Department of Computer Science

Biologically Inspired Approach to Robotic Fishes

Introduction

In nature, fish has astonishing swimming ability after thousands years evolution. It is well known that the tuna swims with high speed and high efficiency, the pike accelerates in a flash and the eel could swim skilfully into a narrow hole. Such astonishing swimming ability inspires us to improve the performance of aquatic man-made robotic systems, namely Robotic Fish. Instead of the conventional rotary propeller used in ship or underwater vehicles, the undulation movement provides the main energy of a robotic fish. The observation on a real fish shows that this kind of propulsion is more noiseless, effective, and manoeuvrable than the propeller-based propulsion. The aim of our project is to design and build autonomous robotic fishes that are able to swim like a real fish, reactive to the environment and navigate toward the charging station. In other words, they should have the features such as autonomously navigating ability, deep sea fish that are not be able to display in an aquarium, cartoon-like appearance that is not-existed in the real world.

Objectives

The objectives of this project are to use biologically inspired approach to building a firm research platform toward many real-world applications such as seabed exploration, oil-pipe leaking detection, sea life investigation, and public awareness. In general, the project lies in an interdisciplinary research area involving sensors, robotics, artificial intelligence, optimisation, and embedded computer systems. It shares many characteristics of real fishes and makes the project very challenging. We will focus on.

- Mimic real fish swimming behaviours.
- Senor-based control & autonomous navigation.
- Team performance and multiple fish interaction.

The project is funded by ***County Hall Aquarium*** in London.

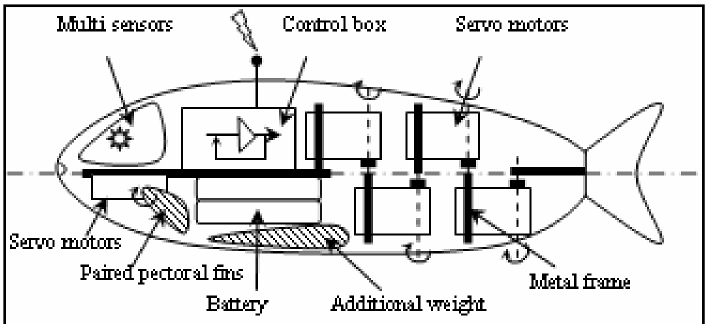

Figure 1 : Structure of the robotic fish

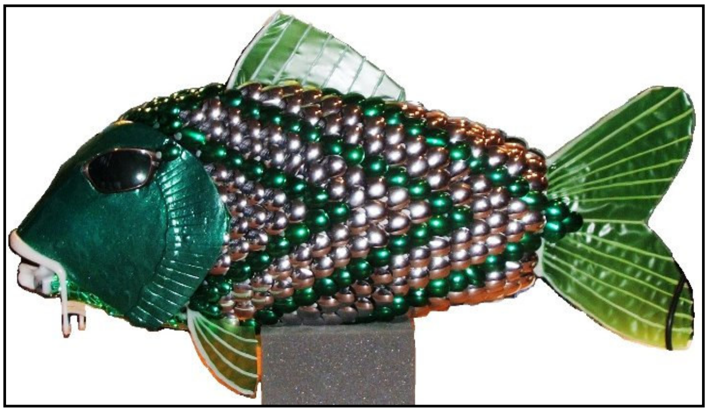
Figure 2 A robotic carp fish

Research Tasks

- To use multi-link mechanism to mimic fish-like swimming behaviours.
- To design effective control algorithms for robotic fishes to operate in 3D underwater environments autonomously.
- To develop strategies for co-evolution within a robot population instead of learning individually.
- To exam how to realise co-operation behaviour with limited sensing and communication.
- To implement human-robot interaction -- a team of robotic fishes that swim in a water tank can react to visitors.

Team members

Huosheng Hu, Ian Dukes, Jindong Liu, Cemre Aksogut, George Gimas.

For further Information and potential collaboration, please contact:

Professor Huosheng Hu
Department of Computer Science
University of Essex, Wivenhoe Park
Colchester CO4 3SQ, United Kingdom
Tel: +44-1206-872297; Fax: +44-1206-872788
Email*:* *hhu@essex.ac.uk*
URL: *http://cswww.essex.ac.uk/staff/hhu*

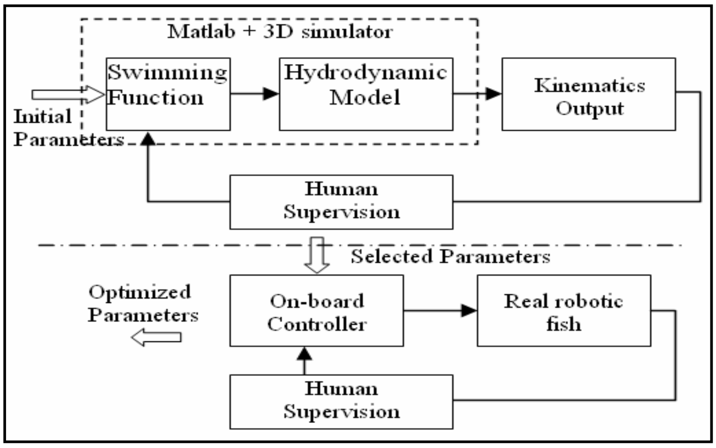

Figure 3 Control design & parameter optimisation