

[Description]

[Title of Invention]

UNDERWATER INSPECTION ROBOT

[Technical Field]

The present invention relates to an underwater inspection robot and, more specifically, to an underwater inspection robot for cleaning the surface of a ship and quickly and safely inspecting the internal space of a ship such as a seachest of a ship.

[Background Art]

In general, since ships operate with the hull's lower part submerged in seawater, foreign substances such as various contaminants, and various aquatic organisms such as aquatic mosses and barnacles may stick to the underwater surfaces or sides.

Various foreign substances and aquatic organisms sticking to the hull not only damage the appearance of the ships, but also act as resistance during operation of the ships, thereby leading to a decrease in the speed of the ships and greatly increasing the fuel consumption of the ships. Accordingly, it is very important to periodically clean away various foreign substances and aquatic organisms sticking on the hull.

In the past, the work of cleaning the outer surface of the hull was typically performed by divers who directly entered the water to clean away foreign substances and aquatic organisms sticking on the outer surface of the hull, but there was a problem that the working environment is poor, physical exertion is high, and cleaning is impossible in areas with strong tides.

Meanwhile, a seachest is designed to allow the main

engine facility of a ship, which has a diesel engine, to intake seawater from the outside for the supply of cooling water, in which a seawater chamber making a seawater storage space is formed by drilling a hole through the outer plate of the hull where the main engine facility is installed, and a seawater inlet connecting the inside of the seawater chamber to the underwater is formed on the bottom of the hull. Further, an inlet protection plate having multiple water inlet holes is installed to prevent foreign substances from entering the seawater inlet.

Such a seachest is a part that plays an important role in supplying cooling water to the main engine facility, but the issue of smuggling abnormal items into various internal spaces of the hull, including a seachest, has recently arisen.

As an example, it has arisen a smuggling issue of removing the protection plate of a seachest, putting drugs or items prohibited from import in the seachest, and then reattaching the protection plate to smuggle them.

In the past, in order to prevent this problem, divers had to go down directly to inspect the internal spaces of the hull such as the seachest. Further, since the visibility underwater in ports is usually not good, divers had to do the work of removing a protection plate, entering the seachest, directly checking whether there are abnormal items, and reattaching the protection plate.

In this way, since divers had to directly dive and do the work of removing and attaching a protection plate in order to inspect the seachest in the past, not only is there a risk of safety accidents, but it also requires a lot of manpower and time to inspect the seachest.

Further, since it requires a lot of manpower and

time to inspect the seachest, it was substantially impossible to inspect the seachests of all of ships.

Accordingly, there is a need for a technique for more quickly and efficiently inspecting various internal spaces of a hull such as a seachest.

[Summary of Invention]

[Technical Problem]

In order to solve the problems described above, an objective of the present invention is to provide an underwater inspection robot for cleaning the surface of the hull, and simultaneously, quickly and safely inspecting a hull inside space such as the seachest of a ship.

The objectives to implement in the present invention are not limited to the technical problems described above and other objectives that are not stated herein will be clearly understood by those skilled in the art from the following specifications.

[Solution to Problem]

In order to achieve the objectives described above, the configuration of the present invention provides an underwater inspection robot that includes: a robot module cleaning the outer surface of a ship; and an inspection module mounted on the robot module to inspect the interior of a space inside the hull.

In the example of the present invention, the robot module may include: a main body forming a body; and wheels disposed at the main body as a magnetic wheel or continuous track type to be movable on a surface of the ship.

In the example of the present invention, the robot

module may include: a recognizer disposed inside a front surface of the main body; and a washing unit disposed at a lower side of the front surface of the main body to discharge water at high pressure toward the surface of the ship.

In the example of the present invention, the robot module may include: an arm assembly disposed on the front surface of the main body to control 3D (x-, y-, and z-axial) displacement of a cable coupled thereto; and the cable connecting the main body and the arm assembly.

In the example of the present invention, the arm assembly may include: a pair of rotary units disposed on the front surface of the main body to be rotatable forward and rearward with respect to the main body on one ends; an arm unit extending such that both ends are coupled to the other ends of the pair of rotary units, respectively; and a grab unit coupled to the arm unit to be movable in a longitudinal direction of the arm unit, and the grab unit has the cable extending from the main body coupled thereto.

