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(54) **INFORMATION PROCESSING DEVICE**

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CPC ***G06Q 30/018*** (2013.01)

(57) **ABSTRACT**

An information processing device includes a control unit. The control unit acquires data of the carbon emission amount of the vehicle and a plurality of parameters correlated with the respective weights of the plurality of cargo groups transported by the vehicle. The plurality of cargo groups includes at least one luggage. The control unit calculates the carbon discharge amount for each of the plurality of cargo groups based on the data of the carbon discharge amount of the vehicle and the plurality of parameters.

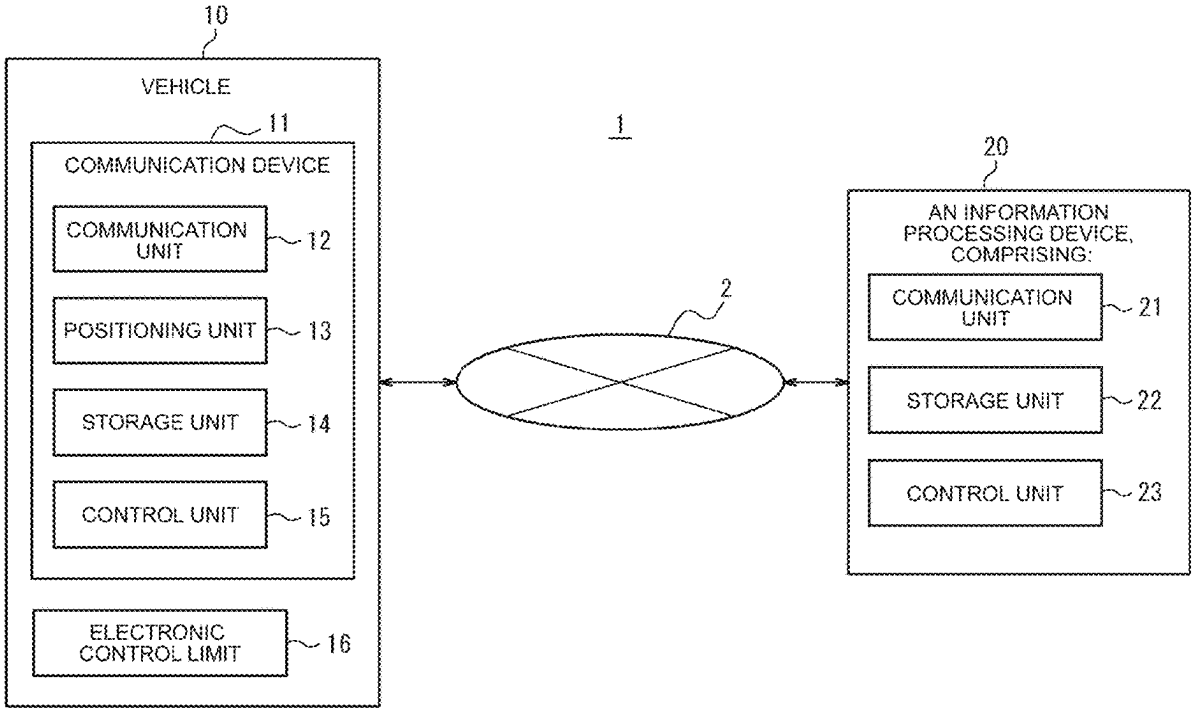
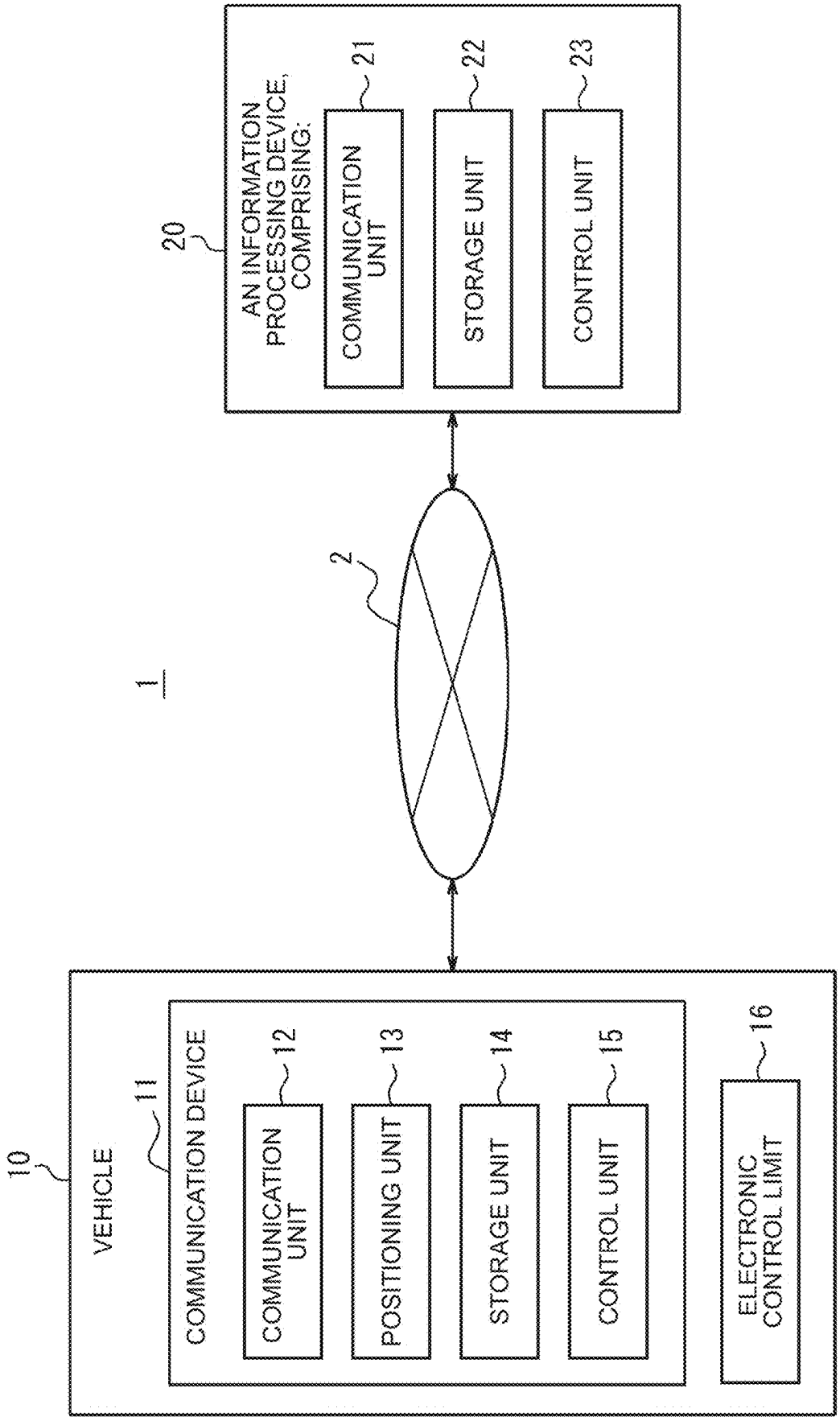


