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System for Monitoring Online Temperature through Cable

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Abstract

With the advent of the era of smart power grids urbanization, distributed optical fiber temperature measurement technology has become a hot research which can be applied on the cable fault detection. For a start, introduce the overall design of the architecture of distributed optical fiber temperature measurement system in briefly. And then combined with the latency phenomenon that online temperature monitoring system often occurs when the page data is updated, cannot guarantee real-time communication. For such problems, analyzes and summarizes the technical features and advantages of Ajax technology, two pages application aspects mainly in historical inquiry and dynamic temperature curve shows. After measurement found that the application of this technology apply to the client browser of distributed fiber optic temperature monitoring systems, just can effectively solve the problem of real-time data. The last details of the introduction of the designing of online monitoring system after bring in Ajax technology.

Keywords: *Real-Timing, Distributed Optical Fiber Temperature Measurement, Ajax Technology, Online Monitoring*

I. INTRODUCTION

With the rapid development of urbanization, growing demand for urban rail transit, which leads to a growing demand for electricity load, relative to some developed countries, China's cable failure rate is relatively high, the effective temperature of the cable line system the lack of detection technology is an important reason leading to high failure rates. The current domestic technology undoubtedly more effective distributed optical fiber temperature measurement system, but because the system is just emerging in recent years, technology has not yet reached the stage of maturity, especially the real-time data publishing system could be improved.

In this paper, based on the browser/server (hereinafter referred to as B/S) structure built AJAX technology cable line temperature monitoring system design, the design for the current performance of the existing real-time distributed temperature measurement system aspects significantly upgrade, and the user mode of operation is simple, but the main thing is time for the maintenance personnel to locate the fault and repair to provide a higher guarantee.

II. ARCHITECTURE OF TEMPERATURE MEASUREMENT SYSTEM

Distributed optical fiber sensing temperature measurement system utilizing fiber optic temperature sensing field temperature signal acquisition range of each segment, and then transmitted to the host temperature, host module makes the collected signal storage, processing, upload the data to the central unit via a bus, and then via the Web server to upload to the remote client monitoring client browser via Ethernet or GPRS[1]. As shown in Figure 1.

System is composed of three modules, namely the Field equipment, data acquisition layer and application layer.

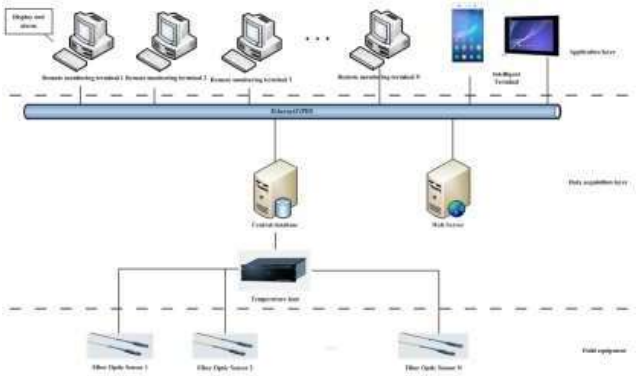


Figure 1 Architecture of temperature measurement system

Field equipment that is used as a temperature signal acquisition and transmission of temperature sensing fiber. In a distributed fiber optic temperature measurement systems, optical fiber is both transmission media and the sensing medium.

Data acquisition layer comprises a host module, Web server and the central database server. Central database server is responsible for front-end storage devices collected over the host temperature data, and the Web server will be responsible for two parts, one is the transmission process client data access request and the corresponding data, and second, users can be useful signal at the Web server mining process, through the relevant numerical analysis algorithm to make an exception analysis, the data will be uploaded abnormal temperature values on the client browser. So users will be able to get the client browser by using a smart terminal device or PC to release all the information.

Application layer is used to display the terminal control device may be a personal PC or smart phones, tablets and other smart terminal equipment.

