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MATSYA - THE ROBOTIC FISH

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Abstract

Matsya is built on the basis of bionics and hydromechanics theory, it is more than a technical robot driven by the tail fin & pectoral fin, by which it can moderate and control the direction of the movement. The Tail fin driven technology is based on reversed "*Von Karman Vortex Street Theory*" from fluid dynamics, which is responsible for repeating pattern of swirling vortices caused by the fluctuating split of the flow of a fluid around blunt bodies. It is different from traditional underwater drone, it can also be used as stealth weapon. This robot features automated balance, obstacle avoidance, GPS tracking, infrared full HD camera, Matsya presents you the best view for underwater world. Matsya gives real feel of a fish because its body is wrapped with the silicon based material. You can experience the underwater world for 14-16 hr. because of its long battery life.

Index Terms: *Hydromechanics Theory, Tail fin, Von Karman Vortex Street Theory, Silicon Material.*

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1. INTRODUCTION :-

Engineers and biologist have long been interested in how aquatic organisms are propelling themselves through water with high efficiency. with advancement in mechanical and mechatronics research in the few years of biomechanics have been an active research area many biomechanics technologies have been created to help humans; for example *"Von Karman vortex street theory"* to generate thrust and "Penguin's hand" for power assistance and direction controlling. Fish seen as a model organisms for understanding locomotive patterns underwater fish are able to move efficiently due to hydrodynamic shape of fish body reduces drag and turbulent flow while kinematics produces thrust for movement. The marine vessels have not yet reach a level of efficiency in proportion mechanism. Matsya is produced to have a better fish swimming propulsion followed by structure and materials, actuator and controllers comparatively used in the past.

In the past few years unmanned underwater Drone made use of propeller, which fills the underwater territory with unpleasant – making it impossible for a Drone to operate silently in the ocean near fishes & which can't capture the natural pictures of the underwater world. The traditional underwater drones are unsafe because of propeller. They are difficult to use because they were controlled by a wire. They have short battery life. To overcome this problems we designed "The Matsya" in which we use tail fin instead of propeller, which fills the underwater territory with pleasant making it possible for the robot to operate silently in the ocean near fishes & which can captures the underwater world. The Matsya can operate wirelessly.

1.1 UNDERWATER ROBOT

Matsya is type of underwater robot fish, that disguise the surrounding and looks similar to other types of fishes and is difficult to identify the robot, as it is covered in a silicon based material that has the exact look and feel as the real fish.
It will be the most agile water fairy, no matter how complex the underwater environment is, it can easily shuttle back and forth in the coral reef with automated obstacle avoidance by the help of infrared ray. This robot has an absolute control algorithm to keep stable in water, this allows it to be prepared for the endless water world any time. You can customize its route as per your preference. Anxious about losing the robot, the robot has a mini satellite control system with a range of 8 - 10 KM.

1.2 WHY DID WE CREATE MATSYA?

Till now the traditional underwater drone where having a propeller, due to which the territory is filled with noise, and operating quietly is difficult.
Disadvantages of a propeller-propelled underwater drone

1. Short battery life
2. Difficult to maneuver
3. Noisy
4. Unsafe
5. Creates unwanted vibration

We see the fish, a creature that enjoys 80 percent of the secrets of the aquatic life on this planet, and to capture the unseen secrets of this oceans we need a robot that can be an eye for humans to have a research on the unseen aquatic life. This robot allows us to freely roam in the oceans without disturbing the marine life. Threats to security are often hidden in underwater locations or discarded evidence as well as contraband traveling on ships explosive places to cause destruction. Matsya offers a safer view of threats an evidence that is hidden beneath the waves without jeopardizing divers safety. This robot will be helpful in environmental research and to survey our oceans for evidence. To lower the risk for divers to perform difficult dives that can prohibit environmental organizations. Matsya provides a cost-effective alternative to make use of grants and funding.

1.3 FISH SWIMMING PROPULSION

There are two categories of fish swimming propulsion, which are caudal fin (CF)locomotion, and paired fin (PF) locomotion. CF and PF swimmers differ from the parts used in swimming. CF swimmers bend their bodies backward and move propulsive waves that extend to their caudal fin, whereas PF swimmers use their median and pectoral fins. Both CF and PF swimmers are further differentiated by two different movement characteristics; undulatory motion and oscillatory motion. The undulatory motion involves the passage of a wave along the propulsive structure, whereas the oscillatory motion involves a part of propulsive structure, which swings back and forth on its base without producing a wave formation, as shown in Figure. Fish are mostly CF swimmers since almost 85% of fish families are CF swimmers.

