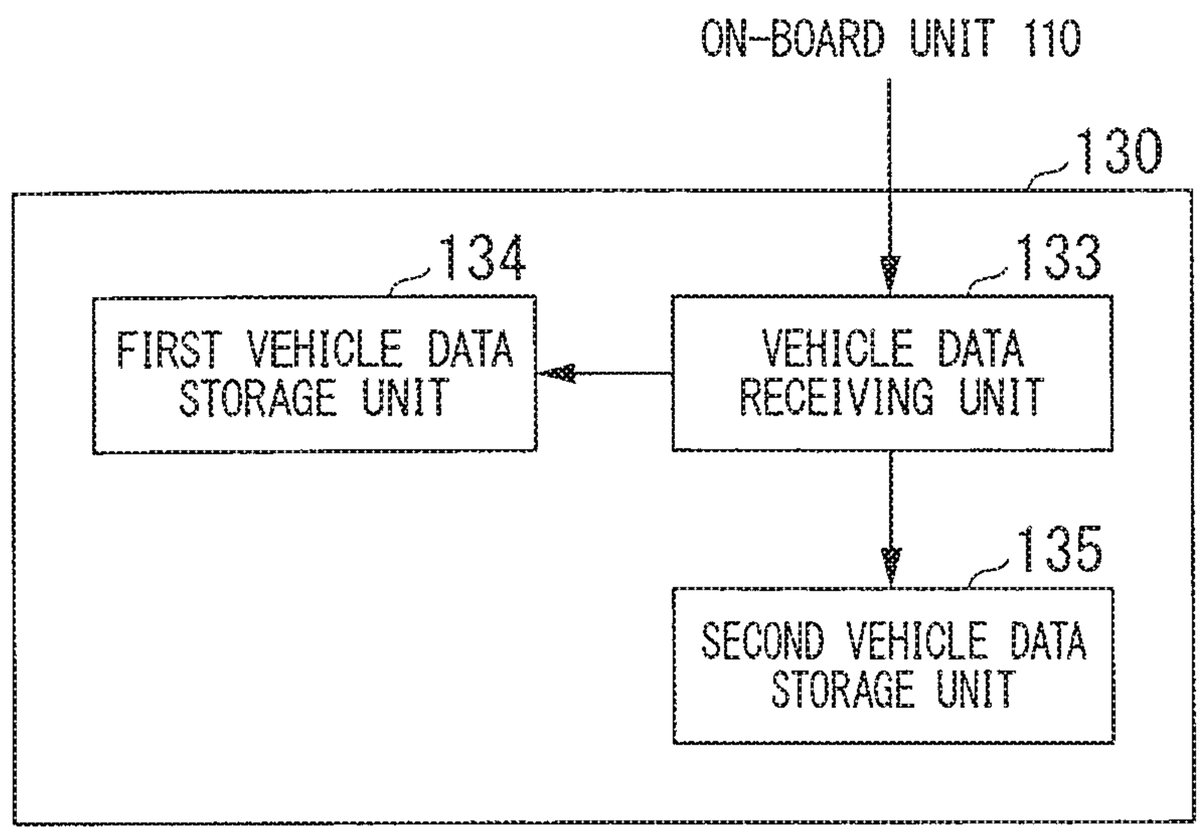

ON-BOARD UNIT 110
130
134
FIRST VEHICLE DATA STORAGE UNIT
133
VEHICLE DATA RECEIVING UNIT
135
SECOND VEHICLE DATA STORAGE UNIT

FIG. 15

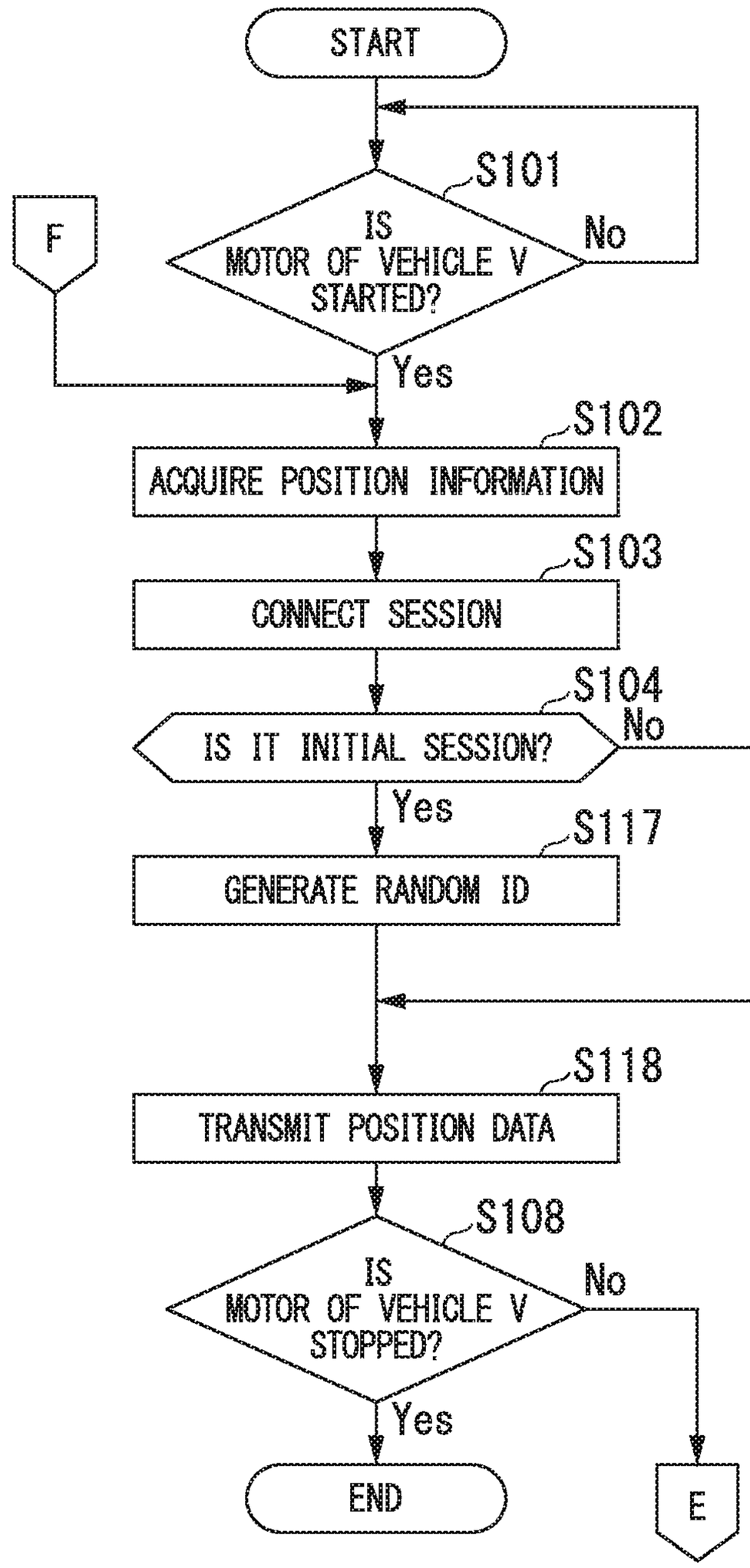

START
S101
IS MOTOR OF VEHICLE V STARTED?
No
Yes
F
S102
ACQUIRE POSITION INFORMATION
S103
CONNECT SESSION
S104
IS IT INITIAL SESSION?
No
Yes
S117
GENERATE RANDOM ID
S118
TRANSMIT POSITION DATA
S108
IS MOTOR OF VEHICLE V STOPPED?
No
Yes
END
E

FIG. 16

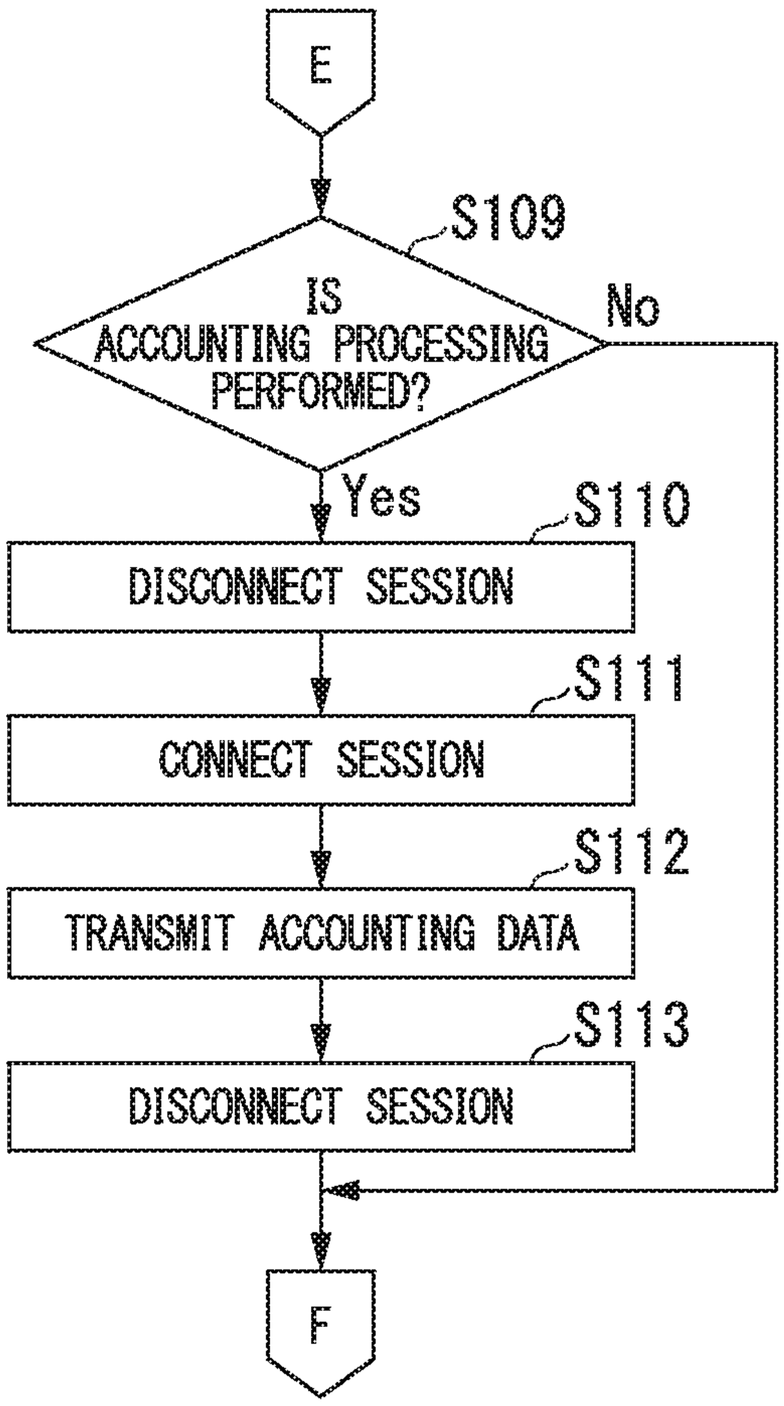

E
S109
IS ACCOUNTING PROCESSING PERFORMED?
No
Yes
S110
DISCONNECT SESSION
S111
CONNECT SESSION
S112
TRANSMIT ACCOUNTING DATA
S113
DISCONNECT SESSION
F

FIG. 17

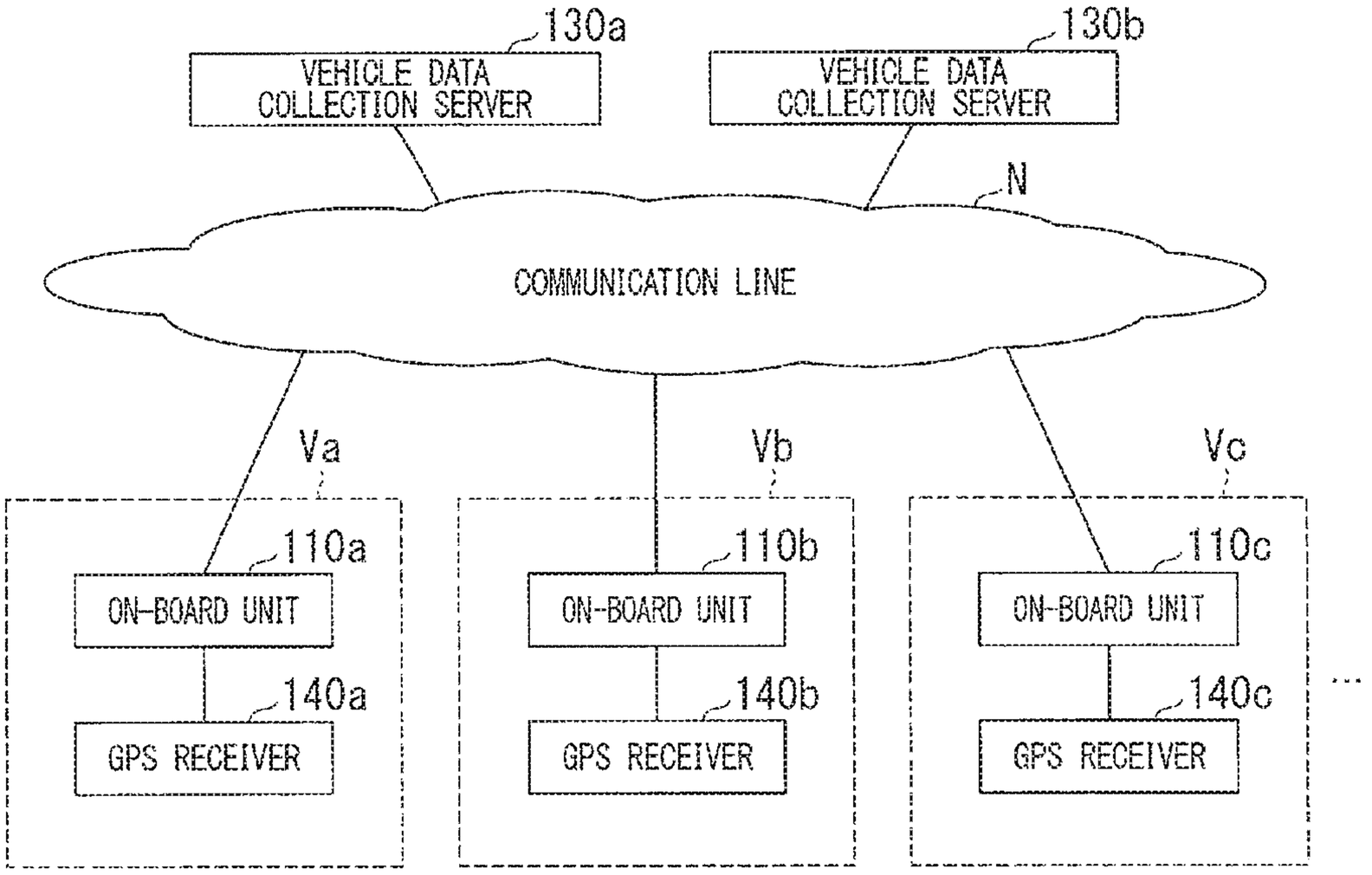

130a
VEHICLE DATA COLLECTION SERVER
130b
VEHICLE DATA COLLECTION SERVER
N
COMMUNICATION LINE
Va
Vb
Vc
110a
ON-BOARD UNIT
140a
GPS RECEIVER
110b
ON-BOARD UNIT
140b
GPS RECEIVER
110c
ON-BOARD UNIT
140c
GPS RECEIVER
...

FIG. 18

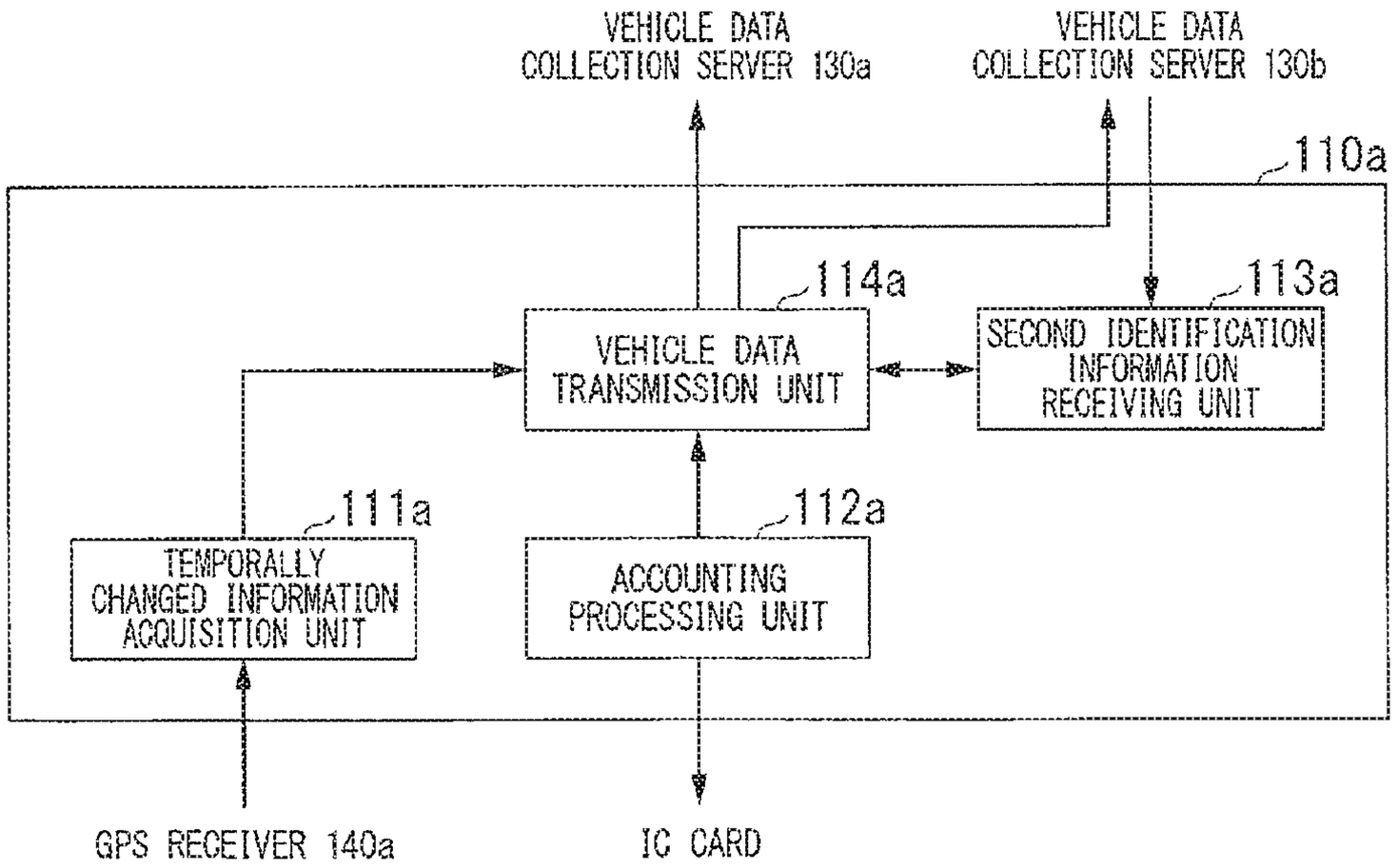

VEHICLE DATA COLLECTION SERVER 130a
VEHICLE DATA COLLECTION SERVER 130b
110a
114a
VEHICLE DATA TRANSMISSION UNIT
113a
SECOND IDENTIFICATION INFORMATION RECEIVING UNIT
111a
TEMPORALLY CHANGED INFORMATION ACQUISITION UNIT
112a
ACCOUNTING PROCESSING UNIT
GPS RECEIVER 140a
IC CARD

