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(54) **SHIP INFORMATION COLLECTION DEVICE, SHIP INFORMATION COLLECTION SYSTEM, AND SHIP INFORMATION COLLECTION METHOD**

(57) To provide a ship information collection device (1) which can easily collect navigation data of other ships while suppressing the amount of communication data. The ship information collection device (1) comprises an acquisition unit (11) for sequentially acquiring navigation data of other ships existing around a ship detected by a detection device mounted on the ship. Further, a decision unit for deciding whether or not to include navigation data of the other ships in a transmission data set sequentially transmitted to a data collection server (200). Thereafter, a generation unit for generating the transmission data set including the navigation data of other ships.

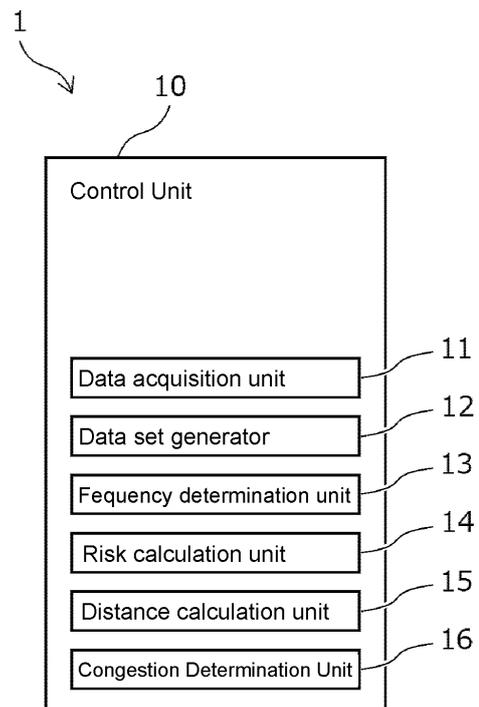


Fig.3

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Description

TECHNICAL FIELD

[0001] The present invention relates to a ship information collection device, a ship information collection system, and a ship information collection method.

BACKGROUND ART

[0002] Patent Document 1 describes that a navigation data and an engine data are automatically collected and stored on an onboard server from a ship's equipment via an onboard LAN system, navigation data and engine data are integrated and displayed on an onboard computer, navigation data and engine data stored on an onboard server are transferred and stored on a portal site server via a satellite communication system, the stored navigation data and the engine data are obtained on a management computer via an Internet line, and the navigation data and the engine data are integrated and displayed on the management computer.

[Reference Document(s) of Conventional Art]

[Patent Document]

[0003] Patent Document 1: Japanese Patent Application No. 2008-198136

DESCRIPTION OF THE DISCLOSURE

[0004] By the way, although it is useful to collect navigation data of ships such as an Automatic Identification System (AIS) data in order to investigate and analyze marine accidents, it is difficult to collect all navigation data due to problems such as the cost of using satellite communication lines and communication speed.

[0005] The present invention has been made in view of the above problems, and its main purpose is to provide a ship information collection device, a ship information collection system, and a ship information collection method which make it easy to collect navigation data of other ships while suppressing the amount of communication data.

[Summary of the Disclosure]

[0006] In order to solve the above mentioned problem, a ship information collection device, according to an aspect of the present invention, is provided with an acquisition unit configured to sequentially acquire navigation data of other ships existing around a ship detected by a detection device mounted on the ship; a decision unit configured to decide whether to include the navigation data of the other ships in a transmission data set sequentially transmitted to a data collection server; and a data set generation unit configured to generate the transmis-

sion data set including the navigation data of the other ships. Thus, the ship information collection device makes it easy to collect navigation data of the other ships while suppressing the amount of communication data.

[0007] In the above embodiment, the ship information collection device may further comprising a risk calculation unit configured to calculate a collision risk value representing the risk of collision between the ship and the other ships based on the navigation data of the ship and the navigation data of the other ships, and a frequency determination unit may decide whether to include the navigation data of the other ships in the transmission data set according to the collision risk value. Thus, the navigation data of the other ships having a relatively high risk of collision may be included in the transmission data set.

[0008] In the above embodiment, the frequency determination unit may determine the frequency of including the navigation data of the other ships in the transmission data set according to the collision risk value. Accordingly, the frequency of including the navigation data of the other ships having a relatively high risk of collision in the transmission data set may be increased.

[0009] In the above embodiment, the ship information collection device may further comprising a distance calculation unit configured to calculate the distance between the ship and the other ships based on the navigation data of the ship and the navigation data of the other ships, and the frequency determination unit may determine whether the navigation data of the other ships included in the transmission data set according to the distance between the ships. As a result, it is possible to include the navigation data of the other ships with relatively short distances between ships in the transmission data set.

[0010] In the above embodiment, the frequency determination unit may determine the frequency of including the navigation data of the other ships in the transmission data set according to the distances between the ships. Thus, the frequency of including navigation data of other ships with relatively short distance between ships in the transmission data set may be increased.

[0011] In the above embodiment, the navigation data of the other ships may be an automatic identification system (AIS) data. In addition, the generation unit may include a predetermined type of data among the AIS data in the transmission data set and may not include the non-predetermined type of data in the transmission data set. Thus, it is possible to suppress the amount of communication data while including the desired type of data in the transmission data set.

[0012] In the above embodiment, the generation unit may include the non-predetermined type of data if the non-predetermined type of data are changed. This allows the non-predetermined type of data to be included in the transmitted data set in the event of a change.

[0013] In the above embodiment, the frequency determination unit may determine the frequency of including the navigation data of the other ship in the transmitted

data set according to the speed of the ship. Thus, for example, when the speed of the ship is high, the frequency of including the navigation data of the other ship in the transmitted data set may be increased.

[0014] In the above embodiment, the frequency determination unit may determine the frequency of including the navigation data of the other ship in the transmission data set according to the ship type of the ship. Thus, for example, it is possible to increase the frequency of including the navigation data of the other ship in the transmitted data set for a relatively large ship.

[0015] In the above embodiment, the ship information collection device may further comprising a congestion determination unit configured to determine the congestion degree in the sea area navigated by the ship, and the frequency determination unit may determine the frequency of including the navigation data of the other ship in the transmitted data set according to the congestion degree. Thus, for example, it is possible to increase the frequency of including the navigation data of the other ship in the transmitted data set when the degree of congestion is relatively high.

[0016] In the above embodiment, the frequency determination unit may determine the frequency of including the navigation data of the other ship in the transmission data set according to the sea area in which the vessel navigates. Thus, for example, when a vessel navigates a predetermined sea area, the frequency of including the navigation data of the other vessel in the transmission data set may be increased.

[0017] In the above embodiment, the frequency determination unit may determine the frequency of including the navigation data of the other ship in the transmission data set more frequently when the ship is navigating in coastal area than when the vessel is navigating in offshore area. Thus, the frequency of including the navigation data of the other vessel in the transmission data set may be increased when the vessel navigates a coastal sea area.

[0018] The ship information collection system, according to another aspect of the present invention, is provided with a detecting device attached onto the ship, and is configured to sequentially detect the navigation data of the other ship in vicinity of the ship, a frequency determination unit configured to decide whether to include the navigation data of the other ship in the transmission data set, a data set generation unit configured to generate the transmission data set including the navigation data of the other ship, a communication device configured to sequentially transmit the transmission data set, and a data collection server configured to collect the transmitted transmission data set. Thus, the ship information collection system makes it easy to collect the navigation data of the other vessel while suppressing the amount of communication data.