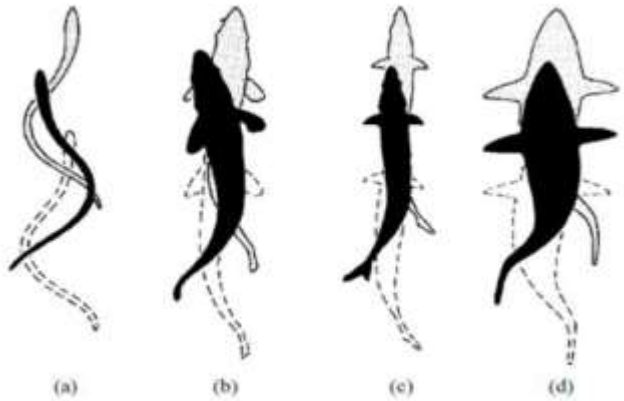

Figure :- CF swimming mode; (a) Anguilliform (b) Subcarangiform (c) Carangiform (d) Thunniform

The locomotion of CF swimmers can be categorized into several modes, which are distinguished by the thrust generated, wavelength and amplitude, and envelope of the propulsive wave. Five modes have been identified which are Anguilliform, Subcarangiform, Carangiform, Thunniform and Ostraciiform, as shown in Figure.
In Anguilliform mode, large amplitude fluctuation are produced by the whole body, and at least one complete wavelength of the propulsive wave appears along the body. Anguilliform swimmers can swim forward or backward by changing the direction of propulsive wave propagation, which is a unique characteristic. Subcarangiform is similar to Anguilliform, but its motion is limited anteriorly and is increased in half of the posterior body. Carangiform swimming mode is even faster.

2. FEATURES OF MATSYA

Matsya is the underwater robot fish that applies the technology of infrared rays and features as follows -

- Automated Obstacle Avoidance:-

Until now many industries are using robots due to their high level of performance and accuracy and which is a helping hand for human beings. The obstacles avoidance system is used for detecting obstacles and preventing crash. This is an automatic robot. The design of obstacle avoidance robot requires the combine work of many sensors according to their task. The obstacle detection is primary requirement of this automatic robot. The robot gets the information from neighboring area through mounted sensors on the robot. Some sensing devices used for obstacle detection like impact sensor, infrared sensor, ultrasonic sensor etc. Ultrasonic sensor is most suitable for obstacle detection and it is of low cost and has high ranging capacity.

- Build-In GPS :-

GPS tracker allows you to never lose your robot and track of anything by working out exactly where it is. Its an ultimate device to prevent your robot from being stolen, have an eye on the route of your robot over its journey, or even to monitor high-valued assets in transit. Latest trackers available on the market can work in different ways. While some other tracking systems store data locally, for example, on an SD card and others can send this information via modem to a centralized database regularly or at specific times upon request. Some even support large colour map displays to analyse this data. GPS trackers have improved in terms of size, power and intensity with methods to correct errors in measurement and advanced signal transmitting techniques.

- Wireless Controlling :-

In this robot we have used a latest wireless controller having a long range for better controlling, Matsya can be fully controlled by remotlessly by the use of mini satellite by using a long range transmitter and receiver in the water the wireless controlling becomes less easier. By using a wireless system we do not have to be near the robot which can be disturbing to the aquatic life.

- Long life battery :-

For the long battery life in Matsya we have used the maxoak battery of 50000 mah capacity. This battery can run for approximately 10 – 12 hours the features of battery are as follows -

Dimension:

206.9*136*33mm

Weight:
1257g
Socket Type:
Micro USB
Battery:
Li-Po battery
Capacity:
50000mAh, 50000mAh
Input:
16.8V 2.5A, 16.8V 2.5A
Output (6 ports):
USB1&2: 5V 2.1A USB3&4: 5V 1A DC1: 12V 2.5A DC: 20V 3A
Charging Time:
6-8 hours
Cycle Life:
Over 1000 times
Product Weight:
1257g

- Full HD waterproof Camera :-

It provides clear vision in the dark and helps for safe parking of the vehicle. Built-in 8 IR LED lights provide night time illumination for dark environments and when visibility is limited. It helps to avoid any obstacles at night and let the low-light illumination help to find way into and out of tight spaces any time of the day. Being waterproof it will never get fogged and will allow you to use on stormy or bad rainy days. Its professional and shockproof design will provide the complete safety and security to your vehicle.

REFERENCES

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