FIG. 19

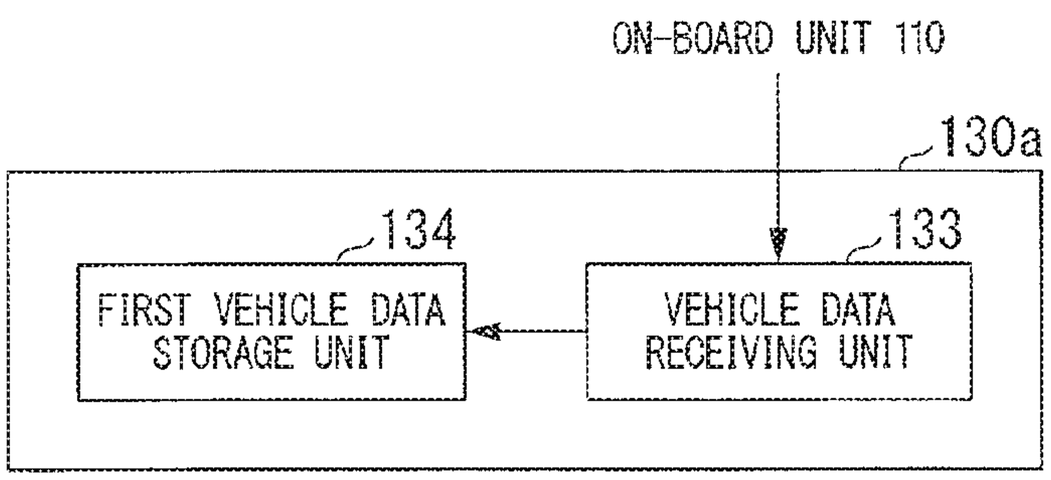

ON-BOARD UNIT 110
130a
134
FIRST VEHICLE DATA STORAGE UNIT
133
VEHICLE DATA RECEIVING UNIT

FIG. 20

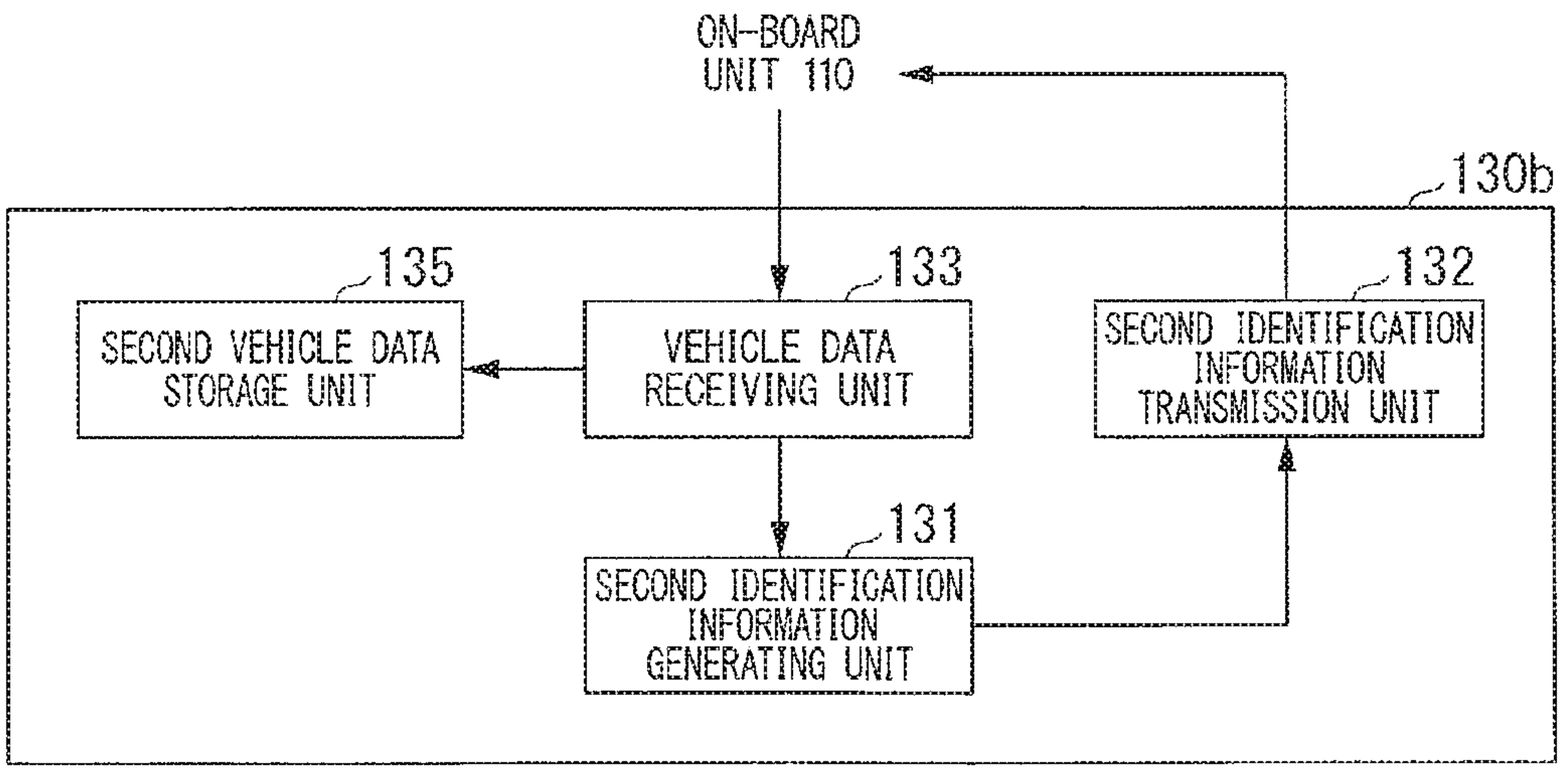

ON-BOARD UNIT 110
130b
135
SECOND VEHICLE DATA STORAGE UNIT
133
VEHICLE DATA RECEIVING UNIT
132
SECOND IDENTIFICATION INFORMATION TRANSMISSION UNIT
131
SECOND IDENTIFICATION INFORMATION GENERATING UNIT

FIG. 21

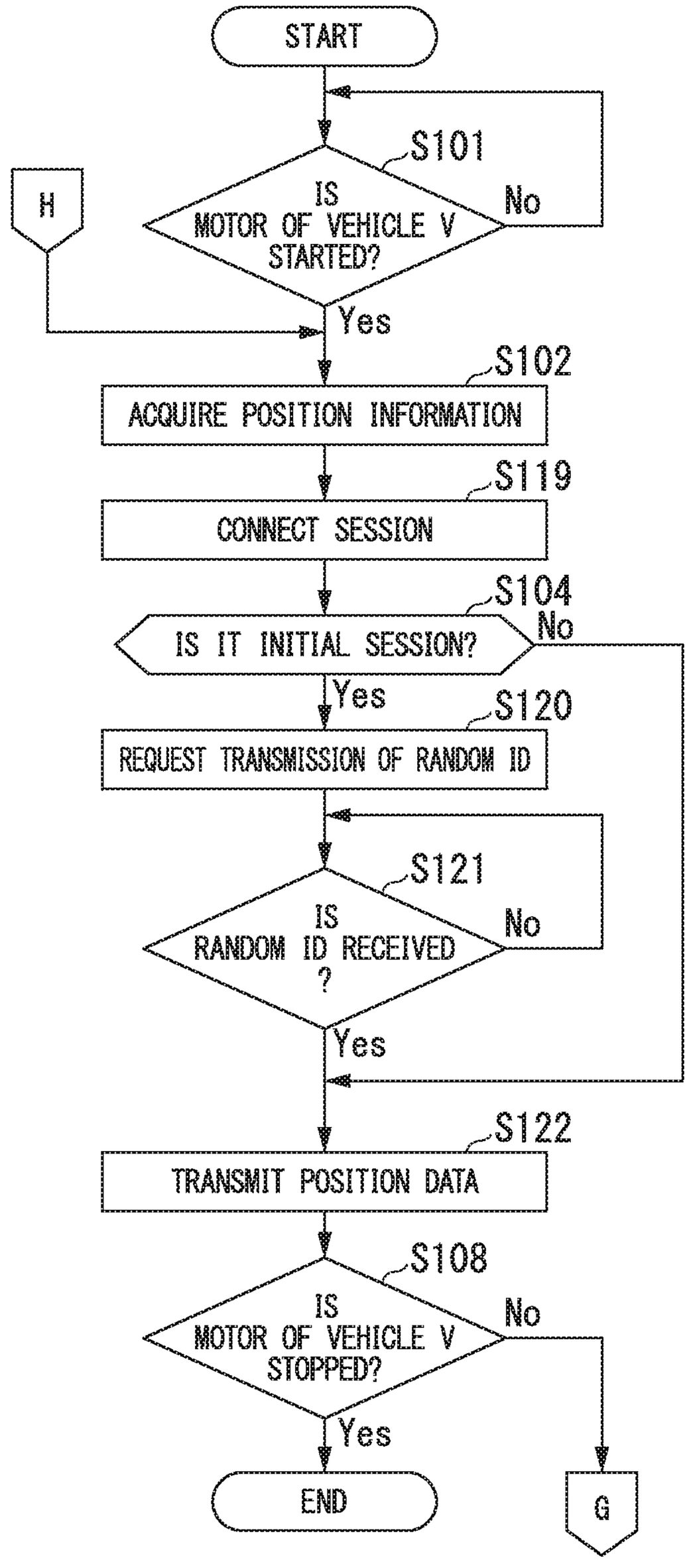

START
S101
IS MOTOR OF VEHICLE V STARTED?
No
Yes
H
S102
ACQUIRE POSITION INFORMATION
S119
CONNECT SESSION
S104
IS IT INITIAL SESSION?
No
Yes
S120
REQUEST TRANSMISSION OF RANDOM ID
S121
IS RANDOM ID RECEIVED ?
No
Yes
S122
TRANSMIT POSITION DATA
S108
IS MOTOR OF VEHICLE V STOPPED?
No
Yes
END
G

FIG. 22

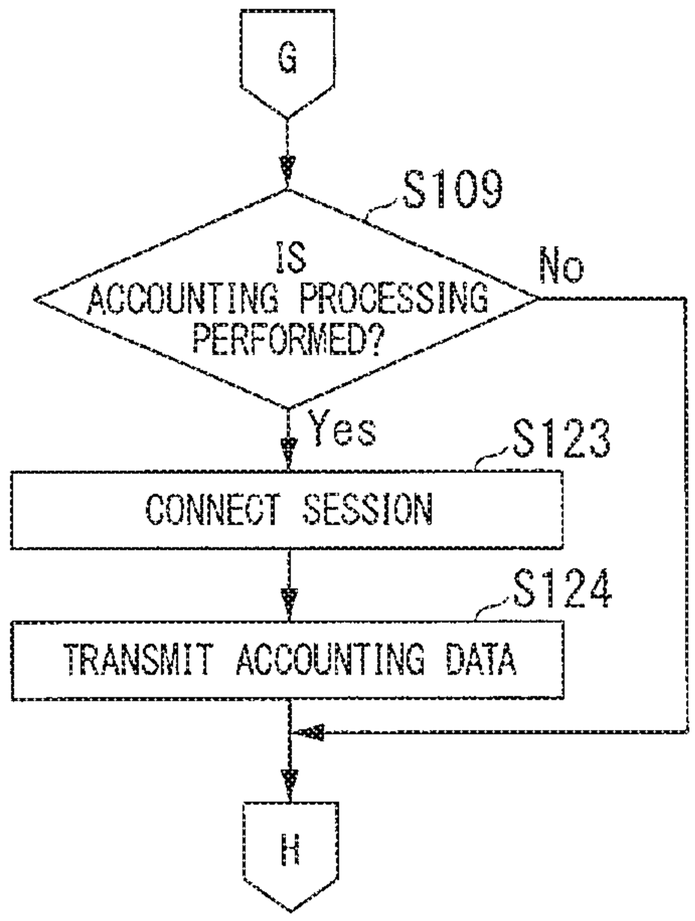

G
S109
IS ACCOUNTING PROCESSING PERFORMED?
No
Yes
S123
CONNECT SESSION
S124
TRANSMIT ACCOUNTING DATA
H

FIG. 23

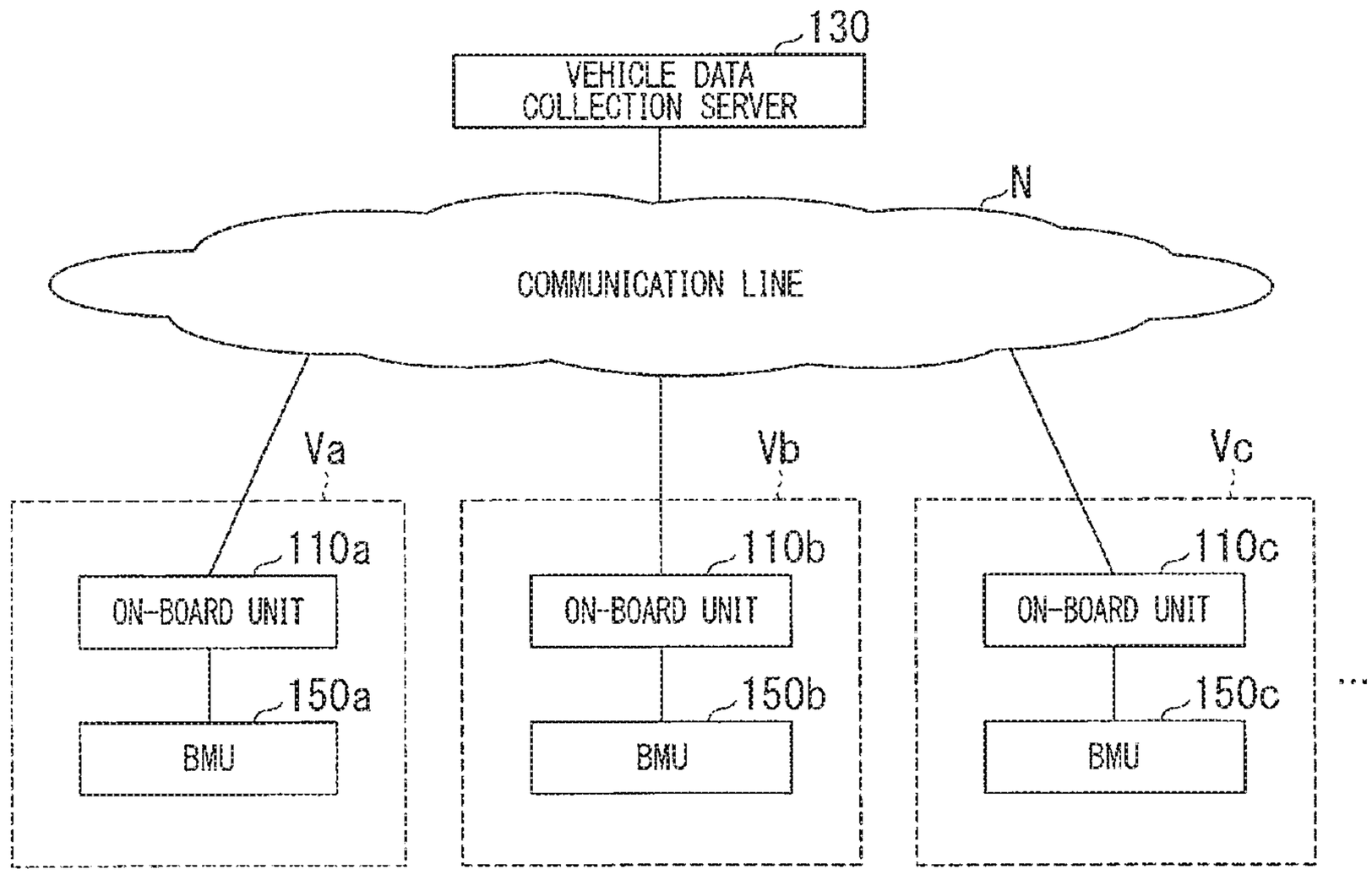

130
VEHICLE DATA COLLECTION SERVER
N
COMMUNICATION LINE
Va
Vb
Vc
110a
ON-BOARD UNIT
150a
BMU
110b
ON-BOARD UNIT
150b
BMU
110c
ON-BOARD UNIT
150c
BMU
...

FIG. 24

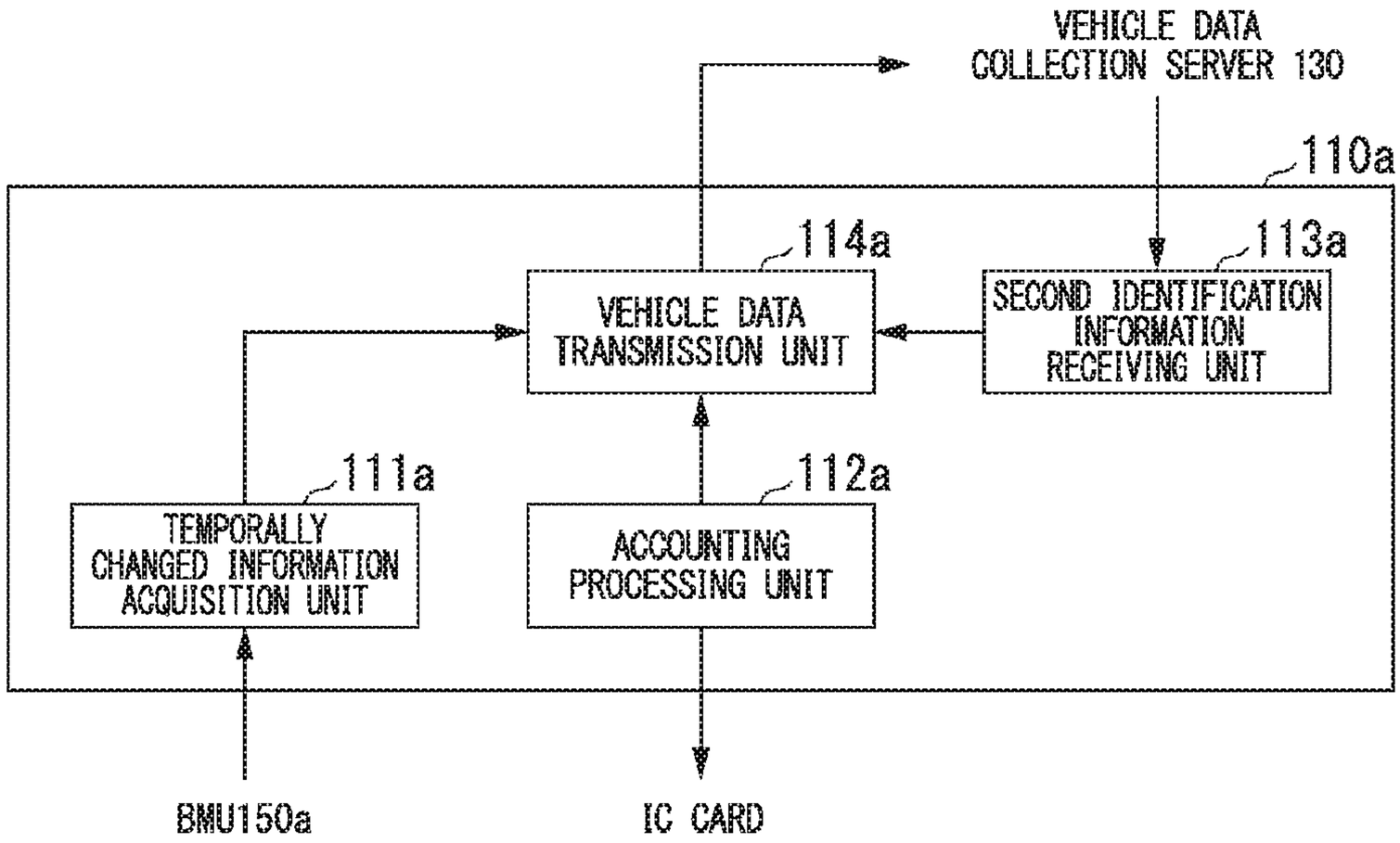


FIG. 25

135

RANDOM ID	SOC(%)	TIME (YEAR/MONTH/DAY/HOUR:MINUTE:SECOND)
042YuRzKwv1C	100	2011/07/15/15:19:00
042YuRzKwv1C	99	2011/07/15/15:22:00
042YuRzKwv1C	99	2011/07/15/15:25:00
⋮	⋮	⋮

