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Robotic schools of fish made from 3D printers will patrol for water pollution

Sep. 19, 2011 (6:50 pm) **By:** Jennifer Bergen

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What better way to monitor water quality than by using cutting-edge robotics technology? Researchers at Michigan State University are developing robotic fish that swim in schools and navigate underwater to watch for pollution in lakes, rivers, streams, and oceans.

According to MSU associate professor and electrical engineer Dr. Xiaobo Tan, "fish behave in a way that underwater vehicles can't yet equal." They can swim in sync with each other and can make sharp turns and change directions in the blink of an eye, which is something a submarine isn't capable of.

The robotic fish have tail fins made of electroactive polymers. The tail fins have no gears or motors but simply move in response to electricity. Often referred to as "artificial muscles," the materials can change their shape in response to electrical stimulation. Tan and his team were able to bind multiple strips of the artificial muscles together in sheets. These sheets make up a flexible artificial fins that can twist and bend just like a real fish fin.

To build the fish, the MSU team actually made multiple patterns and then tested them by making quick and inexpensive copies using a 3D printer. The printer lays thin layers of plastic on top of each other constructed of different plastics that the researchers feed into the printer. These layers-upon-layers create 3D objects that are flexible and soft in some parts, and hard and rigid in other parts.

This isn't the first time we've heard of robotic fish. UK company BMT Group Limited, in conjunction with researchers at the University of Essex, were also building robotic fish to test for water pollution. However, these fish were much larger than MSU's fish, at about 1.5 meters in length compared to Tan's 6-inch prototype, and cost $29,000 each to make.

With funding from the National Science Foundation, the team's goal is to make robotic fish that are smaller, cheaper, and quieter than vehicles powered by propellers. The intent is to make fish that can steer clear of obstacles and need little if any human intervention.

It's hard enough to make just one fish that works independently, but the team is also working on making fish that can be programmed to sense the direction of its neighbors and swim synchronously in a school. The researchers have tested the fish in lakes, but these models only swim halfway submerged in water. The next goal is to make the fish capable of diving and ascending.

The team will soon test the robotic fish in a mixed aquarium tank of real fish to see how they interact with each other. They'll monitor the real fish to see how they escape from the robotic fish, which will take the role of a "predator" for the test, and will look at how they react to the foreign fish. They'll then use that information to program the robotic fish so that they can possibly protect themselves against predators. Having the robo-fish eaten by a dolphin, seal, or shark would be a very pricey meal, let alone unsafe for the predator.

Check out the video below to see the robotic fish in action.

via Scientific American

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