FIG. 1


1
2
10
VEHICLE
11
COMMUNICATION DEVICE
12
COMMUNICATION UNIT
13
POSITIONING UNIT
14
STORAGE UNIT
15
CONTROL UNIT
16
ELECTRONIC CONTROL LIMIT
20
AN INFORMATION PROCESSING DEVICE, COMPRISING:
21
COMMUNICATION UNIT
22
STORAGE UNIT
23
CONTROL UNIT

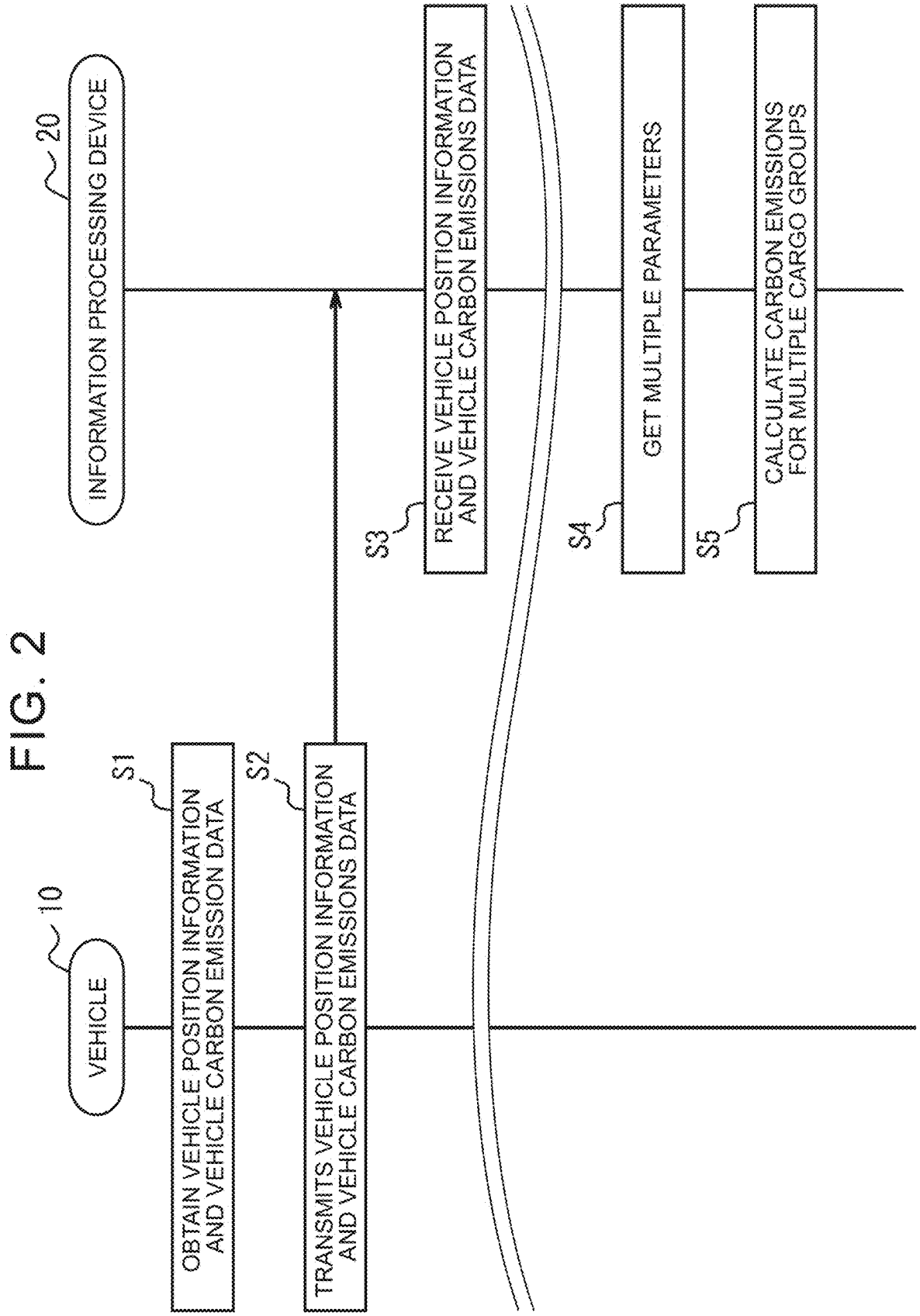

10
VEHICLE
20
INFORMATION PROCESSING DEVICE
S1
OBTAIN VEHICLE POSITION INFORMATION AND VEHICLE CARBON EMISSION DATA
S2
TRANSMITS VEHICLE POSITION INFORMATION AND VEHICLE CARBON EMISSIONS DATA
S3
RECEIVE VEHICLE POSITION INFORMATION AND VEHICLE CARBON EMISSIONS DATA
S4
GET MULTIPLE PARAMETERS
S5
CALCULATE CARBON EMISSIONS FOR MULTIPLE CARGO GROUPS

