Centralized on-line monitoring system for pipeline and cable environment and fresh air of air conditioning

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Abstract—Aiming at the problem of on-line centralized monitoring error of pipeline and cable environment and fresh air of air conditioning, a utility model is designed, a centralized monitoring system of pipeline and cable environment and fresh air of air conditioning is disclosed, the system structure configuration is optimized, and the system performance is improved by combining multiple central air conditioning controllers, data processors, acquisition servers and other equipment, combined with LabVIEW technology, the system software function and operation process are improved. Finally, the experiment proves that the centralized online monitoring system for pipeline and cable environment and air conditioning fresh air can better reduce the monitoring error and ensure the real-time monitoring quality of pipeline and cable environment and air conditioning fresh air.

1. Introduction
The centralized on-line monitoring system for pipeline and cable environment and fresh air of air conditioning is a relatively complex air conditioning unit. Based on the maintenance and application management of pipeline and cable and three air conditioners, it sends inspection equipment and records operation data. However, the inspection interval is too long, which is very inconvenient to find equipment problems in time[1]. The noise of the generator system of the air conditioner exceeds the limit of the national health standard, and the generator system has equipment abnormalities in time in the high noise environment. At the same time, there is a problem of poor effectiveness and authenticity in the centralized online monitoring and recording data of pipeline and cable environment and fresh air of air conditioning[2]. In terms of management, it is not conducive to the comparative analysis of long-time data to provide useful information for the maintenance workshop, and it is not convenient to combine with the maintenance information system[3]. Considering the importance of on-line monitoring of pipeline and cable environment and fresh air of air conditioning to the safe operation of pipeline and cable environment and fresh air of air conditioning, and the advantages of powerful signal acquisition, measurement analysis and network communication of graphical software integrated development environment LabVIEW, the centralized on-line monitoring system of pipeline and cable environment and fresh air of air conditioning is optimized.
2. Design of on-line monitoring system for pipeline and cable environment and fresh air of air conditioning

2.1. Hardware structure of pipeline and cable environment and air conditioning fresh air online monitoring system

A set of remote on-line monitoring system for pipeline and cable environment and fresh air of air conditioning based on LabVIEW is proposed and designed. The hardware structure of the system is as follows: the signal acquisition controller can realize the functions of single channel and multi-channel data acquisition, storage and historical data query\[4\]. The signal analysis processor can realize on-line and off-line signal analysis and processing functions, including signal time domain, frequency domain, amplitude, frequency domain, frequency domain, frequency domain, frequency domain, result display, etc. In the process of system design, the remote data transmission between C/S is realized through the network communication mode of web server. In addition, the system also has a friendly man-machine interface, which is convenient for user maintenance and function expansion\[5\]. Further, the dcm-dfig pipeline cable environment and air conditioning fresh air simulation platform composed of PC, switch, main control PLC, Siemens DC governor, 6RA70, DSP acquisition board, DC motor, DFIG generator, frequency converter, torque speed tester and pulse code is used as the monitoring object to optimize the structure of the pipeline cable environment and air conditioning fresh air online monitoring system:

![System hardware configuration structure](image)

The fluid has circumferential velocity and relative velocity, and the outlet has
circumferential velocity $u$, relative velocity $u_1$ and absolute velocity $u_2$. The inlet velocity $v_{1a}$ and outlet velocity $v_{2a}$ are composed of these three velocity vectors. The absolute velocity $v_a$ can be decomposed along the two vertical directions of circumference and circumference. At this stage, the circular velocity is the same, that is:

$$u_1 = u_2 = u \quad (1)$$

In addition, for incompressible fluid $\beta(\beta_1, \beta_2, \ldots, \beta_n)$, the peripheral velocity at the inlet and outlet of the impeller can be regarded as equal, that is:

$$v_{1a} = v_{2a} = v_a \quad (2)$$

According to the velocity triangle, the following formula can be obtained:

$$\begin{align*}
v_{1a} &= u - v_a \cot \beta_1 \\
v_{2a} &= u - v_a \cot \beta_2 \quad (3)
\end{align*}$$

