

INTEGRATING INDEX-BASED ASSESSMENT AND PUBLIC ALERTING FOR SURFACE WATER QUALITY: INSIGHTS FROM THE DANUBE RIVER

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BACKGROUND

Reliable assessment of surface water quality is crucial for protecting ecosystems and preventing pollution. Traditional approaches, based on periodic sampling and laboratory analyses, often fail to capture short-term fluctuations and cannot provide timely early warnings.

OBJECTIVE

- **Develop IIWQI:** Create and validate an advanced water quality index.
- **Enhance CSWQI:** Improve sensitivity to ecological stressors.
- **Real-Time Alerts:** Integrate into a live monitoring system.

METHODOLOGY

The IIWQI framework was designed to:

- **Apply Modified Upper Threshold Limits (MUTL)** for proactive detection.
- **Focus on four key parameters:** temperature, pH, electrical conductivity, and dissolved oxygen (DO).
- **Use weighted subindices** to reflect ecological importance.
- **Daily data from the Serbian Environmental Protection Agency (SEPA) for the Danube River at Novi Sad (2024)** were processed and analyzed through the integrated software platform.

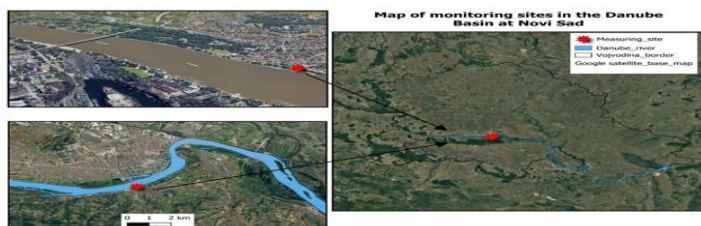


Figure 1. Novi Sad monitoring station operated by the SEPA

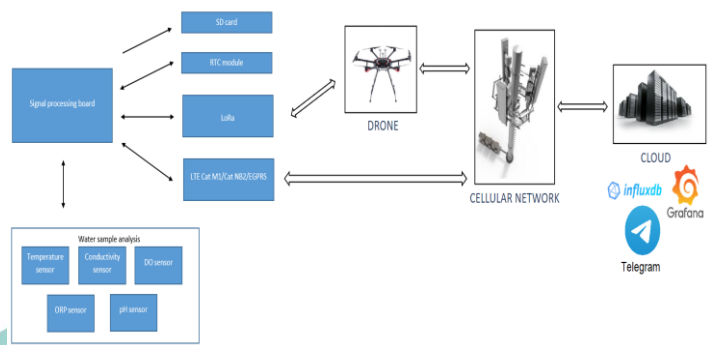


Figure 2. System architecture of the alerting system

RESULTS

CSWQI predominantly classified the water as “poor.” However, the IIWQI revealed more detailed dynamics and identified 15 threshold exceedances (≈4.1% of observed days). Episodes of DO supersaturation (>8.5 mg/L) in winter were flagged by the IIWQI but overlooked by the CSWQI.

The alerting system was implemented through:

- **Grafana dashboards** for visualization, and
- **Telegram notifications** for real-time alerts.
- **This setup distinguished short-term anomalies** from sustained degradation, demonstrating reliability for practical application.

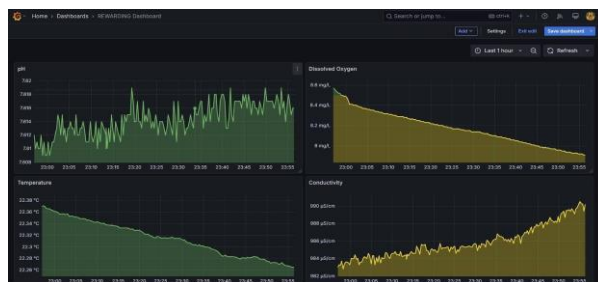


Figure 3. Grafana Dashboard



Figure 4. Multi-Index Comparative Analysis - SEPA's data

SIGNIFICANCE

By combining public datasets with intelligent processing and automated communication tools, the system enables:

- **Early detection of ecological stress,**
- **Rapid institutional response, and**
- **Citizen engagement in water protection.**

The approach operates effectively even without in situ sensor networks, offering a scalable solution for other river basins and supporting EU Water Framework Directive goals.



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