

# Real-Time Monitoring and Sensor Data Providing for the BIM-based Monitoring of Hydraulic Structures Using SensorThings API and MQTT

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## SUMMARY

In many countries, civil engineering structures face challenges from ageing infrastructure, increased inspection and maintenance needs, while at the same time lacking effective real-time digital monitoring methods. This article focuses on hydraulic structures such as locks, weirs, and dams that are essential for waterway transportation. This paper introduces an advanced approach to integrate real-time sensor data into Building Information Modeling (BIM) systems, creating a digital twin framework for improved maintenance and operational efficiency. The project employs the OGC SensorThings API (STA) and MQTT protocol for standardized, real-time data transmission and management, with future plans to incorporate GeoMQTT for enhanced geospatial and temporal filtering.

Edge computing optimizes data preprocessing at the sensor level, enabling real-time analysis while reducing data volume. The proposed system includes a linked data model that semantically connects sensor data to BIM components, enhancing decision-making and visualization. Initial tests demonstrate the feasibility of managing high-frequency data streams with low latency, offering significant improvements in the proactive maintenance of hydraulic structures. Planned enhancements include edge-level data processing and improved (Geo)MQTT message sequencing for robust, scalable, and efficient monitoring.

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