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(54) **SHIP MANAGING DEVICE, SHIP MANAGING SYSTEM, AND PROGRAM**

Publication Classification

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(57) **ABSTRACT**

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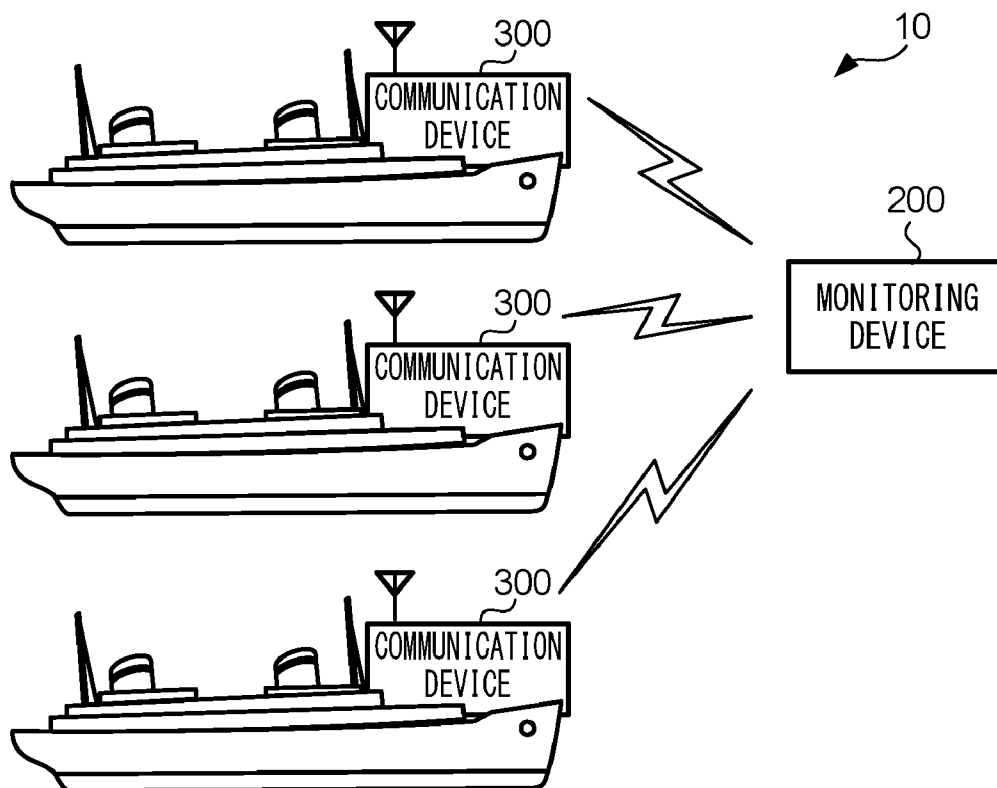
A ship managing device acquires input data indicating a predetermined voyage condition, and extracts condition data corresponding to the input data. The condition data is predetermined data describing a combination of a voyage condition and an amount of fuel consumption. The ship managing device, using the condition data, identifies the amount of fuel consumption under the voyage condition indicated by the input data, and determines whether there is scope for improvement in the amount of fuel consumption. Thereafter, the ship managing device generates and outputs monitoring data corresponding to the result of the determination.

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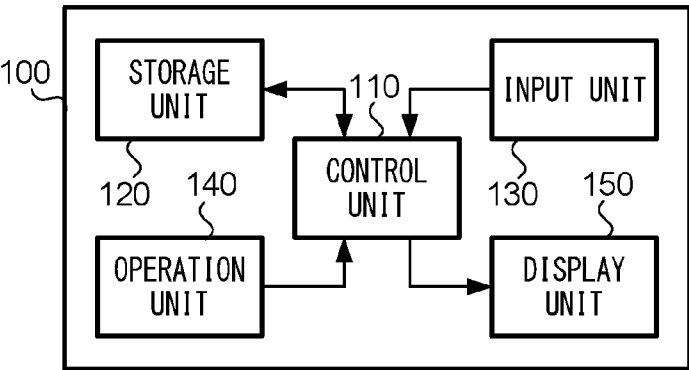


FIG. 1

TRIM	DRAFT	SHIP SPEED	AMOUNT OF FUEL CONSUMPTION
...	...	...	...
...	...	...	...
...	...	...	...
...	...	...	...

