Development of Wireless Remote Monitoring System for Structure Deformation using FBG Sensor

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Abstract. In this paper, we develop wireless remote monitoring system using Fiber Bragg Grating (FBG) sensor. FBG sensors are manufactured using the 248nm excimer laser and phase masks. The adopted wireless networking between PC and FBG interrogator is Wi-Fi, because many devices such as a personal computer, video-game console, smartphone, tablet, or digital audio player can use Wi-Fi. Experimental results show that reflected wavelength values from FBG interrogator are well passed through Wi-Fi network.

Keywords: FBG sensor, Interrogator, Wi-Fi, Remote monitoring.

1 Introduction

Constructing structures is the basic process requiring establishment of grounds. However, cracks due to sinking and distorting ground influence directly on the safety of structural health. Therefore, preventing the loss due structural accidents in advance by acquiring the information on cracks is important [1-4].

Fiber optic sensors is light amplitude, phase, polarization of light such as the optical phenomena though the optical fiber using to detecting for physical quantity to be measured by detecting changes in the structure displacement, temperature, pressure, water level, sound and physical quantity. A Fiber Bragg Grating (FBG) by G. Meltz in 1989 has developed among fiber optic sensors that domestically and internationally widely using study in secure management of the structure. FBG sensor is achieved by creating a periodic variation in the refractive index of the fiber core. Due to their low loss optical fiber sensor technology, most of the research is in progress technology.

It show change by linear Bragg wavelength with respect to stress and temperature by characteristic of the FBG, small size and the type of behavior have characteristics of wavelength encoding, It's real-time detection that deformation by environmental factor for installed in internal and external of structure etc. The phase mask has proposed K. O. Hill and D. Z. Anderson etc., in 1993. It's method to make large

quantity production more easily than the conventional method. This method is currently being studied in a wide range of worldwide [5-7]. Recently, FBG has been accepted widely throughout the civil infrastructures, especially for bridges. A new case study, FBG-based intelligent monitoring system of the Tianjin Yonghe Bridge is introduced [8].

In this study, a wireless remote monitoring system using FBG sensors and interrogator is developed to monitor structure deformation. The adopted wireless networking between PC and FBG interrogator is Wi-Fi, because many devices such as a personal computer, video-game console, smartphone, tablet, or digital audio player can use Wi-Fi. Also it can be connected to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (65 feet) indoors and a greater range outdoors.

2 Optical Sensor Manufacture and System Configuration

We used phase mask that FBG wavelength is 1550nm. It is shown actual manufactured FBG in Fig.1 for center wavelength of 1549.710nm and Reflection level of about -20dBm. It estimates of error for stress by optical fiber with distance by optical fiber and phase mask. FBG fiber is formed by using a polyimide patch type FBG sensors were fabricated.

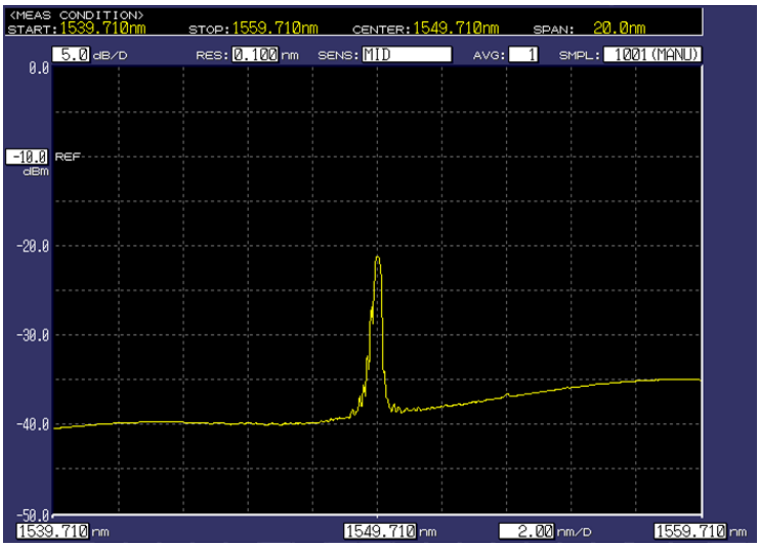

Fig. 1 Designed wavelength of FBG (OSA Output)

Configuration for developed system is shown in fig. 2. The interrogator (Micron Optics, sm125) used to the system has Ethernet module inside.

