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WATER 4.0
DIGITAL WATER ECONOMY

W-Net 4.0 –Unlocking the Potential of Digitalization in Water Supply

Collaboration in Dynamic Value-Added Networks (InKoWe) – Water Cluster

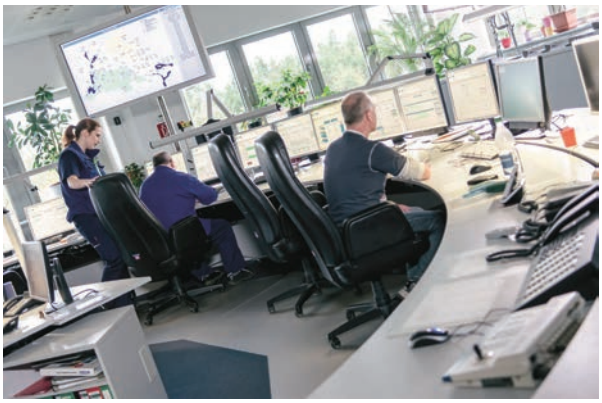
More than 4,000 companies are responsible for drinking water supply in Germany. Very few of them, however, employ IT or automation technology. The main reasons why digitalization has failed to penetrate this sector are software architecture, incomplete data sets and/or the lack of relevant IT and automation expertise. In an attempt to remedy this, joint research project W-Net 4.0 aims to pool geo-information, simulation and data analysis tools in a secure, easy-to-use web-based platform.

Modular, Scalable Platform

The benefits of digitalized, networked water supply speak for themselves. Sensors systematically monitor water quality, network capacity and smooth operation. A control system coupled with suitable drive elements enables flexible control from a central point. Thanks to state-of-the-art data analysis methods, many processes can also be automated. Fully digital data models of the supply pipelines are generated, enabling new scenarios, resulting from additional large loads, for example, to be simulated at any time and any infrastructural interventions to be planned effectively.

Generally speaking, the technologies needed for digitalized water supply have been in place for some time. In practice, however, most water supply companies – many of which are small and medium-sized enterprises – stumble at the first hurdle. More often than not they do not record measurement data systematically, and their pool of data on water networks, geo-information systems (GIS), simulation software or data analysis tools is poorly maintained. The bigger water suppliers, although better equipped on the technical side of things, barely use available data to monitor and optimize drinking water supply due to the absence of networked systems and a lack of dedicated staff.

The partners involved in the W-Net 4.0 project are therefore looking to develop a comprehensive, one-size-fits-all package for water suppliers: a web-based platform that combines GIS system, simulation software and data analysis tools, is accessible to those who are not well versed in Water 4.0, and meets the strictest of data security and IT security requirements. The new platform is based on a modular, scalable concept, meaning it can be customized to meet the needs of any particular company size. It models the entire value-added chain, from data acquisition and digital documentation to model-based simulation testing.



W-Net 4.0 seeks to create dynamic networks between GIS, simulation and data analysis tools in a web-based platform

More than just a Web-Based Platform

The new networked GIS, simulation and data analysis platform is based on data transfer modules that are already in place in industrial production environments. One focus lies on adapted machine-to-machine and human-machine interfaces, meaning the software can even be used by employees with scant IT skills. The new platform will be put to the test in small and medium-sized water companies. The project partners will also be looking at the possibility of using the platform for data analysis purposes, with the approach being trialled at a large-scale water supplier. Complex application cases addressing various issues related to the urban water cycle have been identified for this purpose. In the area of water supply, for example, this includes checking lab data on drinking water quality by looking at the interplay between chem-

ical quality parameters at the waterworks and biosensors and algorithms.

In addition to the web-based platform, the team will also be putting together a series of training courses designed primarily for employees of small and medium-sized enterprises. The W-Net 4.0 project team is also looking to develop new service concepts and business models related to the web-based platform.

Complex processes such as those in waterworks can be monitored and tested more efficiently using the models developed in the W-Net 4.0 project

One Size Fits All

The new platform will give small and medium-sized suppliers the tools they need to run and maintain their supply networks using a needs-based approach. Thanks to improved sensor-data-based monitoring, they will be able to guarantee or even improve the quality of drinking water and detect leaks in the drinking water supply network early. Larger water suppliers, for their part, can enjoy the benefits of an established network of sensor manufacturers and service providers in the area of GIS, simulation and data analysis as well as optimized processes.

Funding Measure
Collaboration in Dynamic Value-Added Networks (InKoWe) – Water Cluster

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Dynamic Value-Added Networks Based on Industry 4.0 Technologies for Sustainable Operational Security and Optimization of Water Systems (W-Net 4.0)

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DynaWater 4.0 – Digitalization in Industrial Water Management

Collaboration in Dynamic Value-Added Networks (InKoWe) – Water Cluster

When it comes to digitalization, industrial water management is still lagging behind the production and processing industries, which are becoming more and more interconnected every day. Due to its close connection to manufacturing processes, however, it is precisely in this area where the water economy needs to become more flexible and interconnected. In the joint research project DynaWater 4.0, eight partners will for the first time be looking at digitalization of water-based processes with a view to scientific, technical and economic potential.

Linking Water Management and Production

Water is a vital resource in the production industry. On the other side, industrial production also generates a lot of wastewater. The ever increasing flexibility and digitalization in the production industry, attributable to the trend towards smaller batch sizes and the manufacuring of personalized products for example, call for a similar development for industrial water management as part of the Industry 4.0 revolution. Even though automation, interconnectivity and digital technology are already essential drivers of transformation in this sector the degree of interconnectivity between resources, information and processes, however, remains inadequate.