In the example of the present invention, y-axial displacement of the cable may be changed by rotation of the rotary units, and x-axial displacement of the cable may be changed when the grab unit is moved in the longitudinal direction of the arm unit.

In the example of the present invention, the robot module may further include a sterilizer disposed on a rear of the main body, and the sterilizer may be a sterilization lamp for removing organisms sticking on the ship.

In the example of the present invention, the inspection module may include: a detector detecting an interior of the ship; an extender assembly coupled to the detector such that a length thereof can be adjusted; a

joint coupled to the extender assembly to be able to bend; a watertight portion coupled to the joint to be able to control a bending direction and a bending angle of the joint; and a frame portion connecting the watertight portion and the robot module and accommodating a cable therein.

In the example of the present invention, the extender assembly may include: a first extender having the detector coupled to an end; and a second extender coupled to the first extender in multiple stages and coupled to an end of the joint, and the first extender may slide in a longitudinal direction of the second extender such that the entire length of the first extender and the second extender can be adjusted.

In the example of the present invention, the joint may include: a joint body extending such that the cable passes through a center therein; and a plurality of wires coupled to the joint body, and the bending direction and the bending angle of the joint may be adjusted by controlling the plurality of wires.

In the example of the present invention, the joint may further include: first cut surfaces formed with regular intervals on both sides of an outer surface of the joint body; second cut surfaces formed on both sides of the joint body in a direction perpendicular to the first cut surfaces and formed at every middle portions of adjacent first cut surfaces; and wire holes formed on center axes of the first cut surfaces and the second cut surfaces, and the wires may be inserted in the wire holes.

In the example of the present invention, the watertight portion may be provided so that the cable may be inserted therethrough and may have an actuator controlling the wires.

In the example of the present invention, the frame portion may extend from the robot module to be coupled to the watertight portion and may accommodate the cable therein.

In the example of the present invention, the detector may include any one or more of a camera unit that images an underwater environment, a SONAR that shows images through sound wave measurement, and a LiDAR that shows light as images.

In the example of the present invention, the underwater inspection robot may further include a water jet provided with the detector and being able to jet high-pressure water.

[Advantageous Effects of Invention]

According to the configuration described above, the present invention has an effect that it is not necessary for divers to directly dive and inspect the interiors of space inside the hull, so it is safe.

Further, according to the present invention, since the recognizer can be introduced inside through the gaps of the protective plate, there is no need for work of removing and attaching the protective plate and time is reduced.

Therefore, according to the present invention, it is possible to quickly and safely inspect abnormal items loaded in the space inside the hull such as a seachest.

The effects of the present invention are not limited thereto and it should be understood that the effects include all effects that can be inferred from the configuration of the present invention described in the following specification or claims.

[Brief Description of Drawings]

FIG. 1 is an exemplary view of an underwater inspection robot connected to a patrol boat according to an example of the present invention.

FIG. 2 is a perspective view of the underwater inspection robot that is introduced into a space inside hull according to an example of the present invention.

FIG. 3 is a side view of the underwater inspection robot according to an example of the present invention.

FIG. 4 is a perspective view of the underwater inspection robot according to an example of the present invention.

FIG. 5 is a bottom perspective view of the underwater inspection robot according to an example of the present invention.

FIG. 6 is a front view of the underwater inspection robot according to an example of the present invention.

FIG. 7 is a perspective view showing the rear of the underwater inspection robot according to an example of the present invention.

FIG. 8 is an exemplary view showing the operation of an arm assembly according to an example of the present invention.

FIG. 9 is an exemplary view of an inspection module according to an example of the present invention.

FIG. 10 is a perspective view of an extended state of an extender assembly according to an example of the present invention.

FIG. 11 is an exemplary view of a joint according to an example of the present invention.

FIG. 12 is an exemplary view of a joint according to an additional example of the present invention.

FIG. 13 is a cross-sectional view of the joint according to an example of the present invention.

FIG. 14 is an exemplary view showing x-axial

movement of the inspection module according to an example of the present invention.

FIG. 15 is an exemplary view showing y-axial movement of the inspection module according to an example of the present invention.