The pressure head formula can be obtained from the unit mass theory of centrifugal fan:

$$H_T = \frac{1}{2} \left( u_2 v_{2a} - u_1 v_{1a} \right) \quad (4)$$

The total pressure is used to overcome the resistance of the ventilation pipe network and improve the air velocity (kinetic energy). Its value is the total pressure difference between the outlet section and the inlet section of the fan, expressed in the following form:

$$p = p_{22} - p_{11} \quad (5)$$

Where $p_{11}$ is the total pressure of the fan inlet section and $p_{22}$ is the total pressure of the fan outlet section. The gas velocity at the fan outlet section is $V$ and the air density is $\rho$. In this method, in addition to the characteristics expressed in the fan characteristics, its flow during operation has a fixed relationship with efficiency, pressure and output power\cite{10}. In order to prevent ordinary users from forcibly closing the monitoring module, the self-protection of the monitoring module is realized to ensure the normal operation of the system. Monitoring the specific process is the main goal of the process protection monitoring system. However, if the monitoring process closes, you cannot monitor other processes. Therefore, the protection program is designed. In Linux system, through ZABBIX / agentnf, you can use source code installation and Yum installation. In Windows system, the executable file exe can be downloaded and modified. Since TCP connection is necessary for data transmission between server and client, when the server and client are configured with SELinux and Linux firewall system or 10050 and 10051 interfaces with host and server, it shall be opened to ensure the safe operation of monitoring equipment.

2.3. Realization of centralized monitoring of pipeline, cable and envelope

In order to ensure the operation effect of the system and further improve the system function, the user login module function is the basic requirement in the process of system operation. In order to better ensure the design goal of multi-user login system at the same time, in the process of login module function design, it is necessary to ensure the user information security, and carry out security identification and encryption according to different user characteristics, Effectively prevent illegal users and risk data intrusion. On this basis, further optimize the function and operation process of the system login module to realize the safe identification and execution of login authority. The specific processing process is as follows:
In this process, the management of system login module is effectively realized. In order to effectively ensure the health of low-voltage communication equipment, it is necessary to collect monitoring data in real time, and realize the health monitoring of low-voltage communication equipment. When monitoring, combined with the constraint principle and fuzzy clustering algorithm, the electromagnetic spectrum of different frequencies is mixed to cluster the interference spectrum, and the characteristic transformation parameters of the interference signal are calculated according to the clustering results.

\[
S_n(m, v) = 2p_1\pi \left[ D_x \exp \left(\pi \left(m^2 \cos p_j + v^2 \cos p_j - 2vm \cos p_j\right)\right) \right]
\]

Among these parameters, D is the farthest influence distance of the interference signal, if r(v) is the spectrum conversion parameter. Through Fourier transform of the collected interference spectrum signal h, the interference spectrum characteristics dv are further obtained to ensure the efficient operation of the equipment.

\[
R_n(m, v) = \int_{-\infty}^{r(v)} h(m-v) S_n(m, v) dv
\]

The interference coefficient of monitoring equipment is \(a_n^j\). When the total amount of interference spectrum data is I and the nonlinear wave frequency is j, the interference signal is characterized. The identification algorithm is as follows:

\[
h = R_n(m, v) \sum_{j=1}^{m} \sum_{i=1}^{n} a_n^j (I - b_j)^2
\]

For the interfered electromagnetic spectrum information signal, when the interference signal f is in the minimum state, the spectrum weight and fuzzy index under different stages and different environmental conditions are obtained, so as to obtain the digital adjustment value of EMI characteristic value, and track and monitor the abnormal basic neurons from now on. The output function of the monitoring equipment is obtained by the deviation g between the standard value parameter K and the actual detection value during system operation:

\[
K_0 = f \left( \sum_{i=1}^{N} C_{ir} + E_r \right), \quad G = f \left( \sum_{i=4}^{N} D_{ij} + F_r \right)
\]

The number of network nodes in the network, represented by CIR. In the network, \(D_{ij}\) is the connection parameter of the output layer node, and \(E_r\) and \(F_r\) are the maximum thresholds for data fault tolerance of different structural units. In the monitoring process, the monitoring equipment can be processed, the time interval can be standardized, and the low-pressure purification equipment in different regions and different states can be effectively monitored and regularly managed to ensure the operation effect of the system.