III. THE REASON FOR THE INTRODUCTION OF AJAX TECHNOLOGY

The early development of the Internet WEB page is static, the user is issued a client HTTP request, waits the server receiving, processing, and then returns a new page. This process, the user can not do anything else on the page, and can only wait for the server returns a new page. Request to receive a new page to be transmitted through the network and server response, this process elapsed time is much longer than the native application users. Therefore dependent page refresh traditional communication model can not meet the needs of WEB applications. At this time, the emergence of Ajax technology. The emergence of Ajax completely subvert the traditional Web application model for the HTTP communication model provides a better solution. This technology provides the ability to asynchronous communication between the client browser and the server. Due to the different needs of each user, the local content may sometimes need to refresh the page only drawbacks of traditional Web applications refresh mode became apparent. Using Ajax technology it is possible to achieve a partial page refresh. In this way, users do not need to waste too much time to update the entire page. Ajax requests the user from cumbersome freed response cycle, greatly improving the efficiency of the user browsing interface.

Compared to the traditional terms of B/S mode control system, monitoring system based on Ajax technology, B/S model has the following main technical application advantages[2].

First, Ajax substantially reduce the burden on the system server. Ajax otherwise would need to do the work on the server side to the client to complete. Usually the user to access the web monitoring system, in which most of the data is unchanged, such as the overall framework of the page and other static data. When a user makes a request local real-time status of the client, the server does not need the entire page is returned to the client. This process does not produce data redundancy and waste.

Secondly, Ajax asynchronous communication with the surveillance system server, this process does not affect user operations. When the user wants to refresh some state information, the monitoring system needs to be loaded before the page data is not received will not refresh the page, the page will not be "black and white" phenomenon. Thus on the one hand reduce the waiting time for users, on the other hand gives users a good experience.

Furthermore, Ajax does not require the use of the process to install the supplied plug-in or download other programs. In addition, the call by Ajax technology some external data, and then display

the page on the surveillance system, such as weather information. Then maintenance personnel can refer to the day's weather conditions to set up a day's warning, alarm parameters to ensure the reliability of the alarm system.

Finally, since Ajax monitoring system is located in the middle layer of the browser and the server-side between. This position determines Ajax only gains the real-time data from the server does not need to care about the Web page rendering. Ajax only need to care about the business logic processing real-time status information. This division of labor model is very beneficial to the future development and maintenance personnel[3].

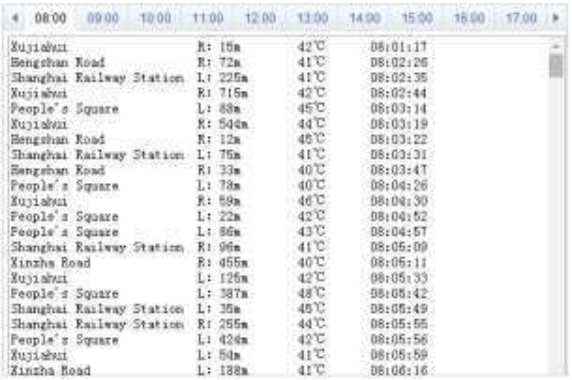
The following details on the two systems in a distributed temperature monitoring interface associated with the Ajax application.

Associated Application 1: History inquiry

a) Tab tag technology

Since the acquisition of data over all updated in real time, so that every day will be a central database server to store large amounts of data, once the maintenance history of the person you want to view a specific day, which requires different levels to query a specific day, sometime , of a lot more than a certain threshold temperature records, if a single label using the drop-down list box to filter the query, it will seem very complex operation and requires repeated operation of the drop-down list box, this way, it will undoubtedly affect the maintenance staff efficiency[4]. But if you switch tabs using Ajax technology, it can be very good to optimize the above cumbersome operating procedures, maintenance personnel can first locate the drop-down list box to the specific filtering criteria to achieve one day a certain temperature threshold, after the page is displayed a day of all time history matching the filter label, because these tags are using inline frame embedded in the HTML page, but when the client browser to submit a query will be immediately after the days of one-time finish loading all data, maintenance personnel can only be switched label head by moving the mouse cursor can freely view any time throughout the day in line with the data recording conditions, the Shanghai Metro line 1, the temperature reached 40 degrees one day history query interface is shown in Figure 2, Figure 3, the use of technology to switch tabs without waiting for the server load and improve the efficiency of maintenance personnel, but also reduce the burden on the server.

