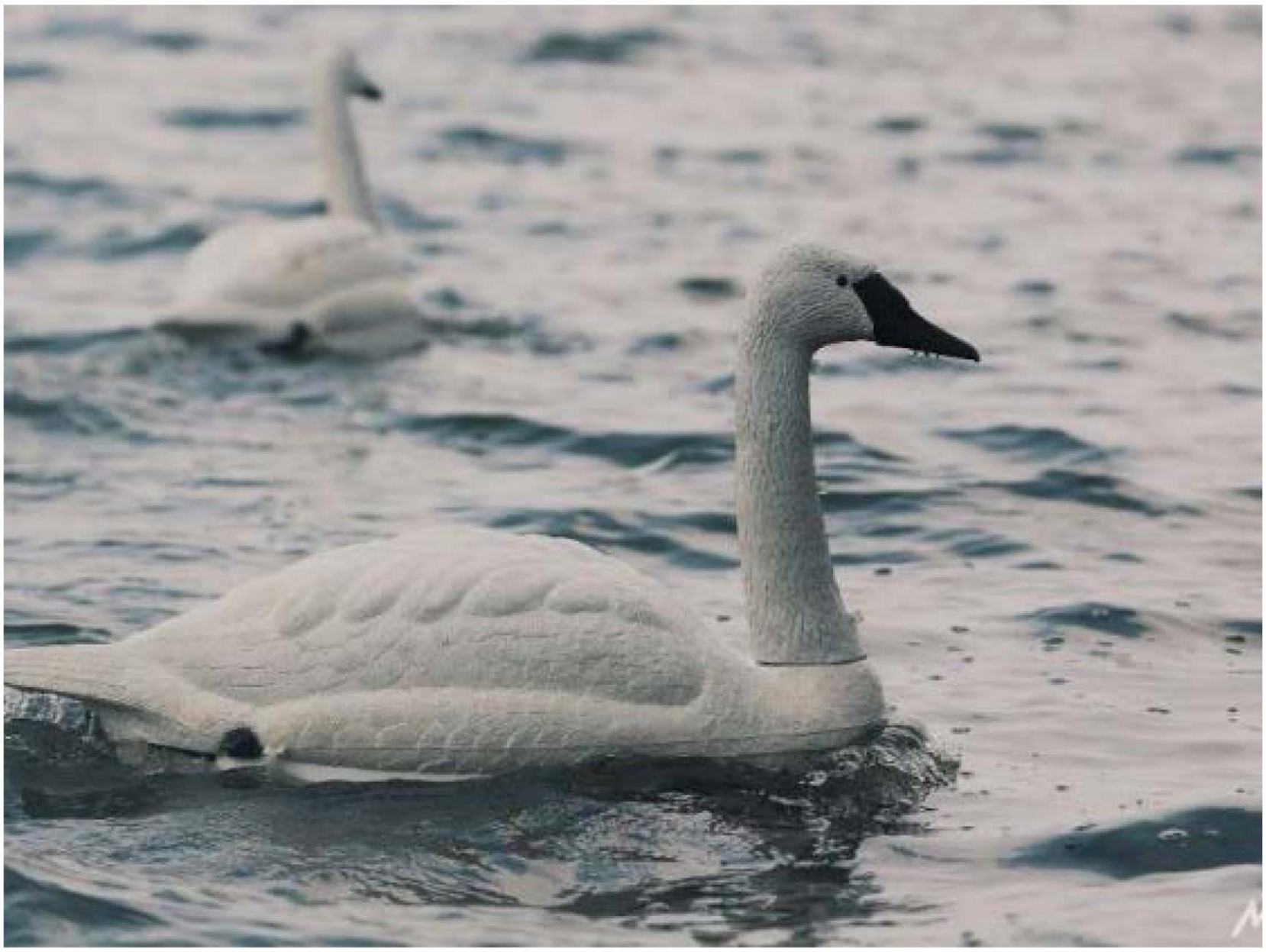
Source: *TODAY Online*
Date: 3 July 2015

Robot swans bring new advanced technology to water testing



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BY JACK BOARD - JULY 3

SINGAPORE — Floating on the surface of Pandan Reservoir in Singapore's south west are what researchers hope will be the future of cheap, real-time water quality testing.