3. Analysis of experimental results
In order to verify the practical application effect of pipeline and cable environment and air conditioning fresh air centralized online monitoring system, and compare the performance of traditional online health system based on Internet of things, hall hs02-p series current sensor is...
selected in the experiment to test DC, AC and pulsating current by using Hall effect and magnetic compensation principle. The current sensor has the characteristics of strong voltage isolation, good mechanical and environmental resistance, high safety and reliability. The system uses hs02-50 / 0.05a-p sensor, and its performance parameters are shown in the table 1 below.

| Parameter               | HSO2-50/0.05A-P |
|-------------------------|-----------------|
| Measuring range         | 0-80A           |
| Response time           | <20μs           |
| Input current           | 5V              |
| Output current          | 60mA            |
| Electrical strength     | 2000V / min     |

Further, the signal monitoring video processing chip of DSP model and MPEG-4 video compression standard are used for experimental detection. In order to ensure that the experimental detection results are true and effective, the experimental parameters are further set uniformly. The specific experimental parameter settings are shown in the table 2.

| Parameter               | Numerical value |
|-------------------------|-----------------|
| Signal input platform   | 3, 6, 9         |
| Input interface level   | 2.5Vp-p         |
| Format standard         | PAL             |
| Sampling rate           | 10KHz           |

According to the actual signal monitoring results, the monitoring modes of the traditional system and the system in this paper are compared and analyzed, and the results are shown in the table 3.

| Monitoring and early warning system | Traditional system | Paper system |
|------------------------------------|--------------------|--------------|
| Modulation grid operation data cycle | 18min              | 3~6min       |
| Equipment overload, voltage and power factor monitoring cycle | 10min              | 1~2min       |
| Intelligent monitoring mode        | Manual calculation | Automatic calculation |
| Automatic sorting                  | nothing            | Automatic alarm |
| Proximity                           | nothing            | Active prompt |
| Man machine page display           | nothing            | The reserved interface shall be set according to the equipment engineering |

In the traditional monitoring system, the time to find equipment overload and voltage value out of limit is about 18 min, while the application of this system only takes about 4 min; The traditional monitoring system finds that it takes about 10min for the power flow value to exceed the limit, while the monitoring system in this paper only takes 3-6min, which greatly improves the signal monitoring accuracy and ensures the reliability of the monitoring system. Further, the monitoring accuracy of the two systems is compared and analyzed in a complex environment, and the results are shown in the figure 3.
Based on the comparison and analysis of the above detection results, it is not difficult to find that the monitoring accuracy of the traditional monitoring system is obviously low in the practical application process under complex interference environment, while the detection accuracy of the system in this paper is higher than 60%. Further compare the operation safety of the monitoring equipment under the operation and maintenance of the two groups of systems. The specific detection results are as follows:

4. Conclusion
The experiment is carried out by using the pipeline and cable environment and air conditioning fresh air simulation experiment platform. The experimental verification shows that the pipeline and cable environment and air conditioning fresh air online monitoring system based on LabVIEW has the advantages of feasible scheme, stable performance, friendly interface, convenient use and strong maintainability. At the same time, due to the use of virtual instrument technology, the system has short development cycle and good flexibility, which provides a new scheme and idea for high-speed data acquisition and analysis of pipeline and cable environment and fresh air of air conditioning. An example is given to illustrate how to configure the web server under LabVIEW, and access and online real-time monitoring the on-line monitoring system interface of the on-site server-side computer through Internet web browsing at the client. The example shows that the on-line monitoring of the system is feasible. In addition, the system can not only carry out data acquisition and on-line monitoring of pipeline and cable environment and fresh air of air conditioning, but also can be used for remote on-line monitoring of multi-channel data acquisition system of other equipment in view of the scalability of the design of the system.

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