⋮

FIG. 2

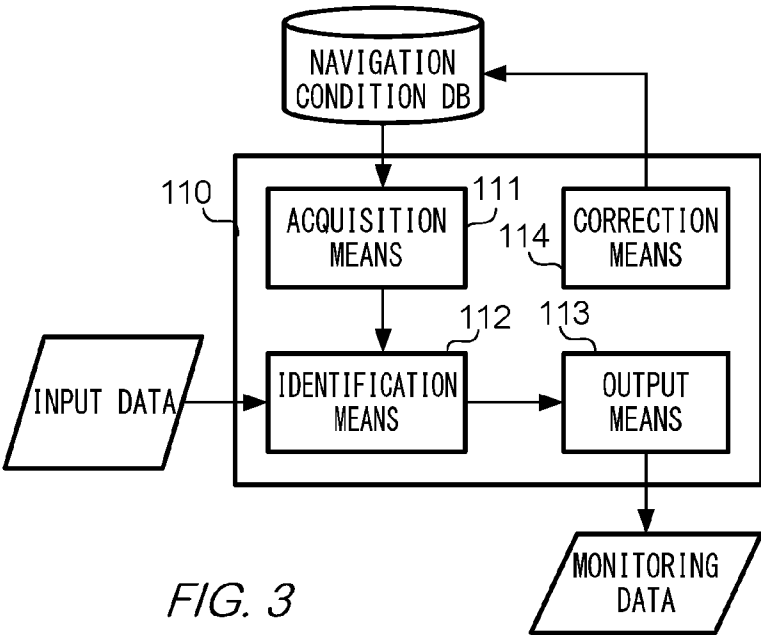


FIG. 3

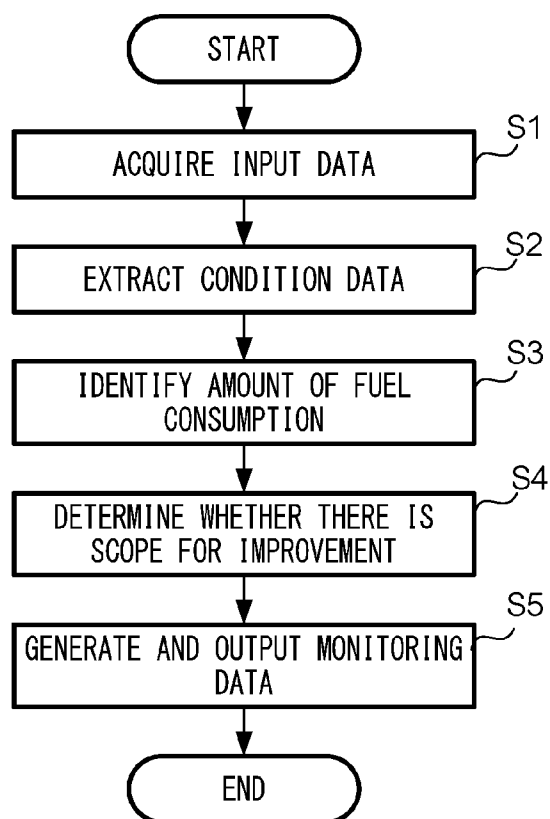


FIG. 4

		TRIM					
		+1m	+0.5m	0m	-0.5m	-1m	-1.5m
DRAFT	12m	101	100	98	100	101	102
	13m	102	101	100	101	102	103
	14m	105	104	103	102	103	104

FIG. 5

IN CASE WHERE TRIM IS +1m

DETERMINATION	TRIM (m)	OPTIMUM TRIM (m)	DRAFT (m)	SHIP SPEED (knot)	SCOPE FOR IMPROVEMENT	REMAINING DISTANCE (mile)	SCOPE TO REDUCE FUEL CONSUMPTION (ton)
C	 +1	0	13	20	2%	300	5

IN CASE WHERE TRIM IS 0m

DETERMINATION	TRIM (m)	OPTIMUM TRIM (m)	DRAFT (m)	SHIP SPEED (knot)	SCOPE FOR IMPROVEMENT	REMAINING DISTANCE (mile)	SCOPE TO REDUCE FUEL CONSUMPTION (ton)
A	 0	0	13	20	0%	300	0

FIG. 6

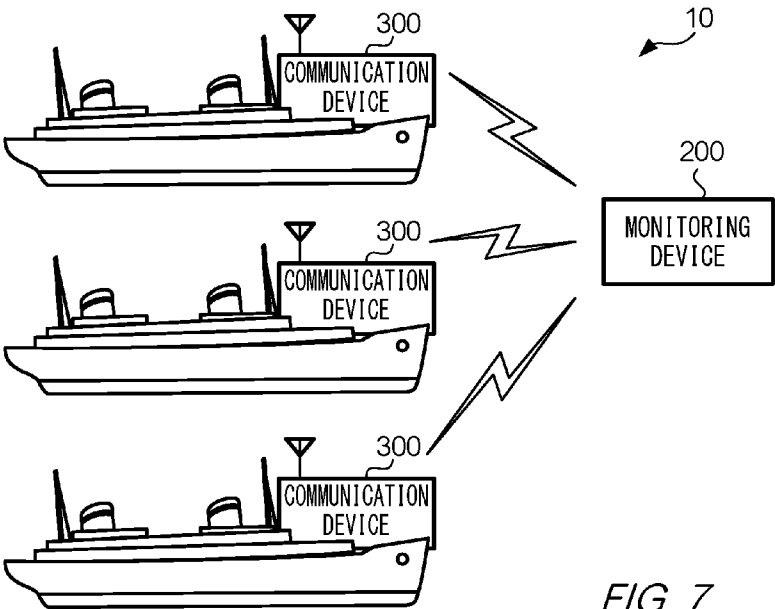


FIG. 7

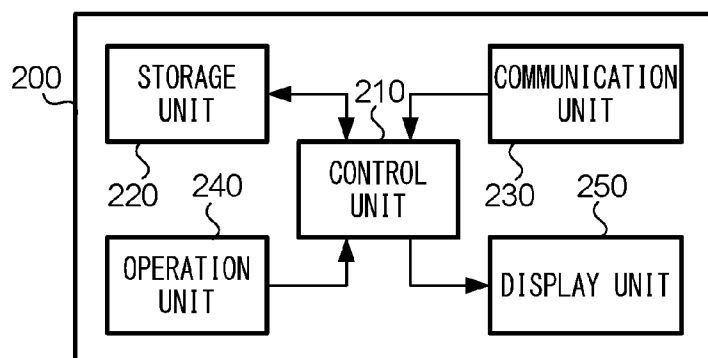


FIG. 8

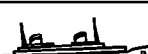
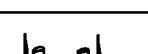
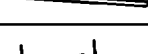
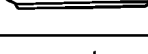
NAME OF SHIP	DETERMINATION	TRIM (m)	OPTIMUM TRIM (m)	DRAFT (m)	SHIP SPEED (knot)	SCOPE FOR IMPROVEMENT	REMAINING DISTANCE (mile)	SCOPE TO REDUCE FUEL CONSUMPTION (ton)
AAA	C	 +1	0	13	20	2%	300	5
BBB	B	 -0.5	-1	10	21	1%	2500	20
CCC	A	 -0.1	0	9	19	0.1%	1000	1
XXX	D	 +1.5	-0.5	9	17	5%	1000	40
YYY	B	 -0.3	-1	10	18	1%	4200	30
ZZZ	D	 0	+2	11	20	5%	4500	100