Developed by a team at the National University of Singapore (NUS), in conjunction with the national water agency PUB, the NUSwan utilises advanced water monitoring technology, fitted into the shell that closely resembles a living, breathing bird.

"We started with a number of smaller bird models, before we decided on the swan. It's just the right size," said Assoc Prof Mandar Chitre, one of the project's lead researchers. "If you just look at in the environment, it just looks like a swan swimming around."

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A small team at the NUS Environmental Research Institute, working with the Tropical Marine Science Institute, initially conceptualised the robot back in 2010 but only began their first series of test bedding last year.

The aim is to mobilise the robotic swans to monitor different physical and biological compounds in fresh water, including pH, dissolved oxygen, turbidity and chlorophyll, which are common indicators used to determine if there are problems in a water source.

At present, water authorities face the logistical challenge of physically having to collect samples from large bodies of water, normally using a boat. It is an approach that requires time and manpower and restricts the speed at which officials can act in the case of an outbreak or a contamination.

“It would be expensive to do similar monitoring manually or using AUVs (Autonomous Underwater Vehicles),” said. “Hence to reduce reliance on manpower and increase efficiency in water quality monitoring, we are constantly looking into developing new technology with improved capabilities.”

“Scientifically, the NUSwan test drives a new paradigm of freshwater monitoring, one that is persistent and interactive, and is potentially able to sample the dynamics of water quality over space and time at improved resolution at an affordable cost,” Assoc Prof Chitre said.

The swans work by trawling particular areas of interest in a water body and wirelessly sending back data through a cloud. Programmers will be able to remotely control the robots, but the aim is to ensure they are as autonomous as possible, requiring just basic monitoring and operation, which can happen from anywhere with an internet connection.

The researchers said the swans’ navigation is more advanced than an automatic vacuum cleaner for instance, which can avoid obstacles but cannot tell where it has already travelled. The SWAN uses GPS to ensure it does not duplicate its monitoring efforts, unless programmed to.

They are durable enough such that even if a recreational water user such as a kayaker, or even a small boat, hits the swan, it will not be damaged, according to the teams behind the technology.

