

AN UNDERWATER INTELLIGENT CLEANING ROBOT AND A SYSTEM THEREOF

Technical Field

[0001] The invention relates to the technical field of underwater cleaning robot, more specifically to an underwater intelligent cleaning robot and a system thereof.

Background

[0002] Structures in the underwater environment, such as hulls, aquaculture cages, offshore drilling platforms, port shorelines, floating wharves and water conservancy dams, etc. will adhere to shellfish and rust spots on their surfaces after long-term seawater immersion, which seriously affects the normal use function of underwater structures. Removing attached Marine life and debris helps to reduce the risk of Marine accidents, enhance stability and storm resistance, while reducing energy consumption and saving operating costs.

[0003] However, at present, the cleaning work of underwater structures is mostly manually cleaned by divers. Due to the influence of divers' diving environment and human body, on the one hand, the underwater environment is complex, and the safety risk of divers' underwater operation is high. On the other hand, the cleaning task of underwater structures cannot be quickly completed, and the cleaning quality cannot be verified when divers clean underwater. The acceptance of the cleaning effect is difficult. At the same time, most divers use the cleaning brush to clean the underwater structure, which will cause damage to the underwater structure and affect life.

[0004] With the development of underwater cleaning technology, there are also a small number of adsorption cleaning equipment on the market, which is attached to the surface

of the structure through the magnetic wheel, but this method is only suitable for the early stage of Marine biological attachment, the coverage is thin, the magnetic adsorption effect is not good in the case of thick biological attachment, large surge or large curved surface, the walking speed is not too fast, and the cleaning efficiency is not high. The adsorption cleaning equipment is only suitable for equipment with strong ferromagnetism, and cannot be applied to non-metallic ships, cages, bridges, dams and other structures.

[0005] Therefore, to provide an efficient and adaptable underwater intelligent cleaning robot and system is an urgent problem for technicians in this field.

Summary of the Invention

[0006] In view of this, the invention provides an underwater intelligent cleaning robot and a system capable of performing a rapid, comprehensive and thorough cleaning of surface attachments of underwater structures.

[0007] In order to realize the above purpose, a first aspect of the present invention provides an underwater intelligent cleaning robot comprising a frame, a buoyant device installed in the middle of the frame, a plurality of main thruster motors installed at the corners of the frame, a plurality of vertical thruster motors arranged on a top of the frame through a rotatable mechanism, a drive device installed at a bottom of the frame through a mounting base, a cleaning brush disk installed on an output shaft of the drive device, an acoustic speedometer and an inertial navigator positioned in a front portion of the frame; and a main control module installed on the frame, wherein the acoustic speedometer and the inertial navigator are electrically connected with the main control module, and the main control module is electrically connected with the plurality of main thruster motors, the plurality of vertical thruster motors and the drive device.

[0008] By adopting the above technical scheme, the beneficial effects of the invention are as follows:

The operation is flexible, the size of the construction surface can be carried out, the construction speed is fast, the construction time is saved, and the complex underwater conditions can be dealt with, the operation safety risks can be avoided, and the underwater structure surface attachments can be completely cleaned.

[0009] According to various aspects of the invention, each of the plurality of main thruster motors is installed on the frame through a motor fixed base, and each main thruster motor is movable between an angle of 0-90° from the front direction.

[0010] According to various aspects of the invention, the rotatable mechanism comprises four rotatable support seats fixed on the frame comprising two front rotatable support seats and two rear rotatable support seats, two first rotatable connectors rotatably connected to the two rear rotatable support seats, two second rotatable connectors rotatably connected to the two front rotatable support seats, a first rotatable connector shaft and a second rotatable connector shaft wherein both ends of the first rotatable connector shaft are respectively rotatably connected with the two first rotatable connectors and both ends of the second rotatable connector shaft are respectively rotatably connected with the two second rotatable connectors, a deceleration motor fixed on the frame, a first chain drive assembly and a second chain drive assembly, wherein the plurality of vertical thruster motors are respectively fixed on the extension ends of the two first rotatable connectors and the two second rotatable connectors, wherein an output shaft of the deceleration motor is connected with the first rotatable connector shaft through the first chain drive assembly and the first rotatable connector shaft is connected with the second rotatable connector shaft through the second chain drive assembly.

[0011] According to various aspects of the invention, the mounting base comprises a connecting frame, a fixed frame and a lifting hook, wherein the connecting frame is fixed with a bottom of the fixed frame,

[0012] According to various aspects of the invention, the drive device is installed on the fixed frame and the connecting frame, wherein one end of the lifting hook is installed at the bottom of the fixed frame, and the other end of the lifting hook is connected with the connecting frame through a connecting pin.

