# A fresh sensation in sensing technology

June 1 2018

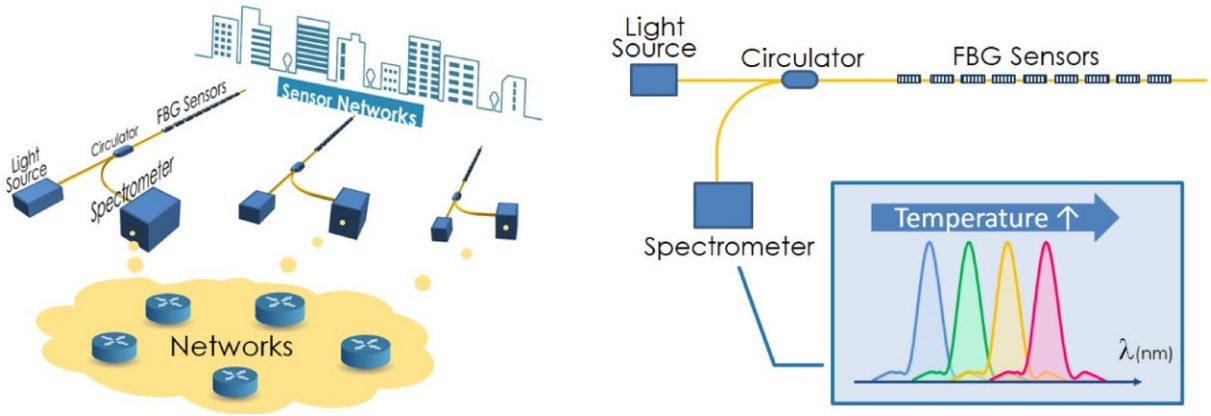


Fig.1 An interrogator consists of two core elements: an optical fiber sensor and a spectrometer. One of the most used optical sensors is the fiber Bragg grating (FBG), which reflects a wavelength of light that changes in response to variations in temperature and/or tension. A spectroscopic instrument in the interrogator detects these changes. Credit: SPIE

The Internet of Things (IoT) is a technology classification that includes home appliances and other items embedded with electronics, software, sensors, and actuators that connect and exchange data. One key IoT technology is optical fiber sensing.

An interrogator for optical fiber sensing analyzes changes in temperature and/or strain from data sent from sensors. In this device, a spectrometer, a key component for signal analysis, is used for measuring the spectrum of light. (Figure 1)

Previously, optical fiber sensing was performed only by devices equipped with an expensive spectrometer with a sub-nanometer scale high resolution due to a theoretical limit of the resolution of the sensor.

Scientists at Osaka University introduced a new super spectral resolution method for multi-channel spectrometers to conventional interrogators for optical fiber sensing. As a result, they performed optical fiber temperature sensing on the sub-nanometer scale with less-expensive spectrometers. (Figure 2)

Their research results were presented at the international conference "Photonics West 2018" held by The International Society for Optical Engineering (SPIE) on January 31, 2018.

"Use of this technology will allow for high-speed, real-time optical fiber temperature sensing at performance levels typical in conventional devices at a low price. This will promote applications of this technology in a wide range of fields, including temperature sensing and strain sensing, which have attracted attention as IoT technologies," lead author Tsuyoshi Konishi said.

The market for optical fiber sensing is expected to reach over $300 million in the next few years. (Figure 3) This group's achievements will be able to reduce costs, a major challenge in expanding optical fiber sensing technology.

