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Information output apparatus and information output method

Abstract

An information output apparatus including: an acquisition part that acquires vehicle identification information of a trailer; vehicle identification information of a tractor, a measured tractor weight measured by a tractor-uncoupled rear axle weight sensor, a calculation part that calculates a second measured load on the basis of the weight of the tractor stored in the storage in association with the vehicle identification information of the tractor and the measured tractor weight to calculate the carried load by subtracting the weight of the trailer stored in the storage in association with the vehicle identification information of the trailer from a total value of the acquired, measured trailer load and the calculated fifth wheel load, and an output part that outputs information indicating the carried load.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) The present application claims priority to Japanese Patent Applications number 2022-042363, filed on Mar. 17, 2022. The contents of this application are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

(2) The present disclosure relates to an information output apparatus and an information output method for outputting information of a vehicle.

(3) Calculating the weight of loaded goods loaded on a trailer of a truck is performed. For example, in Japanese Unexamined Patent Application Publication No. 2009-1257, it is described that the weight of loaded goods is calculated using the load measured with a load detection part provided in a suspension device of rear wheels of a trailer when the loaded goods are loaded, a vehicle body weight of the trailer, and the like.

(4) In the technique described in Japanese Unexamined Patent Application Publication No. 2009-12577, there is a problem that the weight of the loaded goods cannot be calculated when the trailer towed by the tractor is changed to another trailer because the weight of the vehicle body and the like of the trailer change.

SUMMARY

(5) The present disclosure focuses on this point, and its object is to provide an information output apparatus and an information output method capable of calculating the weight of loaded goods when a trailer towed by a tractor is changed to another trailer.
(6) An information output apparatus according to a first aspect of the present disclosure is an information output apparatus that outputs information indicating a carried load of loaded goods mounted on a trailer in a vehicle configured with a tractor and the trailer, and including: a storage that stores vehicle identification information of a plurality of tractors in association with the weight of each of the tractors, and stores vehicle identification information of a plurality of trailers in association with the weight of each of the trailers; an acquisition part that acquires the vehicle identification information of the trailer, the vehicle identification information of the tractor, a measured tractor weight measured by a tractor-uncoupled rear axle weight sensor attached to the tractor, and a first measured load measured by a trailer weight sensor attached to the trailer; a calculation part that calculates a second measured load on the basis of the weight of the tractor stored in the storage in association with the vehicle identification information of the tractor acquired by the acquisition part and the measured tractor weight, and calculates the carried load by subtracting the weight of the trailer stored in the storage in association with the vehicle identification information of the trailer acquired by the acquisition part from a total value of the second measured load and the first measured load; and an output part that outputs information indicating the carried load calculated by the calculation part.
(7) An information output method according to a second aspect of the present disclosure is an information output method for outputting information indicating a carried load of loaded goods mounted on a trailer in a vehicle configured with a tractor and the trailer, the method including computer-implemented steps of: acquiring vehicle identification information of the trailer, vehicle identification information of the tractor, a measured tractor weight measured by a tractor-uncoupled rear axle weight sensor attached to the tractor, and a first measured load measured by a trailer weight sensor attached to the trailer; calculating, by referencing a storage that stores vehicle identification information of a plurality of tractors in association with the weight of each of the tractors and stores vehicle identification information of a plurality of trailers in association with the weight of each of the trailers, a second measured load on the basis of (i) the weight of the tractor stored in the storage in association with the acquired vehicle identification information of the tractor and (ii) the measured tractor weight, and calculating the carried load by subtracting the weight of the trailer stored in the storage in association with the acquired vehicle identification information of the trailer from a total value of the second measured load and the first measured load; and outputting information indicating the calculated carried load.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a diagram showing an outline of an information output system according to an embodiment.
(2) FIG. **2** shows an example of a measuring method for a measured tractor load and a measured trailer load.
(3) FIG. **3** shows a configuration of an information output apparatus.
(4) FIG. **4** shows an example of tractor specification information.
(5) FIG. **5** shows an example of trailer specification information.
(6) FIG. **6** shows an example of outputting information indicating the carried load by an output part.
(7) FIG. **7** is a flowchart showing a processing procedure by the information output apparatus.
DESCRIPTION OF EMBODIMENTS

