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Research on a monitoring terminal for a fibre grating sensing device based on Android

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Abstract

According to the actual needs of FBG sensing instruments in terms of intelligent terminals, software for FBG sensing monitoring systems is designed based on the current mainstream Android operating system, which runs on 3G mobile phones. The software is used to remotely access and manage a fibre optic sensing device. The use of the intelligent terminal software will enhance the level of safety monitoring instrument intelligence so that the management of the monitoring system will be more flexible, system maintenance will be more convenient, and the reliability and security of monitoring equipment can also improved; i.e., it provides good value for the optical fibre sensing application.

Keywords: Android; Intelligent terminal; Optical fibre sensing device; Data collection

Introduction

Optical fibre sensing techniques are an emerging technology that combines the optical, mechanical, electronics, materials and information processing. Optical fibre sensors possess the advantages of small volume, safe and durable operation, lightweight, immunity to electromagnetic interference, better insulation, no danger of deflagration, no power supply required at the sensor, remote measurement, and multi-point sensing. Optical fibre sensors are widely used in the petroleum, chemical, metallurgy, semiconductor, and aerospace industries and other fields. Currently, multi-functional fibre sensing devices are typically placed in the control room or a project site, making it inconvenient for engineering personnel to implement real-time operation, regular inspection, remote login and some other management activities; as a result, an intelligent terminal is required to solve this problem [1–4].

In this paper, based on a detailed analysis of the actual needs of FBG sensing instruments in terms of intelligent terminals, software was designed to operate the FBG sensing monitoring system of intelligent terminals on 3G mobile phones, which enables remote access and management of optical fibre

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sensing devices. The software design is based on the current mainstream Android operating system. The software interfaces with a Fibre Bragg grating sensor monitoring system, which is used for data monitoring of optical fibre sensing devices. The design uses Socket communication technology, which utilises Wi-Fi wireless transmission to perform data communication and Android smart phone terminals to receive data; such data are then stored in a SQLite database, through which users can obtain historical data and plot the data to fully grasp the integrated operational performance of the optical fibre sensing devices. This paper also describes the design of an early warning function. When the monitoring data are beyond the intended scope, warning alarms will be sent to monitoring personnel. At that time, the warning function will inform the relevant worker to address the issue, thereby guaranteeing the safe operation of the equipment.

The 3G smart FBG sensing monitoring intelligent terminal, which is based on the Android operating system, was designed according to the actual needs of the project. This terminal will enhance the level of safety monitoring instrument intelligence by making the management of monitoring system more flexible; as a result, system maintenance will be more convenient and the reliability and security of monitoring equipment can also be improved; i.e., it has a good practical value.

Optical fibre sensing device data collection program

Optical fibre sensing systems are mainly composed of three parts, namely, the front sensors, the FBG demodulator, and the mobile terminal of an Android. An optical fibre sensing device monitoring system is schematically shown in Fig. 1.

The sensors are fixed at the monitoring site; these sensors monitor changes at regular time intervals. The raw data are transmitted to the optical fibre grating demodulator, and are then processed using a computer in the demodulator and stored.

This design uses a multi-channel demodulator, which uses advanced computing spectrum analysis technology to calculate the position of the spectral peak centre. The transmission of data is synchronised, as the demodulation devices regularly send data to the software. The standard transmission of data occurs 150 times per second, which corresponds to new data generated once every 6.66 ms. The software can submit a request for data to the demodulator once every

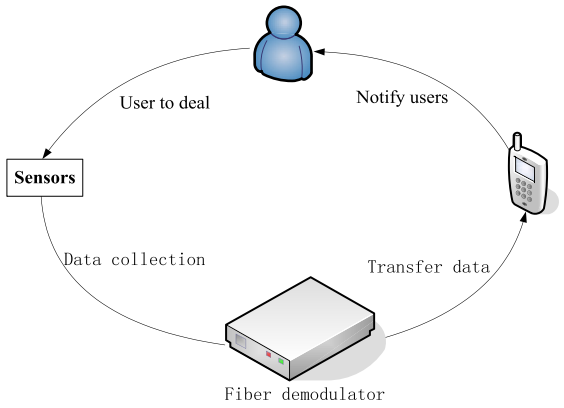

Fig. 1. Optical fibre sensing monitoring system.

4 ms; subsequently, the data are sent from the demodulator.

Within the Wi-Fi network coverage, the staff using the Android handset software can use the mobile terminal to send a request to the FBG demodulator. Once the fibre demodulator receives the request, the data can be transmitted through the socket channel. Subsequently, the data are received by the mobile terminal and then stored in the SQLite, which is the local database of the smart phone, for further analysis and display.

Intelligent monitoring terminal software design

Building the Android development environment

Android application development first involves establishing the development environment; in this study, this development occurred as follows:

(1) Configure JDK. First, download the JDK package, and then click to install. Next, configure the java environment variables;
(2) Configuration Eclipse. First, configure the Android SDK ADT dedicated to Eclipse, and then click on “Help-> Install New Software” and select “Add Site”; enter http://dl-ssl.google.com/android/eclipse/ in the “Location” dialog box and then Click on “Install” to install all of the Development Tools to find and install;
(3) Configure Android SDK. First, unzip the downloaded archive and the configuration environment variable. Next, open the Eclipse on the menu bar “Preference” option, click the Android tab, open “SDK Location:” and select the unzipped Android SDK directory; click on “Apply”, and then set the Android SDK configuration;