

## DESCRIPTION

### TITLE OF INVENTION: SYSTEM FOR GENERATING HULL CLEANING RESULT REPORT AND METHOD FOR GENERATING REPORT USING THE SAME

#### 5    **Technical field**

10        The present invention relates to a system for generating a hull cleaning result report and a method for generating a cleaning result report using the same. More specifically, the present invention relates to a system for generating a hull cleaning result report automatically generating a report on the hull cleaning result using a plurality of photographed images collected from a hull bottom cleaning robot, and a method for generating a cleaning result report using the same.

#### **Background art**

15        In general, various foreign substances such as seaweed, water moss, shellfish, or barnacles may be attached to the outer wall of the hull of a ship. Unless such foreign substances are removed, the speed of the ship slows down, the fuel consumption increases, and the marine ecosystem is disturbed. Accordingly, hull cleaning is performed using a hull bottom cleaning robot.

20        At this time, the hull bottom cleaning robot travels while being attached to the outer surface of the hull of a ship, and cleans the outer surface of the hull using a brush, etc. The robot may take photographs of the state before cleaning the outer surface of the hull by taking photographs of the front using a camera provided at the front surface of the body and take photographs of the state

after cleaning the outer surface of the hull by taking photographs of the rear using a camera provided at the rear surface of the body.

5 The management company of the hull bottom cleaning robot may check whether the outer surface of the ship has been cleaned properly using a plurality of photographed images taken by the hull bottom cleaning robot.

Also, the management company may provide a report on the cleaning result to customers such as the ship owner based on the photographed images after cleaning the hull using the hull  
10 bottom cleaning robot.

However, since the plurality of photographed images collected from the hull bottom cleaning robot are images taken under water, they were taken in poor surroundings and thus clearer images need to be selected among the photographed images. Also, reliability on hull cleaning may  
15 be guaranteed only when clear images are provided as to whether each region of the hull has been cleaned properly.

Accordingly, in the prior art, when generating a report on hull cleaning result, it was difficult for the worker to generate a report because the worker had to review the vast amount of  
20 photographed images collected from the hull bottom cleaning robot, one by one, and select therefrom. In addition, since the report only provided images and information on whether cleaning was performed, there were problems such as low reliability of the report and low customer satisfaction.

## **Summary of invention**

### **Technical task**

The present invention is to provide a system for generating a hull cleaning result report and  
5 a method for generating a cleaning result report using the same. Specifically, the present invention  
is to provide a system for generating a hull cleaning result report capable of automatically  
generating a hull cleaning result report by performing image processing on a plurality of  
photographed images collected from a hull bottom cleaning robot for cleaning the hull, generating  
cleaning image data by selecting images which can clearly check the cleaning state, and inserting  
10 the generated cleaning image data and information analyzing the cleaning state of the hull in a  
report form, and a method for generating a cleaning result report using the same.

The technical tasks to be achieved in the present invention are not limited to the technical  
tasks mentioned above, and other technical tasks not mentioned will be clearly understood by those  
15 of ordinary skill in the art to which the present invention belongs from the description below.

### **Means for solving technical task**

In order to solve the above problems, the present invention provides a system for generating  
20 a hull cleaning result report, comprising: an image selecting unit for selecting images of a  
predetermined sharpness standard or above with respect to a plurality of photographed images  
photographing the outer surface of the hull, generating cleaning image data for detecting the  
cleaning state of the hull for each selected image, and selecting the cleaning image data required  
for generating a report among the plurality of cleaning image data generated; and a report

generating unit for outputting information on the cleaning state of the hull by analyzing the plurality of cleaning image data, and inserting the selected cleaning image data and information on the cleaning state of the hull to generate a report.

5           Also, the present invention provides a system for generating a hull cleaning result report, further comprising: an image collecting unit for collecting a plurality of photographed images photographing the outer surface of the hull from a hull bottom cleaning robot; and an image processing unit for converting the image to detect sharpness for each of the plurality of photographed images, wherein the image selecting unit selects an image of a predetermined sharpness standard or above using the converted image.

          Also, the present invention provides a system for generating a hull cleaning result report, wherein the cleaning image data comprises at least one of a before-cleaning image, an after-cleaning image and a cleaning state video for a region of the outer surface of the hull, and the report generating unit inserts an image of the hull displaying the location of a region corresponding to the selected cleaning image data in the report.