(8) Hereinafter, the present disclosure will be described through exemplary embodiments, but the following exemplary embodiments do not limit the invention according to the claims, and not all of the combinations of features described in the exemplary embodiments are necessarily essential to the solution means of the invention.
(9) [Outline of an information output system S]
(10) FIG. **1** is a diagram showing an outline of an information output system S according to the embodiment. FIG. **2** shows an example of a measuring method for a measured tractor load and a measured trailer load. The information output system S is a system for displaying the carried load of a trailer **2** on an information terminal **300** of a user, such as an administrator or a driver of a vehicle, by having the user set a tractor ID of the tractor **1** that the user wishes to grasp its carried load regardless of the type of the trailer **2** connected to the tractor **1**. The information output system S includes a vehicle **100**, an information output apparatus **200**, and the information terminal **300**.
(11) The vehicle **100** includes the tractor **1** and the trailer **2**. The tractor **1** includes a telematics unit **11**, a first controller **12**, a tractor-uncoupled rear axle weight sensor **13**, and a second controller **14**. The trailer **2** includes a trailer weight sensor **21** and a third controller **22**.
(12) The telematics unit **11** is a communication module for wirelessly communicating with the information output apparatus **200** via a network. The first controller **12** is an electronic control unit (ECU), for example. The first controller **12** communicates with the second controller **14** and the third controller **22**. The first controller **12** communicates with the information output apparatus **200** via the telematics unit **11**.
(13) The tractor-uncoupled rear axle weight sensor **13** is provided in an air suspension, for example. The tractor-uncoupled rear axle weight sensor **13** measures the measured tractor load (corresponding to a measured tractor weight) by measuring air pressure inside the air suspension. The measured tractor load is a load applied to rear wheels of the tractor **1** as indicated by a thick arrow in FIG. **2**.
(14) The second controller **14** is an ECU, for example. The second controller **14** communicates with the first controller **12**. The second controller **14** acquires the measured tractor load measured by the tractor-uncoupled rear axle weight sensor **13**.
(15) The trailer weight sensor **21** is provided in an air suspension, for example. The trailer weight sensor **21** measures the load applied to a plurality of wheels of a trailer. In the example of the present specification, the trailer weight sensor **21** measures the measured trailer load (corresponding to a first measured load) by measuring air pressure inside the air suspension. As shown in FIG. **2**, the measured trailer load is the sum of loads applied to a plurality of wheels of the trailer **2**.
(16) The third controller **22** is an ECU, for example. The third controller **22** communicates with the first controller **12**. The third controller **22** acquires, from the trailer weight sensor **21**, the measured trailer load that has been measured.
(17) The information output apparatus **200** is a server, for example. The information output apparatus **200** communicates with the vehicle **100** and the information terminal **300** via a network. The information output apparatus **200** stores vehicle identification information of a plurality of tractors (hereinafter, also referred to as tractor ID s) in association with specification information such as a tractor-uncoupled rear axle weight (corresponding to the weight of a tractor) of each of the plurality of tractors. The information output apparatus **200** stores vehicle identification information of a plurality of trailers (hereinafter also referred to as trailer IDs) in association with specification information such as the weight of each trailer. The information terminal **300** is a smartphone owned by a driver of the vehicle **100**, for example. The information terminal **300** communicates with the information output apparatus **200** via a network.
(18) The information output apparatus **200** is characterized by outputting information indicating the carried load of loaded goods loaded on the trailer **2** of the vehicle **100**. Hereinafter, with reference to FIG. **1**, processing of the information output apparatus **200** outputting the information indicating