Figure 2 08:00-09:00 period record after having filtered



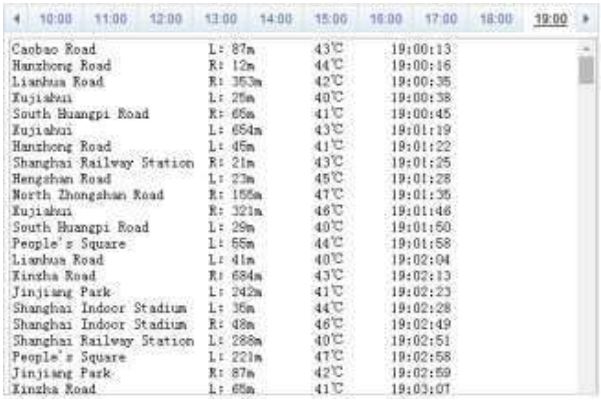


Figure 3 19:00-20:00 period record Bafter having filtered

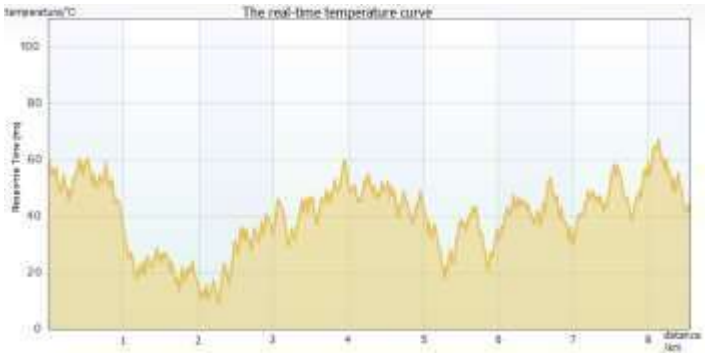
b) Dynamic query browser technology

When maintenance personnel need to query the historical temperature data recording, since the amount of data is huge, if you use the traditional flip query mode, it seems a bit time-consuming, inefficient, then you can use the query page and Ajax dynamic query browser technologies, the technology uses open source components Rico LiveGrid, its main effect is that when users browse large amounts of data, the page can dynamically load data based on the operation of the user can browse through mouse rolling manner at once to view up to 500 history . In this way not only greatly improve the client user browsing speed, but also optimize the client user experiences.

Associated Application 2: Real-time temperature curve

Monitoring interface, real-time temperature curve is temperature maintenance personnel have timely access to critical information collection module, so that the temperature curve real-time updates will be very important, but the traditional way is often through pre-set time to update the entire interval page refresh in real time, but it will waste a lot of server resources, but will take up more bandwidth, real-time updates by operating Ajax after the transformation, not only can reduce the amount of data transmission, which greatly improved transmission efficiency, but also saves bandwidth, which greatly improves the response speed of the system. As shown for the Metro Line 1 to monitor a range of sections of the real-time temperature curve shown in Figure 4.

Figure 4 The real-time temperature curve



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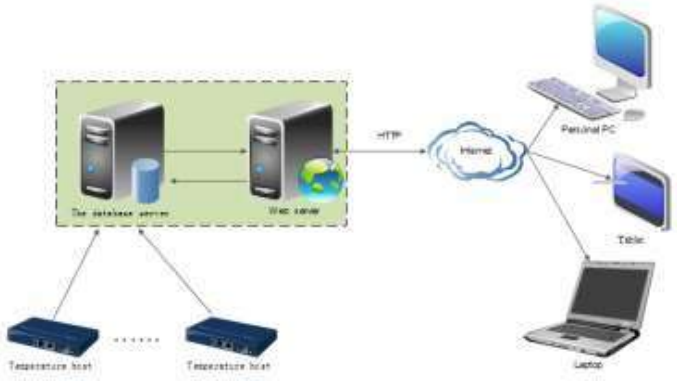
IV. DESIGN OF ONLINE MONITORING SYSTEM

B/S structure pattern Systems Network Architecture

In the system design process, in view of the application cost and size of the system, and in order to improve the stability of the system as much as possible, simplify system design, the use of independent design browser client, and the server and database server on the same host design on the way[5]. Systems Network Architecture as shown in Figure 5.