          Also, the present invention provides a system for generating a hull cleaning result report, wherein the report generating unit inserts cleaning history and identifier information of the hull in the report using previously inputted ship information.

          Also, the present invention provides a system for generating a hull cleaning result report, wherein the report generating unit comprises: a standard setting unit for interconnecting with the image selecting unit and setting a standard for selecting the cleaning image data; an analyzing unit

for analyzing the plurality of cleaning image data and importing a comment corresponding to the cleaning state of the corresponding hull among a plurality of comments previously stored and outputting the same as information; and a generation processing unit for generating a report by inserting the selected cleaning image data and comments on the cleaning state of the hull.

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According to another aspect of the present invention, in order to solve the above technical task, the present invention provides a method for generating a hull cleaning result report, comprising: collecting a plurality of photographed images photographing the outer surface of the hull for each region of the hull from a hull bottom cleaning robot; converting the image to detect sharpness for each of the plurality of photographed images collected; selecting an image with the highest sharpness for each region of the hull using the converted image and generating cleaning image data for each region for detecting the cleaning state of the hull for each region using the selected image; selecting the cleaning image data meeting the predetermined standard among the cleaning image data for each region and inserting the selected cleaning image data in a report form; and inserting information on the cleaning state of the hull by analyzing the cleaning image data for each region in the report form.

The technical tasks to be achieved in the present invention are not limited to the technical tasks mentioned above, and other technical tasks not mentioned will be clearly understood by those of ordinary skill in the art to which the present invention belongs from the description below.

### **Effect of invention**

The system for generating a hull cleaning result report according to an embodiment of the present invention is capable of automatically generating a hull cleaning result report by performing image processing on a plurality of photographed images collected from a hull bottom cleaning robot for cleaning the hull, generating cleaning image data by selecting images which can clearly  
5 the cleaning state, and analyzing the cleaning image data generated.

In addition, the system is capable of generating a report by selecting the cleaning image data inserted into the report according to the standard set according to the needs of customers such as ship owners, and greatly increasing the reliability of the report and customer satisfaction by  
10 providing a report generated to include information analyzing the cleaning state of the hull, cleaning history and identifier information, along with the selected cleaning image data.

The effects obtainable in the present invention are not limited to the above-mentioned effects, and other effects not mentioned may be clearly understood by those of ordinary skill in the  
15 art to which the present invention pertains from the following description.

### **Brief description of drawings**

Fig. 1 illustrates the configuration of a system for generating a hull cleaning result report  
20 according to a first embodiment of the present invention;

Fig. 2 illustrates photographed images collected by a hull bottom cleaning robot according to a first embodiment of the present invention;

Fig. 3 illustrates a process of selecting an image according to a first embodiment of the present invention;

Fig. 4 illustrates a report generated by a report generating unit according to a first embodiment of the present invention;

Fig. 5 is a flowchart illustrating a method for generating a hull cleaning result report according to a first embodiment of the present invention; and

5 Fig. 6 is a flowchart illustrating a method for generating a hull cleaning result report according to a second embodiment of the present invention.

### **Best mode for carrying out the invention**

10 Hereinafter, preferred embodiments according to the present invention will be described in detail with reference to the accompanying drawings.

The detailed description set forth below in conjunction with the accompanying drawings is intended to describe exemplary embodiments of the present invention and is not intended to  
15 represent the only embodiments in which the present invention may be carried out.

In order to clearly explain the present invention in the drawings, portions that are not related to the present invention are omitted, and like reference numerals are used to refer to like elements throughout the specification.

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In an embodiment of the present invention, expressions such as “or” and “at least one” may indicate one of the words listed together, or a combination of two or more.

Fig. 1 illustrates the configuration of a system 100 for generating a hull cleaning result

report according to a first embodiment of the present invention. Fig. 2 illustrates photographed images collected by a hull bottom cleaning robot 10 according to a first embodiment of the present invention. Fig. 3 illustrates a process of selecting an image according to a first embodiment of the present invention. Fig. 4 illustrates a report generated by a report generating unit 140 according to a first embodiment of the present invention.

