

A Clearer Look at Water Purification, With Cost-Cutting Potential

Challenge & Solutions

Clean water is a human requirement, and ensuring that purification processes are working properly is critically important to municipalities worldwide. This long-recognized need has spurred many water treatment plants to install process-monitoring systems, but their effectiveness is limited by available sensing technology – bulky, expensive pressure transducers, which are only able to automatically detect gross underperformance. As a result, problems in multi-step water purification often go undetected until fouling is detected downstream, which then requires costly cleaning and downtime. Detecting these problems earlier would simplify and speed up responses – and improve overall purification plant efficiency, output and economics.

With this in mind, the IN-VITRO proof-of-concept project focused on miniaturizing and vastly improving the measurement of biofouling, while maintaining compatibility with widely used flow cell purification systems. The team shunted water into an experimental flow cell to simulate full-scale operation and test a novel sensing methodology for detecting a specific failure in purification systems. Traditional pressure-differential equipment was replaced with a camera that can detect evidence of biofouling, linked to a cyber-physical system

ing s that that that that system

(CPS) platform for image processing. This approach detects much lower levels of biofouling. In addition, because the new equipment can be networked wirelessly, multiple sensors can be easily retrofitted into existing plants, with their data communicated and reported independently of centralized control systems.

EuroCPS Support

EuroCPS provided the framework for several organizations with diverse expertise to collaborate on design and verification of the new testing procedure. High Tech NL, the Digital Innovation Hub, served as a networking partner guarding the experimental process and the communication with EuroCPS. Intel's Quark microcontroller system-on-a-chip was the foundation for the system's hardware, with a small FOV camera and analog inputs for pressure detection.

Digital Skills

ExAqua: concept idea, applicable domain knowledge about chemical and biological processes and their use in water treatment plants and processes.

DevLab: knowledge of embedded systems, both hardware and software, sensor technologies and wireless networking skills; expertise in image processing with OpenCV.

Impact / What's next

Company

Since

2004

DevLab is an Eindhoven-based collaboration of 12 technology companies working on product development in electronics, mechatronics, embedded software and industrial design (NL) <u>http://www.devlab.nl</u>

165 employees

Partners: HTNL (NL), ExAqua (NL), WMD-NWTR (NL)

High Tech NL Sexaqua

The experiment demonstrated much higher detection sensitivity than existing methods, identifying treatment performance problems that can lead to biofouling. In addition, the system's miniaturization and networking capabilities make treatment-plant operational control more economical and sophisticated. Undetected purification problems account for approximately 30 percent of a typical plant's operational costs, and the team forecasts that mitigation provided by its upstream solution can reduce these costs by up to 30 percent. In the first half of 2018, additional experiments will focus on properties needed for product development, such as adaptation to lighting conditions, and optimizing camera specifications and algorithms. The project will also collect data for longer periods and compare performance of its image-processing algorithms to traditional pressure-difference measurements. Potential applicability of the proposed technique extends well beyond this initial use case, into virtually any process where early detection of biofouling is important.



EuroCPS is an European funded project gathering several design centers in order to boost and initiate synergies between innovative companies, major CPS-platforms and CPS-competency providers.