FIG. 9

TRIM	DRAFT	SHIP SPEED	WIND FORCE	WAVE HEIGHT	AMOUNT OF FUEL CONSUMPTION
...	...	...	...	...	...
...	...	...	...	...	...
...	...	...	...	...	...
...	...	...	...	...	...

⋮

FIG. 10

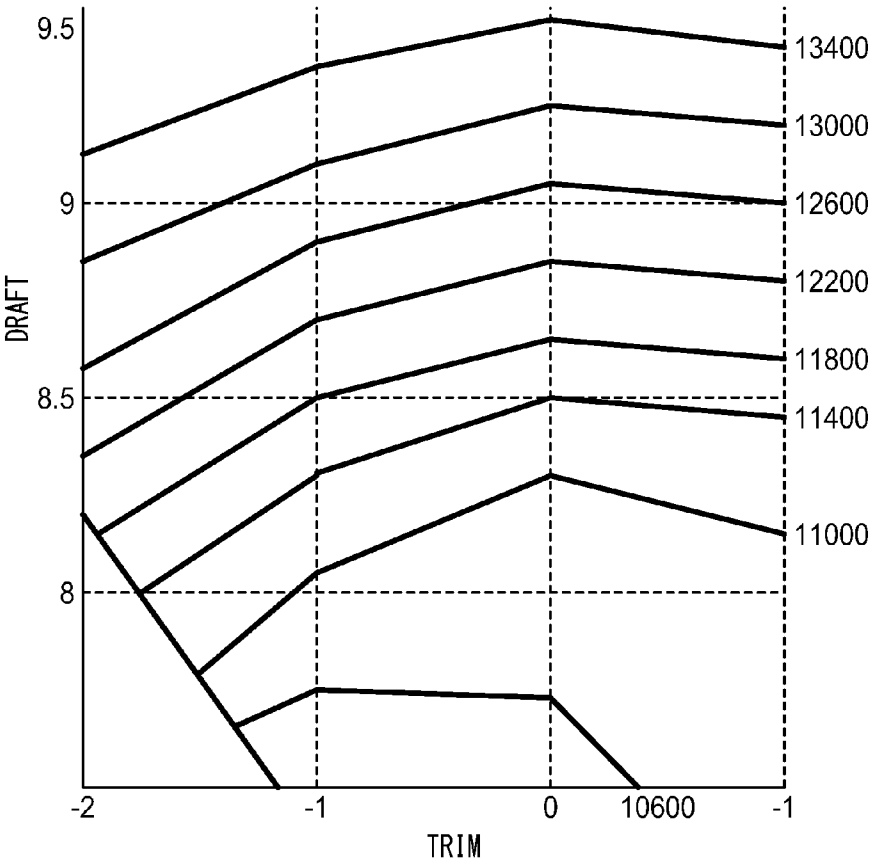


FIG. 11

SHIP MANAGING DEVICE, SHIP MANAGING SYSTEM, AND PROGRAM

TECHNICAL FIELD

[0001] The present invention relates to a technique for supporting an efficient voyage.

BACKGROUND ART

[0002] The attitude (draft, trim, etc.) of a ship affects fuel consumption of the ship. Therefore, it can be expected that appropriate adjustment of the attitude of the ship allows a reduction in of fuel consumption by the ship. JP2009-184378A discloses a voyage system that calculates, referring to a database created on the basis of data acquired in a tank test in which a displacement and a trim of a ship vary, an amount of water pouring into and discharging from a ballast tank such that a trim of a ship in actual operational conditions is optimized.

SUMMARY OF THE INVENTION

[0003] It is an object of the present invention to enable the identification of such a voyage condition that a ship can provide better voyage performance than that when the ship sails in accordance with a predetermined voyage condition.

[0004] In the present invention, there is provided a ship managing device including: an acquisition means that acquires first data indicative of both a first voyage condition indicating a voyage condition of a ship, and voyage performance of the ship corresponding to the first voyage condition, the voyage condition including at least a basic condition regarding a voyage of the ship and an inclination of the ship; an identification means that identifies, based on the first data, at least one voyage performance corresponding to a first voyage condition including a basic condition corresponding to a predetermined voyage condition; and an output means that outputs, as second data, a first voyage condition corresponding to better voyage performance of the at least one voyage performance identified by the identification means.

[0005] In the ship managing device according to the present invention, the basic condition may include at least one of a meteorological phenomenon, a hydrographic phenomenon, fouling of a hull, a draft, ship speed, an amount of fuel consumption, horsepower, and a number of engine rotations; and the voyage performance may include at least one value of ship speed, an amount of fuel consumption, horsepower, and fuel consumption, the at least one value not overlapping the basic condition.

[0006] In the ship managing device according to the present invention, the first data may be provided for each of a plurality of ships different from each other or for each of a type of ship; and the identification means may identify an amount of fuel consumption based on the first data corresponding to a ship or a type of a ship provided as the predetermined voyage condition.

[0007] In the ship managing device according to the present invention, a correction means that corrects the first data based on a measured value acquired during a voyage of the ship, may be included.