FIG. 26

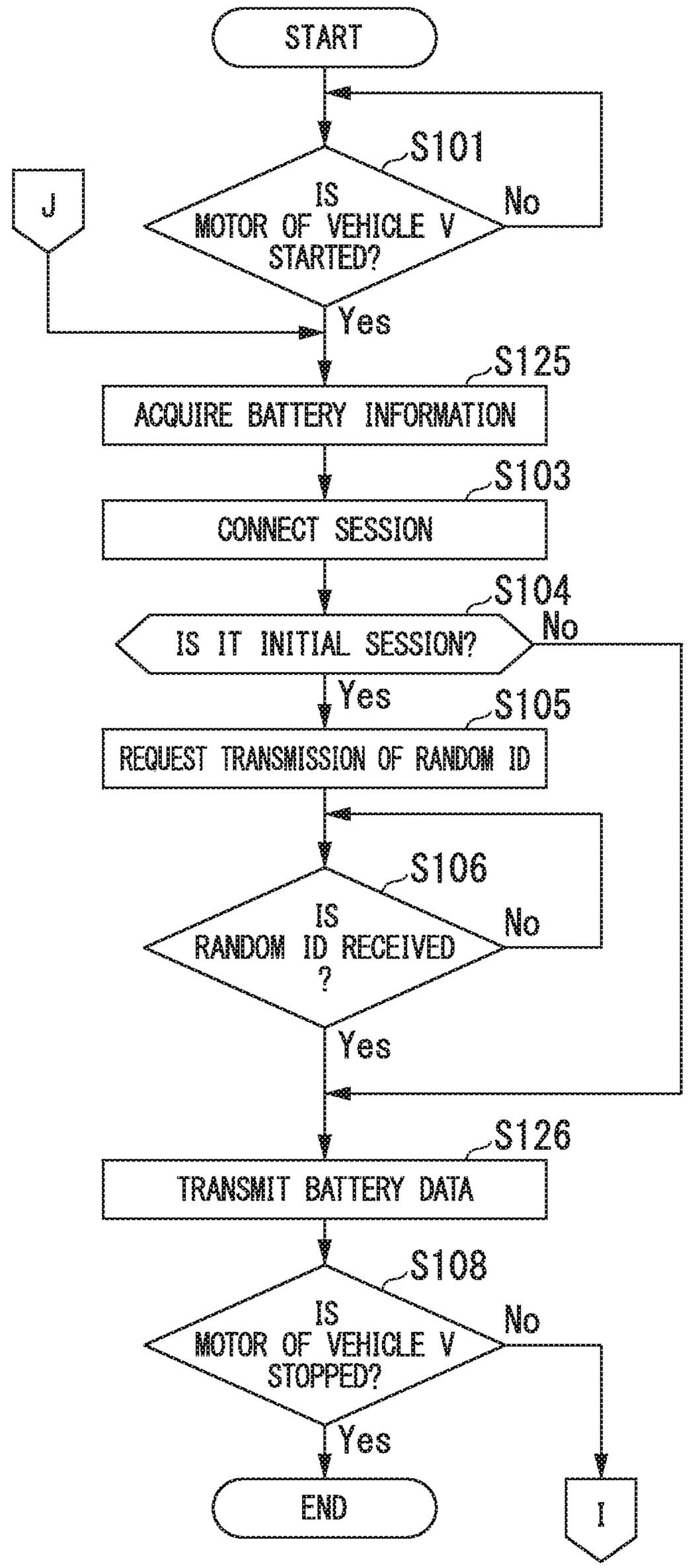

START
S101
IS MOTOR OF VEHICLE V STARTED?
No
Yes
J
S125
ACQUIRE BATTERY INFORMATION
S103
CONNECT SESSION
S104
IS IT INITIAL SESSION?
No
Yes
S105
REQUEST TRANSMISSION OF RANDOM ID
S106
IS RANDOM ID RECEIVED ?
No
Yes
S126
TRANSMIT BATTERY DATA
S108
IS MOTOR OF VEHICLE V STOPPED?
No
Yes
END
I

FIG. 27

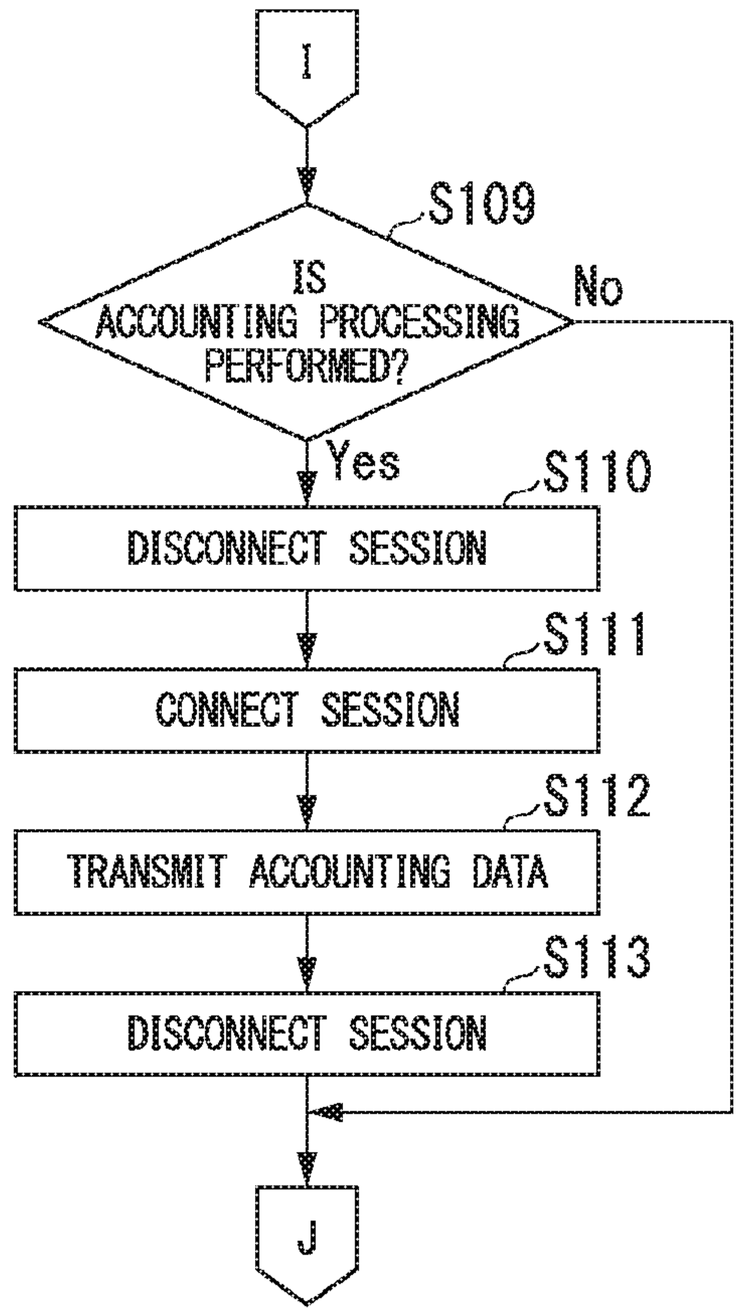

I
S109
IS ACCOUNTING PROCESSING PERFORMED?
No
Yes
S110
DISCONNECT SESSION
S111
CONNECT SESSION
S112
TRANSMIT ACCOUNTING DATA
S113
DISCONNECT SESSION
J

FIG. 28

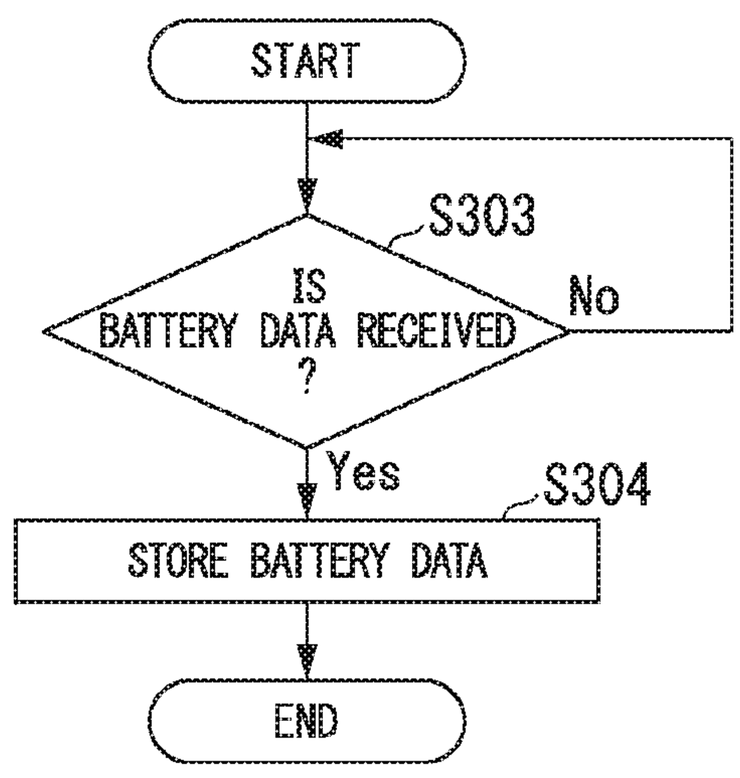

START
S303
IS BATTERY DATA RECEIVED ?
No
Yes
S304
STORE BATTERY DATA
END

FIG. 29

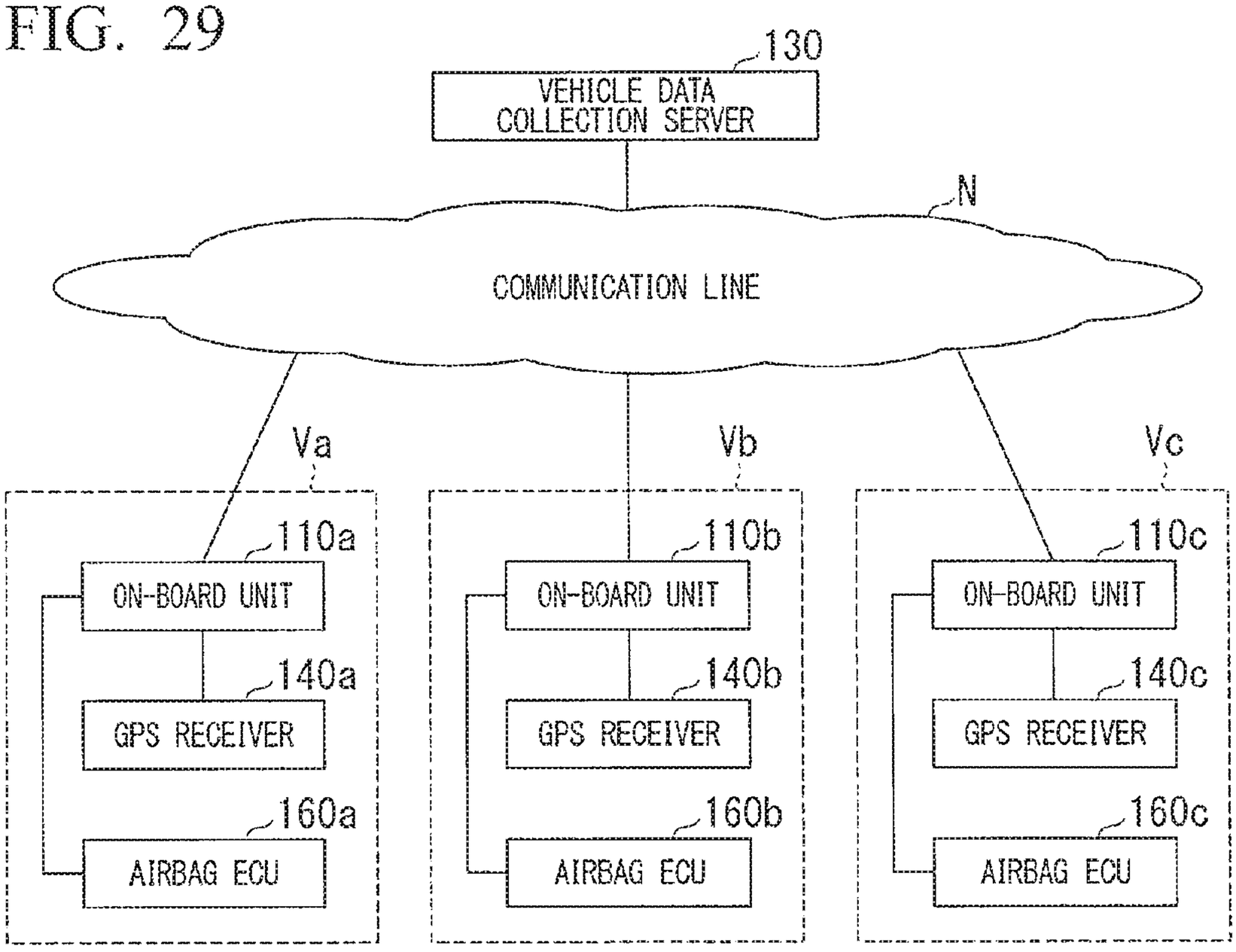

130
VEHICLE DATA COLLECTION SERVER
N
COMMUNICATION LINE
Va
Vb
Vc
110a
110b
110c
ON-BOARD UNIT
ON-BOARD UNIT
ON-BOARD UNIT
140a
140b
140c
GPS RECEIVER
GPS RECEIVER
GPS RECEIVER
160a
160b
160c
AIRBAG ECU
AIRBAG ECU
AIRBAG ECU

FIG. 30

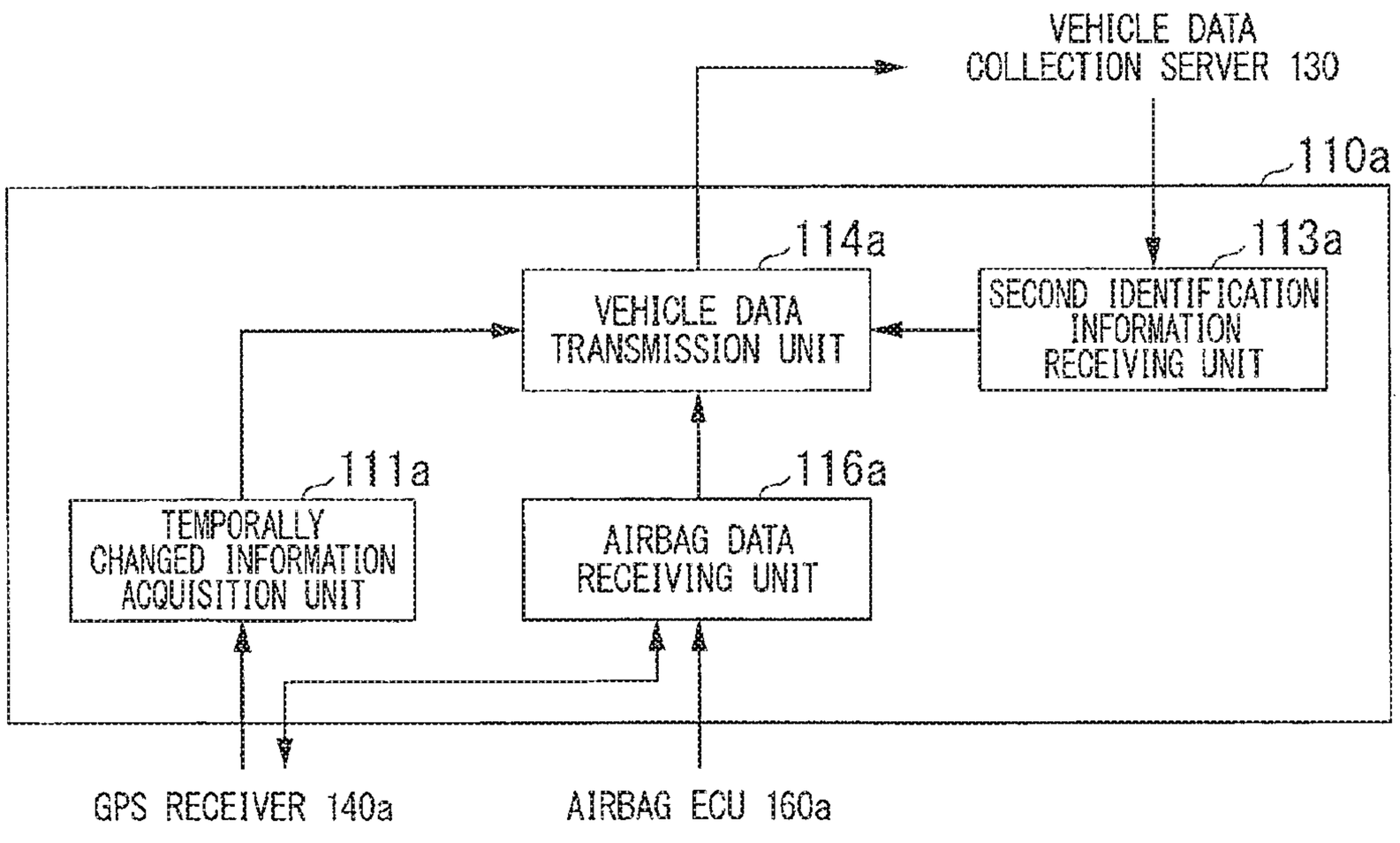

VEHICLE DATA COLLECTION SERVER 130
110a
114a
113a
VEHICLE DATA TRANSMISSION UNIT
SECOND IDENTIFICATION INFORMATION RECEIVING UNIT
111a
116a
TEMPORALLY CHANGED INFORMATION ACQUISITION UNIT
AIRBAG DATA RECEIVING UNIT
GPS RECEIVER 140a
AIRBAG ECU 160a

FIG. 31

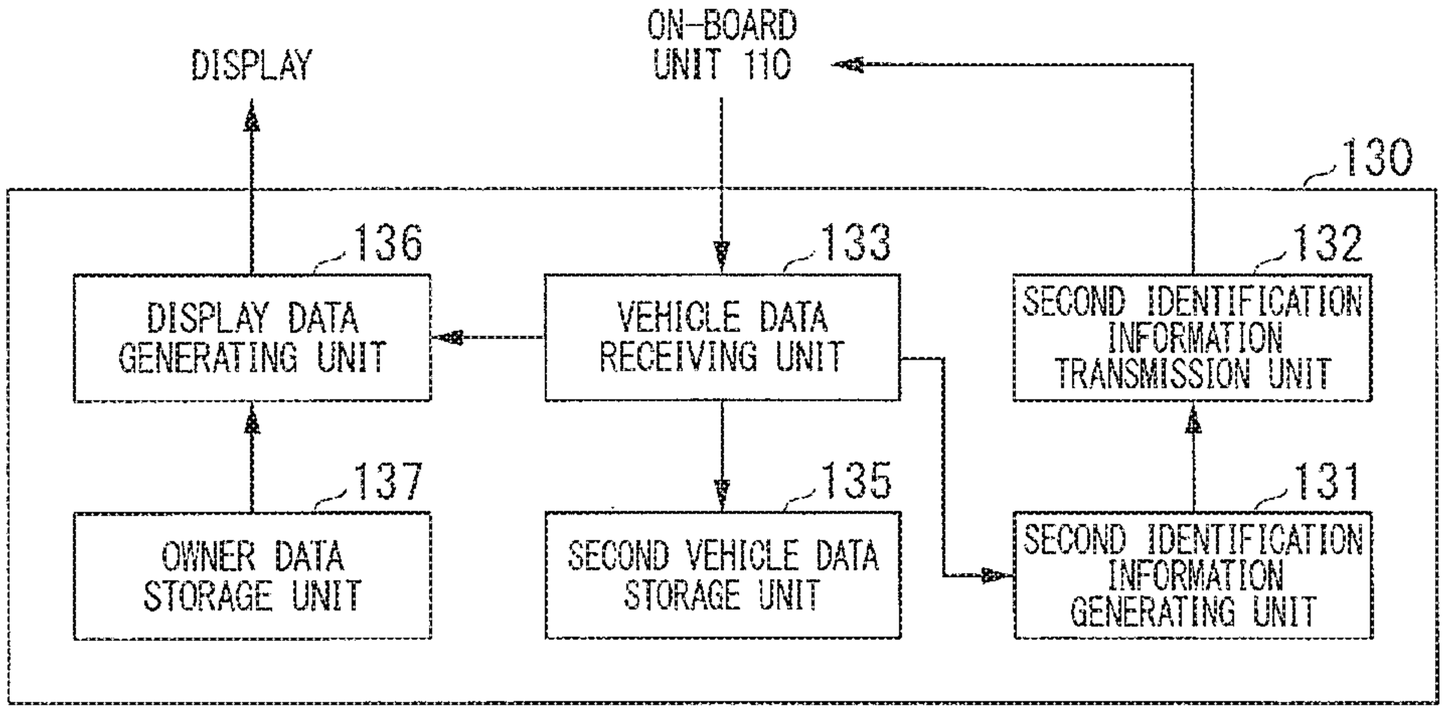


FIG. 32

137

ON-BOARD UNIT ID	NAME	AGE (YEARS)	GENDER	BODY TYPE	COLOR
OBU0001	○○○○	20	FEMALE	2-BOX	WHITE
OBU0002	○○○○	35	MALE	STATION WAGON	SILVER
OBU0003	○○○○	31	FEMALE	LIGHT CAR	BLACK
⋮	⋮	⋮	⋮	⋮	⋮

FIG. 33

D

ACCIDENT OCCURRED.