FIG. 2

FIG. 3

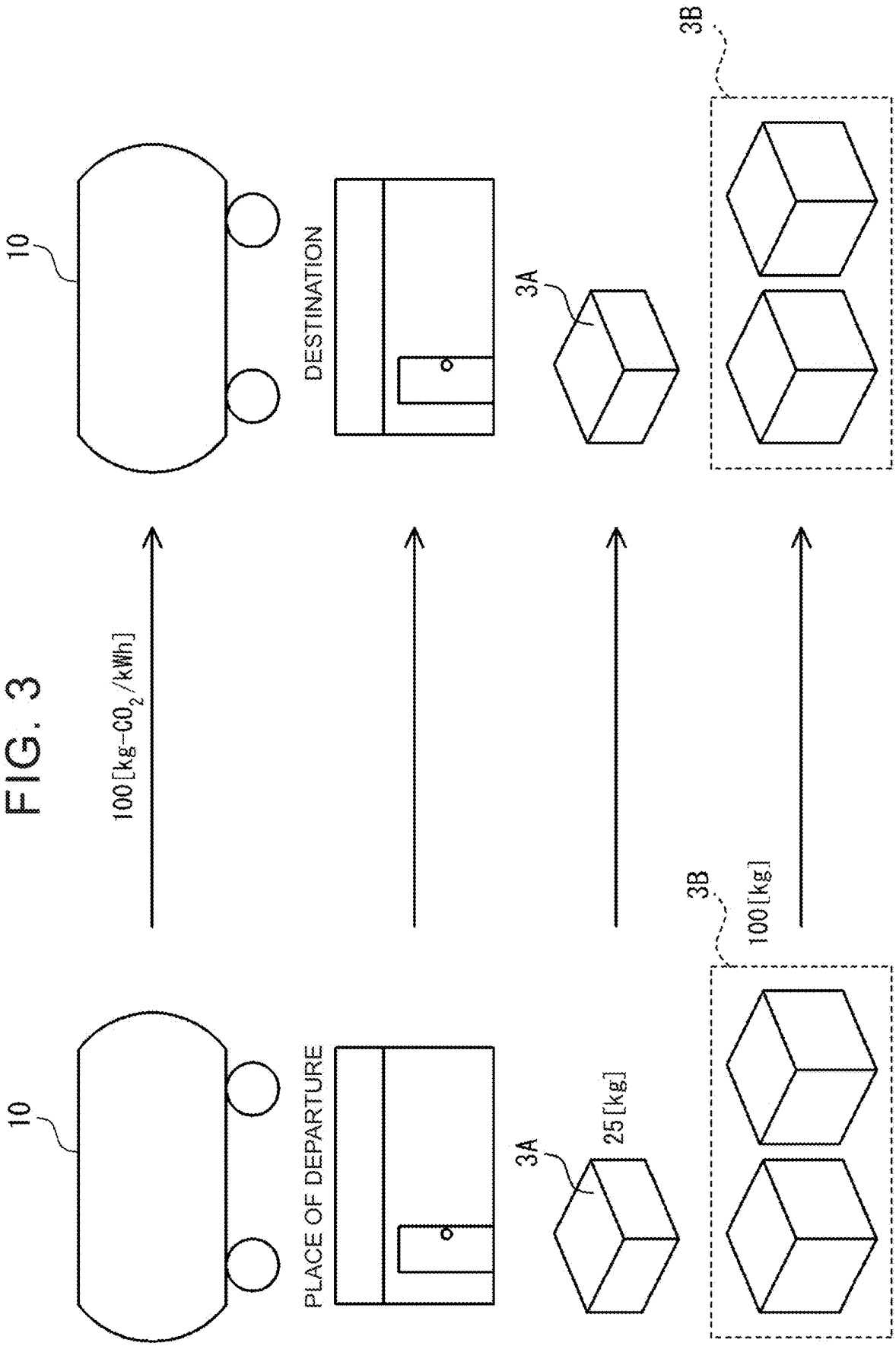
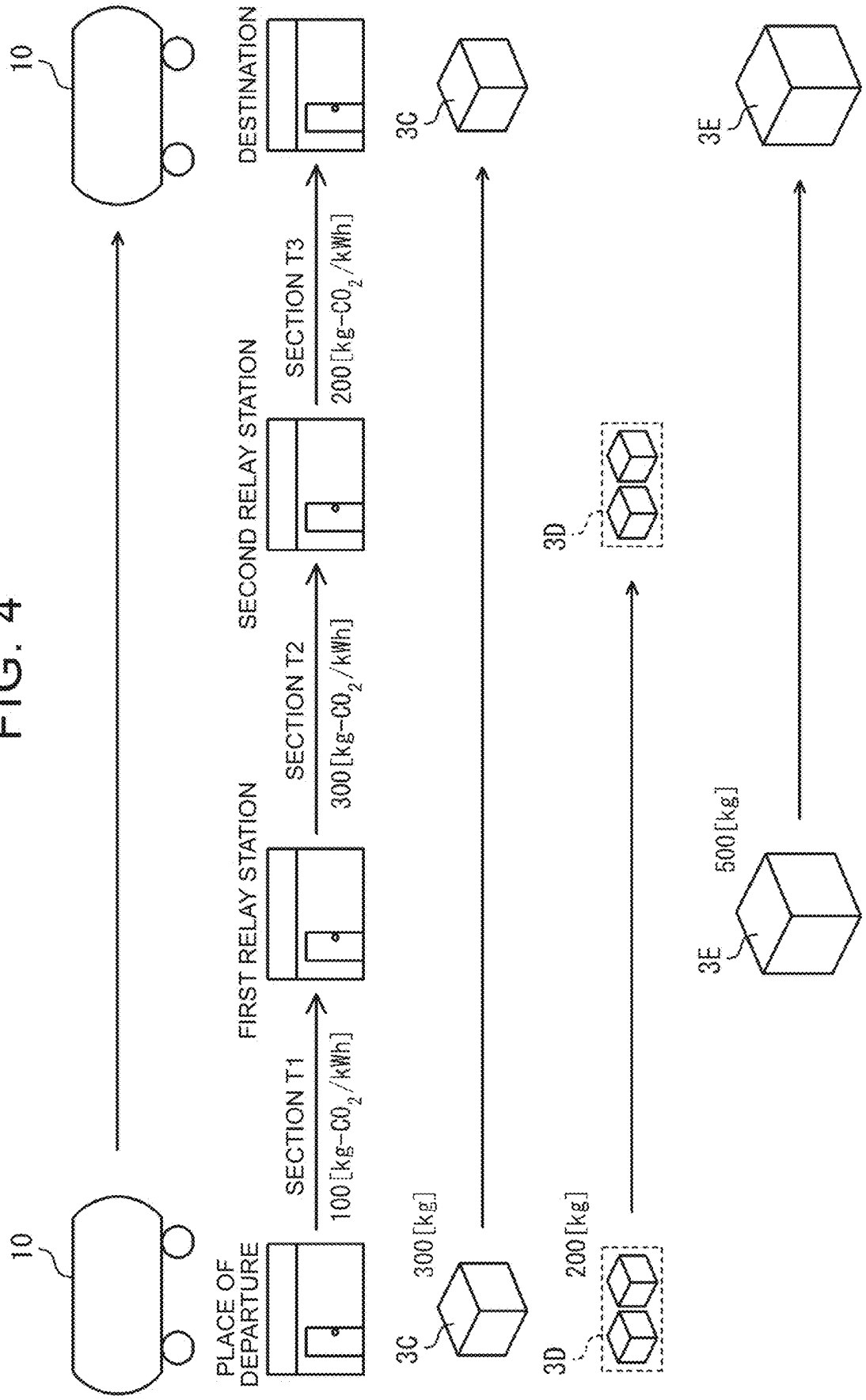

