METU, Department Of Computer Engineering

Graduation Project
Proposal Form

Project Information

Title

CENG-i Fish

Target

Public [ ]	Restricted [x]

Proposer Information

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IP (Intellectual Property) Information

Project Description and Background Information

Description

The project is about the design and implementation of a biomimetic robotic fish.
There are several scenarios for this robotic fish:
The fish must give same response to same input from remote control device. For example, for each "right" input, the fish must rotate same amount to right.
The fish could broadcast with its camera.
The fish could be able to move freely without hitting the obstacles with or without remote control.
The fish could be able to automatically search the desired area.
The fish could be able identify the given target and inform user when it is detected.

Similar Products/Projects

RoboTuna created by MIT: RoboTuna, a project of the Department of Ocean Engineering, will develop a new and better means of propulsion for underwater vehicles, in particular Autonomous Underwater Vehicles, by producing a robot that swims like a fish. [1]
VCUUV created by Draper Laboratory: The Draper Laboratory Vorticity Control Unmanned Undersea Vehicle (VCUUV) is the first mission-scale, autonomous underwater vehicle that uses vorticity control propulsion and maneuvering. Built as a research platform with which to study the energetics and maneuvering performance of fish-swimming propulsion, the VCUUV is a self-contained free swimming research vehicle which follows the morphology and kinematics of a yellowfin tuna. [2]
Robotic Fish created by Fırat University: a propulsion model of a carangiform 4-joints robotic fish is studied. The forward speed of the robotic fish is controlled by sliding mode control with integral compensation technique which provides a robust performance for nonlinear and uncertain systems. [3]
All the other projects: [4]

Justification of the proposal

The project aims to investigate and learn about a biomimetic robotic fish, its ability of maneuver and movement, and some skills such as rescuing from obstacles or detecting some targets.

Although unmanned aerial vehicles and unmanned ground vehicles are so common and, unmanned underwater vehicles are more open to investigate. In addition, there are no projects heard about this area in Turkey except the project of Fırat University.

Contributions, Innovation and Originality Aspects of the Project

Impressed by the project RoboTuna, the design and implementation aims at an underwater system which is flexible, and which can react extremely quickly to unforeseen obstacles. Therefore, such a vehicle should have the speed and agility that such dangerous situations require and the ability to get out of a bad situation.

As stated, there are so many research on ground and aerial vehicles. The originality aspect of the project will be its interest of underwater environment.

Foreseen advantages are the ability of not being affected by pressure and temperature of the liquid environment, and the ability of having a fish's capability of maneuver and propulsion.

We hope that our project initiates further research and/or development activities in the area of unmanned underwater vehicles.

Technical Aspects of the Project

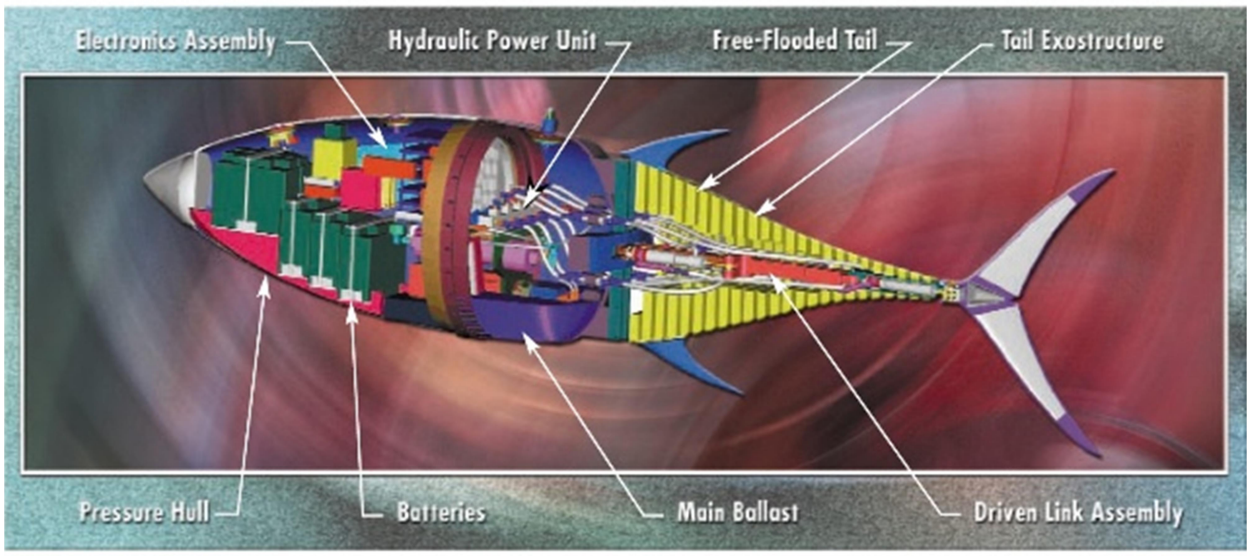
Roughly, the hardware details (subject to further elaboration and change) are as follows: The main mobility for the fish platform will be provided by 4 or 5 servo motors for the spine and another motor for the fins. The motors will be driven by an Arduino. Initially the fish will be remotely controlled; therefore a receiver unit will also be needed. The receiver circuitry might consist of Zigbee units, or some other ad hoc design might be developed (will be decided later based on some cost/availability analysis). Additional payloads like cameras and light bulbs might be added as necessary. The hardware will also include the battery packs and the water proof casing (which will also be an original design specific to the project).

We plan to develop custom communication protocol between the fish and the user platform. The fish motion control code will also need to be designed from scratch and will be tailored to the emerging hardware throughout the project. Finally (and optionally), if we have some free time left towards the end of the project, we also would like to work on turning the fish into a fully autonomous underwater agent by developing code for driving the fish without any human intervention.

Targeted Output, Targeted User/Domain Profile

The model for the end-product is the robotic fish created by Fırat University. All the other projects will also be taken into account.

The model for VCUUV below:



Our first objective is to catch up with current robotic fishes and contribute our experience to that area especially for Turkey. If we reach that level, additional skills will be evaluated.

Target user group is anyone who can utilize this product, such as researchers, military, Search-and-Rescue teams, etc.

Project Development Environment

Embedded software development will be done in this project. According to the level we will come, artificial intelligence methods will be discussed.

External Support

Any required hardware and software support for the project:
-6 Servo Motors
-Arduino
-RC Transmitter and Receiver Units
-Battery Packs

Mobility Research Laboratory will provide working space.

References

[1] https://robotuna.wordpress.com/

[2] https://www.ncbi.nlm.nih.gov/pubmed/21708700

[3] http://web.firat.edu.tr/iats/cd/subjects/Mechatronics/MEC-8.pdf

[4] http://www.robotic-fish.net/index.php?lang=en&id=robots