FIG. 16 is an exemplary view showing diagonal movement of the inspection module according to an example of the present invention.

FIG. 17 is an exemplary view showing a type with pluralities of joints and watertight portions of the inspection module according to an example of the present invention.

[Best Mode]

In order to achieve the objectives described above, the configuration of the present invention provides an underwater inspection robot that includes: a robot module configured to clean the outer surface of a ship; and an inspection module mounted on the robot module to inspect the interior of a space inside a hull.

[Description of Embodiments]

Hereinafter, the present invention is described with reference to the accompanying drawings. However, the present invention may be modified in various different ways and is not limited to the embodiments described herein. Further, in the accompanying drawings, components irrelevant to the description will be omitted in order to clearly describe the present invention, and similar reference numerals will be used to describe similar components throughout the specification.

Throughout the specification, when an element is referred to as being "connected with (coupled to, combined with, in contact with)" another element, it may

be "directly connected" to the other element and may also be "indirectly connected" to the other element with another element intervening therebetween. Further, unless explicitly described otherwise, "comprising" any components will be understood to imply the inclusion of other components rather than the exclusion of any other components.

Terms used in the present invention are used only in order to describe specific exemplary examples rather than limiting the present invention. Singular forms are intended to include plural forms unless the context clearly indicates otherwise. It will be further understood that the terms "comprise" or "have" used in this specification specify the presence of stated features, numerals, steps, operations, components, parts, or a combination thereof, but do not preclude the presence or addition of one or more other features, numerals, steps, operations, components, parts, or a combination thereof.

Terms '~er', '~unit', '~module', etc. used herein mean the units for processing at least one function or operation and may be implemented by hardware, software, or a combination of hardware and software.

Further, in the specification, when a step is positioned "before" or "after" another step, this includes the same right as not only when the step and another step are in a direct time-serial relationship, but when they are in an indirect time-serial relationship in which the orders of the two steps may be time-serially changed such as mixing of the steps after the steps.

Hereinafter, examples of the present invention are described in detail with reference to the accompanying drawings.

FIG. 1 is an exemplary view of an underwater

inspection robot connected to a patrol boat according to an example of the present invention and FIG. 2 is a perspective view of the underwater inspection robot that is introduced into a space inside a hull according to an example of the present invention.

FIG. 3 is a side view of the underwater inspection robot according to an example of the present invention and FIG. 4 is a perspective view of the underwater inspection robot according to an example of the present invention.

FIG. 5 is a bottom perspective view of the underwater inspection robot according to an example of the present invention and FIG. 6 is a front view of the underwater inspection robot according to an example of the present invention.

FIG. 7 is a perspective view showing the rear of the underwater inspection robot according to an example of the present invention and FIG. 8 is an exemplary view showing the operation of an arm assembly according to an example of the present invention.

Referring to FIGS. 1 to 8, an underwater inspection robot 1000 may include a robot module 1100 and an inspection module 1200.

First, the robot module 1100 is configured to clean the outer surface of a ship and may include a main body 1110, wheels 1120, a recognizer 1130, a washing unit 1140, an arm assembly 1150, a cable 1160, and a sterilizer 1170.

The main body 1110 forms the body of the robot module 1100 and may be attached to the outer surface of a ship 10 to move on the surface of the ship 10. In detail, the main body 1110 may be connected with a patrol boat 20 by a connecting cable. Further, the main body 110 has a watertight function to be able to operate even under the

water.

In more detail, the main body 1110 may selectively include a first body 1111 and a second body 1112.

The first body 1111 may have an inclined surface on the front surface and the rear surface. In this configuration, the inclined surfaces may have inclination such that the height of the first body 1111 decreases forward and rearward and the front surface has a smaller inclination angle and a greater length than the rear surface.

The second body 1112 may be provided on the first body 1111 and the cable 1160 may be coupled thereto. In this configuration, a winding unit that can wind and unwind the cable 1160 may be formed in the second body 1112.

The wheels 1120 are disposed under the main body 1110 to be movable while being attached to the outer surface of the ship 10. In detail, the wheels may be provided in a magnet wheel or continuous track type to be movable on the surface of the ship 10 and may be provided in a pair.