CURRENT LOCATION OF VEHICLE INVOLVED IN THE ACCIDENT
STREET IN FRONT OF ○○ HOSPITAL, JINGUUMAE, SHIBUYA-KU, TOKYO

VEHICLE INVOLVED IN THE ACCIDENT
BODY TYPE: 2-BOX
COLOR: SILVER

OWNER
NAME: ○○○○
AGE: 20(YEARS)
GENDER: FEMALE

FIG. 34

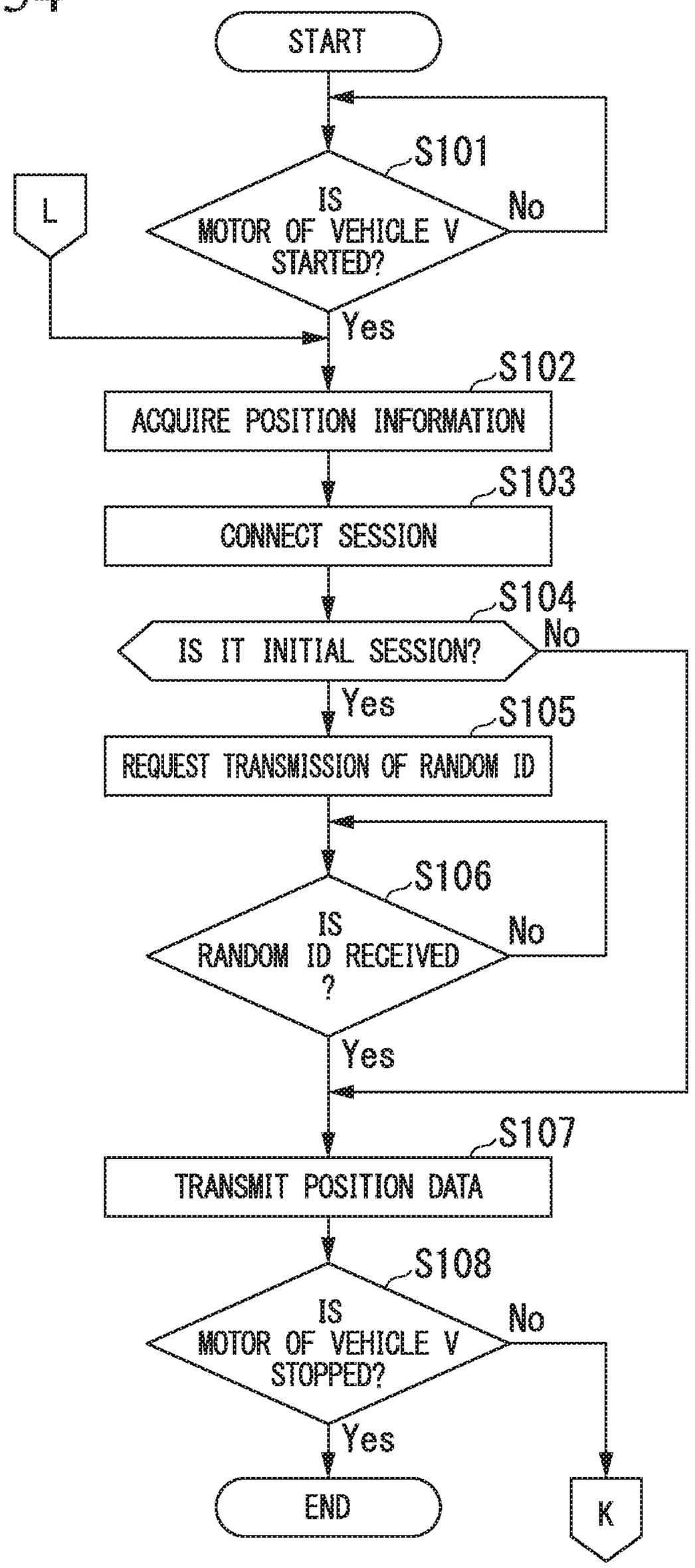

START
S101
IS MOTOR OF VEHICLE V STARTED?
No
Yes
L
S102
ACQUIRE POSITION INFORMATION
S103
CONNECT SESSION
S104
IS IT INITIAL SESSION?
No
Yes
S105
REQUEST TRANSMISSION OF RANDOM ID
S106
IS RANDOM ID RECEIVED ?
No
Yes
S107
TRANSMIT POSITION DATA
S108
IS MOTOR OF VEHICLE V STOPPED?
No
Yes
END
K

FIG. 35

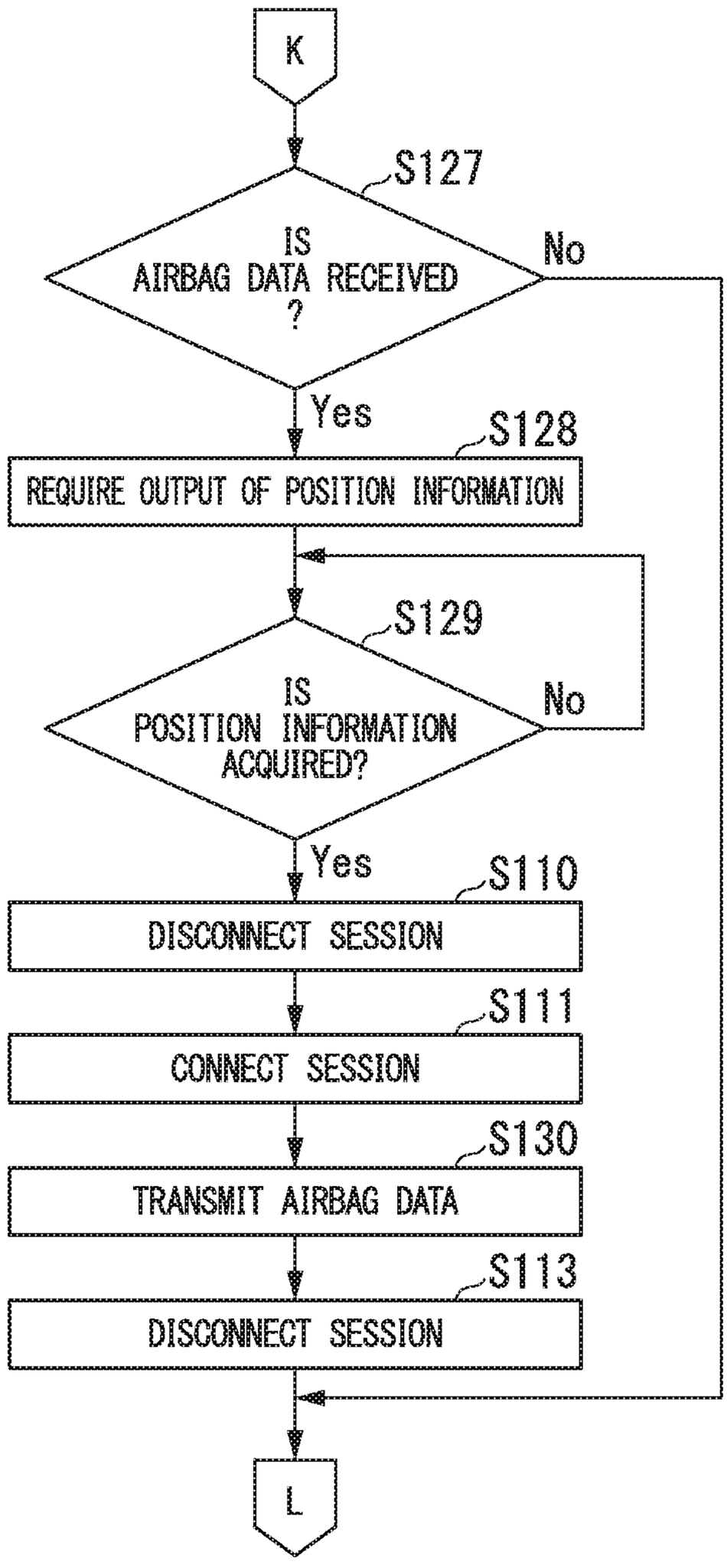
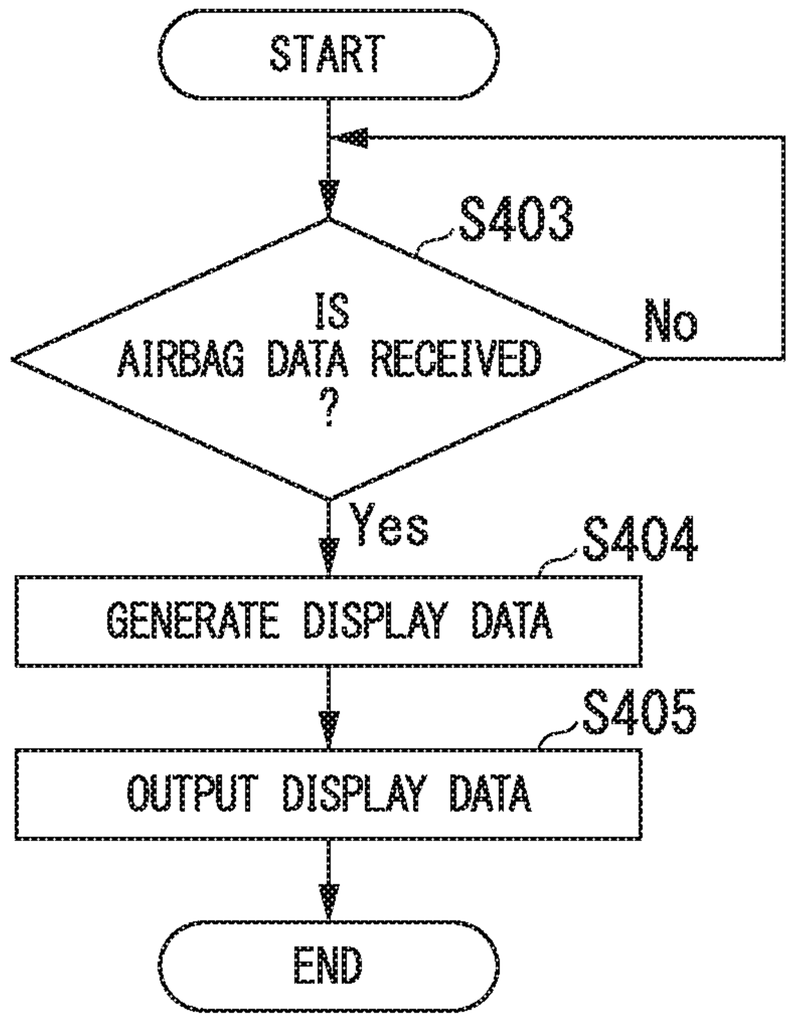

K
S127
IS AIRBAG DATA RECEIVED ?
No
Yes
S128
REQUIRE OUTPUT OF POSITION INFORMATION
S129
IS POSITION INFORMATION ACQUIRED?
No
Yes
S110
DISCONNECT SESSION
S111
CONNECT SESSION
S130
TRANSMIT AIRBAG DATA
S113
DISCONNECT SESSION
L

FIG. 36


START
S403
IS AIRBAG DATA RECEIVED ?
No
Yes
S404
GENERATE DISPLAY DATA
S405
OUTPUT DISPLAY DATA
END

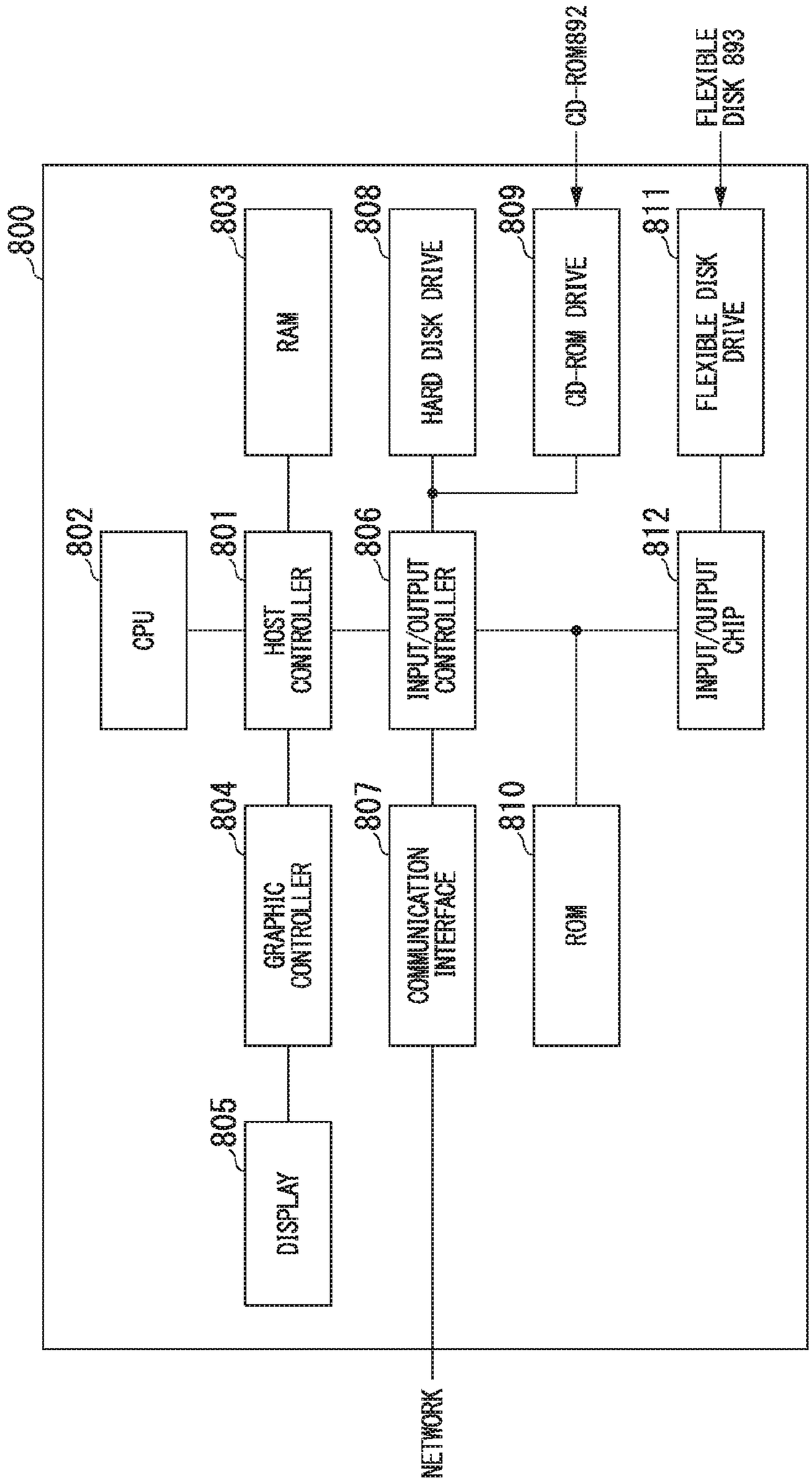

800
803
RAM
808
HARD DISK DRIVE
809
CD-ROM DRIVE
811
FLEXIBLE DISK DRIVE
CD-ROM892
FLEXIBLE DISK 893
802
CPU
801
HOST CONTROLLER
806
INPUT/OUTPUT CONTROLLER
812
INPUT/OUTPUT CHIP
804
GRAPHIC CONTROLLER
807
COMMUNICATION INTERFACE
810
ROM
805
DISPLAY
NETWORK

FIG. 37

VEHICLE DATA COLLECTION SYSTEM, VEHICLE DATA COLLECTION METHOD, VEHICLE-MOUNTED DEVICE, PROGRAM, AND RECORDING MEDIUM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

TECHNICAL FIELD

The present invention relates to a vehicle data collection system, a vehicle data collection method, a vehicle-mounted device, a program, and a recording medium.

This is a reissue application of U.S. Pat. No. 9,495,813, which is a 371 of PCT/JP2013/080521 filed on Nov. 12, 2013, and Priority is claimed on Japanese Patent Application No. 2012-254100, filed Nov. 20, 2012, the content of which is incorporated herein by reference.

BACKGROUND ART

In a vehicle during travel, there are various types of information, for example, information displayed on instruments such as a traveling speed, engine revolution speed, a residual quantity of fuel, and so on, information such as a position of a vehicle, or the like. The concept of a probe car is to collect the information, effectively use the information, and so on.

For example, when the speed and the position of the vehicle are collected, the traffic situation of a predetermined section can be accurately recognized. A large number of sensors configured to measure the number of passing vehicles and their speeds are installed on some roads at short intervals of several hundred meters, and even at present, accurate congestion information is provided. On the other hand, since a probe car uses the vehicle itself as a sensor, information can be collected even on a road on which the sensor is not installed.

In addition, as another method of using a probe car, when information referred to as a brake pedal condition information is collected and a place where a large number of drivers brake suddenly is investigated, a place where a certain hazard easily occurs can be analyzed, and occurrence of an accident can be prevented by taking measures in advance. Further, as another method of using a probe car, a method of collecting ON-OFF information on a switch of a wiper and recognizing a local weather situation is considered.

While there are many other methods of using a probe car, the methods includes problems, such as privacy problems. The probe car may invade the privacy of the driver of a vehicle. This is because who is in the vehicle, when the vehicle moves, and where the vehicle may be determined. Here, the probe car is preferably required to securely protect individual privacy while collecting necessary information, and feed back advantageous information to a user.

As technologies related to such a background, various technologies are known (for example, see Patent Literature 1).

