International Journal of Research in Advent Technology, Vol.7, No.6S, June 2019
E-ISSN: 2321-9637
Available online at www.ijrat.org

Electromated Fish For Underwater Surveillance

Amar Ganapati Hegde, Karuna K, Junaid Gul, Aditya Shridhar Bhat, S Sowndeswari

Abstract—About 71 percentage of the earth's surface is covered by water and this natural resource is being used by humans for various activities. This include applications a such as for trade, transportation, underwater resource extraction and defence. Mankind has experienced various emergency situations related to the activities that are performed over these water bodies and for every emergency circumstances divers are required who may not be available. Also for the exploration and surveillance of underwater environment by human labour is not efficient. To overcome these challenges we propose a UUV (Unmanned Underwater Vehicle) named "Electromated Fish". The proposed system includes the design and construction of theElectromated fish which resembles a natural fish. The term Electromated stands for "Electronically Automated". The design procedure adapts a bio-inspired approach which makes the model resemble a natural fish in both its appearance and movements. The Electromated fish is more competent than current UUVs propelled by motion because the fish is a paradigm of bio-inspired UUV. The Electromated Fish can operate in complex environments. They can perform underwater exploration and also can be used for surveillance of submerged zone. While operating, the proposed model can deliver heightened performance when compared to other UUVs available. An attempt has been made to develop an Electromated fish with improved manoeuvrability (movements) and performance features.

IndexTerms— Electronically Automated, Surveillance, Fin Propulsion, UUV.

I. INTRODUCTION

Underwater world like sea and oceans are huge water bodies which are most unlikely to be fully explored so far. All the water bodies that are found on Earth are not completely explored and recognized. The exploration of these water bodies by manual approach is very much difficult and dangerous. An Unmanned Underwater Vehicle (UUV) is the most suitable approach for achieving this goal of exploring the underwater world. UUVs are much efficient, accurate and safe compared to humans for performing the exploration task. A bio-mimicked (bio inspired) UUV are best than the other UUVs. One such bio-mimicked UUV is this Electromated Fish (ElFi). Fishes are the best natural swimmers and this is a known fact. They are the fastest and their narrowness makes them swim easily at any circumstances underwater. Hence this bio inspired UUV named Electromated Fish is chosen to be a Fish model. The ElFi completely resembles a natural fish in both its appearances as well as manoeuvrability (movement). This is one of the major advantages of bio-inspired model since its appearance and movements leaves the other underwater creatures undisturbed. Another advantage of bio inspired model is, it can be used as a Spy to spy on the enemy countries under military application. The ElFi is implemented using Fin Propulsion system which makes the model to swim as a natural fish.

Robotic fishes developed by the mechanism of thrusters and fans create sediment distortion due to this the monitoring of area was a difficult task. Hence videos and the images that were recorded were not reliable and efficient.But the fish that we have designed is based on complete Fin Propulsion System and is wireless. A robotic fish based on fin propulsion provides higher manoeuvrability, agility and is versatile solutions for different diverse marine applications, for example, examination of submerged animals and assets , assurance ofcontaminations in water and checking the nature of water, perception of living structures, study of submerged territories, deficiency identification in oil pipelines, security and guard applications. The fish is remote controlled which makes the device controlled from outside the water. It also gives instruction for directing the UUV. The UUV is always ready to take the commands from the controller, it constantly monitors the area under surveillance and providing the real time videos and the data related to the area.

Figure 1: Plane Crash

Figure 2: Rescue Operation

Manuscript revised May 13, 2019 and published on June 5, 2019
***Amar Ganapati Hegde**, UG Student,Dept.of ECE, SaIT,Bangalore*
***Karuna K**, UG Student,Dept.of ECE, SaIT,Bangalore*
***Junaid Gul,** UG Student,Dept.of ECE, SaIT,Bangalore*
***Aditya Shridhar** Bhat, UG Student,Dept.of ECE, SaIT,Bangalore*
***S Sowndeswari** Assistant Professor,Dept.of ECE, SaIT,Bangalore*