The wheels 1120 provided in this way may provide a movement speed of 1 m/sec or less for the main body 1110 and may generate underwater towing force of 200 kgf or more.

The recognizer 1130 may be disposed inside the front surface of the main body 1110. The recognizer 1130 provided in this way is disposed to face the surface of the ship 10 and image and recognize the state of the surface state of the ship 10. In this configuration, the recognizer 1130 may be disposed on the front surface of the main body 1110 and inside a transparent plate not to be damaged.

The washing unit 1140 may be disposed at the lower

side of the front surface of the main body 1110 to discharge water at high pressure toward the surface of the ship. In this configuration, the washing unit 1140 may be provided also in a brush type other than the water discharge type. The washing unit 1140 provided in this way can remove marine organisms sticking on the surface of a ship.

In particular, the washing unit 1140 can remove marine organisms sticking in the space inside the hull 11 of the ship 10. In detail, a protective plate 12 may be provided in a lattice type with bars so that sea water can flow into the space inside the hull 11. The inspection module 1200 has to pass through the bars of the protective plate in order to pass through the gaps between the bars of the protective plate 12, but it is difficult to pass them when marine organisms are caught between the bars. Accordingly, the washing unit 1140 can remove marine organisms attached in the space inside the hull 11 to secure a passage that the inspection module 1200 can pass through.

The arm assembly 1150 is disposed on the front surface of the main body 1110 to control 3D (x-, y-, and z-axial) displacement of the cable 1160 coupled thereto, and may include rotary units 1151, an arm unit 1152, and a grab unit 1153.

The rotary units 1151 are provided in a pair at both sides of the front surface of the main body 1110 and may extend forward from the main body 1110. Further, the rotary units 1151 may be provided to be rotatable forward and rearward with respect to the main body 1110 on one ends coupled to the main body 1110.

The arm unit 1152 may extend in a bar shape such that both ends are respectively coupled to the other ends of the pair of rotary units 1151.

The grab unit 1153 may be coupled to the arm unit 1152 and can move in the longitudinal direction of the arm unit 1152. The cable 1160 extending from the second body 1112 of the main body 1110 may be coupled to the grab unit 1153. Further, a frame portion 1250 of the inspection module 1220 may be disposed under the grab unit 1153. In this configuration, the cable 1160 coupled to the grab unit 1153 may be inserted in the frame portion 1250 to extend along the frame portion 1250.

The y-axial displacement of the cable 1160 can be changed by rotation of the rotary units 1151 of the arm assembly 1150. In more detail, the y-axial displacement of the frame portion 1250 can be changed.

Further, it can be provided that the x-axial displacement of the cable 1160 can be changed when the grab unit 1153 is moved in the longitudinal direction of the arm unit 1152. In more detail, the x-axial displacement of the frame portion 1250 can be changed.

The arm assembly 1150 can primarily adjust the position where the inspection module 1200 is inserted inside the protective plate 12 of the space inside the hull 11.

The cable 1160 can connect the main body 1110 and the arm assembly 1150. In detail, the cable 1160 is wound in the second body 1112, extends from the upper portion of the second body 1112, and can be coupled to the grab unit 1153 of the arm assembly 1150. Further, the cable 1160 coupled to the grab unit 1153 may extend under the grab unit 1153 to be connected to the inspection module 1200.

The sterilizer 1170 is disposed on the rear of the main body 1110 and may be a sterilization lamp for removing marine organisms sticking on the ship 10.

FIG. 9 is an exemplary view of an inspection module

according to an example of the present invention and FIG. 10 is a perspective view of an extended state of an extender assembly according to an example of the present invention.

FIG. 11 is an exemplary view of a joint according to an example of the present invention, FIG. 12 is an exemplary view of a joint according to an additional example of the present invention, and FIG. 13 is a cross-sectional view of the joint according to an example of the present invention.

Referring to FIGS. 9 to 13, the inspection module 1200 can inspect the interior of the space inside the hull 11 and may include a detector 1220, an extender assembly 1220, a joint 1230, a watertight portion 1240, and a frame portion 1250.

The detector 1210 can detect the interior of the space inside the hull 11. The seachest 11 is merely an example of the targets that the detector 1210 images and the targets may include all of the internal spaces of a hull that are supposed to be imaged under the water.