[0019] In another aspect of the present invention, the ship information collection method comprising sequentially detecting navigation data of other ships in the vicinity

of a ship by a detecting device attached onto the ship; deciding whether to include the navigation data of the other ships in a transmission data set; generating the transmission data set including the navigation data of the other ship; sequentially transmitting the transmission data set; and collecting the transmission data set transmitted. Thus, it is easy to collect the navigation data of the other ships while suppressing the amount of communication data.

BRIEF DESCRIPTION OF DRAWINGS

[0020]

FIG. 1 is a diagram showing an example of a configuration of a ship information collection system.

FIG. 2 is a diagram showing an example of a configuration of a shipboard system.

FIG. 3 is a diagram showing an example of a configuration of the Ship Information Collection device.

FIG. 4 is a diagram showing an example of the procedure of a Ship Information Collection method.

FIG. 5 is a diagram for explaining a closest point of approach (CPA).

FIG. 6 is a diagram for explaining an obstacle zone by target (OZT).

FIG. 7 is a diagram for explaining a distance between ships.

FIG. 8 is a diagram showing a modification of step S 15.

MODE FOR CARRYING OUT THE DISCLOSURE

[0021] Embodiments of the present invention will now be described with reference to the drawings.

[0022] FIG. 1 is a diagram showing a configuration example of a ship information collection system (300). The ship information collection system (300) includes a shipboard system (100) mounted on a ship (SH) and a data collection server (200) installed on land.

[0023] The shipboard system (100) and the data collection server (200) may communicate with each other by a satellite communication using a satellite (ST). Not limited to this, for example, a radio communication using a microwave, an ultra-short wave, a short wave, or a medium wave may be used.

[0024] FIG. 2 is a block diagram showing a configuration example of the shipboard system (100). In the following description, the ship (SH) equipped with the shipboard system (100) is referred to as "own ship" and other ships are referred to as "other ships". The shipboard system (100) includes a ship information collection device (1), a voyage data recorder (VDR) (20), a data logger (30), and a communication device (40). The VDR (20) and the data logger (30) may be omitted.

[0025] The shipboard system (100) further comprises a radar (3), an automatic identification system (AIS) (4), a camera (5), a global navigation satellite system (GNSS)

receiver (6), a gyrocompass (7), and an Electronic Chart Display and Information System (ECDIS) (8). The devices included in the shipboard system (100), are connected to a communication network, such as a local area network (LAN), for example, and are capable of network communication with each other.

[0026] The ship information collection device (1) is a computer including a central processing unit (CPU), a random access memory (RAM), a read-only memory (ROM), a nonvolatile memory, an input/output interface, and the like. The CPU of the ship information collection device (1) executes information processing according to a program loaded into the RAM from the ROM or the nonvolatile memory.

[0027] The program may be supplied via an information storage medium such as an optical disk or a memory card, or may be supplied via a communication network such as the Internet or the LAN.

[0028] The VDR (20) is connected to the radar (3), the AIS (4), the camera (5), the GNSS receiver (6), the gyrocompass (7), the ECDIS (8), etc., and acquires a navigation system data including navigation data of its own ship and navigation data of other ships from these devices and provides them to the ship information collection device (1).

[0029] The data logger (30) is connected to an engine (91), a generator (92), etc., and acquires engine system data including log data of these machines and provides them to the ship information collection device (1). The communication device (40) may be used for realizing satellite communication via the satellite (ST).

[0030] The data logger (30) is also connected to a boiler, a burner, a pump, a propeller, a shaft horsepower, a water maker, an oil cleaner, a compressor, a ballast water treatment apparatus, an air conditioner, a level gauge, a marine elevator, a deck crane, and the like.

[0031] The radar (3) emits radio waves around the vessel, receives the reflected waves, and generates echo data based on the received signals. The radar (3) also identifies a target from the echo data and generates target tracking (TT) data representing the position and speed of the target.

[0032] The AIS (4) receives the AIS data from another ship or land control existing around the ship. In addition to the AIS, the very high frequency data exchange system (VDES) may be used. The AIS data includes the identification code of other vessels, vessel name, position, course, speed, type, hull length, and destination.

[0033] The camera (5) is a digital camera that generates image data by imaging the outside from its own vessel. The camera (5) may include an image recognition part for estimating the position and type of an object mark of the ship or the like included in the captured image by an object detection model. The image recognition part may be implemented not only in the camera (5) but also in other devices such as the ship information collection device (1).

[0034] The GNSS receiver (6) detects the position of

own ship based on radio waves received from the GNSS. The gyrocompass (7) detects the heading of own ship. Not limited to the gyrocompass (7), a GPS compass may be used.

[0035] The ECDIS (8) acquires the position of the own ship from the GNSS receiver (6) and displays the position of the own ship on an electronic chart. The ECDIS (8) also displays the planned route of the own ship on the electronic chart. In addition to the ECDIS (8), a GNSS plotter may be used.

[0036] In this embodiment, the AIS (4) is an example of a detection device, and the AIS data is an example of navigation data of another ship. The AIS (4) sequentially detects the AIS data. In addition, the radar (3) may be used as an example of a detection device, the TT data may be used as an example of navigation data of another ship, or the camera (5) may be used as an example of a detection device, and the identification data identified from the image may be used as an example of navigation data of another ship.

[0037] FIG. 3 is a block diagram showing a configuration example of the ship information collection device (1). A control unit (10) of the ship information collection device (1) includes a data acquisition unit (11), a data set generation unit or a data set generator (12), a frequency determination unit (13), a risk calculation unit (14), a distance calculation unit (15), and a congestion determination unit (16). These functions are realized by the control unit (10) executing information processing according to a program.

[0038] The data acquisition unit (11) sequentially acquires the AIS data detected by the AIS (4) as navigation data of other ships. The data acquisition unit (11) may acquire the AIS data indirectly from the VDR (20) or directly from the AIS (4).

[0039] Specifically, the data acquisition unit (11) sequentially acquires navigation system data recorded in the VDR (20). The navigation system data includes navigation data of the own ship and navigation data of other ships. The navigation data of the own ship includes, for example, the position, bearing and speed of the own ship.

[0040] The data acquisition unit (11) sequentially acquires engine system data including log data of the engine (91) and the generator (92) and the like recorded in the data logger (30). In addition, the data acquisition unit (11) sequentially acquires equipment monitoring data for monitoring the operation status of each equipment.

[0041] The data set generation unit (12) generates a transmission data set including AIS data as navigation data of other ships. The generated transmission data set is sequentially transmitted by the communication device (40) (see FIG. 2).

[0042] Specifically, the data set generation unit (12) generates a transmission data set including navigation system data, engine system data, and equipment monitoring data acquired by the data acquisition unit (11). The transmission data set may or may not include AIS data.

[0043] FIG. 4 is a diagram showing an example of a process for generating a transmission data set among the ship information collection methods implemented in the ship information collection system (300). The control unit (10) of the ship information collection device (1) executes the information processing shown in the figure according to a program.