doi: 10.32622/ijrat.76S201934

II. LITERATURE SURVEY

Malec et al. [1] designed three-link Cyber Fish by focusing on BCF (Bodies Caudal Fins)-like locomotion. The prototype was produced by using Acrylic, rubber, Aluminium and stainless steel. In the referred work, the angle of the pectoral fins associated with the servomotor is changed to provide up-down motions as sharks.Masoomi et al. [2] used 3D-printing technology in order to construct the tuna-like robotic fish with a main body and flexible tail mechanism. The robot surface was covered with epoxy to provide waterproofness. Kodati et al. [3] developed Ostaciiform-type box fish which has the pectoral and caudal fins. Phamduy et al. [4] designed a miniature robotic fish prototype to investigate animal-robot interaction studies. They used 3D-printing technology to manufacture the robot prototype. Shibata, M. [5] proposed a fish-like underwater robot with a body in a thin plastic film manufactured by using a vacuum packaging machine. The prominent features of this work are that although it is not a biomimetic design, it has a high pressure resistance and is lightweight.

Marchese et al. [6] designed and fabricated a soft robotic fish with rapid motion ability. In this work, they focused on rapid escape responses of the prototype.Chowdhury and Panda [7] proposed to product a robotic fish with Undulatory swimming behaviours. In this work, biological vertebrate fish swimming was integrated to the mobile underwater vehicle.Huang et al. [8] suggested a solution to minimize a swimming robot by using polymer film works as motor. The robotic fish mimics BCF-type Carangiform swimming modes with a propulsive tail mechanism driven by servo motors. An anterior rigid torpedo-shaped body is designed for housing the electronics, sensors and Centre of Gravity (CoG) control mechanism. CoG control mechanism successfully provides up-down motion abilities. The locomotion control is adapted based on Central Pattern Generator (CPG) to generate robust, smooth and rhythmic oscillatory swimming patterns

III. PROPOSED SYSTEM

The UUV seems like a torpedo in numerous viewpoints. It comprises of an impetus framework having a couple of blades, control surfaces that control the development of the vehicle, a streamlined fairing for diminishing hydrodynamic drag and a weight structure to contain control gadgets. The vehicle conveys its own vitality source, and is modified with directions fit for doing submerged mission with help from an administrator. The directions incorporate data required for route between pre-decided geographic positions, measures to be attempted if there should be an occurrence of gear breakdown, systems for payload gadget activity and techniques to maintain a strategic distance from hindrances. Careful check of the UUV is directed before beginning the submerged mission. The vehicle is submerged into the water and discharged to begin the mission. In certain missions, the gathered sensor information must be sent to the administrator to guarantee that the information is of high caliber. In such cases, broadcast communications arrange is accommodated accomplishing this reason. The vehicle goes to its pre-decided endpoint toward the finish of its Mission and the information is recovered from the vehicle.

3.1 Propulsion System: There are several drive procedures for UUVs. Some of them utilize a brushed or brush-less electric engine, gearbox, Lip seal, and a propeller which might be encompassed by a spout or not. These parts installed in the UUV development are engaged with impetus. Different vehicles utilize a thruster unit to keep up the measured quality. Contingent upon the need, the thruster might be furnished with a spout for propeller crash insurance or to decrease commotion accommodation or it might be outfitted with an immediate drive thruster to keep the proficiency at the largest amount and the clamors at the most minimal dimension. Progressed UUV thrusters have a repetitive shaft fixing framework to ensure an appropriate seal of the robot regardless of whether one of the seals comes up short amid the mission.

3.2 Fin Propulsion: Fish motion is the assortment of kinds of creature headway utilized by fish, chiefly by swimming. This anyway is accomplished in various gatherings of fish by an assortment of systems of impetus in water, frequently by wavelike developments of the fish's body and tail, and in different particular fish by developments of the blades. The real types of motion in fish are anguilliform, in which a wave passes equally along a long thin body; sub-Carangiform, in which the wave increments rapidly in sufficiency towards the tail; Carangiform, in which the wave is focused close to the tail, which sways quickly; thunniform, fast swimming with a huge incredible sickle formed tail; and Ostaciiform, with no wavering aside from of the tail blade. Progressively particular fish incorporate development by pectoral blades with a mostly solid body, as in the sunfish; and development by engendering a wave along the long balances with an unmoving body in fish with electric organs, for example, the blade fish.