[0013] According to various aspects of the invention, an elastic buffer device installed between the fixed frame and the frame.

[0014] According to various aspects of the invention, each side of the frame is equipped with a light and a camera, wherein the light and the camera are in electrical communication with the main control module, wherein each corner of the frame is provided with wheels through a wheel fixing frame.

[0015] According to various aspects of the invention, a filter cover is installed on each of the plurality of main thruster motors and each of the plurality of vertical thruster motors.

[0016] According to various aspects of the invention, a lifting hook extends out of the buoyancy device on top of the frame.

[0017] According to various aspects of the invention, device distribution boxes are installed on the centre of the left and right sides of the frame.

[0018] According to various aspects of the invention, the buoyancy device comprises a bottom buoyancy device, a top buoyancy device, a rear buoyancy device and a front buoyancy device, wherein the bottom buoyancy device is installed in the middle position of the bottom of the frame, the top buoyancy device is installed in the middle position of the top of the frame, the rear buoyancy device is installed in the middle position of the rear side of the frame, and the front buoyancy device is installed in the middle position of the front side of the frame.

[0019] According to various aspects of the invention, cover plates are arranged between the left side of the bottom buoyancy device and the left side of the top buoyancy device, and between the right side of the bottom buoyancy device and the right side of the top buoyancy device.

[0020] According to various aspects of the invention, the acoustic speedometer is installed on the front side of the bottom of the frame through a fixed plate, and the inertial navigator is fixed on the fixed plate through an inertial navigator fixed base.

[0021] According to a second aspect of the invention, there is provided an underwater intelligent cleaning system comprising a ground station and an underwater intelligent cleaning robot as described in any of the first aspects of the invention, wherein the underwater intelligent cleaning robot is electrically connected with the ground station through a power supply device.

[0022] The beneficial effect of using the above further technical solution is to reduce the impact when the cleaning disc is in contact with the hull and provide a certain cushioning effect.

[0023] Further, each side of the frame is provided with a light and a camera, each of the light and each of the camera is electrically connected with the main control module, and each corner of the frame is provided with a wheel through a wheel fixing frame.

[0024] The beneficial effect of using the above further technical scheme is that the comprehensive cleaning effect can be detected in real time.

[0025] Further, a filter cover is arranged on each of the main thrust motors and each of the vertical thrust motors.

[0026] The beneficial effect of using the further technical solution mentioned above is to filter seaweed, rope and other objects in the water to prevent them from entering the motor's culvert and becoming entangled with the propeller, causing the motor to stall or other failure problems.

[0027] Further, the top of the frame is arranged with a lifting hook extending the buoyant device.

[0028] Further, the center of the left and right sides of the frame are arranged with a device distribution box.

[0029] The beneficial effect of using the above further technical solutions is that the access power or data can be converted by shunt to output multiple current or data signals and optimize the internal circuit layout of the robot.

[0030] Further, the buoyant device comprises a bottom buoyant device, a top buoyant device, a rear buoyant device and a front buoyant device, the bottom buoyant device is installed in the middle position of the bottom of the frame, the top buoyant device is installed in the middle position of the top of the frame, the rear buoyant device is installed in the middle position of the rear side of the frame, and the bottom buoyant device is installed in the middle position of the rear side of the frame. The front side buoyant device is installed in the middle position of the front side of the frame; Cover plates are arranged between the left side of the bottom buoyant device and the left side of the top buoyant device, and between the right side of the bottom buoyant device and the right side of the top buoyant device; The acoustic speedometer is installed on the front side of the bottom of the frame through a fixed plate, and the inertial navigator is fixed on the fixed plate through an inertial navigator fixed base.

[0031] An underwater intelligent cleaning system comprises a ground station and an underwater intelligent cleaning robot described above, and the underwater intelligent

cleaning robot is electrically connected with the ground station through a power supply device.

[0032] By adopting the above technical scheme, the beneficial effects of the invention are as follows:

The power supply equipment is used to power the underwater intelligent cleaning robot and carry out real-time data interaction and control the underwater intelligent cleaning robot to complete the task through the ground station.

Brief Description of the Drawings

[0033] In order to more clearly state the technical scheme in the embodiment of the invention or the prior art, the following is a brief introduction of the drawings required to be used in the description of the embodiment or the prior art. Obviously, the drawings in the description below are only embodiments of the invention. For ordinary technicians in the field, without creative labor, Additional drawings may also be obtained based on the drawings provided.

