Enabling operational efficiencies through decision intelligence in the water supply network of Singapore

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SUMMARY

PUB, Singapore's National Water Agency, has embarked on a Smart Water Grid initiative in 2013 to improve the operational efficiency and resilience of the water supply network. To date, some 450 sensors have been installed nationwide across the potable, NEWater and industrial water distribution network. These sensors continuously transmit high frequency pressure, water quality, flow and acoustic data in real-time to a data management and analytics platform that enables improved situational awareness. Advance data analytics applications also provide early detection of poor pressure, damaging pressure surges, pipe bursts and water quality events. This paper describes how the smart water system has evolved to support two main applications: (i) online management of response to incidents in the pipe network and (2) planning dashboard to assess performance of the network for targeted management. The enabling technology for these two applications is the digital twin of PUB's pipe network. The digital twin incorporates an online calibrated nationwide hydraulic model that allows accurate simulations of operational scenarios (e.g., valve closure, hydrant flushing, and demand change), water age/TRC prediction, water quality source tracing and a framework that assesses the performance of the network from various singular or composite

perspectives such as material, age, customer complaints, pipe fatigue due to surges, thereby allowing targeted rectification for day-to-day operations as well as long-term planning.

KEYWORDS

Artificial Intelligence, Smart Water Grid, Digital Twin, remote monitoring, wireless sensor network, operational efficiency, Decision Intelligence

INTRODUCTION

The Public Utilities Board (PUB) is responsible for ensuring a sustainable and efficient water supply in Singapore. PUB is responsible for supplying 430 million imperial gallons a day to meet the nation's demand which is expected to double by 2060. PUB is set to meet 85% of this demand through its NEWater and desalination technologies. Since 2013 PUB has embarked on a Smart Water Grid initiative to improve the operational efficiency and resilience of the water supply network. To date, 450 sensors have been installed nationwide across the potable and NEWater mains network.

METHODS

To date, some 450 sensors have been installed nationwide across the potable, NEWater and industrial water distribution network. These sensors continuously transmit high frequency pressure, water quality, flow and acoustic data in real-time to a data management and analytics platform that enables improved situational awareness. Advance data analytics applications also provide early detection of poor pressure, damaging pressure surges, pipe bursts and water quality events. This paper describes how the smart water system has evolved to support two main applications: (i) online management of response to incidents in the pipe network and (2) planning dashboard to assess performance of the network for targeted management. The enabling technology for these two applications is the digital twin of PUB's pipe network. The digital twin incorporates an online calibrated nationwide hydraulic model that allows accurate simulations of operational scenarios (e.g., valve closure, hydrant flushing, and demand change), water age/TRC prediction, water quality source tracing and a framework that assesses the performance of the network from various singular or composite perspectives such as material, age, customer complaints, pipe fatigue due to surges, thereby allowing targeted rectification for day-to-day operations as well as long-term planning.

RESULTS AND DISCUSSION

This paper provides an overview of the system performance and show how the system help in improving the operational efficiency in the Singapore water supply network.

CONCLUSIONS

This paper provides an overview of the system performance and show how the system help in improving the operational efficiency in the Singapore water supply network.