For example, Patent Literature 1 discloses an information processing device capable of acquiring traffic information using a mobile communication terminal. More specifically, the device generates identification information that can

identify a handheld communication terminal carried on one or more moving bodies only to a period required for traffic information collection. Then, the device collects an arrival time when a handheld communication terminal arrives at two or more predetermined places or an arrival position of the handheld communication terminal at two or more predetermined times based on identification information. Then, the device stores the collected arrival time or arrival position to correspond to the generated identification information. Then, the device detects a moving state of the moving body based on the arrival time or the arrival position stored to correspond to the identification information. In addition, the device instructs the handheld communication terminal to remove the identification information stored in the handheld communication terminal at predetermined timing. In this way, for example, a user of the handheld communication terminal can provide place information without fear of invasion of privacy.

CITATION LIST

Patent Literature

[Patent Literature 1] Japanese (Unexamined Patent Application, First Publication No. 2004-030684

SUMMARY OF INVENTION

Technical Problem

It is desired for a probe car to collect information in which an individual related to a vehicle is to be identified and information in which the individual related to the vehicle is not to be identified without invasion of a user's privacy. Here, the information in which the individual is to be identified is, for example, information such as accounting information or the like.

Solution to Problem

In order to solve the problems, according to a first aspect of the present invention, a vehicle data collection system for collecting data related to a vehicle, the system includes: a vehicle-mounted device installed in the vehicle and configured to transmit data related to the vehicle; and a vehicle data collection device configured to collect the data related to the plurality of vehicles, wherein the vehicle-mounted device includes a vehicle data transmission unit configured to transmit first vehicle data, which includes information in which an individual related to the vehicle is to be identified and second vehicle data, which includes information in which the individual related to the vehicle is not to be identified, to the vehicle data collection device in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle.

The vehicle data transmission unit may transmit data further including first identification information that is capable of identifying the individual related to the vehicle only when the first vehicle data is transmitted.

The vehicle-mounted device may further includes a temporally changed information acquisition unit configured to acquire information related to a time-varied event of the vehicle, and the vehicle data transmission unit may transmit the second vehicle data including information acquired by the temporally changed information acquisition unit as the information in which the individual related to the vehicle is

not to be identified whenever the temporally changed information acquisition unit acquires information.

The vehicle data transmission unit may transmit data further including second identification information that is not capable of identifying the individual related to the vehicle and is common to a plurality of sessions when the second vehicle data including the information acquired by the temporally changed information acquisition unit is transmitted in the plurality of sessions.

After a motor of the vehicle is started, when the second vehicle data is initially transmitted, the vehicle data transmission unit may transmit data including a new second identification information.

The vehicle data transmission unit may transmit the first vehicle data and the second vehicle data to different vehicle data collection devices respectively.

According to a second aspect of the present invention, a vehicle data collection method of collecting data related to a vehicle, the vehicle data collection method includes a vehicle data transmission step in which a vehicle-mounted device installed in the vehicle and configured to transmit the data related to the vehicle transmits first vehicle data, which includes information in which an individual related to the vehicle is to be identified and second vehicle data, which includes information in which the individual related to the vehicle is not to be identified, to a vehicle data collection device configured to collect data related to the plurality of vehicles in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle.

According to a third aspect of the present invention, a vehicle-mounted device installed in a vehicle and configured to transmit data related to the vehicle, the vehicle-mounted device includes a vehicle data transmission unit configured to transmit first vehicle data, which includes information in which an individual related to the vehicle is to be identified and second vehicle data, which includes information in which the individual related to the vehicle is not to be identified, to a vehicle data collection device configured to collect data related to a plurality of vehicles in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle.

According to a fourth aspect of the present invention, a program configured to cause a computer to function as a vehicle-mounted device installed in a vehicle and configured to transmit data related to the vehicle, the program is configured to function as a vehicle data transmission unit configured to transmit first vehicle data, which includes information in which an individual related to the vehicle is to be identified, and second vehicle data, which includes information in which the individual related to the vehicle is not to be identified, to a vehicle data collection device configured to collect data related to a plurality of vehicles in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle.

According to a fifth aspect of the present invention, a recording medium on which a program configured to cause a computer to function as a vehicle-mounted device installed in a vehicle and configured to transmit data related to the vehicle is recorded, the recording medium records the program configured to function as a vehicle data transmission unit configured to transmit first vehicle data, which includes information in which an individual related to the vehicle is to be identified and second vehicle data, which includes information in which the individual related to the vehicle is not to be identified, to a vehicle data collection device configured to collect data related to a plurality of vehicles in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle.

Furthermore, the summary of the present invention does not enumerate all of features necessary for the present invention. In addition, sub-combinations of these feature groups also fall into the scope of the present invention.

Advantageous Effects of Invention

As will be apparent from the above-mentioned description, according to the present invention, information in which an individual related to the vehicle is to be identified and information in which the individual related to the vehicle is not to be identified can be collected without invasion of a user's privacy.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a view showing an example of a usage environment of a vehicle data collection system according to a first embodiment.

FIG. **2** is a view showing an example of a block configuration of an on-board unit **110**a.

FIG. **3** is a view showing an example of a block configuration of a vehicle data collection server **130**.

FIG. **4** is a view showing a table indicating an example of information stored in a first vehicle data storage unit **134**.

FIG. **5** is a view showing a table indicating an example of information stored in a second vehicle data storage unit **135**.

FIG. **6** is a view showing an example of an operation flow of an on-board unit **110**.

FIG. **7** is a view showing an example of the operation flow of the on-board unit **110**.

FIG. **8** is a view showing an example of an operation flow of the vehicle data collection server **130**.

FIG. **9** is a view showing an example of the operation flow of the vehicle data collection server **130**.

FIG. **10** is a view showing an example of the operation flow of the vehicle data collection server **130**.

FIG. **11** is a view showing an example of an operation flow of an on-board unit **110** according to a second embodiment.

FIG. **12** is a view showing an example of the operation flow of the on-board unit **110** according to the second embodiment.

FIG. **13** is a view showing an example of a block configuration of an on-board unit **110**a according to a third embodiment.

FIG. **14** is a view showing an example of a block configuration of a vehicle data collection server **130** according to the third embodiment.

FIG. **15** is a view showing an example of an operation flow of the on-board unit **110** according to the third embodiment.

FIG. **16** is a view showing an example of the operation flow of the on-board unit **110** according to the third embodiment.

FIG. **17** is a view showing an example of a usage environment of a vehicle data collection system of a fourth embodiment.

FIG. **18** is a view showing an example of a block configuration of the on-board unit **110**a according to the fourth embodiment.

FIG. **19** is a view showing an example of a block configuration of a vehicle data collection server **130**a according to the fourth embodiment.

FIG. **20** is a view showing an example of a block configuration of a vehicle data collection server **130**b according to the fourth embodiment.

FIG. **21** is a view showing an example of an operation flow of the on-board unit **110** according to the fourth embodiment.

FIG. **22** is a view showing an example of the operation flow of the on-board unit **110** according to the fourth embodiment.

FIG. **23** is a view showing an example of a usage environment of a vehicle data collection system according to a fifth embodiment.

FIG. **24** is a view showing an example of a block configuration of the on-board unit **110**a according to the fifth embodiment.

FIG. **25** is a view showing a table indicating an example of information stored in the second vehicle data storage unit **135** according to the fifth embodiment.

FIG. **26** is a view showing an example of an operation flow of the on-board unit **110** according to the fifth embodiment.

FIG. **27** is a view showing an example of the operation flow of the on-board unit **110** according to the fifth embodiment.

FIG. **28** is a view showing an example of an operation flow of the vehicle data collection server **130** according to the fifth embodiment.

FIG. **29** is a view showing an example of a usage environment of a vehicle data collection system according to a sixth embodiment.

FIG. **30** is a view showing an example of a block configuration of the on-board unit **110**a according to the sixth embodiment.

FIG. **31** is a view showing an example of a block configuration of the vehicle data collection server **130** according to the sixth embodiment.

FIG. **32** is a view showing a table indicating an example of information stored in an owner data storage unit **137** according to the sixth embodiment.

FIG. **33** is a view showing an example of a display screen D displayed on a display.

FIG. **34** is a view showing an example of an operation flow of the on-board unit **110** according to the sixth embodiment.

FIG. **35** is a view showing an example of the operation flow of the on-board unit **110** according to the sixth embodiment.

FIG. **36** is a view showing an example of an operation flow of the vehicle data collection server **130** according to the sixth embodiment.

FIG. **37** is a view showing an example of a hardware configuration of a computer **800** constituting the on-board unit **110** according to the embodiment.

DESCRIPTION OF EMBODIMENTS

Hereinafter, while the present invention will be described with reference to embodiments of the present invention, the following embodiments of the present invention are not intended to limit the scope of the accompanying claims, and not limited as long as all of the combinations of features described in the embodiments are necessary for the solution according to the present invention.

FIG. **1** shows an example of a usage environment of a vehicle data collection system according to a first embodiment. The vehicle data collection system is a system for collecting data related to a plurality of vehicles Va, Vb, Vc, . . . (hereinafter, generally referred to as a vehicle V). Furthermore, the vehicle data collection system may be a system for collecting data related to one vehicle, instead of to a plurality of vehicles.

The vehicle data collection system includes a plurality of on-board units **110**a, **100**b, **100**c, . . . (hereinafter, generally referred to as an on-board unit **110**), a vehicle data collection server **130**, and a plurality of GPS receivers **140**a, **140**b, **140**c, . . . (hereinafter, generally referred to as a GPS receiver **140**). Furthermore, the on-board unit **110** may be an example of "a vehicle-mounted device" of the present invention. In addition, the vehicle data collection server **130** may be an example of "a vehicle data collection device" of the present invention.

The GPS receiver **140** is a device for positioning a position at which the GPS reciver **140** is located on the earth using GPS satellites. More specifically, the GPS receivers **140** are installed in each of the vehicles V. Then, the GPS receiver **140** is electrically connected to the on-board unit **110** installed in the vehicle V. Then, the GPS receiver **140** detects a transmission delay time from time information transmitted from the GPS satellite, and repeatedly calculates latitude and longitude from simultaneous equations using the data of three or four satellites. Then, the GPS receiver **140** outputs data representing the latitude and the longitude to the on-board unit **110** whenever the latitude and the longitude are calculated.

The on-board unit **110** is a device configured to transmit data related to the vehicle to the vehicle data collection server **130**. More specifically, the on-board units **110** are installed in each of the vehicles V. Then, the on-board unit **110** is electrically connected to the GPS receiver **140** installed in the vehicle V. In addition, the on-board unit **110** is connected for communication with the vehicle data collection server **130** via a communication line N. Then, whenever an input of the data output from the GPS receiver **140** is received, the on-board unit **110** transmits position data including position information such as latitude, longitude, and so on, indicated by the data output from the GPS receiver **140** to the vehicle data collection server **130**. In addition, an integrated circuit (IC) card on which contract information or the like is recorded is inserted into a card slot of the on-board unit **110**. Then, the on-board unit **110** records accounting information such as a toll fee or the like of a toll road on the IC card, and transmits accounting data including the accounting information such as the toll fee or the like to the vehicle data collection server **130** when the vehicle V uses the toll road. Here, the on-board unit **110** transmits the accounting data and the position data to the vehicle data collection server **130** in different sessions. Furthermore, the position information may be an example of "information in which an individual related to the vehicle is not to be identified" and "information related to a time-varied event of the vehicle" of the present invention. In addition, the position data may be an example of "second vehicle data" of the present invention. In addition, the accounting information may be an example of "information in which the individual related to the vehicle is to be identified" of the present invention. In addition, the accounting data may be an example of "first vehicle data" of the present invention. In addition, the communication line N includes a computer network such as the Internet or the like, a core network of a telecommunications carrier, and various local networks.

Here, "the information in which the individual related to the vehicle is not to be identified" is information managed without being connected to an individual owner of the vehicle V, and in addition to the position information, for

example, information on a travel distance, information on a travel time, or the like, is considered. Here, "the information in which the individual related to the vehicle is to be identified" is information managed to be connected to an individual owner of the vehicle V, and in addition to the accounting information, for example, information related to request of a roadside assistance or the like is considered. These may be set according to use circumstances but are not classified in a uniform manner. For example, the information on the travel distance may be classified as "the information in which the individual related to the vehicle is to be identified."

The vehicle data collection server **130** is a computer configured to collect data related to the plurality of vehicles V. More specifically, the vehicle data collection server **130** is connected for communication with the on-board unit **110** via the communication line N. Then, the vehicle data collection server **130** receives and manages the accounting data or the position data transmitted from the on-board unit **110**.

FIG. **2** shows an example of a block configuration of the on-board unit **110**a. The on-board unit **110**a has a temporally changed information acquisition unit **111**a, an accounting processing unit **112**a, a second identification information receiving unit **113**a, and a vehicle data transmission unit **114**a.

Furthermore, in addition to the on-board unit **110**a, the on-board units **110**b, **110**c, . . . also have the same components as the components included in the on-board unit **110**a. In the following description, when the component included in the on-board unit **110** is any one of the components of the on-board unit **110** to be distinguished, the same subscript (a, b, c, . . .) as the on-board unit **110** having each component is tagged to each component to distinguish the component. For example, the temporally changed information acquisition unit **111**a, a temporally changed information acquisition unit **111**b, and a temporally changed information acquisition unit **111**c represent components of the on-board unit **110**a, the on-board unit **110**b, and the on-board unit **110**c, respectively. In addition, in the following description, a function and an operation of the component to which the subscript is not tagged represent functions and operations of all of the components to which the same reference numeral is designated. For example, a function and an operation described with reference to a temporally changed information acquisition unit **111** represent functions and operations of the temporally changed information acquisition unit **111**a, the temporally changed information acquisition unit **111**b, and the temporally changed information acquisition unit **111**c, ... In the following description, the function and operation of each of the components will be described in detail.

The temporally changed information acquisition unit **111** acquires position information.

An accounting processing unit **112** performs accounting processing of a toll fee of a toll road when the vehicle V uses the toll road.

A second identification information receiving unit **113** receives a random ID (identifier) transmitted from the vehicle data collection server **130**. Here, the random ID is a randomly generated temporary ID, and thus, cannot identify the owner of the vehicle V (is not connected to the individual owner). The random ID is imparted as a common ID used in a plurlarity of sessions so that the transmission data in the plurality of sessions are associated with each other as the transmission data from the same on-board unit by the random ID. In addition, the random ID is maintained as the same ID while an engine of the vehicle is in operation (between ON-OFF). Furthermore, the random ID may be an example of "second identification information" of the present invention. In addition, the owner of the vehicle V may be an example of "individual related to the vehicle" of the present invention.

A vehicle data transmission unit **114** transmits the accounting data and the position data to the vehicle data collection server **130** in different sessions. More specifically, the vehicle data transmission unit **114** transmits data further including an on-board unit ID only when the accounting data is transmitted. Here, the on-board unit ID is an ID written on the on-board unit **110** upon setup of the on-board unit **110**, and thus, can identify the on-board unit **110** and the owner of the vehicle V at which the on-board unit **110** is installed. In addition, the vehicle data transmission unit **114** transmits the position data including the position information acquired by the temporally changed information acquisition unit **111** whenever the temporally changed information acquisition unit **111** acquires the position information. In addition, the vehicle data transmission unit **114** transmits the position data further including the random ID common to the plurality of sessions when the position data including the position information acquired by the temporally changed information acquisition unit **111** is transmitted in the plurality of sessions. In addition, the vehicle data transmission unit **114** transmits the position data including a new random ID when the position data is initially transmitted after the motor of the vehicle V starts. Furthermore, the on-board unit ID may be an example of "first identification information" of the present invention.

FIG. **3** shows an example of a block configuration of the vehicle data collection server **130**. The vehicle data collection server **130** has a second identification information generating unit **131**, a second identification information transmission unit **132**, a vehicle data receiving unit **133**, a first vehicle data storage unit **134**, and a second vehicle data storage unit **135**. In the following description, the function and the operation of each of the components will be described in detail.

The second identification information generating unit **131** generates the random ID.

The second identification information transmission unit **132** transmits the random ID to the on-board unit **110**.

The vehicle data receiving unit **133** receives the accounting data transmitted from the on-board unit **110**. In addition, the vehicle data receiving unit **133** receives the position data transmitted from the on-board unit **110**.

FIG. **4** shows a table indicating an example of information stored in the first vehicle data storage unit **134**. The information on the on-board unit ID, the accounting time (year/month/day/hour:minute:second), the accounting place, and the accounting price (Yen) are correspondingly stored in the first vehicle data storage unit **134**.

The information on the accounting time (year/month/day/hour:minute:second) is information indicating the time when the on-board unit **110** identified by the on-board unit ID performs the accounting processing. The information on the accounting place is information indicating the place at which the on-board unit **110** identified by the on-board unit ID performs the accounting processing. The information on the accounting price (Yen) is information indicating the accounting price in which the on-board unit **110** identified by the on-board unit ID performs the accounting processing.

FIG. **5** shows a table indicating an example of information stored in the second vehicle data storage unit **135**. The information on the random ID, the position (longitude, latitude), and the positioning time (year/month/day/hour:

minute:second) are correspondingly stored in the second vehicle data storage unit **135**.

The information on the position (longitude, latitude) is information indicating a position on the earth at which the vehicle V in which the on-board unit **110** having the random ID is installed is located. The information on the positioning time (year/month/day/hour:minute:second) is information indicating the time when the position indicated by the information on the position (longitude, latitude) is positioned.

FIGS. **6** and **7** show an example of an operation flow of the on-board unit **110**. FIGS. **8** to **10** show an example of an operation flow of the vehicle data collection server **130**. In the description of the operation flows, a process when the vehicle V uses the toll road during the period from the motor of the vehicle V is started until the motor is stopped will be described in detail. Furthermore, the description of the operation flows will be described with reference to FIGS. **1** to **5**.

The GPS receiver **140** starts the positioning process when the motor of the vehicle V is started (S**101**: Yes). For example, the GPS receiver **140** repeatedly performs the positioning processing. Then, the GPS receiver **140** outputs data indicating the position information configured of the latitude, the longitude, and the positioning time, which are positioning process results, to the on-board unit **110** whenever the positioning process is performed.

The temporally changed information acquisition unit **111** of the on-board unit **110** sends the data to the vehicle data transmission unit **114** when the data output from the GPS receiver **140** is acquired (S**102**).

The vehicle data transmission unit **114** of the on-board unit **110** connects the session with the vehicle data collection server **130** when the data sent from the temporally changed information acquisition unit **111** is received (S**103**). Here, when the session is initially connected to the vehicle data collection server **130** after the motor of the vehicle V is started (S**104**: Yes), the vehicle data transmission unit **114** requests the vehicle data collection server **130** to perform transmission of the random ID (S**105**).

When the transmission request of the random ID from the on-board unit **110** is received (S**201**: Yes), the vehicle data receiving unit **133** of the vehicle data collection server **130** sends the data indicating this request to the second identification information generating unit **131**.

The second identification information generating unit **131** of the vehicle data collection server **130** generates the random ID when the data sent from the vehicle data receiving unit **133** is received (S**202**). Then, the second identification information generating unit **131** sends the ID data indicating the generated random ID to the second identification information transmission unit **132**.

The second identification information transmission unit **132** of the vehicle data collection server **130** transmits the ID data to the on-board unit **110** from which the transmission of the random ID is requested when the ID data sent from the second identification information generating unit **131** is received (S**203**).

The second identification information receiving unit **113** of the on-board unit **110** sends the ID data to the vehicle data transmission unit **114** when the ID data transmitted from the vehicle data collection server **130** is received (S**106**: Yes).

The vehicle data transmission unit **114** of the on-board unit **110** transmits the position data including the random ID indicated by the ID data and the position information indicated by the data received from the temporally changed information acquisition unit **111** to the vehicle data collection server **130** when the ID data sent from the second identification information receiving unit **113** is received (S**107**).

