DOxy: A Dissolved Oxygen Monitoring System

Abstract:

Dissolved oxygen (DO) is a vital parameter for water quality assessment, especially in aquaculture and environmental monitoring, where low oxygen levels can harm aquatic life. Traditional DO meters are often expensive, high-maintenance, or require frequent manual measurements. This paper introduces a low-cost, sustainable, and compact IoT-based DO monitoring solution—DOxy—that utilizes a high-sensitivity pulse oximeter sensor, typically used in biomedical applications, repurposed for detecting DO in water. The system employs optical sensing using infrared light, combined with physical barriers and 3D-printed housings to protect the sensor from water exposure. Measurements taken using DOxy were validated against a commercial DO meter, showing high accuracy and reliability. Although machine learning was used in part for data mapping, a separate curve-fitting approach was also applied to generate a usable conversion formula for offline sensor use—making the system effective even without AI. This enables DOxy to provide real-time, automated, and continuous DO measurements, with applications extending beyond aquaculture to environmental water testing and public health.

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Dissolved Oxygen in Rivers: Concepts and Measuring Techniques

Abstract:

Dissolved oxygen (DO) is one of the most critical indicators of river health and aquatic ecosystem function. This study explores the core concepts and field techniques used to measure DO in flowing water bodies. It compares traditional chemical titration methods like Winkler's technique with more modern electrochemical and optical sensors. Each method has its own strengths and limitations, especially under varying hydrological and environmental conditions. Real-world sensor performance was tested in three rivers in Poland, revealing how sensor placement, calibration, and river dynamics significantly influence the accuracy and resolution of DO data. The paper highlights the effect of abiotic factors—such as water temperature, flow rate, channel shape, and vegetation—on DO distribution. It also discusses phenomena like oxygen oversaturation and diel (daily) fluctuations, as well as the importance of short- and long-term measurements. Through detailed field investigations, the authors emphasize the importance of using appropriate sensing methods in specific riverine settings and provide insights for improving monitoring strategies. This work contributes to more effective environmental management, modeling, and policy development in river systems, without relying on AI or machine learning techniques.

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Field Measurement of Dissolved Oxygen: A Comparison of Methods

Abstract:

Measuring dissolved oxygen (DO) in the field is essential for assessing water quality in groundwater and surface water systems. This paper evaluates several widely used methods for DO measurement, including the traditional Winkler titration and modern electrode-based techniques, under real-world field conditions. The study compares these methods in terms of accuracy, ease of use, equipment portability, and reliability, particularly for applications in groundwater monitoring. The findings reveal that while Winkler titration remains the most accurate method, it is less practical for routine fieldwork due to its complexity and time demands. Electrode-based sensors, on the other hand, offer rapid measurements and reasonable accuracy above 1.0 mg/L of DO, making them more suitable for continuous and in-situ monitoring. The paper concludes that method selection should depend on field constraints and project goals, offering valuable guidance for hydrologists, environmental engineers, and field technicians working in water quality assessment—without relying on AI or automated systems.

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