System for real-time transmission control of AC motor temperature data based on Linux system

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Abstract: In order to study the temperature change of the motor, in the Linux system environment, the fuzzy control query table is established and the membership function corresponding to the element is displayed; the motor temperature is determined to transmit data in real time, and the data is aggregated to form a database and a rule base. Through the real-time summary analysis of the motor temperature data, the fuzzy decision is made, and then the CUPS sets the Linux printer, and the motor temperature parameter is analyzed at any time for more intuitive paper surface comparison analysis. Relying on historical data to establish a big data platform, through the control algorithm to achieve data comparison analysis, you can determine the deviation of the motor operating temperature and accurately diagnose possible faults.

1. Introduction

In modern industrial automation systems, the control of the motor is related to the operational safety and stability of the entire system. With the rapid development of industrial and information technology and the deepening of motor research, real-time monitoring and control of the motor is required to ensure the stable operation of the whole system and reduce the loss of the motor itself. Normally, there are two ways to monitor the motor temperature. The first is to place a PT100 platinum resistor in the stator winding of the motor, and the lead wire is connected to the temperature transmitter. Output industry standard current 4-20mA, after which various types of microcontrollers will collect and analyze it [10]. But in reality, the microcontroller collects data that is significantly and significantly beyond the motor...
winding temperature. The second is to estimate the temperature at which the motor operates by varying the resistance of the stator windings with temperature. In the frequency conversion control, special processing is carried out by combining hardware and software, and a relatively accurate motor temperature change can be obtained. However, the calculation of the resistance must be aware of the voltage and current. For the entire industrial control system, interference and fluctuations are ubiquitous and ubiquitous. Although the accuracy is improved relative to the first method, it still cannot meet the requirements of the industry standard.

In this paper, based on the uncertainty of the motor winding temperature change, temperature acquisition is carried out, and the real-time data transmission is combined with the Linux system. The data platform is constructed based on historical experience data, and the data is compared and analyzed, and the motor operation data can be reported independently. The fuzzy control is combined with the PID control to form the system controller, so as to obtain accurate motor operating temperature data and anti-interference ability.

2. temperature collection

2.1. Combination of PID control and fuzzy control

PID control is one of the most commonly used algorithms in industrial control. The PID control law is effective for most industrial controlled objects, especially for linear constant systems. Most of the stator winding coils on the market today are wound with copper wire. For the notification material, its resistance is linear with temperature. The fuzzy control system has the characteristics of simple and fast implementation. In order to change the staticity of the fuzzy control, the PID control is combined with the fuzzy control. Because the control mode of the motor is different under different environmental conditions, the multi-mode control is tested with different control methods within the allowable range of the input variables. When the deviation is relatively large, pure proportional control is adopted; when the deviation is smaller than a certain; When the value is controlled, the fuzzy control is used; when the deviation belongs to the language value "zero", the PI control is used [6]. This produces the following formula 1:

\[
    u = \begin{cases} 
    K_p e & |e| > e_0 \\
    u_F & |e| \leq e_0 \land e \notin O \\
    K_p e + K_i \sum e & e \in O
    \end{cases}
\]

2.2. Design of motor temperature fuzzy control algorithm

The degree of heat resistance of the motor depends on its insulation rating. In this paper, the insulation grade A is taken as an example. The ambient temperature is 40 °C, and the motor casing temperature should be within 60 °C. Static 60 °C as a set value, the motor temperature measured for the first time is, then the motor temperature deviation is

It is passed as an input variable to the fuzzy controller.

The trigger voltage is the output variable of the fuzzy controller. Since the voltage directly controls the supply voltage of the motor, it is called the control amount.

It is known from the investigation of the fuzzy rule that value can be described by the positive and negative values of the deviation; the value of the machine temperature lower than the set value (high) can be distinguished by the magnitude of the deviation; The machine temperature is equal to the set value and the deviation can be recognized as zero.