When the position data transmitted from the on-board unit **110** is received (S**301**: Yes), the vehicle data receiving unit **133** of the vehicle data collection server **130** correspondingly stores each of information included in the data in the second vehicle data storage unit **135** (S**302**). In this way, the information shown in FIG. **5** is stored in the second vehicle data storage unit **135** of the vehicle data collection server **130**.

Here, when the vehicle V uses the toll road, the accounting processing unit **112** of the on-board unit **110** performs the accounting processing of the toll fee of the toll road (S**109**: Yes). For example, the accounting processing unit **112** performs the accounting processing when the accounting information is received from a roadside wireless device installed in a tollgate of the toll road. In addition, for example, the accounting processing unit **112** performs the accounting processing when use of the toll road is detected, based on the position information in which the positioning is performed by the GPS receiver **140**. In either case, the accounting processing unit **112** records the accounting information such as the toll fee of the toll road or the like on the IC card, and sends the data indicating the accounting information such as the toll fee or the like to the vehicle data transmission unit **114**.

When the data sent from the accounting processing unit **112** is received, the vehicle data transmission unit **114** of the on-board unit **110** disconnects the session with the vehicle data collection server **130** (S**110**), and reconnects the session (S**111**). Then, the vehicle data transmission unit **114** transmits the accounting information such as the toll fee or the like indicated by the data received from the accounting processing unit **112** and the accounting data including the on-board unit ID to the vehicle data collection server **130** (S**112**).

When the accounting data transmitted from the on-board unit **110** is received (S**401**: Yes), the vehicle data collection server **130** correspondingly stores each of information included in the accounting data in the first vehicle data storage unit **134** (S**402**). In this way, the information shown in FIG. **4** is stored in the first vehicle data storage unit **134** of the vehicle data collection server **130**.

Meanwhile, after transmission of the accounting data, the vehicle data transmission unit **114** of the on-board unit **110** disconnects the session with the vehicle data collection server **130** (S**113**). Then, the on-board unit **110** performs the processing from step S**102** again.

As described above, the GPS receiver **140** repeatedly performs the positioning processing, and outputs the data indicating the positioning result. Until the motor of the vehicle V is stopped (S**108**: No), when the accounting processing is not performed (S**109**: No), the on-board unit **110** repeats the processing of steps S**102** to S**107**. When connection of the session with the vehicle data collection server **130** is not the first after the motor of the vehicle V is started (S**104**: No), the vehicle data transmission unit **114** transmits the position data including the random ID indicated by the ID data initially received from the second identification information receiving unit **113** after the motor of the vehicle V is started and the position information indicated by the data received from the temporally changed information acquisition unit **111** to the vehicle data collection server **130** (S**107**). In this way, the position information on the vehicle V during the period from the motor of the vehicle V is started until the motor is stopped is successively

stored in the second vehicle data storage unit **135** of the vehicle data collection server **130**.

In addition, as described above, in the first embodiment, since the session is disconnected before and after the accounting data is transmitted from the on-board unit **110** to the vehicle data collection server **130**, in the vehicle data collection server **130**, the on-board unit **110** from which the position data is transmitted and the on-board unit **110** from which the accounting data is transmitted cannot be associated with each other. In other words, the vehicle data collection server **130** cannot identify the owner of the on-board unit **110** from which the position data is transmitted.

In this way, an operator of the vehicle data collection system can identify the owner of the vehicle V and recognize a use situation of the toll road of the vehicle V by referring to the stored information in the first vehicle data storage unit **134** corresponding to the on-board unit ID.

In addition, the operator of the vehicle data collection system can recognize the temporally changed position of the vehicle V without identifying the owner of the vehicle V by referring to the information stored in the second vehicle data storage unit **135** corresponding to the random ID which is common to the plurality of sessions.

FIGS. **11** and **12** show an example of an operation flow of the on-board unit **110** according to the second embodiment. In the description of the operation flow, different points from the operation of the on-board unit **110** according to the first embodiment will be described in detail. Furthermore, in the description of the operation flow, FIGS. **1** to **10** will be referenced together. In addition, in processing steps of the operation flow of the on-board unit **110** according to the second embodiment, the processing step having the same name to which the same reference numeral is attached as the processing step of the operation flow of the on-board unit **110** according to the first embodiment represents the same processing as the processing of the operation flow of the on-board unit **110** according to the first embodiment.

When the data sent from the accounting processing unit **112** is received, the vehicle data transmission unit **114** of the on-board unit **110** according to the second embodiment connects a new second session with the vehicle data collection server **130** (S**114**). Then, the vehicle data transmission unit **114** transmits the accounting information such as a toll fee or the like indicated by the data received from the accounting processing unit **112** and the accounting data including the on-board unit ID to the vehicle data collection server **130** in the second session (S**115**). The vehicle data transmission unit **114** disconnects the second session with the vehicle data collection server **130** after transmission of the accounting data (S**116**). Then, the on-board unit **110** performs the processing from step S**102** again.

In this way, in the second embodiment, since the second session different from the session for transmitting the position data is used when the accounting data is transmitted from the on-board unit **110** to the vehicle data collection server **130**, in the vehicle data collection server **130**, the on-board unit **110** from which the position data is transmitted and the on-board unit **110** from which the accounting data is transmitted cannot be associated with each other. In other words, the vehicle data collection server **130** cannot identify the owner of the on-board unit **110** from which the position data is transmitted.

FIG. **13** shows an example of a block configuration of the on-board unit **110**a according to the third embodiment. The on-board unit **110** according to the third embodiment has the temporally changed information acquisition unit **111**, the accounting processing unit **112**, a second identification information generating unit **115**, and the vehicle data transmission unit **114**.

Furthermore, among the components of the on-board unit **110** according to the third embodiment, the components having the same name to which the same reference numerals are attached as the components of the on-board unit **110** according to the first embodiment represent the same function and operation as the components of the on-board unit **110** according to the first embodiment. In the following description, functions and operations of the components different from the components of the on-board unit **110** according to the first embodiment will be described in detail.

The second identification information generating unit **115** generates the random ID.

FIG. **14** shows an example of a block configuration of the vehicle data collection server **130** according to the third embodiment. The vehicle data collection server **130** according to the third embodiment has the vehicle data receiving unit **133**, the first vehicle data storage unit **134**, and the second vehicle data storage unit **135**.

Furthermore, among the components of the vehicle data collection server **130** according to the third embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection server **130** according to the first embodiment represent the same functions and operations as the components of the vehicle data collection server **130** according to the first embodiment. In the following description, functions and operations of the components different from the components of the vehicle data collection server **130** according to the first embodiment will be described.

FIGS. **15** and **16** show an operation flow of the on-board unit **110** according to the third embodiment. In the description of the operation flow, different points from the operation of the on-board unit **110** according to the first embodiment will be described in detail. Furthermore, in the description of the operation flow, FIGS. **1** to **14** are referenced together. In addition, in the processing steps of the operation flow of the on-board unit **110** according to the third embodiment, the same processing step to which the same reference numeral is attached as the processing step of the operation flow of the on-board unit **110** according to the first embodiment represents the same processing as the processing of the operation flow of the on-board unit **110** according to the first embodiment.

After the motor of the vehicle V is started, when the session is initially connected to the vehicle data collection server **130** (S**104**: Yes), the vehicle data transmission unit **114** of the on-board unit **110** according to the third embodiment sends the data indicating that the initial session is connected to the second identification information generating unit **115**.

When the data sent from the vehicle data transmission unit **114** is received, the second identification information generating unit **115** of the on-board unit **110** generates the random ID (S**117**). Then, the second identification information generating unit **115** sends the ID data indicating the generated random ID to the vehicle data transmission unit **114**.

When the ID data sent from the second identification information generating unit **115** is received, the vehicle data transmission unit **114** of the on-board unit **110** transmits the position data including the random ID indicated by the ID data and the position information indicated by the data received from the temporally changed information acquisition unit **111** to the vehicle data collection server **130** (S**118**).

In this way, in the third embodiment, since the on-board unit **110** is configured to generate the random ID, a processing load in the vehicle data collection server **130** can be distributed.

FIG. **17** shows an example of a usage environment of a vehicle data collection system according to a fourth embodiment. In the description of the vehicle data collection system according to the fourth embodiment, different points from the vehicle data collection system according to the first embodiment will be described in detail.

The vehicle data collection system according to the fourth embodiment includes the plurality of on-board units **110**, a plurality of vehicle data collection servers **130**a and **130**b (hereinafter, generally referred to as the vehicle data collection server **130**), and the plurality of GPS receivers **140**.

Furthermore, among the components of the vehicle data collection system according to the fourth embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection system according to the first embodiment represent the same functions and operations as the components of the vehicle data collection system according to the first embodiment.

The on-board unit **110** is a device configured to transmit the data related to the vehicle to the vehicle data collection server **130**. More specifically, the on-board units **110** are installed in each of the vehicles V,. Then, the on-board unit **110** is electrically connected to the GPS receiver **140** installed in the vehicle V. In addition, the on-board unit **110** is connected for communication with the vehicle data collection server **130** via the communication line N. Then, whenever the input of the data output from the GPS receiver **140** is received, the on-board unit **110** transmits the position data including the position information such as latitude, longitude, and so on, indicated by the data output from the GPS receiver **140** to a vehicle data collection server **130**b. In addition, an IC card on which contract information or the like is recorded is inserted into a card slot of the on-board unit **110**. Then, when the vehicle V uses the toll road, the on-board unit **110** records the accounting information such as a toll fee of the toll road or the like on the IC card, and transmits the accounting data including the accounting information such as the toll fee or the like to the vehicle data collection server **130**a.

The vehicle data collection server **130** is a computer configured to collect data related to the plurality of vehicles V. More specifically, the vehicle data collection server **130** is connected for communication with the on-board unit **110** via the communication line N. Then, the vehicle data collection server **130**a receives and manages the accounting data transmitted from the on-board unit **110**. Meanwhile, the vehicle data collection server **130**b receives and manages the position data transmitted from the on-board unit **110**.

FIG. **18** shows an example of a block configuration of the on-board unit **110**a according to a fourth embodiment. The on-board unit **110** according to the fourth embodiment has the temporally changed information acquisition unit **111**, the accounting processing unit **112**, the second identification information receiving unit **113**, and the vehicle data transmission unit **114**.

Furthermore, among the components of the on-board unit **110** according to the fourth embodiment, the components having the same name to which the same reference numerals are attached as the components of the on-board unit **110** according to the first embodiment represent the same functions and operations as the components of the on-board unit **110** according to the first embodiment. In the following description, functions and operations of the components different from the components of the on-board unit **110** according to the first embodiment will be described in detail.

The second identification information receiving unit **113** receives the random ID transmitted from the vehicle data collection server **130**b.

The vehicle data transmission unit **114** transmits the accounting data to the vehicle data collection server **130**a. In addition, the vehicle data transmission unit **114** transmits the position data to the vehicle data collection server **130**b.

FIG. **19** shows an example of a block configuration of the vehicle data collection server **130**a according to the fourth embodiment. The vehicle data collection server **130**a according to the fourth embodiment has the vehicle data receiving unit **133**, and the first vehicle data storage unit **134**.

Furthermore, among the components of the vehicle data collection server **130**a according to the fourth embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection server **130** according to the first embodiment represent the same functions and operations as the vehicle data collection server **130** according to the first embodiment. In the following description, functions and operations of the components different from the components of the vehicle data collection server **130** according to the first embodiment will be described in detail.

The vehicle data receiving unit **133** receives the accounting data transmitted from the on-board unit **110**.

FIG. **20** shows an example of a block configuration of the vehicle data collection server **130**b according to the fourth embodiment. The vehicle data collection server **130**b according to the fourth embodiment has the second identification information generating unit **131**, the second identification information transmission unit **132**, the vehicle data receiving unit **133**, and the second vehicle data storage unit **135**.

Furthermore, among the components of the vehicle data collection server **130**b according to the fourth embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection server **130** according to the first embodiment represent the same functions and operations as the vehicle data collection server **130** according to the first embodiment. In the following description, functions and operations of the components different from the components of the vehicle data collection server **130** according to the first embodiment will be described in detail.

The vehicle data receiving unit **133** receives the position data transmitted from the on-board unit **110**.

FIGS. **21** and **22** show an example of art operation flow of the on-board unit **110** according to the fourth embodiment. In addition, in the fourth embodiment, FIG. **10** shows an example of an operation flow of the vehicle data collection server **130**a. In addition, in the fourth embodiment, FIGS. **8** and **9** show an example of an operation flow of the vehicle data collection server **130**b. In the description of these operation flows, different points from the operations of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment will be described in detail. Furthermore, in the description of these operation flows, FIGS. **1** to **20** will be referenced together. In addition, in the processing steps of the operation flow of the on-board unit **110** and the vehicle data collection server **130** according to the fourth embodiment, the processing step having the same name to which the same reference numeral is attached as the processing step of the operation flows of the on-board unit **110** and the vehicle data collection server **130** according

to the first embodiment represents the same processing as the processing of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment.

When the data sent from the temporally changed information acquisition unit **111** is received, the vehicle data transmission unit **114** of the on-board unit **110** connects the session with the vehicle data collection server **130**b (S**119**). Here, after the motor of the vehicle V is started, when the session is initially connected to the vehicle data collection server **130**b(S**104**: Yes), the vehicle data transmission unit **114** requests transmission of the random ID with respect to the vehicle data collection server **130**b (S**120**).

When the transmission request of the random ID from the on-board unit **110** is received (S**201**: Yes), the vehicle data receiving unit **133** of the vehicle data collection server **130**b sends the data that indicates the request to the second identification information generating unit **131**.

When the data sent from the vehicle data receiving unit **133** is received, the second identification information generating unit **131** of the vehicle data collection server **130**b generates the random ID (S**202**). Then, the second identification information generating unit **131** sends the ID data indicating the generated random ID to the second identification information transmission unit **132**.

When the ID data sent from the second identification information generating unit **131** is received, the second identification information transmission unit **132** of the vehicle data collection server **130**b transmits the data to the on-board unit **110** from which the transmission of the random ID is requested (S**203**).

When the ID data transmitted from the vehicle data collection server **130**b is received (S**121**: Yes), the second identification information receiving unit **113** of the on-board unit **110** sends the ID data to the vehicle data transmission unit **114**.

When the ID data sent from the second identification information receiving unit **113** is received, the vehicle data transmission unit **114** of the on-board unit **110** transmits the position data including the random ID indicated by the ID data and the position information indicated by the data received from the temporally changed information acquisition unit **111** to the vehicle data collection server **130**b (S**122**).

When the position data transmitted from the on-board unit **110** is received (S**301**: Yes), the vehicle data receiving unit **133** of the vehicle data collection server **130**bcorrespondingly stores the information included in the data in the second vehicle data storage unit **135** (S**302**). In this way, the information shown in FIG. **5** is stored in the second vehicle data storage unit **135** of the vehicle data collection server **130**b.

Here, when the vehicle V uses the toll road, the accounting processing unit **112** of the on-board unit **110** performs the accounting processing of the toll fee of the toll road (S**109**: Yes). For example, the accounting processing unit **112** performs the accounting processing when the accounting information is received from the roadside wireless device installed in the tollgate of the toll road. In addition, for example, the accounting processing unit **112** performs the accounting processing when use of the toll road is detected, based on the position information in which the positioning is performed by the GPS receiver **140**. In either case, the accounting processing unit **112** records the accounting information such as the toll fee of the toll road or the like on the IC card, and sends the data indicating the accounting information such as the toll fee or the like to the vehicle data transmission unit **114**.

When the data sent from the accounting processing unit **112** is received, the vehicle data transmission unit **114** of the on-board unit **110** connects the session with the vehicle data collection server **130**a (S**123**).

Then, the vehicle data transmission unit **114** transmits the accounting data including the accounting information such as toll fee or the like indicated by the data received from the accounting processing unit **112** and the on-board unit ID to the vehicle data collection server **130**a (S**124**).

When the accounting data transmitted from the on-board unit **110** is received, the vehicle data collection server **130**a correspondingly stores the information included in the accounting data to the first vehicle data storage unit **134**. As a result, the information shown in FIG. **4** is stored in the first vehicle data storage unit **134** of the vehicle data collection server **130**a.

Meanwhile, after transmission of the accounting data, the vehicle data transmission unit **114** of the on-board unit **110** performs the processing from step S**102** again.

In this way, in the fourth embodiment, since the on-board unit **110** is configured to transmit the accounting data and the position data to the different vehicle data collection servers **130**, the on-board unit **110** can be applied to a business model in which an operator who collects accounting information is different from an operator who collects position information.

FIG. **23** shows an example of a usage environment of a vehicle data collection system according to a fifth embodiment. In the description of the vehicle data collection system according to the fifth embodiment, different points from the vehicle data collection system according to the first embodiment will be described in detail.

The vehicle data collection system according to the fifth embodiment includes the plurality of on-board units **110**, the vehicle data collection server **130**, and a plurality of battery management units (BMUs) **150**a, **150**b, **150**c, . . . (hereinafter, generally referred to as a BMU **150**).

Furthermore, in the components of the vehicle data collection system according to the fifth embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection system according to the first embodiment represent the same functions and operations as the components of the vehicle data collection system according to the first embodiment.

The BMU **150** is a device configured to control a secondary battery of the vehicle V. More specifically, the BMUs **150** are installed in each of the vehicles V. Then, the BMU **150** is connected for communication with the on-board unit **110** installed in the vehicle V via a controller area network (CAN). Also, the BMU **150** observes a state of a secondary battery, and repeatedly calculates a state of charge (SOC). Here, the SOC is information indicating a ratio of an amount of remaining charge with respect to a fully charged capacity of the secondary battery. Then, whenever the SOC is calculated, the BMU **150** transmits the data indicating the battery information such as the SOC or the like to the on-board unit **110**. Furthermore, the battery information such as SOC or the like may be "information in which individual related tothe vehicle is not to be identified" and "information related to a time-varied event of the vehicle" of the present invention.

The on-board unit **110** is a device configured to transmit the data related to the vehicle to the vehicle data collection server **130**. More specifically, the on-board units **110** are installed in each of the vehicles V. Then, the on-board unit **110** is electrically connected to the BMU **150** installed in the

vehicle V. In addition, the on-board unit **110** is connected for communication with the vehicle data collection server **130** via the communication line N. Then, whenever the data transmitted from the BMU **150** is received, the on-board unit **110** transmits the battery data including the battery information such as the SOC or the like indicated by the data to the vehicle data collection server **130**. In addition, an IC card on which contract information or the like is recorded is inserted into a card slot of the on-board unit **110**. Then, when the vehicle V uses the toll road, the on-board unit **110** records the accounting information such as a toll fee of the toll road or the like on the IC card, and transmits the accounting data including the accounting information such as the toll fee or the like to the vehicle data collection server **130**a.

Furthermore, the battery data may be an example of "second vehicle data" of the present invention.

The vehicle data collection server **130** is a computer configured to collect data related to the plurality of vehicles V. More specifically, the vehicle data collection server **130** is connected for communication with the on-board unit **110** via the communication line N. Then, the vehicle data collection server **130** receives and manages the accounting data or the battery data transmitted from the on-board unit **110**.

FIG. **24** shows an example of a block configuration of the on-board unit **110**a according to the fifth embodiment. The on-board unit **110** according to the fifth embodiment has the temporally changed information acquisition unit **111**, the accounting processing unit **112**, the second identification information receiving unit **113**, and the vehicle data transmission unit **114**.

Furthermore, among the components of the on-board unit **110** according to the fifth embodiment, the components having the same name to which the same reference numerals are attached as the components of the on-board unit **110** according to the first embodiment represent the same functions and operations as the on-board unit **110** according to the first embodiment. In the following description, functions and operations of the components different from the components of the on-board unit **110** according to the first embodiment will be described in detail.

