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

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JOURNAL OF SENSORS
Article Number: 3023018
DOI: 10.1155/2016/3023018
Published: 2016
View Journal Information

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.

Keywords

KeyWords Plus: WIRELESS SENSOR NETWORKS; DISSOLVED-OXYGEN; DOPED CERIA; NANOPARTICLES

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Funding

Funding Agency	Grant Number
Information Technology Industry Development Agency (ITIDA Egypt)	ARP2013.R13.2

Close funding text
The presented work is part of the awarded Grant "ARP2013.R13.2" funded by Information Technology Industry Development Agency (ITIDA Egypt).

Publisher

HINDAWI PUBLISHING CORP, 315 MADISON AVE 3RD FLR, STE 3070, NEW YORK, NY 10017 USA

Categories / Classification

Research Areas: Engineering; Instruments & Instrumentation

Web of Science Categories: Engineering, Electrical & Electronic; Instruments & Instrumentation

Document Information

Document Type: Article

Language: English

Accession Number: WOS:000383064200001

ISSN: 1687-725X

eISSN: 1687-7268

Journal Information

Table of Contents: Current Contents Connect®
Impact Factor: Journal Citation Reports®

Other Information

IDS Number: DV6RJ

Cited References in Web of Science Core Collection: 36

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