Software solution controls water pressure in distribution networks

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Leaf system is used by 35 companies and has been implemented by Prolagos, the water and sanitation utility for seven municipalities in Rio de Janeiro State . Credit: Prolagos

Software used by Coca-Cola Femsa to reduce liquid waste from the soft drink bottling process has cut water waste due to leakage by 2 percent, equivalent to 2.5 million cubic meters per year.

The system is called Leaf, and was developed by I.Systems. It will now be tested for the control of water abstraction from rivers in the Lakes Region, which comprises the municipalities of Araruama, Armação dos

Búzios, Arraial do Cabo, Cabo Frio, Iguaba Grande, São Pedro da Aldeia and Saquarema. "Given the good results achieved by using the software to control water distribution, the opportunity arose to extend its use to water abstraction, encompassing the entire water supply system in the Lakes Region," says Igor Santiago, president of I.Systems.

According to Santiago, the technology developed by the startup controls several variables in a production line based on fuzzy logic (a branch of Artificial Intelligence, or AI) and is currently used by more than 35 companies.

The 2 percent reduction in leak losses was made possible by using the software to control water pressure in the distribution network operated by Prolagos, the utility that holds the sanitation concession for the region. "Control of water pressure in a distribution network is considered one of the most important operational factors in water distribution," Santiago says. "Low pressure may be insufficient to transport the water to the most distant or highest points in a city. High pressure increases leak losses and may lead to burst pipes."

To control pressure in all parts of a network, utilities use booster pumps to direct water flow via high pressure and pressure-reducing valves (PRVs) to stabilize pressure at certain points. However, current technology is unable to monitor the entire distribution network in real time and in an integrated manner. "The technology available until now basically looks at water pressure before the pump or valve and decides what the booster or PRV should do. The problem is that this may have an impact downstream, such as lack of water in taps or a pressure jump that could lead to a pipe burst," Santiago says.

Prolagos had been pursuing an integrated and automated solution to control boosters and PRVs in its distribution networks in order to reduce leak losses. Its president read a news story about the results obtained by

Coca-Cola Femsa when it implemented the software developed by I.Systems, and contacted Santiago and his partners in the firm.

According to the news story, Coca-Cola Femsa in Jundiaí, São Paulo State, the brand's largest bottling plant in Latin America, achieved a 31 percent reduction in waste due to variations in injected liquid levels and cut losses due to excessive fizzing by 42 percent, as well as being able to control pressure and flow valves at the same time. The result was a saving of 500,000 liters of soft drink and 100,000 PET bottles per year.

"The Prolagos executive assumed that if the technology could regulate the flow of soda into bottles, it should theoretically be able to control water pressure in his company's distribution network," Santiago recalls.

"He contacted us and asked what we thought of applying the system for this purpose. Our answer was that it was designed for industry 4.0, whereas this new application to control water pressure in a distribution network had more to do with solutions for smart cities. We accepted the challenge and decided to do an initial diagnosis. To this end, we submitted a project to PIPE and were accepted directly for Stage 2 of the program [involving research execution]."

The solution uses AI to interconnect variables such as time and date (including whether it is a holiday), local temperature, time of year and whether it is vacation season, among others, and adjusts water pressure accordingly in the distribution network. The software uses all this information to adapt pressure instantly to changes in demand and can predict supply requirements for periods of up to 72 hours.

"Based on this dataset, the AI system makes a projection and assigns water pressure responsibilities to each booster and PRV in the network," Santiago says. "It's as if all the pumps and valves in the network operated as a single intelligence, in a global and integrated manner, instead of

individually. This means, for example, that it prevents activation of a valve causing unwanted effects elsewhere in the work. In sum, it optimizes the operation as a whole."

The system took a week to adapt to the region's water supply profile and then automatically optimized pressure control. The result was a 5.8 percent reduction in the average flow rate without jeopardizing supply. More efficient control thanks to the software also resulted in a 15 percent reduction in the minimum nighttime flow rate and hence cut losses throughout the network.

"We've presented the solution to other water and sanitation utilities in São Paulo State and other parts of Brazil as a first step to its implementation elsewhere," Santiago says. Among the obstacles the firm has faced in its efforts to take the solution to other Brazilian cities is the utilities' limited infrastructure. Most do not have a sufficient level of automation to enable valves to be controlled remotely. "Many utilities still use manual control systems, meaning an operative has to be sent out into the field to change valve aperture. In these situations, our system can't work," Santiago said.

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