In detail, the detector 1210 detects the underwater environment, and particularly, may be provided in a type that can detect abnormal items.

As an example, the detector 1210 may be a camera unit that can detect the interior of the space inside the hull 11. Further, the detector 1210 may be an infrared camera.

Meanwhile, the detector 1210 may further include a SONAR that transmits and receives ultrasonic waves.

The SONAR can derive a shape image of the interior of the space inside the hull 11 using the distance calculated over time from transmission to reception of ultrasonic waves.

Further, a separately provided inspection module

(not shown) can automatically search out abnormal items in the space inside the hull 11 by comparing an initial image of the shape of the designed space inside the hull 11 with the shape image derived by the ultrasonic module.

As an example, the inspection module can determine difference between the initial image and the shape image as suspicious regions and provide images of the suspicious regions to a user.

The SONAR can easily find out whether there are abnormal items in the space inside the hull 11 even when visibility is poor due to muddy seawater in the space inside the hull 11 and when it is difficult to know whether there are abnormal items from images.

The detector 1210 may be a LiDAR to be able to detect a distance by transmitting and receiving a laser.

The abnormal items described above refer to items that are artificially loaded into the space inside the hull 11 for the purpose of transportation and may include smuggled items such as drugs and firearms.

Further, the detector 1210 may have a water jet that can jet out high-pressure water. To this end, a hose (not shown) may extend from the robot module 1100 together with the cable 1160 coupled to the detector 1210 to be connected with the water jet. The water jet can assist in better detecting abnormal items by removing obstacles, including marine organisms, from the interior of the space inside the hull 11.

The extender assembly 1220 may be coupled to the detector 1210 such that the length is adjustable.

In detail, the extender assembly 1220 may include a first extender 1221 and a second extender 1222.

The first extender 1221 has the detector 1210 coupled to the end and may longitudinally extend in a rod shape.

The second extender 1222 may be coupled to the first extender 1221 in multiple stages and may be coupled to the end of the joint 1230.

The first extender 1221 can slide in the longitudinal direction of the second extender 1222 such that the entire length of the first extender 1221 and the second extender 1222 can be adjusted.

The joint 1230 is coupled to the extender assembly 1220 and can be bent.

In detail, the joint 1230 may include a joint body 1231, first cut surfaces 1232, second cut surfaces 1233, wire holes 1234, and a wire 1235.

The cable 1160 is inserted through the center in the joint body 1231 and the joint body 1160 may cover the outer surface of the cable 1160. Further, the joint body 1231 may extend in the longitudinal direction of the cable 1160. The joint body 1231 may be made of a flexible material.

The first cut surfaces 1232 may be formed with regular intervals on both sides of the outer surface of the joint body 1231. In this configuration, the first cut surfaces 1232 may be formed in elliptical shapes on the joint body 1231 by cutting and the first cut surfaces 1232 formed on both sides of the joint body 1231 may be connected with each other at the center portions.

The second cut surfaces 1233 may be formed on both sides of the joint body 1231 in a direction perpendicular to the first cut surfaces 1232. Further, the second cut surfaces 1233 may be formed at every middle portions of adjacent first cut surfaces 1232. In this configuration, the second cut surfaces 1233 may be formed in elliptical shapes on the joint body 1231 by cutting, and the second cut surfaces 1233 formed on both sides of the joint body 1231 may be connected with each other at the center

portions.

When the joint body 1231 bends, the first cut surfaces 1232 and the second cut surfaces 1233 can enable the joint body 1231 to quickly bend by reducing the resistance of water.

The wire holes 1234 may be formed on the center axes of the first cut surfaces 1232 and the second cut surfaces 1233. The wire holes 1234 may be holes with a size in which the wires 1235 can be inserted.

In this configuration, the wire holes 1234 are arranged with regular intervals around the cable 1160 and four or more wire holes may be formed.

In an example, for exemplifying, four wires holes 1234 are formed in the east, west, south, and north directions around the cable 1160.

A plurality of wires 1235 is coupled to the joint body 1231, and the bending direction and bending angle of the joint body 1231 can be adjusted by controlling the plurality of wires 1235.

