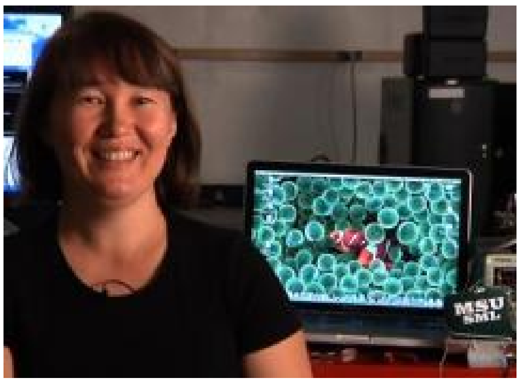
# Robot fish could monitor water quality

November 2 2009



This is Michigan State University assistant professor of zoology Elena Litchman. Credit: G.L. Kohuth, Michigan State University

Nature inspires technology for an engineer and an ecologist teamed up at Michigan State University. They're developing robots that use advanced materials to swim like fish to probe underwater environments.

"Fish are very efficient," explained Xiaobo Tan, an assistant professor of electrical and computer engineering. "They can perform very efficient locomotion and maneuvering in the water."

Robotic fish - perhaps schools of them operating autonomously for months - could give researchers far more precise data on aquatic conditions, deepening our knowledge of critical water supplies and habitats.

Tan and Elena Litchman, an assistant professor of zoology based at MSU's Kellogg Biological Station on Gull Lake in Kalamazoo County, recently won funding from the National Science Foundation to integrate their research.

"The robotic fish will be providing a consistent level of data that hasn't been possible before," Litchman explained. "With these patrolling fish we will be able to obtain information at an unprecedentedly high spatial and temporal resolution. Such data are essential for researchers to have a more complete picture of what is happening under the surface as climate change and other outside forces disrupt the freshwater ecosystems. It will bring environmental monitoring to a whole new level."

The robotic fish will carry sensors recording such things as temperature, dissolved oxygen, pollutants and harmful algae. Tan also is developing electronics so the devices can navigate and communicate in their watery environment.

"This project will greatly advance bio-robotic technology," Tan said. "The project is very practical and we are designing the fish to be inexpensive so they can be used in various applications like sampling lakes, monitoring aquafarms and safeguarding water reservoirs."

The robotic fish might detect toxic algal blooms, for example.

"As air temperature increases, the lakes and reservoirs also heat up," Litchman said. "Increasing water temperature creates strong stratification within the various layers of the water and this may lead to increased growth of harmful algae. Some of these algal blooms create poor conditions for fish and exude toxins that also endanger people."

To mimic how fish swim and maneuver, Tan builds "fins" for robotic fish with electro-active polymers that use electricity to change shape.

Similar to real muscle tissue, ion movements twist and bend the polymer when voltage is applied. The effect works in reverse, too - slender "feelers" could signal maneuvering circuits in a sort of electro-active central nervous system. Infrared sensors also could be used for "eyes" to avoid obstacles.

The robots will communicate wirelessly with a docking station after surfacing at programmed intervals and could similarly be linked to other robotic fish for coordinated maneuvers or signal relay. Global positioning system technology and inertial measurement units will allow precise navigation.

It's not big, but it's a keeper: A 9-inch prototype now swimming in Tan's laboratory tank is modeled on the yellow perch by John Thon, a member of the research team who teaches art at nearby Holt Junior High School. The device isn't strong enough to resist stiff currents, so for now must be confined to relatively still waters. Future versions will incorporate the ability to change buoyancy to assist locomotion and maneuver.

Source: Michigan State University (news : web)

Citation: Robot fish could monitor water quality (2009, November 2) retrieved 17 April 2024 from https://phys.org/news/2009-11-robot-fish-quality.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.