3.3 Types of Fin Propulsion

There are two major types of fin propulsion systems. They are:-

3.3.1 **Oscillatory Fin propulsion:**In oscillatory movements the propulsive structure swivels on its base without showing a wave development. In simple terms, the oscillatory fin propulsion systems have fins that oscillate perpendicular to the hull axis but parallel to the hull plane. This type of fin propulsion systems can be easily observed in sharks.

3.3.2 **Undulatory Fin Propulsion:**Undulatory movements include the entry of a wave along the propulsive structure. In other terms, the Undulatory fin propulsion system uses fin that move along a sinusoidal path parallel to the hull axis but perpendicular to the hull plane. This type of fin propulsion can be easily observed in Manta Rays and Sting Rays. This type of fins is mostly observed in dolphins.

doi: 10.32622/ijrat.76S201934

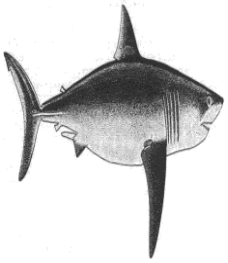

Figure 3: Undulatory Fin Propulsion

Figure 4: Oscillatory Fin propulsion

IV. METHODOLOGY

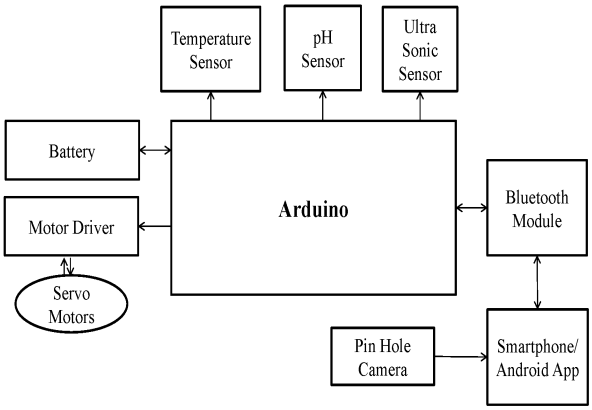

Figure 5: Block Diagram of Proposed System

5.1 FLOWCHART OF PROPOSED SYSTEM

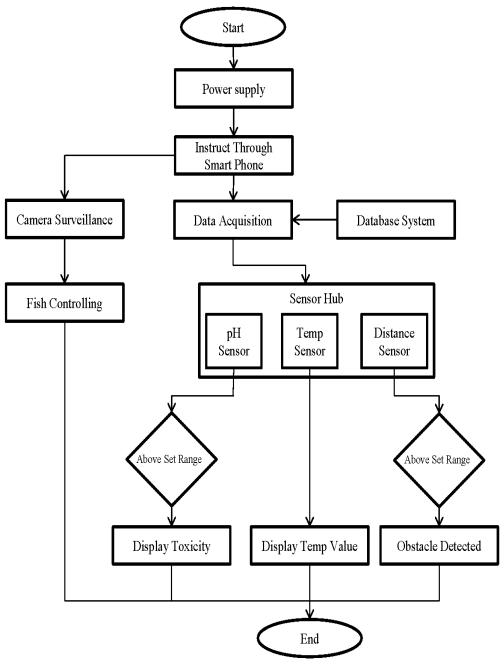

Figure 6: Flow Chart of Proposed System

The Electromated Fish is designed using Fin Propulsion system (FPS) for precise manoeuvrability also it makes the fish more agile. Various types of sensors are embedded within the model to determine the required data with the respect to desired objective. The system is equipped with a camera which will provide the live videos of underwater environment. It also can be used for survey of submerged areas and it can provide latest data regarding the area under surveillance. The data can be retrieved and analysed.Also it is equipped with two types of sensors which are temperature sensor and pH sensor. The temperature sensor will sense the difference in temperature at the different places under the water. The pH sensor will determine whether the water is toxic and it will provide the data regarding the toxicity of the water