The temporally changed information acquisition unit **111** acquires battery information.

The vehicle data transmission unit **114** transmits the accounting data and the battery data to the vehicle data collection server **130** in different sessions. More specifically, only when the accounting data is transmitted, the vehicle data transmission unit **114** transmits the data further including the on-board unit ID. In addition, whenever the temporally changed information acquisition unit **111** acquires the battery information, the vehicle data transmission unit **114** transmits the battery data including the battery information acquired by the temporally changed information acquisition unit **111**. In addition, when the battery data including the battery information acquired by the temporally changed information acquisition unit **111** is transmitted in the plurality of sessions, the vehicle data transmission unit **114** transmits the battery data further including the random ID which is common to the plurality of sessions. In addition, after the motor of the vehicle V is started, when the battery data is initially transmitted, the vehicle data transmission unit **114** transmits the battery data including a new random ID.

The vehicle data collection server **130** according to the fifth embodiment has the second identification information generating unit **131**, the second identification information transmission unit **132**, the vehicle data receiving unit **133**, the first vehicle data storage unit **134**, and the second vehicle data storage unit **135**.

Furthermore, among the components of the vehicle data collection server **130** according to the fifth embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection server **130** according to the first embodiment represent the same functions and operations as the vehicle data collection server **130** according to the first embodiment. In the following description, functions and operations of the components different from the components of the vehicle data collection server **130** according to the first embodiment will be described in detail.

The vehicle data receiving unit **133** receives the accounting data transmitted from the on-board unit **110**. In addition, the vehicle data receiving unit **133** receives the battery data transmitted from the on-board unit **110**.

FIG. **25** shows a table of an example of information stored in the second vehicle data storage unit **135** according to the fifth embodiment. Information on the random ID, SOC (%), and time (year/month/day/hour:minute:second) are correspondingly stored in the second vehicle data storage unit **135** according to the fifth embodiment.

The information on the SOC (%) is information indicating a ratio of an amount of remaining charge with respect to a fully charged capacity of the secondary battery of the vehicle V at which the on-board unit **110** to which the random ID is designated is installed. The information on time (year/month/day/hour:minute:second) is information indicating a time when the amount of remaining charge indicated by the information on the SOC (%) is calculated.

FIGS. **26** and **27** show an example of an operation flow of the on-board unit **110** according to the fifth embodiment. FIG. **28** shows an example of an operation flow of the vehicle data collection server **130** according to the fifth embodiment. In the description of these operation flows, different points from the operations of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment will be described in detail. Furthermore, in the description of these operation flows, FIGS. **1** to **25** will be referenced together. In addition, in the processing step of the operation flows of the on-board unit **110** and the vehicle data collection server **130** according to the fifth embodiment, the processing step having the same name to which the same reference numeral is attached as the processing step of the operation flows of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment represents the same processing as the processing of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment.

When the motor of the vehicle V is started (S**101**: Yes), the BMU **150** starts observation of a state of the secondary battery. For example, the BMU **150** repeatedly calculates the SOC. Then, whenever the SOC is calculated, the BMU **150** transmits the data indicating the battery information such as SOC or the like to the on-board unit **110**.

When the data output from the BMU **150** is received (S**125**), the temporally changed information acquisition unit **111** of the on-board unit **110** sends the data to the vehicle data transmission unit **114**.

Then, the on-board unit **110** performs processing of steps S**103** to S**106**. Then, when the ID data sent from the second identification information receiving unit **113** is received, the vehicle data transmission unit **114** of the on-board unit **110** transmits the battery data including the random ID indicated by the ID data and the battery information indicated by the

data received from the temporally changed information acquisition unit **111** to the vehicle data collection server **130** (S**126**).

When the battery data transmitted from the on-board unit **110** is received (S**303**: Yes), the vehicle data receiving unit **133** of the vehicle data collection server **130** correspondingly stores the information included in the data in the second vehicle data storage unit **135** (S**304**). As a result, the information shown in FIG. **25** is stored in the second vehicle data storage unit **135** of the vehicle data collection server **130**.

In this way, in the fifth embodiment, an operator of the vehicle data collection system can recognize the temporally changed SOC of the secondary battery of the vehicle V by referring to the information stored in the second vehicle data storage unit **135** corresponding to the random ID which is common to the plurality of sessions without identifying the owner of the vehicle V.

FIG. **29** shows an example of a usage environment of a vehicle data collection system according to a sixth embodiment. In the description of the vehicle data collection system according to the sixth embodiment, different points from the vehicle data collection system according to the first embodiment will be described in detail.

The vehicle data collection system according to the sixth embodiment includes the plurality of on-board units **110**, the vehicle data collection server **130**, the plurality of GPS receivers **140**, and a plurality of airbag electronic control units (ECUs) **160**a, **160**b, **160**c, . . . (hereinafter, generally referred to as an airbag ECU **160**).

The GPS receiver **140** is a device configured for positioning a position at which the GPS reviver **140** is located on the earth using GPS satellites. More specifically, the GPS receivers **140** are installed in each of the vehicles V. Then, the GPS receiver **140** is electrically connected to the on-board unit **110** installed in the vehicle V. Then, the GPS receiver **140** detects a transmission delay time from the time information transmitted from the GPS satellites, and repeatedly calculates the latitude and the longitude from the simultaneous equations using the data of three to four satellites. Then, whenever the latitude and the longitude are calculated, the GPS receiver **140** outputs the data indicating the latitude and the longitude to the on-board unit **110**. In addition, in response to request of the on-board unit **110**, the GPS receiver **140** calculates the latitude and the longitude and outputs the data indicating the latitude and the longitude to the on-board unit **110**.

The airbag ECU **160** is a device configured to control an airbag. More specifically, the airbag ECUs **160** are installed in each of the vehicles V. Then, the airbag ECU **160** is electrically connected to an acceleration sensor and an airbag module installed in the vehicle V. In addition, the airbag ECU **160** is connected for communication with the on-board unit **110** through the CAN. Then, when deployment of the airbag is determined based on the output of the acceleration sensor, the airbag ECU **160** outputs the data indicating that the deployment of the airbag to the airbag module, and transmits the data to the on-board unit **110**.

The on-board unit **110** is a device configured to transmit the data related to the vehicle to the vehicle data collection server **130**. More specifically, the on-board units **110** are installed in each of the vehicles V. Then, the on-board unit **110** is electrically connected to the GPS receiver **140** installed in the vehicle V. In addition, the on-board unit **110** is connected for communication with the airbag ECU installed in the vehicle V via the CAN. In addition, the on-board unit **110** is connected for communication with the vehicle data collection server **130** via the communication line N. Then, whenever the input of the data output from the GPS receiver **140** is received, the on-board unit **110** transmits the position data including the position information such as latitude, longitude, and so on, indicated by the data to the vehicle data collection server **130**. In addition, when the data transmitted from the airbag ECU **160** is received, the on-board unit **110** outputs the data indicating a request to output of the information on latitude and longitude to the GPS receiver **140**. Then, when the input of the data output from the GPS receiver **140** is received in response to the request, the on-board unit **110** transmits the airbag data including the position information such as latitude, longitude, and so on, indicated by the data and the airbag information that indicates deployment of the airbag to the vehicle data collection server **130**. Furthermore, the airbag information may be an example of "information in which the individual related to the vehicle is to be identified" of the present invention. In addition, the airbag data may be an example of "first vehicle data" of the present invention.

The vehicle data collection server **130** is a computer configured to collect the data related to the plurality of vehicles V. More specifically, the vehicle data collection server **130** is connected for communication with the on-board unit **110** via the communication line N. Then, the vehicle data collection server **130** receives and manages the airbag data or the position data transmitted from the on-board unit **110**.

FIG. **30** shows an example of a block configuration of the on-board unit **110**aaccording to the sixth embodiment. The on-board unit **110** according to the sixth embodiment has the temporally changed information acquisition unit **111**, an airbag data receiving unit **116**, the second identification information receiving unit **113**, and the vehicle data transmission unit **114**.

Furthermore, in the components of the on-board unit **110** according to the sixth embodiment, the components having the same name to which the same reference numerals are attached as the components of the on-board unit **110** according to the first embodiment represent the same functions and operations as the on-board unit **110** according to the first embodiment. In the following description, functions and operations of the components different from the components of the on-board unit **110** according to the first embodiment will be described in detail.

The airbag data receiving unit **116** receives the data indicating that the airbag ECU has determined to deploy the airbag from the airbag ECU.

The vehicle data transmission unit **114** transmits the airbag data and the position data to the vehicle data collection server **130** in different sessions. More specifically, the vehicle data transmission unit **114** transmits the data further including the on-board unit ID only when the airbag data is transmitted. In addition, whenever the temporally changed information acquisition unit **111** acquires the position information, the vehicle data transmission unit **114** transmits the position data including the position information acquired by the temporally changed information acquisition unit **111**. In addition, when the position data including the position information acquired by the temporally changed information acquisition unit **111** are transmitted in the plurality of sessions, the vehicle data transmission unit **114** transmits the position data further including the random ID which is common to the plurality of sessions in each of the sessions. In addition, after the motor of the vehicle V is started, when

the position data is initially transmitted, the vehicle data transmission unit **114** transmits the position data including a new random ID.

FIG. **31** shows an example of a block configuration of the vehicle data collection server **130** according to the sixth embodiment. The vehicle data collection server **130** according to the sixth embodiment has the second identification information generating unit **131**, the second identification information transmission unit **132**, the vehicle data receiving unit **133**, a display data generating unit **136**, the second vehicle data storage unit **135**, and an owner data storage unit **137**.

Furthermore, among the components of the vehicle data collection server **130** according to the sixth embodiment, the components having the same name to which the same reference numerals are attached as the components of the vehicle data collection server **130** according to the first embodiment represent the same functions and operations as the vehicle data collection server **130** according to the first embodiment. In the following description, functions and operations of the components different from the components of the vehicle data collection server **130** according to the first embodiment will be described in detail.

The vehicle data receiving unit **133** receives the airbag data transmitted from the on-board unit **110**. In addition, the vehicle data receiving unit **133** receives the position data transmitted from the on-board unit **110**.

The display data generating unit **136** generates the display data configured to display the information related to the vehicle V in which the airbag is deployed.

FIG. **32** shows a table indicating an example of information stored in the owner data storage unit **137** according to the sixth embodiment. Information on the on-board unit ID, the name, the age (years), the gender, the body type, and the color is correspondingly stored in the owner data storage unit **137**.

The information on the name is information indicating the name of the owner of the vehicle V at which the on-board unit **110** identified by the on-board unit ID is installed. The information on the age (years) is information indicating the age of the owner of the vehicle V at which the on-board unit **110** identified by the on-board unit ID is installed. The information on the gender is information indicating the age of the owner of the vehicle V at which the on-board unit **110** identified by the on-board unit ID is installed. The information on the body type is information indicating the body type of the vehicle V at which the on-board unit **110** identified by the on-board unit ID is installed. The information on the color is information indicating the color of the vehicle V at which the on-board unit **110** identified by the on-board unit ID is installed.

FIG. **33** shows an example of a display screen D displayed on a display. Information on a current location of the vehicle involved in the accident, the vehicle involved in the accident and the owner are displayed on the display screen D. The information on the vehicle involved in the accident is configured of the information on the body type and the color. The information on the owner is configured of the information on the name, the age, and the gender.

FIGS. **34** and **35** show an example of an operation flow of the on-board unit **110** according to the sixth embodiment. FIG. **36** shows an example of an operation flow of the vehicle data collection server **130** according to the sixth embodiment.

In the description of these operation flows, different points from the operations of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment will be described in detail. Furthermore, in the description of these operation flows, FIGS. **1** to **31** will be referenced together. In addition, in the processing step of the operation flows of the on-board unit **110** and the vehicle data collection server **130** according to the sixth embodiment, the processing step having the same name to which the same reference numeral is attached as the processing step of the operation flows of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment represent the same processing as the processing of the on-board unit **110** and the vehicle data collection server **130** according to the first embodiment.

When the vehicle V collides, the airbag ECU **160** determines whether to deploy the airbag based on an output value of the acceleration sensor. Then, when the airbag is determined to have been deployed, the airbag ECU **160** outputs the data indicating that the airbig is determined to have been deployed to the airbag module, and transmits the data to the on-board unit **110**. As a result, the airbag is deployed.

When the data transmitted from the airbag ECU **160** is received (S**127**: Yes), the airbag data receiving unit **116** of the on-board unit **110** outputs the data indicating a request to output the information on the longitude and the latitude to the GPS receiver **140** (S**128**). Then, when the input of the data output from the GPS receiver **140** in response to the request is received (S**129**: Yes), the airbag data receiving unit **116** sends the airbag data including the position information such as the latitude, longitude, and so on, indicated by the data, the on-board unit ID, and the airbag information that indicates the deployment of the airbag to the vehicle data transmission unit **114**.

When the airbag data sent from the airbag data receiving unit **116** is received, the vehicle data transmission unit **114** of the on-board unit **110** disconnects the session with the vehicle data collection server **130** (S**110**), and connects the session again (S**111**). Then, the vehicle data transmission unit **114** transmits the airbag data received from the airbag data receiving unit **116** to the vehicle data collection server **130** (S**130**).

When the airbag data transmitted from the on-board unit **110** is received (S**403**: Yes), the vehicle data receiving unit **133** of the vehicle data collection server **130** sends the airbag data to the display data generating unit **136**.

When the airbag data sent from the vehicle data receiving unit **133** is received, the display data generating unit **136** of the vehicle data collection server **130** generates display data for displaying the information related to the vehicle V in which the airbag thereof is deployed on the display based on the information included in the airbag data (S**404**). For example, the display data generating unit **136** performs map matching processing using the position information included in the airbag data, and identifies the current location of the vehicle V. In addition, for example, the display data generating unit **136** identifies the information on the vehicle V correspondingly stored in the on-board unit ID included in the airbag data and the information on the owner of the vehicle V, in the information stored in the owner data storage unit **137**. Then, the display data generating unit **136** generates the display data indicating the display screen D including the information identified in this way. Then, the display data generating unit **136** outputs the generated display data to the display (S**405**). Then, the display screen D as shown in FIG. **33** is displayed on the display.

As a result, in the sixth embodiment, the operator of the vehicle data collection system can request an ambulance while identifying the position information on the vehicle V that causes an accident, information indicating features of

the vehicle V, information related to a person who has high probability as being a passenger of the vehicle V, or the like, by referring to the displayed information on the display.

As described above, the vehicle data collection system is a system configured to collect the data related to the plurality of vehicles V. Then, the vehicle data collection system includes the on-board unit **110** installed in the vehicle V and configured to transmit the data related to the vehicle. In addition, the vehicle data collection system includes the vehicle data collection server **130** configured to collect the data related to the plurality of vehicles V. Then, the on-board unit **110** transmits the first vehicle data, which is the data related to the vehicle, including the information in which the individual related to the vehicle it to be identified, and the second vehicle data including the information in which the individual related to the vehicle is not to be identified, to the vehicle data collection server **130** in different sessions.

As a result, it is possible for the vehicle data collection system to collect the information in which the individual related to the vehicle is to be identified and the information in which the individual related to the vehicle is not to be identified without invasion of the privacy of the user. In addition to the case in which vehicle data communication is performed for the purpose of road pricing only, the vehicle data collection system may be a system advantageous for, in particular, the case in which both of collection of the probe information unrelated to the road pricing, and the road pricing are performed.

In addition, as described above, the on-board unit **110** transmits the data further including the on-board unit ID only when the first vehicle data is transmitted.

As a result, it is possible for the vehicle data collection system to identify the individual such as the owner of the vehicle V or the like at which the on-board unit **110** from which the first vehicle data is transmitted, by referring to the on-board unit ID.

In addition, as described above, the on-board unit **110** acquires the information related to time-varying events of the vehicle. Then, whenever the information related to the time-varying events of the vehicle is acquired, the on-board unit **110** transmits the second vehicle data including the information related to the time-varying events of the vehicle as the information in which the individual related to the vehicle is not to be identified.

As a result, it is possible for the vehicle data collection system to collect the information related to the time-varying events of the vehicle V, such as the position information on the vehicle V, the SOC information on the secondary battery of the vehicle V, or the like, without identifying the individual related to the vehicle V.

In addition, as described above, when the second vehicle data including the information related to the time-varying events of the vehicle is transmitted at the plurality of sessions, the on-board unit **110** transmits the data further including the random ID which is common to the plurality of sessions in each session.

As a result, it is possible for the vehicle data collection system to associate and manage the information related to a series of events when the information related to the time-varying events of the vehicle V even if the session between the on-board unit **110** and the vehicle data collection server **130** is disconnected.

In addition, as described above, after the motor of the vehicle is started, when the second vehicle data is initially transmitted, the on-board unit **110** transmits the data including a new random ID.

As a result, it is possible for the vehicle data collection system to associate and collect the information related to the time-varying events of the vehicle V from start to stop of the motor of the vehicle V.

In addition, as described above, the on-board unit **110** transmits the first vehicle data and the second vehicle data to the different vehicle data collection servers **130**.

As a result, it is possible for the vehicle data collection system to apply to a business model in which an operator who collects the information in which the individual related to the vehicle is to be identified is different from an operator who collects the information in which the individual related to the vehicle is not to be identified.

FIG. **37** shows an example of a hardware configuration of a computer **800** configuring the on-board unit **110** according to the embodiment. The computer **800** according to the embodiment includes a CPU peripheral unit which has a central processing unit (CPU) **802**, a random access memory (RAM) **803**, a graphic controller **804**, and a display **805** connected to each other by a host controller **801**, an input/output unit which has a communication interface **807**, a hard disk drive **808** and a compact disk read only memory (CD-ROM) drive **809** connected to each other by an input/output controller **806**, and a legacy input/output unit which has a read only memory (ROM) **810**, a flexible disk drive **811** and an input/output chip **812** connected to an input/output controller **806**.

The host controller **801** connects the RAM **803**, the CPU **802** configured to access the RAM **803** at a high transmission rate, and the graphic controller **804**. The CPU **802** is operated based on a program stored in the ROM **810** and the RAM **803**, and controls the respective parts. The graphic controller **804** acquires image data which is generated on a frame buffer prepared in the RAM **803** by the CPU **802** or the like, and displays the image data on the display **805**. Alternatively, the graphic controller **804** may include the frame buffer configured to store the image data generated by the CPU **802** or the like.

The input/output controller **806** connects the host controller **801**, the communication interface **807**, which is a relatively high speed input/output device, the hard disk drive **808**, and the CD-ROM drive **809**. The hard disk drive **808** stores the program and data used by the CPU **802** in the computer **800**. The CD-ROM drive **809** reads the program or data from a CD-ROM **892**, and provides the program or data to the hard disk drive **808** via the RAM **803**.

In addition, the ROM **810**, the flexible disk drive **811**, and a relatively low speed input/output device of the input/output chip **812** are connected to the input/output controller **806**. The ROM **810** stores a boot program performed upon starting of the computer **800**, a program depending on hardware of the computer **800**, and so on. The flexible disk drive **811** reads the program or the data from a flexible disk **893**, and provides the program or the data to the hard disk drive **808** via the RAM **803**. The input/output chip **812** connects the flexible disk drive **811** to the input/output controller **806**, and connects various input/output devices to the input/output controller **806** via, for example, a parallel port, a serial port, a keyboard port, a mouse port, and so on.

The program provided to the hard disk drive **808** via the RAM **803** is stored in the recording medium such as the flexible disk **893**, the CD-ROM **892**, an integrated circuit (IC) card, or the like, and provided by a user. The program is read from the recording medium, installed in the hard disk drive **808** in the computer **800** via the RAM **803**, and executed in the CPU **802**.