10
PLACE OF DEPARTURE
3A
25[kg]
3B
100[kg]
100[kg-CO2/kWh]
10
DESTINATION
3A
3B

FIG. 4


10
10
PLACE OF DEPARTURE
SECTION T1
100 [kg-CO2/kWh]
FIRST RELAY STATION
SECTION T2
300 [kg-CO2/kWh]
SECOND RELAY STATION
SECTION T3
200 [kg-CO2/kWh]
DESTINATION
3C
300 [kg]
3C
3D
200 [kg]
3D
3E
500 [kg]
3E

INFORMATION PROCESSING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Japanese Patent Application No. 2024-023191 filed on Feb. 19, 2024, incorporated herein by reference in its entirety.

BACKGROUND

1. Technical Field

[0002] The present disclosure relates to an information processing device.

2. Description of Related Art

[0003] Distributors are occasionally requested to report a carbon emission amount of vehicles. For example, designated shippers with a cargo transport volume of 30 million ton-kilometers or more are obligated to periodically report a carbon emission amount to the Environment Agency. Thus, there is known a commercial transaction business system in which exhaust gas emitted from an engine of an automobile is associated with an owner and a user of the automobile (Japanese Unexamined Patent Application Publication No. 2004-252617 (JP 2004-252617 A)).

SUMMARY

[0004] One logistics company occasionally receives a request to transport cargos from a plurality of shippers. In this case, it is useful if it is possible to grasp, for each shipper, how much the transportation of the cargos of the shipper contributes to the carbon emission amount.

[0005] According to the present disclosure made in view of such an issue, it is possible to grasp, for each shipper, how much the transportation of the cargos of the shipper contributes to the carbon emission amount.

[0006] An aspect of the present disclosure provides an information processing device including a control unit that acquires data on a carbon emission amount of a vehicle and a plurality of parameters correlated with respective weights of a plurality of cargo groups transported by the vehicle, the cargo groups including at least one cargo, in which the control unit calculates a carbon emission amount for each of the cargo groups based on the data on the carbon emission amount of the vehicle and the parameters.

[0007] According to the aspect of the present disclosure, it is possible to grasp, for each shipper, how much the transportation of the cargos of the shipper contributes to the carbon emission amount.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Features, advantages, and technical and industrial significance of exemplary embodiments of the disclosure will be described below with reference to the accompanying drawings, in which like signs denote like elements, and wherein:

[0009] FIG. **1** is a block diagram illustrating a schematic configuration of a system according to an embodiment of the present disclosure;

[0010] FIG. **2** is a flowchart illustrating an example of operation of the system illustrated in FIG. **1**;

[0011] FIG. **3** is a diagram illustrating an exemplary route from a departure point to a destination; and

[0012] FIG. **4** is a diagram illustrating another example of a route from a departure point to a destination.

DETAILED DESCRIPTION OF EMBODIMENTS

[0013] Hereinafter, an embodiment of the present disclosure will be described below with reference to the drawings.

Sample System Configuration

[0014] As illustrated in FIG. **1**, the system **1** according to the present embodiment includes a vehicle **10** and an information processing device **20**. In FIG. **1**, the number of vehicles **10** included in the system **1** is one. However, the system **1** may include a plurality of vehicles **10**.

[0015] The vehicle **10** and the information processing device **20** can communicate with each other via the network **2**. The network **2** may be any network including a mobile communication network, the Internet, and the like.