[0034] Figure 1 is a schematic diagram of the overall structure of an underwater intelligent cleaning robot according to various embodiments of the invention;

[0035] Figure 2 is a schematic diagram of the overall structure of an underwater intelligent cleaning robot according to various embodiments of the invention;

[0036] Figure 3 is a main view of an underwater intelligent cleaning robot according to various embodiments of the invention;

[0037] Figure 4 is a top view of an underwater intelligent cleaning robot according to various embodiments of the invention;

[0038] Figure 5 is an upward view of an underwater intelligent cleaning robot according to various embodiments of the invention;

[0039] Figure 6 is a structural diagram of the rotating mechanism according to various embodiments of the invention;

[0040] Figure 7 is a structural diagram of the mounting base according to various embodiments of the invention; and

[0041] Figure 8 is a structural diagram of an underwater intelligent cleaning system according to various embodiments of the invention.

Detailed Description

[0042] The following will be combined with the drawings in the embodiment of the invention, the technology in the embodiment of the invention.

[0043] The scheme is clearly and completely described, and it is obvious that the embodiments described are only a part of the embodiments of the invention and not all embodiments. Based on the embodiments of the invention, all other embodiments obtained by ordinary technicians in the field without making creative labor fall within the scope of protection of the invention.

[0044] As shown in Figure 1-8, the embodiment of the invention discloses an underwater intelligent cleaning robot, which comprises a frame 1, a buoyant device 2, a plurality of main thruster motors 3, a plurality of vertical thruster motors 4, a cleaning brush disk 5, a drive device 6, an acoustic speedometer 7, an inertial navigator 8 and a main control module 9. The frame 1 is preferably a metal frame including a standard round tube, square tube, rectangular tube, U-shaped iron, stainless steel plate welded, in order to ensure the structural strength, beautiful while minimizing the weight of the body, improve the movement performance of the robot. The frame 1 includes one or more of the following materials: 316L stainless steel, 304 stainless steel or titanium alloy, good corrosion resistance, high strength. The buoyant device 2 is installed in the middle of frame 1, within the frame range, and is used to provide buoyancy. The shape of buoyant device 2 is streamlined, which can reduce the resistance of the robot during navigation. A plurality of main thruster motors 3 are respectively installed at the corners of frame 1.

[0045] In the present embodiment, the number of main thruster motors 3 is four, in a vector arrangement; A plurality of vertical thruster motors 4 are installed on the top of frame 1 through a rotating mechanism 25; In this embodiment, the number of thruster motors 4 is four, each thruster motor 4 can rotate around any axis of X, Y, Z axis, or can rotate around any two or three axes of X, Y, Z axis at the same time, four main thruster motors 3 and four thruster motors 4 provide power for the robot. It can move forward and backward, turn left and right, move left and right, float up and dive down, pitch, roll, etc., to achieve a full range of three-dimensional vector motion, good maneuverability and high flexibility. The drive device 6 is installed at the bottom of the frame 1 through the mounting base 26. The cleaning tray 5 is installed on the output shaft of the drive device 6. The cleaning disk 5 is a modular design, and different types of cleaning disks can be replaced according to different tasks, including but not limited to wire brush disks, nylon brush disks and cavitation jet brush disks. In this embodiment, the number of cleaning disks 5 is two, which are located on the left and right sides of the frame 1, respectively, to achieve the cleaning effect. The wire brush on the cleaning brush disk 5 is arranged around the axis of the brush disk, and the number can be 4, 6, 8, 10, 12, etc.. An acoustic speedometer 7 and an inertial navigator 8 are installed on the front of the bottom of frame 1. The main control module 9 is installed on the frame 1. The main control module 9 mainly conducts data interaction and robot motion control decision-making with the ground station 10. The material can be aluminum alloy, stainless steel or titanium alloy. The acoustic speedometer 7 and the inertial navigator 8 are electrically connected with the main control module 9, and the main control module 9 is electrically connected with the main thruster motor 3, the vertical thruster motor 4 and the drive device 6, respectively. The acoustic speedometer 7 is measured by transmitting ultrasonic waves from the sensor probe, reflecting the object after it encounters the object, and receiving the reflected signal from the receiving probe, so as to measure the relative motion speed between the object and the transmitting probe. The inertial navigator 8 is the main sensing system which provides navigation information such as heading, attitude and depth for the underwater intelligent cleaning robot. The invention has the advantages of flexible operation, large and small construction surfaces, fast construction speed and time saving, and can cope with complex underwater working

conditions, avoid operation safety risks, and realize comprehensive and thorough cleaning of the attachments on the surface of underwater structures.