[0008] In the ship managing device according to the present invention, a display means that displays the second data as information represented by a character or a picture, may be included.

[0009] In addition, in the present invention, there is provided a ship managing system including; the ship managing device and a communication device that is installed in the ship, and that transmits third data indicative of the predetermined voyage condition to the ship managing device.

[0010] Furthermore, in the present invention, there is provided a program for causing a computer to function as: an acquisition means that acquires first data indicative of both a first voyage condition indicating a voyage condition of a ship, and voyage performance of the ship corresponding to the first voyage condition, the voyage condition including at least a basic condition regarding a voyage of the ship and an inclination of the ship; an identification means that identifies, based on the first data, at least one voyage performance corresponding to a first voyage condition including a basic condition accorded with a predetermined voyage condition; and an output means that outputs, as second data, a first voyage condition corresponding to high voyage performance of the at least one voyage performance identified by the identification means.

[0011] According to the present invention, it is possible to identify such a voyage condition that a ship can provide better voyage performance than that when the ship sails in accordance with a predetermined voyage condition.

BRIEF EXPLANATION OF THE DRAWINGS

[0012] [FIG. 1] A block diagram showing a hardware configuration of a monitoring device.

[0013] [FIG. 2] A diagram showing by example a data structure of condition data.

[0014] [FIG. 3] A block diagram showing a functional configuration of a control unit.

[0015] [FIG. 4] A flowchart showing processing executed by the control unit of the monitoring device.

[0016] [FIG. 5] A diagram showing an example of the condition data.

[0017] [FIG. 6] A diagram showing by example information displayed on a display unit.

[0018] [FIG. 7] A diagram showing an overall configuration of a ship managing system.

[0019] [FIG. 8] A block diagram showing a hardware configuration of a monitoring device.

[0020] [FIG. 9] A diagram showing by example information displayed on a display unit.

[0021] [FIG. 10] A diagram showing by example a data structure of condition data.

[0022] [FIG. 11] A diagram showing by example a data structure of condition data.

DETAILED DESCRIPTION

First Embodiment

[0023] FIG. 1 is a block diagram showing a hardware configuration of monitoring device **100** according to an embodiment of the present invention. Monitoring device **100** is a device that is installed in a ship, such as a cargo ship, to inform a user (navigator et al.) of a state of the ship during its voyage. Monitoring device **100** may be, for example, implemented by a general personal computer. Monitoring device **100** includes control unit **110**, storage unit **120**, input unit **130**, operation unit **140**, and display unit **150**.

[0024] Control unit **110** is a means for controlling the operation of various parts of monitoring device **100**. Control

unit **110** includes an arithmetic processing device, such as a CPU (Central Processing Unit), and a memory, to perform the display control of display unit **150** and the operation required for the display on display unit **150** by executing a predetermined program.

[0025] Storage unit **120** is a means for storing data. Storage unit **120** includes a recording medium, such as a hard disk or a flash memory, to store data used by control unit **110**. For example, storage unit **120** may store a program executed by control unit **110** and a voyage condition DB (database).

[0026] The voyage condition DB is a database in which a voyage condition that is a condition regarding the voyage of the ship, and an amount of fuel consumption when the ship sails in the voyage condition are recorded for each of voyage conditions. The voyage condition DB records data on the ship in which monitoring device **100** is installed. Therefore, the data recorded on the voyage condition DB is different for each ship or each type of ship. The data stored in the voyage condition DB is an example of “first data” of the present invention.

[0027] FIG. **2** is a diagram showing a data structure of the data recorded in the voyage condition DB. As shown in FIG. **2**, the voyage condition DB records data indicating a combination of three kinds of voyage condition “trim,” “draft,” and “ship speed,” and an “amount of fuel consumption” when the ship sails in the voyage condition. That is, the voyage condition in this embodiment is the trim, draft, and ship speed. The trim as used herein refers to a difference between forward draft and aft draft. The trim has a positive value when the forward draft is greater than the aft draft (trimmed by the bow), or has a negative value when the aft draft is greater than the forward draft (trimmed by the stern). The draft refers to a vertical distance from the bottom of the ship to the waterline. The draft as used herein is the average of the forward draft and the aft draft. The ship speed refers to speed of the ship. The ship speed as used herein is speed over ground (however, it may be speed through the water).

[0028] The voyage condition DB records amounts of fuel consumption corresponding to various voyage conditions. For example, the voyage condition DB describes amounts of fuel consumption corresponding to cases in which the trim varies in 0.5 m increments, the draft varies in 1 m increments, and the ship speed varies in 1 knot increments. It is to be noted that the data recorded in the voyage condition DB is predetermined on the basis of values actually measured in a tank test using a model ship or during a past voyage. In the following description, individual data constituting the voyage condition DB, namely data indicating the combination of the trim, the draft, the ship speed, and the amount of fuel consumption is referred to as “condition data.” The voyage condition included in the condition data is referred to as a “first voyage condition.”

[0029] Input unit **130** and operation unit **140** are means for accepting the input of data. Input unit **130** includes an interface for communicating with a measuring instrument installed in the ship, to acquire data indicating the voyage condition from the connected measuring instrument. Operation unit **140** includes an input device such as a keyboard and a mouse, to provide control unit **110** with data corresponding to the user’s operation.

[0030] Display unit **150** is a means for displaying information. Display unit **150** includes a display device such as a liquid crystal display, to display information (a character or a picture) based on image data provided from control unit **110**.

It is to be noted that display unit **150** may include a means for reproducing a sound (e.g., speaker), to output the information not only visually but also aurally.

