Design and Fabrication of an Underwater Robot for Boat Propeller Blade Algae Detection and Removal

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February 20, 2023

DESIGN AND FABRICATION OF AN UNDERWATER ROBOT FOR BOAT PROPELLER BLADE ALGAE DETECTION AND REMOVAL

– A REVIEW

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ABSTRACT:

You should clean your boat regularly to keep it free of problems and repairs. A boat propeller is a mechanical device with a shaft with angled blades attached. Propellers should be carefully inspected during underwater maintenance. Damaged propellers can affect the performance of the boat. If you find any damage, you should contact repair service to resolve the issue. To enhance the performance of the boat you must use the right propellers. A boat propeller is a mechanical device with shafts having angled blades fixed in it. with the help of this robot we can monitor the propeller shaft without the help of human.detection of the boat propeller and in present of algae its remove. In this study, we have used the sensor fusion technologyas a basis to develop a multi-function unmanned surface vehicle (MF-USV) for obstacle avoidance,water-quality monitoring, and water surface cleaning. The MF-USV comprises, a water surface cleaning system, a communication module, a power module, and a remote human–machine interface.

1. INTRODUCTION:

In recent years, besides other land based robots various kinds of underwater robot have been designed, constructed and developed by many interested researchers. The important part of this project is every parts of this robot have to be waterproof and it maintaining .the boat propeller blades conditions.[1] This paper is proposed to investigate the current state of art about underwater autonomous and dexterous operation robot, underwater autonomous environmental perception, underwater vehicle-manipulator system modeling and coordinated control, target uninjured grasp.[2], an extensive bibliography covering research results in the field of control algorithms is presented, including low level motion control, high level kinematic control and motion planning schemes along with the implementation issues.[3]Bionic amphibious robots are receiving attention and significant interest from the civil and military sectors since they can move on land and swim underwater. When developing a bionic amphibious robot, there is diverserange of underwater and land locomotion methods.[4]The Control system is the core and crucial component to repeat smooth air-water transitions for HAUV. The dynamic model and cross-domain motion control of HAUV under the complex sea state with the wind and wave.[5]An autonomous underwater robot was proposed and tested for early detection The robot's mission is not

just to monitor the detailed structure of oil and gas plumes within the water column.[6] In this article, we describe a bio-inspired underwater snake robot equipped with a passive tail (tail) fin. . In particular, his USR configuration is presented, which is flexible enough to move both on land and in water.[7]The application of underwater robot technology in ship cleaning not only frees divers from engaging in heavy work but also creates safe and efficient industrial [8] We used sensor fusion technology as a foundation for developing a multifunctional .

[9] Underwater is a term used to describe areas submerged in natural features such as seas, oceans, and lakes. This overview describes biofouling in or occurring in water. The purpose of this study was to investigate the benefits of underwater surface cleaning. [10] Underwater cleaning is based on the cavitation effect and is used for qualitative and rapid destruction and removal of marine vegetation of any thickness. If the water tank inside the car is splashed with water, it will collide, and if the water tank outside the car is splashed with water, the car will be flooded. Various forms of underwater vehicles are being developed in different fields of robotics. An electrical system has been developed for a spherical underwater robot.

A remote human–machine interface. [1]the medium range, with complicated background, low contrast and geometric deformation of the image. Secondly, The vehicles will confront with the disturbance from oceanic current, coupling forces and restoring forces from manipulators.[2] It provided a survey of the use of manipulation technology for a variety of sub sea intervention and inspection operations within different offshore areas of application. Both systems have been analysed.[3] Recently, bionic structures, bionic materials, and other cutting-edge research achievements have been applied to bionic amphibious robots, and their excellent performances have shown broad application prospects.[4] the cross-domain motion control algorithm should be applied to the solid platform of the multi-mode amphibious vehicle to carry out experimental verification of cross domain motion control under natural conditions.[5] An autonomous underwater robot SOTAB-I for tracking and monitoring of sub sea plumes after seabed oil spill and gas leak. We found that the proposed system using an under water autonomous robot is as well as oceanographic data and water. [6] the bioinspired underwater snake robot Mamba to enable

comparisons of its performance with and without a passive caudal fin.[7] underwater cleaning techniques and the comparison and analysis of different types of cleaning devices.[8] The architecture of the proposed MF-USV comprises the main control unit, locomotion module, positioning module, obstacle avoidance module, water quality monitoring system, water surface cleaning system, communication module, power module.[9] Brush-based cleaning technology is the most widely used for submersible cleaning of surfaces and its productivity is higher than others (200 m2/h to 1000 m2/h), but these systems It is possible to completely remove biofouling from surfaces that have been shown otherwise [1, 12, 21, 22, 23, 24]. [10] The plant is unique in the way its enviormental firendliness is achived passive voice. The whole principle is based on the recycled water that act as working cleaning agent. The first AUV was developed in 1957 at the University of
Washington's Applied Physics Laboratory by Stan Murphy, Bob Francois and later Terry Ewart. The "Special Purpose Underwater Research Vessel" or SPURV has been used to study dispersion, sound transmission, and underwater growth.

