SURFACE MORPHOLOGICALLY INTELLIGENT UNDERACTUATED ROBOT FOR UNDERWATER HULL CLEANING

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ABSTRACT

The abstract should briefly describe the objective, methodology, results and conclusions of the research. Emphasize the innovation of using morphologically intelligent and less active mechanisms in underwater hull cleaning.

In this paper we discuss a new type of robot For underwater hull cleaning on non-magnetized ships. Helm. This robot is based on the concept of cleaning hulls regularly, without waiting to take them out of the water, will improve the efficiency of ships and allow Reduction in use of commonly used chemicals Employed to prevent the growth of marine life on the hull and which are generally harmful to the environment.

The robot described in this paper is less active morphologically adapted robots that through a suitable Using Morphology and Powers and Constraints Solves the toughest problems that arise in the environment When moving with rudders. Some of these are changing Negotiating aircraft, appendages, avoiding portholes, passing corners, and other elements.

Key word: Surface Morphological Intelligence Underactuated Robotics, Hull Cleaning Robot Underwater Robotics, Non-Destructive Cleaning Artificial Intelligence (AI).

1. INTRODUCTION:

Discuss the importance of maintenance of ship hulls, the challenges involved in underwater hull cleaning and the need for effective robotic solutions.

One of the most important and often expensive ships Maintenance operation is cleaning of the hull. Over time, the ship Hulls are prone to barnacles, algae and other marine attacks life. This bio fuel grows very fast leading to two Various problems: from environmental point of view, This, along with ships' ballast water, Main route of introduction of aquatic invasive species. (AIS) in the local environment of ships' locations From a hydrodynamic point of view, fouling Increases drag, which reduces the speed of the ship. These reductions can be up to 10%, leading to increase in fuel consumption, which, according to some Figures may range from 30% to 40%.

➢ 1.1Methodology

Mechanical design describe the structure of the robot, focusing on its less active elements and how morphological intelligence is integrated into the design. Control System Explain the control algorithms used, emphasizing how they take advantage of the physical structure of the robot to achieve efficient movement and cleaning. Simulation and Modeling: Outline the simulation tools and models used to test robot performance prior Implementation .Prototype Development: Describe the process of building the prototype, including materials used, manufacturing techniques, and assembly. Test Environment: Describe the conditions under which the robot was tested, including tank testing, real-world scenarios, or computational simulations

2.ROBOT DESIGN

The conceptual design of the robot has been taken Keeping in mind when it should take effect Submerged surfaces of boat hulls can be cleaned Made of any material, magnetic or nonmagnetic. It is also assumed that these surfaces can be either flat or are curved and they may exhibit sudden changes their orientation. Robots must be able to heal themselves Move across these surfaces and overcome any obstacles Present. It should also be able to be changed to different passing over the edges dividing the two working surfaces Surfaces even in cases presenting high slope changes For example when full or fin keels are present.

2.1 MECHANICAL DESIGN

A double articulation is used to connect each module Stiff arm. With this configuration, two different Relative rotational motion between connecting arms and each

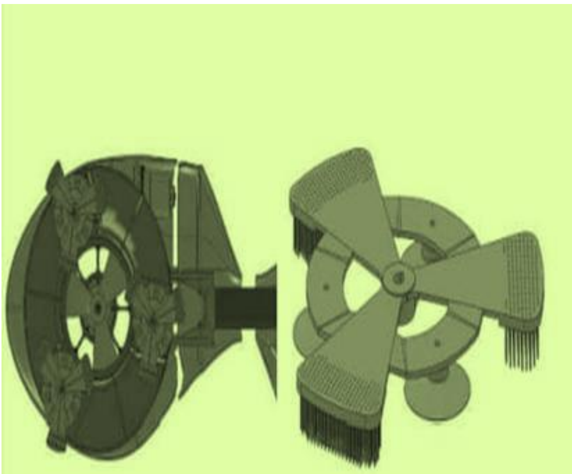

Figure: 3 CLEANING DEVICE

4.MERITS

Cost Effective: Fewer components With fewer actuators, the total cost of manufacturing, maintaining, and repairing the robot is lower. This could make hull cleaning more economically viable for ship operators.

Energy efficiency: Low Actuation Requirements: Low actuation robots have fewer actuators than degrees of freedom, reducing power consumption. This makes them more energy-efficient, which is important for extended underwater operations.

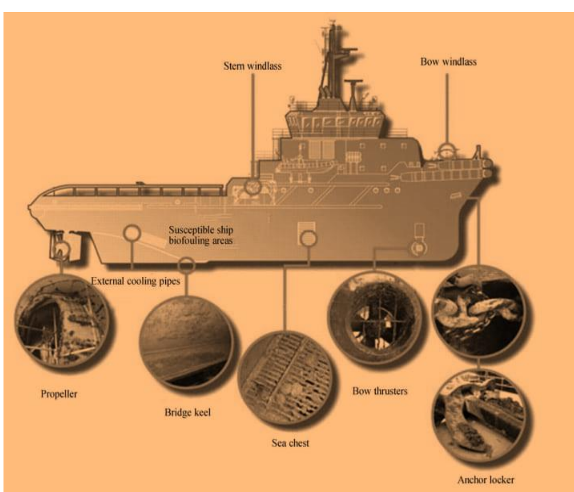

Figure:4 Marine foulingorganisms attach to all subsurfacestructures of the typical ship

5.CONCLUSION

In this paper we present the design and operation of a Unique design of a robot that is built to perform Cleaning of non-magnetic and complex ship hulls. We have designed a robot that can move around Obstacles on the hull as well as changes from one surface to another Another one with a different orientation in a very simple way Manner.

In this way, by Keeping this in mind its actuators are being adequately utilized Passive spring element and its positions environment, it can be controlled to clean Working in quite complex circles in addition to overcoming them accidentally be coming detached from the rudder

We present a design strategy based on ideas Regarding morphologically intelligent robots Environment Or Stare Adaptation Of robotic Morphology and control. Additionally, we address Economy of operation principle by considering a Under actuated robot with very small number of actuations .

Elements that occur through interaction with their environment Capable of meeting all job requirements.

In fact, it can even be placed on the hull to clean itself, simplifying its use on recreational vessels. the robot has Designed and tested and the results obtained are quite good Promising.

REFERENCE(S)

[1] Floret, Oliver, et al. "Review of bio security and contaminant risks associated with in-water cleaning."Australian Department of Agriculture, Fisheries and Forestry (2010).

[2] "Underwater ship husbandry discharges." United Stated Environmental Protection Agency. Office of Wastewater Management .November

[3] Bohlander, Jerry. "Review of options for in-water cleaning of ships". MAF Bio security New Zealand,

[4] K..Vickery, "Acoustic Positioning Systems: A Practical Overview of Current Systems", Proceedings Of The 1998 Workshop on Autonomous Underwater Vehicles (AUV'98), 1998, pp. 5-17

[5] Pfeifer y Bonnard, (2007), "How the Body Shapes the Way we Think".MIT Press.

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