Referring to Figs. 1 to 4, the system 100 for generating a hull cleaning result report according to a first embodiment of the present invention may comprise an image collecting unit 110, an image processing unit 120, an image selecting unit 130 and a report generating unit 140.

The image collecting unit 110 may collect a plurality of photographed images photographing the outer surface of the hull before and after cleaning for each region of the hull from a hull bottom cleaning robot 10.

Here, the hull bottom cleaning robot 10 travels while being attached to the outer surface of the hull of a ship, and cleans the outer surface of the hull for the corresponding region. The state before cleaning the outer surface of the hull may be photographed by taking photographs of the front through a camera provided at the front surface of the body, and the state after cleaning the outer surface of the hull may be photographed by taking photographs of the rear through a camera provided at the rear surface of the body.

When the hull bottom cleaning robot 10 of the present embodiment moves in a state attached to the hull while cleaning within a predetermined region, a plurality of images are

obtained by photographing images at every predetermined distance or time and the obtained images may be collected by the image collecting unit 110.

At this time, the images collected by the image collecting unit 110 may be stored in a database (not shown).

The image processing unit 120 may perform image processing so as to detect sharpness of a plurality of photographed images for each region collected by the image collecting unit 110, i.e., a plurality of images photographing the state of the outer surface of the hull after cleaning.

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Specifically, with respect to each of the plurality of photographed images for each region, the image processing unit 120 may convert the photographed image into at least one of an HSV image and a binary image, and process the image to detect the sharpness of the image which varies according to the cleaning state.

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In the present embodiment, the image processing unit 120 may perform HSV image processing and binary image processing for each of the photographed images photographing the state of the outer surface of the cleaned hull.

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During the process of converting the photographed image of the outer surface of the hull into an HSV image and processing the same at the image processing unit 120, the photographed image consisting of an RGB image expressed by three-dimensional color information of R (red), G (green) and B (blue) may be converted into an HSV image displayed in the form of hue, saturation, and value.

In addition, the image processing unit 120 may extract a color corresponding to the paint color of the outer surface of the hull from the HSV image of the outer surface of the hull after cleaning.

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As an example, in the case of an ordinary ship, since the outer surface of the hull is painted with a red antifouling paint, in the present embodiment, the red color may be extracted from the HSV image of the outer surface of the hull through the image processing unit 120.

10         At this time, the more the paint color, i.e., the red color, is extracted from the HSV image of the outer surface of the hull, it may mean that the outer surface of the hull is more clean.

In addition, during the process of converting the photographed image of the outer surface of the hull into a binary image and processing the same at the image processing unit 120, an ROI  
15         (Region Of Interest) is extracted from the photographed image consisting of an RGB image, and the ROI is converted into a gray image so that the outline is detected. Then, a mask image may be generated by a binarization process.

At this time, the ROI indicates the region of the outer surface of the hull in the  
20         photographed image, and when only the outer surface of the hull is shown in the photographed image, the ROI may be the entire region of the photographed image.

In addition, when binarizing a gray image, according to a predetermined reference value, pixels exceeding the reference value in the gray image may be displayed as a binary value of 1,

and pixels of the reference value or below may be displayed as a binary value of 0 to generate a binarized mask image.

For example, in a binarized mask image, pixels displayed as 1 may represent a clean part of the outer surface of the hull, and when a plurality of pixels displayed as 1 form a region, the corresponding region is a clean region, and the pixels displayed as 1 along the perimeter of the region may be the boundary of the clean region.

Also, the image processing unit 120 may generate a binary image by performing binarization by matching the ROI with the mask image.

At this time, each pixel of the ROI is binarized according to a predetermined reference value, and the binary value of each pixel of the ROI and the binary value of each pixel of the mask image may be overlaid and matched.

During this process, when the pixels of the ROI and the pixels of the mask image which match each other have the same binary value, the corresponding binary value is maintained, and when the pixels of the ROI and the pixels of the mask image which match each other have different binary values, they may be changed to the same binary value according to a predetermined standard.

For example, when the pixels of the ROI and the pixels of the mask image which match each other have the same binary value of 1, the overlaid corresponding pixel may maintain the binary value of 1.