[0044] First, the control unit (10) acquires navigation system data from the VDR (20) (see FIG. 2) (S11, processing as the data acquisition unit (11)).

[0045] Next, the control unit (10) acquires engine system data from the data logger (30) (see FIG. 2) (S12, processing as the data acquisition unit (11)).

[0046] Next, the control unit (10) acquires equipment monitoring data of each device (S13, processing as the data acquisition unit (11)).

[0047] Next, the control unit (10) determines whether or not the AIS data is included in the transmission data set (S14). The frequency of including the AIS data in the transmission data set (frequency, e.g., once in a few seconds, minutes, or tens of minutes) is predetermined and stored by the control unit (10). The determination of the frequency may be described in detail later.

[0048] If this is the time to include the AIS data in the transmission dataset (S14: YES), the control unit (10) generates a transmission data set including the AIS data (Processing as S15, the data set generation unit (12)).

[0049] On the other hand, if this is not the time to include the AIS data in the transmission dataset (S14: NO), the control unit (10) generates a transmission data set that does not include the AIS data (Processing as S16, the data set generation unit (12)).

[0050] Next, the control unit (10) performs transmission processing of the generated transmission data set (S17). The transmission data set is transmitted to the outside from the communication device (40) (see FIG. 2) and finally collected to the data collection server (see FIG. 1) via satellite communication.

[0051] The control unit (10) repeats the processing of S11 to S17 described above every time a predetermined time elapses (S18).

[0052] Return to the description of FIG. 3. The frequency determination unit (13) determines whether or not to include the AIS data in the transmission data set. Specifically, the frequency determination unit (13) determines how often to include the AIS data in the transmission data set. In other words, the frequency determination unit (13) determines whether to include AIS data for each of the sequentially transmitted transmission data sets.

[0053] The frequency determination unit (13) may determine a time-based frequency, for example, once every few seconds, minutes, or tens, or it may determine a frequency-based frequency, for example, once every few times. The frequency determination unit (13) may determine that the AIS data should be included in all transmission data sets, or it may determine that it should not be included in all transmission data sets.

[0054] The frequency determination unit (13) deter-

mines the frequency with which the AIS data should be included in the transmission data sets by various techniques described below.

[0055] The risk calculation unit (14) calculates a collision risk value representing the risk of collision between the own ship and the other ship based on the navigation data of the own ship and the navigation data of the other ship. The frequency determination unit (13) determines the frequency of including the AIS data in the transmission data set according to the collision risk value calculated by the risk calculation unit (14).

[0056] The collision risk value is, for example, Time to Closest Point of Approach (TCPA)/Distance to Closest Point of Approach (DCPA). As shown in Fig. 5, the TCPA represents the time until another ship comes closest to its own ship, and the DCPA represents the distance when another ship comes closest to its own ship.

[0057] The frequency determination unit (13) increases the frequency of including AIS data in the transmission data set when, for example, at least one of the TCPA and the DCPA falls below a threshold. The frequency determination unit (13) may incrementally increase the frequency of including AIS data in the transmission data set with, for example, a decrease in at least one of the TCPA and the DCPA.

[0058] The frequency determination unit (13) determines for each AIS data the frequency of including AIS data in the transmission data set when there are multiple other vessels, i.e., multiple AIS data. For example, for other vessels whose collision risk value is higher than the threshold, the frequency of including AIS data in the transmission data set is higher than for other vessels whose collision risk value is lower than the threshold.

[0059] The collision risk value may be calculated based on, for example, an Obstacle Zone by Target (OZT). As shown in FIG. 6, in the method of displaying the OZT, the risk calculation unit (14) calculates a collision risk value representing the risk of collision between the own ship and the other ship at each judgment point on the forecast course of the other ship, assuming that the own ship changes its course to reach each judgment point.

[0060] Specifically, the risk calculation unit (14) calculates the probability that the own ship and the other ship exist at the judgment point simultaneously when it is assumed that the own ship reaches the judgment point by changing from the current position while maintaining the speed and that the other ship reaches the judgment point by maintaining the speed from the current position as a collision risk value of the collision, and displays the OZT at the judgment point where the collision risk value is equal to or greater than the threshold value.

[0061] The frequency determination unit (13) increases the frequency of including the AIS data in the transmission data set when the OZT exists on the bow line or the planned route of the OZT, for example. Without limitation, the frequency determination unit (13) may increase the frequency of including the AIS data in the transmission data set when the OZT exists within a pre-

determined distance from the OZT, for example.

[0062] The distance calculation unit (15) calculates the distance between the own ship and the other ship based on the navigation data of the own ship and the navigation data of the other ship. The frequency determination unit (13) determines the frequency of including the AIS data in the transmission data set according to the distance between the ships calculated by the distance calculation unit (15).

[0063] As shown in FIG. 7, the frequency determination unit (13) sets a plurality of thresholds a1 to a3 for the distance between ships and progressively changes the frequency with which AIS data is included in the transmission data set. For example, a nautical mile of 1 nm or less is set to a 15 second interval, a nautical mile of 1 nm or more is 10 set to a 1 minute interval, and a nautical mile of 10 nm or more is set to a 20 5 minute interval.

[0064] The frequency determination unit (13) determines, for each AIS data, the frequency of including the AIS data in the transmission data set when there are multiple other ships, that is, when there are multiple AIS data. For example, when the distance between ships is shorter than the threshold, the frequency of including the AIS data in the transmission data set is higher than when the distance between ships is longer than the threshold.

[0065] The congestion determination unit (16) determines the congestion degree of the sea area navigated by the ship. Specifically, the congestion determination unit (16) determines the congestion degree in the sea area that the ship navigates based on the occupancy rate of the slot map of the AIS (4) (see FIG. 2).

[0066] The frequency determination unit (13) determines the frequency of including AIS data in the transmission data set in accordance with the congestion degree calculated by the congestion determination unit (16). For example, if the congestion degree in the sea area in which the ship navigates is higher than the threshold, the AIS data will be included in the transmission data set more frequently than if the congestion degree is lower than the threshold.

[0067] As described above, by determining the frequency of including the AIS data in the transmission data set in accordance with the collision risk value, the distance between ships, or the congestion degree, it is possible to collect the AIS data of higher importance from the viewpoint of accident verification, while reducing the amount of communication data.

[0068] In addition, the frequency determination unit (13) may determine the frequency of including the AIS data in the transmission data set in accordance with the speed of the own ship. For example, the frequency determination unit (13) may include the AIS data in the transmission data set more frequently as the speed of the own ship is higher.

[0069] The frequency determination unit (13) may also determine the frequency of including the AIS data in the transmission data set depending on the ship type of the own ship or other ship. For example, the frequency de-

termination unit (13) may include the AIS data in the transmission data set more frequently the larger the ship type of the own ship.

[0070] Also, the frequency determination unit (13) may include the AIS data in the transmission data set more frequently as the other ship is a ship type with a smaller hull. This is because it is difficult to read the behavior of smaller ships because they have smaller turns.

[0071] The frequency determination unit (13) may also determine the frequency of including the AIS data in the transmission data set, depending on the sea area in which the ship navigates. The sea area in which the ship navigates is determined based on electronic chart data.