[0031] FIG. **3** is a block diagram showing a functional configuration of control unit **110**. Control unit **110** can implement functions corresponding to acquisition means **111**, identification means **112**, output means **113**, and correction means **114** shown in FIG. **3** by executing a predetermined program. In other words, control unit **110** can serve as the ship managing device according to the present invention by executing the program.

[0032] Acquisition means **111** is a means for acquiring the condition data. Acquisition means **111** acquires the condition data from the voyage condition DB stored in storage unit **120**. It is to be noted that acquisition means **111** does not have to acquire all condition data included in the voyage condition DB together, but may acquire only required condition data.

[0033] Identification means **112** is a means for identifying voyage performance when the ship sails according to a predetermined voyage condition. In this embodiment, identification means **112** sequentially acquires data indicating the voyage condition of the ship while the ship is underway, and identifies an amount of fuel consumption at that time based on the acquired data and the condition data acquired by acquisition means **111**. The amount of fuel consumption as used herein is an example of an index indicating the voyage performance. Identification means **112** identifies the amount of fuel consumption at a predetermined time interval (e.g., every one minute).

[0034] Identification means **112** acquires the data indicating the voyage condition of the ship while the ship is underway through input unit **130** or operation unit **140**. In the following description, the data acquired at this time is referred to as “input data.” The input data is a measured value of the voyage condition. The input data may be input directly from the measuring instrument installed in the ship, or may be input by the user using an input device after the user visually checks the measuring instrument or the like.

[0035] Output means **113** is a means for outputting monitoring data. The monitoring data as used herein refers to data representing, with a character or a picture, information regarding the voyage condition of the ship while the ship is underway and the amount of fuel consumption of the ship. In this embodiment, output means **113** outputs the monitoring data as image data to provide display unit **150** with the image data. The monitoring data is an example of “second data” of the present invention.

[0036] Correction means **114** is a means for correcting the condition data included in the voyage condition DB. Correction means **114** corrects the condition data based on the measured value. Correction means **114** corrects the condition data as necessary when a relationship between the voyage condition and the amount of fuel consumption that are indicated by the condition data differs from the actual relationship. It is to be noted that values of the corrected condition data may be calculated by control unit **110**, or may be input by the user using the input device.

[0037] The configuration of monitoring device **100** is as described above. Under this configuration, monitoring device **100** sequentially acquires the input data indicating the voyage condition of the trim, draft, and ship speed during the voyage of the ship, and provides the user with a variety of information by comparing the input data with the condition data. In this embodiment, monitoring device **100** can provide the user

with information contributing to saving (namely, reducing) the amount of fuel consumption by identifying such a trim that the amount of fuel consumption is minimized when the ship sails at the ship speed and in the draft that are provided by the input data. That is, in this embodiment, monitoring device **100** fixes the ship speed and the draft, and identifies such a trim that the amount of fuel consumption is minimized under the condition in which the ship speed and the draft are held constant. In the following description, the fixed voyage condition, such as the ship speed and draft in this case, of the first voyage condition refers to a “basic condition.” The voyage condition that is the subject of the identification (namely, a variable voyage condition of the first voyage condition), such as the trim in this case, refers to a “variable condition.”

[0038] FIG. 4 is a flowchart showing processing executed by control unit **110** of monitoring device **100**. Control unit **110** executes the processing shown in FIG. 4 upon acquisition of the input data (step S1). That is, control unit **110** executes the processing shown in FIG. 4 each time the input data is acquired, and sequentially updates the display on display unit **150**.

[0039] Upon acquiring the input data, control unit **110** extracts required condition data (step S2). In step S2, control unit **110**, referring to the ship speed indicated by the input data acquired in step S1, retrieves the condition data including the ship speed corresponding to that in the input data from storage unit **120**.

[0040] FIG. 5 is a diagram showing an example of the condition data extracted in step S2. In FIG. 5, a relationship between the draft and trim when the ship speed is 20 knots, and the amount of fuel consumption per unit distance (e.g., 1 mile), is shown. It is to be noted that for convenience of explanation, in this example the amount of fuel consumption corresponding to the case where the draft is 13 m and the trim is 0 m, is normalized to value “100.” Each amount of fuel consumption is shown as a value that is obtained by the comparison with the normalized value “100.” However, in the actual condition data, an actual weight (or volume) of fuel may be described as the amount of fuel consumption, or alternatively horsepower requirements of the ship (e.g., horsepower requirements or engine output of the main engine of the ship) may be described as a value indicating the amount of fuel consumption (namely, a value convertible to the amount of fuel consumption). Storage unit **120** may set in a table a data group including the same ship speed as shown in FIG. 5, and may store the table for each ship speed instead of the condition data having the structure shown in FIG. 2.

[0041] Control unit **110** then identifies an amount of fuel consumption in a voyage condition at that time using the data acquired in steps S1 and S2 (step S3). Control unit **110** identifies the condition data indicating the voyage condition corresponding to the voyage condition indicated by the input data, thereby being able to identify the amount of fuel consumption corresponding to this voyage condition. It is to be noted that since the identification performed on the basis of the condition data is only an estimate; the identified amount of fuel consumption does not have to accord with an actual amount of fuel consumption.

[0042] Upon identifying the amount of fuel consumption, control unit **110** determines whether there is scope for improvement in the amount of fuel consumption (step S4). Specifically, control unit **110**, using the condition data, identifies the minimum amount of fuel consumption corresponding to the same basic condition (in this embodiment, the ship

speed and draft; namely, the values other than the trim), and calculates a difference between the minimum amount and the amount of fuel consumption identified in step S3. Control unit **110** determines whether there is scope for improvement in the amount of fuel consumption based on the difference calculated in this manner. However, a specific determination method used by control unit **110** is not limited to the foregoing. For example, it may be determined through the use of the difference of the horsepower requirements, or may be determined by taking into consideration the remaining distance.

