Robotic fish for environmental monitoring

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A group of researchers from Centre for Automation and Robotics (CAR CSIC-UPM) in collaboration with researchers from University of Florence are designing autonomous underwater vehicles with biosensors to monitor water quality. These robots, which mimic a swimming fish in order to reduce fish stress, can detect in-situ real-time anomalies to control environmental conditions in fish farms.

Aquaculture has become the fastest-growing animal food sector in the world. Today, fish, crustaceans and shellfish comprise around 50 percent of all fish that is consumed by humans globally. In order to keep aquaculture systems at an optimal level and to avoid disease and physiological stresses in fish, water quality and adequate nutrition must be monitored and controlled.

In order to tackle this problem, researchers from Bio-inspired Systems Lab at CAR UPM-CSIC, in collaboration with researchers from the Chemical Department of University of Florence (Italy), are developing an autonomous underwater vehicle with biosensors to provide real-time and on-site monitoring of water quality in fish farms.

In order to minimize possible stress in fish, the robot is bio-mimetic, designed to resemble a fish. In addition to providing water data, the robotic fish is also able to modify the way it swims according to the water conditions. Because water acidity directly affects other indicators both water quality and fish health, researchers have developed a special electrochemical pH sensor based on polyaniline film electrochemically deposited on the graphite screen-printed electrode surface. Thanks to

this, the robotic fish is able to change its swimming patterns according to the conditions detected by this sensor.

The overall length of the fish is 30 cm, not including the tail. The prototype adopts shape memory alloys actuators that bend a continuous flexible structure (the backbone of the robot fish), made of polycarbonate of 1 mm thickness. An additional structure of ribs was employed to support the latex-based skin.

According to Claudio Rossi, a developer of this bio-inspired fish, "This system provides early information on environmental change, so we can control the parameters of water quality and improve management decisions of fish farms, and consequently, the wellness of the fish."

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