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Cloud-Based IoT System for Real-Time Harmful Algal Bloom Monitoring: Seamless ThingsBoard Integration via MQTT and REST API

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Abstract
Harmful Algal Blooms (HABs) pose a severe threat to aquatic ecosystems, drinking water supplies, and public health. Existing water quality monitoring methods are often costly and complex thus limiting their accessibility and scalability for continuous monitoring. This work proposes a scalable, cloud-based IoT solution for real-time water quality monitoring, specifically targeting HAB detection using cost-effective sensors. The system architecture utilizes Microsoft Azure hosted ThingsBoard platform for data management, integrating telemetry data from sensors via MQTT and REST API protocols to enable reliable, low-latency data transmission and storage. Through a combination of numeric and graph-based dashboards, end users can monitor both real-time and historical data, supporting early anomaly detection and rapid response. This work uses a cloud-based system to manage IoT devices, ensures secure data transmission, and displays the data on ThingsBoard without needing extra cloud services. The proposed system is cost-effective, flexible, and easily extendable to different monitoring environments. In addition, it could be contributing to proactive water resource management and public health protection against HABs threats. © 2024 IEEE.

Author Keywords
Azure VM; Cloud Integration; Hab; IoT; MQTT; Non-Industrial Sensors; Real-Time Data Visualization; REST API; Telemetry; ThingsBoard; Water Quality Monitoring

Index Keywords
Data privacy, Mineral springs, Network security, Outages, Steganography, Telemetering systems; Azure VM, Cloud integrations, Hab, Industrial sensor, IoT, MQTT, Non-industrial sensor, Real-time data, Real-time data visualization, REST API, Thingsboard, Water quality monitoring; Blooms (metal)

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