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Journal of Sensors
Volume 2016, 2016, Article number 3023018
Open Access

System-Aware Smart Network Management for Nano-Enriched Water Quality Monitoring (Article)

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Abstract

This paper presents a comprehensive water quality monitoring system that employs a smart network management, nano-enriched sensing framework, and intelligent and efficient data analysis and forwarding protocols for smart and system-aware decision making. The presented system comprises two main subsystems, a data sensing and forwarding subsystem (DSFS), and Operation Management Subsystem (OMS). The OMS operates based on real-time learned patterns and rules of system operations projected from the DSFS to manage the entire network of sensors. The main tasks of OMS are to enable real-time data visualization, managed system control, and secure system operation. The DSFS employs a Hybrid Intelligence (HI) scheme which is proposed through integrating an association rule learning algorithm with fuzzy logic and weighted decision trees. The DSFS operation is based on profiling and registering raw data readings, generated from a set of optical nanosensors, as profiles of attribute-value pairs. As a case study, we evaluate our implemented test bed via simulation scenarios in a water quality monitoring framework. The monitoring processes are simulated based on measuring the percentage of dissolved oxygen and potential hydrogen (PH) in fresh water. Simulation results show the efficiency of the proposed HI-based methodology at learning different water quality classes. © 2016 B. Mokhtar et al.

Indexed keywords

Engineering controlled terms: Biochemical oxygen demand; Data visualization; Decision making; Decision trees; Dissolved oxygen; Fuzzy logic; Learning algorithms; Nanosensors; Network management; Quality control; Trees (mathematics); Water quality

Attribute-value pairs; Forwarding protocols; Operation management; Optical nanosensors; Potential hydrogens; Rule learning algorithms; Water quality monitoring; Water quality monitoring systems

Engineering main heading: Information management

ISSN: 1687725X **Source Type:** Journal **Original language:** English
DOI: 10.1155/2016/3023018 **Document Type:** Article
Publisher: Hindawi Publishing Corporation

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