Meanwhile, according to FIG. 12, the joint body 1231 of the joint 1230 may be formed with the outer surface is covered such that center portions of the first cut surfaces 1232 and the second cut surfaces 1233 are not connected with each other.

In detail, a joint cover 1235 may be further provided to cover the outer surface of the joint body 1231. The joint cover 1236 may be made of an elastic material such as rubber.

FIG. 14 is an exemplary view showing x-axial movement of the inspection module according to an example of the present invention.

As an example, referring to FIG. 14, when the detector 1210 is moved in one direction on the x-axis, a second wire 1235b contracts and a fourth wire 1235d

stretches, so the joint body 1231 can be bent toward the second wire 1235b.

Further, the extender assembly 1220 extends such that the detector 1210 can approach and detect abnormal items.

FIG. 15 is an exemplary view showing y-axial movement of the inspection module according to an example of the present invention.

For example, referring to FIG. 15, when the detector 1210 is moved in one direction on the y-axis, a third wire 1235c contracts and a first wire 1235a stretches, so the joint body 1231 can be bent toward the third wire 1235c.

Further, the extender assembly 1220 extends such that the detector 1210 can approach and detect abnormal items.

FIG. 16 is an exemplary view showing diagonal movement of the inspection module according to an example of the present invention.

Referring to FIG. 16, when the detector 1210 is moved diagonally between the first wire 1235a and the fourth wire 1234d, the first wire 1235a and the fourth wire 1235d contract, and the second wire 1235b and the third wire 1235c stretch such that the joint body 1231 can be diagonally bent.

In the plurality of wires 1235, the wires in the movement direction of the detector 1210 are contracted and the opposite wires are stretched, whereby it is possible to bend the joint body 1231 in desired directions.

The watertight portion 1240 may be coupled to the joint 1230 to be able to control the bending direction and the bending angle of the joint 1230.

In detail, the watertight portion 1240 may be

coupled between the joint 1230 and the frame portion 1250, and the cable 1160 may be inserted through it.

Further, the watertight portion 1240 is provided for waterproofness and may have an actuator that controls the plurality of wires 1235

FIG. 17 is an exemplary view showing a type with pluralities of joints and watertight portions of the inspection module according to an example of the present invention.

Referring to FIG. 17, pluralities of watertight portions 1240 and joints 1230 may be provided alternately between the extender assembly 1220 and the frame portion 1250.

When pluralities of watertight portions 1240 and joints 1230 are provided, the watertight portions 1240 control the bending angle of the joint 1230, whereby even though there is an obstacle, it is possible to avoid the obstacle and detect abnormal items.

The frame portion 1250 connects the watertight portion 1240 and the robot module 1100, and the cable 1160 may be accommodated therein.

According to the present invention described above, it is not necessary for divers to directly dive and inspect the interior of the space inside the hull 11, so it is safe.

Further, according to the present invention, since the inspection module 1200 can be introduced inside through the gaps of the protective plate 12, there is no need for work of removing and attaching the protective plate 12 and the time required for inspection can be reduced.

Therefore, according to the present invention, it is possible to quickly and safely inspect abnormal items loaded in the space inside the hull 11.

Although the present invention was described with reference to limited drawings, the above description is provided as an exemplary example of the present invention, and it should be understood that the present invention may be easily modified in other various ways without changing the spirit or the necessary features of the present invention by those skilled in the art. Therefore, the examples described above are only exemplary and should not be construed as being limitative in all respects. For example, the components described as single parts may be divided and the components described as separate parts may be integrated. Further, the techniques described above may be performed in a different order from the described method.

The examples described herein and the accompanying drawings are only exemplary for describing a portion of the technical spirit included in the present invention. The scope of the present invention is defined by the following claims, and all of changes and modifications obtained from the meaning and range of claims and equivalent concepts should be construed as being included in the scope of the present invention.

[Reference Signs List]

10: Ship
11: Space inside hull
12: Protective plate
20: Patrol boat
1000: Underwater inspection robot
1100: Robot module
1110: Main body
1111: First body
1112: Second body
1120: Wheel

1130: Recognizer
1140: Washing unit
1150: Arm assembly
1151: Rotary unit
1152: Arm unit
1153: Grab unit
1160: Cable
1170: Sterilizer
1200: Inspection module
1210: Detector
1220: Extender assembly
1221: First extender
1222: Second extender
1230: Joint
1231: Joint body
1232: First cut surface
1233: Second cut surface
1234: Wire hole
1235: Wire
1236: Joint cover
1240: Watertight portion
1250: Frame portion

[Claims]

[Claim 1]

An underwater inspection robot comprising:
a robot module configured to clean an outer surface of a ship; and
an inspection module mounted on the robot module to inspect a space inside hull.

