

Harnessing AI for Water Management in Agriculture: A Leap Towards Sustainable Farming

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The agricultural industry is undergoing a technological revolution, with artificial intelligence (AI) playing a pivotal role in enhancing productivity and addressing labor shortages. However, the focus has largely been on these aspects, often overlooking environmental concerns, particularly water management. Effective water management is crucial given the increasing climate variability and the need for sustainable agricultural practices. This blog explores the potential of AI in transforming water management in agriculture, emphasizing the work of leading companies and the innovative solutions being developed.

Water is a critical resource in agriculture, yet its management often suffers from inefficiencies and lack of data. Traditional irrigation practices can lead to overuse or underutilization of water, impacting both crop yields and resource sustainability. AI technologies, however, offer a promising solution by integrating various data sources to optimize water usage. For instance, AI can combine satellite imagery with precipitation data to guide farmers on irrigation needs, making it a powerful tool for climate change adaptation (HelioPas AI, 2021).

WABOOST is a Slovenian hi-tech company specializing in developing water treatment solutions using nanobubble technology. This technology enhances irrigation water by infusing it with ultra-fine bubbles of oxygen and other gases, significantly improving its value for agricultural and other industrial uses. The company addresses the strong need for better water measurement, management, and enrichment in agriculture. Their approach includes real-time data collection and IoT-based water treatment, such as disinfection and oxygen enrichment, which are crucial for maintaining water quality and optimizing its use.



Figure 1 (left): Waboost Nanobubble generator. Figure 2 (right): Waboost IoT application

Despite the potential of AI, several challenges remain. There is a significant lack of water condition and quality measurements in agriculture. Effective water management requires comprehensive data collection from various sources, including rainwater, lakes, and springs. WABOOST aims to tackle these challenges by:

1. Improving real-time data intake from remote water sources.
2. Overlaying this data with open-source information on micro-location weather and temperature.
3. Determining the suitability of different water types for various agricultural uses.
4. Optimizing water intake using AI to enhance crop yields and resource efficiency.
5. Providing a graphical, real-time map of water sources and quality metrics to aid management decisions.

By learning the specifics of different water sources and integrating this data with external environmental factors, AI systems can offer tailored recommendations for water use, ultimately benefiting various stakeholders in the agricultural ecosystem.

WABOOST's pilot project includes developing AI-enabled services for continuous monitoring and optimization of water quality. The system will intake data from IoT sensors and combine it with public open-source data, such as government river measurements and pollution data. This inclusive data system will support:

1. Real-time monitoring of water quality from diverse sources.
2. Prognostic alerts to inform stakeholders of necessary actions regarding water addition or potential system issues.
3. Optimization of water management for energy and water savings, enhancing agricultural productivity.

This innovative approach promises to reduce water loss and energy waste while ensuring better crop outcomes.

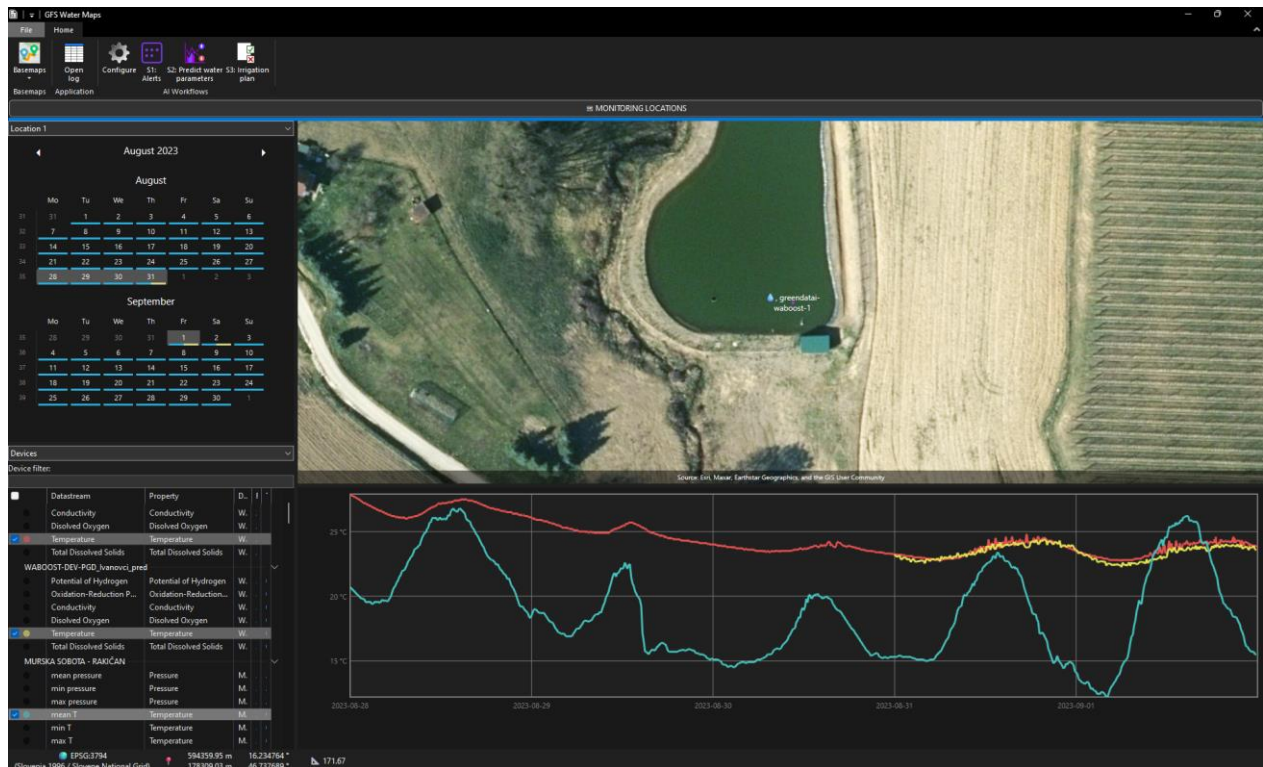


Figure 3: Dashboard with water quality data and predictions (yellow color)

The pilot project led by WABOOST involves a Wacognis platform infrastructure, including digital sensors for water measurement, IoT data collectors, and GeMMA Fusion Suite an end-to-end solution for rapid mapping (in-house development provided by the University Maribor). A wide array of data sources, from national meteorological data to international water quality databases. This comprehensive data integration will enable a detailed understanding of water conditions at micro-locations, facilitating precise and efficient water management strategies. University of Maribor (UM), Laboratory for Geospatial Modelling, Multimedia and Artificial Intelligence (GeMMA Lab) is the technical lead, developing the overall solution and integration in the existing platform supported also by partners co-developing the data analytics services.

The project's goals are to have farmer users in Slovenia, advisory services provided, and the production of detailed water management maps. By lowering response times and optimizing learning processes through AI, the pilot aims to deliver substantial social and economic benefits. WABOOST's pilot group includes farmers using various irrigation methods and greenhouses.

The ultimate goal is to create a sustainable, efficient, and resilient agricultural water management system that can adapt to changing environmental conditions and support the global push towards greener agricultural practices.