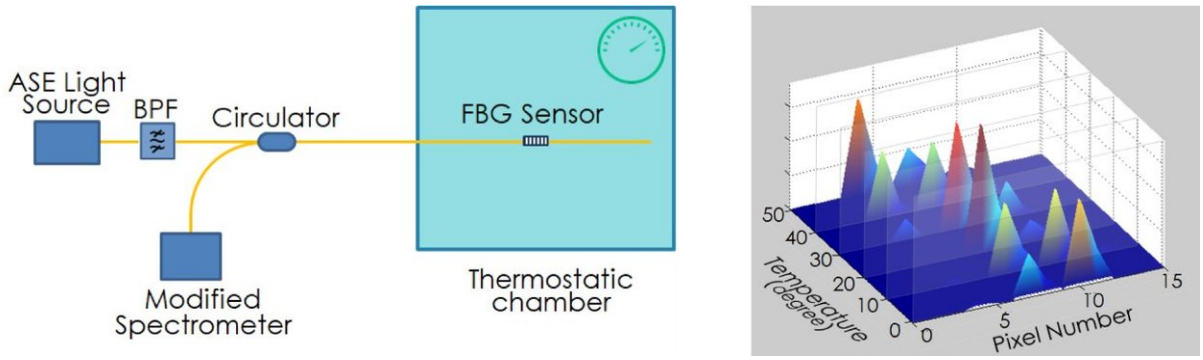


Fig.2 Fiber Bragg Grating (FBG) technology-based temperature sensors remarkably Improved sensitivity, showing changes in temperature in a thermostatic chamber within a range of 0 ~ 50°C in increments of 10°C. Use of an FBG temperature sensor enhanced the spectral resolution of commercially available spectrometers in increments of 10°C. Credit: SPIE

**U.S. distributed fiber optic sensor market by application, 2014 - 2025 (USD Million)**

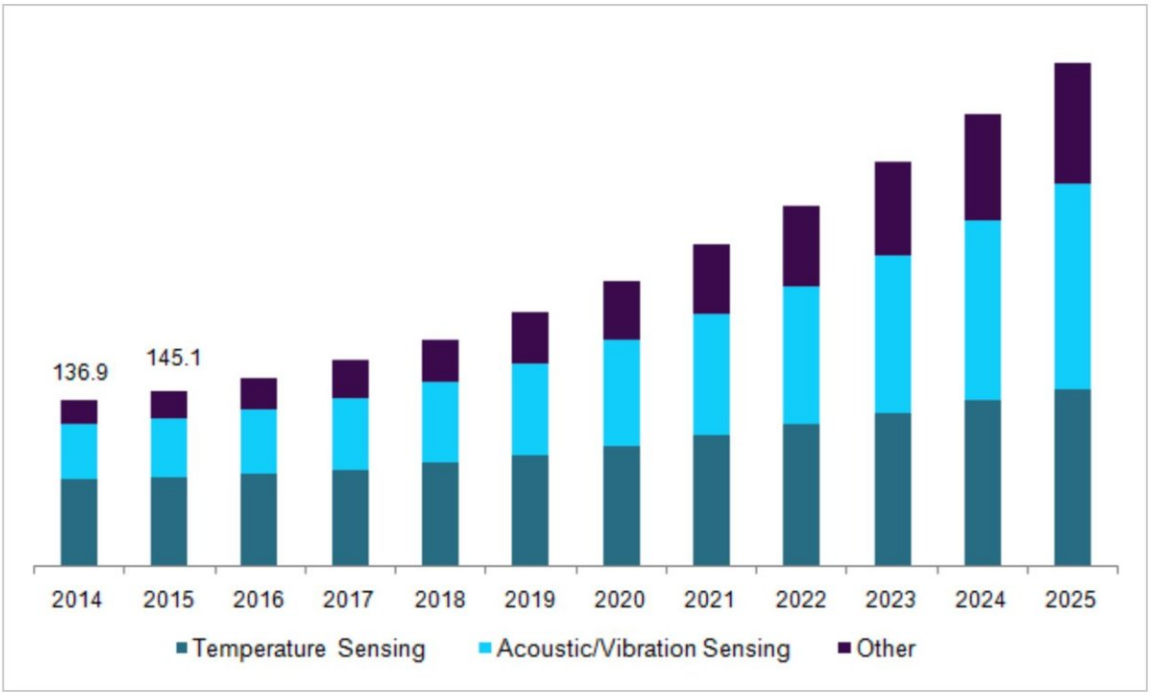

Fig.3 Fiber Optic Sensor/Sensing (DFOS) Market Analysis distributed by Grand View Research. Credit: Grand View Research

**More information:** Yu Yamasaki et al. Compact and cost-effective multi-channel optical spectrometer for fine FBG sensing in IoT technology, *Optical Data Science: Trends Shaping the Future of Photonics* (2018). DOI: 10.1117/12.2297230

Provided by Osaka University