[0016] The vehicle **10** is used, for example, by a logistics company. The vehicle **10** is, for example, a truck. However, the vehicle **10** may be any type of vehicle as long as it can transport a package.

[0017] As illustrated in FIG. **3** or FIG. **4**, which will be described later, the vehicle transports a plurality of packages from a departure point to a destination. The cargo group includes at least one luggage. The cargo group is set for each shipper. In other words, the cargo group may collectively include packages for each shipper. The consignor is also a requester who requests the logistics company using the vehicle **10** to transport his or her luggage. The route from the departure point to the destination may include one or more relays, as shown in FIG. **4** below. In response to a request from the shipper, the vehicle **10** may transport the cargo group from the departure point to the relay point or the destination, or may transport the cargo group from the relay point to another relay point or the destination.

[0018] The vehicle **10** includes a communication device **11** and an electronic control unit **16**. The communication device **11** and the electronic control unit **16** can communicate with each other via an in-vehicle network such as a CAN (Controller Area Network) or a dedicated line. The communication device **11** includes a communication unit **12**, a positioning unit **13**, a storage unit **14**, and a control unit **15**. However, the communication device **11** may not include the positioning unit **13**.

[0019] The communication unit **12** includes at least one communication module connectable to the network **2**. The communication module is, for example, a communication module conforming to mobile communication standards such as the long term evolution (LTE), fourth generation (4G), or fifth generation (5G).

[0020] The communication unit **12** is configured to include at least one communication module capable of communicating with components of the vehicle **10**, such as the electronic control unit **16**. The communication module is a communication module corresponding to a standard of an in-vehicle network such as a CAN or a dedicated line.

[0021] The positioning unit **13** can acquire position information of the vehicle **10**. The positioning unit **13** is configured to include at least one reception module corresponding

to the satellite positioning system. The receiving module is, for example, a receiving module corresponding to the global positioning system (GPS).

[0022] The storage unit **14** includes at least one semiconductor memory, at least one magnetic memory, at least one optical memory, or a combination of at least two types thereof. The semiconductor memory is, for example, a random access memory (RAM), a read-only memory (ROM), or the like. The RAM is, for example, a static random access memory (SRAM), a dynamic random access memory (DRAM), or the like. ROM is, for example, EEPROM (Electrically Erasable Programmable Read-Only Memory). The storage unit **14** may serve as a main storage device, an auxiliary storage device, or a cache storage device. The storage unit **14** stores data used for the operation of the communication device **11** and data obtained by the operation of the communication device **11**. The storage unit **14** may store an arbitrary program used for the operation of the communication device **11**. For example, the storage unit **14** stores at least one of a system program, an application program, and embedded software.

[0023] The control unit **15** includes at least one processor, at least one dedicated circuit, or a combination thereof. The processor is, for example, a general-purpose processor such as a central processing unit (CPU) or a graphics processing unit (GPU), or a dedicated processor specialized for a specific process. The dedicated circuit is, for example, a field-programmable gate array (FPGA) or an application-specific integrated circuit (ASIC). The control unit **15** executes processing related to the operation of the communication device **11** while controlling each unit of the communication device **11**.

[0024] The electronic control unit **16** is an ECU (Electronic Control Unit) of the vehicle **10**. The electronic control unit **16** controls various functions of the vehicle **10**.

[0025] The information processing device **20** is a dedicated computer configured to function as a server, a general-purpose personal computer, a cloud computing system, or the like.

[0026] The information processing device **20** is managed by, for example, a logistics company using the vehicle **10**. As will be described later, the information processing device **20** calculates the carbon emission amount for each of the plurality of cargo groups transported by the vehicle **10**. In the present embodiment, the carbon discharge amount of the cargo group is, for example, a carbon discharge amount which is considered to have contributed to the transportation of the cargo group among the carbon discharge amounts discharged by the vehicle **10** when the vehicle **10** transports the plurality of cargo groups.

[0027] The information processing device **20** includes a communication unit **21**, a storage unit **22**, and a control unit **23**.

[0028] The communication unit **21** is configured to include at least one communication module that can be connected to the network **2**. The communication module is, for example, a communication module compatible with a standard such as a wired local area network (LAN) or a wireless LAN. The communication unit **21** is connected to the network **2** via a wired LAN or a wireless LAN by a communication module.

[0029] The storage unit **22** includes at least one semiconductor memory, at least one magnetic memory, at least one optical memory, or a combination of at least two types thereof. The semiconductor memory is, for example, a RAM, or a ROM. The RAM is, for example, an SRAM or a DRAM. The ROM is, for example, an EEPROM. The storage unit **22** may function as a main storage device, an auxiliary storage device, or a cache memory. The storage unit **22** stores data used for the operations of the information processing device **20** and data obtained through the operations of the information processing device **20**. The storage unit **22** may store an arbitrary program used for the operation of the information processing device **20**. For example, the storage unit **22** stores at least one of a system program, an application program, and embedded software.

[0030] The storage unit **22** stores, for example, a plurality of parameters. The plurality of parameters is a parameter correlated to the weight of each of the plurality of cargo groups transported by the vehicle **10**.

[0031] As an example, the plurality of parameters may indicate a weight of each of the plurality of cargo groups. The weight of the cargo group may be the sum of the weights of the packages included in the cargo group.

[0032] As another example, the plurality of parameters may indicate a volume of each of the plurality of cargo groups. The volume of the cargo group may be the sum of the volumes of the packages included in the cargo group. Here, the larger the volume of the load, the larger the weight of the load may be. Therefore, it can be said that the volume of the cargo group correlates with the weight of the cargo group.

[0033] As yet another example, the plurality of parameters may indicate a density of each of the plurality of baggage groups. The density of the cargo group may be an average value of the densities of the packages included in the cargo group, or may be the sum of the densities of the packages included in the cargo group. Here, the larger the density of the load, the larger the weight of the load may be. Therefore, it can be said that the density of the cargo group correlates with the weight of the cargo group.