V. RESULT AND ANALYSIS

ELECTROMATED FISH	OTHER UUV
It uses Fin Propulsion System which reduces noise and gives smooth locomotion.	They use Thrusters and Fans which are noisy.
Controlling is through smart phone connected through Bluetooth.	Controlling is through Remote.
Single device performs multiple applications like water quality determination using pH Sensor and obstacle detection using Ultra Sonic Sensor.	Does not combine all these objectives in one UUV model.
Performance and Efficiency is more compared to other UUV.	Performance and Efficiency is comparatively less.
Bio-inspired approach hence resembles natural fish which leaves other aquatic creatures undisturbed	May not resemble a natural creature.

doi: 10.32622/ijrat.76S201934

VI. CONCLUSION

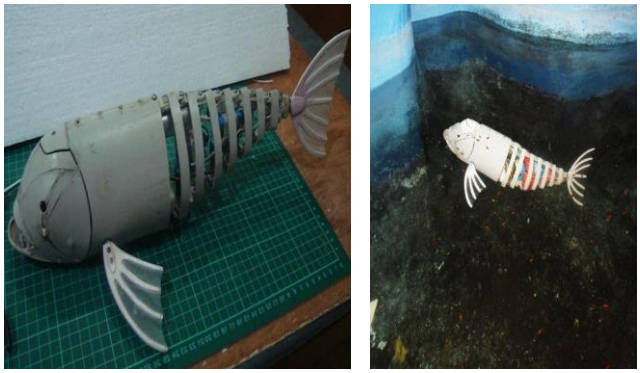

Figure 7: Working Fish model

This examination shows the bio emulate plan and development of the Electromated fish model dependent on bio Inspired swimming to perform certifiable investigation and review missions. The created mechanical fish mirrors the regular fish swimming modes with tail component. This fish can fill in as a standout amongst the best UUV. It tends to be utilized for different submerged applications.

The Electromated Fish accomplishes the targets like examination of submerged assets, assurance of contaminations and checking the nature of water, perception of living structures, Survey of submerged territories, territory observing to check if the specific zone is alright for plunging and angling, it can likewise be utilized for impediment location. It gives precautionary measure and spares lives and assets from being lost. This model can be stretched out for progressively future applications, for example, shortcoming identification in gas or oil pipelines, coastline security and military missions, giving live recordings of the submerged condition

REFERENCES

[1]. Malec, M.;Morawski, M.; Zajac,"J. Fish-like swimming prototype of mobile underwater robot" J. Autom. Mob. Robot. Intell. Syst. 2010
[2]. Masoomi, S.F.; Haunholter, A.; Merz, D.; Gutschmidt, S.; Chen, X.; Sellier, M. "Design, fabrication, and swimming performance of a free-swimming tuna-mimetic robot". J. Robot. 2014
[3]. Kodati, P.; Hinkle, J.; Deng, X. Micro autnonomous robotic ostraciiform (Marco): Design and fabrication. In Proceedings of the IEEE International Conference Robotics and Automation, Roma, Italy, 10–14 April 2007
[4]. Phamduy, P.; Vazquez, M.A.; Kim, C.; Mwaffo, V.; Rizzo, A.; Porfiri, M. "Design and characterization of a miniature free-swimming robotic fish based on multi material 3D printing" Int. J. Intell. Robot. Appl.2017
[5]. Shibata, M.; Sakagami, N. "Fabrication of a fish-like underwater robot with flexible plastic film body". Adv. Robot. 2015
[6]. Marchese, A.D.; Onal, C.D.; Rus, D. "Autonomous soft robotic fish capable of escape maneuvers using fluidic elastomer actuator" Soft Robot. 2014,
[7]. Chowdhury, A.R.; Panda, S.K. "Brain-map based carangiform swimming behaviour modeling and control in a robotic fish underwater vehicle" Int. J. Adv. Robot. Syst. 2015
[8]. Huang, C.; Lv, J.A.; Tian, X.; Wang, Y.; Yu, Y.; Liu, J. "Miniaturized swimming soft robot with complex movement actuated and controlled by remote light signals" Sci. Rep. 2015

doi: 10.32622/ijrat.76S201934