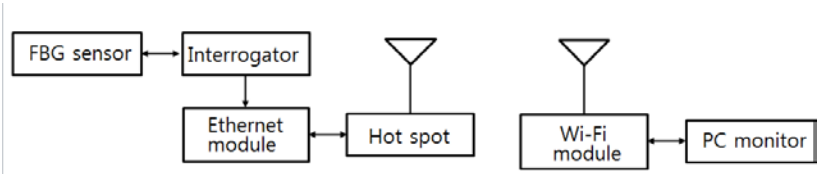

Fig. 2 A wireless remote monitoring systems using a FBG sensor.

3 Experimental Results

For measuring structure deformation and wireless remote monitoring, FBG sensor, interrogator, wireless hotspot, and Wi-Fi on a laptop are configured as shown in fig. 3.

Fig. 4 show that reflected wavelength values from FBG interrogator are well passed through Wi-Fi network.

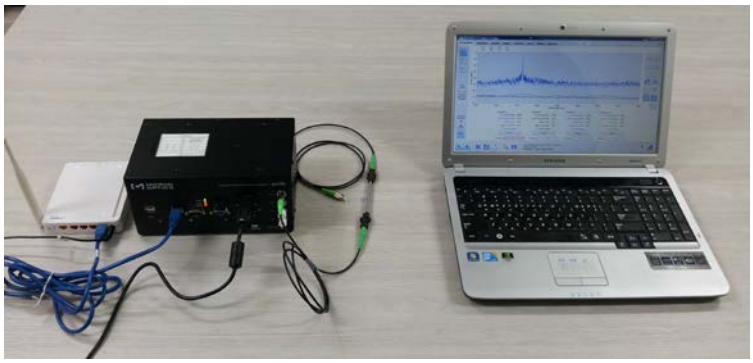

Fig. 3 Configuration of Wi-Fi network between interrogator and laptop.

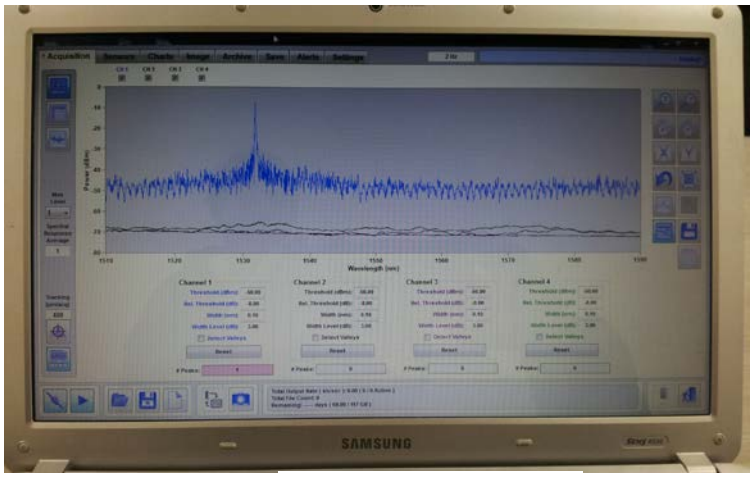

Fig. 4 A laptop monitor scene with reflected wavelength values transferred from wireless remote FBG interrogator.

4 Conclusions

In this paper, for more effective monitoring structure deformation, wireless remote monitoring systems based on Wi-Fi network were developed. Experimental results show that reflected wavelength values from FBG interrogator are well passed through Wi-Fi network. Many devices such as a personal computer, video-game console, smartphone, tablet, or digital audio player can use Wi-Fi. Sooner or later, we hope to develop remote structure deformation monitoring system using smartphone App.

Acknologement

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