At this time, the boundary of the clean region (region of a plurality of pixels displayed as 1) in the ROI, and the boundary of the clean region in the mask image which are overlaid and matched may have different binary values. Then, a binary image in which the boundary of the overlaid clean region is clearly processed may be generated by changing each boundary to have the same binary value according to the predetermined standard.

In the above-described binarization method, a binarization method in which an image is displayed as binary values of 1 and 0 has been described as an example. However, a method of binarizing into white and black may be applied in which pixels exceeding a predetermined reference value in the image are displayed in white, and pixels of the reference value or below are displayed in black.

The image selecting unit 130 expresses a numerical value for the cleaning state of the outer surface of the hull in the photographed image using the HSV image and the binary image for each photographed image, and selects a photographed image having the highest value among a plurality of photographed images for each region.

In other words, the image selecting unit 130 may select the best photographed image which can clearly check the cleaning state for each region of the hull.

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Specifically, the image selecting unit 130 may calculate the area of the paint color (e.g., red) of the outer surface of the hull extracted from the HSV image of the photographed image, and also calculate the area of the clean region in the binary image of the corresponding photographed image.

In addition, a predetermined weight may be granted to the calculated area value of the paint color and the area value of the clean region in the binary image, so as to calculate a clean point that is expressed as a numerical value for the clean state of the outer surface of the hull in the image for the corresponding photographed image.

At this time, a weight granted to the area value of the clean region in the binary image may be set to be relatively higher than a weight granted to the area value of the paint color extracted from the HSV image.

As an example, as illustrated in Fig. 3, the present embodiment shows that a weight of 30 is granted to the area value of the clean region in the binary image, and a weight of 0.5 is granted to the area value of the paint color in the HSV image.

In addition, in calculating a clean point for the photographed image, for example, when the area value of the clean region in the binary image is 150 and the area value of the paint color in the HSV image is 500, the clean point may be calculated to be 4750 by adding a value multiplying the area value of the clean region, 150, by the weight, 30, and a value multiplying the area value of the paint color, 500, by the weight, 0.5.

Accordingly, the image selecting unit 130 may calculate a clean point for each of a plurality of photographed images photographing one region of the hull, and select the photographed image having the highest clean point among the plurality of photographed images and decide it as the sharpest image in the corresponding region.

At this time, the selected image refers to the sharpest image after cleaning in the corresponding region of the hull, and the selected image after cleaning may be stored in a database (not shown) together with the image before cleaning of the corresponding region and the cleaning state video of the region.

Accordingly, in the same method as described above, the image selecting unit 130 may generate cleaning image data for each region grouping the after-cleaning image, the before-cleaning image, and the cleaning state video having the highest clean point for each region of the hull, and store the data in a database (not shown).

In addition, the image selecting unit 130 may align the cleaning image data for each region stored in a database (not shown), and secondarily select the cleaning image data that meets a predetermined standard among the cleaning image data aligned for each region, and provide the selected cleaning image data to the report generating unit 140.

At this time, the selection standard of the cleaning image data may be set through the report generating unit 140 according to the needs of customers such as ship owners.

As an example, when the cleaning state difference between the before-cleaning image and the after-cleaning image is set as the selection standard, the image selecting unit 130 may use the cleaning image data for each region stored in a database (not shown), to select the cleaning image data having the greatest difference in cleaning state between the before-cleaning image and the

after-cleaning image among the cleaning image data for a plurality of regions and provide the selected cleaning image data to the report generating unit 140.

At this time, the clean point may be calculated for the before-cleaning image, and three or  
5 more cleaning image data having the greatest clean point difference between the before-cleaning image and the after-cleaning image may be selected. For example, one of the cleaning image data for each region of the left side surface of the hull, one of the cleaning image data for each region of the right side surface of the hull, and one of the cleaning image data for each region of the bottom of the hull may be selected, and the three most representative cleaning image data selected  
10 may be provided to the report generating unit 140.

The report generating unit 140 may insert the cleaning image data selected by the image selecting unit 130 and information on the cleaning state of the hull in a report form and automatically generate a cleaning result report.

