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# Enhancing water quality monitoring for Tasik Chini

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**O**VER the years, Tasik Chini in Pekan, Pahang, has become increasingly contaminated with toxic waste, which calls for urgent water quality monitoring. As one of the only two United Nations Educational, Scientific and Cultural Organisation (Unesco) biosphere reserves in Malaysia, the rural lake serves as a sustainable development learning site.

Covering 5,084ha, Tasik Chini is home to 87 species of freshwater fish, 189 species of birds, 51 low-forest species, 15 freshwater swamp forest species and 25 aquatic plants.

The surrounding Orang Asli communities rely on the lake for their food source and daily water consumption.



Associate Professor Dr Rosdiadee Nordin

Due to geographic restrictions, an inefficient manual approach has been used for water data sample collection. To address this issue, researchers from Universiti Kebangsaan Malaysia (UKM) worked to produce an innovative solution to better monitor Tasik Chini's water quality and its surrounding environment.

The group aimed to provide an Internet-of-Things (IoT) based solution, which focuses on facilitating Machine-to-Machine (M2M) communication through a wireless sensor network.

Their research led to the creation of the Airborne IoT Network (AIN), which uses a low-altitude wireless M2M platform to establish a

reliable line of sight (LoS) for data transmission.

Led by UKM Centre of Advanced Electronic and Communication Engineering (PAKET) vice-chair Associate Professor Dr Rosdiadee Nordin, the project is carried out in collaboration with the National Institute of Information and Communications Technology (NICT) Japan and Mimos Bhd.

The innovation will monitor water quality parameters, such as pH, temperature, water pressure, turbidity and depth.

Rosdiadee said: "Establishing a direct LoS in Tasik Chini is difficult due to its surroundings, which consists of tall and thick tropical rainforest trees of around 25m in height and hilly terrain."

AIN features low-altitude and a narrow-band wireless spectrum, which will provide a reliable wireless communications link with better coverage in rural areas, such as Tasik Chini.

To ensure its sustainability, Rosdiadee said the sensors were powered by traditional batteries and solar energy.

Its "balloon platform" is a superior alternative for remote sensing of water quality compared with a permanent communications tower.

Rosdiadee said: "The lake is surrounded by a dense jungle, so it's nearly impossible to build a permanent steel structure which would cost over hundreds of thousands of ringgit."

"AIN is a more affordable solution. Aside from that, its balloon system is flexible and practical as it could be deployed anywhere," said Rosdiadee, adding that its sampling points were scattered across the lake.

The project is funded under the Research University Grant (GUP) from UKM amounting to RM80,000 and a matching grant from NICT



Associate Professor Dr Rosdiadee Nordin (second from left), Dr Kentaro Ishizu (centre), Dr Nor Fadzilah Abdullah (fifth from left) and Dr Fumihide Kojima (right) with the Airborne IoT Network.



Associate Professor Dr Rosdiadee Nordin (left) and Dr Fumihide Kojima (centre) explaining about the Wireless Smart Utility Network. With them is Dr Nor Fadzilah Abdullah.



The tall tropical rainforest trees at Universiti Kebangsaan Malaysia (UKM) Tasik Chini Research Centre.

## CONCEPTUAL DRAWING OF AIN AND THE AIM TO OVERCOME THE CHALLENGING TERRAIN



that values to about RM70,000.

NICT completed the design of the sensor network through its Wireless Smart Utility Network (WISUN) and LoRa (Long Range) gateway, while MIMOS developed a cloud server for visualisations and data analytics.

Currently undergoing the proof of concept (PoC) process near Tasik Kejuruteraan in UKM, AIN will be deployed to Tasik Chini upon its successful integration and verification.

The project is expected to benefit native communities around Tasik Chini by providing water quality reports, while preserving the biodiversity and ecosystem for the species which regard the lake as their natural habitat and part of the food chain.

The innovation will contribute towards the preservation of the lake's Unesco biosphere

reserve status as well as addressing Sustainable Development Goal (SDG) 6 (Clean water and sanitation) and SDG 14 (Life below water).

Rosdiadee is the head of the UKM research team, which comprise Electrical and Electronic Engineering Programme senior lecturer Dr Nor Fadzilah Abdullah and PhD student Haider Alabdai.

Other research members include NICT Wireless System Laboratory director Dr Fumihide Kojima and project manager Dr Kentaro Ishizu, as well as Dr Hafizal Mohamad and Dr Nordin Ramli from MIMOS.

Since its inception a decade ago, the UKM Tasik Chini Research Centre has been continuously working to promote biotic and abiotic-based research activities at the nation's second-largest freshwater lake.