the carried load will be described.
(19) When the driver or the administrator of the vehicle **100** performs an operation for displaying the carried load of the vehicle **100** in the information terminal **300**, the information terminal **300** transmits a carried load display request together with a tractor ID to the information output apparatus **200** ((**1**) in FIG. **1**). Thereafter, the information output apparatus **200** periodically requests information indicating the load measured in the vehicle **100**, for example.
(20) In the vehicle **100** that has received the request for the information indicating the load, the second controller **14** transmits, to the first controller **12**, information indicating the measured tractor load measured by the tractor-uncoupled rear axle weight sensor **13**. The second controller **14** transmits the tractor ID to the first controller **12** together with the information indicating the measured tractor load ((**2**) in FIG. **1**).
(21) The third controller **22** transmits, to the first controller **12**, information indicating the measured trailer load measured by the trailer weight sensor **21**. The third controller **22** transmits the trailer ID to the first controller **12** together with the information indicating the measured trailer load ((**3**) in FIG. **1**). The first controller **12** transmits, to the information output apparatus **200**, the tractor ID acquired from the second controller **14**, the information indicating the measured tractor load, the trailer ID acquired from the third controller **22**, and the information indicating the measured trailer load ((**4**) in FIG. **1**).
(22) The information output apparatus **200** identifies specification information such as the tractor-uncoupled rear axle weight stored in the storage **202** (see FIG. **3** described later) in association with a tractor ID that is the same as the tractor ID acquired from the information terminal **300**. The information output apparatus **200** identifies, from the first controller **12**, the specification information such as the trailer weight stored in the storage **202** in association with the trailer ID that is the same as the trailer ID acquired together with the tractor ID, which is acquired from the information terminal **300** ((**5**) in FIG. **1**).
(23) The information output apparatus **200** calculates a fifth wheel load (corresponding to a second measured load) on the basis of the measured tractor load acquired from the vehicle **100** and the stored tractor-uncoupled rear axle weight. The fifth wheel load is the load by which the tractor **1** supports the trailer **2** in a coupler, which is a coupling unit between the tractor **1** and the trailer **2**. The information output apparatus **200** identifies the carried load of the trailer **2** by subtracting the identified trailer weight from a total value of the acquired measured trailer load and the calculated fifth wheel load ((**6**) in FIG. **1**). The information output apparatus **200** outputs the calculated carried load to the information terminal **300** of the user who has requested the display of the carried load of the vehicle **100** ((**7**) in FIG. **1**).
(24) In this manner, the information output apparatus **200** identifies the specification information corresponding to the tractor ID and the specification information corresponding to the trailer ID, and calculates the carried load of the trailer **2** on the basis of the identified specification information. Therefore, the information output apparatus **200** can calculate the weight of loaded goods even when the trailer **2** towed by the tractor **1** is changed to another trailer **2**.
(25) [Configuration of the information output apparatus **200**]
(26) FIG. **3** shows a configuration of the information output apparatus **200**. The information output apparatus **200** includes a communication part **201**, a storage **202**, and a control part **203**. The control part **203** includes an acquisition part **31**, an identification part **32**, a calculation part **33**, and an output part **34**.
(27) The communication part **201** is an interface for communicating with the vehicle **100** and the information terminal **300**. The storage **202** includes a read only memory (ROM), a random access memory (RAM), and the like, for example. The storage **202** stores various types of data and various types of programs for causing the control part **203** to function.
(28) The storage **202** stores tractor specification information in which a plurality of tractor IDs are associated with their respective tractor-uncoupled rear axle weights, coupler offsets, and

wheelbases. The tractor specification information is information concerning the dimensions and weight of each part of the tractor **1**. FIG. **4** shows an example of the tractor specification information. The wheelbase is the distance between the front wheel center and the rear wheel center of a tractor, as shown in FIG. **2**. The coupler offset is the distance between the rear wheel center of the tractor and the coupler, as shown in FIG. **2**. The coupler is the coupling unit between the tractor **1** and the trailer **2**. The tractor-uncoupled rear axle weight is a load applied to rear wheels of the tractor **1** measured by the tractor-uncoupled rear axle weight sensor **13** in a state in which the trailer **2** is not coupled to the tractor **1**.

(29) In the tractor specification information stored in the storage **202**, a tractor ID "T101," a wheelbase of "7000" millimeters, a coupler offset of "1300" millimeters, and a tractor-uncoupled rear axle weight of "2700" kilograms are associated with each other in the example of the first row from the top of FIG. **4**. In the tractor specification information stored in the storage **202**, a front axle weight may be associated with the tractor ID. The front axle weight is a load applied to front wheels of the tractor **1** in a state in which the trailer **2** is not coupled to the tractor **1**.