[0034] The control unit **23** includes at least one processor, at least one dedicated circuit, or a combination thereof. The processor is a general-purpose processor such as a CPU or a GPU, or a dedicated processor specialized for a specific process, for example. The dedicated circuit is, for example, an FPGA or an ASIC. The control unit **23** executes processing related to the operation of the information processing device **20** while controlling each unit of the information processing device **20**.

Example of System Operation

[0035] FIG. **2** is a flowchart illustrating an operation example of the system **1** illustrated in FIG. **1**. For example, when the vehicle **10** starts from a departure point, the system **1** starts S1 process.

[0036] In S1 process, the control unit **15** of the communication device **11** of the vehicle **10** acquires the position information of the vehicle **10** and the carbon emission amount data.

[0037] As a process of acquiring the position information of the vehicle **10**, the control unit **15** acquires the position information of the vehicle **10** by the positioning unit **13**. However, for example, when the communication device **11** does not include the positioning unit **13**, the control unit **15** may acquire the position information of the vehicle **10** by receiving the position information from the electronic control unit **16** by the communication unit **12**.

[0038] As a process of acquiring data of the carbon emission amount of the vehicle **10**, the control unit **15** may acquire the carbon emission amount by calculating the carbon emission amount of the vehicle **10**. The control unit **15** may calculate the carbon emission amount of the vehicle **10** by, for example, a fuel method, a fuel consumption method, or an improved ton-kilometer method. The control unit **15** may receive any data used to calculate the carbon emission amount from the electronic control unit **16** by the communication unit **12**. For example, in the fuel method, the carbon emission amount of the vehicle **10** is calculated using the data of the fuel consumption amount of the vehicle **10**. Therefore, when the carbon emission amount is calculated by the fuel method, the control unit **15** receives the data of the fuel consumption amount of the vehicle **10** from the electronic control unit **16** by the communication unit **12**. Further, in the fuel efficiency method, the carbon emission amount of the vehicle **10** is calculated by using the traveling distance data of the vehicle **10**. Therefore, in the case of calculating the carbon emission amount by the fuel efficiency method, the control unit **15** receives data of the travel distance of the vehicle **10** from the electronic control unit **16** by the communication unit **12**.

[0039] In S**2** process, the control unit **15** transmits the position information of the vehicle **10** and the carbon emission amount data of the vehicle **10** acquired in S**1** process to the information processing device **20** via the network **2** by the communication unit **12**.

[0040] In S**3** process, the control unit **23** of the information processing device **20** receives the position information of the vehicle **10** and the carbon emission amount data of the vehicle **10** from the vehicle **10** via the network **2** by the communication unit **21**. In the present embodiment, the control unit **23** acquires the position information of the vehicle **10** and the data of the carbon emission amount of the vehicle **10** by receiving the position information of the vehicle **10** and the data of the carbon emission amount of the vehicle **10** from the vehicle **10**. However, the control unit **23** may acquire the position information of the vehicle **10** and the data of the carbon emission amount of the vehicle **10** by an arbitrary method. For example, the control unit **23** may acquire the data of the carbon emission amount of the vehicle **10** by calculating the data of the carbon emission amount of the vehicle **10** in the same manner as or similar to the control unit **15** as described above in S**1** process. The control unit **23** causes the storage unit **22** to store the received positional information of the vehicle **10** and data of the carbon emission amount.

[0041] Here, the communication device **11** repeatedly executes S**1**, S**2** process at predetermined intervals until the vehicles **10** arrive at the destination. The predetermined time may be set based on the average speed of the vehicle **10** or the like. When the communication device **11** repeatedly executes S**1**, S**2** process, in the information processing device **20**, the control unit **23** repeatedly executes S**3** process and repeatedly receives the position information of the vehicle **10** and the carbon emission amount of the vehicle **10**.

[0042] S**4** process is executed after the vehicles **10** arrive at the destination. For example, the control unit **23** of the information processing device **20** detects that the vehicle **10** has arrived at the destination from the position information of the vehicle **10** received in S**3** process.

[0043] In S**4** process, the control unit **23** acquires a plurality of parameters from the storage unit **22**.

[0044] In S**5** process, the control unit **23** calculates the carbon discharge amount for each of the plurality of cargo groups on the basis of the carbon discharge amount data acquired in S**3** process and the plurality of parameters acquired in S**4** process. An example of S**5** process will be described below.

Example 1

[0045] When the plurality of parameters indicate the respective weights of the plurality of cargo groups, the control unit **23** may calculate the weight ratios of the plurality of cargo groups by the plurality of parameters. The control unit **23** may calculate the carbon discharge amount for each of the plurality of cargo groups based on the data of the carbon discharge amount of the vehicle **10** and the weight ratio of the plurality of cargo groups. By using the weight ratios of the plurality of cargo groups as described above, it is possible to accurately calculate the carbon discharge amount for each of the plurality of cargo groups.

[0046] For example, as illustrated in FIG. **3**, it is assumed that the vehicle **10** transports the cargo group **3**A, **3**B from the departure point to the destination. Further, it is assumed that the carbon emission from the departure point to the destination is 100 [kg-CO_2/kWh], the weight of the cargo group **3**A is 25 [kg], and the weight of the cargo group **3**B is 100 [kg]. Here, the control unit **23** calculates that the weight ratio of the cargo group **3**A, **3**B is (the cargo group **3**A: the cargo group **3**B=1:4). Further, the control unit **23** calculates that the carbon discharge amount of the cargo group **3**A is 20 [kg-CO_2/kWh], and calculates that the carbon discharge amount of the cargo group **3**B is 80 [kg-CO_2/kWh].