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Specifically, the report generating unit 140 may comprise a standard setting unit 141 for setting a standard for selecting cleaning image data inserted into a report form, an analyzing unit 142 for analyzing a plurality of cleaning image data stored in a database (not shown) and providing information on the cleaning state of the hull, and a generation processing unit 143 for inserting the  
20 selected cleaning image data and information on the cleaning state of the hull in the report form and generating a report.

Here, the standard setting unit 141 may provide the standard for selecting cleaning image data set to meet the needs of the customers such as ship owners to the image selecting unit 130,

and accordingly the image selecting unit 130 may select the cleaning image data required for generating a report among a plurality of cleaning image data stored in a database (not shown) using the selection standard.

5           In addition, the analyzing unit 142 may analyze a plurality of cleaning image data stored in a database (not shown) and provide information on the cleaning states of the left side surface, the right side surface, and the bottom surface of the hull.

10           At this time, a comment that meets the cleaning state of the corresponding ship may be imported from the previously stored comments and provided to the generation processing unit 143.

15           The generation processing unit 143 may use the cleaning image data selected by the image selecting unit 130 to insert the before-cleaning image, the after-cleaning image, and the cleaning state video into the report form.

            The comments on the cleaning state of the hull provided from the analyzing unit 143 may be inserted into the report form.

20           The generation processing unit 143 may use the previously inputted ship information to display the location corresponding to the selected cleaning image data on the hull image and insert the same into the report form.

            Accordingly, in the cleaning result report generated by the report generating unit 140, the location in the hull corresponding to the selected cleaning image data may be displayed on the ship

image, the before-cleaning image, the after-cleaning image and the cleaning state video of the corresponding location in the hull may be displayed, and comments on the cleaning state of the hull may be displayed.

5           As an example, referring to Fig. 4, as for cleaning image data selected from the region on the left side surface of the hull, the corresponding location of the side surface region of the hull may be displayed on the ship image, and the before-cleaning image, the after-cleaning image and the cleaning state video of the corresponding location may be displayed, and comments on the overall cleaning state of the side surface of the hull may be displayed.

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          As for the cleaning image data selected from the region on the right side surface of the hull and the cleaning image data selected from the region of the bottom surface of the hull, in the same manner, the location in the hull, the before-cleaning image, the after-cleaning image and the cleaning state video of each selected cleaning image data may be displayed, and comments on the overall cleaning state on the right side surface of the hull and the bottom surface of the hull may be inserted in the report form.

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          The generation processing unit 143 may use the previously inputted ship information to input the cleaning history of the corresponding ship in the report form, and enter identifier information on who inspected the cleaning state of the corresponding ship.

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          Fig. 5 is a flowchart illustrating a method for generating a hull cleaning result report according to a first embodiment of the present invention.

Referring to Figs. 1 and 5, the image collecting unit 110 may collect a plurality of photographed images photographing the outer surface of the hull for each region of the hull from a hull bottom cleaning robot (S110).

5           At this time, the image collecting unit 110 may collect a plurality of photographed images for each region of the hull, and store the plurality of photographed images collected in a database (not shown).

Next, for each of the plurality of photographed images collected, the image processing unit  
10   120 may convert the images to detect sharpness (S120).

During this process, the image processing unit 120 may convert the photographed image into at least one of an HSV image and a binary image for each of the plurality of photographed images for each region of the hull, and process the image to detect the sharpness of the image.  
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Then, using the converted image, the image selecting unit 130 may select the image with the highest sharpness for each region of the hull, and use the selected image to generate cleaning image data for each region to detect the cleaning state of the hull for each region (S130).

20           At this time, by expressing a numerical value for the cleaning state of the outer surface of the hull in the photographed image using the HSV image and the binary image for each photographed image, the image selecting unit 130 may select the photographed image having the highest value among the plurality of photographed images for each region as the sharpest image.

In addition, for each region of the hull, the cleaning image data for each region grouping the clearest after-cleaning image, before-cleaning image, and cleaning state video may be stored in a database (not shown).

5           Next, the image selecting unit 130 may select cleaning image data that meets a predetermined standard among the cleaning image data for each region, and the report generating unit 140 may insert the selected cleaning image data in a report form (S140).

10           Here, the standard for selecting the cleaning image data may be set according to the needs of customers such as ship owners, etc.