[0046] Specifically, each main thruster motor 3 is installed on the frame 1 through a motor fixed base 19, which is cut by U-shaped steel or rectangular tube, welded or fixed on the frame 1 by threaded connection. Each main thruster motor 3 is at an angle of 0-90° from the front direction, and provides thrust based on the front and back direction, rotation direction and side movement direction of the robot coordinate system. The number of thruster motors 4 is four, and the rotating mechanism 25 comprises four rotating support seats 251, two first rotating connectors 252, two second rotating connectors 253, the first rotating connecting shaft 254, the second rotating connecting shaft 255, the deceleration motor 256, the first chain drive assembly 257 and the second chain drive assembly 258. Four rotating support mounts 251 are uniformly fixed on frame 1. Two first rotating connectors 252 are respectively penetrated and rotationally connected on two rotating support mounts 251 located at the rear side. Two second rotating connectors 253 are respectively penetrated and rotationally connected on two rotating support mounts 251 located on the front side. Four vertical thruster motors 4 are fixed at the extended ends of two first rotating connectors 252 and two second rotating connectors 253 respectively. The two ends of the first rotating connecting shaft 254 are respectively fixed connected with two first rotating connecting pieces 252. The two ends of the second rotating connecting shaft 255 are respectively fixed connected with two second rotating connecting pieces 253. The gear motor 256 is fixed on the frame 1. The output shaft of the gear motor 256 is connected with the first rotating connecting shaft 254 through the first chain transmission assembly 257. The first rotating connection shaft 254 and the second rotating connection shaft 255 are connected by the second chain transmission component 258. With the motor as the power source and the chain transmission as the transmission mode, the tilt angle of the underwater propeller can be adjusted 360 degrees to change the direction of thrust, so as to achieve more accurate and flexible control and improve adaptability. Moreover, the four vertical thruster motors 4 can be controlled synchronously to make them rotate in the same direction, further improving the maneuverability and working efficiency of the

underwater intelligent equipment. In this embodiment, the first chain drive assembly 257 and the second chain drive assembly 258 have the same structure, including the driving sprocket, the driven sprocket and the driven sprocket are connected through the chain drive.

[0047] Specifically, the mounting base 26 comprises a connecting frame 261, a fixed frame 15 and a lifting hook 262, and the connecting frame 261 is fixedly connected with the fixed frame 15 at the bottom. In this embodiment, the connecting frame 261 is welded with standard square tube, rectangular tube and stainless-steel plate, which ensures the structural strength and aesthetics while minimizing the weight of the body and improving the movement performance of the robot. The materials for the connecting frame 261 is one or more of the following: 316L stainless steel, 304 stainless steel or titanium alloy, good corrosion resistance, high strength; The drive device 6 is installed on the fixed frame 15 or/and the connecting frame 261, and the driving mode of the cleaning brush disk 5. The drive device 6 may be hydraulic driven or electric driven. In the present embodiment, the drive device 6 comprises a hydraulic chamber 61, a hydraulic pump 62 and a hydraulic motor 63. The hydraulic chamber 61 is fixed on the top of the connecting frame 261. The hydraulic pump 62 is threaded with the hydraulic chamber 61. The hydraulic motor 63 is installed on the fixed frame 15. The hydraulic pump 62 is connected with the hydraulic motor 63. The cleaning brush plate 5 is connected with the output shaft of the hydraulic motor 63, and the motor in the hydraulic chamber 61 drives the hydraulic pump 62 to operate, producing hydraulic oil with a certain pressure and flow rate, thus controlling the rotation of the hydraulic motor 63, thus controlling the operation of the cleaning brush plate 5. One end of the hook 262 is installed at the bottom of frame 1, and the other end of the hook 262 is connected to the connecting frame 261 by connection pin 263. In the present embodiment, the hook 262 is made of 316L stainless steel with good corrosion resistance and is fixed to frame 1 by welding or threaded connection.

[0048] In particular, an elastic buffer device 202 is installed between the fixed frame 15 and the frame 1. In the present embodiment, the elastic buffer device 202 is an elastic buffer device 202 composed of a spring and a damper, which is used to connect the frame 1 and

the fixed frame 15 to reduce the impact when the cleaning brush plate 5 is in contact with the hull and provide a certain cushioning effect.