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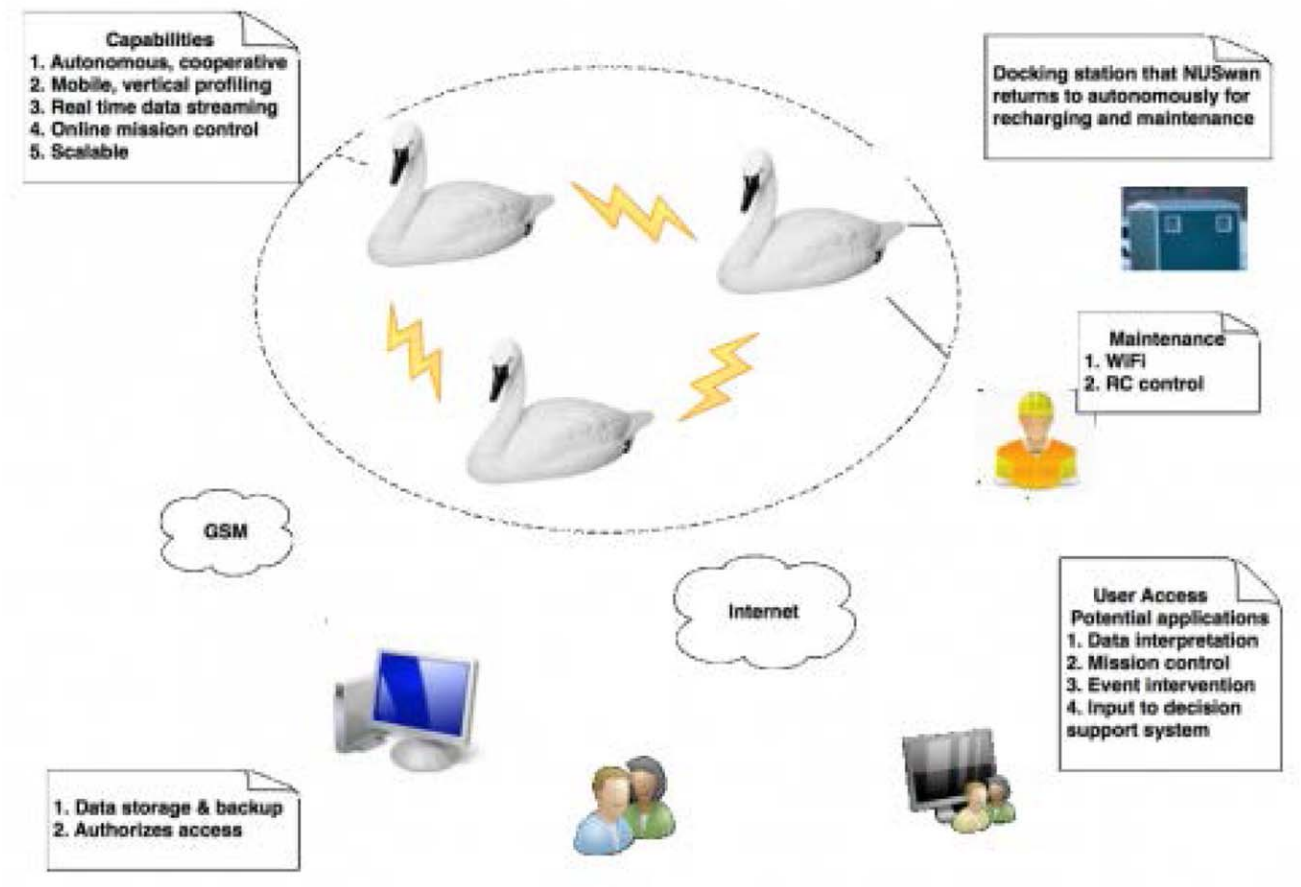
Assoc Prof Koay Teong Beng remotely controls the robotic swans on Pandan Reservoir. Photo: Channel NewsAsia

TECHNOLOGY POTENTIAL

They believe they are at just the tip of realising the potential of this system and have designed the NUSwan to be adaptable to various environmental challenges that may arise.

“The NUSwan platform is designed to be extendable – new sensors and actuators can be added on demand to increase its sensing capability,” said Assoc Prof Koay Teong Beng, one of the other leading researchers on the project.



Graphic: NUS

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Already the team is collaborating with other university researchers to combine technologies and stretch the swans to their technological limits.

This includes a highly sensitive freshwater phosphate sensor, which is being developed independently by a separate NUS team. Phosphates are key nutrients in the development of blue-green algal blooms, which can be devastating for water sources.

There is a hope that technology such as the phosphate sensor could be mobilised by the NUSwan, and provide a real-world alarm system to the threat of algal blooms, a common problem encountered in more polluted waterways as a result of fertilisers, sewerage and domestic waste.

Earlier this year, a proliferation of algal blooms in oxygen-depleted, bacteria-rich waters caused thousands of fish to die. While the phosphate sensor has only been tested in fresh water, it is this kind of scenario that it is designed to help prevent.

“Phosphate detection was lacking; phosphate sensors are not available in the market,” said Mr Lanry Yung, Associate Professor of Chemical and Bio-molecule Engineering . “The prototype is finished. Now we are trying to do automation and collaboration with the NUSwan team to work on hardware.

“Salt complicates the process, but nonetheless it’s something to look into at the next stage,” he said.

The NUSwan has received interest from water authorities across the region, particularly in China where water pollution is a pressing issue and where the system will be tested on several rivers in the south of the country. That could potentially see the robotic swans floating on some of the world’s largest water reservoirs in the near future.

“We see the potential of having NUSwans deployed in urban freshwater bodies and coastal water beyond Singapore. With the data stored in the cloud, collaborators may share and aggregate data and understand global phenomena,” Assoc Prof Chitre said.
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