[0072] For example, frequency determination unit (13) allows the AIS data to be included in the transmission data set more frequently when the ship navigates coastal waters than when the ship navigates offshore waters. Since the number of accidents is generally higher in coastal waters than in offshore waters, it is preferable to increase the frequency in coastal waters from the viewpoint of accident verification.

[0073] On the contrary, the frequency determination unit (13) may include the AIS data in the transmission data set more frequently when the ship sails in offshore waters than when the ship sails in coastal waters. In coastal waters, AIS data received by base stations on land are often available, so it is preferable to reduce the frequency in order to reduce the amount of communication data.

[0074] Although various methods for determining the frequency of including AIS data in the transmission data set have been described above, these methods are not limited to single applications and may be applied in combination as appropriate.

[0075] FIG. 8 is a diagram showing a modification of step S15 of FIG. 4. The AIS data includes dynamic information (Msg 1-3 etc., Class B Msg 18 etc.) that constantly changes, such as the position of another ship, and static information (Msg 5 etc., Class B Msg 24 etc.) that almost never changes.

[0076] In this example, the control unit (10) of the Ship Information Collection device (1) monitors the static information of the AIS data, and if the static information of the AIS data does not change (S151: NO), only the dynamic information of the AIS data is included in the transmission data set, and the static information is not included in the transmission data set (S152).

[0077] On the other hand, the control unit (10) of the Ship Information Collection device (1) includes not only the dynamic information of the AIS data but also the static information of the AIS data in the transmission data set if the static information of the AIS data changes (S151: YES) (S153). Only some static information that has changed may be included in the sending data set, or all static information may be included in the sending data set.

[0078] In this way, by collecting only dynamic information of AIS data under normal circumstances and also

collecting static information when static information has changed, it is possible to collect necessary information of AIS data while reducing the amount of communication data.

[0079] Although the embodiments of the present invention have been described above, the present invention is not limited to the embodiments described above, and it is of course possible for a person skilled in the art to make various changes.

DESCRIPTION OF REFERENCE CHARACTERS

[0080]

- 1 Ship Information Collection device,
- 3 Radar,
- 4 AIS,
- 5 Camera,
- 6 GNSS Receiver,
- 7 Gyrocompass,
- 8 ECDIS,
- 10 Control Unit,
- 11 data acquisition unit,
- 12 data set generation unit,
- 13 frequency determination unit,
- 14 Risk Calculation Unit,
- 15 Distance Calculation Unit,
- 16 Congestion Determination Unit,
- 20 VDR,
- 30 Data Logger,
- 40 Communication Device,
- 100 shipboard system,
- 200 data collection server,
- 300 Ship Information Collection System,
- SH Ship,
- ST Satellite

Claims

1. A ship information collection device (1), comprising:
 - a data acquisition unit (11) configured to sequentially acquire navigation data of other ships existing around a ship detected by a detection device mounted on the ship;
 - a frequency determination unit (13) configured to decide whether to include the navigation data of the other ships in a transmission data set sequentially transmitted to a data collection server; and
 - a data set generation unit (12) configured to generate the transmission data set including the navigation data of the other ships.
2. The ship information collection device (1) of claim 1, further comprising:
 - a risk calculation unit (14) configured to calculate a

- collision risk value representing risk of collision between the ship and the other ships based on the navigation data of the ship and the navigation data of the other ships, wherein:
 - the frequency determination unit (13) is further configured to determine whether to include the navigation data of the other ships in the transmission data set according to the collision risk value.
- 3. The ship information collection device (1) of claim 2, wherein:
 - the frequency determination unit (13) is further configured to determine the frequency of including the navigation data of the other ships in the transmission data set according to the collision risk value.
- 4. The ship information collection device (1) of any one of claims 1 to 3, further comprising:
 - a distance calculation unit (15) configured to calculate the distance between the ship and the other ships based on the navigation data of the ship and the navigation data of the other ships, wherein:
 - the frequency determination unit (13) is configured to determine whether the navigation data of the other ships is included in the transmission data set according to the distance between the ship and the other ships.
- 5. The ship information collection device (1) of any one of claim 1 to 4, wherein:
 - the frequency determination unit (13) is further configured to determine the frequency of including the navigation data of the other ship in the transmission data set according to the distance between the ship and the other ships.
- 6. The ship information collection device (1) of any one of claim 1 to 5, wherein:
 - the navigation data of the other ships is Automatic Identification System (AIS) data.
- 7. The ship information collection device (1) of any one of claim 1 to 6, wherein:
 - the data set generation unit (12) is further configured to include a predetermined type of data from the AIS data in the transmission data set and not to include a non-predetermined type of data in the transmission data set.
- 8. The ship information collection device (1) of any one of claim 1 to 7, wherein:
 - the data set generation unit (12) is further configured to include the non-predetermined type of data if the non-predetermined type of data are changed.
- 9. The ship information collection device (1) of any one of claim 1 to 8, wherein:
 - the frequency determination unit (13) is further con-

figured to determine the frequency of including the navigation data of the other ships in the transmission data set according to speed of the ship.

- 10.** The ship information collection device (1) of any one of claim 1 to 9, wherein:
the frequency determination unit (13) is further configured to determine the frequency of including the navigation data of the other ships in the transmission data set according to the ship type of the ship. 5 10
- 11.** The ship information collection device (1) of any one of claim 1 to 10, further comprising:
a congestion determination unit (16) configured to determine congestion degree in the sea area navigated by the ship, wherein:
the frequency determination unit (13) is further configured to determine the frequency of including navigation data of the other ships in the transmission data set according to the congestion degree. 15 20
- 12.** The ship information collection device (1) of any one of claim 1 to 11, wherein:
the frequency determination unit (13) is further configured to determine the frequency of including the navigation data of the other ships in the transmission data set according to the sea area in which the ship navigates. 25
- 13.** The ship information collection device (1) of any one of claim 1 to 12, wherein:
the frequency determination unit (13) is further configured to determine the frequency of including the navigation data of the other ships in the transmission data set more frequently when the ship is navigating in coastal area than when the vessel is navigating in offshore area. 30 35
- 14.** A ship information collection system (300), comprising: 40
a detecting device attached onto a ship, and configured to sequentially detect navigation data of other ships in the vicinity of the ship;
a frequency determination unit (13) configured to decide whether to include navigation data of the other ships in a transmission data set;
a data set generation unit (12) configured to generate transmission data set including navigation data of the other ships; 45 50
a communication device (40) configured to sequentially transmit the transmission data set; and
a data collection server (200) configured to collect the transmission data set transmitted. 55
- 15.** A ship information collection method, comprising:

sequentially detecting navigation data of other ships in the vicinity of a ship by a detecting device attached onto the ship;
deciding whether to include navigation data of the other ships in a transmission data set;
generating the transmission data set including navigation data of the other ships;
sequentially transmitting the transmission data set; and
collecting the transmission data set transmitted.

