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Responsibility

Robotic vehicle applications in aquaculture

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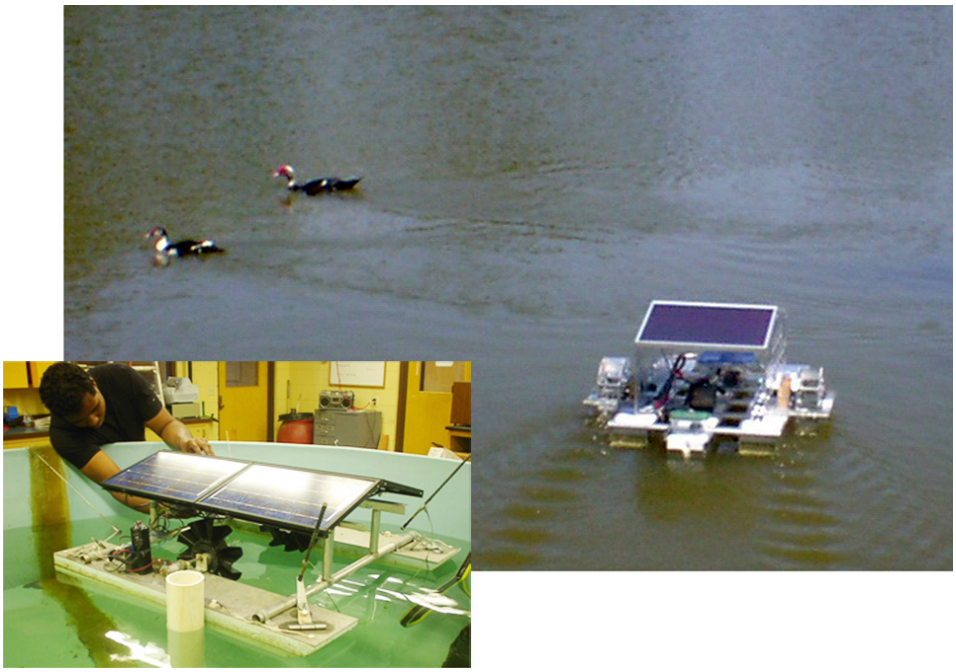
Self-guided boats cruise ponds to scare away birds, monitor water quality



Solar panels on the “scarebot” charge batteries that drive paddlewheel controlled by electronic micro controllers guided by shore feeders or a GPS unit.

Attention to environmental issues in aquaculture has been growing in recent years, and with a continuing challenge to do so in an environmentally friendly way. Various aspects of aquaculture production can even reduce environmental impacts while improving yield.

To this effect, the authors recently explored the technology of autonomous vehicles at the Louisiana State University Agriculture Center in Baton Rouge, Louisiana, USA, to address bird predation issues and track water quality and other environmental parameters.

Robotic autonomy

Robotic autonomy implies the capability of the device to operate for extended periods, make decisions, and act without human direction. Small autonomous vehicles provide an environmentally friendly alternative approach to labor-intensive or destructive methods used to maintain production and water quality. Some robotic successes have included bird predation reduction devices, mobile environmental monitoring equipment, and remote photography systems.

Bird predation and control

Bird predation in aquaculture can decimate fish yields. Researchers have reported losses on catfish farms amounting to U.S. $3.3 million in Mississippi, USA, alone due to double-crested cormorants. Present approaches to control the birds include sonic cannons, poison, scarecrows, and nets. Each method has environmental, toxicity, or cost constraints.

Alternatively, small self-guided boats can patrol the pond, using passive and active methods to scare the birds away. They use small shore sensors that close a magnetic switch and guide the boat back into the pond, or global positioning, especially in open water. Low-power (< 0.1 ampere at 5

V) microprocessors provide guidance, while solar panels provide power. Infrared sensors can be used to identify birds and onboard water cannons can actively repel birds.

Efficacy tests

Efficacy tests were carried out in 0.4-ha catfish fingerling ponds located at the Louisiana State University Agriculture Center Aquaculture Research Station (ARS). Atimelapse video cassette recorder was used to record bird activity with a security camera.

Statistical analysis showed a significant reduction of cormorant, egret, and heron predation on ponds with boats. The diving cormorants were reduced from an average of 5.45 to 0.81 birds per hour, a 70 percent reduction. Wading birds went from 4.47 to 1.36 birds per hour. On an averaged daily basis, the reductions in predation by diving and wading birds were 64 percent and 55 percent, respectively.

Additional developments

Additional developments include motion-detection systems that use near-infrared sensors and machine vision, energy conservation improvements, more-effective navigation, and additional environmentally friendly bird-hazing mechanisms such as laser lights or sounds.

Other applications

Environmental applications include using the device to drive birds off recreational ponds, and swimming or drinking water reservoirs. Additionally, the boats can be fitted with water quality and environmental-monitoring equipment such as temperature, dissolved oxygen, nitrogen, pH, or other probes to measure water quality parameters and biological activity.

Semiautonomous vehicles that can be radio-controlled during part of their task and autonomous – with or without GPS guidance – during other parts of their work are being tested. Related developments of autonomous vehicles for land, water, and air applications in agriculture and the environment are also under way.

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