Software that locates real-time leaks in water, oil or gas pipes

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Often, water, gas or oil distribution networks develop leaks in storage

tanks, experience pumping failures or illegal connections. In order to avoid economic losses due to these causes, Cristina Verde Rodarte, researcher at the Institute of Engineering, of the Autonomous National University of Mexico (UNAM), designed a virtual guard that immediately detects abnormalities in any type of duct.

The software, called VIVIUNAM, performs logical deductions in real time, identifying the type of failure and getting to the root of the problem, thus avoiding time lost digging or manually searching for the problem throughout the pipeline.

The virtual vigilante uses an algorithm, which, by the laws of physics and the application of a mathematical model of fluid mechanics, calculates a series of data indicating the behavior of gas, water or oil pipelines in normal operating conditions. These, in turn, are compared with the record of pressure measurements within the pipe and the difference between these measurements indicates the presence of leakage.

When the results from the mathematical model do not match the automatically recorded measurements, an error or an abnormal event is detected and the software seeks likely scenarios; for example, the pressure sensor may be disconnected, a leak could be present, or an illegal connection or a disturbance exists that alters the behavior of fluids within the pipeline.

Engineer Verde Rodarte says that the chemical and oil industries, as well as other industries reliant on general processes involving fluid transport systems, should have automatic, safe and efficient monitoring in order to avoid accidents with highly volatile fluids or pollutants that cause a great impact on the environment, damage society and the economy. Therefore, her proposal is to place the VIVIUNAM system in control distribution networks to report the presence of disturbances and implementing adequate contingency plans.

In various networks such as the Cutzamala system, the Xotepingo pumping plant in Mexico City, or Mexican oil transport systems, pipelines already have pressure and fluid gauges. However, the data is only used for administrative purposes, and not exploited to look for leaks or correct any problems, says Cristina Verde.

The experimental work emulating leakages was conducted in a pilot pipeline of 200 meters of longitude with a diameter of 10.4 inches, instrumented with pressure and expense sensors. VIVIUNAM ran from a laptop and the effectiveness of the algorithms developed by scholars of II-UNAM was tested.

The technology used to diagnose leakage is based on mass balances, measuring expense, pressure and temperature at the ends of a pipeline without laterals. Calibration for each model is performed according to the topology and physical properties of the fluid and duct in question. This technique is economical because it does not require additional sensors beyond those already available in distribution pipelines, and the software only requires data from the distribution network for the algorithm to work, says the university academic.

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