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Research on Insulator Fault Diagnosis and Remote Monitoring System Based on Infrared Images

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Abstract

In order to solve the problems of manual judgment and low automation in traditional fault diagnosis methods, a fault diagnosis and remote detection system based on infrared images is designed. The computer server of this system realizes the analysis and processing of the infrared image of the insulator by calling the MATLAB software, and transmits the diagnostic data to the Android mobile phone. Simulation results show that the system is effective and convenient.

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Keywords: Insulator, SIFT algorithm, Matlab, Android, Remote monitoring

1. Introduction

Insulator plays a key role in the power system, fault insulators will seriously affect the power supply, and even threaten the security, stability and reliability of the power grid. Therefore, it is very important to diagnose the fault of insulator.

With the development of China's economy, unmanned aerial vehicles (UAVs) are widely used in inspection of transmission lines, which has the advantages of low cost and high efficiency, and is widely used in power transmission line inspection. And gradually become the development trend of future transmission line inspection. For UAV line inspection system, imaging sensors are widely used in the detection of insulators in the diagnosis. In this paper, based on infrared images taken by infrared thermal imager, relying on the Android platform, implements fault diagnosis and remote monitoring of insulators[1,2].

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In the detection of fault insulators, the extraction and recognition of insulator targets are the prerequisite for follow-up work. Yao Chun-yu proposed a recognition method based on insulator color information[3], but because of its low signal-to-noise ratio and insignificant target textural features, the recognition method is not obvious. Li-Yan proposed a method of identifying and locating the insulator based on HOG (Histogram of Oriented Gradient) feature and SVM (Support Vector Machine), which, to a certain degree, solves the problem of insulator identification and location in the complicated background of catenary[4], but in the large sample, the recognition speed decreased significantly. CAO Jing proposed adaptive particle swarm optimization algorithm combined with the traditional maximum inter-class variance method for insulator segmentation, and then apply the mathematical morphology of the insulator image after segmentation processing, which identifies the insulator[5].

However, the use of the above algorithm is limited by actual environment background and image quality of insulator infrared image. In this paper, From the comprehensive and operational point of view, segments the image by the algorithm of two-dimensional maximum entropy threshold segmentation, identifies the location of the insulator based on the SIFT(Scale-invariant feature transform) feature point matching method, and gets the insulator part temperature data through the establishment of the gray value and the temperature value of the model, realizes fault diagnosis of insulator according to the standard of insulator fault diagnosis in "Application of Infrared Diagnostic Device of Dotted Device" Finally, the back-end server will push the diagnosis data to Android mobile terminal, and the operator can obtain the insulator in real time, and obtains the accurate geo-location of the fault insulator, the remote monitoring system of the fault insulator is realized.

2. System overall framework design

Fault diagnosis of insulator infrared image and remote monitoring system is composed of mobile terminal and computer server, The mobile terminal is to display and monitoring the real-time data of insulator and locating the fault insulator, and back-end server is mainly realizes the fault diagnosis of insulators. The specific structure of the system is shown in Fig.1:

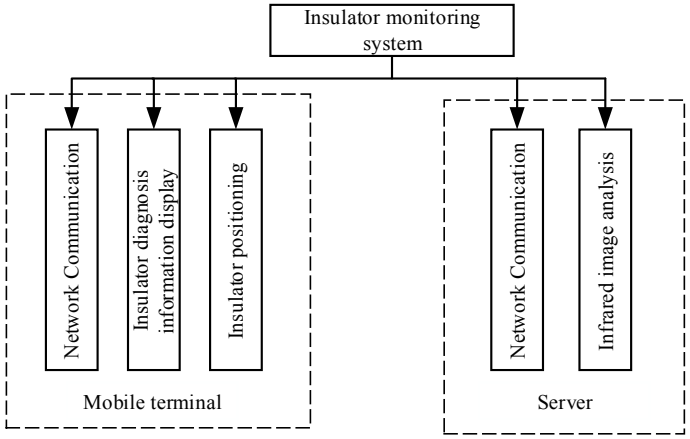

Fig. 1. insulator fault monitoring system framework

2.1. Server module

The server is mainly composed of network communication and infrared image analysis and processing. The network communication module is the middle interface between the back-end server and the Android terminal. Through the network communication module, the background server can send the diagnostic data of insulator to the mobile terminal. The image analysis and processing module is responsible for the identification and fault diagnosis of the insulator infrared images stored locally. The server interface using Qt programming to achieve the following functions: (1) Matlab engine calls: analysis and processing of insulator infrared image in this paper are realized based on Matlab simulation platform; (2) Socket network communication: writes the insulator data to the database and send it to the Android mobile terminal through the Socket network communication module.