CLEANING DEVICES AND METHODS:

Manual Hull Cleaning:

Manual cleaning of biofoulingsurfaces is usually done in small containers. B. Pleasure yachts and small fishing vessels. Remove biofouling organisms using a cloth, brush, or scraper, depending on the amount and nature of the biofouling (slime, biofilm, seaweed, crusting organisms, etc.) and the type of antifouling agent applied or it is impossible for a diver to perform cleaning manually. Removes all marine life from the hull. A survey of the extent of biofouling remaining on the ship's rudder, propeller, stern tube and struts was conducted before and after manual cleaning. A professional diver from a cleaning company scrubbed off the biofouling with a hand brush, but approximately 40% of the species remained in the study area after cleaning.

Powered Rotary Brush Cleaning Systems:

Particularly for large vessels, underwater cleaning methods are gradually evolving from manual operations to mechatronic devices. Developed hand cleaners, large vacuum cleaners, and cleaning robot systems. Larger brush instruments can generally be used to quickly clean flat or slightly curved hulls, while smaller brushes can be used for better results when cleaning propellers (Davidson (2008; Hopkins et al. 2009). Large rotating brush units can be fitted with single, double or multiple brushes driven by hydraulic motors.

Unpowered Cleaning Brush:

Brushes are used all the time to remove debris from ship surfaces. Generally, different types of brushes are used, depending on the type of biofouling to be removed and the color of the container. Nylon brushes can be used to clean a certain thickness of mud and seaweed on the hull, and steel brushes can be used to clean barnacles, heavy grass, and zebra shells.Depending on the hull construction material, You should choose a suitable cleaning brush. For example, nylon or non-metallic brushes are used for vessels constructed of fiberglass, wood, aluminum, and steel, and metallic brushes are used for vessels constructed of aluminum or steel. Many companies such as Armada Systems, Inc. (www.armadahull.com), Subsea Industries (www.subind.net), Phosmarine Brush Kartetc

(www.brush-kart.de) are working on the popular underwater vessel cleaning equipment I
made it. Using Armada Systems, Inc. as an example, we investigated representative rotating brush products.

Powered Rotating Devices:

Manual rotary brushing device can be divided into single brush head, double brush head and multi brush head. The electric rotating device generates an attracting force as the brush unit rotates, causing the brush unit to adhere to the hull.It is adjustable to the driver the cleaning . In addition to hydraulic brushes, electric devices are used in underwater robots. Companies focused on developing marine cleaning equipment such as Armada Systems, Inc. and Subsea Industry use a variety of brushes to remove marine organisms adhering to submerged hulls and attach them to various hulls. We manufacture a number of powered rotary devices that adjust coatings by hand.

Contactless Underwater Cleaning Method:

Cleaning or maintenance of vessels, ships or structures. B. Vessels and oil platforms commonly include cleaning methods using brushes, scrapers, and other abrasive means (Cioanta and McGhin 2017). These processes can damage welds, rivets, and protrusions in water tanks or underwater structures, compromising their mechanical integrity. Current cleaning or maintenance methods are not thorough enough, leaving behind biofilms that provide substrate and contain nutrients that various marine organisms use for growth and anchorage (Cioanta and McGhin 2017). Here, we mainly introduce non-contact cleaning
methods and equipment such as high-pressure water jet method, cavitation water jet method, and ultrasonic cleaning method.

Using these cleaning techniques to remove biofouling from hulls can reduce damage to coatings compared to rotating brushes (Morrisey and Woods 2015).