Figure 5 Systems Network Architecture



Design of Web server

Throughout the monitoring system, Web server is the core link, is responsible for the connection between the browser and the database server, the browser you want to update the data must first go through the server to access the central database, in order to achieve real-time to refresh the data more effectively.

In the monitoring system based on AJAX technology, B/S design mode, the browser interface is sent through the AJAX engine periodically access requests to the Web server, and then wait for the server terminated by request, it can be based on AJAX request Uniform Resource locator (hereinafter referred to as: url) to do the appropriate processing operation, and then to access the database server, then the database server processes the data required by the client and then sent to the browser in the form of an XML document, the browser parses XML document last updated the data obtained in the browser interface[6]. Web server software workflow as shown in Figure 6.

Figure 6 Web server software workflow

Design of database server

Taking into account the nature and size of the system in real time, using the Web server and database server integrated development approach,

Through an XML document to replace the traditional way of repeated calls to the database, which makes the Web server when accessing the database can access the data files on the local hard disk directly, thus greatly increasing the speed of data access system.

In the monitoring system B/S design pattern based on AJAX technology, the database server has two main functions:

1. Connected to the front of the host temperature, temperature measurement system is responsible for storing large amounts of data collected over.

2. To interact with the Web server to communicate, respond to data access requests to the Web server. When the Web server requires real-time data, the database server to obtain data from the memory array and forwarded to the Web server; when the Web server requires historical data, the database server reads the data file format of the XML document from the local hard disk. Access to the database server flow chart is shown in Figure 7.

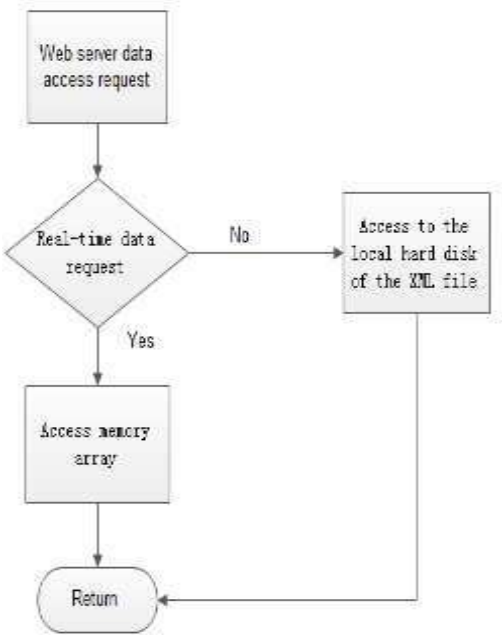


Figure 7 Access to the database server flow chart

3.4 Design of the client browser software

Clients of this system uses Ajax technology, allows the client and server interaction via asynchronous communication, Ajax engine is run using JavaScript written on the client browser script, responsible for client browser and data exchange between Web servers, following the adoption of this intermediate layer, so that after a user requests the data without waiting for response to these requests by the Ajax engine to handle, update user data back and forth without having to refresh the entire page, you can still continue browsing monitors the interface, thereby greatly enhancing the speed of response.

Using Ajax technology to achieve the client browser and Web server asynchronous interaction browser design process is as follows:

Step 1: Create Ajax asynchronous objects, the following code is used to create an Ajax asynchronous objects ajaxObj, this Ajax asynchronous objects ajaxObj defined in a function create AJAXObj (), as follows:

```
function createAJAXObj(){ var
    ajaxObj = null;
    try{
            ajaxObj = new ActiveXObject("microsoft.xmlhttp");
    }catch(e1){
            ajaxObj = new XMLHttpRequest();
    }
    return ajaxObj;
}
```

Given the major mainstream browser to the underlying Ajax asynchronous implementation of the object is different, so we still have to create a good debugging object browser compatibility. Wherein, ActiveXObject objects are compatible with IE5-IE12, while non-IE browser compatible XMLHttpRequest object. Objects created here are built-in browser, without third-party jar package.