(30) The storage **202** stores trailer specification information in which a plurality of trailer IDs are associated with each trailer's vehicle weight. FIG. **5** shows an example of trailer specification information. The trailer weight indicates the weight of a trailer in a state in which no load is loaded. In the example of the first row from the top of FIG. **5**, the trailer ID "L101" and the trailer weight of "7000" kilograms are associated.

(31) The storage **202** stores driver information in which the tractor ID and a user ID of the information terminal **300** of the driver of the tractor **1** are associated. The storage **202** stores load history information in which (i) a plurality of tractor IDs, (ii) a plurality of pieces of location information indicating locations of the vehicle **100**, (iii) acquisition timings at which the plurality of pieces of location information are acquired, and (iv) the carried loads of the vehicle **100** corresponding to the plurality of acquisition timings are associated with each other. The load history information indicates past time-series changes in the carried load of the vehicle **100**.

(32) The control part **203** is a central processing unit (CPU), for example. The control part **203** functions as the acquisition part **31**, the identification part **32**, the calculation part **33**, and the output part **34** by executing the programs stored in the storage **202**.

(33) The acquisition part **31** acquires various types of information from the vehicle **100** via the communication part **201**. The acquisition part **31** acquires the tractor ID and the measured tractor load measured by the tractor-uncoupled rear axle weight sensor **13** which is attached to the tractor **1**. The acquisition part **31** acquires the trailer ID and the measured trailer load (corresponding to the first measured load) measured by the trailer weight sensor **21** which is attached to the trailer **2**. The acquisition part **31** acquires location information indicating a location of a vehicle.

(34) The acquisition part **31** acquires the measured tractor load, the tractor ID, the measured trailer load, the trailer ID, and the location information for every predetermined time period, for example. The predetermined time period is preset by the driver of the vehicle **100**, and may be one minute or ten minutes for example. The acquisition part **31** may acquire the measured tractor load or the like when the vehicle **100** stops. The acquisition part **31** causes the storage **202** to store vehicle information in which the acquired (i) tractor ID, (ii) date and time of acquiring the tractor ID, (iii) measured tractor load, (iv) trailer ID, (v) measured trailer load, and (vi) location information are associated with each other.

(35) In addition, the acquisition part **31** acquires (i) a user's instruction requesting an output of the carried load and (ii) the tractor ID from the information terminal **300**. The acquisition part **31** references the vehicle information stored in the storage **202**, and acquires the measured tractor load, the trailer ID, and the measured trailer load stored in association with the tractor ID which is acquired from the information terminal **300**. The acquisition part **31** outputs the acquired tractor ID and trailer ID to the identification part **32**. The acquisition part **31** outputs the acquired measured tractor load and measured trailer load to the calculation part **33**.

(36) The identification part **32** identifies the tractor-uncoupled rear axle weight which is stored in the storage **202** in association with the tractor ID acquired by the acquisition part **31** from the information terminal **300** of the user. The identification part **32** identifies the coupler offset and the wheelbase stored in the storage **202** in association with the tractor ID acquired by the acquisition part **31**, in addition to the tractor-uncoupled rear axle weight. In the example of FIG. **4**, when the acquisition part **31** acquires the tractor ID "T101," the identification part **32** identifies the wheelbase of "7000" millimeters, the coupler offset of "1300" millimeters, and the tractor-uncoupled rear axle weight of "2700" kilograms, which are associated with the tractor ID "T101" in the tractor specification information stored in the storage **202**. The identification part **32** may identify the front axle weight stored in the storage **202** in association with the tractor ID acquired by the acquisition part **31**.

(37) The identification part **32** identifies the trailer weight stored in the storage **202** in association with the trailer ID associated with the tractor ID acquired by the acquisition part **31** from the information terminal **300** of the user. In the example of FIG. **5**, supposing that the acquisition part **31** has acquired the trailer ID "L101," the identification part **32** identifies the trailer weight "7000" kilogram associated with the trailer ID "L101" in the tractor specification information stored in the storage **202**.

(38) The calculation part **33** calculates the carried load of the trailer **2**. First, the calculation part **33** measures the fifth wheel load on the basis of the tractor-uncoupled rear axle weight acquired by the identification part **32** and the measured tractor load acquired by the acquisition part **31**. In the example of the present specification, the calculation part **33** calculates the fifth wheel load on the basis of the identified coupler offset and the identified wheelbase in addition to the tractor-uncoupled rear axle weight identified by the identification part **32** and the measured tractor load acquired by the acquisition part **31**.