High-pressure Water Cleaning Jets:

High-pressure water washing relies on unique impact forces to remove biofouling from the hull. A high working pressure results in a good cleaning effect (Albitar et al. 2016). Some researchers have used high-pressure water techniques for underwater hull washing (Osaka and Norita 2014; Smith and Colvin 2014; Chen et al. 2017; Hua et al. 2018; Yang et al. 2019). If the slime layer is safely removed with adequate water pressure, the impact on the hull coating is minimal (Floerl et al. 2010). Her HullWiper (HullWiper, https://www.hullwiper.co/), shown in Figure 6a, cleans the hull while removing biofouling removed from the vessel rather than discharging it directly into the water. Collect. The latter carries the risk of seed spreading. HullWiper uses local water as the hull cleaning medium, spraying high pressure water up to 50-450 bar onto the hull to remove biofouling at up to 1500 m2/h. The Magnetic Hull Crawler (Cybernetix, www.cybernetix.fr) vehicle shown in Figure 6b is a remote control system dedicated to inspection, cleaning and maintenance of ships, offshore floating units and the offshore oil and gas industry. Over 10 years. Magnetic Hull Crawlers use high pressure nozzles up to 1000 bar and are available with a variety of nozzle openings and angles of attack. The system's underwater cleaning width is 500mm, and the cleaning efficiency reaches 100-200m2/h. Hana et al. (2018) designed an in-transit hydroblasting system that uses high-pressure water cleaning jets to prevent hull biofouling.

Cavitating Water Cleaning Jets:

Cavitation water jet technology is an improved version of high pressure water cleaning technology that uses specially designed nozzles that convert high pressure water into cavitation water . A cavitation jet introduces cavitation into high pressure pure water. This is very aggressive and improves hull cleaning. The number of bubbles in cavitation water can be increased by improving the nozzle design. When the air bubbles get close to the hull, they burst, creating very high local stresses and increasing cleaning power. This feature is a significant advantage over conventional high pressure water jet nozzles operating at the same
pump pressure. Many companies are developing jet nozzles and cleaning equipment/systems based on cavitation water jet technology to enable efficient underwater cleaning. Using CaviJet International as an example, we examined typical cavitation waterjet products, jet nozzles, and cleaning equipment manufactured by Cavi-Jet International. Cavi-Jet International offers a variety of hull cleaning systems, from handheld to diver-powered vehicles. Divers use the Cavi-Jet gun to clean complex surfaces of various shapes and areas that are difficult to reach with large cleaning equipment. The Cavi-Jet Water & Sand Blast Gun is specifically designed for removing stubborn marine debris from ship hulls. With a pump capacity of 25-35 MPa, these Cavi-Jet guns can handle up to 50-100 m2 of hard algal, crustacean and mussel growth or 100-250 m2 of soft barnacle and mussel growth per hour. increase. The Cavi-Jet Nozzle is used to clean flat and slightly curved surfaces of the hull and is equipped with a suction system to adhere to the hull to be cleaned. A Cavi-Jet robot can be remotely controlled to clean slightly curved hull surfaces at high speed.

IMAGE PROCESSING AND DEFECT DETECTION:

Image processing and error detection Images are the information carrier of image processing. Image processing and analysis are key techniques for automatically understanding hardwarecaptured images in visual recognition systems . Image processing has a long history. In the 1920s, the first images were successfully transmitted from London to New York via submarine cables using digital compression technology. This is the origin of digital image
processing technology . Initially, simple error detection could be achieved using primitive filter methods. For example, Ejiri et al. Described how to detect defects in complex patterns such a using two-dimensional nonlinear logic filtering. Copyright 2015, SAGE Publications International Journal of Precision Engineering and Manufacturing - Green Technology1 3as PCB. Complex patterns of errors can be detected in real time. Next, Hara et al. Proposed an algorithm for comparing the local features of an inspected sample with those of a reference sample, intended for application in automated PCB inspection systems. Today, with the development of computer technology and mathematical theory, image processing and analysis methods are becoming more popular and advanced. The flexible configuration of modern manufacturing systems allows quick changeover from one product to another . Traditional machine learning requires designing complex feature extractors for specific cases to obtain the desired features. Additionally, new products exhibit complex texture patterns and intensity variations, and surface defects can come in all sizes, orientations, and shapes. Therefore, in complex surface scenarios or dynamic processes, manually designed features can lead to poor or unsatisfactory inspection performance. A major advantage of deep learning compared to traditional machine learning is that these rich features are not designed by human engineers, but are automatically learned from raw data by convolutional neural networks . Deep learning has proven to be very good at discovering complex structures in high-dimensional

data . Therefore, deep learning for defect detection by machine vision systems based on image processing technology can play an important role in ushering in the era of intelligent machine vision recognition.

3.0 CONCLUSION:

The main result of this project is the creation of a robotic system that monitors the boat's propeller rudder. Propellers and technology are analyzed under different conditions to test the technology. This project may be published as a paper and may even be patented as a new technology. The main result of this project is the creation of a robotic system that monitors the boat's propeller rudder. Propellers and technology are analyzed under different conditions to test the technology. This project may be published as a paper, and may be patented as a new technology.

The main conclusions are:

1. Observe conditions such as propeller hydrodynamic roughness
2. From the image processing technology, any material presented to the propeller can be observed.

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