Step 2: AJAX object is ready to send an asynchronous request to the server. Mainly through the Ajax asynchronous calling object's open () method and the send () method, to achieve the requested access. open () method is ready to send a request to the server, and send () method is being sent to the server request, two are sequential. Implementation code sends a request to the server as follows:

```
var ajaxObj = createAJAXObj();

var url = "${pageContext.request.contextPath}/url-pattern;

var method = "GET";// Here it can also be "POST", but you need to set the request
```

header.

```
ajaxObj.open(method,url,Boolean b);

    ajaxObj.send();
```

The first parameter method open () method is http request method, either GET or POST.

If it is POST, you need to set request headers alone, fixed format, as follows:

```
ajaxObj.setRequestHeader("content-type","application/x-www-form-urlencoded");
```

The second parameter is the url server-side request page. The third parameter is a Boolean type, if true, indicates that the request is a request asynchronous mode, if it is false, the request is synchronous mode.

Parameters send () method is empty, if you can call this method to send a request to the server operation.

Step 3: AJAX asynchronous objects continuously monitor the status of the server response. First introduced AJAX asynchronous object a listening event on ready state change, the event has five status codes are 0,1,2,3,4, and when the state code is:

0: asynchronous AJAX object has been created, but not yet call open () method.

1: Indicates that the object has an asynchronous AJAX call open () method, but does not call send () method.

2: the AJAX asynchronous object has called the send () method, but the request has not yet reached the server.

3: Indicates that the server has received the request AJAX asynchronous object being processed response.

4: represents an asynchronous AJAX object has received all the information server response. (But not necessarily the correct information.)

You need to define an anonymous callback function in onreadystatechange event. Code is as follows:

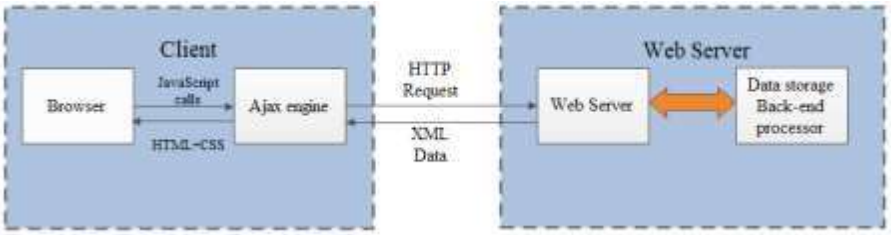
```
ajaxObj.onreadystatechange = function(){
                                    // If the state of AJAX code is 4.
                                    if(ajaxObj.readyState == 4){
                                        // If the server response code is 200, showing Normal from the
                                        server object

if(ajaxObj.status == 200){
        // Get asynchronous AJAX response


        var String = ajax.responseXml;

        //( According to DOM parsing rules, the response will be dynamically added to the page
```

within a specified Node tab.)

```
document.getElementsByTagName("Node")[0].firstChild.nodeValue = String;
                    }
                }
            }
        }
```

Executing the above statement, it will return to the Data Node node to obtain these data can be efficiently updated in real time the contents of the page.

At this point, the browser client with a full asynchronous server interaction is completed, the browser client can immediately send another Ajax request data, start another asynchronous interaction, enabling periodic updates of the data. Figure 8 is an interactive process of client and Web server[7].



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V. CONCLUSION

Based on B/S structure and build AJAX technology cable line temperature monitoring system and temperature monitoring system compared to the traditional model, greatly improving the timeliness and reliability of the data page, perhaps the traditional model in real life more common, even far beyond the functions of the new B/S model, but for the purposes of cable line temperature measurement in the field, the top priority is to protect the real-time data transmission, if a temperature measurement system can do for power cable fault alarm in time to quickly and accurately determine the location of power cable fault, guidance related to maintenance personnel rushed to the site of the accident in a timely manner and to repair power cables, is a strong public safety travel.

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