[0049] Specifically, each side of frame 1 is equipped with a light 11 and a camera 12, each light 11 and each camera 12 are electrically connected with the main control module 9, in this embodiment, the camera 12 and the light 11 are fixed on the polypropylene plate, and then through the polypropylene plate with the frame 1 to facilitate the observation of the target and the working effect; In addition, the camera 12 and the light 11 have a certain Angle with the polypropylene plate when they are installed downward, the Angle range is 0° - 90° , of course, the camera 12 and the light 11 can also be installed diagonally, and can be installed at an Angle with the front, the Angle range is 0° - 90° , and the surrounding environment can be observed in all directions through the multi-channel camera 12. Provide reference information for sports.

[0050] Specifically, each corner of frame 1 is installed with wheel 14 through a wheel fixer 13. In this embodiment, the wheel fixer 13 is made of 316L stainless steel with good corrosion resistance, symmetrically arranged on the four corners of frame 1, and fixed on the frame 1 of the robot by welding or threaded connection. The size of wheel 14 can be 6 inches, 8 inches, 10 inches, 12 inches and other common sizes, the material of wheel 14 can be nylon, rubber, polyurethane, PVC, metal, etc., and the connection between wheel 14 and wheel fixer 13 can be pin connection, thread connection, key connection, etc. In addition, an elastic buffer device composed of springs and dampers can also be installed between wheel 14 and wheel fixer 13 to reduce vibration during robot transfer or operation.

[0051] In order to further optimize the technical scheme of the invention, a filter cover is installed on each main thrust motor 3 and each vertical thrust motor 4, which is used to filter the seaweed, rope and other objects in the water to prevent them from entering the motor's culvert and entangling with the propeller, causing the motor to stop running or other problems.

[0052] In particular, the top of frame 1 is mounted with a lifting hook 16 extending a buoyant device 2. In the present embodiment, the lifting hook 16 is made of round or square steel bent in 316L stainless steel or 304 stainless steel and is welded or threaded to frame 1.

[0053] In order to further optimize the technical scheme of the invention, the center of the left and right sides of the frame 1 is installed with a device distribution box 17, which can output multiple current or data signals through shitter conversion to optimize the internal line layout of the robot.

[0054] Specifically, buoyant device 2 includes bottom buoyant device 21, top buoyant device 22, rear buoyant device 23 and front buoyant device 24, bottom buoyant device 21 is installed in the middle of the bottom of frame 1, top buoyant device 22 is installed in the middle of the top of frame 1, and rear buoyant device 23 is installed in the middle of the back of frame 1. The front side buoyant device 24 is installed in the middle of the front side of frame 1. In the present embodiment, the installation method is mounting by screws; Cover plate 18 is installed between the left side of the bottom buoyant device 21 and the left side of the top buoyant device 22, and between the right side of the bottom buoyant device 21 and the right side of the top buoyant device 22. In this embodiment, the material of cover plate 18 is carbon fiber, which covers the gap part of the robot while reducing weight, so as to prevent the robot from working. The impurities of the cleaned garbage enter the main body of the robot, causing the weight of the robot to increase and affecting the working efficiency of the robot; The acoustic speedometer 7 is mounted on the front side of the bottom of frame 1 through a fixed plate 20, and the inertial navigator 8 is fixed on a fixed plate 20 through an inertial navigator fixed base 201. In the present embodiment, the inertial navigator fixing base 201 is made of polypropylene or nylon, and the fixed plate 20 is made of 316L stainless steel, 304 stainless steel or titanium alloy.

[0055] The embodiment of the invention also discloses an underwater intelligent cleaning system, which comprises a ground station 10 and the above underwater intelligent cleaning

robot. The underwater intelligent cleaning robot is electrically connected with the ground station 10 through a power supply device 203. The power supply device 203 of the invention is used to supply power to the underwater intelligent cleaning robot and carry out real-time data interaction, and control the underwater intelligent cleaning robot to complete the task through the ground station 10.

[0056] Each embodiment in this specification is described in a progressive manner, and each embodiment focuses on its differences from other embodiments. The same and similar parts of each embodiment can be referred to each other. For the device disclosed by the embodiment, because it corresponds to the method disclosed by the embodiment, the description is relatively simple, and the relevant points can be described in the method section.

[0057] The above description of the disclosed embodiments enables persons skilled in the art to realize or use the invention. Various modifications to these embodiments will be apparent to those skilled in the art, and the general principles defined herein may be realized in other embodiments without departing from the spirit or scope of the present invention. Therefore, the invention will not be limited to these embodiments shown herein, but will conform to the widest range consistent with the principles and novel features disclosed herein.