[Claim 2]

The underwater inspection robot of claim 1, wherein the robot module comprises:
a main body forming a body; and
wheels disposed at the main body as a magnetic wheel or continuous track type to be movable on a surface of the ship.

[Claim 3]

The underwater inspection robot of claim 2, wherein the robot module comprises:
a recognizer disposed inside a front surface of the main body; and
a washing unit disposed at a lower side of the front surface of the main body to discharge water at high pressure toward the surface of the ship.

[Claim 4]

The underwater inspection robot of claim 2, wherein the robot module further comprises:
an arm assembly disposed on the front surface of the main body to control 3D (x-, y-, and z-axial) displacement of a cable coupled thereto; and
the cable connecting the main body and the arm assembly.

[Claim 5]

The underwater inspection robot of claim 4, wherein the arm assembly comprises:

a pair of rotary units disposed on the front surface of the main body to be rotatable forward and rearward with respect to the main body on one ends;

an arm unit extending such that both ends are coupled to the other ends of the pair of rotary units, respectively; and

a grab unit coupled to the arm unit to be movable in a longitudinal direction of the arm unit; and

the grab unit has the cable extending from the main body coupled thereto.

[Claim 6]

The underwater inspection robot of claim 5, wherein y-axial displacement of the cable is changed by rotation of the rotary units, and

x-axial displacement of the cable is changed when the grab unit is moved in the longitudinal direction of the arm unit.

[Claim 7]

The underwater inspection robot of claim 2, wherein the robot module further comprises:

a sterilizer disposed on a rear of the main body, and

the sterilizer is a sterilization lamp for removing organisms sticking on the ship.

[Claim 8]

The underwater inspection robot of claim 1, wherein the inspection module comprises:

- a detector detecting an interior of the ship;
- an extender assembly coupled to the detector such that a length thereof can be adjusted;
- a joint coupled to the extender assembly to be able to bend;
- a watertight portion coupled to the joint to be able to control a bending direction and a bending angle of the joint; and
- a frame portion connecting the watertight portion and the robot module and accommodating a cable therein.

[Claim 9]

The underwater inspection robot of claim 8, wherein the extender assembly comprises:

- a first extender having the detector coupled to an end; and
- a second extender coupled to the first extender in multiple stages and coupled to an end of the joint, and
- the first extender slides in a longitudinal direction of the second extender such that the entire length of the first extender and the second extender can be adjusted.

[Claim 10]

The underwater inspection robot of claim 8, wherein the joint comprises:

- a joint body extending such that the cable passes through a center therein; and
- a plurality of wires coupled to the joint body, and
- the bending direction and the bending angle of the joint are adjusted by controlling the plurality of wires.

[Claim 11]

The underwater inspection robot of claim 10, wherein

the joint further comprises:

first cut surfaces formed with regular intervals on both sides of an outer surface of the joint body;

second cut surfaces formed on both sides of the joint body in a direction perpendicular to the first cut surfaces and formed at every middle portions of adjacent first cut surfaces; and

wire holes formed on center axes of the first cut surfaces and the second cut surfaces, and

the wires are inserted in the wire holes.

[Claim 12]

The underwater inspection robot of claim 10, wherein the watertight portion is provided so that the cable is inserted therethrough and has an actuator controlling the wires.

[Claim 13]

The underwater inspection robot of claim 8, wherein the frame portion extends from the robot module to be coupled to the watertight portion and accommodates the cable therein.

[Claim 14]

The underwater inspection robot of claim 8, wherein the detector comprises any one or more of a camera unit that images an underwater environment, a SONAR that shows images through sound wave measurement, and a LiDAR that shows light as images.

[Claim 15]

The underwater inspection robot of claim 8, further comprising a water jet provided with the detector and being able to jet high-pressure water.