

OPINION

Officers monitoring data from across Singapore at PUB's Joint Operations Centre. To further improve the accuracy of rainfall predictions, PUB's rainfall monitoring and prediction system is to be enhanced with machine learning to improve the model's performance with every rain event.
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Using digitalisation to manage nation's water

World Water Day, which falls on March 22, is an occasion to reflect on how we manage this vital resource amid the uncertainties of climate change. PUB is tackling the challenge with an array of digital approaches, from radar rainfall monitoring to robotic swans.

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For The Straits Times

Many Singaporeans have experienced driving along the expressway where it can be sunny in one area – and suddenly it starts raining so heavily that it is difficult to see the lane markings or the car in front. Yet, a couple of minutes later, the rain completely stops.

For PUB, which is responsible for ensuring a sustainable and efficient water supply in Singapore, the high variability of rainfall – making it difficult to forecast – has wider implications, such as in flood management.

PUB has managed this challenge by turning to digital solutions. Indeed, how water utilities like PUB can continue to serve their customers just as well, if not better, in the future, is a timely issue, amid rising public expectations and the uncertainties brought about by climate change, together with the need to manage manpower and resource constraints.

In the case of flood management and Singapore's erratic rainfall patterns, PUB has invested in radar technologies and installed six X-band radars – which can monitor rainfall within a radius of

up to 30km – in the northern, eastern and western parts of Singapore.

These feed data to a rainfall forecast model to predict the movement, growth and decay of rainclouds and produce 30-minute forecasts. With the knowledge of where heavy rain is likely to fall, PUB can then deploy its mobile crews ahead of time to areas with high flood risk. This reduces travel time and enables flood management action to be taken. This includes traffic management, deploying portable flood barriers and diverting floodwater away from footpaths to keep road users and pedestrians safe.

To further improve the accuracy of rainfall predictions, PUB's rainfall monitoring and prediction system is to be enhanced with machine learning to improve the model's performance with every rain event. What other ways is PUB using digitalisation to manage Singapore's water?

SENSING, DATA-DRIVEN DECISIONS Core to all efficient operations is knowing what is happening on the ground as well as how assets are performing.

To achieve that, PUB relies on enhanced ground sensing. A large number of sensors in the field and throughout its infrastructure collect data related to rainfall, such as through rain gauges and the X-band radars. Other data that is

collected includes water quality in lakes and other bodies of water, service reservoirs, piped networks and plant processes; water levels in waterways, reservoirs and the sea; and the condition of PUB's mechanical and electrical equipment.

While traditionally a lot of the sensors are mounted in fixed positions, PUB has also started to use sensors installed on aerial drones or aquatic robots, such as robotic swans. These "swans" monitor water quality in real time. They are designed to look like real swans and can access remote locations autonomously.

PUB has also started to use small sensors that can travel through the piped network to gather data for the purpose of monitoring the inside of underground pipes. All this data enables PUB to know what's going on and respond quickly if anomalies are detected or thresholds are breached.

Now that all this data is collected, analysing it can yield insights to improve planning and operations.

Again, advancements in technology have made it possible to analyse large volumes of data in a relatively short period of time, to make predictions on what could happen if certain actions are taken, and even to recommend the best course of action to take. In this aspect, PUB has done much and is continuing to explore and

implement solutions to improve its operations.

CRACKING DOWN ON LEAKS

As a water-stressed nation, every drop of water is important and should not be lost or wasted.

Over the years, PUB has adopted various solutions to improve the detection of leaks so that pre-emptive action can be taken to repair the pipes and prevent further water loss.

This involves installing pressure and acoustic sensors in water supply pipelines, the data from which is analysed by a central system to pinpoint the location of leaks within 3m. The system also enables PUB's officers to simulate operations to ensure that water consumers are not adversely affected.

PUB's leak detection teams have also recently used smartphone sensors to detect leaks in smaller pipes and will be using inline pipe inspection tools to detect cracks or anomalies in the pipeline. These technologies have been proven to be more effective than the traditional method of using listening sticks, which rely on the hearing and experience of the user and as such is less accurate.

This year, PUB has embarked on a project to install 300,000 smart water meters at residential, commercial and industrial premises. It complements and enhances PUB's capabilities in

early leak detection within the water supply network as well as within customers' premises.

Conventional water meters in Singapore are read manually once every two months, whereas the smart water meters will take readings several times a day and transmit them automatically to PUB's systems.

This will enable PUB to detect anomalous water consumption much faster, and customers can then be notified and take action to rectify the issue and save some money.

Putting this data in the hands of the customers empowers them to make smarter decisions about how they use water, from shorter showers to turning off the tap while brushing their teeth, or washing only on a full load.

In earlier trials, households reported an average of 5 per cent water savings attributed to early leak detection and changing their water habits. Together with other measures and programmes that PUB has in place, it hopes to reduce household water consumption to 130 litres per person per day by 2030 from 158 litres per person per day currently.

INDIVIDUALS PLAY THEIR PART, TOO

Today's approach is a far cry from 1965 when Singapore became independent and its urban water management was similar to many cities of developing countries.

But under then Prime Minister Lee Kuan Yew, Singapore made tremendous advances in urban water and wastewater management. In about 25 years, its water management became the envy of the world. The Republic reduced its flood-prone areas from more than 3,000ha in the 1970s to 28ha in 2020.

In 2018, the Singapore Government launched its Digital Government Blueprint, using data and technologies to build a digitally confident and enabled workforce and services that are easy to use, reliable and relevant.

In that same year, PUB launched its Smart PUB road map, which outlined PUB's plan to use digital solutions and smart technologies like the industrial Internet of Things, robotics and autonomous systems, data and artificial intelligence to strengthen its operational resilience, productivity, safety, and security. Other pluses included improved efficiency and incident response times.

However, while the Government and PUB are doing their bit, each individual must play his part to make every drop count and to protect precious water resources. This is by not only using water wisely and responsibly, but also protecting water catchments by keeping them clean, as well as reporting incidents – such as floods, pollution and illegal fishing – to PUB. Yes, there is an app for that, too.

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