

PROJECT PROFILE

202001

AQUA [Aquatic Qualification with AI]



Fresh water is essential to human life. Yet only a small fraction of water on Earth (2.5%) is potable (suitable for drinking). Moreover, this vital fresh water can be contaminated with naturally occurring pollutants or chemicals produced by human activity. This makes reliable water quality monitoring in water distribution networks of the utmost importance. However, while existing water quality monitoring systems can help spot problems, they cannot determine and classify the specific type of contaminants present in real-time.

The AQUA project partners aim to take water monitoring to a new level, so water companies can detect, classify and react to problems rapidly, and more generally, improve incident prevention. AQUA will achieve this through the application of Artificial Intelligence (AI) and the creation of novel online sensor systems that support new data analytics and classification technology. Ultimately, the project's outcomes will benefit society worldwide by helping to ensure supplies of safe, clean drinking water through AI-based systems and services.

The need for faster, classified contaminant detection

The quality of potable water can fluctuate during both production and distribution, due to contaminants from the source water and other sources such as pipeline leakages or mixing of water streams. There are also risks from deliberate contamination, for instance, as an act of terrorism.

Hence, the crucial importance of monitoring potable water quality throughout the entire production and distribution infrastructure. Indeed, water utilities are typically under a legal obligation to conduct quality monitoring. Mostly, this is done through 'grab sampling' – taking a sample of the water over a short period of time then analysing it in a laboratory. However, this provides only a 'snapshot' of water composition, with no indication of variations over a longer time. Plus, it may take hours or days to get the analysis results. This limits water companies' ability to take timely action, and it also limits their ability to conduct pro-active network maintenance.

In effect, water utility companies need real-time contamination detection based on acquiring, analysing, and classifying high-quality real-time data on deviations from required norms. This monitoring would be able to discriminate between acceptable operationally induced changes in water quality and changes due to contaminants or adverse incidents. However, no such monitoring tool that can provide this actionable information currently exists.

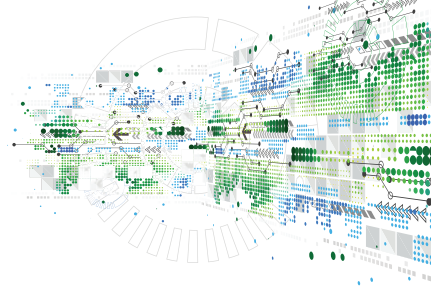
AQUA takes monitoring to a new level

AQUA will transform this situation by developing advanced machine learning (ML) frameworks that use today's conventional sensor systems, but which go beyond current capabilities to enable this crucial, advanced real-time event detection and classification.

In particular, the AQUA ML frameworks will be integrated into two existing sensor systems, which in turn will be integrated into a single system (the AQUA platform). Overall, the consortium will develop innovations along the complete technology value chain from sensor components and ML frameworks to industrial-grade monitoring systems that are part of a larger sensor network.

These include:

1. A ML framework that will allow an existing commercial sensor platform to perform **ultra-sensitive local water quality monitoring** based on optical refractive index sensing
2. A ML framework that will allow an existing commercial sensor platform, based on a Fish Activity Monitoring System, to perform **local monitoring of physiologically relevant changes** in water quality
3. A ML-framework that can be used to interpret the **water quality in decentralised production**
4. The **AQUA platform**, a modular integrated monitoring system using ML



KEY APPLICATION AREAS



Digital society



Health and Wellbeing

PARTNERS

DE WATERGROEP
DEMCON
HAL24K
OPTIQUA
ZWEEC ANALYTICS

COUNTRIES INVOLVED



Belgium



Netherlands



Singapore

PROJECT LEADER

Gido Akse
Company : DEMCON.

KEY PROJECT DATES

Start: 01-03-2021
End: 29-02-2024

5. A ML-based **data analysis and event classification system** utilising a proven platform that can interpret sensor data on the **water network level**

6. An automated **water sampler prototype** to take on-site water quality samples to generate sensor data for ML training and validation

7. A **water quality monitoring pilot**, integrating the two sensor platforms, that will be tested in the water distribution network of two water distribution companies

From the outset, the partners will pay special attention to end-users needs. Together, they will develop tools and methodologies to verify sensor data that have been processed with AI.. The partners will also build demonstrators to help technology and industrial end-product suppliers within the project to develop a strong market proposition.

In short, AQUA will provide water utility companies with novel ML-based analytical toolsets and sensor systems that can act as an early warning system allowing them to rapidly respond to adverse (or even toxic) water quality events, and thereby maintain production and distribution of the highest quality potable water to consumers. This will represent a major step towards the ultimate monitoring goal – a digital twin capable of monitoring all process and quality parameters within the entire water production and distribution network.

Experienced partners: from technology providers to utility companies

To do all this, the AQUA consortium brings together an experienced engineering company, a data intelligence scale-up, two technology providers, and a large water company. Together, they combine

the necessary innovation expertise and real-world experience spanning research, technology and industrial end-product supply and end-users. Moreover, they all are active in RD&I: every partner has developed unique knowledge over many years that together forms the foundation of the project.

Huge and growing market

AQUA's outcomes will meet the needs of a vast market. Annual global expenditure on drinking water production and distribution currently exceeds 180 billion USD. Within this, the segment for water quality monitoring and analysis constitutes an estimated volume of 3.75 billion USD for 2020 and is expected to reach USD 4.68 billion by 2025.

The market is being driven by a range of factors including increasing industrial activities that spur demand for water monitoring products, greater government funding for pollution monitoring and control, the growth of smart city concepts, and the emergence of ML-enhanced water quality monitoring itself. In Europe alone, the water quality monitoring market is expected to grow exponentially based on increased awareness of water pollution and contamination.

AQUA's primary focus will be on utilities and industrial applications. However, the AQUA platform will have added value in terms of individual components and of a complete and integrated solution, covering local and network-wide, centralised and decentralised production needs.

In the short term, AQUA's novel ML-based sensor platforms will be applied by water distribution companies in Singapore and Taiwan. Further ahead, in the mid-to long-term, the project's outcomes are expected to help ensure safe, clean drinking water in monitoring applications worldwide.

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