Example 2

[0047] When the plurality of parameters indicates the respective volumes of the

[0048] plurality of cargo groups, the control unit **23** may calculate the volume ratios of the plurality of cargo groups by the plurality of parameters. The control unit **23** may calculate the carbon discharge amount for each of the plurality of cargo groups based on the data of the carbon discharge amount of the vehicle **10** and the volume ratio of the plurality of cargo groups. By using the volume ratios of the plurality of cargo groups as described above, it is possible to calculate the carbon discharge amount for each of the plurality of cargo groups even when the weights of the plurality of cargo groups are not known, for example.

Example 3

[0049] When the plurality of parameters indicates the density of each of the plurality of cargo groups, the control unit **23** may calculate the density ratio of the plurality of cargo groups by the plurality of parameters. The control unit **23** may calculate the carbon discharge amount for each of the plurality of cargo groups based on the data of the carbon discharge amount of the vehicle **10** and the density ratio of the plurality of cargo groups.

Example 4

[0050] The route from the departure point to the destination of the vehicle **10** may include a section in which at least

some of the plurality of packages of the plurality of packages transported by the vehicle **10** are transported. For example, in FIG. **4**, the vehicle **10** transports the cargo group **3**C, **3**D, **3**E as a plurality of cargo groups. The route from the departure point to the destination of the vehicle **10** includes the section T**1**, T**2**, T**3**. The section T**1** is a section from the departure point to the first relay point. The section T**2** is a section from the first relay point to the second relay point. The section T**3** is a section from the second relay point to the destination. The vehicle **10** transports the cargo group **3**C, **3**D in the section T**1** among the cargo group **3**C, **3**D, **3**E. The vehicle **10** transports the cargo group **3**C, **3**D, **3**E in the section T**2** among the cargo group **3**C, **3**D, **3**E. The vehicle **10** transports the cargo group **3**C, **3**E in the section T**3** among the cargo group **3**C, **3**D, **3**E.

[0051] When the route from the departure point to the destination of the vehicle **10** includes the above-described section, the control unit **23** acquires data of the carbon emission amount of the vehicle **10** in the section on the basis of the position information of the vehicle **10** and the data of the carbon emission amount acquired in S**3** process. Further, the control unit **23** calculates the carbon discharge amount for each of the plurality of cargo groups transported in the section based on the data of the carbon discharge amount of the vehicle **10** in the section and the plurality of parameters correlated with the respective weights of the plurality of cargo groups transported in the section.

[0052] For example, in FIG. **4**, the control unit **23** acquires 100 [kg-CO_2/kWh] of the carbon emissions of the section T**1**. The control unit **23** acquires 300 [kg-CO_2/kWh] of the carbon emissions of the section T**2**. The control unit **23** acquires 200 [kg-CO_2/kWh] of the carbon emissions of the section T**3**. Further, in FIG. **4**, the parameter correlated with the weight of the cargo group **3**C indicates 300 [kg] which is the weight of the cargo group **3**C. The parameter correlated to the weight of the cargo group **3**D indicates 200 [kg] which is the weight of the cargo group **3**D. The parameter correlated to the weight of the cargo group **3**E indicates 500 [kg] which is the weight of the cargo group **3**E.

[0053] For example, in the section T**1** in FIG. **4**, the control unit **23** calculates that the weight ratio of the cargo group **3**C, **3**D is (the cargo group **3**C: the cargo group **3**D=3:2) based on the parameter of the cargo group **3**C, **3**D. The control unit **23** calculates, based on T**1** of 100 [kg-CO_2/kWh] of the carbon discharge amount in the section T**1** and the weight ratio of the cargo group **3**C, **3**D, that the carbon discharge amount of the cargo group **3**C in the section is 60 [kg-CO_2/kWh]. Further, the control unit **23** calculates that the carbon emission of the cargo group **3**D in the section T**1** is 40 [kg-CO_2/kWh].

[0054] For example, in the section T**2** in FIG. **4**, the control unit **23** calculates that the weight ratio of the cargo group **3**C, **3**D, **3**E is (the cargo group **3**C: the cargo group **3**D: the cargo group **3**E=3:2:5) based on the parameter of the cargo group **3**C, **3**D, **3**E. The control unit **23** calculates, based on T**2** of the section 300 [kg-CO_2/kWh] of the carbon discharge amount and the weight ratio of the cargo group **3**C, **3**D, **3**E, that the carbon discharge amount of the cargo group **3**C in the section T**2** is 90 [kg-CO_2/kWh]. Further, the control unit **23** calculates that the carbon emission of the cargo group **3**D in the section T**2** is 60 [kg-CO_2/kWh]. Further, the control unit **23** calculates that the carbon emission of the cargo group **3**E in the section T**2** is 150 [kg-CO_2/kWh].

[0055] For example, in the section T**3** in FIG. **4**, the control unit **23** calculates that the weight ratio of the cargo group **3**C, **3**E is (the cargo group **3**C: the cargo group **3**E=3:5) based on the parameter of the cargo group **3**C, **3**E. The control unit **23** calculates, based on T**3** of the section **200** [kg-CO_2/kWh] of the carbon discharge amount and the weight ratio of the cargo group **3**C, **3**E, that the carbon discharge amount of the cargo group **3**C in the section T**3** is 75 [kg-CO_2/kWh]. Further, the control unit **23** calculates that the carbon emission of the cargo group **3**E in the section T**3** is 125 [kg-CO_2/kWh].

[0056] The control unit **23** calculates the carbon discharge amount for each of the plurality of cargo groups based on the calculation result of the carbon discharge amount for each of the plurality of cargo groups in the section.

[0057] For example, in the cargo group **3**C, the control unit **23** adds 60 [kg-CO_2/kWh] of the carbon emission amount of the cargo group **3**C in the section T**1**, **75** [kg-CO_2/kWh] of the cargo group **3**C in the section T**2**, and 90 [kg-CO_2/kWh] of the cargo group **3**C in the section T**3**. The control unit **23** calculates that the carbon emission of the cargo group **3**C is 225 [kg-CO_2/kWh].

