CRC for Water Sensitive Cities

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CRC WSC C5.1

Intelligent Urban Water Systems

Automatically Detecting Abnormal Water Use

Case Study: Detecting Abnormal Water Use of Aquatic Leisure Centres in WA

Summary

Detecting abnormal readings in Smart Water Meters helps businesses to take actions to save water. We present an algorithm and a software system to detect and visualise abnormal (anomalous) water use. The system automatically generates anomaly scores with interpretable information. Figure 1 shows the system overview. We deployed the system in two aquatic leisure centres, Cannington and Riverton, in Western Australia. The system reads water consumption data each day from the smart meters in the aquatic centres and calculates an anomaly score. A daily email message containing the anomaly score, reason for the score and a visualisation (Figure 2) is sent to the aquatic centre managers. The managers can comment about the anomaly score via a web interface. The comments are stored in a database to improve performance of the system.

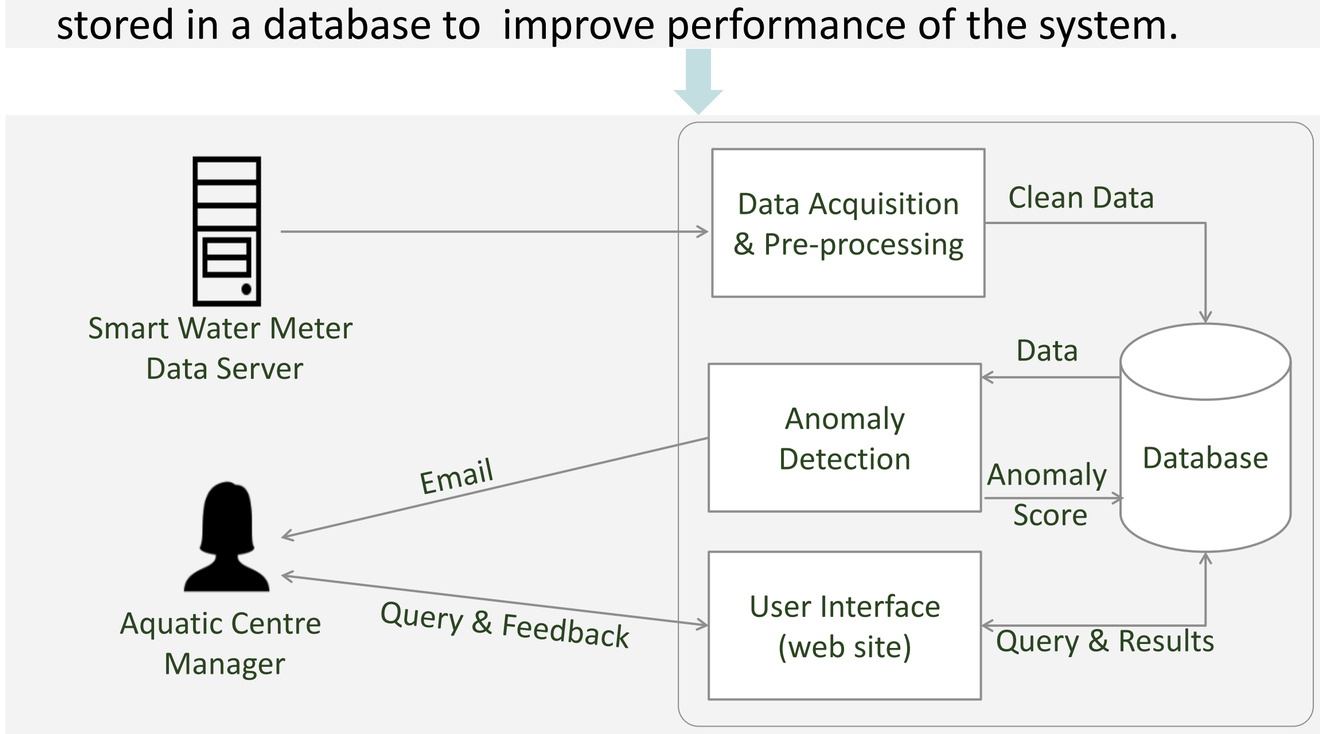
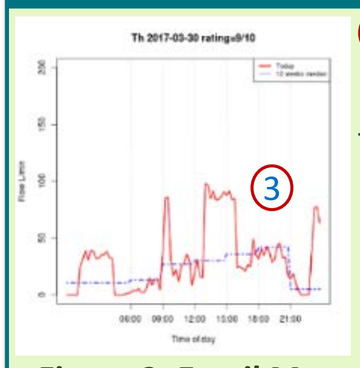


Figure 1: System Overview

Anomaly Detection Algorithm

- The Anomaly Detection algorithm considers the effects of ***features*** and ***contexts*** for anomaly score calculation for a given day.
- Water consumption during a given period of a day is a feature. The proposed algorithm use time of the day based features (E.g. 0-6am consumption) and flow based features (E.g. minimum flow).
- Seasons affect water consumption. The algorithm uses time window based context that reflects seasonal effects.

Informed Decision making



1 *86% score due to unusual flows:*
2 *100% in PM12-3, 98% in Dawn and 60% in daily flow*

Figure 2: Email Message Generated by the System

An email generated by the system (Figure 2) helps the aquatic centre managers make informed decisions on daily operations

1. Summarises abnormality of the day
2. Provide reasons for the anomaly score
3. Visualises how a normal day (blue) compares to an abnormal day (red)

Results

1.We developed a system for **automatically** detecting anomalous water use days compared to the manual configuration in the existing system.

2.The system send emails to the aquatic centre managers to assist **informed decision making** (Figure 2).

3.The system enables users to **save their comments** on anomaly score and water consumption patterns. This information is important for future research.

4.The system can detect a **variety of anomalies** compared to the single anomaly type detected by the existing monitoring system.

5.During the trial, the system detected **more days with anomalous water consumption** compared to the existing monitoring system

References

S. Patabendige, R. Cardell-Oliver, R. Wang, W. Liu. "Detection and Interpretation of Anomalous Water Use for Non-residential Customers." (Under review in the Environmental Modelling and Software Journal)

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