(39) More specifically, the calculation part **33** calculates the fifth wheel load by dividing the product of the value obtained by subtracting the tractor-uncoupled rear axle weight identified by the identification part **32** from the measured tractor load measured by the tractor-uncoupled rear axle weight sensor **13** and the identified wheelbase by the value obtained by subtracting the identified coupler offset from the wheelbase. When expressed by a mathematical equation, the calculation part **33** calculates the fifth wheel load (FWL) (kg) with the following equation.

$$FWL=(DAL-DAW)*(WB/(WB-CO)) \quad (1)$$

In Equation 1, DAL is the measured tractor load (kg), DAW is the tractor-uncoupled rear axle weight (kg), WB is a wheelbase (mm), and CO is coupler offset (mm).

(40) Next, the calculation part **33** calculates a total value of the calculated fifth wheel load and the measured trailer load acquired by the acquisition part **31**. The calculation part **33** calculates the carried load by subtracting the trailer weight identified by the identification part **32** from the calculated total value. When expressed by a mathematical equation, the calculation part **33** calculates the carried load CL (kg) of the trailer with the following equation.

$$CL=ALS+FWL-TVW \quad (2)$$

In Equation 2, ALS is the measured trailer load (kg), and TVW is the trailer weight (kg).

(41) The calculation part **33** can accurately calculate the fifth wheel load from the measured tractor load measured by the tractor-uncoupled rear axle weight sensor **13**, using the fact that the wheelbase and the coupler offset do not change. Since the calculation part **33** calculates the carried load using the calculated fifth wheel load and the measured trailer load measured by the trailer weight sensor **21**, it is possible to prevent the occurrence of an error in the calculated carried load even when positions of the loaded goods in the trailer **2** change. Therefore, the calculation part **33** can improve accuracy of calculating the carried load.

(42) The calculation part **33** may calculate a front axle load which is a load applied to the front wheels of the tractor **1**. For example, the calculation part **33** calculates the front axle load with the following equation.

FAL=FAW+FWL*(CO/WB) (3)

In Equation 3, FAL is the front axle load (kg), and FAW is the front axle weight (kg). The calculation part **33** notifies the output part **34** of the calculated carried load and front axle load.

[Outputting of Information Indicating the Carried Load]

(43) The output part **34** communicates with the vehicle **100** or the information terminal **300** via the communication part **201**. The output part **34** outputs information indicating the carried load calculated by the calculation part **33**. For example, the output part **34** outputs the information indicating the carried load calculated by the calculation part **33** to a display of the information terminal **300**. The output part **34** reads, from the storage **202**, the driver information in which the tractor ID and the user ID of the information terminal **300** of the driver of the tractor **1** are associated with each other. The output part **34** references the read driver information and outputs the information indicating the carried load to the information terminal **300** of the user ID stored in association with the tractor ID acquired by the acquisition part **31**.

(44) The output part **34** associates a location of a vehicle with information indicating the carried load of the vehicle calculated by the calculation part **33**, and displays them over a map displayed on the information terminal **300**. Before outputting the carried load, the output part **34** causes the storage **202** to store load history information in which (i) the plurality of tractor IDs acquired by the acquisition part **31** from the information terminal **300**, (ii) the location information stored in association with each of the plurality of tractor IDs in the vehicle information, (iii) the plurality of acquisition dates and times, and (iv) the calculated plurality of carried loads, in association with each other. When the acquisition part **31** acquires the user's instruction requesting the output of the carried load and the tractor ID from the information terminal **300**, the output part **34** displays, for a vehicle **100** of the acquired tractor ID, a plurality of locations of the vehicle **100** corresponding to different times and the carried loads of the vehicle **100** corresponding to the respective locations of the vehicle **100** over the map by referencing the load history information stored in the storage **202**.