15           As an example, according to the selection standard, the image selecting unit 130 may select the cleaning image data having the greatest difference in cleaning state between the before-cleaning image and the after-cleaning image among the plurality of cleaning image data for each region, and the report generating unit 140 may insert the selected cleaning image data in the report form as a representative image.

20           At this time, the before-cleaning image, the after-cleaning image, and the cleaning state video included in the selected cleaning image data may be inserted in the report form.

          Then, information on the cleaning state of the hull may be inserted in the report form by analyzing a plurality of cleaning image data stored in a database (not shown) (S150).

At this time, a comment that meets the cleaning state of the corresponding ship may be imported from the previously stored plurality of comments and inserted into the report form.

In addition, using the previously inputted ship information, the cleaning history of the corresponding ship may be inserted in the report form and information on an identifier who inspected the cleaning state of the corresponding ship may be inserted in the report form (S160).

Hereinafter, a system for generating a hull cleaning result report according to a second embodiment of the present invention and a method for generating a cleaning result report using the same will be described.

Fig. 6 is a flowchart illustrating a method for generating a hull cleaning result report according to a second embodiment of the present invention.

The system for generating a hull cleaning result report according to a second embodiment of the present invention has the same configuration as the first embodiment described above, but unlike the first embodiment which collects photographed images for each region of the hull, processes images and selects the image, the second embodiment collects photographed images for the entire hull, processes images and selects the image.

Referring to Fig. 6, the image collecting unit may collect a plurality of photographed images photographing the outer surface throughout the entire hull from a hull bottom cleaning robot (S210).

At this time, while moving being attached to the hull and performing cleaning, the hull bottom cleaning robot obtains a plurality of images by photographing images of the outer surface of the hull at every predetermined distance or time, and the obtained images may be collected by the image collecting unit and stored in a database.

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Next, for each of the plurality of photographed images collected, the image processing unit may convert the images to detect sharpness (S220).

During this process, the image processing unit may convert the photographed image into  
10 at least one of an HSV image and a binary image for each of the plurality of photographed images of the hull, and process the image to detect the sharpness of the image.

Then, using the plurality of converted images, the image selecting unit may select an image that meets a predetermined sharpness standard, and generate cleaning image data for detecting the  
15 cleaning state of the hull for each of the selected images (S230).

During this process, using the HSV image and the binary image for each photographed image, the image selecting unit may express a numerical value for the cleaning state of the outer surface of the hull in the photographed image. The higher the value, the cleaning state of the image  
20 may be more clearly checked. The image selecting unit may select the image with a numerical value satisfying the predetermined sharpness standard among the plurality of photographed images expressed as numerical values.

In addition, the selected image, that is, the clear after-cleaning image, may be grouped together with the corresponding before-cleaning image and the cleaning state video to generate cleaning image data, and cleaning image data may be generated for each of the plurality of selected images and stored in the database.

5

Next, the image selecting unit 130 may select cleaning image data that meets a predetermined standard among the plurality of cleaning image data, and the report generating unit may insert the selected cleaning image data in a report form (S240).

10

Here, the standard for selecting the cleaning image data may be set according to the needs of customers such as ship owners, etc., and the before-cleaning image, after-cleaning image, and cleaning state video included in the selected cleaning image data may be inserted in the report form.

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The report generating unit may analyze a plurality of cleaning image data stored in the database and insert a comment on the cleaning state of the hull in the report form (S250). Also, using the previously inputted ship information, the report generating unit may insert the cleaning history of the corresponding ship and information on an identifier who inspected the cleaning state of the corresponding ship in the report form (S260).

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Meanwhile, when receiving a plurality of photographed images photographing the outer surface of the hull from the outside, the system 100 for generating a hull cleaning result report according to the present embodiment may convert the received photographed images at an image

processing unit 120, and select the plurality of converted images at the image selecting unit 130 and generate a report at a report generating unit 140.

In addition, in the above-described embodiment, the plurality of photographed images are converted by the image processing unit 120, the plurality of converted images are selected by the image selecting unit 130, and a report is generated by the report generating unit 140. However, the present invention is not necessarily limited thereto, and a plurality of photographed images may be selected by the image selecting unit without having the images converted, and a report may be generated by the report generating unit using the selected images.

