An IoT digital twin to create Sydney's coolest park

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Abstract: Urban parks and green spaces offer the potential to mitigate heat impacts within cities when optimally managed. The Smart Irrigation Management for Parks and Cool Towns (SIMPaCT) project, a collaboration between academic institutions and industry partners, aims to create a digital system for better understanding and managing park irrigation. Using a low-cost environmental sensing network and digital twin technology, SIMPaCT is currently being developed, tested and operationalised at Bicentennial Park in Sydney.

The system employs an Internet of Things (IoT) network with 200+ soil moisture sensors, 50 air temperature sensors, and 13 weather stations. The data are ingested into a digital twin, and fused with weather forecast data, enabling the forecasting of environmental conditions, optimising irrigation schedules for urban greening and cooling, and enhancing the park experience for visitors. Initial findings show that providing irrigation before a heat wave can reduce average ambient air temperatures by up to 2 degrees Celsius.

The digital architecture of SIMPaCT is designed to be both scalable and replicable for any park or urban irrigation system. The pilot at Bicentennial Park includes a sensor network, a digital twin platform for ingesting sensor data and conducting analysis and optimisation, and a connection to the existing irrigation system for command and feedback to operate the irrigation in more than 200 zones. The digital twin, hosted on Eratos's SENAPS platform (Coombe et al. 2017), incorporates a robust muti-level decision-making model to optimise the park's irrigation for plant health and urban cooling on a daily basis.

The presentation will share key insights and lessons from the development and application of SIMPACT's digital twin solution, including:

- Challenges in the design of a digital twin solution building on a low-cost IoT environmental sensor network
- Development and design of a robust digital twin solution based on a multi-level decision-making model incorporating ML and conceptual hydrological models and an air temperature response model to produce reliable forecasts with the best available information from the large sensor network and the forecasting data
- Park-Live (https://www.simpact-australia.com), which communicates live sensor data to the public meaningfully using widgets, interactive maps, and a dashboard visualising the current heat stress conditions, the coolest location, and the temperature distribution across the park.

REFERENCES

Coombe, Mac, Paul Neumeyer, Joe Pasanen, Chris Peters, Chris Sharman, and Peter Taylor. 2017. "SeNAPs: A Platform for Integrating Time-Series with Modelling Systems." *Proceedings - 22nd International Congress on Modelling and Simulation, MODSIM 2017*

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