CLAIMS

1. An underwater intelligent cleaning robot comprising:
 - a frame;
 - a buoyant device installed in the middle of the frame;
 - a plurality of main thruster motors installed at the corners of the frame;
 - a plurality of vertical thruster motors arranged on a top of the frame through a rotatable mechanism;
 - a drive device installed at a bottom of the frame through a mounting base;
 - a cleaning brush disk installed on an output shaft of the drive device;
 - an acoustic speedometer and an inertial navigator positioned in a front portion of the frame; and
 - a main control module installed on the frame, wherein the acoustic speedometer and the inertial navigator are electrically connected with the main control module, and the main control module is electrically connected with the plurality of main thruster motors, the plurality of vertical thruster motors and the drive device.
2. The underwater intelligent cleaning robot according to claim 1, wherein each of the plurality of main thruster motors is installed on the frame through a motor fixed base, and each main thruster motor is movable between an angle of 0-90° from the front direction.
3. The underwater intelligent cleaning robot according to claim 1, wherein the rotatable mechanism comprises:
 - four rotatable support seats fixed on the frame comprising two front rotatable support seats and two rear rotatable support seats,
 - two first rotatable connectors rotatably connected to the two rear rotatable support seats;
 - two second rotatable connectors rotatably connected to the two front rotatable support seats;

a first rotatable connector shaft and a second rotatable connector shaft wherein both ends of the first rotatable connector shaft are respectively rotatably connected with the two first rotatable connectors and both ends of the second rotatable connector shaft are respectively rotatably connected with the two second rotatable connectors;

a deceleration motor fixed on the frame;

a first chain drive assembly and a second chain drive assembly;

wherein the plurality of vertical thruster motors are respectively fixed on the extension ends of the two first rotatable connectors and the two second rotatable connectors;

wherein an output shaft of the deceleration motor is connected with the first rotatable connector shaft through the first chain drive assembly and the first rotatable connector shaft is connected with the second rotatable connector shaft through the second chain drive assembly.

4. The underwater intelligent cleaning robot according to claim 1, wherein the mounting base comprises a connecting frame, a fixed frame and a lifting hook,

wherein the connecting frame is fixed with a bottom of the fixed frame,

wherein the drive device is installed on the fixed frame and the connecting frame,

wherein one end of the lifting hook is installed at the bottom of the fixed frame, and the other end of the lifting hook is connected with the connecting frame through a connecting pin.

4. The underwater intelligent cleaning robot according to claim 4, further comprising an elastic buffer device installed between the fixed frame and the frame.

5. The underwater intelligent cleaning robot according to claim 1, wherein each side of the frame is equipped with a light and a camera, wherein the light and the camera are in electrical communication with the main control module, wherein each corner of the frame is provided with wheels through a wheel fixing frame.

6. The underwater intelligent cleaning robot according to claim 1 or 2, wherein a filter cover is installed on each of the plurality of main thruster motors and each of the plurality of vertical thruster motors.

7. The underwater intelligent cleaning robot according to claim 1, further comprising a lifting hook extending out of the buoyancy device on top of the frame.

8. The underwater intelligent cleaning robot according to claim 1, further comprising device distribution boxes installed on the center of the left and right sides of the frame.

9. The underwater intelligent cleaning robot according to claim 1, wherein the buoyancy device comprises a bottom buoyancy device, a top buoyancy device, a rear buoyancy device and a front buoyancy device,

wherein the bottom buoyancy device is installed in the middle position of the bottom of the frame, the top buoyancy device is installed in the middle position of the top of the frame, the rear buoyancy device is installed in the middle position of the rear side of the frame, and the front buoyancy device is installed in the middle position of the front side of the frame.

10. The underwater intelligent cleaning robot according to claim 9, further comprising cover plates arranged between the left side of the bottom buoyancy device and the left side of the top buoyancy device, and between the right side of the bottom buoyancy device and the right side of the top buoyancy device.

11. The underwater intelligent cleaning robot according to claim 1, wherein the acoustic speedometer is installed on the front side of the bottom of the frame through a fixed plate, and the inertial navigator is fixed on the fixed plate through an inertial navigator fixed base.

12. An underwater intelligent cleaning system comprising a ground station and an underwater intelligent cleaning robot as described in any one of the claims 1-11, wherein

the underwater intelligent cleaning robot is electrically connected with the ground station through a power supply device.