As described above, the system 100 for generating a hull cleaning result report according to an embodiment of the present invention is capable of automatically generating and providing a hull cleaning result report by performing image processing on a plurality of photographed images collected from a hull bottom cleaning robot for cleaning the hull, generating cleaning image data by selecting images which can clearly check the cleaning state, and analyzing the generated cleaning image data.

In addition, the system is capable of generating a report by selecting the cleaning image data inserted into the report according to the standard set according to the needs of customers such as ship owners, and greatly increasing reliability of the report and customer satisfaction by providing a report generated to include information analyzing the cleaning state of the hull, cleaning history and identifier information, along with the selected cleaning image data.

The embodiments of the present invention disclosed in the present specification and

drawings are merely illustrative examples of the present invention to easily explain the technical disclosure of the present invention and facilitate understanding of the present invention, and are not intended to limit the scope of the present invention.

- 5           Accordingly, in addition to the embodiments disclosed above, all modifications or changes derived based on the technical idea of the present invention should be construed as being included in the scope of the present invention.

**What is claimed is:**

1. A system for generating a hull cleaning result report, comprising:

an image selecting unit configured to select images of a predetermined sharpness standard  
5 or above with respect to a plurality of photographed images photographing outer surface of a hull,  
generating cleaning image data for detecting a cleaning state of the hull for each of the selected  
images, and selecting cleaning image data for generating a hull cleaning result report among the  
generated cleaning image data; and

a report generating unit configured to output information on the cleaning state of the hull  
10 by analyzing the selected cleaning image data, and insert the selected cleaning image data and the  
output information on the cleaning state of the hull to generate the hull cleaning result report.

2. The system of claim 1, further comprising:

an image collecting unit configured to collect the plurality of photographed images  
15 photographing the outer surface of the hull from a hull bottom cleaning robot; and

an image processing unit configured to convert each of the plurality of photographed  
images to detect sharpness,

wherein the image selecting unit is configured to select the images of the predetermined  
sharpness standard or above using the converted images.

3. The system of claim 1, wherein the cleaning image data includes at least one of a before-  
cleaning image, an after-cleaning image and a cleaning state video for a region of the outer surface  
of the hull, and

the report generating unit is configured to insert an image of the hull displaying the location of a region corresponding to the selected cleaning image data in the hull cleaning result report.

4. The system of claim 1, wherein the report generating unit is configured to insert cleaning history and identifier information of the hull in the hull cleaning result report using previously inputted ship information.

5. The system of claim 1, wherein the report generating unit comprises:

a standard setting unit configured to interconnect with the image selecting unit and set a standard for selecting the cleaning image data;

an analyzing unit configured to analyze the selected cleaning image data and import a comment corresponding to the cleaning state among a plurality of comments previously stored; and

a generation processing unit configured to generate the hull cleaning result report by inserting the selected cleaning image data and comments on the cleaning state of the hull.

6. A method for generating a hull cleaning result report, comprising:

collecting a plurality of photographed images photographing outer surface of a hull for each region of the hull from a hull bottom cleaning robot;

converting each of the plurality of photographed images to detect sharpness;

selecting an image with the highest sharpness for each region of the hull using the converted image and generating cleaning image data for each region for detecting a cleaning state of the hull for each region using the selected image;

selecting the cleaning image data of a predetermined standard among the cleaning image data for each region and inserting the selected cleaning image data in the hull cleaning result report;  
and

5 inserting information on the cleaning state of the hull by analyzing the cleaning image data for each region in the hull cleaning result report.

7. A method for generating a hull cleaning result report, comprising:

collecting a plurality of photographed images photographing outer surface of a hull from a hull bottom cleaning robot;

10 converting each of the plurality of photographed images to detect sharpness;

selecting an image of a predetermined sharpness standard using the converted image and generating cleaning image data for detecting a cleaning state of the hull for each selected image;

selecting the cleaning image data of the predetermined standard among the generated cleaning image data and inserting the selected cleaning image data in the hull cleaning result report;

15 and

inserting information on the cleaning state of the hull by analyzing the plurality of cleaning image data in the hull cleaning result report.

8. The method of claim 7 or claim 8, further comprising:

20 inserting cleaning history and identifier information of the hull in the hull cleaning result report using the previously inputted ship information.