

Sensing Equipment Specifications

Performance	Leak detection range*: 1.5 Km (4921 ft) on large transmission mains or 1Km ² (0.4 Square Mile) in a dense looped pipe network; Leak detection limit*: down to 2 l/sec Localization accuracy*: up to 20m (65ft) <small>*Depended on accurate GIS network representation , pipe material , pipe diameter & node spacing</small>
Sensor specifications	Pressure range:0-300psi (20 bar) for normal applications; < 300psi (20 bar) for specific applications (accuracy ±0.1%) Liquid temperature: -40°C (-40°F) to 105°C (221°F) for normal applications; <105°C (221°F) for special applications Pipe material & diameter: any Hydrophone sensitivity:-180dB re: 1V/μPa (±4 dB 20Hz to 4KHz)
Data acquisition and wireless telemetry	Proprietary RTU: ARM Cortex M3 architecture -2GB SD card storage Wireless: 3G/GSM/GPRS module (Telit) Time sync: GPS module (Ublox) Security: SSL v2/v3 and TLS protocols; SFTP; RSA SSH-1 and SSH-2 Encryption
Cloud computing	Amazon Web Services (AWS)
Power	12V SLA battery (33Ah or 18Ah); Optional power: Solar or AC
Enclosure	Powder coated steel enclosure (Waterproof IP68)

KEY FEATURES

LeakIntel™ is **easy to install and use**. A unique well-tested algorithm prescribes the optimal placement of sensors, and allows for much less equipment required, as compared with other monitoring alternatives. The sensing equipment is installed on existing infrastructure (Hydrants, Air-valves, existing taps) hence requiring minimal capex. Clients can choose between a stand-alone web-based user interface or a link into their existing platform. The system is fully maintained throughout the contract period

LeakIntel™ provides **clear and quick ROI**. With real-time alerts, localization and prioritization of pipe failures, it saves clients time and money, not just directly from reducing the water loss but more from preventing the potential impact of highly disruptive events. The system allows clients much improved operational efficiency. No longer will they need to find needles in a haystack.

LeakIntel™ provides clients with **peace of mind**. With 24/7 support from Visenti's Control Center, clients can be assured of an additional alert mechanism for fast response to critical events. Clients can also be assured of effective cost management: Visenti's Cloud-based solution replaces the need for costly data center investment and maintenance.



Visenti Pte Ltd, a spin-off from MIT, is focused on supporting pipe network operators in monitoring their infrastructure and optimizing their operations. Visenti integrates patent-protected hardware, wireless data transmission and software services. The core technical team of Visenti bring tens of years of experience in pipe network hydraulic analysis, software systems and embedded sensing that is complemented by operations and execution expertise, and an expert advisory board from MIT and Technion.

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LeakIntel™

Real-time Pipe Leak Localization
Using High-Rate Pressure
Transients

- 24/7 pipe failure alerts and leakage detection, localization & prioritization
- Live pipe repair operations simulation & impact assessment

Real-time Pipe Breakage Detection

ADVANCED HIGH-RATE PRESSURE SENSING INTEGRATED WITH CLOUD-BASED ANALYTICS

Visenti's LeakIntel™ system is comprised of high-rate (250 samples/sec) pressure sensors installed at optimal locations. These sensors transmit continuous information about the condition of the pipe network to a Cloud-based data management and analytics engine.

The LeakIntel™ system identifies the pressure transients generated by potential pipe breakage and localizes the event to the faulty pipe with high likelihood.

HIGH-RATE PRESSURE SENSORS GIVE THE ABILITY TO CATCH PIPE BREAK EVENTS 24/7 IN REAL-TIME

When a pressurized pipe breaks, it releases a high-rate pressure transient that propagates along the pipes in very high velocity. LeakIntel™ is a unique system that can capture these short-term leak related transients before they are dampened. It localizes to the faulty pipe and prioritizes the pipe failure criticality (leak magnitude & impact on consumers) to allow immediate & timely response with minimum impact on network integrity. Distractions are minimized, because this real-time intelligent machine learning system filters out false alerts.

REAL-TIME NOTIFICATIONS



LeakIntel™ is an automated system supported by Visenti's 24/7 Control Center. Once a critical leak event is identified, Visenti's Control Center is activated to respond to the alert and the most relevant network operators are notified.