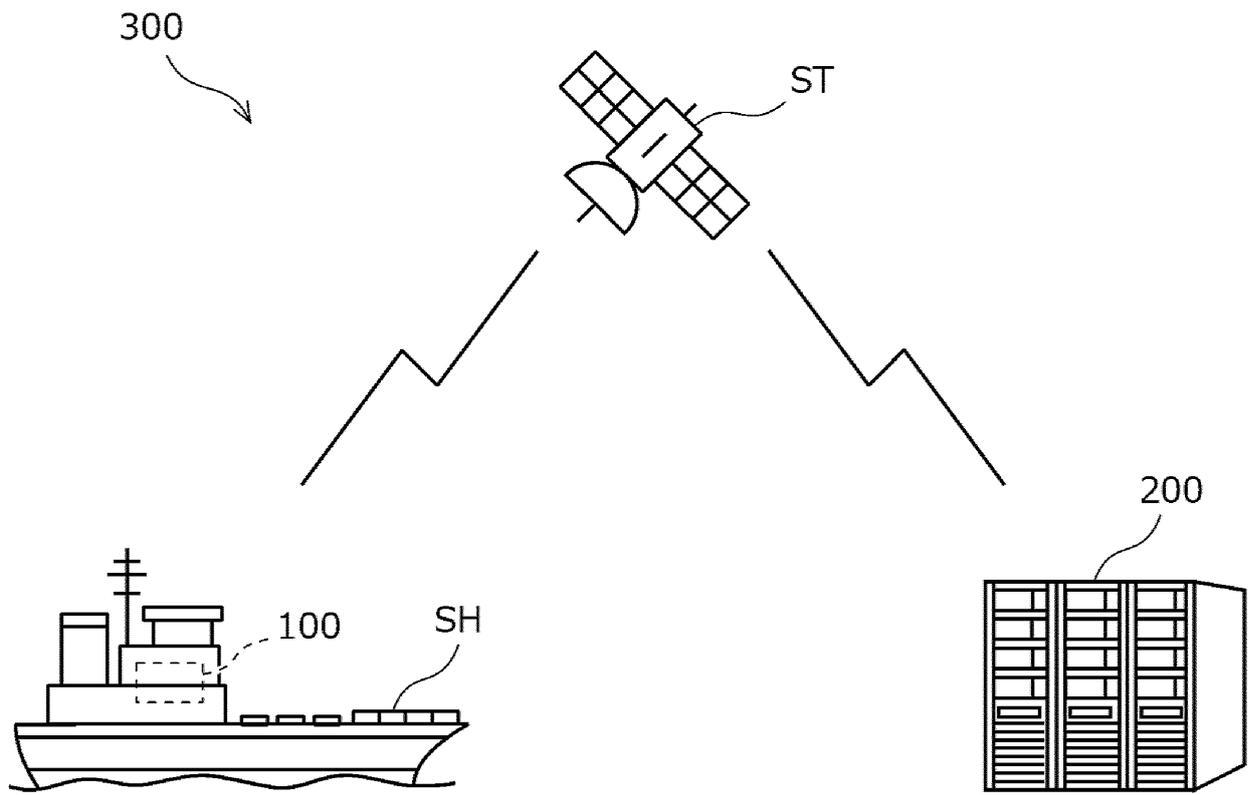


Fig.1

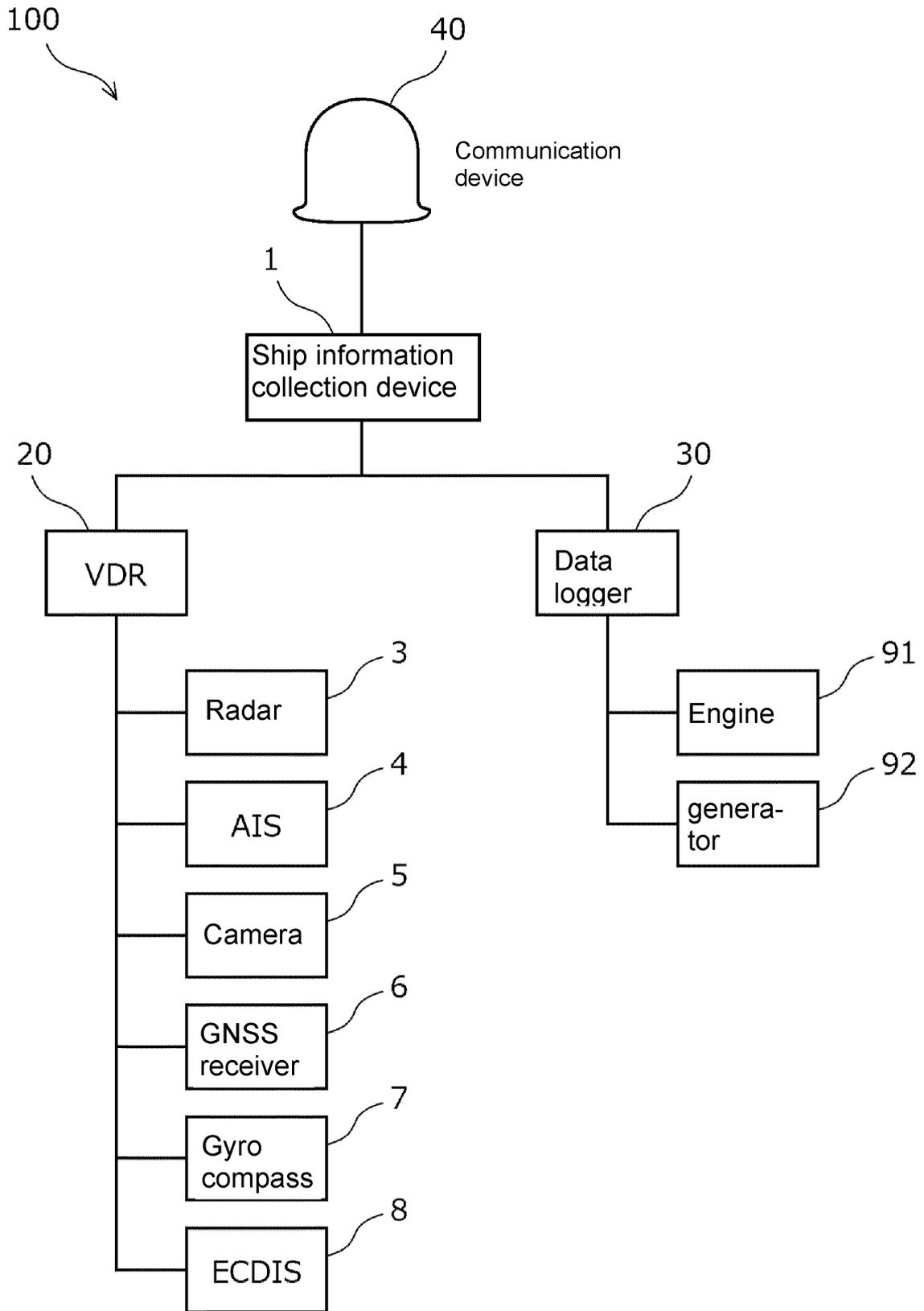


Fig.2

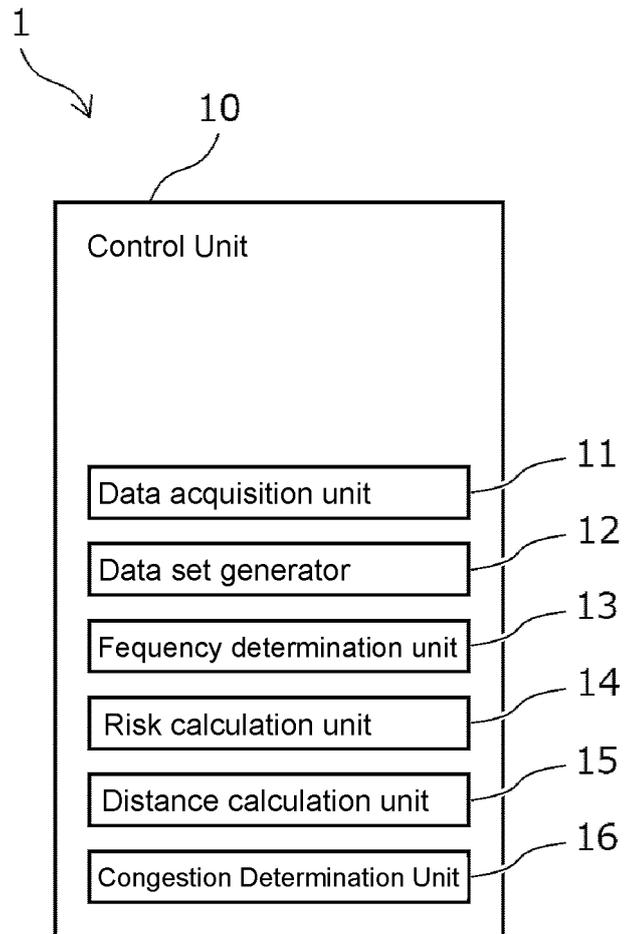


Fig.3

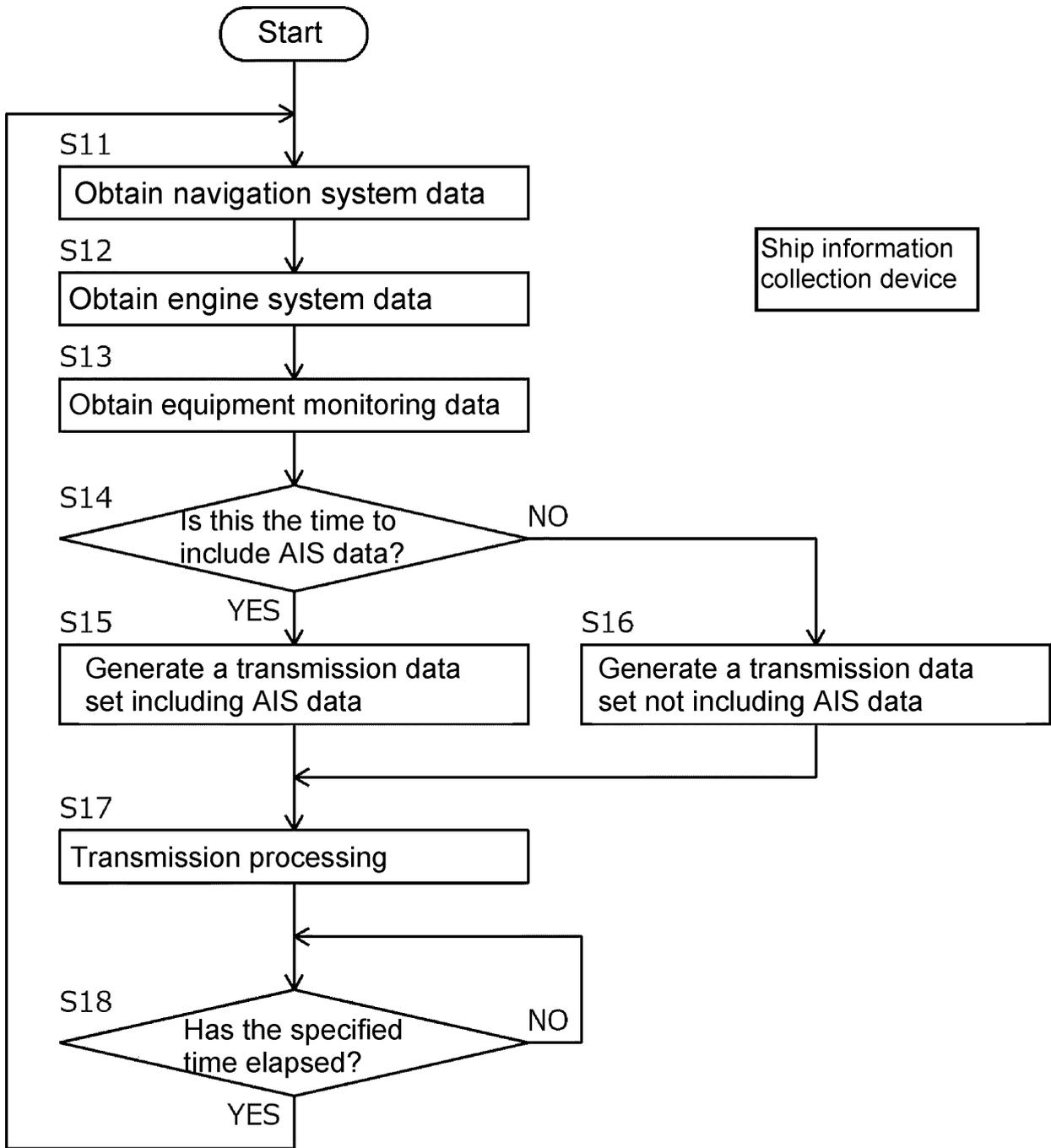


Fig.4

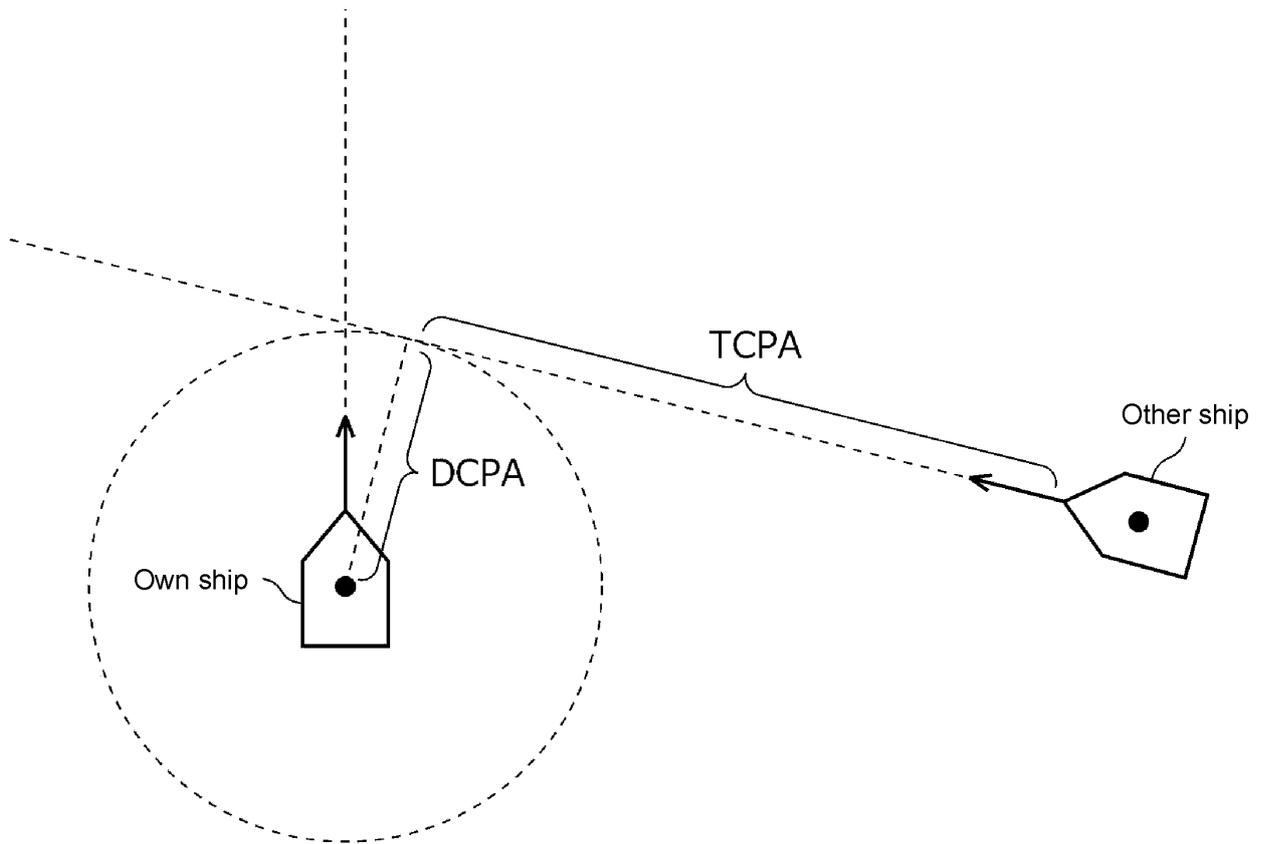


Fig.5

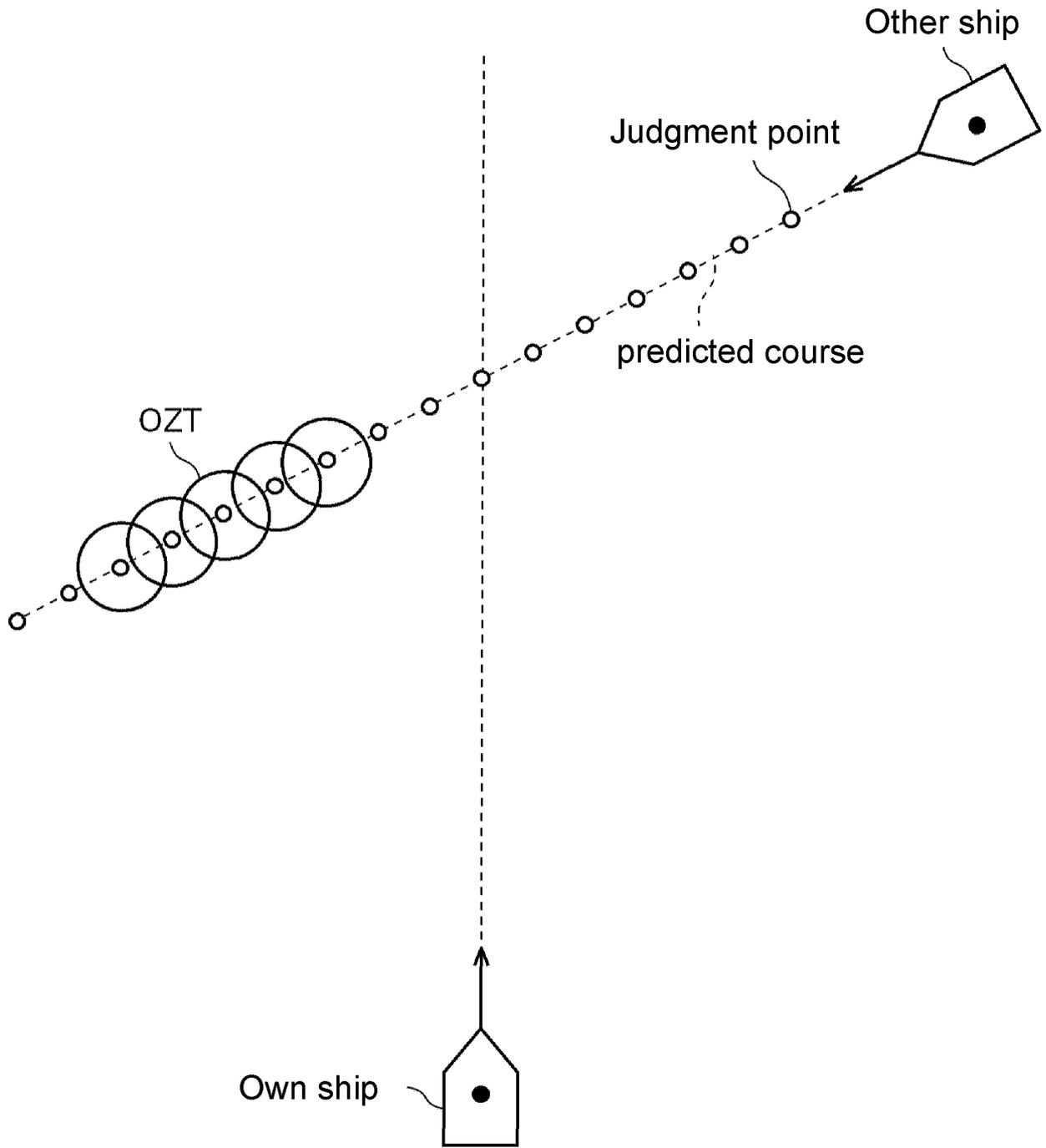


Fig.6

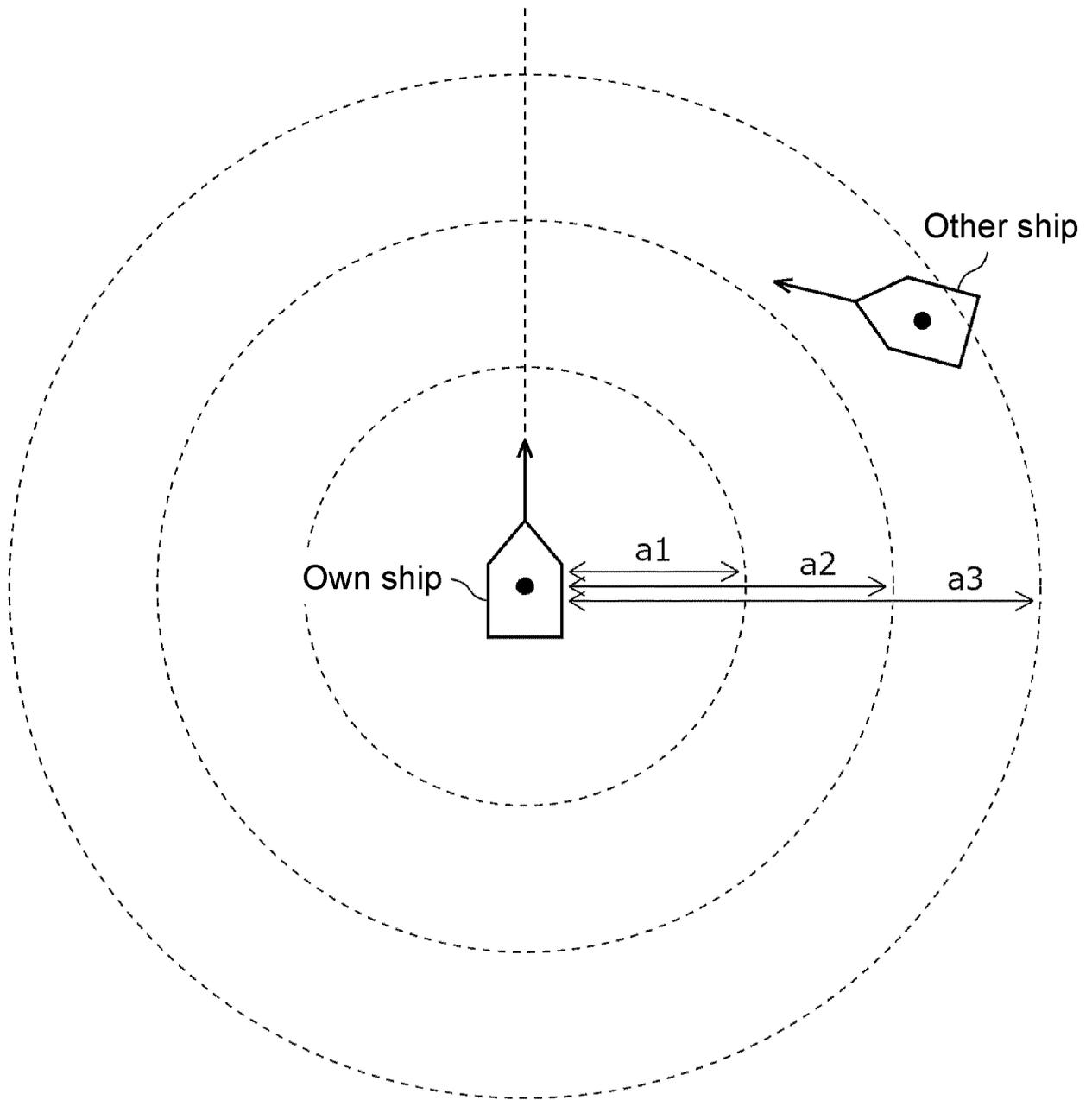


Fig.7

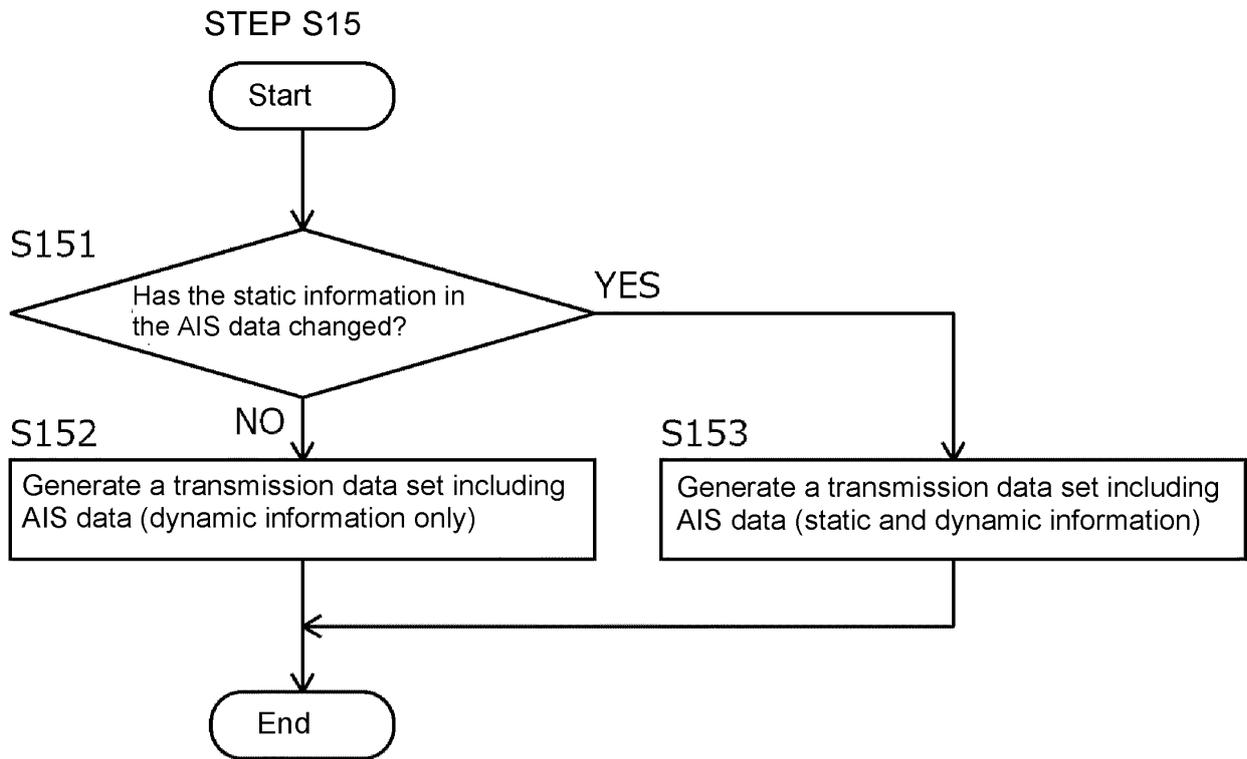


Fig.8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/012634

5	A. CLASSIFICATION OF SUBJECT MATTER	
	<i>B63B 49/00</i> (2006.01)i; <i>G08G 3/02</i> (2006.01)i; <i>B63B 79/40</i> (2020.01)i FI: G08G3/02 A; B63B49/00 Z; B63B79/40	