(45) FIG. **6** shows an example of outputting information indicating carried load by the output part **34**. An image shown in FIG. **6** is displayed on the display of the information terminal **300**. As shown in FIG. **6**, the output part **34** displays a travel route of the vehicle **100** over a map. The output part **34** displays (i) acquisition dates and times of the location information and (ii) carried loads of the vehicle **100** corresponding to a plurality of locations on the travel route, respectively. In the case of FIG. **6**, the output part **34** outputs information indicating that the vehicle **100** including the tractor **1** having the tractor ID “T101” arrived at Terminal A at 11:00 a.m. on Feb. 9, 2022, and that the carried load of the trailer **2** was 2000 kilograms at that timing.

(46) The output part **34** may output the front axle load calculated by the calculation part **33**, in addition to the carried load. The output part **34** may output (i) the location of the vehicle **100** and (ii) information indicating the carried load and front axle load of the vehicle **100** calculated by the calculation part **33** in association with each other on the map.

(47) [Variation Example of Outputting the Carried Load and the Like to the Display of the Vehicle **100**]

(48) The output part **34** is not limited to the example in which the information indicating the carried load is output to the information terminal **300**. For example, the output part **34** may output the information indicating the carried load to a display (not shown) such as a display audio mounted on the vehicle **100**. Similarly, the output part **34** may output (i) the location of the vehicle and (ii) the information indicating the carried load of the vehicle calculated by the calculation part **33** in association with each other on a map displayed on the display of the vehicle **100**. In this case, upon accepting an operation for displaying the carried load by the driver of the vehicle, the first controller **12** of the vehicle acquires the information indicating the carried load by transmitting the tractor ID and the trailer ID as well as transmitting a request for calculating the carried load to the information output apparatus **200**.

(49) [Processing Procedure by the Information Output Apparatus **200**]

(50) FIG. **7** is a flowchart showing a processing procedure by the information output apparatus **200**. This processing procedure starts when the acquisition part **31** acquires a user's instruction requesting the display of the carried load from the information terminal **300** of the user (S**100**), for example.
(51) The acquisition part **31** acquires a trailer ID, a measured tractor load, and a measured trailer load from a vehicle **100** corresponding to a tractor ID acquired together with the user's instruction (S**101**). By referencing the tractor specification information stored in the storage **202**, the identification part **32** identifies a tractor-uncoupled rear axle weight, a coupler offset, and a wheelbase stored in the storage **202** in association with the tractor ID acquired, from the information terminal **300**, by the acquisition part **31** together with the instruction to display the carried load. By referencing the trailer specification information stored in the storage **202**, the identification part **32** identifies a trailer weight stored in the storage **202** in association with the trailer ID acquired from the vehicle **100** by the acquisition part **31** together with the tractor ID.
(52) The calculation part **33** calculates the fifth wheel load on the basis of the tractor-uncoupled rear axle weight identified by the identification part **32** and the measured tractor load acquired by the acquisition part **31** (S**102**). The calculation part **33** calculates the total value of the calculated fifth wheel load and the measured trailer load acquired by the acquisition part **31**. The calculation part **33** calculates the carried load by subtracting the trailer weight identified by the identification part **32** from the calculated total value (S**103**). The output part **34** outputs information indicating the carried load calculated by the calculation part **33** to the information terminal **300** (S**104**).
(53) Next, the control part **203** determines whether a predetermined time period, which is a waiting time period until the next calculation of the carried load, has passed (S**105**). When it is determined that the predetermined time period has passed (YES in S**105**), the control part **203** determines whether the acquisition part **31** has acquired a user's instruction requesting to finish the output of the carried load from the information terminal **300** (S**106**). When it is determined that the acquisition part **31** has acquired the user's instruction requesting to finish the output of the carried load (YES in S**106**) from the information terminal **300**, the control part **203** finishes the processing. When it is determined that the acquisition part **31** has not acquired the user's instruction requesting to finish the output of the carried load from the information terminal **300** in the determination of S**106** (NO in S**106**), the control part **203** returns to the processing of S**101** and repeats the processing from S**101** to S**105**.
(54) [Effect of the Information Output Apparatus of the Present Embodiment]
(55) In the information output apparatus **200** of the present embodiment, the identification part **32** identifies the specification information corresponding to the tractor ID and the specification information corresponding the trailer ID, and the calculation part **33** calculates the carried load of the trailer **2** on the basis of the identified specification information. Therefore, even when the trailer **2** towed by the tractor **1** is changed to another trailer **2**, the calculation part **33** can calculate the weight of loaded goods by using the specification information of the tractor **1** and the specification information of the changed trailer **2**.
(56) The present disclosure has been described above on the basis of the exemplary embodiments. The technical scope of the present disclosure is not limited to the scope explained in the above embodiments, and it is obvious to those skilled in the art that various changes and modifications within the scope of the invention may be made. An aspect to which such changes and modifications are added can be included in the technical scope of the present disclosure is obvious from the description of the claims.

