

*Abstract*

# **Research on a Wireless-Based Acoustic Signal Acquisition Smart Sensor Platform for Structural Health Monitoring of the Piping System in a Power Plant †**

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† Presented at the 5th International Symposium on Sensor Science (I3S 2017), Barcelona, Spain, 27–29 September 2017.

Published: 30 November 2017

A sensor is a device that has functions of converting physical quantities such as temperature, pressure, acceleration, and displacement into an electrical signal, and is an essential element for constructing a system that can be used for various purposes. For their utilization, those sensors are being developed to have characteristics such as improved performance, size, and special purpose through research, and are widely used in industry. In the mid-2000s, with the development of wireless-based industrial networks, studies on the functional and structural development of sensors for various applications and research on merging them with a wireless network have been conducted. As a result, they have started to be applied throughout the industry and the Information and Communication Technology (ICT) including the Internet of Things (IOT). Because of its abilities to compensate the limitations of the general sensor element related to the development of the ICT technology, the smart sensor can be used independently and can monitor a wide range by configuring the network. In addition, it has a micro-controller and can be independently used to control measurements and performances such as data processing, storage, automatic correction, self-diagnosis, making decision and communication. These various types of smart sensors are applied to various fields such as automobiles, mobile devices, robots, environment, defense/security, medical devices, household appliances, and industrial/measuring instruments.

Structural health monitoring (SHM) is used to identify, diagnose, and evaluate structures—a wide range or a large number of structures—such as power generation facilities. In this case, the sensor used to evaluate the safety of the structure is used in various applications and it is necessary to have a high performance collection module. Currently, most of the sensors and signal acquisition modules used to monitor the health of structures are high-performance products based on wired lines. Because of measurement processes requiring manpower, there is an unnecessary use of time and money.

In this study, a smart sensor platform based on wireless and standalone technology was constructed to monitor the health of structures and it was applied to examine the leakage phenomenon that can occur in the piping system of the power plant. The smart sensor that is capable of one channel and 20~20 KHz sound signals input was used and three sensors were installed at intervals in a test bed of 3.6 m × 4.5 m and all signals generated by leak signals at arbitrary positions were collected. The collected signal is used to determine whether leakage occurred through the signal processing, and the data transmitted to the wireless monitoring server is used to estimate the location of the leak source by the time delay difference between two channels. As a result, it was possible to estimate the leakage phenomenon and the location of the leakage source in the testbed and it has a position error of up to 300 mm.

**Acknowledgments:** This work was supported by the National Research Council of Science & Technology (NST) grant by the Korea government (MSIP) (No. CRC-15-05-ETRI).



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