	According to International Patent Classification (IPC) or to both national classification and IPC	
10	B. FIELDS SEARCHED	
	Minimum documentation searched (classification system followed by classification symbols) G08G3/00; G08G3/02; G01S13/00-13/95; B63B49/00; B63B79/40	
	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
15	Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2022 Registered utility model specifications of Japan 1996-2022 Published registered utility model applications of Japan 1994-2022	
	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)	
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
	Category*	Citation of document, with indication, where appropriate, of the relevant passages
		Relevant to claim No.
	A	WO 2017/204075 A1 (FURUNO ELECTRIC CO., LTD.) 30 November 2017 (2017-11-30)
25	A	JP 2006-163765 A (NATL. INST. FOR LAND & INFRASTRUCTURE MANAGEMENT MLIT.) 22 June 2006 (2006-06-22)
	A	JP 11-345397 A (MURAYAMA, Masami) 14 December 1999 (1999-12-14) paragraph [0014]
30	A	JP 6-131600 A (THOMSON CSF) 13 May 1994 (1994-05-13) paragraph [0012]
35	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.	
40	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	
	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
50	Date of the actual completion of the international search	Date of mailing of the international search report
	20 April 2022	10 May 2022
55	Name and mailing address of the ISA/JP	Authorized officer
	Japan Patent Office (ISA/JP) 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915 Japan	
		Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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JP	2006-163765	A	22 June 2006	(Family: none)			
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				column 4, lines 49-52			
				EP	562940	A1	
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				KR	10-1993-0020328	A	
				NO	931046	L	

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