[0043] Thereafter, control unit **110** generates and outputs monitoring data based on the processing of steps S3 and S4, and provides display unit **150** with the monitoring data (step S5). That is, control unit **110** displays the result of monitoring on display unit **150**. It is to be noted that control unit **110** may generate data used for reproducing a warning sound or a synthesized voice at this time. For example, control unit **110** may reproduce synthesized voice “now, a trim is good” based on the result of determination of step S4.

[0044] FIG. 6 is a diagram showing an example of information displayed on display unit **150**. In FIG. 6, on the assumption that the condition data shown in FIG. 5 is used, information displayed when an actual trim of the ship is “+1 m” and information displayed when the actual trim is “0 m” are shown as an example. It is to be noted that in either case it is assumed that the draft is 13 m and the ship speed is 20 knots. In this example (and an example of the second embodiment described later), as a result of the determination, symbol “A” is used when the scope for improvement of the amount of fuel consumption is smaller than 1%, symbol “B” is used when the scope is greater than or equal to 1% and is smaller than 2%, symbol “C” is used when the scope is greater than or equal to 2% and is smaller than 5%, and symbol “D” is used when the scope is greater than or equal to 5%.

[0045] In this example, the amount of fuel consumption is minimized when the trim has value “0 m” as shown in FIG. 5. In this example, when an actual trim of the ship is “+1 m,” there is scope for 2% improvement in the amount of fuel consumption. This is because, when the amount of fuel consumption in the case where the trim is “0 m” is “100,” the amount of fuel consumption in the case where the trim is “+1 m” is “102,” namely the amount of fuel consumption increases by 2%. Therefore, when the actual trim of the ship is “+1 m,” the result of the determination made by control unit **110** is “C.” It is to be noted that in the column for the trim, a picture representing the hull of the ship is shown. The picture, in which the bow is represented on the right side and the stern is represented on the left side, visually shows a state of a trim of the ship.

[0046] In this example, it is assumed that the amount of fuel consumption scheduled for the remaining distance (300 miles) is 250 tons. Then, in the case where the trim is “+1 m,” if the ship sails the remaining distance in the same voyage condition, an extra 5 tons (250 tons $\times$ 2%) of fuel is consumed as compared to the case where the trim is optimized (namely, 0 m). Therefore, when the trim is “+1 m,” there is scope to save five tons of fuel. Control unit **110** can execute such a calculation using the input data and the condition data, and can inform the user that there is scope for improvement, which is implemented by the adjustment of the trim, of the amount of fuel consumption or scope to save fuel. It is to be noted that the optimum trim as used herein refers to such a trim that the amount of fuel consumption is minimized.

[0047] Furthermore, control unit **110** may differentiate a display appearance of the information according to the result of determination. For example, control unit **110** may differentiate a display color of a character or other information when the result of determination is “A” from that when the result of determination is not “A,” or may generate and output such image data that a character or other information is displayed in a blinking manner when the result of determination is not relatively good (namely, when there is relatively much scope for improvement in the amount of fuel consumption).

[0048] Although it is not shown in FIG. 5, control unit **110** may correct the condition data as necessary. For example, control unit **110** may correct the condition data at a time when the user performs an operation to execute the correction, or at a predetermined timing. Control unit **110** determines an error of the amount of fuel consumption using the measured value of the voyage condition (namely, input data) and the measured value of the amount of fuel consumption, and corrects the condition data such that the error is reduced when there is such condition data that the error exceeds a predetermined range.

[0049] As described above, according to monitoring device **100**, the optimal variable condition (trim) corresponding to the basic condition (ship speed and draft) at that time is notified, whereby the user can be informed that there is a possibility of navigating the ship with a smaller amount of fuel consumption than that when the ship sails according to a current voyage condition. Referring to the output of monitoring device **100** allows the user to navigate the ship in the optimal trim. However, the ship cannot always sail in the optimum trim due to various factors such as a meteorological phenomenon, a hydrographic phenomenon, and a structural strength of the ship. Therefore, the user, in fact, operates the ship in a voyage condition appropriate to a state at that time while referring to the output of monitoring device **100**.

Second Embodiment

[0050] FIG. 7 is a diagram showing an overall configuration of ship managing system **10** according to another embodiment of the present invention. Ship managing system **10** includes a plurality of communication devices **300** installed in a plurality of ships at sea, and monitoring device **200** that communicates with the plurality of communication devices **300** by wireless communication. In this embodiment, monitoring device **200** is used onshore instead of being used on board the ship. That is, the user of monitoring device **200** is a person who generally monitors the operations of the plurality of ships. In this respect, the user is different from the user in the first embodiment.

[0051] It is to be noted that in this embodiment, components and data described using the same names as that of the above first embodiment are identical or similar to those described in the first embodiment. In this embodiment, for the components or the data with the same names as those of the first embodiment, the duplicate description is omitted as appropriate. A difference from the first embodiment will be mainly described.

[0052] Communication devices **300** are devices for transmitting input data acquired in the ships in which communication devices **300** are installed. Communication devices **300** transmit the input data to monitoring device **200** by wireless communication via a communication satellite; namely, using satellite communications. Each communication device **300** may be connected to a measuring instrument installed in the

ship to receive the input data from the measuring instrument, or may receive the input data that is manually input by the user on board of the ship (a different person from the user of monitoring device **200**). It is to be noted that communication unit **300** not only transmits the input data, but also receives data from monitoring device **200** as necessary. The input data in this embodiment is an example of “third data” of the present invention.