Exactly what form digitalization could take in industrial water management was outlined by industry experts in the Industrial Water 4.0 concept published in 2018. Drawing on this, the DynaWater 4.0 project partners will be connecting models, sensor networks and data platforms as well as water management components and production processes. Optimum control and management of industrial wastewater treatment processes, for example, will help bring the processes into line with the actual quantities and qualities generated, saving on resources such as water and treatment chemicals. The researchers will be demonstrating and evaluating the potential that digitalization offers using concrete examples across various sectors.

Exploring Potential with Digital Twins

To explore the potential, the project partners will take existing components of water/wastewater technology and adapt them to production processes, developing models of the individual components and sub-processes. These models make it possible to create a digital twin of the process equipment. The twin can model the entire process at any given time, enabling forecasts and adjustments to be made. In practice, the intelligent products developed are

DynaWater 4.0 project: connecting water management and production processes

tested at ever increasing levels of connectivity in applications in the chemical, steel and cosmetics industries. This approach makes it possible to model the digital collaboration between water management and production at different levels, and gauge the potential for optimization this offers. The project team evaluates the results and demonstrates how these might be used in other branches of industry.

Huge Market Potential in Equipment Upgrades

The project findings are directly transferable to the process industry and plant engineering sector. In small and medium-sized enterprises in particular (SMUs) this could help lower running costs and improve process stability. The greatest market potential is to be found in upgrades to existing industrial wastewater systems in the form of retrofitted components and models.

The intelligent products are tested in various sectors

Funding Measure
Collaboration in Dynamic Value-Added Networks (InKoWe) – Water Cluster

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Dynamic Value-Added Networks through Digital Collaboration between Industrial Water Management and Production (DynaWater 4.0)

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WaterGridSense 4.0 – Intelligent Sensor Platform for Status Monitoring in Water and Wastewater Networks

Collaboration in Dynamic Value-Added Networks (InKoWe) – Water Cluster

Vast water and wastewater networks covering hundreds and thousands of miles and counting are in operation across the world today. Utility companies, however, whether in Germany or elsewhere, have no or only very little knowledge of what is happening in these networks, be it under normal conditions or heavy rainfall. The WaterGridSense 4.0 joint research project, in an attempt to obtain a better picture of the network conditions, will be developing a micro sensor platform that will help utility companies optimize network evaluations, monitoring and operational planning.

Sensor Networks Transmit Data from Underground

Utility companies need data on the status of their water and wastewater networks in order to be able to manage them effectively. Such information enables them to improve or even restructure their planning, operation and maintenance measures as well as document and analyze unexpected conditions in the system. Existing measurement equipment for online monitoring and status information, however, is either too large or too expensive for use across entire networks. Another problem is the absence of suitable energy or CIT infrastructures in existing networks – and the cost of installing such infrastructures is prohibitive. This is where the WaterGridSense 4.0 project comes into play. The four partners involved in this project will be developing largely energy-autonomous, wireless sensors for use in rainwater and sewage systems. The sensors can work in clusters and are installed on a purpose-built platform which is roughly the size of a matchbox.

Three-in-one Platform for Different Applications

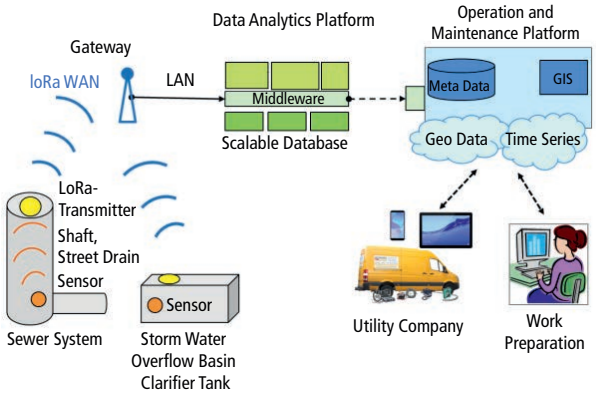
The new platform will be trialled in three applications, the first being rainwater drains. The platform, fitted close to the surface with integrated manipulation-proof, maintenance-friendly sensors, will send drainage status reports and analyze the need for cleaning. The second trial area is a stationary application, where the sensor platform is permanently installed at designated points in a sewage system, e.g. shafts or pumping stations, and the sensors measure the volumetric flow rate, water quality, infiltration or inflow. The third and final application will be a mobile, energy-autonomous sensor platform installed in a sewage system for temporary measurement series. The sensors transmit online data from certain points or stretches of pipe where measurements are usually unfeasible.

The new sensor platform will offer a scalable, cost-efficient means of mapping these scenarios at defined intervals and sending the information to the Internet via wireless communication. The sensor data is combined and analyzed by dedicated processing systems. An operation and maintenance platform connected to the data platform analyzes and displays status reports as well as the respective status in the sewage system. With the help of state-of-the art machine learning methods, the system will also make suggestions for predictive maintenance action.

Sensor networks will help to monitor conditions in rainwater and sewage systems and optimize operation

Intelligent Status Monitoring Optimizes Operation

In terms of outcome, the project partners hope to design a new micro sensor platform that works in combination with an operation and maintenance platform for intelligent status monitoring in combined sewer systems. The new platform would enable utility companies to prepare their networks for specific weather events. If heavy rainfall is forecast, for instance, utility companies could drain sections of the network to prevent the mixed sewage and rainwater from overflowing into water bodies.



WaterGridSense 4.0 schematic

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Collaboration in Dynamic Value-Added Networks (InKoWe) – Water Cluster

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