[0058] For example, in the cargo group **3**D, the control unit **23** adds 40 [kg-CO_2/kWh] of the carbon discharge amount of the cargo group **3**D in the section T**1** and 60 [kg-CO_2/kWh] of the carbon discharge amount of the cargo group **3**D in the section T**2**. The control unit **23** calculates that the carbon emission of the cargo group **3**D is 100 [kg-CO_2/kWh].

[0059] For example, in the cargo group **3**E, the control unit **23** adds 150 [kg-CO_2/kWh] of the carbon discharge amount of the cargo group **3**E in the section T**2** and 125 [kg-CO_2/kWh] of the carbon discharge amount of the cargo group **3**E in the section T**3**. The control unit **23** calculates that the carbon emission of the cargo group **3**E is 275 [kg-CO_2/kWh].

[0060] As described above, in the information processing device **20** according to the present embodiment, the control unit **23** calculates the carbon discharge amount for each of the plurality of cargo groups based on the data of the carbon discharge amount of the vehicle **10** and the plurality of parameters correlated with the respective weights of the plurality of cargo groups. By calculating the carbon discharge amount for each of the plurality of cargo groups, it is possible to grasp, for each of the cargo holders, how much the cargo of the cargo holder contributes to the carbon discharge amount even when the cargo of the different cargo holders is transported.

[0061] Further, in the present embodiment, the route from the departure point of the vehicle **10** to the destination may include a section in which a plurality of cargo groups of at least a part of the plurality of cargo groups transported by the vehicle **10** are transported. The control unit **23** may calculate the carbon discharge amount for each of the at least some of the plurality of cargo groups in the section based on the data of the carbon discharge amount of the vehicle **10** in the section and the plurality of parameters correlated with the respective weights of the at least some of the plurality of cargo groups. With such a configuration, as shown in FIG. **4**, even when the relay point is included in the route from the departure point to the destination of the vehicle **10**, the carbon emission amount for each cargo group can be cal-

culated. A group of luggage is loaded on the vehicle **10** or a group of luggage is unloaded from the vehicle **10** at the relay site.

[0062] Although the present disclosure has been described above based on the drawings and the embodiment, it should be noted that those skilled in the art may make various modifications and alterations thereto based on the present disclosure. It should be noted, therefore, that these modifications and alterations are within the scope of the present disclosure. For example, the functions or the like included in each component or each step or the like can be rearranged so as not to logically contradict each other, and a plurality of components or steps or the like can be combined or divided into one.

[0063] For example, in Example 4 described above with respect to FIG. **4**, the plurality of parameters correlated with the respective weights of the plurality of cargo group **3**C, **3**D, **3**E are described as indicating the weights of the plurality of cargo group **3**C, **3**D, **3**E. However, the plurality of parameters correlated with the respective weights of the plurality of cargo group **3**C, **3**D, **3**E may be other parameters such as the respective volumes of the plurality of cargo group **3**C, **3**D, **3**E.

[0064] For example, in the above-described embodiments, the plurality of parameters correlated with the weight of each of the plurality of cargo groups is described as indicating the weight, volume, or density of each of the plurality of cargo groups. However, the plurality of parameters may be correlated with the respective weights of the plurality of cargo groups, and are not limited thereto. As another example, the plurality of parameters may be a combination of volume and density of the plurality of cargo groups.

[0065] For example, in the above-described embodiment, the configuration and operation of the information processing device **20** may be distributed among a plurality of computers capable of communicating with each other. Furthermore, for example, an embodiment in which a part of or all of the components of the information processing device **20** are provided in the vehicle **10** is also possible. For example, the communication device **11** of the vehicle **10** may include some or all of the constituent elements of the information processing device **20**.

[0066] For example, a general-purpose computer may function as the information processing device **20** according to the above-described embodiment. Specifically, a program describing processing contents for realizing each function of the information processing device **20** according to the above embodiment is stored in a memory of the general-purpose computer, and the program is read out and executed by the processor. Therefore, the present disclosure can also be realized as a program that can be executed by the processor or a non- transitory computer-readable medium that stores the program.

What is claimed is:

1. An information processing device comprising

a control unit that acquires data on a carbon emission amount of a vehicle and a plurality of parameters correlated with respective weights of a plurality of cargo groups transported by the vehicle, the cargo groups including at least one cargo, wherein

the control unit calculates a carbon emission amount for each of the cargo groups based on the data on the carbon emission amount of the vehicle and the parameters.

2. The information processing device according to claim **1**, wherein:

the parameters indicate the respective weights of the cargo groups; and

the control unit is configured to

calculate weight ratios of the cargo groups using the parameters, and

calculate the carbon emission amount for each of the cargo groups based on the data on the carbon emission amount of the vehicle and the weight ratios of the cargo groups.

3. The information processing device according to claim **1**, wherein:

the parameters indicate respective volumes of the cargo groups; and

the control unit is configured to

calculate volume ratios of the cargo groups using the parameters, and

calculate the carbon emission amount for each of the cargo groups based on the data on the carbon emission amount of the vehicle and the volume ratios of the cargo groups.

4. The information processing device according to claim **1**, wherein:

a route from a departure location to a destination of the vehicle includes a section in which a plurality of cargo groups that is at least some of the cargo groups is transported; and

the control unit calculates a carbon emission amount for each of the at least some of the cargo groups in the section using data on the carbon emission amount of the vehicle in the section and a plurality of parameters correlated with respective weights of the at least some of the cargo groups.

5. The information processing device according to claim **4**, wherein the control unit calculates a carbon emission amount for each of the cargo groups transported by the vehicle based on a result of calculating the carbon emission amount for each of the at least some of the cargo groups in the section.

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