[0053] FIG. 8 is a block diagram showing a hardware configuration of monitoring device **200**. Monitoring device **200** has the same configuration as monitoring device **200** of the first embodiment, with the exception of including communication unit **230** instead of input unit **130**. Communication unit **230** is a means for transmitting and receiving data to and from communication device **300**.

[0054] It is to be noted that storage unit **220** in this embodiment stores the condition data for the plurality of ships in the voyage condition DB. In this respect, storage unit **220** differs from storage unit **120** of the first embodiment. However, if there are ships having the substantially identical relationship between the voyage condition and the amount of fuel consumption, the condition data may be shared between the ships. For example, ships of the same type may correspond to these ships.

[0055] The configuration of ship managing system **10** is as described above. Under this configuration, in ship managing system **10** input data from the plurality of ships is collected in monitoring device **200**. Monitoring device **200** individually performs a determination similar to that of monitoring device **100** of the first embodiment for each of the plurality of ships based on the condition data corresponding to each of the plurality of ships, and displays information according to the result of the determination.

[0056] FIG. 9 is a diagram showing information displayed on display unit **250**. As shown in FIG. 9, monitoring device **200** displays the result of determination, voyage condition, etc. for the plurality of ships. The user can input an instruction to adjust the trim or other instructions as necessary, by the communications with communication device **300**.

Modification

[0057] The present invention is not limited to the embodiments described above, but may be carried out in other modes such as the following modifications. The following modifications may be combined and be carried out as necessary.

Modification 1

[0058] In the present invention, the voyage condition refers to various conditions that may affect the voyage performance during voyage of the ship. The voyage performance as used herein refers to performance that the ship can provide in a given voyage condition. The voyage performance may be identified by ship speed, horsepower (engine output), fuel consumption, etc., in addition to the amount of fuel consumption. In this case, the condition data (first data) is not limited to data associating the voyage condition with the amount of fuel consumption, but may be data associating the voyage condition with the ship speed, the horsepower, the fuel consumption, etc. For example, the horsepower required to navigate at a certain ship speed may vary depending on the variable condition such as the trim. In this case, the ship speed corresponds to a basic condition, and the horsepower corresponds to the voyage performance. Similarly, a number of

rotations of a propeller may be used as the basic condition, and the ship speed or the horsepower may be used as the voyage performance. It is to be noted that for the ship speed, better voyage performance refers to higher speed. For the horsepower, better voyage performance refers to low horsepower. For the fuel consumption, better voyage performance refers to low fuel consumption.

[0059] However, a value used as an index of the voyage performance is required not to overlap the basic condition indicated by the condition data. This is because the basic condition of the present invention refers to the fixed voyage condition; that is, it is assumed that the basic condition has a fixed value. For example, when the ship speed is used as the voyage performance, since the ship speed cannot be included in the basic condition, the ship speed has to be excluded from the basic condition.

[0060] The voyage condition is not limited to the trim, draft, and ship speed, and also does not have to include all of these values. For example, a meteorological phenomenon, a hydrographic phenomenon, hull fouling, etc. may correspond to an example of the voyage condition according to the present invention. The meteorological phenomenon as used herein refers to weather, wind force (or wind speed), wind direction, etc. The hydrographic phenomenon refers to ocean current, tidal current, wave height, etc. The hull fouling refers to, for example a deposit on the hull (e.g., marine organisms). The amount of fuel consumption is likely to increase as the hull fouling increases. The hull fouling can be used as the voyage condition by, for example, the user checking the extent of hull fouling visually, and quantifying the degree of the fouling at a predetermined stage.

[0061] FIG. 10 is a diagram showing another example of a data structure of the condition data. The condition data shown in FIG. 10 differs from the condition data shown in FIG. 2 in that the voyage condition includes “wind force” and “wave height.” The wind force as used herein is indicated by a predetermined index (e.g., the Beaufort scale of wind force). The use of this condition data allows an improvement in the accuracy of identifying the voyage performance as compared with the case where fewer voyage conditions are used (such as the case shown in FIG. 2).

[0062] FIG. 11 is a diagram showing another example of a data structure of the condition data. The condition data shown in FIG. 11 is an example where the horsepower requirement of the main engine is used as the voyage performance. FIG. 11 represents the horsepower with contour lines (namely, contour diagram). In this example, the voyage condition is the “ship speed,” “trim (horizontal axis),” and “draft (vertical axis).” The ship speed is used as the basic condition.

[0063] In the example of FIG. 11, there is no value of the horsepower in a region where both the trim and the draft have great values (specifically, the lower left of FIG. 11). This region shows that the ship is not able to sail under such voyage condition. For example, this region represents a state that the ship is not able to sail in practice since the draft is shallow and the ship is trimmed by the bow, as a result of which the propeller is exposed. The exclusion of this kind of values of the voyage performance (values that are not able to be used in practice) in advance can prevent non-practical monitoring data from being output.

Modification 2

[0064] In the above embodiment, the trim is an example of an index indicating the inclination of the ship. In the present

invention, the inclination of the ship may be identified by a value other than the trim (namely, a difference between the forward draft and the aft draft). For example, it is possible to identify the inclination of the ship by installing in the ship a measuring instrument such as a so-called inclinometer, without directly reading the forward draft and the aft draft.

[0065] In the present invention, the voyage condition may include the inclination in the left and right direction of the ship (namely, the direction perpendicular to a sailing direction), instead of or in addition to the inclination in the fore-and-aft direction of the ship (namely, the sailing direction). Accordingly, the present invention may optimize not only the trim, but also the heel.