The program installed in the computer **800** and configured to cause the computer **800** to serve as the on-board unit **110** causes the computer **800** to function as the vehicle data transmission unit **114** configured to transmit the first vehicle data including the information in which the individual related to the vehicle is to be identified and the second vehicle data including, the information in which the individual to the vehicle is not to be identified, which are data related to the vehicle, to the vehicle data collection server **130** in different sessions.

Further, the program may cause the computer **800** to function as the vehicle data transmission unit **114** configured to transmit the data further including the on-board unit ID that can identify the individual related to the vehicle only when the first vehicle data is transmitted.

Further, the program may cause the computer **800** to function as the temporally changed information acquisition unit **111** configured to acquire the information related to the time-varied events of the vehicle, and the vehicle data transmission unit **114** configured to transmit the second vehicle data including the information acquired by the temporally changed information acquisition unit **111** as the information in which the individual related to the vehicle is not to be identified, whenever the temporally changed information acquisition unit **111** acquires the information.

Further, the program may cause the computer **800** to function as the vehicle data transmission unit **114** configured to transmit the data further including the random ID which is common to the plurality of sessions in each session when the second vehicle data including the information acquired by the temporally changed information acquisition unit **111** are transmitted in the plurality of sessions.

Further, the program may cause the computer **800** to function as the vehicle data transmission unit **114** configured to transmit the data including a new random ID after the motor of the vehicle is started, when the second vehicle data is initially transmitted.

Further, the program may cause the computer **800** to function as the vehicle data transmission unit **114** configured to transmit the first vehicle data and the second vehicle data to the different vehicle data collection servers **130**.

The information processing described in these programs functions as the temporally changed information acquisition unit **111** and the vehicle data transmission unit **114**, which are specific units cooperating with the software and the above-mentioned various hardware resources by being read by the computer **800**. Then, as calculation or processing of the information according to a use purpose of the computer **800** of the embodiment are realized by these specific units, a specific on-board unit **110** according to the use purpose is constructed.

As an example, when communication is performed between the computer **800** and an external device or the like, the CPU **802** executes a communication program loaded on the RAM **803**, and instructs the communication interface **807** to perform communication processing based on the processing content described in the communication program. The communication interface **807** is controlled by the CPU **802**, and reads the transmission data stored in a transmission buffer region or the like installed on a storage device such as the RAM **803**, the hard disk drive **808**, the flexible disk **893**, the CD-ROM **892**, or the like, to transmit the transmission data to a network, or writes the data received from the network on a reception buffer region or the like installed on the storage device. In this way, the communication interface **807** may transmit the transmitted/received data between the storage device and the communication interface **807** by a direct memory access type, and alternatively, the CPU **802** may read the data from the storage device of the transmission source or the communication interface **807**, and may transmit the transmitted/received data by writing the data to the transmission address of the communication interface **807** or the storage device.

In addition, the CPU **802** reads all or a necessary portion of a file, database, or the like, stored in the external storage device such as the hard disk drive **808**, the CD-ROM **892**, the flexible disk **893**, or the like, using the RAM **803** through direct memory access transmission or the like, and performs various processing on the data on the RAM **803**. Then, the CPU **802** writes back the processed data to the external storage device through the direct memory access transmission or the like.

Since the RAM **803** can be seen to temporarily hold the contents of the external storage device in such processing, in the embodiment, the RAM **803**, the external storage device, and so on, generally refer a memory, a storage unit, a storage device, or the like. Various types of information such as various types of programs, data, tables, databases, or the like, of the embodiment are stored on such a storage device, and become a subject of the information processing. Furthermore, the CPU **802** can include a part of the RAM **803** in a cache memory, and perform reading and writing on the cache memory. In this constitution, since the cache memory carries a part of the function of the RAM **803**, in the embodiment, the cache memory is also included in the RAM **803**, the memory, and/or the storage device, unless it is stated otherwise.

In addition, the CPU **802** performs various types of processing, which includes various types of calculations, processing of information, conditional judgments, searches for information, substitutions, and so on, described in the embodiment and designated by an order line of the program, on the data read from the RAM **803**, and writes back to the RAM **803**. For example, when the conditional judgment is performed, the CPU **802** determines whether various variables shown in the embodiment satisfy conditions that are larger than, smaller than, higher than, lower than, or equal to another variable or constant, and when the conditions are satisfied or not satisfied, they are branched into different order lines or call a subroutine.

In addition, the CPU **802** can search the file in the storage device or the information stored in the database or the like. For example, when a plurality of entries in which attribute values of second attributes correspond to attribute values of first attributes are stored in the storage device, the CPU **802** can obtain the attribute values of the second attributes corresponding to the first attributes that satisfy a predetermined condition by searching for the entry coinciding with the condition designated by the attribute values of the first attributes from the plurality of entries stored in the storage device, and reading the attribute values of the second attributes stored in the entry.

The program or the module as described above may be stored in an external storage medium. The storage medium may use an optical recording medium such as a digital versatile disk (DVD), a compact disk (CD), or the like, a magneto-optical recording medium such as a magneto-optical disk (MO) or the like, a tape medium, a semiconductor memory such as an IC card or the like, in addition to the flexible disk **893** and the CD-ROM **892**. In addition, a storage medium such as a hard disk, a RAM, or the like, installed in a server system connected to an exclusive communication network or the Internet may be used as a

recording, medium, and the program may be provided to the computer **800** via the network.

As described above, while the embodiments of the present invention have been described, the technical scope of the present invention is not limited to the scope disclosed in the embodiments. It will be apparent to those skilled in the art that various modifications and improvements may be made without departing from the technical scope of the present invention. While the embodiments to which such modifications or improvements are added also fall into the technical scope of the present invention, it will be apparent from the disclosure of the accompanying claims.

It should be noted that an execution sequence of the processing of the operation, procedure, step, stage, and so on, in the system, method, device, program, and recording medium, described in the scope of the claims, specification and drawings may be realized in an arbitrary sequence as long as "earlier than," "previously," or the like, is not especially described and output of the previous processing is not used in the next processing. In the operation flows of the scope of the claims, specification and drawings, for convenience, even when "first," "next," or the like, is used for description, it does not necessarily mean that the processing should be performed in that sequence.

INDUSTRIAL APPLICABILITY

The present invention can be applied to a vehicle data collection system for collecting data related to a vehicle, a vehicle data collection method, a vehicle-mounted device installed in a vehicle and configured to transmit data related to a vehicle, a program configured to cause a computer to function as the vehicle-mounted device, and a recording medium on which the program is recorded.

REFERENCE SIGNS LIST

110 on-board unit
111 temporally changed information acquisition unit
112 accounting processing unit
113 second identification information receiving unit
114 vehicle data transmission unit
115 second identification information generating unit
116 airbag data receiving unit
130 vehicle data collection server
131 second identification information generating unit
132 second identification information transmission unit
133 vehicle data receiving unit
134 first vehicle data storage unit
135 second vehicle data storage unit
136 display data generating unit
137 owner data storage unit
140 GPS receiver
150 BMU
160 airbag ECU
800 computer
801 host controller
802 CPU
803 RAM
804 graphic controller
805 display
806 input/output controller
807 communication interface
808 hard disk drive
809 CD-ROM drive
810 ROM
811 flexible disk drive
812 input/output chip
892 CD-ROM
893 flexible disk
D display screen
N communication line
V vehicle

The invention claimed is:

1. A vehicle data collection system for securely collecting data related to a vehicle, the system comprising:

a vehicle-mounted computing device installed in the vehicle and configured to transmit data related to the vehicle; and

a vehicle data collection server configured to collect the data related to the vehicle,

wherein the vehicle-mounted computing device comprises:

a temporally changed information acquisition unit configured to acquire information related to a time-varied event of the vehicle; and

a vehicle data transmission unit configured to transmit first vehicle data, which includes first identification information that is capable of identifying an individual related to the vehicle and information which is other than the first identification information and in which the individual related to the vehicle is to be identified, and second vehicle data, which includes second identification information that is not capable of identifying the individual related to the vehicle and information which is other than the second identification information and which is acquired by the temporally changed information acquisition unit as information in which the individual related to the vehicle is not to be identified, to the vehicle data collection server in different sessions, the first vehicle data and the second vehicle data are data related to the vehicle,

wherein the vehicle data transmission unit is configured to:

connect a first session with the vehicle data collection server and send the second vehicle data whenever the temporally changed information acquisition unit acquires information;

connect a second session with the vehicle data collection server after disconnecting the first session and send the first vehicle data when the vehicle data transmission unit needs to send the first vehicle data while the first session is connected; and

connect a third session with the vehicle data collection server after disconnecting the second session and send the second vehicle data whenever the temporally changed information acquisition unit acquires information when the vehicle data transmission unit completes sending the first vehicle data, and

wherein the vehicle data transmission unit is configured to send the second vehicle data including the second identification information which is common to the first session and the third session.

2. The vehicle data collection system according to claim **1**, wherein, after a motor of the vehicle is started, when the second vehicle data is initially transmitted, the vehicle data transmission unit transmits data including a new second identification information.

3. The vehicle data collection system according to claim **1**, wherein the vehicle data transmission unit transmits the first vehicle data and the second vehicle data to different vehicle data collection servers respectively.

4. A vehicle data collection method of securely collecting data related to a vehicle, the vehicle data collection method comprising:

a temporally changed information acquisition step of acquiring information related to a tine-varied event of the vehicle; and

a vehicle data transmission step of transmitting first vehicle data, which includes first identification information that is capable of identifying an individual related to the vehicle and information which is other than the first identification information and in which the individual related to the vehicle is to be identified, and second vehicle data, which includes second identification information that is not capable of identifying the individual related to the vehicle and information which is other than the second identification information and which is acquired in the temporally changed information acquisition step as information in which the individual related to the vehicle is not to be identified, from a vehicle-mounted computing device, which is installed in the vehicle and configured to send data related to the vehicle, to a vehicle data collection server configured to collect data related to a plurality of vehicles in different sessions, the first vehicle data and the second vehicle data being data related to vehicle,

wherein the vehicle data transmission step includes steps of:

connecting a first session with the vehicle data collection server and sending the second vehicle data whenever information is acquired in the temporally changed information acquisition step;

connecting a second session with the vehicle data collection server after disconnecting the first session and sending the first vehicle data when the first vehicle data need to be transmitted while the first session is connected; and

connecting a third session with the vehicle data collection server after disconnecting the second session when the step of sending the first vehicle data is completed and sending the second vehicle data whenever information is acquired in the temporally changed information acquisition step, and

wherein the second vehicle data including the second identification information which is common to the first session and the third session is transmitted in the vehicle data transmission step.

5. A vehicle-mounted computing device installed in a vehicle and configured to securely transmit data related to the vehicle, the vehicle-mounted computing device comprising:

a temporally changed information acquisition unit configured to acquire information related to a time-varied event of the vehicle; and

a vehicle data transmission unit configured to transmit first vehicle data, which includes first identification information that is capable of identifying an individual related to the vehicle and information which is other than the first identification information and in which the individual related to the vehicle is to be identified, and second vehicle data, which includes second identification information that is not capable of identifying the individual related to the vehicle and information which is other than the second identification information and which is acquired by the temporally changed information acquisition unit as information in which the individual related to the vehicle is not to be identified, to a vehicle data collection server configured to collect data related to a plurality of vehicles in different sessions, the first vehicle data and the second vehicle data being data related to the vehicle,

wherein the vehicle data transmission unit is configured to:

connect a first session with the vehicle data collection server and send the second vehicle data whenever the temporally changed information acquisition unit acquires information:

connect a second session with the vehicle data collection server after disconnecting the first session and send the first vehicle data when the vehicle data transmission unit needs to send the first vehicle data while the first session is connected; and

connect a third session with the vehicle data collection server after disconnecting the second session and send the second vehicle data whenever the temporally changed information acquisition unit acquires information when the vehicle data transmission unit completes sending the first vehicle data, and

wherein the vehicle data transmission unit is configured to send the second vehicle data including the second identification information which is common to the first session and the third session.

[6. A program configure to cause a computer to function as a vehicle-mounted computing device installed in a vehicle and configured to securely transmit data related to the vehicle, the program configured to function as:

a temporally changed information acquisition unit configured to acquire information related to a time-varied event of the vehicle; and

a vehicle data transmission unit configured to transmit first vehicle data, which includes first identification information that is capable of identifying an individual related to the vehicle and information which is other than the first identification information and in which the individual related to the vehicle is to be identified, and second vehicle data, which includes second identification information that is not capable of identifying the individual related to the vehicle and information which is other than the second identification information and which is acquired by the temporally changed information acquisition unit as information in which the individual related to the vehicle is not to be identified, to a vehicle data collection server configured to collect data related to a plurality of vehicles in different sessions, the first vehicle data and the second vehicle data being data related to the vehicle,

wherein the vehicle data transmission unit is configured to:

connect a first session with the vehicle data collection server and send the second vehicle data whenever the temporally changed information acquisition unit acquires information;

connect a second session with the vehicle data collection server after disconnecting the first session and send the first vehicle data when the vehicle data transmission unit needs to send the first vehicle data while the first session is connected; and

connect a third session with the vehicle data collection server after disconnecting the second session and send the second vehicle data whenever the temporally changed information acquisition unit acquires information when the vehicle data transmission unit completes sending the first vehicle data, and

wherein the vehicle data transmission unit is configured to send the second vehicle data including the second

identification information which is common to the first session and the third session.]

7. A non-transitory computer-readable recording medium on which a program configured to cause a computer to function as a vehicle-mounted computing device installed is a vehicle and configured to securely transmit data related to the vehicle is recorded, the non-transitory computer-readable recording medium on which the program configured to function as:

a temporally changed information acquisition unit configured to acquire information related to a time-varied event of the vehicle; and

a vehicle data transmission unit configured to transmit first vehicle data, which includes first identification information that is capable of identifying an individual related to the vehicle and information which is other than the first identification information and in which the individual related to the vehicle is to be identified, and second vehicle data, which includes second identification information that is not capable of identifying the individual related to the vehicle and information which is other than the second identification information and which is acquired by the temporally changed information acquisition unit as information in which the individual related to the vehicle is not to be identified, to a vehicle data collection server configured to collect data related to a plurality of vehicles in different sessions is recorded, the first vehicle data and the second vehicle data being data related to the vehicle,

wherein the vehicle data transmission unit is configured to:

connect a first session with the vehicle data collection server and send the second vehicle data whenever the temporally changed information acquisition unit acquires information;

connect a second session with the vehicle data collection server after disconnecting the first session and send the first vehicle data when the vehicle data transmission unit needs to send the first vehicle data while the first session is connected; and

connect a third session with the vehicle data collection server after disconnecting the second session and send the second vehicle data whenever the temporally changed information acquisition unit acquires information when the vehicle data transmission unit completes sending the first vehicle data, and

wherein the vehicle data transmission unit is configured to send the second vehicle data including the second identification information which is common to the first session and the third session.

8. A vehicle data collection system comprising:

a vehicle-mounted computing device installed in the vehicle and configured to transmit data related to the vehicle;

a battery management unit installed in the vehicle and configured to observe a state of a battery of the vehicle and transmit a battery data, which includes information in which the individual related to the vehicle is not to be identified and which is related to a state of charge (SOC) of the battery of the vehicle, to the vehicle-mounted computing device; and

a plurality of vehicle data collection servers each of which is configured to collect the data related to the vehicle,

wherein the vehicle-mounted computing device comprises:

a vehicle data transmission unit configured to connect a first session with a first vehicle data collection server and transmit identification information which is capable of identifying an individual related to the vehicle; and

an information acquisition unit configured to receive the battery data from the battery management unit, and

wherein the vehicle data transmission unit is configured to connect a second session with a second vehicle data collection server after the first session and transmit the battery data, the second vehicle data collection server held by a business operator different from a business operator who holds the first vehicle data collection server.

9. The vehicle data collection system according to claim 8,

wherein the vehicle-mounted computing device further comprises an accounting processing unit configured to transmit an accounting information to the vehicle data transmission unit; and

wherein the vehicle data transmission unit is configured to transmit the accounting information with the identification information to the vehicle data collection server.

10. The vehicle data collection system according to claim 9,

wherein the accounting processing unit is configured to perform an accounting processing with an integrated circuit (IC) card on which contract information is recorded.

11. A method for transmitting vehicle data, the method comprising:

connecting a first session with a first vehicle data collection server and transmitting identification information which is capable of identifying the individual related to the vehicle from a vehicle-mounted computing device installed in the vehicle to the first vehicle data collection server;

receiving battery data including information in which the individual related to the vehicle is not to be identified and which is related to a state of charge (SOC) of a battery of the vehicle from a battery management unit installed in the vehicle; and

connecting a second session with a second vehicle data collection server after the first session and transmitting the battery data from the vehicle-mounted computing device to the second vehicle data collection server.

12. A vehicle, comprising:

a battery;

a vehicle-mounted computing device configured to transmit data related to the vehicle; and

a battery management unit configured to observe a state of a battery of the vehicle and configured to transmit a battery data, which includes information in which the individual related to the vehicle is not to be identified and which is related to a state of charge (SOC) of the battery of the vehicle, to the vehicle-mounted computing device;

wherein the vehicle-mounted computing device comprises:

a vehicle data transmission unit configured to connect a first session with a first vehicle data collection server and transmit identification information, which is capable of identifying an individual related to the vehicle, to the first vehicle data collection server; and

an information acquisition unit configured to receive the battery data from the battery management unit, and

wherein the vehicle data transmission unit is configured to connect a second session with a second vehicle data collection server after the first session and transmit the battery data to the second vehicle data collection server.

13. A vehicle data collection server comprising a first vehicle data collection server and a second vehicle data collection server:

wherein the first vehicle data collection server is configured to receive identification information, which is capable of identifying an individual related to the vehicle, from a vehicle-mounted computing device when a first session is connected with the vehicle-mounted device, and

wherein the second vehicle data collection server is configured to receive battery data including information in which the individual related to the vehicle is not to be identified and which is related to a state of charge (SOC) of a battery of the vehicle from the vehicle-mounted device when a second session is connected with the vehicle-mounted device.

14. A vehicle-mounted computing device comprising:

a vehicle data transmission unit configured to connect a first session with a first vehicle data collection server and transmit identification information which is capable of identifying an individual related to the vehicle to the first vehicle data collection server; and

an information acquisition unit configured to receive battery data including information in which the individual related to the vehicle is not to be identified and which is related to a state of charge (SOC) of a battery of the vehicle from a battery management unit installed in the vehicle,

wherein the vehicle data transmission unit is configured to connect a second session with a second vehicle data collection server after the first session and transmit the battery data to the second vehicle data collection server.

15. The vehicle according to claim 12,

wherein the first vehicle data collection server and the second vehicle data collection server are held by different business operators.

16. The vehicle according to claim 15,

wherein the vehicle-mounted computing device further comprises an accounting processing unit configured to transmit accounting information to the vehicle data transmission unit; and

wherein the vehicle data transmission unit is configured to transmit the accounting information with the identification information to the vehicle data collection server.

17. The vehicle according to claim 16,

wherein the accounting processing unit is configured to perform an accounting processing with an integrated circuit (IC) card on which contract information is recorded.

18. The vehicle data collection server according to claim 13,

wherein the first vehicle data collection server is configured to receive accounting information together with the identification information from the vehicle-mounted computing device.

19. The vehicle data collection server according to claim 18,

wherein the first vehicle data collection server is configured to receive the accounting information in which an accounting process is processed with an integrated circuit (IC) card on which contract information is recorded.

20. The vehicle-mounted computing device according to claim 14, further comprising an accounting processing unit configured to transmit accounting information to the vehicle data transmission unit, and

wherein the vehicle data transmission unit is configured to transmit the accounting information with the identification information to the vehicle data collection server.

21. The vehicle-mounted computing device according to claim 20,

wherein the accounting processing unit is configured to perform the accounting processing with an integrated circuit (IC) card on which contract information is recorded.

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