Start-up commercialises AI that can detect leaks instantly in gas pipelines

January 21 2021

Credit: Petr Kratochvil/Public Domain

A sensor network powered by an artificial intelligence (AI) algorithm developed by scientists from Nanyang Technological University, Singapore (NTU Singapore) can accurately detect, in real-time, gas leaks and unwanted water seepage into gas pipeline networks.

Successful in field trials conducted on Singapore's gas pipeline networks,

the algorithm has been patented and spun off into a start-up named Vigti, which is now commercializing the technology. It has recently raised early start-up funding from Artesian Capital and Brinc, Hong Kong.

The NTU start-up is incubated by the University's EcoLabs Center of Innovation for Energy, a national center launched in April 2019 to help small and medium-sized enterprises (SMEs) and start-ups innovate, grow and thrive in the energy sector.

A smart warning system that can detect gas leaks and broken gas pipes in real-time has been a long-term goal for the public utility industry, as the current industry best practice for inspecting pipes is for workers to undertake manual surveillance at regular intervals.

While big leaks can be easily detected via conventional sensors as the gas volume and pressure differences will fluctuate sharply in the pipe networks, small leaks are much harder to detect.

In 2014, the Energy Market Authority of Singapore (EMA) awarded a grant to NTU researchers led by Dr. Justin Dauwels, then an associate professor at the School of Electrical & Electronic Engineering, to develop an anomaly identification software for low-pressure pipeline networks.

Over a four-year period starting from 2015, the NTU researchers developed, deployed and tested their AI solution on certain segments of the local city gas network in Singapore over six months, which was shown to be successful in detecting all tested types of anomalies.

"We have designed novel AI algorithms, trained on a massive amount of field data, to identify anomalies such as leaks, bursts and water ingress, which can aid energy companies to better manage their pipe networks," added Dr. Dauwels, who is now the AI Advisor of Vigti.

The EMA funded project concluded in 2019 after the successful field trials and Vigti was then formed to continue developing the innovation and bring it to the global market.

Chief Executive Officer of Vigti, Mr Ishaan Gupta, said: "We aim to reduce the methane emissions in the global gas supply chain to a minimum, with our early detection system, helping companies to save costs while protecting lives. Our mission is to create a safe, smart and a sustainable world, one pipeline at a time."

Professor Subodh Mhaisalkar, Executive Director of the Energy Research Institute @ NTU (ERIAN) and a Governing Board Member of EcoLabs, said Vigti's technology is a prime example of an NTU innovation going from lab to market.

"With aging infrastructure and rising gas leaks around the world, Vigti's solution is well-positioned to solve a global problem, mitigating gas emissions and leaks that impact climate change and pose a potential threat to the well-being of communities. At NTU EcoLabs, we have pooled together expertise and the funding for Vigti, which enabled the pilot-scale testing of the technology, paving the way for actual market adoption."

Conventional sensors vs AI-based algorithm

While within a typical gas network there are sensors installed at regulator points which can detect major fluctuation in the network and calculate the Unaccounted-for-Gas (UFG) loss, small leaks and cracks can escape notice and thus must be manually detected.

With the conventional threshold-based approach, leaks can only be detected if the pressure drop due to the leak is higher than the pressure variation of the network during normal operation. If it is lower than the

pressure variation, the leaks will be very hard to detect unless the pipes are inspected manually.

The cumulative loss of all the small leaks for major companies across the world is estimated between 1.5 to 3 per cent of total gas consumption.

Total natural gas consumption worldwide is estimated to be 3.9 trillion cubic meters as of 2019, thus even a 1 per cent loss would mean some 39 billion cubic meters globally (10 times the total consumption of natural gas of Singapore in 2017).

Leveraging machine learning and AI

To tackle these issues, the NTU team performed various computational simulations to understand the leak and water ingress phenomena in the city's natural gas distribution networks.

A variety of sensors that can measure pressure, flow, temperature and vibration, were deployed and the resulting signals associated with the anomalies in the network's pipes were analyzed. This process established unique 'signatures' within the sensor data for each anomaly.

Using machine learning and AI, the team then developed a software algorithm that is extremely sensitive in detecting anomalies by matching these unique signatures within the sensor data that is routinely monitored.

During the field trial, a total of 16 pressure sensors and 4 flow sensors of various types were deployed at the riser, service line and main line, across three different locations. Data was then analyzed at each location and leak and water ingress tests were also performed at these sites.

At the end of the project, a test was done to establish the effectiveness of NTU's AI comprising 13 different anomaly tests. All 13 were successfully identified by the algorithm as leaks, along with the nearest sensor location and the time duration of these leaks.

Provided by Nanyang Technological University

Citation: Start-up commercialises AI that can detect leaks instantly in gas pipelines (2021, January 21) retrieved 20 September 2024 from https://techxplore.com/news/2021-01-start-up-commercialises-ai-leaks-instantly.html