Modification 3

[0066] The present invention may be used for not only the monitoring of the voyage condition during voyage, but also an estimate before the voyage or an analysis after the voyage. In this case, the input data of the present invention (in other words, data indicating a predetermined voyage condition) does not have to be the measured value. For example, when a voyage plan of the ship is made, the present invention may be used for estimating an amount of fuel consumption for each of voyage conditions in which the ship may sail. In this case, the estimated value is used as the input data. When the voyage condition includes the meteorological phenomenon and the hydrographic phenomenon, a forecast value on the planned route may be used as the input data. The forecast value of the meteorological phenomenon or the hydrographic phenomenon may be provided from a public or private agency that provides the forecast value.

Modification 4

[0067] In the present invention, the data (second data, monitoring data) output from the output means may be used for not only the display, but also other purposes such as the control of the ship. For example, when there is such a value of the trim that the ship can sail with the amount of fuel consumption smaller than the amount of fuel consumption identified by the identification means, the present invention may control a ballast pump such that the trim has this value.

Modification 5

[0068] In the present invention, a method for notifying the voyage condition is not limited to the display as shown in FIG. 6 and FIG. 9. For example, monitoring device 100 displays the warning only when the result of determination is not relatively good (e.g., “C” or “D”), while monitoring device 100 may display no information particularly when the result of determination is relatively good (e.g., “A” or “B”). Alternatively, when such a warning is performed, only a warning sound may be emitted instead of displaying information on display unit 150. For the warning sound in this case, different sounds may be used between a case where the actual trim is greater than the optimal value and a case where the actual trim is smaller than the optimal value. That is, for the notification performed by monitoring device 100, any specific method may be employed as long as the user can recognize by the notification that there is such voyage condition that the amount of fuel consumption can be reduced compared with the actual voyage condition at that time.

Modification 6

[0069] The present invention may be used for the adjustment of the voyage condition other than the trim (namely, the inclination of the ship), for example, it may be used for the adjustment of the draft. For example, in the voyage condition shown in FIG. 5, if the draft is not limited to “13 m,” the amount of fuel consumption is minimized when the draft is “12 m” and the trim is “0 m.” It is to be noted that in the case of ships, although it is possible to reduce the amount of fuel consumption by reducing the ship speed, if the ship speed is reduced, a time required to reach a destination increases.

Modification 7

[0070] The present invention may be understood not only as the ship managing device or ship managing system including the ship managing device, but also as a ship managing method using the ship managing device, a program for causing a computer to function as the ship managing device of the present invention, etc. Furthermore, the program according to the present invention may be provided by being stored in a recording medium such as an optical disk, or may be provided by being downloaded to the computer via a network such as the Internet and by being installed into the computer so as to be made available. In addition, the ship managing device according to the present invention may be composed of a plurality of operation subjects such that the identification means and the output means are implemented by separate devices.

DESCRIPTION OF REFERENCE NUMERALS

[0071] 10 . . . Ship managing system, 100, 200 . . . Monitoring device, 110, 210 . . . Control unit, 111 . . . Acquisition means, 112 . . . Identification means 113 . . . Output means, 114 . . . Correction means, 120, 220 . . . Storage unit, 130 . . . Input unit, 140, 240 . . . Operation unit, 150, 250 . . . Display unit, 230 . . . Communication unit, 300 . . . Communication device.

What is claimed is:

1-7. (canceled)

8. A ship managing device comprising:

an acquisition means that acquires first data indicative of both a first voyage condition indicating a voyage condition of a ship, and voyage performance of the ship corresponding to the first voyage condition, the voyage condition including at least a basic condition regarding a voyage of the ship and an inclination of the ship;

an identification means that identifies, based on the first data, at least one voyage performance corresponding to a first voyage condition including a basic condition corresponding to a predetermined voyage condition; and

an output means that outputs, as second data, a first voyage condition corresponding to high voyage performance of the at least one voyage performance identified by the identification means.

9. The ship managing device according to claim 8, wherein:

the basic condition includes at least one of a meteorological phenomenon, a hydrographic phenomenon, hull fouling, a draft, ship speed, an amount of fuel consumption, horsepower, and a number of rotations; and

the voyage performance includes at least one value of ship speed, an amount of fuel consumption, horsepower, and fuel consumption, the at least one value not overlapping the basic condition.

10. The ship managing device according to claim 8, wherein:

the first data is provided for each of a plurality of ships different from each other or for each of a type of ship; and

the identification means identifies an amount of fuel consumption based on the first data corresponding to a ship or a type of a ship provided as the predetermined voyage condition.

11. The ship managing device according to claim 8, further comprising a correction means that corrects the first data based on a measured value acquired during the voyage of the ship.

12. The ship managing device according to claim 8, further comprising a display means that displays the second data as information represented by a character or a picture.

13. A ship managing system comprising;

a ship managing device according to claim 8; and

a communication device that is installed in the ship, and that transmits third data indicative of the predetermined voyage condition to the ship managing device.

14. A non-transitory tangible computer-readable medium storing program instructions for causing a computer device to execute the program instructions, wherein the program instructions cause the computer device to function as:

an acquisition means that acquires first data indicative of both a first voyage condition indicating a voyage condition of a ship, and voyage performance of the ship corresponding to the first voyage condition, the voyage condition including at least a basic condition regarding a voyage of the ship and an inclination of the ship;

an identification means that identifies, based on the first data, at least one voyage performance corresponding to a first voyage condition including a basic condition corresponding to a predetermined voyage condition; and

an output means that outputs, as second data, a first voyage condition corresponding to high voyage performance of the at least one voyage performance identified by the identification means.

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