Challenge Statement:
Real Time Monitoring and Analytic System of In-building Water Distribution

(Predictive Maintenance of the Water Distribution System)

Challenge Theme – Sustainable Water usage

Background

Water Price Revisions

Water prices will be revised in two phases on 1 April 2024 and 1 April 2025.

Potable Water Price

|	Before 1 April 2024		From 1 April 2024		From 1 April 2025	
	Price ($/m³)		Price ($/m³)		Price ($/m³)	
Monthly Water Usage	0 - 40m³	> 40m³	0 - 40m³	> 40m³	0 - 40m³	> 40m³
Tariff	$1.21	$1.52	$1.29	$1.63	$1.43	$1.81
Water Conservation Tax (% of Tariff)	$0.61 (50% of $1.21)	$0.99 (65% of $1.52)	$0.65 (50% of $1.29)	$1.06 (65% of $1.63)	$0.72 (50% of $1.43)	$1.18 (65% of $1.81)
Waterborne Tax	$0.92	$1.18	$1.00	$1.25	$1.09	$1.40
Total Price	$2.74	$3.69	$2.94	$3.94	$3.24	$4.39

Note: Water is charged per cubic metre (m³), which is equivalent to 1000 litres. Higher water price applies for households with monthly usage above 40 cubic metres, to encourage water conservation. All figures are before GST.

https://www.pub.gov.sg/Public/WaterLoop/Water-Price

To prevent wastage and ensure water is used efficiently, it is import to have early detection of:

Leakages
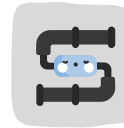
Faulty fittings

Abnormally high usages

Challenges

1. **Concealed pipe leaks**

    *   Water distribution pipes concealed within false ceilings, behind walls and underground.

    *   As a building ages, there might be potential leaks in the pipes which will pose an issue if not discovered in a timely manner.

    *   Leaks will gradually worsen over time. If left undetected, it may lead to property damage and hinders businesses.

2. **Malfunctioning flush valve and water fittings**

    *   Flush valves and water fittings might become faulty due to wear and tear.

    *   High wastage when the faulty valves/fittings happens during off-peak periods (e.g. night, weekends, etc).

3. **Misuse of taps at common areas**

    *   Taps are commonly available in common areas.

    *   These are usually locked up and used by the conservancy team for common area washing.

    *   Locks are often broken and illegal used.

Envisioned Solution

JTC is seeking innovative solutions to achieve water savings through predictive maintenance of water distribution system in an industrial building.

- A smart water management system with predictive maintenance and machine learning capabilities to detect leakages before it happens; and

- Identify abnormal water usage using real-time information on water usage activities within an industrial building.

Proposed location: CleanTech One

Solutions may be a combination of AI solutionings and sensory devices:

Generative AI for improved user experience

Smart water meters

Water pH level/metal ion measurement

Vibration sensors

CCTVs

Desired Outcome

The envisioned solution shall:

- Real-time information on various water usage activities at various areas (e.g. toilets, Cooling Towers, general washing, etc);

- Utilise industry benchmarks and past data to predict potential pipe leaks (including underground pipes), before it happens

- Early detection of areas with unusual usage in water consumption

- Provide diagnostic reports

- Calculate the potential cost avoidance due to early detection/ predictive maintenance

- Chart and analyse water consumption

- Compares the total water supplied to the building, the actual water consumed within all the water end uses and total water leaving the site. This information should be presented/visualised in an easy-to-understand format.

Requirements

1. Able to gather accurate real-time information of areas of interests

2. Able to track the total water supplied to the building, the actual water consumed within all the water end uses and total water leaving the site

3. Water management assessment results are to be presented/visualised in an easy-to-understand format

4. Use machine learning to be able to predict a pipe leak (before it happens)

5. Use machine learning to identify spikes/unusual usages, analyse and propose potential root cause (e.g. leak, location, illegal tapping, etc)

6. Produce diagnostic reports, recommendations and follow up actions that is simple and understandable to a non-technical person

7. Able to provide estimated cost avoidance due to the predictive maintenance/early detection

8. Ensure minimal disruption to tenants during installation and operation

9. Ensure minimal disruption to the existing domestic water supply system