Claims

1. An information output apparatus that outputs information indicating a carried load of loaded goods mounted on a vehicle trailer in a vehicle configured with a vehicle tractor and the vehicle

trailer, the information output apparatus comprising: a memory that stores: tractor specification information of a plurality of tractors including: vehicle identification information of each of the tractors, tractor-uncoupled rear axle weight of each of the tractors, coupler offset of each of the tractors, and wheelbase of each of the tractors, and trailer specification information of a plurality of trailers including: vehicle identification information of each of the trailers, and weight of each of the trailers; and a processor executing programs stored in the memory, wherein the processor: acquires vehicle identification information of a trailer, vehicle identification information of a tractor, a measured tractor load measured by a tractor rear axle weight sensor attached to the tractor, and a first measured load measured by a trailer weight sensor attached to the trailer; identifies the tractor-uncoupled rear axle weight, the coupler offset, and the wheelbase with the same vehicle identification information to the acquired vehicle identification information of the tractor; identifies the weight of the trailer with the same vehicle identification information to the acquired vehicle identification information of the trailer; calculates a calculated load on a basis of the identified tractor-uncoupled rear axle weight, the identified coupler offset, the identified wheelbase, and the measured tractor load, calculates the carried load by subtracting the identified weight of the trailer from a total value of the calculated load and the first measured load; and outputs information indicating the calculated carried load.

2. The information output apparatus according to claim 1, wherein the processor calculates the calculated load by which the tractor supports the trailer between the tractor and the trailer by dividing a product of a value obtained by subtracting the identified tractor-uncoupled rear axle weight from the measured tractor load measured by the tractor rear axle weight sensor and the identified wheelbase by a value obtained by subtracting the identified coupler offset from the wheelbase.

3. The information output apparatus according to claim 1, wherein the processor: acquires the measured tractor load, the first measured load, and location information indicating a location of the vehicle from the vehicle during traveling, and outputs the location of the vehicle and information indicating the carried load of the vehicle on a map.

4. The information output apparatus according to claim 1, wherein the processor: calculates a front axle load which is a load applied to front wheels of the tractor, on a basis of the calculated load, the wheelbase, and the coupler offset, and outputs a location of the vehicle, information indicating the carried load of the vehicle, and information indicating the front axle load on a map.

5. An information output computer-implemented method for outputting information indicating a carried load of loaded goods mounted on a vehicle trailer in a vehicle configured with a vehicle tractor and the vehicle trailer, the method comprising: acquiring vehicle identification information of a trailer, vehicle identification information of a tractor, a measured tractor load measured by a tractor rear axle weight sensor attached to the tractor, and a first measured load measured by a trailer weight sensor attached to the trailer; identifying, by referencing a memory storing: tractor specification information including: vehicle identification information of a plurality of tractors, tractor-uncoupled rear axle weight of each of the tractors, coupler offset of each of the tractors and wheelbase of each of the tractors, and trailer specification information including: vehicle identification information of a plurality of trailers, weight of each of the trailers, the tractor-uncoupled rear axle weight, the coupler offset, the wheelbase stored in the memory, in the tractor specification information, with the same vehicle identification information to the acquired vehicle identification information of the tractor; identifying, by referencing the memory, the weight of the trailer stored in the memory with the same vehicle identification information to the acquired vehicle identification of the trailer; calculating a calculated load on a basis of the identified tractor-uncoupled rear axle weight, the identified coupler offset, the identified wheelbase, and the measured tractor load; calculating the carried load by subtracting the identified weight of the trailer from a total value of the calculated load and the first measured load; and outputting information indicating the calculated carried load.