In view of the above expression distinction, the input-level output variables use the following language values:

Negative big, negative small, zero, small, big
Or can be written as
NB, NS, O, PS, PB
among them:
NB: Negative Big
NS: Negative Small
O: Zero
PS: Positive Small
PB: Positive Big

For ease of understanding, only the bias is considered in the fuzzy domain, which can be understood as a set of 7 elements. They are -8, -4, -2, 0, 2, 4, 8. The collection can be expressed as
={-8,-4,-2,0,2,4,8}

The analogy is that the fuzzy domain of the control quantity is
={-8,-4,-2,0,2,4,8}

By defining the above language values in the fuzzy domain, the corresponding membership function can be obtained. As shown below:

![Figure 1 Membership function of the language value](image)

The language value membership results corresponding to the elements -8, -4, -2, 0, 2, 4, 8 are as follows:

PB: 0,0,0,0,0,0.5,1
PS: 0,0,0,1,0,5,0
O: 0,0,5,1,0,5,0,0
NS: 0,0.5,1,0,0,0,0
NB: 1,0.5,0,0,0,0

It can be known from the linguistic value membership degree data that the control of the motor temperature can meet the control requirements of the industrial automation system, and the accuracy is further improved. The design of the fuzzy control algorithm is explained by the description of the temperature control system, which lays a foundation for further research on the fuzzy controller design method.

3. Real-time data transmission under Linux system

3.1. Fuzzy Control Data Query Table

In the actual industrial production automation system, the correspondence between the deviation and deviation variation and the control output is stored in the computer in the form of a fuzzy control table. When the fuzzy controller is in normal operation, the industrial control opportunity first determines the control output according to the quantized value of the deviation and the variation amount of the deviation obtained by sampling, and then multiplies the control output by the optimized scale factor. This will get the control output of the controlled object. The system structure is shown below:
The fuzzy control data lookup table is established under the offline situation, so it has no influence on the real-time operation of the fuzzy controller, and also meets the control requirements of real-time monitoring.

3.2. Linux system database
One of the best places in Linux is its multitasking environment, multi-user [14]. The control system can separately set up the file database in the motor of the automation system, so that not only the motor temperature data but also the comprehensive data of the motor can be recorded, so as to grasp the real-time running state of the motor. The data is synchronously written to disk according to the command statement sync of the Linux system. In reality, the general account can also use sync, but the general account user can only update their own data when updating the data, root can update the data of the entire system. This makes it possible to build a Linux central database on top of FCS. In order to facilitate the review of the data, the file is recorded as a log and the log file is to be security set.

In order to facilitate Linux user management, the server of the log file is related. In the syslog.conf file, the recorded log file data can be transferred to a remote host or printer. In doing so, even if the hacker deletes /var/log/, it doesn't matter. The important data is directly recorded on the printer, which increases the security and reliability of the system.

Printers are an important tool for us to record feedback data at any time. We can use CUPS to set up a Linux printer [15]. The Linux host also serves as a dialogue for the Printing server. CUPS supports online, so that we can establish a protocol channel and connect different computers through the protocol channel. In addition to the inherent body of the host, the printer must also be able to support Linux, as well as install the print component under the Linux system. As shown in the figure below:
Figure 4 Schematic diagram of each component of the print behavior

4. conclusions
Using the Linux system to monitor the database in real time, build a knowledge base for the temperature parameters of the AC motor and the rest of the industrial detection parameters, establish a rule base through the combination of fuzzy control and PID, and then achieve good control effect through the inference engine. The Linux system database establishes different folders to establish an online system with the distributed control of the industrial site, records the running state of the motor in the form of logs, and realizes the secure transmission of data through the components of the printing behavior. Relying on historical data to establish a big data platform, through the control algorithm to achieve data comparison analysis, you can determine the deviation of the motor operating temperature and accurately diagnose possible faults.

Acknowledgment
Fund Project: Gansu Basic Research Innovation Group Project (18JR3RA133); National Natural Science Foundation Project (51767017)

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