Internet of Things

By David Stewart Jones

Las Vegas district employs acoustic monitoring to maintain pipe integrity

Dubbed the first installation of its kind in the country by the Nevada Center for Excellence, a new leak detection system in Las Vegas is a combination of technology concepts incorporating sensor-based data gathering and next-generation Internet of Things (IoT) networking. A convergence of environmental monitoring, system automation and infrastructure management, the platform harnesses IoT networking of "smart" sensors and devices using Internet-connected wireless technologies for remote monitoring and management of a large-scale leak detection systems.

Partnering with IBM and AT&T, Echologics and the EchoShore-TX deployment in Las Vegas are part of the Global City Teams Challenge, a program sponsored by the National Institute of Standards and Technologies that fosters and showcases new technologies to create "smart cities" using IoT connectivity and networking technologies. The Las Vegas deployment incorporates AT&T wireless connectivity to collect, transmit and manage data from the EchoShore-TX monitoring nodes, and IBM-developed software providing an analytics-based water management system with analytical, visualization and reporting capabilities.

Preventing Big Problems

The system uses acoustic sensors and proprietary processing algorithms that detect and pinpoint the sources of faint noises emitted by leaks before they become detectable by other detection methods. Battery-powered monitoring "nodes" incorporating a sensitive hydrophone sensor enabled the system to identify and locate potential leaks or flow issues by analyzing and comparing data from pipeline events detected by two or more nodes. Detecting these pipeline leaks is crucial because they can be an early warning system for future catastrophic ruptures.

"This type of pipe doesn't just catastrophically fail all of a sudden," said Charles Scott, Las Vegas Valley Water District (LVVWD) engineering project manager. "Rather, it fails by having a very small leak which develops into a larger leak, eventually becoming a sinkhole. This technology enables us to monitor the pipe on a continuous basis, detect those small leaks before they get to be big leaks, and schedule repairs as needed—enabling us to significantly extend the life of our pipes."

The nodes use wireless networking to collect essential data about the pipeline status. Uploading the data at predetermined times, the system connects and uploads acoustical data to a secure server, where advanced algorithms interpret the data, search for leak signals and generate reports. Customized software and information interfaces integrated into existing client software programs provide immediate access to critical information—sending alerts to mobile devices—enabling water utility operators to react quickly and decisively to a detected pipeline leak or problem.

"The information and notifications the system delivers about the status of our water distribution system enables us to swiftly respond on site to verify a leak or system-detected issue in short order," said Bronson Mack, district spokesperson. "The system also enables us to identify specific sections of any pipeline that may require repair or replacement in the near future—instead of being forced to unnecessarily replace entire sections of pipeline at great cost."

Benefits for Water Utilities

The monitoring system in Las Vegas uses 12 permanent acoustic sensor nodes monitoring a 3-mile section of aging large-diameter pipeline installed under Las Vegas Boulevard. The non-invasive deployment, including below-ground installation, commissioning, testing and online activation, was completed in just over two weeks—with no interruption to water service or to street traffic on The Strip.

"Non-invasive leak detection technologies are revolutionizing water distribution system maintenance just as non-invasive scanning technologies like X-rays, MRIs and CT scans revolutionized healthcare," said Charlie Fricke, Echologics vice president. "It represents a turning point in the ability of a water utility to monitor hidden or accessible water distribution assets, and a game-changer for water utilities that must make every budget dollar count."

Known as an early adopter of new technologies for efficiently managing infrastructure assets, Las Vegas also is noted for progressive water conservation efforts that achieve one of the lowest rates of water loss in the country. The national average for water loss within a typical municipal water distribution system is about 15%. Water loss in Southern Nevada is closer to 5% or 6%—and the LVVWD plans to use the monitoring system to drive water loss as close to zero as possible.

"This kind of advanced technology opens up a whole new world for water utilities," said David Johnson, LVVWD deputy general manager. "It gives us a new set of 'eyes and ears' within our underground water distribution network, enables us to fully optimize the lifecycles of our pipeline and helps us become more fiscally responsible—so tax dollars raised in Vegas, stay in Vegas." w&wd

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