LeakIntel™ complements acoustic monitoring technologies for leakage detection and allows the integration of hydrophones into the sensing units

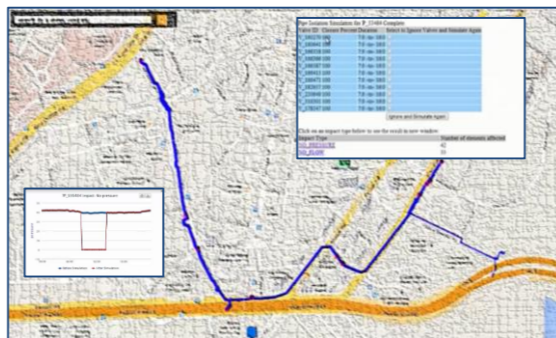
PIPE REPAIR OPERATION SIMULATION AND IMPACT ASSESSMENT ON MOBILE PLATFORM



A leaking pipe can be difficult to isolate and repair. In dense pipe networks, it can take significant amount of time to identify an appropriate set of valves needed for isolating the leaking pipe. It can also be tough to assess the impact of the unexpected pipe isolation on the rest of the network.

LeakIntel™ incorporates the network GIS data, pipe network model and live pressure data to automatically identify the locations of the valves needed to be shut-off in order to isolate the leaking pipe. And if a valve is faulty or stuck, LeakIntel™ instantly identifies alternative valves to shut off. This system also notifies in case there is a negative impact on the rest of the network such as low pressure or interruption of supply to key customers. This prevents unintended consequences of the repair operation.

LeakIntel™ is available on mobile devices too; all the simulations can easily be done while in the field, during the operation. This saves time, money and minimizes damage to the environment from trial and error.



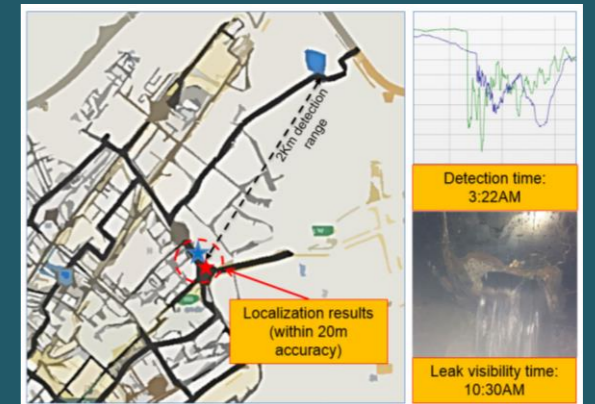
Pipe isolation simulation results

CASE STUDY: SINGAPORE'S CENTRAL BUSINESS DISTRICT (CBD)

Singapore's national water supply agency, PUB, has implemented Visenti's pressure monitoring and leakage localization tools in the complex pipe network of downtown Singapore. This CBD network comprises 300 km of pipes spread around an area of 60 km² and delivers 40 MLD of potable water to approximately 0.5 million customers.

Processed data from 35 pressure-monitoring/leak-detection devices, deployed in optimized locations within the CBD network, enable the system, which manages pressure data streams, performs real-time analytics and sends SMS and Email notifications in real-time to the relevant field teams so that they can prioritize their operations based on the event severity and respond quickly to critical events to minimize any negative impact on consumers.

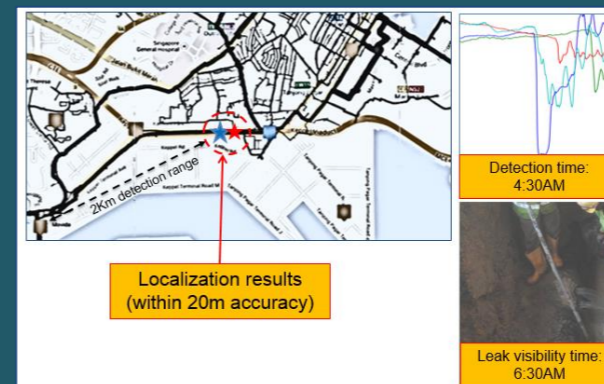
Since its implementation in April 2013, the system has detected critical pipe bursts. In these events, it has been able to localize the leaks within a 20-meter accuracy. The ability to detect leaks 24/7, even before they reach the surface, together with the ability to pin-point these leaks with existing complementary acoustic loggers, provides utility operators with vital lead time for operational planning and prioritization.



800mm (32") steel pipe burst detected and localized



300mm (12") Ductile Iron pipe burst detected and localized



700mm (28") steel pipe burst detected and localized



Typical sensing installation alternatives on existing hydrants, pipe taps or air valves

Seamless deployment
of a cost effective solution

DETECTION SOLUTIONS
SUB-SURFACE DETECTION TECHNOLOGIES

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